STANDARD SPECIFICATIONS

FOR

CONSTRUCTION PROJECTS

IN

VERNAL CITY

REVISED JULY 2014

REVIEWED AND APPROVED BY:

STREET SUPERINTENDENT

WATER AND SEWER SUPERINTENDENT

VERNAL City

CALDWELL RICHARDS SORENSEN

Answers to Infrastructure®

TABLE OF CONTENTS

** END OF TABLE OF CONTENTS **

Division 01

General Requirements

SECTION 01 31 00
CONTROL OF WORK

PART 1 — GENERAL

1.1 DESCRIPTION

This section specifies special requirements relating to the work in the Vernal City Right of Way.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

B. MORATORIUM ROAD: A road that has been reconstructed or had an overlay of greater than one inch of asphalt within the last 5 years.

C. OR EQUIVALENT: At any time in these specifications when products are specified and an OR EQUIVALENT option is given, decisions of equivalency will be at the sole interpretation of Vernal City. A blanket statement that equipment or materials proposed will meet all requirements will not be sufficient to establish equivalence. Those wishing to establish equivalence must furnish Vernal City all descriptive literature, manufacturer's compliance certificates and all other data on the items proposed as equivalent.

1.3 DISCREPANCIES WITH OTHER CONTRACT DOCUMENTS

A. If discrepancies exist with these documents (Vernal City Standard Specifications and Standard Drawings) and other binding documents for projects in the Vernal City right of way, or any project of which Vernal City will take ownership, the most restrictive document in favor of Vernal City shall be prevail.

PART 2 — MATERIALS

(Not Used)

PART 3— EXECUTION

3.1 PUBLIC RELATIONS

A. PUBLIC NOTICE

The CONTRACTOR shall provide hard backed signs at **each end of each specific work area**. Signs are to be a minimum of 48 inches by 48 inches and have a high intensity prismatic face with black lettering on a white background. **Information on the sign must include, and only include, the following information:**

"PROJECT INFORMATION"

"CALL"

Contractor name

24-hour available **local** phone number

Signs shall be clearly legible 150 feet from each sign location during both day and night. **Lettering shall be retro-reflective, in good repair, and not less than 5" high (6" lettering preferred)**.

Vernal City or Vernal City representatives maintain the authority to halt work any time signs are not present. Signs are to remain at the project site until final clean up for the project. Complaint response and

resolution shall take place within one (1) hour of notification, or Vernal City may correct the problem and charge the CONTRACTOR for the work required to solve the problem.

All signs for traffic control, work control, public notification or safety will be provided by the CONTRACTOR as incidental to construction.

B. PUBLIC DEMEANOR

Due to the sensitive nature of the in-town work areas involved in this project the CONTRACTOR shall maintain the work area in an orderly fashion. Trash, improper language, loud music, and improper attire will not be tolerated. The CONTRACTOR shall be responsible to maintain a non-obtrusive work site at all times. Employees shall be respectful and pleasant to property owners. Any and all complaints shall be handled swiftly and decisively by the CONTRACTOR. All employees involved in any way on a project in the Vernal City right of way shall be subject to the Vernal City drug and alcohol policy and said policy shall be strictly enforced by the CONTRACTOR.

C. PUBLIC SAFETY

1. The CONTRACTOR shall erect barricades and enclosures, provide warning devices, channel foot and vehicular traffic, establish detours and alternate pathways, and all other measures necessary to protect the general public. Public safety must be in compliance with the latest MUTCD/ADA regulations.

2. No blasting shall be performed without written consent of Vernal City.

D. WORK HOURS RESTRICTION

1. Work which generates noise from equipment shall not be performed between the hours of 10:00 pm and 7:00 am, except upon written approval of Vernal City.

3.2 MAINTENANCE OF WORK SITE

A. PROPERTY ACCESS

The CONTRACTOR shall perform work diligently and in a sequence that will insure access to property is blocked only for a reasonable time required for construction. Particular attention shall be made to accommodate handicapped and aged residents and maintain access to their property during construction.

Access to retail and commercial businesses shall be provided during construction by whatever means possible. The CONTRACTOR will arrange with retail and commercial businesses for continuing access by blocking only part of the access at a time, or providing alternative means of access during construction.

The CONTRACTOR shall provide immediate access for emergency vehicles and personnel within the construction area.

B. DUST CONTROL

Dust shall be contained as specified in Section 01 57 00.

C. MAINTENANCE DURING CONSTRUCTION

The CONTRACTOR shall provide daily maintenance of the roadway during construction, including but not limited to grading for automobile traffic, grading for drainage, and repair of soft or spongy areas. The CONTRACTOR shall repair soft or spongy areas caused by his operations. No additional compensations will be allowed for maintenance.

D. MAINTENANCE DURING CONSTRUCTION STOPPAGE

The CONTRACTOR shall be responsible to grade and daily maintain partially completed work during winter months, inclimate weather, or other work stoppages. Roadways shall be maintained in a smooth, passable condition and shall completely drain.

3.3 UTILITIES

The CONTRACTOR shall do everything possible to avoid damage to existing infrastructure during construction activities. Any damage to existing infrastructure which is not part of, but is due to the construction activities shall be replaced and/or repaired at the expense of the CONTRACTOR.

A. LOCATION OF UTILITIES

The CONTRACTOR shall comply with all Blue Stakes requirements for utility location prior to work in any area. The CONTRACTOR shall be responsible for locating and protecting and re-opening of all storm drainage structures, irrigation structures, utility covers, water valve boxes, and sewer lids prior to any type of work.

B. NOTIFICATION OF WATER, SEWER AND STREET DEPARTMENT

The CONTRACTOR shall notify the Water, Sewer and Street Department 48 hours before paving operations to allow inspection of water valves, ground sterilization and sewer manhole covers prior to placing asphalt. CONTRACTOR shall also notify the Water and Sewer Department as soon as paving operations are complete so the valves and manholes can be inspected to insure paving operations did not damage or alter their function.

C. IRRIGATION WATER

The CONTRACTOR is advised that curb and gutter is often used for delivery of irrigation water. The CONTRACTOR shall be responsible to make contact and coordinate with the water users for possible diversion and delivery of water through the project. The CONTRACTOR shall assume all liability for damages to irrigation facilities or failure of delivery to users caused by CONTRACTOR operations during construction.

3.4 PERMITS AND LICENSES

Unless otherwise specified, permits and licenses from governmental agencies which are necessary only for and during the prosecution of the work and the subsequent guarantee period shall be secured and paid for by the CONTRACTOR

A. WORK ON OR ADJACENT TO STATE ROADS

The CONTRACTOR shall contact the Utah Department of Transportation (801-227-8017) to obtain a UDOT permit prior to commencing any construction on or adjoining any state-owned road or highway.

B. WORK ON OR ADJACENT TO COUNTY ROADS

The CONTRACTOR shall contact the Uintah County Road Department permits office (435-789-1070) to obtain an encroachment permit prior to commencing any construction on or adjoining any county-owned road or highway.

C. WORK ON OR ADJACENT TO VERNAL CITY ROADS

1. The CONTRACTOR shall contact Vernal City (435-789-6924) to obtain a city encroachment permit prior to commencing any construction on or adjoining any city owned roads or highways or in the City right of way. A copy of the encroachment permit shall be available on the job site at all

time work is under progress and presented upon the request of the Vernal City representative.

D. WORK ON OR ADJACENT TO NAPLES CITY ROADS

The CONTRACTOR shall contact Naples City(435-789-9090) to obtain a city encroachment permit prior to commencing any construction on or adjoining any city owned roads or highways.

E. WORK ON OR ADJACENT TO IRRIGATION LINES

The CONTRACTOR shall contact the responsible irrigation company to obtain written permission prior to commencing any construction on or in any irrigation line, lateral, canal or right of way.

F. AT THE JOB SITE

Copies of the Vernal City Encroachment Permit and Traffic Control Plan (Section 01 55 26) must be kept at the job site and presented upon request by a Vernal City Representative. If work is on a MORATORIUM ROAD, a copy of the permit to work on a MORATORIUM ROAD must be kept at the job site and presented upon request by a Vernal City Representative.

3.5 STAGING YARD AND MATERIALS STOCKPILES

A. PRIVATE PROPERTY

Construction materials shall not be stockpiled and construction equipment shall not be parked on private property without the written consent of the property owner. Disputes with property owners shall be immediately resolved by the CONTRACTOR. The CONTRACTOR shall assume all liability for stockpiling or damage on private property.

B. WRITTEN EVIDENCE

The CONTRACTOR shall provide written evidence to Vernal City of permission from the property owners prior to use of private property.

3.6 CONTIGUOUS WORK BY OTHERS

Should contiguous and or interrelated work arise on or near the project area, the CONTRACTOR shall coordinate construction efforts with all others performing such work for the benefit of the traveling public.

3.7 WARRANTY OF WORK

All work within the Vernal City right of way shall be backed by a 1-year warranty by the CONTRACTOR. The 1-year time period begins at the time of final acceptance of the project by Vernal City.

3.8 WORK ON MORATORIUM ROADS

A. ALLOWABLE CIRCUMSTANCES

Projects that impact MORATORIUM ROADS will only be considered if all of the following are met:

1. Permission to work on a MORATORIUM ROAD is given by the City Council.
2. CONTRACTOR backfills all excavations with flowable fill (see Section 31 05 15) to the bottom of the asphalt section. If pipe is being installed, the pipe bedding area need not be flowable fill.
3. Asphalt restoration must use heat scarifying method (see Section 32 01 16.75) in addition to other asphalt restoration requirements.
4. CONTRACTOR pays any additional moratorium impact fees as per Vernal City ordinances.

B. EMERGENCY CIRCUMSTANCES

If needed to prevent imminent loss of life or property that would occur by waiting for City Council approval, emergency excavations may be made on a MORATORIUM ROAD. In such cases the CONTRACTOR must:

1. Notify the Vernal City Police Department immediately.
2. Notify the Vernal City Planning and Zoning Department no later than the first business day following the emergency to secure a formal permit.
3. Follow all other requirements for working on MORATORIUM ROADS.

END OF SECTION

SECTION 01 31 13
COORDINATION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Coordination among the CONTRACTOR'S employee's, and any utility company, separate CONTRACTOR, property owner, Vernal City, and authority having jurisdiction.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.2 COORDINATING WITH VERNAL CITY REPRESENTATIVE

A. Cooperate with Vernal City representative, inspectors, and separate people performing work to establish on-site lines of authority for communication.

B. Develop procedures for handling submittals, reports, records, recommendations, coordination drawings, and schedules.

C. Notify in writing of problems that develop during construction.

D. Ensure agency responsible for operation and maintenance of the completed facility is advised before a project or parts thereof are open for use.

E. Maintain and operate the Work until accepted and turned over to the agency responsible for operation and maintenance.

1.3 COORDINATING WITH PRIVATE AND PUBLIC AGENCIES

A. Notify private and public agencies affected by the proposed construction, coordinate required adjustments, and arrange for all necessary adjustments of utilities within or adjacent to the limits of construction.

1. Uintah School District - Bus Coordinator
   781-3180
   781-5988
   828-3113
2. G & H Garbage Service
   789-2743
3. R.D.T. Inc. (Garbage Service)
   789-2743
4. Basin Garbage Service
   789-6547
5. U.S. Post Office
   789-2393
6. Golden Age Center Van
   789-2169

B. Obtain utility locations from the one-call center (Blue Stake) or other utility coordination service 2 to 7 working Days prior to any excavation. Locations must be updated every 14 Days.

C. All utilities and utility appurtenances within the limits of the Work that are to be relocated or adjusted shall be moved by the affected utility company, unless specified otherwise.

D. Notify police, fire and transit authority.
   1. Central Dispatch - Fire, Police, Gold Cross
      789-4222

1.4 COORDINATING WITH SEPARATE CONTRACTORS

A. Coordinate with separate CONTRACTORS at no additional cost to Vernal City to leave Work complete and finished.

B. Inspect and promptly report any apparent discrepancies or defects in work done by separate CONTRACTORS that render Work unsuitable for proper execution and results. Failure to inspect and report shall constitute acceptance of separate CONTRACTOR'S work as fit and proper to receive work of this contract, except as to defects that may develop in the other separate CONTRACTOR'S work after the execution of the CONTRACTOR'S work.

1.5 COORDINATING WITH ADJACENT PROPERTY OWNER

A. Notice: Notify the property owner in writing 10 Days prior to the start of construction and at least 48 hours in advance of the interruption of utility service or the interruption of access, or the installation of bituminous material. A copy of the notice is to be submitted to the Vernal City representative at the same time.

B. Access: Provide all weather access to property owner at all times, unless property owner or Vernal City representative approve otherwise.

C. Easements: Where work is on easements on private property, coordinate work with the property owner so that work will minimize inconvenience to property owner.

D. Refuse Collection:
   1. Coordinate with all affected refuse collection businesses or agencies.
   2. Notify all affected property owners ahead of time by written notice. Notify them not to put out any refuse at the appropriate time. Tell them another time that will be the time to collect their refuse.
   3. If necessary haul refuse to nearest point of suitable collection as determined by the refuse collection agency.

E. Mail: Cooperate with the U.S. Postal Service in the delivery of mail.

1.6 INTERRUPTION OF UTILITIES

A. Notify fire and police services in local jurisdiction if emergency is safety related or if construction activities interrupt any utility service.

B. Contact the affected utility company. Find out how soon repairs can be made as well as when the repairs will begin.

C. Contact the affected local residences or businesses. Inform when repairs will begin and how long it will take to complete them.

D. Inform Vernal City representative and OWNER.

1.7 INTERRUPTION OF VERNAL CITY'S OPERATIONS

A. If any aspect of normal Vernal City operations needs to be interrupted for completion of the Work, notify Vernal City representative in writing.

B. Submit notice with an alternate plan to cover contingency problems. In the alternate plan allow for maintenance of utilities or other essential services that must be interrupted for any period otherwise deemed necessary by Vernal City to be unacceptable for necessary Vernal City operations.

C. Shutdown of utilities must be accomplished during approved hours at no additional cost to Vernal City. If work

requires a longer shutdown, it must then be accomplished during separate periods.

D. Do not proceed with proposed shutdown without written approval.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION (Not Used)

END OF SECTION

SECTION 01 35 29
SAFETY AND HEALTH

PART 1 – GENERAL

1.1 SCOPE

A. This section specifies responsibilities for safety and health on the project.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SAFETY AND HEALTH REGULATIONS

A. The CONTRACTOR shall comply with, and is responsible for enforcement of Safety and Health Regulations for Construction, promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act, as set for in Title 29, C.F.R. Copies of these regulations may be obtained from Labor Building, 14th and Constitution Avenue NW, Washington, D.C. 20013.

B. The CONTRACTOR shall also comply with the provisions of the Federal Occupational Safety and Health Act, as amended.

C. Portable restrooms shall be provided by the CONTRACTOR at the project site as required by State and local health and safety codes.

D. Safe drinking water shall be provided for workers at the project site.

1.4 VERNAL CITY AND VERNAL CITY REPRESENTATIVE RESPONSIBILITY

A. Vernal City and their designated representatives are not responsible for site safety, or the means, methods, sequences and operations of construction. The functions are vested solely in the CONTRACTOR.

B. Vernal City and their designated representatives may express specific concerns for health and safety to the CONTRACTOR. If such conditions, for which concerns are expressed, are not immediately corrected, Vernal City or their designated representative may report those conditions to such governmental agency having authority for safety or health.

1.5 GENERAL LIABILITY ADDITIONAL INSURED

A. The CONTRACTOR shall provide certificates of general liability insurance naming the Vernal City and Vernal City representatives as additional insured.

PART 2 – MATERIALS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Traffic control requirements.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ASTM D 4956: Retroreflective Sheeting for Traffic Control.

B. Instructions to Flaggers. Publication of UDOT.

C. Work Zone Traffic Control Guide: Publication of the Utah LTAP Center.

D. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

1.4 SUBMITTALS

A. Traffic control plan within 10 days prior to the start of work.

B. Flagger or traffic control technician certificates when requested by the Vernal City representative, or by Vernal City.

1.5 TRAFFIC CONTROL PLAN

A. Create a traffic control plan using the following resources. Resolve discrepancies between resources in descending order shown.
   1. As required by Vernal City.
   2. MUTCD.
   3. Work Zone Traffic Control Guide.
   4. ATSSA.

B. Include the following documentation as part of the traffic control plan.
   1. Written description of phasing.
   2. Drawing showing phasing (if required for clarity).
   3. Drawing showing placement of traffic control devices.

C. Notify private and public agencies affected by the proposed construction, coordinate required adjustments, and arrange for all necessary adjustments of utilities within or adjacent to the limits of construction according to Section 01 31 13.

D. Show how to move pedestrians through or around the Work site, including ADA requirements.

E. Show how to handle signalized intersections.

F. Meet grade, slope and protection requirement of the Americans with Disabilities Act (ADA).

G. The CONTRACTOR shall not begin work until the Traffic Control Plan has been approved by Vernal City.

H. Traffic control and all signs for traffic control, work control, public notification or safety shall be provided by the CONTRACTOR as incidental to construction.

I. Local Access:
   1. The Traffic Control Plan shall allow for local traffic access during the project. The CONTRACTOR shall make provision for local access to homes, businesses and driveways during both working and non-working hours. Particular attention shall be made to accommodate handicapped and aged residents and maintain access to their property during construction.
   2. Access to retail and commercial businesses shall be maintained during construction by whatever means possible. The CONTRACTOR shall arrange with retail and commercial businesses for maintaining access by only blocking part of the access at a time, or providing alternative means of access during construction.

J. Channelization: Adequate warning, delineation, and channelization shall be provided where appropriate to assist in guiding road users in advance of and through the work zone by using proper pavement markings, signing, or other devices which are effective under varying conditions of light and weather.

K. Monitoring Changing Conditions: work zones shall be carefully monitored under varying conditions of traffic volume, light, and weather, to ensure that traffic control measures are operating effectively and that all applicable devices used are clearly visible, clean, in good repair and in substantial compliance with the Traffic Control Plan and MUTCD.

L. The approved Traffic Control Plan shall be available at the job site and shall be presented upon the request of the Vernal City representative.

1.6 TRAFFIC CONTROL TECHNICIAN

A. Certified by ATSSA or AGC.
   1. The CONTRACTOR shall designate a Traffic Control Supervisor, who will be available 24 hours per day, 7 days per week to respond to traffic control problems. The CONTRACTOR will provide Vernal City with the name, address, and telephone number of the Traffic Control Supervisor at least five (5) working days prior to the beginning of the work.
   2. The Traffic Control Supervisor must respond within one (1) hour of being notified by Vernal City concerning a traffic control issue or Vernal City may correct the problem and charge the CONTRACTOR for the work required to solve the problem.

1.7 FLAGGER

A. Certified by ATSSA, AGC or UDOT.

B. Equipment: MUTCD/UDOT latest requirements
   1. 24” x 24” “Stop/Slow” sign with 8" lettering.
   2. 6” to 8” long red wand for night flagging.
   3. Light plant for night flagging.

C. Clothing: MUTCD/UDOT latest requirements
   1. Clothed; full length pants and long or short sleeved shirt.
   2. Hard toed shoes.
   3. Orange, red-orange hardhat and vest.
   4. Night clothing to be reflectorized type 3 and 10" of retroreflective marking on hard hat.
   5. Day time clothing shall be reflectorized type 2.

D. Personal items:
   1. Personal vehicle shall be kept minimum of 100 feet from flagging station.
   2. Flagging station shall be free of clutter.

PART 2 — PRODUCTS

2.1 PAVEMENT MARKINGS, SIGNS, BARRICADES

A. MUTCD.
   1. All traffic control devices used on street and highway construction, maintenance or utility operations, shall conform to the applicable standards and guidelines of the current edition of the MUTCD and addendums. All work within State Highways shall also be permitted and coordinated with UDOT and meet UDOT requirements.

B. Channelizing Devices: Crash worthy plastic cones, drums and barricades.

C. Reflective Sheeting: ASTM D 4956.

D. Pavement Markings: Section 32 17 23.

PART 3 – EXECUTION

3.1 FLAGGING

A. MUTCD.
   1. Flagging should be employed any time all other methods of traffic control are inadequate or inappropriate to warn and direct drivers, or as directed by Vernal City.

3.2 TRAFFIC CONTROL DEVICES

A. Install before work activities begin.

B. Maintain to ensure proper, continuous function.

C. Remove when no longer needed.
   1. All traffic control devices shall be removed as soon as practical when no longer needed.
   2. When work is suspended for short periods of time:
      a. Advance warning signs which are no longer appropriate shall be removed, covered, or turned 180 degrees and upside down. Signs that are turned or covered must have a retroreflective chevron pattern.
      b. Other inappropriate devices shall be removed from the temporary traffic control zone.

3.3 ROAD CLOSURES

A. Roads shall not be closed merely for the convenience of the CONTRACTOR, but shall be closed only when all other options for maintaining at least one lane of traffic open are shown to be impossible.

B. Roads shall only be closed by express written permission from Vernal City.

END OF SECTION

SECTION 01 57 00
TEMPORARY CONTROLS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Requirements for controlling surface and subsurface environmental conditions at the construction site, and related areas under the responsibility of the CONTRACTOR.

B. Requirements for removal of physical evidence of temporary controls upon completion of the Work.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. See Section 01 75 01 Surface Utility Crossings for additional controls.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Temporary Materials: CONTRACTOR'S choice.

PART 3 — EXECUTION

3.1 NOISE CONTROL

A. Use equipment that is equipped with noise attenuation devises. Comply with local Laws and Regulations.

B. Construction noise in residential areas is prohibited between the hours of 9:00 pm and 7:00 am and on weekends except in the case of urgent necessity in the interest of public health and safety, and then only with express written permission from Vernal City.

3.2 DUST AND MUD CONTROL

A. Provide suitable equipment to control dust or air pollution caused by construction operations.

B. Provide suitable mud and dirt containment, so Work site, access roadways and properties adjacent to the Work site are kept clean.

3.3 SURFACE WATER CONTROL

A. Control all on-site surface water. Provide proper drainage so flooding of the site or adjacent property does not occur.

B. Provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the site.

C. Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of Work site area.

D. Provide berms or channels as necessary to prevent flooding or saturation of the subgrade. Promptly remove all water collecting in depressions.

E. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

3.4 GROUND WATER CONTROL

A. Provide a dewatering system sufficient to maintain Excavations and foundations dry and free of water on a 24 hour basis.

B. Remove all dewatering facilities when no longer required.

D. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

3.5 POLLUTION CONTROL

A. Soil: Prevent contamination of soil from discharge of noxious substances (including engine oils, fuels, lubricants, etc.) during construction operations. Excavate and legally dispose of any such contaminated soil off-site, and replace with acceptable compacted fill and topsoil.

B. Water: Prevent disposal of wastes, effluent, chemicals, or other such substances adjacent to or into streams, waterways, sanitary sewers, storm drains, or public waterways. Perform any emergency measures that may be required to contain any spillage.
1. The CONTRACTOR shall comply with all applicable rules and regulations of the Utah Department of Environmental Quality.

C. Air: Control atmospheric pollutants.
1. The CONTRACTOR shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of any legally constituted authority. The CONTRACTOR shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water, or other means as necessary.
2. The CONTRACTOR shall apply water for dust control as directed to ensure traffic safety, to reduce dust nuisance to adjacent property, and to allay dust in crusher and pit operations and on roads used to haul materials. The CONTRACTOR shall wet the project a minimum of twice a day for dust control or more frequently if dusty conditions persist after two applications of water. The use of water, in amounts which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.
3. The CONTRACTOR shall comply with the Utah administrative Code R307-309 Nonattainment and Maintenance Areas for PM10: Fugitive Emissions and Fugitive Dust, as in effect February 1, 2006, or the latest amendment thereof currently in effect.

`` D. Solid Waste: Construction debris, rubbish, and all other solid waste shall be hauled to a public landfill which has been approved by the Utah Department of Environmental Quality

E. Hazardous Waste: Hazardous waste, including contaminated soils and asphalt, shall be disposed of in accordance with rules and regulations of the Utah Department of Environmental Quality

3.6 EROSION CONTROL

A. Use measures such as berms, dikes, dams, sediment basins, fiber mat netting, gravel, mulches, slopes, drains and other erosion control devices or methods to prevent erosion and sedimentation.

B. Provide construction and earthwork methods which control surface drainage from cut, fill, borrow, and waste disposal areas, to prevent erosion and sedimentation.

C. Inspect earthwork during execution to detect any evidence of the start of erosion. Apply corrective measures as required.

3.7 SITE MAINTENANCE

A. The CONTRACTOR shall keep the work site clean and free from rubbish and debris. Materials and equipment

shall be promptly removed from the site when they are no longer necessary. Upon completion of the work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

END OF SECTION

SECTION 01 57 01
SURFACE UTILITY CROSSINGS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Requirements for pedestrian/ADA utility crossings.

B. Requirements for vehicle utility crossings.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Temporary Materials: CONTRACTOR'S choice.

B. Manufactured Pipe Crossing Devices: CONTRACTOR'S choice.

PART 3 — EXECUTION

3.1 Pedestrian Crossings

A. If Temporary Materials are to be used:
   1. Crossing must be a minimum of 4 feet wide.
   2. All ADA requirements must be met. Including requirements for ramps, landings, slopes, etc.
   3. Crossing must be finished with a hard surface pavement.

B. If Manufactured Pipe Crossing Device is to be used:
   1. All ADA requirements must be met.

3.2 Vehicle Crossings

A. If Temporary Materials are to be used:
   1. Crossing must be a minimum of 20 feet wide if within 75 feet of the middle of an intersection. A 12-foot minimum crossing maybe used for each direction of travel if not within 75 feet of an intersection. A single 20-foot minimum crossing may be used for two way traffic instead of two 12-foot crossings.
   2. Crossing must be finished with a hard surface pavement.
   3. The Approach and departure ramp must have a maximum slope of 1:12, the crossing must also have a landing a minimum of 5 feet long.

B. If Manufactured Pipe Crossing Device is to be used:
   1. Crossing must be a minimum of 20 feet wide if within 75 feet of the middle of an intersection. A 12- foot minimum crossing maybe used for each direction of travel if not within 75 feet of an intersection. A single 20-foot minimum crossing may be used for two way traffic instead of two 12-foot crossings.

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND PROTECTION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Storage, handling and protection of products to be incorporated in the Work.

1.2 SUBMITTALS

A. Submit a copy of written permission if property other than Vernal City's is used to store materials or equipment.

1.3 STORAGE

A. Store products immediately on delivery, per manufacturer's instructions, with seals and labels intact and legible.

B. Store products subject to damage by elements in weather-tight enclosures.
   1. Maintain temperatures within ranges required by manufacturer's instructions.
   2. Provide humidity control for sensitive products, as required by manufacturer's instructions.
   3. Store unpacked products on shelves, in bins or in neat piles, accessible for Inspection.

C. Provide substantial platforms, blocking or skids to support fabricated products above ground, to prevent soiling or staining. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

D. Store loose granular materials on solid surfaces to prevent mixing with foreign matter. Provide surface drainage to prevent flooding or ponding of rainwater. Prevent mixing with refuse or injurious materials. Do not store construction materials and equipment in municipal rights-of-way for more than 5 days.

E. Arrange storage in manner to provide easy access for Inspection.

1.4 STORAGE ON SIDEWALK, CURB AND GUTTER

A. Do not remove, block, or otherwise render sidewalks unusable by either the storage of construction equipment or materials or construction procedures used, unless a safe, usable, alternate walkway meeting current ADA requirements and at least 4 feet wide is provided.

B. Maintain curb and gutter clean and clear of debris, dirt, or excavated materials at all times.

1.5 MAINTENANCE OF STORAGE

A. Maintain periodic system of Inspection of stored products on scheduled basis to assure that:
   1. State of storage facilities is adequate to provide required conditions.
   2. Required environmental conditions are maintained.
   3. Surfaces of products exposed to elements are not adversely affected.

B. Any weathering of products, coatings and finishes is not acceptable.

1.6 STORAGE AREA RESTORATION

A. Remove all plant, equipment and stockpiles from the Work.

B. Restore all storage areas and service roads to prior condition without any additional cost to Vernal City.

1.7 PROTECTION

A. Installed Product: Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion and acceptance of Work.

B. Finished Surfaces: Provide coverings to protect finished surfaces from damage.
   1. Cover projections, wall corners, jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent work.
   2. Protect finished floors and stairs from dirt and damage.
      a. In areas subject to foot traffic, secure heavy paper, sheet goods, or other materials in place.
      b. For movement of heavy products, lay planking or similar materials in place.
      c. For storage of products, lay tight wood sheathing in place.
      d. Cover walls and floor of elevator cars, and unprotected surfaces of car doors when used by construction personnel.

C. Waterproofed and roofed surfaces:
   1. Prohibit use of surfaces for traffic of any kind, and for storage of any products.
   2. When some activity must take place in order to carry out the Work, obtain recommendations of Supplier and installer for protection of surface.
      a. Install recommended protection and remove on completion of that activity.
      b. Restrict use of adjacent unprotected areas.

D. Security: Provide security for materials, equipment and tools. Vernal City will not protect Work from vandalism.

1.8 PROTECTION OF LAWNS AND LANDSCAPING

A. Protect planted lawn and landscaped areas from pedestrian and vehicular traffic.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION (Not Used)

END OF SECTION

SECTION 01 74 13
PROGRESS CLEANING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Cleaning and disposal of waste materials, debris, and rubbish.

B. Cleaning of Work prior to Final Inspection.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Prior to Project Closeout: Certificate of disposal of Hazardous Waste if applicable.

1.4 JOB CONDITIONS

A. On Site Burning: Not permitted.

PART 2 — PRODUCTS

2.1 CLEANING MATERIALS

A. Use only materials which will not create hazards to health or property, and which will not damage surfaces.

B. Use only cleaning materials recommended by manufacturer of item being cleaned.

PART 3 — EXECUTION

3.1 CLEANING DURING CONSTRUCTION

A. Initiate and maintain a specific cleaning program to prevent accumulation of debris. Maintain areas under control of the CONTRACTOR free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition.

B. Provide covered containers for the deposit of debris and rubbish.

C. Periodically clean interior areas to provide suitable conditions for finish work.

D. Remove debris and rubbish from closed or remote spaces prior to closing the space.

E. Broom clean interior areas prior to the start of surface finishing, and continue cleaning on an as-needed basis.

F. Control cleaning operations so that dust and other particulate will not adhere to wet or newly-coated surfaces.

3.2 DISPOSAL DURING CONSTRUCTION

A. Regularly remove and legally dispose of waste materials, debris, and rubbish from site.

B. Provide additional collections and disposal of debris whenever the periodic schedule is inadequate to prevent accumulation.

3.3 CLEANING PRIOR TO FINAL INSPECTION

A. Site:
   1. Clean exposed-to-view surfaces.
   2. Remove waste, debris, and surplus materials from site.
   3. Clean grounds; sweep clean paved areas.
   4. Rake clean other surfaces.

B. Building:
   1. Clean interior and exterior exposed-to-view surfaces.
   2. Remove temporary protection and labels not required to remain.
   3. Clean finishes free of dust, stains, films and other foreign substances.
   4. Clean transparent and glossy materials to a polished condition. Polish reflective surfaces to a clear shine.
   5. Vacuum clean carpeted and similar soft surfaces.
   6. Clean resilient and hard-surface floors.
   7. Clean surfaces of equipment; remove excess lubrication.
   8. Clean plumbing fixtures to a sanitary condition.
   9. Clean permanent filters of ventilating equipment and replace disposable filters when units have been operated during construction; in addition, clean ducts, blowers, and coils when units have been operated without filters during construction.
   10. Clean lighting fixtures and lamps.
   11. Continue cleaning until acceptance.
   12. Remove waste and debris from roofs, gutters, area ways, and drainage systems.

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Requirements for collecting, maintaining, updating, and submitting Record Documents.

1.2 DEFINITIONS

A. Record Documents: Those documents maintained and annotated by the CONTRACTOR during construction for the purpose of recording the "as built" condition of the Work.

B. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs starting with a series of photographs before the start of any physical construction, and continuing for as long as the Work progresses.
   1. In digital format of 7 Megapixels or greater for each photograph, or size approved by the Vernal City representative, showing the regular progress of the Work. Provide not less than 12 exposures of different subjects or angles of view each time from different locations in the Project area at intervals not exceeding one month.
   2. On each photograph indicate the date, job title, photograph identification, and direction the camera was facing.
   3. Deliver photographs with each request for payment.
   4. Upon completion of the Work, submit all photographs on a disk. The Vernal City representative may request an additional 10 copies of the project photographs.

B. Secure the Vernal City representative's approval if a video tape is to be substituted for the photographs.

1.4 DOCUMENTS ON SITE

A. Keep at job site 1 copy of each of the following, if issued for the Work.
   1. Contract Drawings.
   2. Project Manual.
   3. Addenda.
   4. Reviewed Shop Drawings, Product Data and Samples.
   5. Modifications to the Contract Documents.
   6. Field test records.
   7. Inspection certificates.
   8. Manufacturer's certificates.
   9. Survey documentation.

B. Do not use Record Documents for construction purposes.

C. Store Record Documents in a location, apart from documents used for construction.

D. Maintain Record Documents in a clean, dry, legible condition.

E. Provide adequate files and racks for storage of Record Documents that will allow ready access for review and updating.

F. Make Record Documents available at all times for review and Inspection by the Vernal City representative.

1.5 MARKING DEVICES

A. Red colored waterproof for all marking unless requested otherwise.

1.6 RECORDING

A. Clearly and legibly label each document "PROJECT RECORD".

B. Number Record Documents in a manner which will allow ready retrieval of documents and allow indexing of documents for submittal to Vernal City representative.

C. Update Record Documents as work occurs to show the current status of the Work.

D. Do not permanently cover or conceal any work until all required information has been recorded on the Record Documents.

E. Contract Drawings: Legibly mark contract Drawings to record following actual construction information.
   1. Measured depths of various elements of foundation or finish grading in relation to finish floor datum or other permanent benchmark.
   2. Measured horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   3. Measured location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of construction.
   4. Field changes of dimension and detail.
   5. Changes made by contract Modifications.
   6. Details not contained in original contract Drawings.

F. Project Manual and Addenda: Legibly update each to record:
   1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
   2. Changes made by contract Modifications.
   3. Other technical matters and details included in the Work, but not originally specified.

G. Shop Drawings: Maintain reviewed Shop Drawings as Record Documents; legibly annotate drawings to record changes made to Shop Drawings.

H. Product Data and Samples: Maintain reviewed product data and samples as Record Documents; update and document any variations from the reviewed product data and samples after acceptance.

1.7 SUBMITTAL OF DOCUMENTS

A. At the completion of the Work, submit all Record Documents to Vernal City.

B. Accompany the submittal with a transmittal letter, in duplicate, containing:
   1. Submittal date.
   2. Project title and number.
   3. CONTRACTOR'S name and address.
   4. Title and number of each Record Document.
   5. Certification that each document as submitted is complete and accurate.
   6. Signature of CONTRACTOR, or CONTRACTOR'S authorized representative.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION (Not Used)

END OF SECTION

Division 02

Existing Conditions

SECTION 02 41 14
PAVEMENT REMOVAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Removal of roadway Pavement.

B. Milling roadway Pavement.

C. Removal of curb, gutter, sidewalk, Driveway Approach, waterway, or similar flatwork.

D. Disposal of removed materials.

1.2 RELATED WORK

A. Demolition of structures and utilities.

1.3 DEFINITIONS

A. ADA: Americans with Disabilities Act.

1.4 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

1.5 SITE CONDITIONS

A. Control dust, Section 01 57 00.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION

3.1 PREPARATION

A. General:
1. Coordinate utility location, Section 01 31 13.
2. Preserve all active utilities.
3. Notify neighborhood of day and time of operation.
4. Make sure invert covers are properly installed in storm drain and sanitary sewer systems.
5. Mark existing utilities on redline drawings.

B. Traffic Control: Provide worker and public safety, Section 01 55 26.

C. Tree Roots:
1. Avoid or minimize damage to tree roots. Roots provide anchorage, storage of energy, and absorption and conduction of water and mineral elements. Loss of root connection affects health and stability of tree and safety of people and property.
2. Provide certified arborist observation of root cuts larger than 4 inches diameter. Notify the Vernal City representative of such root cut.

D. Existing Surfaces:
1. Do not damage adjacent concrete surfaces that are not scheduled for removal.
2. Use rubber cleats or Pavement pads when operating backhoes, outriggers, track equipment, or any other equipment on or crossing paved surfaces.

3. Restore paved surfaces that are damaged by removal operations at no additional cost to the OWNER. Match the existing Pavement surface plus 1 inch.

3.2 SAW-CUT PEDESTRIAN TRIP HAZARDS

A. Make saw cuts 1:8 slope measured to grade.

B. Eliminate trip hazards across the full width of the hazard.

3.3 SAW-CUT CURB HORIZONTALLY

A. Saw cut curbs for ADA ramps at 1:12 slope. No trip hazard at gutter flow line.

B. Saw cut curbs for flares:
   1. 1:4 slope measured to grade, or
   2. 1:12 slope measured horizontally when complying with ADA.

3.4 REMOVE PORTLAND CEMENT CONCRETE

A. Remove concrete to the nearest expansion joint or vertical saw cut.

B. Make concrete cuts straight, vertical to the surface, true, full depth.

C. DO NOT use machine mounted impact hammers.

3.5 REMOVE ASPHALT CONCRETE

A. Saw cut full depth and remove Pavement.

B. When asphalt concrete overlays Portland cement concrete Pavements do not use a machine mounted impact hammer.

3.6 MILLING

A. Machine:
   1. Equipped to prevent air pollution.
   2. Equipped with a system to control slope of mill cut.

B. Tolerances:
   1. Milling Depth: As indicated plus or minus 10 percent not uniformly high or uniformly low.
   2. Striation Texture: Uniform, discontinuous, longitudinal, 3/16 inch deep maximum, 3/4 inch center to center.
   3. Smoothness: Plus or minus 5/16 inch in 25 feet.
   4. Cross Slope: Plus or minus 1/4 inch in 10 feet.

C. Performance:
   1. Lower utility frames, covers, and other Street Fixtures.
   2. Mill surfaces to the depth shown on the Drawings or indicated by VERNAL CITY REPRESENTATIVE. Do not disfigure adjacent work or existing surface improvements.
   3. If milling exposes smooth underlying Pavement surfaces, mill the smooth surfaces to make them rough.
   4. Mill off material if it ponds water or if it has been damaged by water.
   5. Where vehicles or pedestrians must pass over milled edges provide safe temporary ramps suitable to speed of user vehicles (or suitable for wheel chair user needs).
   6. Remove excess material and clean milled surfaces.
   7. If work equipment is removed from the milling site and milled surface awaits further work, provide appropriate traffic control and cleaning.

3.7 GRINDING

A. Machine:
   1. Cutting head 36 inches wide minimum.
   2. 50 to 60 diamond blades per foot of head.

B. Preparation:
   1. Control traffic.
   2. Provide water truck, waste truck, and other support machinery.
   3. Mark areas to be ground.

C. Tolerances:
   1. 1/4 inch lip transverse to the direction of vehicular travel. Potential for ponding not allowed.
   2. 1/8 inch lip (or dent) parallel to direction of vehicular travel.
   3. Taper ground areas from the lane/shoulder line into the shoulder area at 1/4 inch per foot.

D. Performance:
   1. Skid resistance of final ground surface must be comparable to adjacent sections not requiring corrective work.
   2. Surface treatement of ground areas.
      a. Asphalt Concrete: Asphalt tack coat and sand blotter, Section 32 12 14.
      b. Hydraulic Concrete: Water repellant, Section 07 19 00.
   3. Waste grindings legally.
   4. Protect downstream fish habitat.

3.8 CLEANING

A. Remove all debris and concrete dust. Clean surrounding rails, sidewalks, Driveways, landscaping and other objects in vicinity of work.

END OF SECTION

SECTION 02 41 15
PAVEMENT PULVERIZING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Full depth reclamation.

B. Stabilizer selection guide.

1.2 REFERENCES

A. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM C 150: Standard Specification for Portland Cement.

C. ASTM D 558: Standard Test Methods for Moisture-Density Relations of Soil-Cement Mixtures.

D. ASTM C 595: Standard Specifications for Blended Hydraulic Cement.

E. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

F. ASTM D 2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

G. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

H. ASTM D 4832: Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders.

1.3 SUBMITTALS

A. List of equipment to be used.

B. Mix design showing percentage and quantity of stabilizer needed.

C. Traffic control plan; Section 01 55 26.

1.4 SITE CONDITIONS

A. Section 01 57 00; control dust.

1.5 ACCEPTANCE

A. Gradation: Random measure.

B. Depth: Random measure each 1,000 square yards.

C. Density: Nuclear gage or proof roll.

D. Quantity of stabilizer added matches submittal data.

PART 2 — PRODUCTS

2.1 TACK COAT CURING COMPOUND

A. Cationic or anionic emulsified asphalt, Section 32 12 03.

2.2 STABILIZER

A. Cement:
   1. Type I or II, ASTM C 150, or
   2. Type IP or IS; ASTM C 595.

B. Aggregate: Gravel, untreated base course, crushed Portland cement concrete.

C. Chemical Stabilizer: Use type allowed by VERNAL CITY REPRESENTATIVE.

2.3 MIX DESIGN

A. Gradation ASTM C 136.

Sieve	Percent Passing by Weight
3”	100
1”	85 to 95
No. 4	45 maximum

B. Stabilizer: Use the following table as a guide.

Table 1 – Stabilizer Selection Guide	
Characteristics of Reclaimed Aggregate Before Addition of Stabilizer	*Stabilizer*
Asphaltic binder content greater than 15 percent	Aggregate
More than 45 percent of material passes No. 4 sieve	Aggregate or Cement
Plasticity Index (ASTM D4318) for material passing No. 4 sieve is more than 10	Cement

1. Unless specified otherwise, cement stabilization per ASTM D 4832 is to be in the range of 300 to 800 psi at 7 days.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Capable of cutting to the required depth, pulverizing, and sizing the material.

3.2 PREPARATION

A. Identify location of all buried utilities.

B. Notify neighborhood of day and time of operation.

C. Set traffic control devices.

D. Install invert covers.

E. Lower Street Fixtures.

F. Determine need for stabilizer.

3.3 CONSTRUCTION

A. Pulverize full depth. Do not remove excess material until full depth pulverizing is complete.

B. Remove excess material.

C. Pulverize a second time if stabilizer is required.

D. Shape, grade, roll, compact.

E. Cure stabilized material with water or asphalt tack coat.

3.4 FIELD QUALITY CONTROL

A. Reclaimed Aggregate: 96 percent minimum compaction using
   1. Optimum water content and maximum density, ASTM D 558, and
   2. Nuclear gage shallow depth, ASTM D 2922.

B. Stabilized Reclaimed Aggregate: Proof roll (prior to cement set).

3.5 REPAIR

A. Repair surface irregularities.

B. Seal cracks in cured stabilized material.

END OF SECTION

SECTION 02 41 19
SELECTIVE BUILDING DEMOLITION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Removal of building components.

1.2 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain Vernal City's property unless indicated otherwise by the Vernal City representative.

B. Remove and Salvage: Items indicated to be removed and salvaged remain Vernal City's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Vernal City's designated storage area.

C. Remove and Reinstall: Remove items indicated. Clean, service, and otherwise prepare them for re- use. Store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Vernal City representative, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.3 PROJECT CLOSEOUT

A. Record removals on Drawings. Submit record documents, Section 01 78 39.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION

3.1 PREPARATION

A. Survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition.

B. All furnishing, accessories, equipment, etc. that are to be removed from site shall remain the property of Vernal City. The Vernal City representative shall determine appropriate action for property in question.

C. If portions of the building immediately adjacent to selective demolition area are occupied, conduct selective demolition so the occupant's operations will not be disrupted. Provide not less than 72 hours' notice to the occupant of activities that will affect the occupant's operations. 72 hour notifications shall be submitted to the Vernal City representative.

D. Vernal City assumes no responsibility for actual condition of buildings to be selectively demolished.

3.2 DEMOLITION

A. Comply with Laws and Regulations before, during, and after selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Photograph or videotape existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

C. Storage or sale of removed items or materials on site will not be permitted.

END OF SECTION

Division 03

Concrete

SECTION 03 11 00
CONCRETE FORMING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete.

B. Openings in formwork for other affected work.

C. Form accessories such as snap ties, bracing, etc.

D. Stripping formwork.

1.2 REFERENCES

A. ACI 347: Recommended Practice for Concrete Formwork.

1.3 DEFINITIONS

A. Shoring: The activity to support formwork.

B. Reshoring: The activity to reduce the amount of formwork supporting concrete elements. As concrete sets and strength increases, less need for formwork occurs gradually until concrete becomes free standing.

C. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.4 SUBMITTALS

A. Shop Drawings: Fabrication and erection drawings of forms for specific finished concrete surfaces, as indicated. Show general construction of forms, jointing, special joints or reveals, location and pattern of form tie placement, and other items affecting exposed concrete visibility.

B. Form Release Agent: Where concrete surfaces are scheduled to receive special finishes or applied coverings which may be affected by agent submit manufacturer's instructions for use of agent.

1.5 QUALITY ASSURANCE

A. Designer's Qualifications: Structural professional engineer who complies with Utah licensing law, has experience in concrete formwork, and is acceptable to the authority having jurisdiction.

B. Design Forms:
1. With sufficient strength to maintain finished tolerances indicated in Section 03 35 00, to support loads, pressures, and allowable stresses as outlined in ACI 347 and for design considerations such as wind loads, allowable stresses, and other applicable requirements of local Laws and Regulations.
2. To permit easy removal.
3. For required finishes.

C. The design, engineering, and construction of formwork is the responsibility of the CONTRACTOR.

1.6 JOB CONDITIONS

A. For reference purposes, establish and maintain sufficient control points and bench marks to check tolerances. Maintain in an undisturbed condition and until final completion and acceptance of Work.

B. Regardless of tolerances specified, allow no portion of Work to extend beyond legal boundaries.

1.7 FIELD SAMPLES

A. Prepare field samples and submit to Vernal City representative.

B. Construct and erect sample formwork panel for architectural concrete surfaces receiving special treatment or finish as a result of formwork. Formwork is to include vertical and horizontal form joints and typical rustication joints when required.

C. Size panel to indicate special treatment or finish required, including form release agent.

D. Remove formwork after casting concrete.

1.8 ACCEPTANCE

A. Secure Vernal City representative inspection of form layout for concrete flat work.

PART 2 — PRODUCTS

2.1 FORM MATERIALS

A. Faced with material which will produce smooth and uniform texture on concrete, unless indicated otherwise.

B. Arrange facing material orderly and symmetrical, keeping number of seams to a minimum.

C. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.

2.2 FORMWORK ACCESSORIES

A. Form Ties:
1. Use ties constructed so that end fasteners can be removed without spalling concrete faces.
2. After end fasteners of ties have been removed, embedded portion of ties are to terminate not less than 2 times the diameter or thickness of the fasteners from formed faces of concrete, but in no case greater than 3/4 inch.
3. When the formed face on concrete is not exposed, form ties may be cut off flush with formed surfaces. Use ties with 3/4 inch diameter cones on both ends or an approved equal for water retaining structures.

B. Premolded Expansion Joint Filler: Unless indicated otherwise, provide Type F1, Section 32 13 73.

C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, impair natural bonding or color characteristics of concrete. To prevent contamination, agents used on potable water structures are subject to review by VERNAL CITY REPRESENTATIVE prior to use.

D. Fillets for Chamfered Corners: Wood strips 1 inch x 1 inch size,maximum length possible.

PART 3 — EXECUTION

3.1 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 FORM CONSTRUCTION

A. Make forms sufficiently tight to prevent loss of concrete.

B. Unless indicated otherwise, place chamfer strips in corners of forms to produce beveled edges on permanently

exposed exterior corners.

C. To maintain specified finish tolerances, camber formwork to compensate for anticipated deflections.

D. Provide positive means of adjustment using wedges, jacks, Shores, and struts to take up all settlement during concrete placing operation.

E. Provide temporary ports in formwork to facilitate cleaning and Inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. At construction joints, overlap forms over hardened concrete at least 6 inches. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.

G. Construct wood forms for wall openings to facilitate loosening, or counteract swelling.

H. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.

I. Anchor formwork to Shores, supporting surfaces or members to prevent upward or lateral movement and deflection of any part of formwork system during concrete placement.

J. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing.

K. Position expansion joint material and other embedded items accurately and support to prevent displacement.

L. To prevent entry of concrete, fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material.

M. For architectural concrete, limit deflection of facing materials between studs as well as deflection of studs and walers to 0.0025 times span.

N. For underground concrete work, do not use soil walls for forming unless authorized by VERNAL CITY REPRESENTATIVE.

3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings for elements embedded in or passing through concrete.

B. Coordinate work of other sections for the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install accessories per manufacturer's instructions. Ensure items are not disturbed during concrete placement.

3.4 FORM FINISHES

A. Use forms with smooth rubbed, scrubbed, sand floated finishes that meet ACI 347 unless indicated otherwise.

B. For As-cast Finishes:
   1. Install form panels in orderly arrangement with joints planned in approved relation to building elements.
   2. Where panel joints are recessed or otherwise emphasized, locate form ties within joints, not within panel areas.
   3. Where an as-cast finish is required, no grouting will be permitted in the finishing operation.

C. Textured Finishes: As indicated.

3.5 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent on formwork per manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.6 FORM REMOVAL

A. Do not pry against face of concrete. Use only wooden wedges.

B. When repair of surface defects or finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.

C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.

D. Loosen wood forms for wall openings as soon as it can be accomplished without damage to concrete.

E. Formwork for columns, walls, sides of beams, and other members not supporting the weight of concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal.

F. Where no Reshoring is planned, leave forms and Shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength.

G. Where Reshoring is planned, supporting formwork may be removed when concrete has reached 70 percent of specified strength, provided Reshoring is installed immediately.

H. When Shores and other vertical supports are so arranged that non-load carrying, form-facing material may be removed without loosening or disturbing Shores and supports, facing material may be removed at an earlier age as directed.

3.7 RESHORING

A. When Reshoring is permitted or required, plan operations in advance and obtain approval.

B. During Reshoring do not subject concrete in beam, slab, column, or any other structural member to combined dead and construction loads and live loads in excess of loads permitted for developed concrete strength at time of Reshoring.

C. Place Reshores as soon as practical after stripping operations are complete, but in no case later than end of working day on which stripping occurs.

D. Tighten Reshores to carry required loads without over-stressing.

E. Leave Reshores in place until the concrete being supported has reached its specified strength.

F. For floors supporting Shores under newly placed concrete, level original supporting Shore or Reshore.
   1. Reshoring system shall have a capacity to resist anticipated loads in all cases equal to at least 1/2 the capacity of the Shoring system.
   2. Unless otherwise specified locate Reshores directly under a Shore.
   3. In multistory buildings, extend Reshoring through a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads in such a manner that design loads of floors and supporting Shores are not exceeded.

G. Design, engineering, and construction of Shoring and Reshoring is the responsibility of the CONTRACTOR.

3.8 REMOVAL STRENGTH

A. When removal of formwork or Reshoring is based on concrete reaching a specified strength, it shall be assumed

that concrete has reached this strength when either of the following conditions has been met:

1. When test cylinders, field cured along with the concrete they represent, have reached the specified strength.
2. When concrete has been cured per Section 03 39 00 for the same length of time as the site-cured cylinders that reached specified strength. Determine the length of time the concrete has been cured in the structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature is above 50 deg. F. and concrete has been damp or sealed from evaporation and loss of moisture.

3.9 REUSE OF FORMS

A. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of concrete surface.

B. Thoroughly clean and properly coat forms before reuse.

3.10 FIELD QUALITY CONTROL

A. Before commencing a pour, verify connections, form alignment, ties, inserts and Shoring are placed and secure.

B. Observe formwork continuously while concrete is being placed to verify that the forms are plumb and there are no deviations from desired elevation, alignment, or camber.

C. If during construction any weakness develops and false-work shows undue settlement or discoloration, stop work, remove affected construction if permanently damaged, and strengthen false-work.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.

B. Support chairs, bolsters, bar supports, and spacers for supporting reinforcement.

1.2 REFERENCES

A. AASHTO M 254: Standard Specification for Corrosion Resistant Coated Dowel Bars.

B. ACI 301: Specifications for Structural Concrete for Buildings.

C. ACI 315: Details and Detailing of Concrete Reinforcement.

D. ASTM A 82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

E. ASTM A 185: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

F. ASTM A 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

G. ASTM A 706: Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

H. ASTM C 1116: Standard Specification for Fiber-Reinforced Concrete and Shotcrete.

I. ASTM D 3963: Standard Specification for Epoxy-Coated Reinforcing Steel.

J. AWS D1.1: Structural Welding Code Steel.

K. AWS D1.4: Structural Welding Code Reinforcing Steel.

L. CRSI Document: Manual of Standard Practice.

1.3 SUBMITTALS

A. Manufacturer's Certificate: Submit mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis.

B. Welder's certification.

C. Shop Drawings.
   1. Indicate sizes, spacings, locations, and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting, and spacing devices.
   2. When required, prepare shop drawings by an engineer who complies with Utah licensing law and is acceptable to agency having jurisdiction.

1.4 QUALITY ASSURANCE

A. Perform concrete reinforcement work per CRSI Manual of Standard Practice.

B. Comply with ACI 301.

C. Welders: Certified to comply with AWS D1.1 or AWS D1.4 as applicable.

1.5 ACCEPTANCE

A. Unless specified otherwise, chairs for supporting reinforcement in flat slabs are spaced as follows.
   1. 3 feet maximum for No. 5 and smaller bars.
   2. 5 feet maximum for bars larger than No. 5.

B. Dowels are placed on dowel baskets and properly aligned.

C. Epoxy and galvanized coatings are not chipped or cut. Ends of cut bars are epoxy coated or galvanize painted prior to placement.

D. Minimum covering over reinforcement is as specified.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Fiber Reinforcement: ASTM C 1116 glass.

B. Reinforcing Steel: Deformed 60 ksi yield grade steel, ASTM A 615 and supplementary requirements S1 or ASTM A 706 for welding.

C. Welded Steel Wire Fabric: ASTM A 185 plain type in flat sheets or coiled rolls. Dimensions of the mesh 4”x 4” or as indicated.

D. Stirrups: ASTM A 82 steel.

E. Plain Dowel Bars for Expansion Joints: Smooth grade 60 ksi yield grade steel, ASTM A 615,
   1. Galvanized or epoxy coated in roadway Pavements.
   2. Provide metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section. Design caps with 1 end closed.
   3. Provide for movement equal to joint width plus 1/2 inch.
   4. For load transfer bars, paint with 1 coat of paint conforming to AASHTO M 254 and coat 1/2 with grease.

F. Coatings for Corrosion Protection:
   1. Epoxy coat, ASTM D 3963.
   2. Galvanized, Section 05 05 10.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type or an acceptable patented system.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.3 FABRICATION

A. Fabricate reinforcement, ACI 315 providing for concrete cover.

B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.

C. Weld reinforcing bars; with AWS D1.4.

PART 3 — EXECUTION

3.1 PLACING

A. All reinforcement to be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.

B. Place all reinforcement in the exact position indicated. With tie wire, tie bars together at all intersections except where spacing is less than 12 inches in each direction, in which case tie alternate intersections.

C. Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the Work must be approved before concrete is placed.

D. Overlap sheets of metal mesh one square plus 6 inches to maintain a uniform strength. Securely fasten at the ends, edges, and supports to maintain clearances.

E. Flat Slab Work:
   1. Support reinforcing steel of formed flat slabs with metal chairs, precast concrete blocks or other slab bolsters.
   2. Size chairs or bolsters to position the steel in the exact location indicated.
   3. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 5 feet on centers in each direction.
   4. Plastic or epoxy coat that portion of the metal support in contact with the forms to prevent rust.
   5. Tie down deck steel to beams or forms at regular intervals of not more than 5 feet on centers along the beams or forms to prevent movement of the steel during concrete placement.

3.2 SPLICING

A. Furnish all reinforcement in the full lengths indicated unless otherwise permitted. Splicing of bars, except where indicated is not permitted without written approval. Stagger splices where possible.

B. Unless indicated otherwise, overlap reinforcing bars a minimum of 30 diameters to make the splice. In lapped splices, place the bars and wire to maintain the minimum distance for clear spacing to the surface of the concrete.

C. Do not use lap splices on bars greater in diameter than No. 11 unless approved.

D. Weld reinforcing steel only if indicated or if authorized in writing. Weld in conformance to AWS D1.4.

E. Do not bend reinforcement after embedding in hardened concrete.

F. Do not permit reinforcement or other embedded metal items bonded to the concrete, to extend continuously through any expansion joint, except dowels in floors bonded on only one side of joints.

3.3 PLACING EMBEDDED ITEMS

A. Place all sleeves, inserts, anchors and embedded items prior to concrete placement. Temporarily fill voids in embedded items to prevent entry of concrete.

B. Give all trades whose work is related to the concrete section ample notice and opportunity to introduce or furnish embedded items before concrete placement.

END OF SECTION

SECTION 03 30 04
CONCRETE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Material requirements.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

B. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

C. ACI 211.3: Standard Practice for Selecting Proportions for No-Slump Concrete.

D. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete.

E. ACI 301: Specifications for Structural Concrete for Buildings.

F. ACI 305: Hot Weather Concreting.

G. ACI 306: Cold Weather Concreting.

H. ACI 318: Building Code Requirements for Reinforced Concrete.

I. ASTM C 33: Standard Specification for Concrete Aggregates.

J. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

K. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

L. ASTM C 94: Standard Specification for Ready-Mixed Concrete.

M. ASTM C 117: Standard Test Method for Material Finer than 75ì (No. 200) Sieve in Mineral Aggregates by Washing.

N. ASTM C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

O. ASTM C 143: Standard Test Method for Slump of Hydraulic-Cement Concrete.

P. ASTM C 150: Standard Specification for Portland Cement.

Q. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete

R. ASTM C 227: Standard Test Method for Potential Reactivity of Cement-Aggregate Combinations (Mortar Bar Method).

S. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

T. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.

U. ASTM C 289: Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).

V. ASTM C 295: Standard Practice for Petrographic Examination of Aggregates for Concrete.

W. ASTM C 441: Standard Test Method for Effectiveness of Mineral Admixtures or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to The Alkali-Silica Reaction.

X. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.

Y. ASTM C 595: Standard Specification for Blended Hydraulic Cements.

Z. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

AA. ASTM C 1064: Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

BB. ASTM C 1116: Standard Specification for Fiber-Reinforced Concrete and Shot Crete.

CC. ASTM C 1157: Standard Performance Specification for Blended Hydraulic Cement.

DD. ASTM C 1240: Standard Specification for Use of Silica Fume as a Mineral Admixture in Hydraulic Cement Concrete, Mortar, and Grout.

EE. ASTM C 1260: Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

FF. ASTM C 1293: Standard Test Method for Concrete Aggregates by Determination of Length Change of Concrete Due to Alkali-Silica Reaction.

GG. ASTM C 1567: Standard Test Method for Determining the PotentialAlkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).

HH. ASTM C 1602: Standard Specification for Mixing Water Used in The Production of Hydraulic Cement Concrete.

I I. ASTM D 1077: Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

J J. ASTM STP 15-C: Manual on Quality Control of Materials.

1.4 SUBMITTALS

A. Quality Assurance: Submit names, certification levels, and years of experience of testing agency's laboratory and field technicians that are assigned to the Work. Verify laboratory complies with ASTM and ACI standards.

B. Mix Design: Submit.
1. Date of mix design. If older than 365 days, recertify mix design.
2. Cement source, type and chemical composition.
3. Aggregate soundness and potential reactivity.
4. Average Strength (fcr), per quality control chart.
5. Allowable range of slump and air content.
6. Water cement ratio.
7. Proportions of materials in the mix.
8. Unit weight.
9. Analysis of water if water is not potable.
10. Mortar bar test results if a pozzolan is included in the mix.

11. Technical data sheets for additives to be used at the plant and at the job site. Certify additives are compatible with each other.

C. Pre-approved mix design, submit name and address of Supplier.

D. Before changing mix design, submit a new design and give Vernal City Representative 10 days to evaluate the changes.

E. Source Quality Control Inspections and Testing Report: If requested, submit report describing quality control activities and test results from the CONTRACTOR and the Supplier.

1.5 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with ASTM D 1077.

B. Reject concrete that does not meet requirements of this section.

C. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures except as allowed by mix design.

D. Store bagged and bulk cement in weatherproof enclosures. Exclude moisture and contaminants.

E. Prevent segregation and contamination of aggregate stockpiles.

F. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

G. Use of admixtures will not relax hot or cold weather placement requirements.

1.6 ACCEPTANCE

A. Materials:
1. At the Source: Verify aggregate gradation. Determine percent of combined aggregate passing No. 200 sieve.
2. At the Site: Verify mix identification, batch time, slump, air content, and temperature.
3. At the Laboratory: Verify strength in 28 days.

B. Placement:
1. Concrete in general, Section 03 30 10.
2. Pavement, Section 32 13 13 and 32 01 26.
3. Exterior flatwork, Section 32 16 13 or 32 16 14.

C. Defective Material:
1. The CONTRACTOR is to replace all defective material at their own expense.

PART 2 — PRODUCTS

2.1 CEMENT

A. General:
1. Do not use air entraining cement except for hand mixed applications.
2. Do not use cement that contains lumps or is partially set.
3. Do not mix cement originating from different sources.

B. Standard Set Cement:
1. Type II cement per tables 1 and 3 in ASTM C 150, or Type V when necessary, or
2. Low-alkali cement per table 2 in ASTM C 150.

C. Rapid Set Cement: As above and as follows.
   1. Initial set time: 15 minutes minimum.
   2. Color: Acceptable to the Vernal City representative.

D. Blended Hydraulic Cement: The following are the cement equivalencies when substituting blended cement for a portland cement.

Table 1 – Cement Equivalencies		
ASTM C150 (Low Alkali)	*ASTM C595*	*ASTM C1157*
Type I	IP	GU
Type II	IP (MS)	MS
Type III	---	HE
Type IV	---	---
Type V	---	HE

2.2 WATER

A. Clean, non-staining, non-detrimental per ASTM C 1602.

B. Screen out extraneous material.

C. Do not use alkali soil water.

2.3 AGGREGATES

A. Material: Clean, hard, durable, angular, and sound consisting of gravel, crushed gravel, crushed stone, crushed concrete, slag, sand or combination.

B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.
   1. Deleterious Substances and Physical Properties:
      a. Coarse Aggregate: Class designation 4S in table 3 in ASTM C 33.
      b. Fine Aggregate: Table 1 in ASTM C 33. Organic impurities producing a dark color concrete may cause rejection.
   2. Reactivity:
      a. Average prism length change in 12 months in an unmodified ASTM C 1293 test is less than 0.04 percent, or
      b. Average mortar bar length change at 16 days in an unmodified ASTM C 1260 test is less than 0.10 percent, or
      c. Historical data acceptable to VERNAL CITY REPRESENTATIVE, or
      d. Petrographic limits per ASTM C 295.
         I. Optically strained, micro fractured, or microcrystalline quartz: 5.0% maximum.
         ii. Chert or chalcedony: 3.0% maximum.
         iii. Tridymite or cristobalite: 1.0% maximum.
         iv. Opal: 0.5% maximum.
         v. Natural volcanic glass in volcanic rocks: 3.0% maximum.

2.4 ADMIXTURES

A. Calcium Chloride: Not allowed.

B. Air Entrainment: ASTM C 260. For extrusion enhancement use nonvinsal resin.

C. Set Enhancement and Water Reducing Agents: ASTM C 494.
1. Type A: Water reducing.
2. Type B: Set retarding.
3. Type C: Set accelerating.
4. Type D: Water reducing and set retarding.
5. Type E: Water reducing and set accelerating.
6. Type F: High range water reducing (super plasticizer). *
7. Type G: High range water reducing and set retarding. *

* Keep the relative durability factor of water reducing additives not less than 90 and the chlorides content (as Cl-) not exceeding 1 percent by weight of the admixtures.

D. Pozzolan:
1. Natural or fly ash per ASTM C 618.
2. Silica fume per ASTM C 1240.

E. Special Admixtures: Allowed if mix design submittal is accepted.
1. Lithium nitrate based solution for control of reactive aggregates.
2. Calcium nitrite based solution for corrosion protection of reinforced structures subject to chloride-induced corrosion.
3. Shrinkage reducer for controlling drying shrinkage in concrete.
4. Viscosity modifier for enhancement of self consolidating concrete or for workability.

2.5 MIX DESIGN

A. Selection of Cement: ASTM C 150 or C 1157.
1. For sulfate resistance, use Type V portland cement, or Type II with Class F fly ash. Class F fly ash may be used as an addition to Type V portland cement.
2. Do not use fly ash with Type IP(MS) or Type III portland cement.

B. Selection of Aggregates.
1. Maximum Particle Size:
a. 1/5 of narrowest dimension between forms.
b. 1/3 of depth of slab.
c. 3/4 of minimum clear spacing between reinforcing bars.
2. Gradation: ASTM C 33.
a. Coarse Aggregate: Choose from the following grades. Gradations are based upon percent of material passing sieve by weight.

Table 2 – Coarse Aggregates

Sieve Size	*Grade*			
	357 (2")	*467 (1.5")*	*57 (1")*	*67 (3/4")*
2-1/2"	100	---	---	---
2"	95-100	100	---	---
1 ½"	---	95-100	100	---
1"	35-20	---	95-100	100
3/4"	---	35-70	---	90-100
½"	10-30	---	25-60	---

3/8"	---	10-30	---	20-55
No. 4	0-5	0-5	0-10	0-10

b. Fine Aggregate:

Table 3 – Fine Aggregates	
Sieve Size	*Percent Passing (by weight)*
3/8"	100
No. 4	95-100
No. 16	45-80
No. 50	10-30
No.100	2-10

c. Silts and Clays: The amount of material smaller than the No. 200 sieve in any combined gradation sample is limited to the following percentages by weight of the combined sample.
   I. 1.75 percent maximum for concrete subject to abrasion.
   ii. 3.0 percent maximum for all other concrete.

C. Selection of Pozzolan:
1. General: If a blended aggregate passes an unmodified ASTM C 1293 test, use of a pozzolan is CONTRACTOR'S choice, otherwise select a pozzolan (or blended cement, or both) and determine the effective dosage to meet one of the following tests.
   a. ASTM C 1567. The expansion of a cement-pozzolan-aggregate job-mix mortar bar is less than or equal to 0.10 percent at 16 days. Do not use this test if a lithium admixture is used in the job-mix.
   b. ASTM C 441. The expansion of a test mixture at 56 days is less than or equal to a control mixture prepared with cement with equivalent alkalis between 0.5 and 0.6 percent.
2. Fly Ash (Class F): Allowed as a cement replacement under the following conditions.
   a. Before replacement is made, use the minimum cement content in the design formula to establish the water/cement ratio.
   b. Replace up to 20 percent of the cement by weight on a minimum basis of 1 part fly ash to 1 part cement.
   c. Submit to the Vernal City Representative a quality history of the fly ash identifying a minimum of 20 of the most current ASTM C 618 analysis.
3. Natural Pozzolan (Class N): Allowed as a cement replacement if the 14 day expansion test (ASTM C 1567) with job aggregates, job cement and natural pozzolan does not exceed the 14 day expansion test of job aggregates, job cement and Class F fly ash.
4. Silica Fume: Allowed as a cement replacement if replacement of hydraulic cement on a 1 part silica fume to 1 part cement does not exceed 10 percent, and water/cement ratio is established before cement is replaced with silica fume.

D. Selection of Fiber Reinforcement: The basis for determining material proportions of fiber-reinforced concrete is the Supplier's responsibility per ASTM C 1116 subject to mix property requirements of this Section. Unless specified otherwise provide synthetic fibers.

E. Selection of Mix Properties: Select and proportion mix to produce appropriate strength, durability and workability. Use ACI 211.1, 211.2, or 211.3, and meet the following properties and limitations.

Table 4 – Mix Properties and Limitations					
Properties		*Test Method*	*Class*		
			2000	*3000*	*4000*
Compressive Strength (f'c) at 28 days, psi, minimum		ASTM C39	2000	3000	4000
Compressive Strength at 7 days, psi, (for reference only)		ASTM C39	1340	2010	2680
Average Strength, psi (fcr)		ACI 214	(a)	(a)	(a)
Cement Content, bags, minimum (b)		---	4.5	5.5	6.5
Water-cement Ratio (by weight), maximum (d)		ACI 318	©	©	©
Entrained Air, percent (based on aggregate size) (e)	2" 1-1/2" 1" 3/4"	ASTM C231	3.0 - 6.0 " " "	4.5 - 7.5 " " "	4.0 - 7.0 4.5 - 7.5 5.0 - 7.5 5.0 - 7.5
Slump		ASTM C143	©	©	©

NOTES
(a). The amount by which average strength (fcr) exceeds compressive strength (fc') is based upon statistical assurance that no more than 1 test in 100 tests will fall below compressive strength (fc').
(b) Unless allowed otherwise by VERNAL CITY REPRESENTATIVE.
© Specific to exposure conditions and finishing need.
(d) Before pozzolan substitution.
(e) Comply with ACI 211.1 if air content is changed.
(f) 1 bag of cement = 94 pounds.

1. Cold Weather: ACI 306. Unless allowed otherwise by VERNAL CITY REPRESENTATIVE, increase cement content in the mix design by 1 bag between October 1 and March 1, i.e. 5.5 becomes 6.5, or 6.5 becomes 7.5, etc.
2. Hot Weather: ACI 305. Reduce temperature of mix ingredients or use an admixture appropriate to job conditions when air temperature is over 75 deg. F.
3. Concrete Deposited Under Water: Increase cement content 1 bag per cubic yard greater than the design required for concrete placed above water or use viscosity modifying admixture.

2.6 SOURCE QUALITY CONTROL

A. Once selected, do not change source quality control sampling point.

B. Aggregate:
   1. Soundness, ASTM C 88.
   2. Alkali-silica Reactivity: ASTM C 289, C 1567, C 227 and C 1293.
   3. Petrographically examine fine and coarse aggregate sources once every 3 years per ASTM C 295.

C. Concrete Mix: Obtain samples per ASTM C 172 and run the following tests.
   1. Compressive strength, ASTM C 39.
   2. Unit weight, ASTM C 138.
   3. Slump, ASTM C 143.
   4. Air, ASTM C 231.

5. Temperature, ASTM C 1064.

D. Concrete Quality Charts: Comply with ACI 214 and ACI 301. Plot new results and identify trends on quality control charts that comply in form to ASTM STP 15-C. Show the Specified Strength (fc'), the required Average Strength (fcr), and the compressive strength versus date of Sample.

E. Equipment: Certify through the services of a professional engineer that trucks and plant equipment comply with the requirements of the National Ready Mixed Concrete Association. Do so at least every 2 years.
   1. Transit Trucks: Equip transit trucks with plates indicating total volume, agitating volume and mix volume.
   2. Weights and Measures: Comply with regulatory requirements of State of Utah.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Placement, Section 03 30 10.

B. Pavement restoration, Section 32 01 18.

C. Driveways, sidewalks, curb, gutter, Section 32 16 13.

D. Roadway pavement, Section 32 13 13.

3.2 FIELD QUALITY CONTROL

A. Truck Mixed Concrete (Dry Batch): ASTM C 94.
   1. Truck Mixer: Fill drum no more than 63 percent of the gross drum volume and no less than 2 cubic yards. Use drum manufacturer's recommended mixing speed (between 12 – 18 rpm).
   2. Truck Agitator: Do not fill drum greater than 80 percent of the gross drum volume. Use drum manufacturer's recommended agitating speed (between 2 – 6 rpm).

B. Mixing Plant: ASTM C 94.
   1. Use option C and requirements in this section for preparing ready-mixed concrete.
   2. Use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.
   3. Mixing time must exceed 80 seconds after adding air entrainment admixture.

C. Hand Mixing:
   1. Do not hand mix batches larger than 0.5 cubic yard.
   2. Hand mix only on a watertight platform.
   3. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency prior to adding water.

END OF SECTION

SECTION 03 30 05
CONCRETE TESTING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Concrete sampling and testing requirements.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ACI 318: Building Code Requirements for Reinforced Concrete.

B. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.

C. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

D. ASTM C 42: Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

E. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

F. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

G. ASTM C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

H. ASTM C 143: Standard Test Method for Slump of Portland Cement Concrete.

I. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.

J. ASTM C 173: Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

K. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

L. ASTM C 567: Standard Test Method for Unit Weight of Structural Lightweight Concrete.

M. ASTM C 1064: Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

N. ASTM D 1077: Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

1.4 SUBMITTALS

A. Concrete Supplier: If requested, submit reports and material certificates verifying concrete quality control.

B. Laboratory: Promptly submit test data results for 7 and 28 day breaks to Supplier, CONTRACTOR and Vernal City representative.

1.5 QUALITY ASSURANCE

A. Provide an ASTM D 1077 compliant and ACI certified laboratory.

B. Provide level I ACI certified field sampling technicians.

1.6 SITE CONDITIONS

A. Assist the Vernal City representative: Furnish labor to assist the Vernal City representative in obtaining and handling acceptance samples at site or sources.

B. Store and Cure Test Specimens: Safely store and cure concrete test specimens and acceptance test specimens for first 24 hours.
   1. Follow ASTM C 31 in making and curing cylinders or beams at site. Do not move the cylinders or beams for the initial 16 hour cure period. Provide initial cure temperature as follows.
      a. 60 to 80 deg. F. for Class 4,000 or less.
      b. 68 to 78 deg. F. for Class 5,000 or greater.
   2. Equip storage device with an automatic 24 hour temperature recorder with an accuracy of plus or minus 2 deg. F.
   3. Use water containing hydrated lime if water is to be in contact with cylinders or beams.
   4. Ensure the device(s) can accommodate the required number of test cylinders or beams. Lack of capacity will cause the placement of concrete to cease.
   5. Have the storage devices available at the point of placement at least 24 hours before placement.
   6. A 24 hour test run may be required.

1.7 ACCEPTANCE

A. At the Site:
   1. Sampling: ASTM C 172. Reject non-complying batches until 2 consecutive batches are compliant then proceed in random batch testing for acceptance.

Table 1 – Concrete Mix

Rate of Placement (cubic yard / day)	*Temperature*	*Air*	*Slump*	*Strength*
0 - 8	1	1	1	Determined by Engineer
0 - 50	1	1	1	1
Each additional 50 cu.yd. or fraction thereof	1	1	1	1
NOTES (a) Sampled at discharge chute prior to placement, or at pumper hose after priming grout has been wasted				

   2. Temperature, ASTM C 1064.
   3. Air content, ASTM C 231 or ASTM C 173 if lightweight aggregate is used.
   4. Slump, ASTM C 143.

B. At the Laboratory:
   1. Compressive strength, ASTM C 31.
   2. Flexure strength, ASTM C 78.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION

3.1 PRECAST PRODUCTS

A. Obtain composite Samples from different portions of the batch.

B. Make and cure concrete test specimens for acceptance, ASTM C 31.

C. Cure all precast products with water vapor or water.

D. Do not damage precast products by stripping forms or handling before the concrete reaches its specified strength.

3.2 CAST-IN-PLACE PRODUCTS

A. Obtaining Samples:
   1. Batch samples, ASTM C 172.
   2. Core samples, ASTM C 42.

B. Identify location of tests on test reports.

C. Compressive strength , ASTM C 39.
   1. Mold 4 test specimens, ASTM C 31.
   2. For each strength test perform slump, air, unit weight, and temperature test.
   3. Break 1 cylinder at 7 days and 3 cylinders at 28 days. The average strength of 3 cylinder breaks shall be considered the test result.
   4. If any one cylinder in a 28 day test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the cylinder. The average strength of the remaining cylinders shall be considered the test result.

D. Tensile (flexural) strength, ASTM C 78.
   1. Mold 4 test specimens, ASTM C 31.
   2. For strength test perform slump, air, unit weight, and temperature test.
   3. Break 1 beam at 7 days and 3 beams at 28 days. The average strength of the 3 beam breaks shall be considered the test result.
   4. If any one beam in a 28 day test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the beam. The average strength of the remaining beams shall be considered the test result.

E. Aggregate, ASTM C 136 for fine and coarse aggregate.

F. Slump test, ASTM C 143.

G. Air Test:
   1. Normal weight concrete, ASTM C 231.
   2. Light weight concrete, ASTM C 173.

H. Unit Weight:
   1. Normal weight concrete, ASTM C 138.
   2. Light weight concrete, ASTM C 567.

I. When requested, test in-place concrete by impact hammer, sonoscope, or other non-destructive device:
   1. To determine relative strengths in various locations in Work.
   2. To aid in evaluating concrete strength.
   3. To select areas to be cored.
   4. To verify quality control in the absence of control testing.

3.3 RETESTING DEFECTIVE CONCRETE

A. If CONTRACTOR desires to do a retest, a request to VERNAL CITY REPRESENTATIVE for retesting must be made within 35 days from time of concrete placement. No coring or retesting shall be done after 40 days have

elapsed from the time of placement.

1. Choose 3 random test locations and verify choice with VERNAL CITY REPRESENTATIVE. Obtain retest samples per ASTM C 42 and test compressive strength per ASTM C 39 or flexure strength per ASTM C 78.
2. Establish a chain of custody for all test samples.
3. If concrete placed in the Work will be dry under service condition, air dry cores for 7 days before tests. Unless otherwise specified, use air temperature 60 to 80 deg. F. and relative humidity less than 60 percent.
4. If concrete placed in the Work will be more than superficially wet under service conditions, test cores after moisture conditioning (liquid or vapor water cure).
5. If more than 1 core shows evidence of having been damaged before testing provide replacement cores, otherwise evaluation will be done on 2 or more core samples.
6. Evaluate cores in accordance with ACI 318 requirements.
7. If core tests are inconclusive, or impractical to obtain, or if structural analysis does not confirm the safety of the Work, load test may be used and evaluated in accordance with ACI 318 requirements.

B. Coat sides of core hole with concrete epoxy resin adhesive. Fill core holes with non-shrink concrete mortar. Match color and texture of surrounding concrete.

C. Within 40 days from time of placement publish the chain of custody record and the results of retesting.

END OF SECTION

SECTION 03 30 10
CONCRETE PLACEMENT

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Concrete placement for slabs on grade, slabs on fill, structural building frame, and other concrete components.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings.

B. ACI 305: Hot Weather Concreting.

C. ACI 306: Cold Weather Concreting.

D. ACI 309: Standard Practice for Consolidation of Concrete.

E. ASTM C 881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

F. ASTM C 1059: Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

G. Vernal City Standard Drawing 1, Typical Curb, Gutter and Sidewalk.

1.4 SUBMITTALS

A. Batch Delivery Ticket: For each batch delivered to site, identify.
   1. Date and Project description.
   2. Producer and plant.
   3. Name of CONTRACTOR.
   4. Serial number of ticket.
   5. Mix identification.
   6. Truck number and time dispatched.
   7. Volume of concrete.
   8. Type and amount of cement.
   9. Total water and water/cement ratio.
   10. Water added for receiver of concrete and receiver's initials.
   11. Admixture types.
   12. Separate weights of fine and coarse aggregate.
   13. Statement of whether batch is pre-mixed at plant or mixed in transit.

B. Record of Placed Concrete: Identify record date, location of pour, quantity, air temperature, and CONTRACTOR'S quality control test samples taken.

C. Bonding Compound: Identify product name, type, and chemical analysis.

1.5 QUALITY ASSURANCE

A. Provide ACI certified finishers.

B. Remove and replace any placed concrete suffering hot or cold weather damage.

C. For control testing follow Section 03 30 05 requirements.

1.6 ACCEPTANCE

A. Concrete work that fails to meet any of the following requirements will be considered defective. Replace any Defective Work at no additional cost to Vernal City.
   1. Placement:
      a. Reinforcing steel size, quantity, strength, position, damage, or arrangement is not as specified or does not comply with code.
      b. Formwork differs from required dimensions or location in such a manner as to reduce concrete's strength or load carrying capacity or physical esthetics.
      c. Concrete curb and gutter or sidewalk that is placed without the required contraction and expansion joints as stated on Vernal City Standard Drawing 1, Typical Curb, Gutter and Sidewalk.
      d. Workmanship likely to result in deficient strength.
   2. Finishing:
      a. Concrete exposed to view has defects that adversely affect appearance.
      b. Slab tolerances of Section 03 35 00 are not met.
   3. Protection:
      a. Method of curing is not as specified.
      b. Inadequate protection of concrete during early stages of hardening and strength development from
         i. temperature extremes.
         ii. rapid moisture loss.
      c. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Concrete, Section 03 30 04. Class as indicated.

B. Bonding compound, ASTM C 1059. Either polyvinyl acetate base or acrylic base latex.
   1. Use type I in areas not subject to high humidity or immersion in water with minimumbond strength of 400 psi.
   2. Use type II in areas subject to high humidity or immersion in water with minimum bond strength of 1250 psi.

C. Vapor Barrier, ASTM 1745 Class A compliant product. Permeance as tested after mandatory conditioning (ASTM E1745 paragraphs 7.1.1-5): less than 0.01 perms ($gr/ft^2/in\text{-}Hg$). Type recommended for below grade application.

D. Forms, Section 03 11 00.

E. Reinforcement, Section 03 20 00.

F. Coverings and curing compound, Section 03 39 00.

G. Shinkage compensating grout, Section 03 61 00.

H. Epoxy adhesive, Section 03 61 00.

PART 3 — EXECUTION

3.1 PREPARATION

A. Notify the Vernal City representative a minimum of 24 hours prior to commencement of concrete placement operations.

B. Do not allow construction loads to exceed structural capacity.

C. Clean previously placed concrete. Apply bonding compound per manufacturer's instructions.

D. At locations where new concrete is dowelled to existing work, drill, remove dust, insert and pack steel dowels with shrink compensating grout.

3.2 EXAMINATION

A. Verify items to be cast into concrete are accurately placed and held securely.

B. Verify slump, air content range, mix identifty, and batch time on delivery ticket matches mix design.

C. Verify slab steel mats are supported by steel chairs, precast concrete blocks, or other slab bolsters. Do not pour if absent.

3.3 DELIVERY

A. Slump and Air Content: Keep slump and air content within the allowable range.

B. Placement Time:

Table 1 – Placement Time	
Air Temperature	*Time after Initial Batching*
Less than 90° F	1-1/2 hours
Greater than 90°F	1 hour (without retarder)
Greater than 90° F	1-1/2 hours (with retarder)
To increase time past 1-1/2 hours, a hydration stabilizer that is acceptable to Supplier may be used.	

C. Tempering:
1. Water may be added if all following conditions are met.
   a. The mix design water/cement ratio is not exceeded.
   b. The delivery ticket allows for addition of water based upon water/cement ratio.
   c. The amount of water added is accurately measured to within 1 gallon of the design addition.
   d. Water addition is followed by 3 minutes of mixing at mixing speed prior to discharge.
   e. Supplier and CONTRACTOR mutually agree on who is authorized to add water.
2. Do not add water after 1 curbic yard of contrete has discharged from the delivery vehicle.

D. Super-plasticizer: Comply with manufacturer's requirements. If none, then as follows.
1. If added at site, add agent using injection equipment capable of rapidly and uniformly distributing the admixture to the concrete. Prior to discharge, mix for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm.
2. If added at plant; do not deliver to site unless batch delivery ticket displays water/cement ratio prior to super-plasticizer addition.

3.4 CONCRETE PLACEMENT

A. Place concrete, ACI 301.
1. Hot Weather Placement: ACI 305. If the rate of evaporation approaches 0.2 lb./ft2/hr. precautions against plastic shrinkage cracking are necessary. (i.e. dampening Subgrade and forms; placing concrete at the lowest possible temperature; erecting windbreaks and sunshades; fog sprays; use of evaporation

retardants; or rescheduling time of placement).

2. Cold Weather Placement: ACI 306. Non-chloride accelerating admixture may be used in concrete work placed at ambient temperatures below 50 deg. F. Use of admixtures will not relax cold weather placement, curing, or protection requirements.

B. Concrete Temperature: Keep mixed concrete temperature at time of placement between 60 deg. F. and 90 deg. F.

C. Do not disturb reinforcement, inserts, embedded parts, and formed joints.

D. Do not break or interrupt successive pours such that cold joints occur.

E. Honeycomb or embedded debris in concrete is not acceptable.

3.5 JOINTS AND JOINT SEALING

A. Steel edging and jointing tools are acceptable. Preferred are magnesium, aluminum or wood tools

B. Pavement joint sealing, Section 32 13 73.

3.6 CONSOLIDATION

A. Keep spare vibrator available during concrete placement operations, ACI 309.

3.7 FINISHING

A. Section 03 35 00 and as follows.

Table 2 – Finishes

Type of Work	*Type of Finish*
Sidewalks, garage floors, ramps, exterior concrete pavement	Broom or belt finish
Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials	Non-slip finish
Surfaces intended to receive bonded applied cementitious applications	Scratched finish
Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces that are future floors or sand bed terrazzo	Floated finish
Floors and roof surfaces that are floors intended as walking surfaces or to receive floor coverings	Troweled
Unpainted concrete surfaces not exposed to public view	Rough as-cast form finish
Unpainted concrete surfaces exposed to public view	Smooth as-cast form finish
Concrete surfaces to receive paint or plaster	Grout cleaned finish

3.8 CURING

A. Section 03 39 00. Use a membrane forming compound unless specified otherwise.

3.9 PROTECTION AND REPAIR

A. Protection: Section 01 66 00.
   1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, graffiti, and mechanical injury.
   2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

B. Repair:
   1. Modify or replace concrete not conforming to required levels, lines, details, and elevations.
   2. Structural analysis and additional testing may be required at no additional cost to Vernal City when the strength of a structure is considered potentially deficient.
   3. To patch imperfections refer to Section 03 35 00 requirements.
   4. Remove graffiti and mechanical injury.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Finishing interior and exterior concrete surfaces.

1.2 REFERENCES

A. ACI 303: Guide to Cast-in-Place Architectural Concrete Practice.

B. ASTM C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

C. ASTM C1315: Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.3 SUBMITTALS

A. Name, type, chemical analysis and manufacturer's recommended rate of application for cure and seal compound and other finishing products.

1.4 PROJECT CONDITIONS

A. Protect adjacent materials and finishes from dust, dirt and other surface or physical damage during finishing operations. Provide protection as required and remove from site at completion of Work.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Masonry Mortar and Grout: Section 04 05 16.

B. Dry Shake: Blend of metallic or mineral aggregate with Portland cement concrete in proportions recommended by manufacture.

C. Proprietary Materials: If permitted or required, proprietary compounds may be used in lieu of or in addition to foregoing materials. Use such compounds per manufacturer's recommendations.

D. Cure and Seal Compound: Cure and seal concrete with a water or solvent based, resin, membrane-forming product that effectively controls moisture loss during the curing process and provides a long-lasting seal on the concrete surface. Product meets ASTM C309, Type 1, Classes A & B; ASTM C1315, Type 1, Class A.

E. Liquid-Chemical Hardener: Colorless, aqueous solution containing a blend of magnesium fluosilicate, zinc fluosilicate and a wetting agent. Mixture contains not less than 2 pounds fluosilicate per gallon and does not interfere with adhesives and bonding.

PART 3 — EXECUTION

3.1 PREPARATION

A. Examine the areas and conditions under which work of this section will be performed.

B. Correct conditions detrimental to timely and proper finishing.

C. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHING HORIZONTAL SLABS

A. Do not begin finishing operations until bleed water disappears from the surface of the concrete.

B. Do not apply water (i.e. sprinkle) to any surface of concrete when finishing slabs. If the contractor applies water to the concrete surface, they shall be required to remove the concrete and replace it at their own expense.

C. Edges and Joints: Tools may be made out of steel. Preferred is wood, aluminum or magnesium.

D. Tolerances:
   1. Class A: 1 in 1000.
   2. Class B: 1 in 500.
   3. Class C: 1 in 250.

E. Float Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating.
   1. Only use wood or magnesium floats.
   2. Begin floating when water sheen has disappeared and surface has sufficient stiffness.
   3. During or after first floating, check planeness of entire surface with a 10 feet long straightedge applied at 2 or more different angles.
   4. Cut down high spots and fill low spots to the required tolerance.
   5. Refloat slab immediately to a uniform sandy texture.

F. Trowel Finish:
   1. Only use wood or magnesium trowels for finishing concrete.
   2. Do not use steel or power trowels on exterior concrete or on concrete that contains more than 3 percent air.
   3. First troweling shall produce smooth surface relatively free of defects but which may still show some trowel marks.
   4. Second troweling after surface has stiffened shall make finished surface essentially free of trowel marks, uniform in texture and appearance.
   5. On surfaces intended to support floor coverings, grind off defects that would show through floor covering.

G. Broom or Belt Finish: Sweep surface with brushes, rakes, tines or burlap belt before final set.

H. "Dry Shake" Finish: Give the surface a floated finish. Evenly apply approximately 2/3 of a blended unsegregated material.
   1. Begin floating immediately after application of first "dry shake".
   2. After material has been embedded by floating, apply remainder of blended material to surface at right angles to previous application.
   3. Make second application heavier in any areas not sufficiently covered by first application.
   4. Immediately follow with second floating.
   5. After selected material has been embedded by second floating, complete operation with a broomed, floated, or troweled finish, as indicated.

I. Non-slip Finish: Give surface a "dry shake" application, using crushed ceramically bonded aluminum oxide particles. Apply at 25 pounds per 100 square feet.

J. Exposed Aggregate Finish: Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone.
   1. Embed aggregate into surface by light tamping.
   2. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance.
   3. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgment.

4. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.
5. Continue until aggregate is uniformly exposed.
6. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

K. Cure and Seal Compound: Apply curing and sealing compound according to manufacturer's recommendations.

L. Chemical-Hardener Finish: Apply liquid chemical-hardener finish to interior concrete floors where indicated. Do not apply liquid chemical hardener on floor areas scheduled to receive synthetic matrices terrazzo, setting beds for tile, terrazzo, vinyl flooring, or like items. Apply hardener after complete curing and drying of concrete surface per manufacturer's recommendations. Evenly apply each coat, and allow 24 hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.3 FINISHING FORMED SURFACES

A. General:
1. Allow concrete to cure not more than 72 hours before commencing surface finish operations, unless approved otherwise.
2. Revise the finishes as needed to secure approval.

B. As-Cast Form Finish:
1. Rough: Patch defects, chip or rub off fins exceeding 1/4 inch height.
2. Smooth: Patch tie holes and defects and remove fins completely.
   a. When surface texture is impaired and form joints misaligned, grind, bush-hammer, or correct affected concrete.
   b. Slurry grout areas evidencing minor mortar Leakage to match adjacent concrete.
   c. Repair major mortar Leakage as a defective area.
   d. When workmanship is less than acceptable standard, provide one of rubbed finishes at no additional cost to OWNER.

C. Rubbed Finish:
1. Smooth Rubbed: Remove forms and perform necessary patching as soon after placement as possible.
   a. Finish newly hardened concrete no later than 24 hours following form removal.
   b. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
2. Grout Cleaned: Undertake no cleaning operations until all contiguous surfaces are completed and accessible.
   a. Wet surface of concrete sufficiently to prevent absorption of water from grout.
   b. Apply grout uniformly.
   c. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids.
   d. While grout is still plastic, remove excess grout by working surface with rubber float or sack.
   e. After surface whitens from drying, rub vigorously with clean burlap.
   f. Keep damp for at least 36 hours after final rubbing.
3. Cork Floated: Remove forms within 2 to 3 days of placement where possible.
   a. Remove ties.
   b. Remove all burrs and fins.
   c. Dampen wall surface.
   d. Apply mortar with firm rubber float or with trowel, filling all surface voids.
   e. Compress mortar into voids.
   f. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.
   g. Produce final texture with cork float using a swirling motion.

D. Unformed Finish:
1. After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.

2. Float to texture that is reasonably consistent with formed surfaces.
3. Continue final treatment on formed surfaces uniformly across uniformed surfaces.

E. Blasted Finish:
1. Perform abrasive blasting within 24 to 72 hours after casting.
2. Coordinate with form work construction, concrete placement schedule, and formwork removal to ensure that surfaces are blasted at the same age for uniform results.
3. Reapply curing protection after blast finishing

F. Architectural Finish: Refer to ACI 303.
1. Tooled Finish:
   a. Dress thoroughly cured concrete surface with electric, air, or hand tools to uniform texture, and give a bush hammered surface texture.
   b. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

G. Patched Finish:
1. Repair defective areas.
   a. Remove honeycomb and defective concrete to sound concrete.
   b. Make edges perpendicular to surface or slightly undercut.
   c. Feathered edges are not permitted.
   d. Dampen area to be patched and at least 6 inches surrounding it to prevent absorption of patching mortar water.
   e. Prepare bonding grout.
   f. Mix to consistency of thick cream.
   g. Brush into surface.
2. Tie Holes: Unless indicated otherwise, after being cleaned and thoroughly dampened, fill tie hole solid with patching mortar.
3. Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial and obtain a good color match with concrete when both patch and concrete are cured and dry.
   a. Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint.
   b. Use a minimum amount of mixing water.
   c. Mix patching mortar in advance and allow to stand without frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.
   d. After initial set, dress surfaces of patches manually to obtain same texture as surrounding surfaces.
4. After surface water has evaporated from patch area, brush bond coat into surface.
   a. When bond coat begins to lose water sheen, apply patching mortar.
   b. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface.
   c. Leave undisturbed for at least 1 hour before final finish.
   d. Keep patched area damp for 72 hours or apply curing compound.
   e. Do not use metal tools in finishing an exposed patch.
5. Where as-cast finishes are indicated, total patched area may not exceed 1 in 500 of as-cast surface. This is in addition to form tie patches, if ties are permitted to fall within as-cast areas.
6. In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate.
   a. Outer 1 inch of patch shall contain same aggregates as surrounding concrete.
   b. For aggregate transfer finish, patching mixture shall contain same selected colored aggregates.
   c. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

END OF SECTION

SECTION 03 39 00
CONCRETE CURING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Concrete curing requirements.

1.2 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings

B. ACI 305: Hot Weather Concreting.

C. ACI306: Cold Weather Concreting

D. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.

E. ASTM C 1315: Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.3 SUBMITTALS

A. Curing agent data sheet.

B. Curing plan. Describe estimated cure quantity and procedure.

C. Manufacturer certificates, Section 01 33 00 that shows product meets performance criteria.

D. Manufacturer's recommended installation procedures which, when accepted by the Vernal City representative, will become the basis for accepting or rejecting the installed product.

1.4 QUALITY ASSURANCE

A. Use workers knowledgeable of ACI 301, 305, 306.

1.5 PRODUCT HANDLING

A. Protect materials of this section before, during, and after installation.

B. Protect the work and materials of other trades.

C. In the event of damage, immediately make replacements and repair at no additional cost to OWNER.

1.6 WEATHER LIMITATIONS

A. Above 75 deg. F., ACI 305

B. Below 55 deg. F., ACI 306.

PART 2 — PRODUCTS

2.1 COVERS

A. Water or Fog-spay: Clean, non-staining and non-detrimental to concrete.

B. Sheet Coverings: White waterproof paper, polyethylene film, or polyethylene coated burlap sheet complying with ASTM C 171.

C. Mat Coverings: Clean roll goods of cotton or burlap fabric.

D. Insulating Coverings: Non-staining curing blankets.

2.2 MEMBRANE FORMING COMPOUND

A. Material.
1. Styrene-acrylic.
2. Styrene-butadiene.
3. Alpha- methylstyrene.

B. Performance Criteria: ASTM C 1315 compound.
1. Type ID Class A (clear with fugitive dye), or
2. Type II Class A or B (white pigmented).

C. Volatile Organic Compounds (VOC): Comply with local, state and federal requirements.

PART 3 — EXECUTION

3.1 PREPARATION

A. Do not use membrane forming curing compound on surfaces that are to receive hardeners.

B. Commence curing operation within 20 minutes after finishing.

3.2 APPLICATION – COVERS

A. Water: Apply water-fog spray or ponding.

B. Absorptive Mat: Place absorptive mat to provide coverage of concrete surfaces and edges. Lap over adjacent absorptive covers. Thoroughly saturate with water and keep continuously wet.

C. Moisture-Retaining Sheet: Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss. Repair any holes or tears during curing period.

D. Formed Surface Curing: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period. If forms are removed prior to curing completion, applying cure film or penetrant or use methods indicated above, as applicable.

3.3 APPLICATION – MEMBRANE FORMING COMPOUND

A. Apply coating continuously and uniformly. Follow manufacturer’s recommendations

B. Protect continuity of film coatings and repair damage during cure period.

C. If forms are removed before expiration of cure period, apply coating to unprotected areas.

3.4 CONCRETE CURE TEMPERATURE

A. During cure period, eliminate thermal shock of concrete by keeping cure temperature even throughout extent and depth of concrete.

3.5 SCHEDULE

A. Concrete Exposed to Potable Water (as in Water Storage reservoirs):
   1. Moisture cover curing, or
   2. Acrylic cure, or
   3. Styreen acrylic silane co-polymer cure.

END OF SECTION

SECTION 03 40 00
PRECAST CONCRETE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Pre-cast concrete, complete with required connecting and supporting devices.

1.2 REFERENCES

A. ACI 318: Building Code Requirements for Reinforced Concrete. This reference standard includes other ASTM material standards.

B. ASTM A 36: Standard Specification for Structural Steel.

C. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Sections.

D. ASTM C 857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.

E. ASTM C 858: Standard Specification for Underground Precast Concrete Utility Structures.

F. ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.

G. AWS D1.1: Structural Welding Code Steel.

H. AWS D1.4: Structural Welding Code Reinforcing Steel.

I. PCI: Design Handbook.

J. PCI MNL-116: Quality Control and Assurance for Plant Production of Prestressed Concrete.

K. PCI MNL-117: Quality Control and Assurance for Plant Production of Architectural Precast Concrete.

1.3 DESIGN CRITERIA

A. Design structural precast concrete units, ACI 318 and PCI design handbook.

B. Design utility precast units, ASTM C 857 and C 858.

C. Under direct supervision of professional engineer who is fully experienced in design of units.

D. Design units to support required stripping and handling loads, live, dead and construction loads.

E. Design component connections to provide adjustment to accommodate misalignment of structure during installation.

1.4 SHOP DRAWINGS

A. Prepare shop drawings under seal of licensed professional.

B. Submit shop drawings to the Vernal City representative

C. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points. Unit identification marks to appear on all manufactured units.

D. Do not proceed with fabrication until shop drawings have been accepted.

1.5 QUALITY ASSURANCE

A. Manufacture:
   1. Prestressed: PCI certified.
   2. Precast Concrete Units: PCI or NPCA certified
   3. Precast Utility Structures and Pipe: ACPA certified.

B. Transporter: Acceptable to precast or prestressed product manufacturer.

C. Erector:
   1. Prestressed: PCI certified.
   2. Precast: Has 5 years minimum experience in erecting precast units.

D. Welders: Certified, AWS D1.1 and AWS D1.4.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle precast units in positions consistent with their shape and design. Lift and support only from support points indicated on shop drawings.

B. Embedded Lifting or Handling Devices: Capable of supporting units in positions anticipated during manufacture, storage, transportation, and erection.

C. Block and laterally brace units while stored at manufacturers. Provide lateral bracing that is sufficient to prevent bowing and warping that is clean, nonstaining, and will not inhibit uniform curing of exposed surfaces.

D. Provide edges of units with adequate protection to prevent staining, chipping, or spalling of concrete.

E. Unless otherwise approved in writing, do not deliver units to job site until required for installation.

PART 2 — PRODUCTS

2.1 CONCRETE

A. Concrete for Above Ground Structures: 5000 psi minimum, Section 03 30 04 and ACI 318.

B. Concrete for Underground Structures: Class 4000 minimum, Section 03 30 04 and ASTM C 478 or ASTM C 858.

2.2 ACCESSORIES

A. Connecting and Supporting Devices: Steel, ASTM A 36.

B. Bolts, Nuts, and Washers: High-strength steel, Section 05 05 23.

C. Reinforcement: Grade 60 steel, Section 03 20 00.

2.3 FABRICATION

A. Maintain plant records and quality control program during production of structural precast concrete. Make records available to the Vernal City representative.

B. Use molds which are rigid and constructed of material that will result in uniform finished products.

C. If self consolidating concrete is NOT used, vibrate concrete to ensure proper consolidation, elimination of

unintentional cold joints, and minimize entrapped air on surface.

D. Fabricate required connecting devices, plates, angles, items fit to steel framing members, bolts and accessories.

E. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are sufficiently embedded, anchored and property located.

F. Ensure finished surfaces of precast structural units are uniform.

G. Cure units under identical conditions to develop specified concrete quality, and minimize appearance blemishes such as non-uniformity, staining or surface cracking.

2.4 DESIGN DEVIATIONS

A. Deviation: Provide installation equivalent to basic intent without additional cost to Vernal City. Deviations from exact required cross-section will be permitted only with approval.

B. Manufacturer's Proposed Design: Supported by complete design calculations and drawings. When requested, submit design calculations for review bearing seal and signature of professional engineer.

2.5 OPENINGS

A. Provide required openings, 6 inches or larger. If approved, smaller sizes may be field constructed by coring or sawing.

2.6 FINISHES

A. General: The required finish will be described in one of the following paragraphs. If no finish is indicated or selected by the Vernal City representative, Standard.

B. Standard Finish: Produced in forms such as plastic or metal lined that impart a smooth finish to the concrete. Small surface holes, normal form joint marks, minor chips and spall are acceptable if approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.

C. Commercial Finish: Produced in forms such as plywood or lumber that impart texture to concrete. Remove fins and large projections. Fill holes over 3/8 inch. Make faces true and well defined. Correct exposed ragged edges by rubbing or grinding.

D. Architectural Grade A Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch. Coat with neat cement paste using float. After paste coat has dried, rub with burlap to remove loose particles.

E. Architectural Grade B Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch.

F. Special Finishes: Sandblasting, acid washing, retarders or form liners as approved by the Vernal City representative. Special finishes require submittal of two 12 x 12 inch samples showing a representative color and texture to be used.

G. Painted Finishes: On concrete to be painted, use a form release agent acceptable to the paint manufacturer.

2.7 REPAIR

A. Repair of damaged units is acceptable if structural integrity or appearance is not impaired.

2.8 ALLOWABLE TOLERANCES

A. Length: Plus or minus 3/4 inch, or plus or minus 1/8 inch per 10 feet of length, whichever is greater, or as indicated.

B. End Squareness: 1/2 inch maximum.

C. Blockouts: 1 inch of centerline location indicated.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Do not install precast units until concrete has attained its design compressive strength.

B. Install members plumb, level, and in alignment within PCI MNL-116 or PCI MNL-117 and indicated limits of erection tolerances.

C. Clean weld marks or other marks, debris, or dirt from exposed surfaces of units.

D. Install underground utility precast units per ASTM C 891.

3.2 PERFORMANCE REQUIREMENTS

A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required.

B. Rejection: Units may be rejected for any one of the following.
1. Exceeding specified installation tolerances.
2. Damaged during construction operations.
3. Exposed-to-view surfaces which develops surface deficiencies.
4. Other defects as listed in PCI MNL-116 or PCI MNL-117.

END OF SECTION

SECTION 03 61 00
CEMENTITIOUS GROUTING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Pre-mixed non-metallic shrinkage resistant grout, pre-mixed water stop hydraulic cement grout, epoxy grout, and portland cement grout.
   1. Grout for leveling beds of structural steel plates.
   2. Sealing of joints and gaps between piping and structures.
   3. Sealing of joints between construction components.

1.2 REFERENCES

A. ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens).

B. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar.

C. ASTM C 150: Standard Specification for Portland Cement.

D. ASTM C 190: Standard Test Method for Tensile Strength of Hydraulic Cement Mortars.

E. ASTM C 207: Standard Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C 472: Standard Methods for Physical Testing of Gypsum Plasters and Gypsum Concrete.

G. ASTM C 595: Standard Specification for Blended Hydraulic Cements.

H. ASTM C 881: Standard Specification for Epoxy - Resin - Base Bonding Systems for Concrete.

I. ASTM C 1090: Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

J. ASTM C 1107: Standard Specification for Packaged Dry Hydraulic Cement (Non-Shrink).

K. ASTM C 1157: Standard Performance Specification for Blended Hydraulic Cement.

L. ASTM D 570: Standard Test Method for Water Absorption of Plastics.

M. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.

N. ASTM D 695: Standard Test Method for Compressive Properties of Rigid Plastics.

1.3 SUBMITTALS

A. Grout mix components. Indicate proportions used, environmental conditions, and admixture limitations. Indicate material "Type", "Grade", and "Class" which suits Project requirements.

B. Manufacturer's data for latex bonding agent.

PART 2 — PRODUCTS

2.1 MATERIALS - GENERAL

A. Cement:

1. ASTM C 150 natural color Type II (normal) or Type IIA (air entrained).
2. ASTM C 595, or C 1157: Blended.

B. Lime: ASTM C 207, Type S, hydrated.

C. Water: Clean, non-staining and non-detrimental.

D. Grout Aggregate: ASTM C 144, standard masonry type.

2.2 PORTLAND CEMENT GROUT

A. Proportions by Volume: 1 part Portland cement, and sand equal to 2-1/2 to 3 times sum of volumes of cement and lime.

B. Mix thoroughly with water to form a stiff workable plastic putty.

C. Compressive Strength: ASTM C 109, 2800 psi in 28 days.

2.3 GYPSUM PLASTER GROUT

A. Premixed, prepackaged, wood fiber gypsum plaster with an ASTM C 472 minimum average dry compressive strength of 2000 psi in 28 days.

B. Mix with water per manufacturer's instructions for intended use to form a stiff plastic mix required for workability.

2.4 CEMENT BASED SHRINKAGE RESISTANT GROUT

A. Grade B or grade C premixed, non-metallic, non-gaseous product; ASTM C 1107 at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through flow cone after slight agitation, in temperatures of 40 deg. F. to 90 deg. F.

B. Bleeding: None.

C. Compressive Strength: 6500 to 9000 psi, ASTM C 109 in 28 days.

D. Non-shrink percentage: 0.5 percent, ASTM C 1090.

2.5 EPOXY ADHESIVE GROUT

A. Two component material suitable for use on dry or damp surfaces, 100 percent solids, high modulus, moisture insensitive, complying with ASTM C 881.
1. Tensile Strength: ASTM D 638, 5000 psi, minimum in 14 days.
2. Tensile Elongation: ASTM D 638, 2 percent minimum.
3. Compressive Strength: ASTM D 695, 6500 psi minimum in 24 hours and 70 deg. F., 12,500 psi in 28 days and 70 deg. F.
4. Water Absorption: ASTM D 570, 1 percent maximum.
5. Bond Strength:
   a. Direct Shear: 400 psi.
   b. Direct Tension: 250 psi.
   c. Beam Break: 800 psi.
6. Pot Life: 5 minutes maximum at 70 deg. F.

2.6 BONDING GROUT

A. Of approximately 1 part cement to 1 part fine sand passing a No. 30 sieve with approved latex bonding agent when allowed.

2.7 PNEUMATICALLY PLACED PLASTER ("GUNITE" OR "SHOTCRETE")

A. Materials: Portland cement, lime, water and sand.

B. Compressive Strength: ASTM C 109, 2800 psi in 28 days.

C. Proportioning: 1 part cement to not more than 5 parts sand.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Fill joints, voids, and pockets, completely.

B. Comply with manufacturer's instructions and UBC Chapter 47.

C. Finish surfaces exposed to view smooth.

D. Pneumatically Placed Plaster: Screened and reused rebound material in an amount not greater than 25 percent of the total sand in any batch.

END OF SECTION

Division 05

Metals

SECTION 05 05 10
METAL GALVANIZING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Application of a zinc coating on fabricated metal items.

B. Repair of damaged galvanized surfaces.

1.2 REFERENCES

A. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A 153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A 780: Standard Practice for Repair of Damaged Hot-Dip Galvanized Coatings.

D. ASTM B 6: Standard Specification for Zinc (Slab Zinc).

E. ASTM E 376: Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.

F. FS TT-P-641: Primer Coating, Zinc Dust - Zinc Oxide (for Galvanized Surfaces).

G. MIL P-21035: Paint, High Zinc Dust Content, Galvanizing Repair.

1.3 QUALITY ASSURANCE

A. When requested, verify weight of zinc coating in accordance with ASTM E 376.

PART 2 — PRODUCTS

2.1 ZINC METAL

A. Use zinc for coating that conforms to ASTM B 6 and is at least equal to the grade designated as "Prime Western".

PART 3 — EXECUTION

3.1 GALVANIZING

A. Provide a zinc coating for those items indicated or specified to be galvanized as follows:
   1. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strips 1/8 inch thick and heavier.
   2. ASTM A 153 for galvanizing iron and steel hardware.

3.2 WEIGHT OF COATING

A. Apply zinc on 1/8 inch to 3/16 inch thick steel at a rate of at least 2-ounces per square foot of surface area.

B. Apply zinc on 1/4 inch and thicker steels at a rate of at least 2.3 ounces per square foot with no individual test measuring less than 2-ounces per square foot of surface area.

3.3 REPAIR OF DAMAGED COATING

A. Repair all shop damaged galvanized surfaces by the metallizing, hot stick or zinc rich paint, ASTM C 780 process.

B. Repair field damaged, cut, burned or uncoated surfaces in the field by coating with a dust-zinc oxide paint conforming to FS TT-P-641 or MIL P-21035.

END OF SECTION

SECTION 05 05 23
BOLTS, NUTS AND ACCESSORIES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Steel bolts, nuts, washers, clamps, straps, rods and accessories.

B. Galvanize bolts, nuts and accessories unless specified otherwise.

1.2 REFERENCES

A. AISC M011: Manual of Steel Construction.

B. ASME B1.1: Unified inch Screw Threads (UN and UNR Thread Form), Supplement.

C. ASTM A 126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

D. ASTM A 197: Standard Specification for Cupola Malleable Iron.

E. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

F. ASTM A 325: Standard Specification for High-Strength Bolts for Structural Steel Joints.

G. ASTM A 506: Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality and Structural Quality.

H. ASTM A 575: Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.

I. ASTM F 593: Standard Specifications for Stainless Steel Bolts, Hex Cap Screws, and Studs.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Bolts, Nuts, Accessories: Galvanized steel, Section 05 05 10 (except if stainless steel).

B. All sizes bolts and nuts, American Standard machined heavy hexagon heads with class 2 fit and threads, ASME B1.1.

C. Standard Bolts: Steel, ASTM A 307.

D. High Strength Bolts: Steel, ASTM A 325.

E. Anchor Bolts: Steel, ASTM A 307, or ASTM F 593 stainless steel when indicated.

F. Washers: Grey iron, ASTM A 126.

G. Clamps and Straps: Steel, ASTM A 506.

H. Rods: Steel, ASTM A 575.

I. Rod Coupling: Mallable iron, ASTM A 197.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Torque all nuts and bolts by procedures contained in AISC M011 to secure items requiring fastening.

B. Extend bolt through nut not less than 1/4 inch beyond nut.

END OF SECTION

SECTION 05 56 00
METAL CASTINGS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Castings for grates, frames and covers for Manholes, catch basins, tree wells, monument boxes, water meters, etc.

1.2 REFERENCES

A. ASTM A 27: Standard Specification for Steel Castings, Carbon, for General Application.

B. ASTM A 48: Standard Specification for Gray Iron Castings.

C. ASTM A 148: Standard Specification for Steel Castings, High-Strength, for Structural Purposes.

D. ASTM B 22: Standard Specification for Bronze Castings For Bridges and Turntables.

E. ASTM B 584: Standard Specification for Copper Alloy Sand Castings For General Applications.

F. ASTM D 1187: Standard Specification for Asphalt-Base Emulsion for Use as Protective Coatings for Metal.

G. ASTM E 10: Standard Test Method for Brinell Hardness of Metallic Materials.

1.3 SUBMITTALS

A. Submit shop drawings.

B. Submit manufacturer's affidavit certifying materials comply with Part 2 requirements. (X-ray certification mandatory).

1.4 QUALITY ASSURANCE

A. Make castings true to pattern in form and dimension and free from defects that would affect the service value of the casting.

B. Repair minor defects that do not impair the strength of a casting.

C. Reject castings that show injurious defects revealed by X-ray or machining operations.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver and handle castings and gratings to prevent warping, rusting and damage.

B. Store all items on flexible surface and protect items from adverse environmental conditions.

PART 2 — PRODUCTS

2.1 STEEL CASTINGS

A. High Strength Steel Castings For Structural Purposes: ASTM A 148, Grade 80-50, except that the steel shall contain not less than 0.60 percent of manganese and not less than 0.20 percent silicon.

B. Mild-to-Medium Carbon Steel Castings For General Applications: ASTM A 27 Grade 65-35 with a minimum Brinell hardness number of 130 when tested in accordance with ASTM E 10.

2.2 GRAY IRON CASTINGS

A. All castings not specifically classified below shall conform to the requirements of ASTM A 48, Class 30.
   1. Grate, frame and cover castings sets; ASTM A 48, Class 35.
   2. Railings, railing posts and wheel guards; ASTM A 48, Class 40.
   3. Rockers, rocker plate bearings and bearing plates for bridges; ASTM A 48, Class 50.

2.3 BRONZE CASTINGS

A. Expansion and Bearing Plates: ASTM B 22, Alloy C.

B. Ornamental Tablets, Railings, Miscellaneous Ornaments and Fixtures: ASTM B 584, Alloy 1B.

PART 3 — EXECUTION

3.1 PREPARATION

A. Fit bearing surfaces of flush fitting machined castings together firmly without rocking. The Vernal City representative reserves the right to reject rocking sets.

B. Ensure castings are boldly filleted at angles and the arises are sharp and true. Unless indicated otherwise all letters shall be heavily raised and spaced to secure a uniform and balanced effect over the entire area of the panel.

C. Before castings are removed from the foundry, ensure they are cleaned and the parting lines, gates, and risers are ground flush.

D. Ensure sets are coated in quality ASTM D 1187 asphalt paint unless galvanized or bronze sets are specified or required.

3.2 INSTALLATION

A. Furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation of castings.

B. Adjust Street Fixture elevation; Section 33 05 14.

C. Install countersunk flat head screw security bolts flush with top of grate.

3.3 CLEANING

A. Clean all castings free of grease, dirt, burrs, etc.

END OF SECTION

Division 07

Thermal and Moisture Protection

SECTION 07 19 00
WATER REPELLANT

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Penetrating sealer over concrete and masonry.

1.2 REFERENCES

A. ASTM C 67: Standard Methods of Sampling and Testing Brick, and Structural Clay Tile

B. ASTM C 140: Standard Methods of Sampling and Testing Concrete Masonry Units

C. ASTM C 642: Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

D. ASTM C 672: Standard Test Method for Sealing Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

E. NCHRP 244 Series IV: Concrete Sealers for Protection of Bridge Structures, National Cooperative Highway Research Program, Report 244, Dec 1981, Transportation Research Board, Washington D.C.

1.3 SUBMITTALS

A. Manufacturer's recommended installation procedures.

B. Performance criteria data sheet showing compliance.

PART 2 — PRODUCTS

2.1 PENETRATING COMPOUND

A. Material: CONTRACTOR’s choice of the following.
   1. Organo-silane,
   2. Organo-siloxane,
   3. Silocanate,
   4. Potassium silicate.
   5. Styrene acrylic silane co-polymer

B. Performance Criteria:
   1. Water Absorption Reduction, ASTM C 67, ASTM C 140, or ASTM C 642: 75 percent minimum
   2. Scaling Resistance, ASTM C 672: Weight loss less than 2 percent when subject to 500 cycles of freeze-thaw.
   3. Chloride Ion Reduction: 75% minimum; NCHRP 244 series IV.
   4. Moisture Vapor Permeability: 100% minimum; NCHRP 244 series IV.
   5. Maximum Drying Time: 1-1/2 hours.

C. Volatile Organic Compounds (VOC): Comply with local, state and federal requirements.

PART 3 — EXECUTION

3.1 PREPARATION

A. Do not use water repellant on surfaces that are to receive hardeners. Refer to Section 03 35 00.

B. Cure new concrete for 28 days prior to sealer application.

C. Remove curing compound before applying sealer. Do not expose large aggregate.

D. Make surfaces dry and free of laitance, dirt, dust, paint, grease, oil, rust, and other contaminants.

3.2 APPLICATION

A. Apply coating continuously and uniformly. Keep surface wet for 30 to 45 minutes.

END OF SECTION

Division 31

Earthwork

SECTION 31 05 13
FILL MATERIALS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Common fill materials.

1.2 REFERENCES

A. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.

B. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

D. ASTM C 535: Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

E. ASTM D 1883: Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.

F. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

G. ASTM D 2487: Standard Test Method for Classification of Soils for Engineering Purposes.

H. ASTM D 2844: Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.

I. ASTM D 3282: Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

J. ASTM D 3740: Standard Recommended Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

K. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

L. ASTM D 5821: Standard Test Method for Determining the percentage of Fractured Particles in Coarse Aggregate.

1.3 SUBMITTALS

A. Provide documentation that proposed material meets specifications.

B. Prior to delivering material to site, identify.
   1. Name of Supplier and source, And.
   2. Gradation of common fill material.

C. If a change in source of material is required, submit name of Supplier, source and gradation analysis of material prior to delivery to site.

1.4 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with Section 01 45 00 and ASTM D 3740.

B. Remove any product found defective after installation and install acceptable product at no additional cost to OWNER.

PART 2 — PRODUCTS

2.1 BORROW

A. Classifications A-1-a through A-4, ASTM D 3282.

2.2 GRANULAR BORROW

A. Classifications A-1-a, A-1-b, A-2-4, or A-3, ASTM D 3282.

B. Material meets design CBR-value (ASTM D 1883) or R value (ASTM D 2844) for suitability of source, not for project control testing.

C. Particle size; 6 inches maximum.

2.3 GRANULAR BACKFILL BORROW

A. Classification A-1, ASTM D 3282.

B. Well graded.

C. Particle size; 1-1/2 inch maximum.

D. Material meets design CBR-value (ASTM D 1883) or R value (ASTM D 2844) for suitability of source, not for project control testing.

2.4 RECYCLED FILL

A. Material: Pulverized portland cement concrete, pulverized asphalt pavement or combination, either mixed with or not mixed with a new aggregate.

B. Gradation: Meet the requirements of this Section based upon use; e.g. borrow, granular borrow, granular backfill borrow, etc.

2.5 CLAY

A. Classification CL, CL-ML, or ML, ASTM D 2487.

B. Free of organic matter, frozen material, debris, rocks, and deleterious materials.

C. Homogeneous, relatively uniform.

2.6 SAND

A. Friable river or bank aggregate, free of loam and organic matter. Graded as follows.

Sieve	Percent Passing by Weight
3/8	100
100	1 – 10

2.7 GRAVEL

A. Material: Rock, stone, or other high quality mineral particle or combination.

B. Gradation: As follows. Up to 10% allowed to be No. 4 minus fines.
1. 1 1/2" Drain Rock.

Nominal Size	Percent Passing
1 1/2"	90 – 100
3/4"	0 – 10

2. 3/4" Pea Gravel.

Nominal Size	Percent Passing
3/4"	90 – 100
3/8"	0 – 10

3. 3/8" Pea Gravel.

Nominal Size	Percent Passing
3/8"	90 – 100
No. 8	0 – 10

2.8 UNTREATED BASE COURSE

A. Material: Well-graded, clean, hard, durable, tough and should crushed rock, gravel, sand or other high quality mineral particle, or combination; free of organic matter and contamination from chemical or petroleum products.

Table 2 – Properties

Physical Property	*Units*	*Aggregate Class*			*ASTM Test*
		A	*B*	*C*	
Dry Rodded Unit Weight, min.	lb/ft3	75			C 29
Liquid Limit, max. (a)		25			D 4318
Plastic Index, max. (a)		0	0	≤ 6	D 4318
Sand Equivalent, min. (a)	percent	35			D 2419
Wear (hardness), max. (b)	percent	50			C 131
Gradation		Table 3			C 136
Two Fractured Faces, min. (c)	percent	70	70	n/a	D 5821
CBR, min. (d)	percent	50	n/a	n/a	D 1883

NOTES
(a) Liquid limit, plastic limit, sand equivalent: Passing No. 40 sieve.
(b) Wear: Retained on No. 8 sieve.
(c) Faces: Retained on No. 4 sieve.
(d) CBR: Use a 10 lb surcharge measured at 0.20 inch penetration at 96 percent of modified Proctor.

B. All percents passing will be within the gradation limits.

Table 3 – Gradation Limits			
US Sieve Size	*Job Mix Job Mix Gradation Bands*		
	1-1/2" Grade	*1" Grade*	*3/4" Grade*

1-1/2"	100	-	-
1"	-	100	-
3/4 "	70 – 85	-	100
½"	-	79 - 91	-
3/8"	55 – 75	-	78 – 92
No. 4	40 – 60	49 – 61	55 – 67
No. 16	25 – 40	27 – 35	28 – 38
No. 200	7 – 11	7 – 11	7 – 11
NOTES Percent passing based on total aggregate (dry weight), and fine and coarse aggregate having approximately the same bulk specific gravities.			

2.9 SELECT BEDDING

A. Material: rocks, sands, silts, and clays which have passed through a screen having 3/4" or smaller openings.

2.10 TOPSOIL

A. Chemical Characteristics:
   1. Acidity/alkalinity range: pH 5.5 to 7.7
   2. Soluble Salts: Less than 2.0 mmhos/cm.
   3. Sodium Absorption Ratio (SAR): less than 3.0
   4. Nitrogen (NO3N): 48 ppm minimum
   5. Phosphorus (P): 11 ppm minimum
   6. Potash (K): 130 ppm minimum
   7. Iron (Fe): 5.0 ppm minimum

B. Physical Characteristics:
   1. Fertile, loose, friable.
   2. Containing more than 2 percent organic matter.
   3. Free of weeds, subsoil, lumps or clods of hard earth, plants or their roots, sticks, toxic minerals, chemicals and stones greater than 1-1/2 inch diameter.
   4. Composition.

Material	Percent Passing
Sand	15 – 60
Silt	10 – 70
Clay	5 – 30

2.11 RIPRAP

A. Durable, angular, hard stone free from seams and cracks.

B. Graded in size to produce a reasonably dense mass.

C. The greatest dimension of 25 percent of the stones shall be at least, equal to but not more than 1-1/2 times the thickness of riprap indicated.

D. The greatest dimension of 50 percent of the stone shall be at least 3/4, but not more than 1-1/2 times the thickness of riprap indicated.

E. Not more than 10 percent of the aggregate shall have a dimension less than 0.1 times the thickness of riprap.

F. At least 95 percent of the stones shall have a minimum of 2 fractured or clean angular faces.

2.12 SOURCE QUALITY CONTROL

A. Verify gradation, ASTM C 136.

B. Select Samples on a random location and time basis.

C. If tests indicate materials do not meet specified requirements, change materials and retest at no additional cost to OWNER.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Trenches, Section 31 23 24.

B. Structures or landscaping, Section 31 23 23.

END OF SECTION

SECTION 31 05 15
CEMENT TREATED FILL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Controlled low-strength material (CLSM) requirements.

1.2 REFERENCES

A. ASTM C 33: Standard Specification for Concrete Aggregates.

B. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 150: Standard Specification for Portland Cement.

D. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.

E. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.

F. ASTM C 595: Standard Specification for Blended Hydraulic Cement.

G. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

H. ASTM D 4832: Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders.

1.3 SUBMITTALS

A. Batch proportions: Submit to VERNAL CITY REPRESENTATIVE seven days before placement.

B. Trial batch: Submit certified test results or conduct laboratory trial batch to verify strength prior to placement..

PART 2 — PRODUCTS

2.1 CEMENT TREATED FLOWABLE FILL

A. Cement:
   1. Type II, ASTM C 150 or
   2. Types IP, ASTM C 595.

B. Aggregate: Non-plastic sand, ASTM C 33.

C. Water: Non-detrimental.

D. Admixtures: As needed for strength and flowability.
   1. Pozzolan (fly ash): ASTM C 618.
      a. Class F.
      b. Loss on ignition: not to exceed 3 percent.
      c. Maximum allowable CaO content: not to exceed 15 percent.
      d. Use fly ash from the list of UDOT pre-qualified sources maintained by the UDOT Materials Quality Assurance.
      e. Label the storage silo for fly ash to distinguish it from cement.
      f. Use different size unloading hoses and fittings for cement and fly ash.
   2. Air: 4 percent to 35 percent, ASTM C 173.

E. Strength: 60 psi maximum in 28 days per ASTM D 4832.

PART 3 — EXECUTION

3.1 FIELD QUALITY CONTROL

A. Cement Treated Fill (Flowable Fill):
   1. Mold 3 test cylinder, ASTM D 4832. Test cylinders at 28 days.
   2. If a cylinder test shows improper sampling, molding, handling, curing, or testing, discard the cylinder. Use remaining cylinders to determine average strength.

3.2 INSTALLATION

A. Combine materials to meet the requirements for strength and constructability as required.

B. Determine a suitable aggregate size and gradation for the intended application.

END OF SECTION

SECTION 31 05 19
GEOTEXTILES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Geotextile fabrics.

1.2 REFERENCES

A. ASTM D 146: Standard Methods of Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.

B. ASTM D 276: Standard Test Methods for Identification of Fibers in Textiles.

C. ASTM D 882: Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.

D. ASTM D 3786: Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.

E. ASTM D 4354: Standard Practice for Sampling of Geotextiles for Testing.

F. ASTM D 4355: Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon - Arc Type Apparatus).

G. ASTM D 4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

H. ASTM D 4533: Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

I. ASTM D 4632: Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).

J. ASTM D 4751: Standard Test Method for Determining Apparent Opening Size for a Geotextile.

K. ASTM D 4759: Standard Practice for Determining Specification Conformance of Geosynthetics.

L. ASTM D 4833: Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

M. ASTM D 4873: Standard Guide for Identification, Storage, and Handling of Geotextiles.

N. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials.

O. ASTM E 154: Standard Methods of Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.

1.3 DEFINITIONS

A. MARV (acronym for minimum average roll value): A statistical value of a particular test property embracing 95 percent confidence level of all possible values of that property. For a normally distributed set of data, it is approximately the mean value plus and minus two standard deviations.

1.4 SUBMITTALS

A. Submit prior to use:
   1. Sample of geotextile.
   2. Manufacture's certificate that each fabric complies with requirements of this section.

1.5 DELIVERY STORAGE AND HANDLING

A. Label fabric, ASTM D 4873.

B. Deliver geotextile dry, in a wrapping that protects it from the elements during shipping and storage. Keep fabric dry.

C. Protect geotextile from ultraviolet light and temperature greater than 140 deg. F. until application.

1.6 QUALITY ASSURANCE

A. Provide manufacturer's on-site technical supervision and assistance.

PART 2 — PRODUCTS

2.1 GEOTEXTILE - GENERAL

A. Stated values are for non-critical, non-severe applications.

B. Fabric consists of synthetic fibers at least 85 percent by weight of polyolefins, polyesters or polyamides.

C. Resistant to chemical attack, rot and mildew.

D. No tears or defects that adversely alter fabric's physical properties.

E. All numerical values represent minimum average roll values in the weaker principal direction.

2.2 STABILIZATION-SEPARATION GEOTEXTILES

A. Woven or non-woven fabric. Meet the following properties and survivability ratings.

Table 1 – Stabilization-Separation Geotextile

Property	*ASTM*	*MARV*			
		Moderate		*High*	
		Woven	*Nonwoven*	*Woven*	*Nonwoven*
Grab Tensile Strength, lbs.	D 4632	180	115	270	180
Grab Elongation, percent	D 4632	<50	>50	<50	>50
Trapezoid Tear, lbs.	D 4533	70	40	100	75
Puncture Resistance, lbs.	D 4833	70	40	100	60
Apparent Opening Size, (AOS-US Sieve)	D 4751	≥30	≥60	≥30	≥60
Construction Survivability					

Subgrade, CBR	1		1-2		> 2	
Tire Pressure, psi	<50	>50	<50	>50	<50	>50

6 inches Cover Thickness	NR	NR	H	H	M	M
12 inches Cover Thickness	NR	NR	H	M	M	M
18 inches Cover Thickness	H	M	M	M	M	M
Where H = High; M = Medium; NR = Not Recommended						

2.3 SILT FENCE GEOTEXTILE

A. Use woven fabric. Meet standard or high performance properties.

Table 2 – Silt Fence Geotextile

Property	*ASTM*	*MARV*	
		Standard	*High*
Grab Tensile Strength, lbs. (a)	D 4632	90	120
Grab Elongation, percent	D 4632	< 40	< 40
Flux, gal/min/ft2	D 4491	15	90
Apparent Opening Size, (AOS-US sieve)	D 4751	> 20	> 30
Ultraviolet Degradation, percent	D 4355	70	90
NOTES (a) Percent of tensile strength retained determined after weathering, ASTM D 4355 for 500 hours			

B. High performance fence to have tape yarns in one principle direction only.

C. Add stabilizers or inhibitors to make the filaments resistant to sunlight or heat deterioration.

D. Finish edges to prevent outer yarn from pulling away from the fabric.

E. Sheets of fabric may be sewn or bonded together. Provide minimum width recommended by manufacturer.

F. No deviation from any requirement in Table 2 due to the presence of seams.

G. Manufactured with pockets for posts, hems with cord, or with posts preattached using staples or button head nails.

2.4 EROSION CONTROL GEOTEXTILES

A. Use woven or non-woven fabric.

Table 3 – Erosion Control Geotextile

Property	*ASTM*	*MARV*		
		Class A	*Class B*	*Class C*
Grab Tensile Strength, lbs. (a)	D 4632	300	200	100
Grab Elongation, percent	D 4632	>15	>50	>50

Puncture Resistance, lbs.	D 4833	100	60	30
Trapezoid Tear, lb.	D 4533	80	50	40
Flux, gal/min/ft^2	D 4491	25	25	25
Apparent Opening Size, (AOS-US sieve)	D 4751	>59	>59	>59
Ultraviolet Degradation, percent	D 4355	70	70	70
Permittivity, sec.-1 (b)	D 4491	0.1	0.1	0.1
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours. (b) This number reflects typical not minimum values for this test method only. The k value of the geotextile shall be greater than the k value of the soil.				

B Class A erosion control applications are those where the geotextile is used under conditions where installation stresses are greatest (more severe than Class B, i.e., stone placement height should be no more than 5 feet and stone weights should not exceed 250 pounds.

C. Class B erosion control applications for geotextiles are used under conditions where installation stresses are more severe than Class C, i.e., stone placement height should be less than 3 feet and stone weights should not exceed 250 pounds.

D. Class C erosion control applications are those where the geotextile is used in structures or under conditions where the geotextile is protected by a sand cushion or by "zero drop height" placement of stone.

2.5 ROADWAY PAVEMENT GEOTEXTILES

A. Sheet Fabric: Non-woven. Heat bonded only on one side to assist in preventing bleed through of tack coat and sticking of fibers to wheels of laydown equipment.

Table 4 – Roadway Paving Geotextile

Property	*ASTM*	*MARV*	
		Standard	*Heavy Duty*
Grab Tensile Strength, lbs. (a)	D 4632	80	120
Grab Elongation, percent	D 4632	50	50
Asphalt Retention, gal/yd^2	--	0.2	0.3
Melting Point, deg. F.	D 276	300	300
Ultraviolet Degradation	D 4355	70	70
Apparent Opening Size, (AOS-US sieve)	D 4751	≥60	≥60
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours.			

B. Crack Patch Fabric: Needle-punched non-woven coated with asphalt cement and a rubberized asphalt adhesive.

Table 5 – Crack Patching Geotextile		
Property	*ASTM*	*MARV*
Strip Tensile, lbs/in (a)	D 882	50
Puncture resistance, lb	E 154	200
Permeance, perms	E 69 Method B	0.10 (max)
Pliability (b)	D 146	No crack in fabric or rubberized asphalt
NOTES (a) Using 12 in/min test speed and 1" initial distance between grips. (b) Using 180 degree bend on 1/4" mandrel at –25 deg. F.		

2.6 DRAINAGE GEOTEXTILES

A. Use non-woven fabric.

Table 6 – Drainage Geotextile			
Property	*ASTM*	*MARV*	
		Class A	*Class B*
Grab Tensile Strength, lbs. (a)	D 4632	200	100
Grab Elongation, percent	D 4632	>50	>50
Puncture Strength, lbs.	D 4833	60	30
Trapezoid Tear, lbs.	D 4533	50	40
Flux, gal/min/ft^2	D 4491	25	25
Apparent Opening Size,(AOS - US Sieve)	D 4751	>59	>59
Permittivity, $sec.^{-1}$ (b)	D 4491	0.1	0.1
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours. (b) The k value of the geotextile shall be greater than the k value of the soil. This number reflects typical not minimum values for this test method only.			

B. Class A drainage applications are for fabrics where installation stresses are more severe than Class B, i.e. very coarse sharp angular aggregate is used, a heavy degree of compaction (greater than or equal to 96 percent Standard Proctor) is specified or depth of Trench is greater than 10 feet deep.

C. Class B drainage applications are those where fabric is used with smooth graded surfaces having no sharp angular projections, no sharp angular aggregate, compaction requirements are light, (less than 96 percent Standard Proctor), and Trenches are less than 10 feet deep.

2.7 WEED BARRIER GEOTEXTILE

A. Use non-woven fabric.

Table 7 – Weed Barrier Geotextile		
Property	*ASTM*	*MARV*
		Standard
Grab Tensile Strength, lbs. (a)	D 4632	90
Grab Elongation, percent	D 4632	>50
Puncture Strength, lbs.	D 4833	25
Trapezoid Tear, lbs.	D 4533	30
Apparent Opening Size,(AOS - US Sieve)	D 4751	>49
Ultraviolet Degradation, percent	D 4355	70
NOTES (a) Percent of tensile strength retained determined after ultraviolet weathering, ASTM D 4355 for 500 hours.		

2.8 POSTS

A. Minimum length: 4 feet.

B. Steel: Round, U shaped, T shaped, or C shaped with a minimum weight of 1.3 pounds per foot, and have projections for fastening wire.

C. Wood as follows:
1. Soft wood posts at least 3 inches in diameter, or nominal 2 x 4 inches and straight to provide a fence without noticeable misalignment.
2. Hard wood post providing a minimum cross sectional area of 2.25 square inches.

D. Fasteners for Wooden Posts:
1. Wire staples No. 17 gage minimum with a crown at least 3/4 inches wide and legs at least 1/2 inch long.
2. Nails 14 gage minimum, 1 inch long with 3/4 inch button heads.

2.9 SOURCE QUALITY CONTROL

A. Sampling practices, ASTM D 4354.

B. Conformance verification, ASTM D 4759.

PART 3 — EXECUTION

3.1 STABILIZING POOR LOAD BEARING SOILS

A. Remove all organic material larger than 1 inch in diameter from the Subgrade and grade to elevations required for overlaying backfill.

B. Compact Subgrade to the extent allowed by the condition of the substrate.

C. Roll fabric onto Subgrade so Subgrade remains smooth. Do not drag.

D. Fold or overlap geotextile in direction of drainage.

E. Provide fabric overlap joints as follows.

Table 8 – Geotextile Overlap		
Soil CBR Rating	*Overlap Required*	
	Unsewn, inches	*Sewn, inches*
Less than 1	--	4
1-2	36	4
2-3	30	3
3-5	24	--
Greater than 5	18	--
NOTES (a) Sewn seams, both factory and field seams shall conform to 90 percent of the grab tensile strength requirements.		

F. Place granular material on top of fabric and spread carefully to insure no puncture. Minimum backfill lift on fabric; 6 inches.

G. Cover fabric with 12 inches of sand before placing rock larger than 4 inches diameter on top of fabric.

H. Avoid sudden stops or turning motions by equipment operating on aggregate placed over the fabric.

I. Compact backfill soils over fabric to a Standard Proctor Density of 96 percent or greater.

J. Repair any puncture by covering with new fabric using the same overlap dimensions indicated in Table above.

3.2 SILT FENCE

A. Beginning work means acceptance of existing conditions.

B. The quantity of temporary silt fences may be increased, decreased, or eliminated entirely at CONTRACTOR's discretion at no additional cost to OWNER. Maintain the silt fence until the Work is accepted or until the fence and silt accumulations are removed.

C. Clear area of any debris and obstructions that may damage geotextile.

D. Place post in all low points.

E. Install posts a maximum of 8 feet apart with at least 18 inches in the ground. If not possible to achieve depth, secure posts to prevent overturning.

F. Attach filter fabric by wire, cord, pockets, staples, nails, or other effective means.
1. When using a wire support fence, provide at least 6 horizontal wires with a minimum of 12 gage wire. Space vertical wires 6 inches maximum. Secure geotextile to the up slope side of the post. Extend wire into the Trench a minimum of 2 inches and extend a maximum or 36 inches above the ground surface.

G. Install fabric so 6 to 8 inches of fabric is left at the bottom to be buried. Splice together only at support posts with any a minimum overlap of 18 inches. Extend buried portion 6 inches deep and the rest upstream of the fabric fence.

H. Sediment Removal: Remove sediment before deposit reaches 1/2 of the height of the silt fence, or extend height of silt fence. After removal of sediment, dress landscape.

I. Schedule of Locations: Typical locations include the toe of fill slopes, the downhill side of fill slopes, the downhill side of large cut areas, and at natural drainage areas. Limit geotextile materials to handle an area

equivalent to 1,000 square feet per 10 feet of fence. Use caution should site slope be steeper than 1:1, and water flow rates exceed 1 cubic foot per second per 10 feet of fence face.

3.3 EROSION CONTROL

A. Install fabric in locations shown on the Drawings.

B. Unless otherwise specified, the geotextile shall be overlapped a minimum of 2 feet at all longitudinal and transverse joints, or the geotextile shall be sewn.

C. If overlapped, the geotextile shall be placed so that the upstream sheet overlaps the downstream sheet.

D. For placement on slopes, each strip shall overlap the next downhill strip.

E. The geotextile shall be anchored using key Trenches or aprons at the crest and toe of the slope.

F. Pins, usually 18 inches in length, may be helpful in securing the geotextile during installation.

G. Repair: Place patch over damaged area and extend 3 feet beyond the perimeter of the tear or damage.

3.4 ROADWAY PAVING FABRICS

A. Preparing Asphalt Concrete Surface:
1. Brush road surface clean of debris, dust and gravel. Remove all water from surface and allow to dry.
2. Patch holes and level any uneven areas with asphalt concrete.
3. Fill cracks between 1/8 inch to 1/2 inch with asphalt cement. Allow cement to cure prior to geotextile placement.
4. Clean cracks larger than 1/2 inch to a depth of 3 inches and fill with asphalt concrete. Where Pavement is severely cracked, rutted, deformed or distressed, secure approval for providing an asphalt concrete leveling course prior to geotextile placement.

B. Tacking Asphalt Surface for Pavement Fabric: Use tack asphalt recommended by fabric manufacturer. Apply tack as follows:
1. Dry Pavement surface; 0.20 to 0.30 gallons per square yard. Within street intersections, on steep grades and in zones where vehicle speed changes are commonplace, reduce the application rate to no less than 0.20 gallons per square yard.
2. Heavy duty fabrics; 0.30 to 0.40 gallons per square yard.
3. Provide a tack width equal to geotextile width plus 6 inches.
4. Apply tack only as far in advance of geotextile installation as is appropriate to insure a tacky surface at the time of geotextile placement.
5. Allow tack time to cure with no moisture remaining prior to placing the geotextile and overlay.
6. Clean excess tack material from the road surface.

C. Placement of Fabric:
1. Place paving fabric into the asphalt with a minimum amount of wrinkling or folding. Wrinkles or folds in excess of 1 inch shall be slit and laid flat.
2. Shingle-lap all transverse joints and slit folds or wrinkles in the direction of the paving operation.
3. Maximize geotextile contact with the Pavement surface by brooming or pneumatic rolling.
4. Additional hand-placed asphalt may be required at laps and repairs.

D. Protection and Repair:
1. Do not allow traffic except necessary construction equipment and emergency vehicles to drive on the fabric.
2. Turn paver and other vehicles gradually and keep turning to a minimum to avoid movement and damage to the geotextile. Do not permit abrupt starts and stops.
3. Remove and replace damaged geotextile with the same type of geotextile, and shingle-lap the overlaps in the direction of paving. Restrict overlaps to a maximum of 6 inches.

3.5 SUBSURFACE DRAINAGE

A. Excavate Trench to size and depth indicated.

B. Cut fabric to width required and place in Trench. Prevent damage to geotextile.

C. Overlap geotextile 12 inches or the full width of the Trench, whichever is less at the top of the Trench.

D. Overlap successive pieces of geotextile a minimum of 12 inches in the direction of flow.

E. Place fill to hold fabric in place.

F. Repair any damage to geotextile by placing patches extending 3 feet in all directions beyond the damaged area.

3.6 WEED BARRIER

A. Preparation:
   1. Remove sharp objects, large stones and undesirable vegetation.
   2. If placing geotextile over existing bed, cut an "X" over each plant and push geotextile under plant base. If placing over new bed, roll geotextile over soil and cut an "X" for each plant hole. Fold excess geotextile under and cover with specified landscaping materials.

B. Surface Cover: Provide a minimum of 4 inches of cover on all areas on the geotextile unless otherwise specified by VERNAL CITY REPRESENTATIVE. If using large landscape rock, increase thickness of cover material over geotextile to 3 times the diameter of the largest rock material. Do not leave any portion of geotextile exposed to direct sunlight.

C. Repair: Repair immediately. Clear the damaged area plus an additional 3 feet and apply geotextile patch.

D. Maintenance: Maintain surfaces and supply additional landscape materials where necessary, including areas affected by erosion.

3.7 FIELD QUALITY CONTROL

A. Reject fabric at the time of installation, if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, handling or storage.

END OF SECTION

SECTION 31 05 21
GEOGRIDS/GEOCOMPOSITES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Geogrid and geocomposite material requirements.

1.2 REFERENCES

A. ASTM D 4354: Standard Practice for Sampling of Geotextiles for Testing.

B. ASTM D 4759: Standard Practice for Determining Specification Conformance of Geosynthetics.

C. ASTM D 4873: Standard Guide for Identification, Storage, and Handling of Geotextiles.

D. ASTM D 5321: Standard Practice for Determining the Coefficient of Soil and Geosynthetic by Direct Shear.

E. ASTM D 6213: Standard Tests to Evaluate the Chemical Resistance of Geogrids to Liquids.

F. ASTM D 6637: Standard Test Method for Determining Tensile Properties of Geogrid.

G. FHWA-SA-96-071: Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines.

1.3 DEFINITIONS

A. Geocomposite: Fabric composed of a geogrid and geotextile.

1.4 SUBMITTALS

A. Geogrid sample.

B. Geocomposite sample

C. Manufacturer’s warranty.

D. Installer’s warranty.

1.5 DELIVERY STORAGE AND HANDLING

A. Label, handle and store product, ASTM D 4873.

B. Deliver product dry, in a plastic wrapping that protects the entire roll.

C. Protect product from ultraviolet light and temperature greater than 160 deg. F. until application. Cover product within 14 days of deployment.

1.6 QUALITY ASSURANCE

A. Provide manufacturer’s on-site technical supervision and assistance if required for manufacturer’s warranty.

1.7 WARRANTY

A. Manufacturer: Warrant product for a period of 20 years on a prorated basis against manufacturing defects, workmanship, and deterioration due to exposure to the elements.

B. Installer: Warrant material and workmanship for 2 years.

PART 2 — PRODUCTS

2.1 GEOGRID/GEOCOMPOSITES - GENERAL

A. Synthetic fiber net at least 85 percent by weight of polypropylene, polyethylene, polyester, polyvinyl alcohol, or polyamide.

B. Resistant to chemical attack, rot and mildew.

C. No tears or defects that will adversely alter properties of product.

2.2 ROADWAY PAVEMENT GEOCOMPOSITE

A. Placement is between asphalt layers. Product is geogrid glued to a lightweight non-woven bitumen coated geotextile.

Table 1 – Roadway Pavement Geocomposite

Property	*ASTM*	*MARV*
Ultimate Tensile Strength, lb/ft	D 6637	3425 x 3425
Tensile Strength at 3 percent Strain, lb/ft	D 6637	825 x 825
Melting Point (geogrid), deg. F.	–	490
Softening Point (geotextile), deg. F.	–	220

2.3 ROADWAY AGGREGATE GEOGRID

A. Subbase geogrid is placed on the Subgrade below new fill or crushed aggregate base.

B. Base course geogrid is placed between fills or crushed aggregate bases.

Table 2 – Roadway Aggregate Geogrid

Property	*ASTM*	*MARV*	
		Subbase	*Base Course*
Ultimate Tensile Strength, lbs/ft.	D 6637	900 x 1400	900 x 1400
Tensile Strength at 2 percent Strain, lbs/ft.	D 6637	–	300 x 445
Tensile Strength at 5 percent Strain, lbs/ft.	D 6637	580 x 920	–
Coefficient of Direct Shear	D 5321	1.0	1.0
Chemical Resistance range, pH	D 6213	2 – 12	2 – 12
Aperture Size range, inches	Measured	0.5 – 1.3	0.5 – 1.3
Open Area, percent	-	50 – 80	50 – 80

2.4 EMBANKMENT GEOGRID

A. Geogrid is used for earth slope and retaining wall reinforcement.

Table 3 – Embankment Geogrid				
Property	*ASTM*	*MARV*		
		Type 1	*Type 2*	*Type 3*
Long Term Design Strength, lb/ft	(a)	700	1300	1900
Chemical resistance, pH	D 6213	2 – 12	2 – 12	2 – 12
Aperture Size inches	Measured	0.8 – 1.2	0.8 – 1.2	0.8 – 1.2
NOTES (a) FHWA-SA-96-071.				

2.5 CLAMPS, TAPE, RUBBER PADS

A. Recommended by manufacturer.

2.6 SOURCE QUALITY CONTROL

A. Sample geogrids and geocomposites using ASTM D 4354 standard practices.

B. Verify specification conformance, ASTM D 4759.

PART 3 — EXECUTION

3.1 PREPARATION

A. Instruct workers about protecting product of this section.

B. Repair damage to Subgrade surface prior to installation.

C. Round edges of Excavation and grade changes.

3.2 GRANULAR BASE REINFORCEMENT

A. Deploy each panel per manufacturer's recommendations.

B. Provide sufficient material to allow for expansion and contraction.

C. Do not fold. Do not tie overlaps.

D. Install panels so overlapping panel is upgrade of the underlying panel.

E. Provide geogrid overlap as follows.

Soil CBR Rating	Recommended Overlap
3 +	0.5 feet
2 – 3	1.0 feet
1 – 2	2.0 feet
less than 1	3.0 feet

F. Provide a minimum fill thickness of six inches prior to operating tracked vehicles over geogrid.

3.3 ASPHALT CONCRETE PAVEMENT REINFORCEMENT

A. Clean the surface of the asphalt concrete base course.

B. Seal cracks wider than 1/8 of an inch. Repair larger cracks, Potholes, depressions, and irregularities.

C. Spray on tack coat uniformly at 0.08 - 0.10 gal/yd2 and place geogrid on the tack coat.

D. Overlap in a shingle fashion in the direction of overlay placement. Overlap all roll edges and ends six inches.

E. Place 2 inches minimum asphalt concrete over the geogrid. Compact.

3.4 SOIL REINFORCEMENT

A. Compact Embankment Subgrade.

B. Place Embankment geogrid at the locations and elevations shown on the Plans or controlled by the geogrid manufacturer. Place any specified free draining crushed aggregate base above the geogrid. Compact the fill to a standard proctor of 96 percent or greater.

3.5 PROTECTION

A. At least 6 inches of fill cover is required if tracked vehicles are operated over geogrid.

END OF SECTION

SECTION 31 11 00
SITE CLEARING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Removal of trees, stumps, roots, and tree debris.

B. Clearing site of plant life, root systems and shrubs.

C. Removal of fences, fence posts, mail box posts, and miscellany.

1.2 REFERENCES

A. NAA: Pruning Standards for Shade Trees.

B. Utah Shade Tree Pruning Standards.

1.3 QUALITY ASSURANCE

A. Provide at least one person, who is familiar with NAA pruning standards for the type of tree involved, to be present during tree pruning operations.

1.4 SITE CONDITIONS

A. Repair or replace damaged trees and shrubs at no additional cost to Vernal City.

1.5 PROTECTION

A. Protect roots and branches of trees to remain.

B. Construct temporary barricading at tree's approximated drip line. Place continuous barricades at least 3 feet high.

C. When setting posts, avoid damaging tree roots.

D. Do not permit heavy equipment or stockpiling of materials or debris within the barricaded area, or permit earth surface to be changed.

E. Provide water and fertilizer to maintain existing trees.

PART 2 — PRODUCTS

2.1 STUMP TREATMENT SOLUTION

A. Formulated to kill existing vegetation.

PART 3 — EXECUTION

3.1 EXAMINATION

A. The Drawings do not purport to show all trees and shrubs existing on site.

B. Verify with VERNAL CITY REPRESENTATIVE which plantings are to be removed or to remain.

C. Tree root inspection:

1. Assist the Vernal City representative by removing and replacing existing surface improvements.

3.2 PREPARATION

A. Locate utilities. Preserve utilities that are to remain in service.

B. Review work procedures with the Vernal City representative.

C. Schedule work carefully with consideration for property owners and general public.

D. Before starting, arrange for the disconnection of all utility services that are to be removed or which interfere with work.

3.3 SITE CLEARING

A. Remove all vegetation to outside Excavation, fill slope lines, and limits of slope rounding.

B. Remove fences, posts, appurtenances, and miscellaneous objects.

3.4 TREE REMOVAL

A. Remove branches, limbs, and debris.

B. Remove stumps and roots to 18 inches below proposed grade.

C. For stumps larger than 6 inches caliper remove and treat as follows:
1. Remove chips and debris from around remaining stump.
2. Apply stump treatment solution in accordance with manufacturer's recommendations.
3. Do not allow chemical solution to mist, drip, drift, or splash onto adjacent ground surfaces or desirable vegetation.
4. Replace any existing vegetation damaged or killed through improper use of chemical at no additional cost to Vernal City.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Excavation and disposal of excavated materials.

B. Protection of existing facilities, utilities, and structures affected by excavation.

1.2 DEFINITIONS

A. Extra Excavation: Upper limit of Excavation is proposed excavation limit. Lower and lateral limits are as authorized by Vernal City representative.

B. Classified Excavation: The excavation of specified materials.

C. Incidental Excavation: Excavation done for CONTRACTOR'S benefit, excavation error, dewatering of Excavation, slough, or over-break.

D. Unclassified Excavation: The excavation of all materials encountered regardless of the nature, size, or manner in which they are removed. Presence of isolated boulders or Rock fragments will not be sufficient cause to change classification of surrounding materials.

E. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 STORAGE AND HANDLING

A. Stockpile excavated material to cause a minimum of inconvenience to public and provide for emergency services as necessary.

B. Provide free access to all existing fire hydrants, water and gas valves, and meters.

C. Provide free flow of storm water in all gutters, conduits, and natural water courses.

D. Utilize traffic control signs, markers, and procedures in product storage and handling activities.

E. Promptly remove other material from site.

1.4 SITE CONDITIONS

A. Prior to excavation, photograph existing surfaces along which work may take place in order to determine, after construction is completed, whether any damage to existing improvements occurred prior to construction operations.

B. Perform Incidental Excavation at no additional cost to Vernal City.

1.5 WATER QUALITY

A. Obtain all discharge permits, easements, or other necessary approvals from regulatory agencies for disposal of waters from excavations. Comply with all laws and requirements related to water quality.

PART 2 — PRODUCTS

2.1 MATERIALS FOR OVER EXCAVATED AREAS

A. Fill materials, Section 31 05 13.

B. Stabilization fill, crushed aggregate base or common fill with maximum rectilinear particle size of 1-1/2 inches.

C. Stabilization fabric, Section 31 05 19.

PART 3 — EXECUTION

3.1 PREPARATION

A. Use white paint and mark the proposed Excavation.

B. Call the one-call center and wait the required amount of time. Color of one call center marks indicate the following.
1. White: Proposed Excavation
2. Pink: Temporary survey markings
3. Red: Electric power lines, cables, conduit and lighting cables
4. Yellow: Gas, oil, steam, Petroleum or gaseous materials
5. Orange: Communications, alarm, signal, cables or conduits.
6. Blue: Potable water.
7. Purple: Reclaimed Water, irrigation and slurry lines
8. Green: Sewer and storm drain lines

3.2 PROTECTION

A. Identify required lines, grades, contours, and benchmarks.

B. Pothole, expose or otherwise locate utilities as necessary to give utility company at least 7 days notice to protect, preserve, or relocate a utility that interferes with or may be damaged by excavation work.

C. Where utilities or structures conflict with design grades, report conflict to the appropriate utility company and Vernal City representative 14 days prior to the initiation of work within the conflict area.

D. For temporary controls, refer to Section 01 57 00.

E. Support and protect from damage any existing facility and structure that is adjacent to, exists in, passes through, or passes under the site.

F. No Contract Time extension shall be granted and no additional compensation shall be made if CONTRACTOR fails to pothole and identify buried utilities or structures which conflict with the Work.

3.3 TOPSOIL

A. Excavate topsoil only to depth that will preserve topsoil quality.

B. Do not mix topsoil with subsoil during stockpiling or spreading.

3.4 LANDSCAPE SPRINKLER SYSTEMS

A. Protect existing landscape sprinkler systems.

B When disturbance of existing sprinkler system is required, interrupt and repair system so operation of system is maintained.

3.4 SHORING

A. Slope, shore, sheet, brace or otherwise support Excavations over 4 feet deep, Section 31 41 00.

B. When soil conditions are unstable, Excavations shallower than 4 feet deep must also be sloped, supported or shored.

3.6 DEWATERING

A. Keep Excavation free from surface and ground water. Should groundwater be encountered, the CONTRACTOR shall provide sufficient well points, sumps, pumps, hoses, generators, and other necessary equipment to maintain a static water level 1 foot below the bottom of the excavation depths shown on the plans or directed by the Vernal City representative at no additional cost to Vernal City.

B. If ground water table is in the intended construction operations, dewater Excavations. Bring the presence of groundwater to the attention of the Vernal City representative immediately.

C. If there are no olfactory or visual indications of contamination in the water, discharge according to requirements of Federal, State or local agency having jurisdiction.

D. If any evidence of contamination in the water, based on olfactory or visual indications, cease excavation work until potential risks are evaluated. During evaluation, handle water as a contaminated material.

E. Pay for damages and costs resulting from dewatering operations.

3.7 GENERAL EXCAVATION REQUIREMENTS

A. Excavate topsoil from areas to be relandscaped or regraded and other marked areas.

B. Excavate site to line and grade indicated.

C. Carefully excavate soils in vicinity of buried utility marks placed by the one-call center.

D. Where soil has been softened or eroded by flooding or hardened by drying during unfavorable weather, rework all damaged areas or replace with approved material at no additional cost to Vernal City.

E. Notify the Vernal City representative of unexpected subsurface conditions.

F. Underpin adjacent structure, service utilities and pipe chases that may be damaged by Excavation work.

G. Protect Excavation walls as required. If conditions permit, slope Excavation Sides to maintain a safe and clean working area. Remove loose materials.

H. Where the Vernal City representative deems Subgrade material to be susceptible to frost heave or otherwise unsatisfactory, excavate additional depth. Excavating additional depths up to 1 foot shall be at no additional cost to Vernal City.

3.8 ROADWAY EXCAVATION

A. In advance of setting line and grade stakes, clean Subgrade area of brush, weeds, vegetation, grass, and debris. Drain all depressions or ruts that contain water.

B. Backfill and compact over excavation, Section 31 23 26.

C. Standard procedures:

1. Finish excavation to reasonably smooth and uniform surface.

2. Use only trackhoe or backhoe to excavate roadways to avoid pumping of the subgrade. Excavation methods with loaders and similar equipment should not be used. Limit truck traffic on the subgrade to prevent pumping.

3. Provide and maintain satisfactory access to roads, streets, and adjacent property during all phases of construction according to the Traffic Control Plan.

4. Remove material in all cut sections to the depth indicated. When necessary to obtain compaction, scarify to a 8 inch depth and compact to at least 96% of maximum laboratory density.

5. Excavate and waste unsuitable material.

6. Use suitable granular material encountered in excavation to construct the top layers of embankment, for finishing the roadbed, of for backfill when directed by the Vernal City representative.

7. When practical, haul the granular material directly from the excavation to the final position on the roadbed.

D. Excavate solid rock 0.5 ft. to 1.0 ft. below subgrade and backfill with acceptable material. Rock removed more than 1.0 ft. below subgrade will not be measured nor paid for. Backfilling of depth greater than 1.0 ft. below subgrade will not be measured nor paid for.

3.9 STRUCTURAL AND LANDSCAPE EXCAVATION

A. Provide Shoring, cribs, cofferdams, caissons, pumping, bailing, draining, sheathing, bracing, and related items.

B. For piling work, coordinate special requirements for piling. Protect Excavation walls.

C. If conditions permit, slope Excavation Sides as excavation progresses. Maintain a safe and clean working area.

D. Support Excavations. Do not interfere with the bearing of adjacent foundations, pipelines, etc.

E. Excavation for structures shall also conform to the following:
1. Ground shall not be disturbed within 3 inches from any finished subgrade. Disturbed subgrade shall be over-excavated and backfilled as specified below.
2. The bottom shall not be more than 0.15 foot above or below the lines and grades specified. If the elevation of structure excavation is not specified, the excavation shall be not more than 0.15 foot above or below the elevation specified for fill material below the structure. Slopes shall vary no more than 0.5 foot from specified grade unless the excavation is in rock where the maximum variation shall be 2 feet.
3. Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the CONTRACTOR's operations and require over-excavation and backfill, the CONTRACTOR shall refill such excavated space to the proper elevation in accordance with the procedure specified for backfill.
4. Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.

F. The foundation treatment for structures shall conform to the following:
1. Rock foundations for concrete or masonry footings shall be excavated to sound material. The rock shall be roughly leveled or cut to steps and shall be roughened. Seams in the rock shall be grouted under pressure as directed by the Vernal City representative and paid for as extra work.
2. When footings are to be supported on piles, excavations shall be completed to the bottom of the footings before any piles are drilled or driven therein. When swell or subsidence results from driving piles, the CONTRACTOR shall excavate, or backfill the footing area to the grade of the bottom of the footing with suitable material as specified. If material under footings is such that it would mix into the concrete during footing placement or would not support the weight of the fluid concrete, the CONTRACTOR shall replace the material with suitable material, install soffit forms or otherwise provide a suitable platform on which to cast the footing as directed by the Vernal City representative. This shall be paid for as extra work.

3. When soft or "quick" foundations are encountered, the Vernal City representative may order over-excavation in accordance with paragraph 3.1.
4. Whenever any structure excavation is substantially completed to grade, the CONTRACTOR shall notify the Vernal City representative who will make an inspection of the foundation. No concrete or masonry shall be placed until the foundation has been inspected by the Vernal City representative. The CONTRACTOR shall, if directed by the Vernal City representative, dig test pits and make test bores and foundation bearing tests. If the material tested is undisturbed soil, the cost thereof will be paid for as extra work.

3.10 TRENCH EXCAVATION

A. Conform to current OSHA requirements in all trenches.

B. Grade bottom of Trenches to provide uniform bearing surface.

C. If necessary, make bellholes and depressions required to complete joining of pipe or box.

D. Limit width of Trench excavations to the dimensions suitable for worker access per pipe manufacturer's recommendation. Provide enough space for compaction equipment. Notify Vernal City representative if excavation operations exceed any indicated line and grade limits.

E. Do not place trench spoils, bedding materials, or pipe in locations or adjacent to improvements which will damage or stain improvements.

F. In public thoroughfares and regardless of Trench depth, limit length of open Trenches to 40 lineal feet whenever excavation is not taking place, except as approved by Vernal City representative. Provide barricading, Section 01 55 26. Protect Trenches over night.

3.11 EXTRA EXCAVATION (OVER EXCAVATION)

A. If unstable material is encountered at the bottom of any Excavation, the CONTRACTOR shall excavate additional material and backfill with suitable material until the excavation is stabilized.

B. Any extra excavations are to be filled with acceptable material approved by the Vernal City representative.

C. The Volume of Extra Excavation will be determined by the method of average-end-areas in the original position.

3.12 TOLERANCE

A. Grading: Top surface of Subgrade = plus or minus 1 inch.

END OF SECTION

SECTION 31 23 17
ROCK REMOVAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Requirements for Rock removal and the use of explosives to assist in Rock removal.

1.2 REFERENCES

A. NFPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

1.3 DEFINITIONS

A. Rock: Solid mineral material that cannot be removed with equipment reasonably expected to be used in the Work without cutting, drilling or blasting.

1.4 SUBMITTALS

A. Submit proposed method of blasting, delay pattern, explosive types, type of blasting mat cover, and intended Rock recovery method.

B. Submit photographs of existing site conditions and facilities in vicinity of Work prior to blasting. Refer to construction photographic requirements, Section 01 78 39.

1.5 QUALITY ASSURANCE

A. Seismic Survey Firm: Company specializing in seismic surveys with 2 years documented experience.

B. Explosive Firm: Company specializing in explosives for disintegration of Rock with 2 years documented experience.

PART 2 — PRODUCTS

2.1 EXPLOSIVES

A. Type recommended by explosives firm following seismic survey and required by authorities having jurisdiction.

2.2 DELAY DEVICES

A. Type recommended by explosives firm.

2.3 BLASTING MAT MATERIALS

A. Type recommended by explosives firm.

PART 3 — EXECUTION

3.1 PREPARATION

A. Verify site conditions and note irregularities affecting work of this section.

B. Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.

C. Verify utility locations, Section 01 31 13.

D. Beginning work of this section constitutes acceptance of existing conditions.

E. Comply with NFPA 495.

3.2 STORAGE OF BLASTING MATERIALS

A. Securely store all explosives in compliance with Laws and Regulations.

B. Mark all storage places clearly.

C. Where no local Laws or Regulations apply, provide storage not closer than 1,000 feet from any road, building, camping area or place of human occupancy.

3.3 ROCK REMOVAL - NONEXPLOSIVE METHOD

A. Cut away Rock at Excavation bottom to form level bearing.

B. Remove shaled layers to provide sound and unshattered base for foundations.

C. Remove and legally dispose of excess excavated material and debris off-site unless indicated otherwise.

D. Correct unauthorized Rock removal at no additional cost to Vernal City.

3.4 ROCK REMOVAL - EXPLOSIVE METHOD

A. Provide a qualified explosives expert to act as an advisor and consultant during drilling and blasting operations.

B. Advise owners of adjacent buildings or structures and utility companies in writing prior to setting up seismographs. Describe blasting and seismic operations.

C. Obtain and pay for a seismic survey prior to Rock excavation to determine maximum charges that can be used at different locations in area of Excavation without damaging adjacent properties and utilities.

D. Provide seismograph monitoring during progress of blasting operations.

E. Disintegrate and remove Rock from excavation operations.

END OF SECTION

SECTION 31 23 23
BACKFILLING FOR STRUCTURES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Structural backfill materials.

B. Structural backfilling requirements.

1.2 DEFINITIONS

A. Open Excavation: Any area of digging or fill that has width limits beyond 8 feet measured in the shortest direction.

B. Trench: Any area of digging or fill that has width limits of 8 feet or less measured in the shortest direction.

C. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
   1. Subgrade material, and
   2. Each type of fill to be used.

1.4 QUALITY ASSURANCE

A. Do not change material sources, or aggregate without notifying the Vernal City representative.

B. Reject backfill material that does not comply with requirements specified in this section.

C. Passing test results do not relieve the CONTRACTOR of warranty to work.

1.5 STORAGE

A. Safely stockpile backfill materials.

B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

C. Avoid displacement of and injury to Work while compacting or operating equipment.

D. Movement of construction machinery over Work at any stage of construction is solely at the risk of the CONTRACTOR.

1.6 SITE CONDITIONS

A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to Vernal City.

B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.

C. Reshape and compact damaged structural section to required density.

1.7 WARRANTY

A. Restore incidentals damaged by settlement at no additional cost to Vernal City for a period of 3 years after the acceptance date.

PART 2 — PRODUCTS

2.1 BACKFILL MATERIALS

A. Fill materials, Section 31 05 13.

B. Cement treated fill, Section 31 05 15.

2.2 ACCESSORIES

A. Water:
   1. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
   2. Comply with local Laws and Regulations at no additional cost to Vernal City when securing water from water utility company.

PART 3 — EXECUTION

3.1 PREPARATION

A. Verify:
   1. Stockpiled fill meets gradation requirements.
   2. Foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water.
   3. Ground surface is not frozen.

B. If subgrade is not readily compactable secure written authorization for extra excavation and backfill, Section 31 23 16.

C. Identify required line, levels, contours, and datum.

D. Stake and flag locations of underground utilities.

E. Upon discovery of unknown utility or concealed conditions, notify the Vernal City representative.

3.2 PROTECTION

A. Protect existing trees, shrubs, lawns, existing structures, fences, roads, sidewalks, paving, curb and gutter and other features.

B. Protect above or below grade utilities. Contact utility companies to repair damage to utilities. Pay all cost of repairs.

C. Protect Subgrade from desiccation, flooding and freezing.

D. Do not fill adjacent to structures until Excavation is checked by the Vernal City representative.

E. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.

F. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in Trenches.

G. Restore any damaged structure to its original strength and condition.

3.3 LAYOUT

A. Maintain all benchmarks, control monuments and stakes, whether newly established by surveyor or previously existing. Protect from damage and dislocation.

B. If discrepancy is found between Contract Documents and site, the Vernal City representative shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to the CONTRACTOR or Vernal City.

3.4 FOUNDATIONS AND SLABS ON GRADE

A. Place backfill materials in lifts not exceeding 8 inches after compaction.

B. Do not backfill against walls until concrete has obtained 14 day strength. Backfill against foundation walls simultaneously on each side.

C. Fill unauthorized excavations with material acceptable to the Vernal City representative at no additional cost to Vernal City.

D. Do not damage adjacent structures or service lines.

E. Where flowable fill is used, use fill that flows easily and vibration for compaction is not required.

3.5 COMPACTION

A. Place backfill material in uniform layers and bring up uniformly on all sides of the structure in lifts no greater than 8 inches uncompressed depth.

B. Compact backfill; Section 31 23 26 to the following maximum dry densities.
   1. Under Footings: 98 percent.
   2. Interior Crawl Spaces: 90 percent.
   3. Interior Slab-On-Grade: 98 percent.
   4. Side of Foundation Walls and Retaining Walls:
      a. Exterior: 96 percent.
      b. Interior: 98 percent.
   5. Miscellaneous Structures: 96 percent.

C. Compaction tests are to be taken half way up the area to be filled and on the surface of the fill area or every 3 feet of fill which ever is less.

D. Frequency of compaction tests are as follows:
   1. Trench - 1 test every 100 lineal feet of trench at the vertical frequency listed above.
   2. Open Excavation - 1 test in each 500 square foot area.

3.6 CLEANING

A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 31 23 24
BACKFILLING TRENCHES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Trench backfill materials.

B. Trench backfilling requirements.

C. Surface restoration requirements.

1.2 DEFINITIONS

A. Bedding: That surface of the Excavation or portion of the Pipe Zone below the pipe.

B. Pipe Zone: That zone in a backfilling operation which supports, and surrounds the pipe barrel, and extends to 1 foot above the top of the pipe barrel.

C. Trench: Any area of digging or fill that has width limits of 8 feet or less measured in the shortest direction.

D. Parallel Trench: A trench parallel to a roadway alignment.

E. Road Crossing: A trench that cuts through the roadway alignment at a specific point.

F. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
   1. Subgrade material, and
   2. Each type of fill to be used.

1.4 QUALITY ASSURANCE

A. Do not change material sources, or aggregate without notification of the Vernal City representative.

B. Reject backfill material that does not comply with requirements specified in this section.

C. Passing test results do not relieve person doing work from warranty to work.

1.5 STORAGE AND PROTECTION

A. Storage:
   1. Safely stockpile backfill materials.
   2. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

B. Protection:
   1. During installation or repair, plug end of pipe or fitting except when installing next section of pipe or fitting.
   2. Avoid displacement of and injury to Work while compacting or operating equipment.
   3. Movement of construction machinery over Work at any stage of construction is solely at the risk of the CONTRACTOR.

1.6 SITE CONDITIONS

A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to Vernal City.

B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.

C. Reshape and compact damaged structural section to required density.

D. Restore any damaged structure to its original strength and condition.

E. Replace contaminated backfill at no additional cost to Vernal City.

1.7 SEQUENCING

A. Coordinate backfilling operation with pipeline commissioning requirements in Section 33 08 00.

1.8 WARRANTY

A. Any settlement noted in Trench backfill or in structures built over the Trench backfill will be considered to be caused by improper compaction methods and shall be corrected at no cost to Vernal City.

B. Restore structures damaged by settlement at no additional cost to Vernal City for a period of 3 years after the final acceptance date.

PART 2 — PRODUCTS

2.1 BACKFILL MATERIALS

A. Fill materials, Section 31 05 13.

B. Cement treated fill, Section 31 05 15.

C. Slag or asphalt bearing material not allowed.

2.2 ACCESSORIES

A. Water: Make arrangements for sources of water during construction and make arrangements for delivery of water to site. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.

B. Geotextile Fabric: Section 31 05 19.

C. Identification Tape: Permanent, bright-colored, continuous-printed magnetic plastic tape, intended for direct-burial service; not less than 6 inches wide by 4 mils thick. The tape shall read "CAUTION: BURIED INSTALLATION BELOW". Color of tape as follows.
   1. Red: Electric power lines, cables, conduit and lighting cables
   2. Yellow: Gas, oil, steam, Petroleum or gaseous materials
   3. Orange: Communications, alarm, signal, cables or conduits.
   4. Blue: Potable water
   5. Purple: Reclaimed Water, irrigation and slurry lines
   6. Green: Sewer and storm drain lines

D. Trace wire: Place trace wire on top of pipe along the centerline. Trace wire and splice to be as called out on drawings, but at a minimum shall be 250 lb tensile strength wire with direct bury splices.

PART 3 — EXECUTION

3.1 PREPARATION

A. Verify backfill material meets gradation requirements, foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water, and Trench bottom is not frozen.

B. If Subgrade is not readily compactable, excavate to stable conditions; Section 31 23 16.

C. Avoid injuring and displacement of pipe and structures while compacting soil or operating equipment next to pipeline.

D. Place geotextile fabrics; Section 31 05 19.

3.2 GENERAL BACKFILLING REQUIREMENTS

A. Protect Subgrade from desiccation, flooding and freezing.

B. Do not damage corrosion protection on pipe.

C. Repair or replace damaged pipe at no additional cost to Vernal City.

D. Withdraw sheathing, Shoring, piles, and similar supports as backfilling progresses. Backfill and compact all holes left by removals.

E. Provide sufficient water quality facilities to protect downstream fish and wildlife, and to meet State water quality requirements.

F. Water settling of Trench backfill is not permitted. "Jetting" of Trench backfill is prohibited.

G. Cement treated fill is required for use as backfill above the pipe zone in all Vernal City street right of ways.
   1. Cement treated fill is required to be placed above the pipe zone and the entire width of the trench to the bottom of asphalt.

3.3 PIPE ZONE

A. Maintain uniform foundation along barrel of pipe with sufficient relief for joint connections.

B. Install trace on top of pipe and above the centerline of the pipe.

C. Use backfill materials meeting pipe manufacturer's recommendations. Maximum backfill particle size is 1/4 inch for plastic pipe.

D. Do not permit free fall of backfill material which may damage pipe, pipe finish, or pipe alignment.

E. Except where piping must remain exposed for tests, fill Pipe Zone as soon as possible.

3.4 TRENCH ABOVE PIPE ZONE.

A. Cement Treated Fill (see Section 31 05 15) is the only material permitted between the pipe zone and the asphalt except where written permission is granted from Vernal City Public Works Department prior to construction.

B. With written permission from Vernal City Public Works Department prior to construction, landscape areas may be backfilled with UTBC to within 2 feet of the surface compacted according to paragraph 3.5 of this section. The top 2 feet shall be backfilled with topsoil in 6 inch lifts and shall be plate compacted or water treated to prevent settling.

C. Do not damage adjacent structures or service lines.

D. When Cement Treated Fill is used as the backfill material, utility warning ribbon is not required.

3.5 COMPACTION

A. Compact backfill, Section 31 23 26.
   1. A-1 soils: greater than or equal to 96 percent of a Modified Proctor Density.
   2. Other soils: greater than or equal to 96 percent of a Standard Proctor Density.

B. Compaction tests are to be taken 12" above the top of the pipe zone and every 12" thereafter and one at the surface of the trench prior to paving.

C. Frequency of compaction tests are as follows:
   1. Road Crossings - 1 test on each half of the roadway and at the vertical frequency listed above.
   2. Parallel Trench - 1 test every 100 lineal feet of trench at the vertical frequency listed above.

3.6 COMPRESSIVE STRENGTH

A. Where a cement treated fill is used, provide compressive strength indicated in Section 31 05 15. Use fill which flows easily and vibration is not required.

3.7 SURFACE RESTORATION

A. Provide paved surfaces where trenches pass through roadways, driveways or sidewalks.

B. Restore paved surfaces; Section 32 01 18.

C. Finish landscaped surfaces with grass, Section 32 92 00 or with other ground cover, Section 32 93 13.

3.8 CLEANING

A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 31 23 25
BACKFILLING ROADWAYS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Roadway backfill materials.

B. Roadway backfilling requirements.

1.2 DEFINITIONS

A. Embankment: A raised earthen structure to carry a roadway.

B. Pavement: Artificially covered surfaces including but not limited to roadway surfaces, parking lot surfaces, sidewalks, curb, gutter, curb ramps, Driveway ramps, etc.

C. Subgrade: A surface of earth or Rock leveled off as to receive backfill materials.

D. Open Excavation: Any area of digging or fill that has width limits beyond 8 feet measured in the shortest direction.

E. Pothole: Any excavation with dimensions of 8 feet by 8 feet or less.

E. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
   1. Subgrade material, and
   2. Each type of fill to be used.

B. Submit aggregate batch delivery tickets showing name of material source, Serial number of ticket; date and truck number; name of Supplier; job name and location; volume of material delivered, And aggregate classification.

1.4 QUALITY ASSURANCE

A. Do not change material sources, or aggregate without notification of the Vernal City representative.

B. Reject backfill material that does not comply with requirements specified in this section.

C. Passing test results do not relieve person doing work of warranty to work.

1.5 STORAGE

A. All storage to be as per section 01 31 00 paragraph 3.5

B. Safely stockpile backfill materials.

C. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

D. Avoid displacement of and injury to Work while compacting or operating equipment.

E. Movement of construction machinery over Work at any stage of construction is solely at the risk of the

CONTRACTOR.

1.6 SITE CONDITIONS

A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to Vernal City.

B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.

C. Reshape and compact damaged structural section re required density.

D. Soil Cement: Do not spread soil cement mixture when air temperature is less than 40 deg. F. in the shade.

E. Drainage: Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of Work area.

1.7 WARRANTY

A. Any settlement noted in Embankment or Pavement construction will be considered to be caused by improper compaction methods and shall be corrected at no cost to Vernal City.

B. Restore incidentals damaged by settlement at no additional cost to Vernal City.

C. Warranty shall be valid for a period of 3 years after final acceptance by Vernal City.

PART 2 — PRODUCTS

2.1 BACKFILL MATERIALS

A. Fill Materials, Section 31 05 13.

B. Cement treated fill, Section 31 05 15.

2.2 ACCESSORIES

A. Water:
   1. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
   2. Comply with local Laws and Regulations at no additional cost to Vernal City when securing water from water utility company.

B. Geotextile Fabric, Section 31 05 19.

PART 3 — EXECUTION

3.1 PREPARATION

A. Verify.
   1. Backfill material meets gradation requirements.
   2. Areas to be backfilled are free of debris, snow, ice or water, and
   3. Bearing surfaces are not frozen.

B. If extra excavation is required, secure the Vernal City representative’s written permission and follow Section 31 23 16 requirements.

C. Place geotextile fabrics, Section 31 05 19.

3.2 SUBGRADE PREPARATION

A. Protect Subgrade from desiccation, flooding, and freezing.

B. If ground water table is in the intended construction operations, dewater.

C. Before beginning backfilling operations over Subgrade, secure the Vernal City representative's review of Subgrade surface preparations.

3.3 EMBANKMENTS

A. Place backfill material in lifts not exceeding 8 inches after compaction.

B. Build shoulders to a grade higher than that of adjacent fills. Provide surface runoff at all times.

C. Commence compaction along edge of area to be compacted and gradually advance toward center.

D. Operate compaction equipment along lines parallel or concentric with the center-line of the Embankment being constructed.

E. Do not damage subsurface structures or utilities.

3.4 BASE COURSES

A. Place backfill material in lifts not exceeding 6 inches before compaction.

B. Maintain moisture content in compaction operations.

C. Avoid segregation when spreading backfill. Keep surfaces free from pockets of coarse and fine aggregate.

D. Rework fills which do not conform to compaction requirements until requirements are met.

E. Protect cement treated fill against freezing and traffic for 7 days.

3.5 COMPACTION

A. Compact backfill, Section 31 23 26 as follows.
   1. A-1 soils: greater than or equal to 96 percent of a Modified Proctor Density.
   2. Other soils: greater than or equal to 96 percent of a Standard Proctor Density.

B. Compaction tests are to be taken at the midpoint of the fill and on the surface of the fill or every 12 inches, whichever is less, prior to paving.

C. Frequency of compaction tests are as follows:
   1. Road Ways -
      a. Transverse Direction: 1 test every 12 feet (three tests minium) and at the vertical frequency listed above
      b. Longitudinal Direction: 1 test every 200 lineal feet of roadway and at the vertical frequency listed above.
   2. Open Excavations - 2 tests in each 500 square foot area at the vertical frequency listed above.
   3. Pot Holes (under 10 square feet) - 1 Test in each pot hole at the vertical frequence listed above.

3.6 COMPRESSIVE STRENGTH

A. Where a flowable fill is used, provide compressive strength indicated in Section 31 05 15.

3.7 PROOF ROLLING TEST

A. Prior to placing fill material for roadbed backfills, proof roll Subgrade using gross weight of 18,000 pounds/tandem axle, with a tire pressure at least 90 psi.

B. All proof roll passes will traverse the Subgrade parallel to the roadbed centerline. All subsequent passes will be offset 1/2 the vehicle width until the entire Subgrade is tested.

C. The Vernal City Representative will analyze, determine, designate and measure the areas, if any, requiring additional compaction or reconstruction.

D. Once Subgrade passes the proof rolling test, protect the surface from construction operations and traffic damage. Repair all cuts, ruts, and breaks. Keep surface in a satisfactory condition until geotextile fabric or base course has been placed.

3.8 CLEANING

A. Remove stockpiles from the site upon Work Completion. Grade site to prevent free standing surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 31 23 26
COMPACTION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Compaction of granular fill materials.

1.2 REFERENCES

A. ASTM D 698: Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kNm/m3)).

B. ASTM D 1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

C. ASTM D 2216: Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

D. ASTM D 2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 3017: Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 3282: Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

G. ASTM D 3740: Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

1.3 DEFINITIONS

A. A-1 Soil: Defined in ASTM D 3282.

B. Modified Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D 1557 using procedure A, B or C as applicable.

C. Relative Density (or Relative Compaction): The ratio of field dry density to the maximum laboratory density expressed as a percentage.

D. Standard Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D 698 using procedure A, B or C as applicable.

E. CONTRACTOR: Any person, private business, public business, government agency or municipal agency that is performing work within the Vernal City right of way.

1.4 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with ASTM D 3740.

B. Passing test results do not relieve the CONTRACTOR of warranty issues.

PART 2 — PRODUCTS Not Used

PART 3 — EXECUTION

3.1 COMPACTION

A. Moisten or dewater backfill material to obtain a moisture content within 2% of optimum moisture for compaction.

B. Correct deficient compaction conditions. Replace or repair materials and damaged facilities.

C. All work inside the Vernal City right of way shall be compacted to 96 percent.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform control testing of materials. Perform additional testing at no additional cost to OWNER.
   1. Because of changes in source of materials or proportions requested by CONTRACTOR.
   2. Because of Failure of materials to meet specification requirements.
   3. For other testing services needed or required by CONTRACTOR.

B. Report: For each material tested, record the following.
   1. Vertical and horizontal location of the test.
   2. Optimum laboratory moisture content.
   3. Field moisture content.
   4. Maximum laboratory dry density.
   5. Field density.
   6. Percent compaction results.
   7. Certification of test results by testing agency.

C. Optimum Soil Density: Use ASTM D 2216 and the following industry standards.
   1. For A-1 Soils: Use test method C of ASTM D 1557 (Modified Proctor)
   2. For All Other Soils: Use test method C of ASTM D 698 (Standard Proctor).

D. Field Density:
   1. Use ASTM D 3017 and test method C of ASTM D 2922 for shallow depth nuclear testing.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Erosion control and slope protection facilities including blankets or mulches.

B. Construction of drainage facilities to protect work area.

1.2 SUBMITTALS

A. Submit prior to using:
1. Sample of blanket or geotextile materials.
2. Mulch formula.
3. Grass mixture listing.
4. Plant list.
5. Geotextile manufacturer's certification.

B. Application rate of fiber mulches recommended by tackifier manufacturer.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver seed in original containers with certified germination test results showing analysis of seed mixture, percentage of pure seed, year of production, and date of packaging. Damaged packages are not acceptable. Store seed free of moisture.

B. Deliver fertilizer in waterproof bags showing weight, chemical composition and name of manufacturer.

C. Deliver blanket in original wrapping showing name of manufacturer and product weight.

D. Deliver plant materials immediately prior to placement.

E. Replace plant when original root protection system (burlap bag wrap of earth ball, plastic container with special plant bedder, etc.) has been broken or displaced prior to planting.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Riprap: Rock, Section 31 05 13.

B. Blankets: Uniform open weave jute, wood fiber, biodegradable or photodegradable synthetic fiber matting.

C. Geotextiles: Refer to fabric in Section 31 05 19.

D. Erosion Control Vegetation Mats: Permanent three dimensional mats which allow for revegetation where high water flows are expected.

E. Fiber Mulches: Straw, hay, wood or paper free from weeds or foreign matter detrimental to plant life.

F. Mulch Binder: Vegetable based gel tackifier with growth stimulant.

G. Topsoil and Fertilizer: Refer to Section 31 05 13 and Section 32 92 00.

PART 3 — EXECUTION

3.1 PREPARATION

A. Remove foreign materials, roots, rocks, and debris.

B. Grade to eliminate rough spots, and ponding areas.

C. Grade soil to drain perimeter water away from protected areas.

D. As applicable.
   1. Temporary controls, Section 01 57 00.
   2. Grass, Section 32 92 00.

3.2 SLOPE PROTECTION BLANKET

A. Cover seeded slopes where grade is greater than 3 horizontal to 1 vertical with blanket. Roll down over slopes carefully and loosely without stretching or pulling.

B. Lay blanket smoothly on prepared soil surface. Bury top end of each section in a narrow Trench. Leave 24 inches overlap from top roll over bottom roll. Leave 12 inches overlap over adjacent section.

C. Toe-in top end of each section in narrow Trench at least 12 inches deep. Toe-wrap fabric at bottom of slope.

D. Staple loosely the outside edges and overlaps.

E. In ditches, lay matting in upstream direction. Overlap and staple ends 6 inches with upstream section on top.

F. If natural drainage water traverses protected or controlled area; construct a channel or riprap according to Drawings.

G. Lightly dress slopes with topsoil to ensure close contact between cover and soil.

H. Present alternative methods of protection for approval prior to starting any work.

3.3 GEOTEXTILE

A. Placement, Section 31 05 19.

3.4 MULCHES

A. Apply mulches at the rate indicated.

B. When installed with a tackifier, apply at the rate recommended by the tackifier Supplier.

3.5 SURFACE COVER

A. Grass, Section 32 92 00.

B. Ground cover, Section 32 93 13.

3.6 MAINTENANCE

A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion.

B. Protect and repair geotextiles, Section 31 05 19.

C. Keep surface of soil damp only as necessary for seed germination.

D. Apply water slowly so surface of soil will not puddle and crust.

E. Replant damaged grass areas showing root growth Failure, deterioration, bare or thin spots, and eroded areas.

F. Re-fertilize 60 days after planting.

G. Remove weeds that are over 3 inches high.

END OF SECTION

SECTION 31 31 19
VEGETATION CONTROL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Application of soil treatment to remove weed and vegetation.

1.2 SUBMITTALS

A. Submit certificate identifying composition of non-selective control herbicide.

PART 2 — PRODUCTS

2.1 HERBICIDE

A. Water soluble herbicide for non-selective control of annual and perennial weeds.

PART 3 — EXECUTION

3.1 MIXING

A. Mix herbicide solution in strict accordance with manufacturers instructions and applicable Laws and Regulations.

3.2 APPLICATION

A. Execute all work in an orderly and careful manner with due consideration for surrounding plantings which are to remain.

B. Apply herbicide solution with a shield applicator. Do not allow solution to mist, drip, drift, or splash onto desirable vegetation.

C. Apply solution according to manufacturer's recommendations 7 days before preparation of surface to receive additional cover material. Do not add cover material until the Vernal City representative reviews spraying results.

D. Do not spray under windy or adverse weather conditions.

E. Replace portions of surrounding vegetation damaged or killed through this operation.

END OF SECTION

SECTION 31 41 00
SHORING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Shoring for open Excavations requiring a Protective System.

B. Underpinning to stabilize adjacent structure.

1.2 DEFINITIONS

A. Accepted Engineering Practices: Those requirements or practices that are compatible with standards required by a duly licensed or recognized authority.

B. Benching: A method of protecting persons and property against cave-ins by excavating the Sides of an Excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

C. Excavation: Any man-made cut, cavity, or depression in an earth surface, including Trenches, formed by earth removal and producing unsupported earth conditions (Sides). If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a Trench.

D. Failure: The permanent deformation or breakage of a structural member or connection; or the collapse of all or part of an Excavation.

E. Protective System: Any recognized method of protecting persons and property against cave-ins, the collapse of adjacent structures, or material that may fall or roll from an Excavation Side or into an Excavation. Protective systems include Support Systems, Sloping and Benching systems and Shield systems.

F. Shield: A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect persons and property within the structure without preventing a cave-in. Shields may be permanent structures or may be designed to be portable and moved along as work progresses. Portable Shields used in Trenches are usually referred to as "trench boxes" or "trench shields".

G. Shoring: A structure that supports the Sides of an Excavation and thereby protects persons and property by preventing cave-ins.

H. Side: Vertical or inclined earth surface formed at the outer edges of an Excavation.

I. Sloping: A method of protecting persons and property against cave-ins by excavating to form Sides that are inclined away from the Excavation, the angle of incline being of such a degree for the conditions of exposure that a cave-in will not occur.

J. Support System: A structure that protects persons and property by providing support to an adjacent structure, underground installation, or the Sides of an Excavation.

K. Trench: A narrow Excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.

L. Trench Box: See Shield.

M. Unfractured Rock: Rock that can be excavated with vertical Sides and remain intact while exposed. Fractured Rock is considered equivalent to unfractured Rock when the material on the Side or Sides of the Excavation is secured against cave-in or movement by Rock bolts, netting, or other means approved by a professional engineer.

N. CONTRACTOR: Any person, private business, public business, government agency or municipal agency that is performing work within the Vernal City right of way.

1.3 DESIGN OF PROTECTIVE SYSTEMS

A. Design Support Systems, Shield systems, and the structural components of these systems, and Sloping and Benching systems to resist all loads that are intended to be imposed or transmitted to them.

B. Design system for any hydrostatic pressure in the Sides of an Excavation.

1.4 SUBMITTALS

A. Submit a Protective System plan when requested.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Choice of CONTRACTOR.

PART 3 — EXECUTION

3.1 PREPARATION

A. Make safe or remove trees, surface encumbrances which are hazardous to Shoring operations.

B. Provide adequate ventilation of Excavations.

C. Control dust and groundwater.

3.2 STABILITY OF ADJACENT STRUCTURES

A. Support adjoining buildings, walls, sidewalks, Pavements, or other structures endangered by excavation operations.

B. Excavation below level of base of footing of any structural foundation or wall shall not be permitted except as follows:
1. Underpinning or other Support Systems is provided to ensure stability of structure, or
2. Excavation is in Unfractured Rock, or
3. A professional engineer determines in writing that such work will in no way pose a hazard to persons and property or the integrity of the structure.

3.3 PROTECTION OF PERSONS AND PROPERTY

A. Protect from cave-ins. Install a Support System, by Sloping, by Benching, by use of a Shield system, or by use of a combination of these methods.

B. Scale to remove loose material. Use Rock bolting, wire mesh, installation of protective barricades, or provide equivalent protection.

C. Stairway, Ladder, Ramp: Comply with OSHA.

D. Protect against cave-ins from vibratory loads adjacent to excavation operations.

3.4 INSPECTIONS

A. Inspect Excavations daily for evidence of possible cave-ins, indications of Failure of Protective Systems, or

other hazardous conditions.

B. Upon discovery of hazardous conditions, cease all work in the Excavations until additional precautions have been taken to ensure persons and property safety.

3.5 SHIELD SYSTEMS

A. Minimize the time the Sides of the Excavation remain unsupported.

B. Do not subject Shield systems to loads other than those considered for in their design.

C. Remove persons and property from Excavation when portable Shields are being relocated.

3.6 INSTALLATION AND REMOVAL OF SUPPORT SYSTEMS

A. Do not overload Support Systems.

B. Install additional members to carry the loads imposed upon the Support System when temporary removal of individual members is necessary.

C. When removing the Support System, release member by member slowly to avoid Failure of the remaining members or cave-ins.

D. Coordinate backfilling to minimize time an unsupported Excavation remains open.

END OF SECTION

Division 32

Exterior Improvements

SECTION 32 01 05
INFORMATION, REGULATORY, AND WARNING SIGNS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Information, regulatory, and warning signs but not street name signs or construction signs.

1.2 REFERENCES

A. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways.

B. APA: American Plywood Association.

C. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

D. FS L-P 380: Plastic Molding Material Methacrylate.

E. FS L-S-300: Sheeting and Tape, Reflective: Nonexposed Lens.

F. PS 1: Construction and Industrial Plywood.

1.3 DEFINITIONS

A. For definition purposes, the various types of signs are identified by a combination of letter and number. The letter represents the type of sign panel construction and the number represents the type of lettering and symbols to be used as follows:
   1. Panel Type:
      a. Panel Type A: Reflectorized sheeting on sheet aluminum.
      b. Panel Type B: Reflectorized sheeting on plywood.
   2. Letter Type:
      a. Letter Type 1: Reflectorized demountable cutout letters, symbols, and borders with prismatic reflectors.
      b. Letter Type 2: Opaque legend and borders.
      c. Letter Type 3: Reflectorized permanently attached cutout letters, symbols, and borders or reflectorized screen processed letters, symbols, and borders.

1.4 SUBMITTALS

A. Submit shop drawings of support structures prior to fabrication.

B. Submit sample of each color of reflective sheeting including manufacturer's name and product number.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Sheet Aluminum Sign Blank: 0.1 inch thick ASTM B 209 alloy 6061-T6.

B. Aluminum Extrusion Sign Blank: 0.1 inch thick ASTM B 209 alloy 6063-T5 and 6063-T6.

C. Softwood Plywood Sign Blank: PS 1 Group 1 with each panel bearing initials DFPA Grade - Trademark of the American Plywood Association; painted to Vernal City representative’s choice of color unless indicated.

D. Posts: Galvanized structural steel, U-shaped, T-shaped, C-shaped, box-shaped, or round tube, with 3/8 inch diameter mounting holes.

E. Fabricated Supports: Galvanized steel, Section 05 05 10.

F. Reflective Sheeting: Reflective per FS L-S-300 requirements with 2,200 hours minimum durability.

G. Nonreflective Sheeting: Nonchalking, weather resistant transparent plastic having a protected adhesive backing and a smooth flat outer surface with glass spheres embedded within.

H. Prismatic Reflectors: Methyl methacrylate lens meeting FS L-P-380 requirements with aluminum frame.

I. Bolts, Nuts, Accessories: Galvanized steel, Section 05 05 23.

J. Cast-in-place Concrete: Class 3000, Section 03 30 04.

2.2 COLORS AND FORMAT

A. Sign Colors and Format: Conform to MUTCD.

B. Provided colors of same reflectorized hue in daylight and night under artificial white illumination.

PART 3 — EXECUTION

3.1 PREPARATION

A. Indentify utility location, Section 01 31 13.

B. Excavation, Section 31 23 16.

3.2 INSTALLATION

A. Do not remove a sign that is being replaced until the new sign is placed and uncovered.

B. Unless indicated otherwise use clearance and locations shown in MUTCD. Install posts plumb and in proper alignment.

C. Establish proper elevation and orientation of all signs, structures, and determine proper sign post lengths as dictated by construction slopes.

D. Cover signs that require temporary covering with a porous cloth or fiber material folded over the sign edges and secured at the rear of the sign in such a manner that the sign is not damaged. Maintain covering until removal.

E. Construct sign post foundations with concrete conforming to indicated dimensions. Finish foundations flush with or below natural ground.

F. Construct overhead support structures where indicated. Support sign by mounting posts on anchor bolts placed in reinforced concrete foundations. Construct signs horizontal and perpendicular to roadway. The minimum allowable vertical clearance from the high point of Pavement is 16.5 feet.

3.3 WORKMANSHIP

A. Carefully fabricate and erect signs. Damage signs will be rejected.

B. Make all vertical joints and cuts flat and true.

C. Elevator bolts may be used or bolt holes relocated where conflict exists with sign border, legend, or copy.

D. Lay out and properly balance on the sign face all Type 1 legend and copy before fastening. Plug holes left by shifting of copy or legend with the same type screw used to fasten the legend.

E. Wash all sign faces prior to Final Inspection, Section 01 74 13.

END OF SECTION

SECTION 32 01 06
POST MOUNTED SIGNS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Requirements for street name sign and components.

1.2 REFERENCES

A. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. FS L-S-300: Sheeting and Tape, Reflective: Nonexposed Lens.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Sheet Aluminum Sign Blanks: 0.1 inch thick ASTM B 209 alloy 6061-T6, of the height indicated with length required to spell the street name (18, 24, 30, 36, 42, 48 inches).

B. Nonmetallic Sign Blanks: Fiberglass reinforced composite bonded with a thermosetting polymer and the following properties.
   1. Tensile strength (transverse), 5,000 psi minimum.
   2. Tensile strength (longitudinal), 25,000 psi minimum.
   3. Lengths as required to spell the street name (18, 24, 30, 36, 42, 48 inches).
   4. Height as indicated.

C. Posts: Galvanized structural steel, U-shaped, T-shaped, C-shaped, box-shaped, or round tube per Section 05 05 10 requirements, with 3/8 inch diameter mounting holes.

D. Reflective Sheeting: Reflective per FS L-S-300 requirements with 2,200 hour minimum durability.

E. Sign Lettering: White upper case and lower case letters, reverse silk screened on white with specified background color transparent ink.

F. Letter Composition: Spell out street name and give numerical coordinate on the right hand side; include neighborhood logo, if applicable, on the left hand side. Font as indicated.

G. Rail for Sign Blank: Tensile strength 40,000 psi minimum.

H. Bolts, Nuts, Accessories: Galvanized steel, Section 05 05 23.

I. Cast-in-place Concrete: Class 3000, Section 03 30 04.

PART 3 — EXECUTION

3.1 PREPARATION

A. Identify utility location, Section 01 31 13.

B. Excavation, Section 31 23 16.

3.2 INSTALLATION

A. Set posts 2 feet deep and anchored in concrete.

B. Provide 10 feet high clearance from the ground level to the bottom of sign.

C. Install posts plumb so closest edge of sign is 2 feet from vertical projection of the curb face at the point of curve (PC) of the intersection approach curb.

D. Restore all surfaces damaged during installation.

END OF SECTION

SECTION 32 01 07
RELOCATE POST MOUNTED SIGNS AND MAIL BOXES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Relocate post mounted signs.

B. Relocate mail boxes to supports which are approved by USPS.

1.2 REFERENCES

A. USPS: United States Postal Service, mailbox requirements.

1.3 DEFINITIONS

A. Post Mounted Signs: Street name signs and traffic control signs such as regulatory signs, warning signs, guide signs, detour and closure signs.

PART 2 — PRODUCTS

2.1 CONCRETE

A. Cast-in-place Concrete: Class 3000 minimum, Section 03 30 04.

2.2 MAIL BOX SUPPORTS

A. Wood: Salt treated fir, hemlock or pine for post, shelf and brace. Grade: No. 2 or better.

B. Metal: Galvanized or dark epoxy painted steel post, shelf and brace with no defects.

PART 3 — EXECUTION

3.1 PREPARATION

A. Coordinate utility location, Section 01 31 13.

B. Excavate, Section 31 23 16.

C. Reuse existing mail boxes, street signs and posts unless indicted otherwise.

3.2 EXISTING TRAFFIC CONTROL SIGNAGE

A. Maintain all existing street signs in full view of the intended traffic.

B. Coordinate relocations such that view of post mounted sign is maximized.

3.3 SIGN RELOCATION

A. Maintain existing signs until construction requires removal. Coordinate with the Vernal City representative 24 hours in advance of removal of any sign.

B. Relocate existing street signs as indicated or ordered by the Vernal City representative.

C. Remove concrete from existing posts where posts are to be reused.

D. Protect new signs and posts until Project is accepted.

E. Reset post in concrete, 8 inches in diameter to the depth indicated or ordered by the Vernal City representative.

F. Completely fill and compact hole left by removing sign post. Match adjacent surface.

3.4 MAIL BOX RELOCATION

A. Completely remove all designated mail box posts and footings.

B. Furnish and install new posts, shelf, and brace.

C. Relocate existing mail boxes indicated or ordered by the Vernal City representative.

D. Attach box firmly to shelf and post.

E. Repair any damage done to the mail box during moving or replace if irreparable to the Vernal City representative and mail box owner's satisfaction.

F. Compact soil around post and provide firm support.

G. Provide support for temporary mail box as required during construction at no extra cost to Vernal City, with temporary mail box located in accordance with United States Postal Service requirements.

H. Restore original location of box to condition equivalent to adjacent area.

3.5 PAVEMENT MARKINGS

A. Section 32 17 23.

END OF SECTION

SECTION 32 01 10
RELOCATE FENCES AND GATES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Moving and resetting existing fences and gates to locations indicated or directed by the Vernal City representative.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Nails, Spikes and Staples: Galvanized steel for exterior, high humidity locations, and treated wood, Size and type to suit applications.

B. Chain Link Fences and Gates: Section 32 31 13.

C. Wire Fences and Gates: Section 32 31 16.

D. Cast-in-place Concrete: Class 3000 minimum, Section 03 30 04.

PART 3 — EXECUTION

3.1 PREPARATION

A. Coordinate locating utilities, Section 01 31 13.

B. Excavation, Section 31 23 16.

3.2 INSTALLATION

A. Completely remove all existing posts, footings, wires, gates, and other items used in fencing.

B. Remove concrete on posts. Reuse posts, wire, and gates from existing fence unless directed otherwise by the Vernal City representative.

C. Replace any fencing materials and gates that are damaged, lost, or broken during fence and gate relocations. Provide new materials as required which meets Specifications, for fence and gates of the same type.

D. Set relocated fences and gates straight and true.

E. Fill in old post holes unless they become part of new construction.

F. Reset posts in concrete, 8 inches in diameter to depth indicated or 2 feet minimum.

END OF SECTION

SECTION 32 01 13
SLURRY SEAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Stone and paving asphalt slurry evenly spread as a roadway surface treatment.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ASTM C 88: Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

B. ASTM C 117: Standard Method of Test for Amount of Material Finer Than 0.075 mm Sieve in Aggregate.

C. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

D. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

E. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

F. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.

G. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

H. ASTM D 3319: Standard Test Method for Accelerated Polishing of Aggregates Using the British Wheel.

I. ASTM D 3628: Standard Practice for Selection and Use of Emulsified Asphalts.

J. ASTM D 3910: Standard Practices for Design, Testing, and Construction of Slurry Seal.

K. ASTM D 5821: Standard Test Method for Determining the percentage of Fractured Particles in Coarse Aggregate.

1.4 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

B. Mix Design: 10 days prior to use, submit proportions of aggregate, filler, water and emulsions in the mix.

C. Equipment: Submit list of construction equipment to be used.

D. Asphalt Bill of Lading: Identify.
   1. Weight of asphalt.
   2. Weight of emulsified asphalt (after water has been added).
   3. Paving asphalt complies with Section 32 12 03 requirements.

E. Quality Control Report: Upon request of the Vernal City representative, submit a written quality control inspections and testing report describing source and field quality control activities performed by the

CONTRACTOR'S Supplier for the CONTRACTOR.

1.5 QUALITY ASSURANCE

A. Determine emulsion weights by mix design.
   1. The person performing the work will permit Vernal City to take samples of the aggregate and asphalt emulsion used in the project at Vernal City's discretion.
   2. Gradation and sand equivalent tests may be run on the aggregate and residual asphalt content tests on the emulsion. Test results will be compared to specifications. Tests will be run at the expense of Vernal City.
   3. Samples of the slurry seal will be taken directly from the slurry unit(s) at a minimum rate of one sample per mixing unit per each day's use. Consistency and residual asphalt content tests may be made on the samples and compared to the specifications. Tests will be run at the expense of the buyer. The buyer must notify the person performing the work immediately if any test fails to meet specifications. Vernal City may use the recorders and measuring facilities of the slurry seal unit to determine application rates, asphalt emulsion content, mineral filler and additive(s) content for an individual load. It is the responsibility of the person performing the work to check stockpile moisture content and to set the machine accordingly to account for aggregate bulking.
   4. If any two successive tests fail on the stockpile material, the job shall be stopped. It is the responsibility of the person performing the work, at his own expense, to prove to Vernal City that the conditions have been corrected. If any two successive tests on the mix from the same machine fail, the use of the machine shall be suspended. It will be the responsibility of the person performing the work, at his own expense, to prove to Vernal City that the problems have been corrected and that the machine is working properly.

B. Do not change source of emulsified asphalt or aggregate without supporting changes in mix design data.

C. Reject coating products that do not meet requirements of this Section.

1.6 WEATHER

A. Temperature:
   1. Apply seal coat when air and roadbed termperatures in the shade are 45 deg. F. and rising.
   2. Do not apply seal coat if pavement or air temperature is below 55 deg. F. and falling or if the finished product will freeze before 24 hours.

B. Moisture: Do not apply seal coat during rain, unsuitable weather, or if humidity prolongs curing.

C. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

1.7 NOTICE

A. Send written notice to residents and businesses within affected area at least 3 days before applying slurry seal.

B. Indicate application time and when new surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood..

D. Should work not occur on specified day, send a new notice.

1.8 ACCEPTANCE

A. General:
   1. Acceptance is by Lot. Lot is specified below.
   2. Opening slurry seal surface to traffic does not constitute acceptance.

B. Slurry Seal Materials:
   1. Paving Asphalt: Acceptance is not specified in this Section. Refer to Section 32 12 03 for acceptance.
   2. Aggregate: Lot size is one day's production with 300 tons sub-lots Collect Samples randomly from

hauling equipment and test gradation, ASTM C 136. Lot will be acceptable if,
   a. Average gradation of each sieve for the Lot is within Target Grading Band for that sieve, and
   b. Number of Samples in Lot with any sieve measurement outside of Target Grading Band does not exceed 2, and
   c. No Sample varies from Target Grading Band by more than target tolerance on any one sieve.
3. Price Adjustment: Aggregate gradation defects may be accepted if 5 percent price reduction is applied against Lot for each condition not met. Maximum price reduction for a Lot is 10 percent.

C. Placement: Accepted on a block-by-block basis.
1. Mat Appearance: Installation must survive the following visual examinations.
   a. No free liquid drains out of mat edges.
   b. No drag marks or streaking.
   c. No debonding due to road contaminants.
   d. Straight longitudinal edges with proper joints.
2. Price Adjustment: Appearance defects may be accepted if 5 percent price reduction is applied against the Lot for each condition not met. Maximum price reduction for the Lot is 10 percent.

PART 2 — PRODUCTS

2.1 PAVING ASPHALT

A. Tack Coat: Section 32 12 14.

B. Emulsified Asphalt: ASTM D 3628 or as indicated.
1. The residual asphalt shall constitute at least 60 percent of the emulsion by weight.
2. The Saybolt Furol viscosity of the emulsion at 77 deg. F., ASTM D 2170 shall not exceed 50 seconds.

2.2 WATER

A. Clean, non-detrimental, free from harmful chemicals.

2.3 AGGREGATE

A. Material: Stone, slag, or other high quality particle or combination with the following physical properties. For heavy-duty surface applications use 100 percent crushed material.
1. Angularity (fractured faces): Greater than 80 percent of particles by weight with at least 1 mechanically fractured faces or clean angular faces, ASTM D 5821.
2. Hardness (toughness): less than 35 percent wear of aggregate retained on the No. 8 sieve, ASTM C 131.
3. Weight Loss (soundness): less than 10 percent for combined coarse and fine aggregate when subjected to 5 cycles of sodium sulfate, ASTM C 88.
4. Polishing: Greater than 38, ASTM D 3319.
5. Water Absorption: Less than 1.25 percent.

B. Gradation: ASTM C 136. Graded by dry weight on a percent passing basis. Gradation must not vary from a high limit on one screen to a low limit on the next.
1. Target Gradation Curve must lie within one of the following Master Grading Bands. Field samples shall not vary from the Target Gradation Curve by more than the Target Tolerance.

Table 1 – Master Grading Band and Target Tolerance Limits

US Sieve Size	*Master Grading Band Limits*			*Target Tolerance Percent*
	SS-I	*SS-II*	*SS-III*	

3/8 in.	–	100	100	–
No. 4	100	90 – 100	70 – 90	+/- 5
No. 8	90 – 100	65 – 90	45 – 70	+/- 5
No. 16	65 – 90	45 – 70	28 – 50	+/- 5
No. 30	40 – 65	30 – 50	19 – 34	+/- 5
No. 50	25 – 42	18 – 30	12 – 28	+/- 4
No. 100	15 – 30	10 – 21	7 – 18	+/- 3
No. 200	10 – 20	6 – 15	5 – 15	+/- 2

NOTES
(a) Portion retained on the No. 4 sieve clean and free of clay coatings.
(b) Portion passing No. 200 sieve determined by ASTM C 117 includes mineral fillers.

C. TOLERANCES
1. Tolerances for individual materials as well as the slurry seal mixture are as follows:
   a. After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.
   b. The percentage of aggregate passing shall not go from the high end to the low end of the specified range of any two successive sieves.
   c. The slurry consistency shall not vary more than ± 2 inches from the job mix formula after field adjustments.
   d. The rate of application, once determined by Vernal City, shall not vary more than ± 1 lb./sq. yd. while remaining within the design application rate.

2.4 MINERAL FILLER

A. ASTM D 242.

B. Portland cement, hydrated lime, limestone dust, flyash, or aluminum sulfate to regulate setting time and improve workability.

C. Limestone dust, fly ash, and rock dust to alter aggregate gradation.

2.5 MIX DESIGN

A. Proportioning: Use the consistency test of ASTM D 3910 to determine optimum ratio of aggregate, filler, water, and emulsion.
1. Additives may be used to accelerate or retard the break-set of the slurry seal or to improve the resulting finished surface. The use of additives in the slurry mix (or individual materials) shall not be permitted until approved by Vernal City
2. The contractor shall submit to Vernal City for approval a complete mix design prepared by the contractor or product manufacturer. Compatibility of the aggregate, emulsion, mineral fill, and other additives shall be verified by the mix design. The mix design must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) (usage), and asphalt emulsion based on the dry weight of the aggregate. All the component materials used in the mix design shall be representative of the materials proposed by the contractor to be used on the project. The percentages of each individual material required shall be shown in the mix design. Adjustmens may be required during the construction, based on the field conditions. Vernal City will give final approval for all such adjustments. Vernal City shall approve the mix design and all slurry seal materials and methods prior to use. The component materials shall be within the following limits:

Component Material	Limits
Residual Asphalt	10-16%
Mineral Filler	0.5-2.0% (Based on dry weight of aggregate)
Additives	As needed
Water	As needed to achieve proper mix consistency

B. Cure Time: Select to meet opening to traffic requirements.

C. Stripping: More than 90 percent of bituminous-coated particles retain asphalt coating, ASTM D 1664.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Use equipment capable of applying at least 15,000 square yards of material per day.
   1. All equipment, tools, and machines used in performance of this work shall be maintained in satisfactory working condition at all times to ensure a high-quality product.

B. Use a continuous-flow mixing unit capable of accurately delivering a predetermined portion of aggregate, water, and asphalt emulsion to the mixing chamber.
   1. MIXING EQUIPMENT: The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled, slurry seal mixing machine of either truck-mounted or continuous-run design. Continuous-run machines are those that are equipped to self-load materials while continuing to lay slurry seal. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving mixer and to discharge the mixed product on a continuous-flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls. Vernal City must approve the type of equipment that will best suit the project. Generally, truck-mounted machines or continuous-run machines may be used on the project. If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speeds during application of the slurry seal. It shall be equipped with a self-loading device, opposite-side driver stations, and forward and reverse speed controls.
   2. PROPORTIONING DEVICES: Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt and additive) shall be provided and properly marked. The proportioning devices are usually revolution counters or similar devices and are used in material calibration and determining the material output at any time.
   3. SPREADING EQUIPMENT: The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strikeoff shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform, highly textured mat.
   4. AUXILIARY EQUIPMENT; Suitable surface preparation equipment, traffic control equipment, hand tools, and any other support equipment shall be provided as necessary to perform the work.
   5. CALIBRATION & VERIFICATION: Each mixing unit to be used in performance of the work shall be calibrated prior to construction. No machine will be allowed to work on the project until the calibration has been completed. Test strips will be made by each machine after calibration and prior to construction. Test strips shall be a portion of the project. Test strips must be accepted or rejected within 24 hours after application.

C. Prevent loss of slurry from the distributor by using a mechanical type squeegee distributor equipped with flexible material in contact with the surface.

D. Provide a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the mix design application rate.

3.2 PREPARATION

A. General:
   1. Fat or bleeding Pavements may require scratch course application.

2. Cracked or porous pavements may require thin SSI slurry surface treatment.
3. Asphalt concrete inlay may be required in rut deformations.

B. Protection:
1. Protect trees, plants and other ground cover from damage.
2. Prune trees; Section 32 01 93. Allow equipment passage underneath. Repair tree damage at no additional cost to Vernal City
3. Install invert covers.
4. Mask Street Fixtures.
5. Protect curb, gutter, and sidewalk from spatter, mar or overcoat.

C. Traffic Control:
1. Control pedestrian and vehicular traffic, Section 01 55 26. Do not proceed without flaggers.
2. Protect slurry seal from traffic until cured. Cure time depends on type of asphalt, mixture characteristics and weather.
3. Do not apply lane marking tape or paint until layout and placement has been verified with the Vernal City representative.

D. Surface Repair: Patch holes, raveled areas, and low areas with asphalt concrete.

E. Crack Repair: Section 32 01 17.
1. Remove plant materials from cracks, edges and joints.
2. Blow cracks clean.
3. Seal cracks with crack pouring asphalt. Remove excess asphalt.
4. Allow crack seal to dry before applying slurry seal.

F. Cleaning:
1. Remove mud spots, sand, dust, oil, vegetation and other objectionable material.
2. Remove loose material that may cause drag marks.
3. Do not flush water over cracked Pavement.

G. Existing Roadway Striping: Use reflective tabs to mark roadway striping before applying slurry seal.

H. Tack Coat:
1. Apply tack coat to high-absorbent, polished, oxidized, or raveled asphalt surfaces or to concrete or brick surfaces.
2. Apply tack coat and pave over concrete Cover Collars.
3. Use the same asphalt emulsion as used in slurry seal application.
A. If required, the tack coat should consist of one part emulsified asphalt/three parts water.
4. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gal/sq yd. The tack coat shall be allowed to cure before application of the slurry seal.

3.3 APPLICATION

A. General:
1. Application rates:
a. SS-I: 8 to 12 pounds per square yard.
b. SS-II: 12 to 16 pounds per square yard.
c. SS-III: 15 to 18 pounds per square yard.
2. Machine meter settings must match mix design. Water and mineral filler may be changed per mix design; otherwise, a new mix design is required.

B. In the Spreader Box:
1. Do not exceed 4-minutes total mixing time.
2. No additional water.
3. No lumping, balling or unmixed aggregate.
4. No segregation of the emulsion and aggregate fines from the coarse aggregate.

5. No breaking of emulsion.
6. No overloading. Carry a sufficient amount of slurry in all parts of the spreader for complete coverage.

C. Spreading:
1. Dampen surface immediately prior to application of slurry seal. All surfaces are to be uniformly damp with no free water standing on the surface or in cracks when seal coat is applied. The rate of application of the fog spray shall be adjusted during the day to suit temperature, surface texture, humidity, and dryness of the pavement. The slurry seal shall be of the desired consistency upon leaving th mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. If excess oversize develops, the job will be stopped until the contractor proves to the Owner that the situation has been corrected. Some situations may require screening the aggregate just prior to loading it into the units going from the stockpile area to the lay-down operation.
2. If coarse aggregate settles to bottom of mix, remove slurry from pavement.
3. Except for lanes in which 2 or more boxes are used in tandem in placing slurry, do not seal adjacent lanes until at least 2 hours have elapsed between placing one lane and that of adjacent lane. Lap adjacent lanes at edges to provide complete sealing at overlap.
4. When sealing short lanes, the waiting period may be omitted if the adjacent lane can be sealed before emulsion in the previously sealed lane has broken and started to cure.
5. In areas where spreader box cannot be used, apply slurry by hand.
   a. Use hand squeegees to provide complete and uniform coverage.
   b. The area to be hand worked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork.
   c. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

D. Joints:
1. Correct any joints or cracks not filled by slurry seal.
2. Do not permit build-up on longitudinal or transverse joints.
3. Smooth thick spots before emulsion breaks so a uniform surface with no breaks or discontinuities is obtained.
4. The contractor shall provide suitable width-spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed in visually pleasing places. Half passes and odd-width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of six inches (6") shall be allowed for overlap of longitudinal line joints.

E. Lines:
1. Mask off end of streets and intersections to provide straight lines.
2. Make straight lines along lip of gutter and shoulders. No runoff on these areas permitted.
3. Vary edge lines no more than 2 inches per 100 feet.

F. Rolling:
1. Parking areas shall be rolled by a self-propelled, 10-ton pneumatic roller with a tire pressure of 50 PSI, equipped with a water spray system.
2. The surfaced areas shall be subjected to a minimum of two (2) full coverage passes by the roller.
3. Rolling shall not commence until the slurry has cured enoughso that it will not pick up on the tires of the roller.

3.4 AFTER APPLICATION

A. Do not permit traffic on slurry seal until cured.

B. Leave no streaks caused by oversized aggregate, or buildup on squeegees.

C. Leave no holes, bare spots, or cracks.

D. The slurry, when cured shall present a uniform, skid-resistant appearance with all cracks filled.

E. Do not apply traffic and lane marking tape or paint until layout and placement has been verified by the Vernal City representative.

3.5 FIELD QUALITY CONTROL

A. ASTM C 136. If tests show aggregate gradation non-compliance, either remove the material or blend in other aggregates to bring it into compliance. This may require a new mix design. Screening may be required at the stockpile to remove any defective material.

3.6 REPAIR

A. Remove spatter or mar from curb and gutter, sidewalk, guard rails and guide posts at no additional cost to Vernal City.

B. Remove slurry seal from Street Fixtures.

C. Make correction lines straight. Provide good appearance.

D. Fill any joints or cracks that are not covered by slurry seal. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate the underlying Pavement.

E. Repair collateral damage caused by construction.

END OF SECTION

SECTION 32 01 14
CHIP SEAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Paving asphalt and cover aggregate evenly spread as a uniform, skidresistant roadway surface treatment.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ASTM C 88: Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

B. ASTM C 117: Standard Method of Test for Amount of Material Finer Than 0.075 mm Sieve in Aggregate.

C. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

D. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

E. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

F. ASTM D 2170: Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens).

G. ASTM D 3319: Standard Test Method for Accelerated Polishing of Aggregates Using the British Wheel.

H. ASTM D 3628: Standard Practice for Selection and Use of Emulsified Asphalts.

I. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.

J. ASTM D 5821: Standard Test Method for Determining the percentage of Fractured Particles in Coarse Aggregate.

1.4 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

B. Mix Design: Identify.
   1. Type and grade of paving asphalt to be used (if not specified).
   2. Aggregate gradation.
   3. Asphalt/aggregate compatibility.
   4. List of asphalt additives.

C. Equipment: Submit list of construction equipment to be used.

D. Asphalt Bill of Lading: Identify.
   1. Weight of asphalt.
   2. Weight of emulsified asphalt (after water has been added).

E. Quality Control Report: Upon request of the Vernal City representative, submit a written quality control inspections and testing report describing source and field quality control activities performed by the

CONTRACTOR'S Suppliers and the CONTRACTOR.

1.5 QUALITY ASSURANCE

A. Do not change source of supply of paving asphalt or aggregate without supporting changes in mix design.

B. Reject product that does not meet requirements of this Section.

C. Remove any product found defective after installation and install acceptable product at no additional cost to Vernal City.

1.6 WEATHER

A. Temperature:
   1. Apply chip seal when air and roadbed temperatures in the shade are 70 deg. F. and rising.
   2. Allow 4 weeks of warm weather cure time. This generally limits performance of work from May 15 to August 31.
   3. Do not apply chip seal if Pavement surface is above 120 deg. F.
   4. Do not place seal coat during rain, when the surface is wet, when rain is forecast within 6 hours, or during other adverse weather conditions.

B. Moisture: Do not apply chip seal during rain, unsuitable weather, or if humidity prolongs curing.

C. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

1.7 NOTICE

A. Send written notice to residents and businesses within affected area 3 days before applying chip seal.

B. Indicate application time and when new surface can be used.

C. Warn them of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on the specified day, send a new notice.

1.8 ACCEPTANCE

A. General:
   1. Acceptance is by Lot. Lot size is specified below.
   2. Opening chip seal surface to traffic does not constitute acceptance.

B. Material:
   1. Paving Asphalt: Acceptance is not specified in this Section. Refer to Section 32 12 03 for acceptance.
   2. Aggregate: Lot size is one day's production with 500 tons sub-lots. Collect Samples randomly from the hauling equipment and test gradation, ASTM C 136. Lot will be acceptable if,
      a. Average gradation of each sieve for Lot is within Target Grading Band for that sieve, and
      b. Number of Samples in Lot with any sieve measurement outside of Target Grading Band does not exceed 2, and
      c. 200 sieve gradation is not exceeded.

C. Placement: Accepted on a block by block basis.
   1. Paving Asphalt: Uniform with no ridging and no bare spots.
   2. Aggregate:
      a. Embedment: After rolling and evaporation, random sampling reveals large particles are embedded in the paving asphalt on their flat side to a depth of 50 percent to 70 percent.
      b. Asphalt See-Through: Not more than 15 percent black (asphalt) can be seen through the newly laid and compacted rock chip after sweeping.

PART 2 — PRODUCTS

2.1 PAVING ASPHALT

A. Cationic or anionic emulsion, Section 32 12 03. All chip oil to be latex modified unless otherwise agreed to by Vernal City in writing.

B. Use any of the following additives to match aggregate particle charge, weather conditions and mix design.
1. Anti-strip: To change or neutralize particle charges.
2. Enhancer: To promote greater film thickness on the aggregate.
3. High Float Agent: To improve temperature susceptibility of the asphalt and impart a gel structure to the asphalt.
4. Polymer: To reduce stripping, improve coating, decrease temperature susceptibility and increase stability of mix.
5. Rejuvenator: To adjust the penetration of the base asphalt or soften reclaimed asphalt.

2.2 COVER AGGREGATE

A. Material: 100 percent crushed stone, slag or other high quality particle or combination with the following physical properties.
1. Angularity (fractured faces): Greater than 60 percent of particles by weight with at least 2 mechanically fractured faces or clean angular faces, ASTM D 5821.
2. Hardness (toughness): Less than 30 percent wear of aggregate, ASTM C 131 unless specific aggregates having higher values are known to be satisfactory.
3. Weight Loss (soundness): For combined coarse and fine aggregate, ASTM C 88,
   a. Less than 12 percent using Na2SO4
   b. Less than 18 percent using MgSO4
4. Polishing: Greater than 38, ASTM D 3319.
5. Flat or Elongated Particles: 10 percent maximum of a 3:1 ratio for material retained above the 3/8 inch sieve, ASTM D 4791
6. Friable Particles: Less than 3 percent by weight of aggregate passing the No. 4 sieve, ASTM C 142.

B. Gradation: ASTM C 136. Graded by dry weight on a percent passing basis. Gradation must not vary from a high limit on one screen to a low on the next.

Table 1 – Master Grading Band and Target Tolerance Limits

Sieve	*Grade A*	*Grade B*	*Grade C*
1/2 in.	100	–	100
3/8 in.	85 – 100	–	70 – 90
No. 4	0 – 20	–	0 – 5
No. 8	0 – 5	85 – 100	0 – 3
No. 16	–	10 – 25	–
No. 50	–	0 – 5	–
No.200	0 – 1	0 – 2	0 – 2

NOTES
(a) Portion retained on the No. 4 sieve clean and free of clay coatings.
(b) Portion passing No. 200 includes mineral filler, ASTM C 117.

2.3 MIX DESIGN

A. Select type and grade of emulsified asphalt, ASTM D 3628.

B. Determine asphalt application rate based upon achieving an aggregate embedment of 50 to 70 percent. Note: It is difficult to get adequate embedment of 3/8 inch aggregate with a 0.30 gallons per square yard asphalt

application rate.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Distributor truck: Use triple overpass distributor bar setting. Apply binder uniformly (no drilling).

3.2 PREPARATION

A. General:
   1. Wait at least 7 days before placing chip seal on newly patched surfaces.
   2. Asphalt concrete inlay may be required if rut deformation exists in the roadway.

B. Protection:
   1. Protect trees, plants and other ground cover from damage.
   2. Prune trees per Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to Vernal City.
   3. Install invert covers.
   4. Mask Street Fixtures (such as water valves, manhole covers, etc.)
   5. Protect curb, gutter, and sidewalk from spatter, mar or overcoat.

C. Traffic Control:
   1. Control pedestrian and vehicular traffic, Section 01 55 26. Do not proceed without flaggers.
   2. Protect chip seal from traffic until cured. Cure time depends on type of asphalt emulsion and weather.
   3. Do not proceed if flaggers are required and not yet in place.
   4. Do not apply traffic and lane marking tape or paint until layout and placement has been verified with the Vernal City representative.

D. Surface Repair: Patch holes, raveled areas, and low areas with asphalt concrete.

E. Crack Repair: Section 32 01 17.
   1. Remove plant material from cracks, edges and joints.
   2. Blow cracks clean.
   3. Seal cracks with crack pouring asphalt. Remove excess asphalt.
   4. Allow crack seal to dry before applying chip seal.

F. Cleaning:
   1. Remove loose material, mud spots, sand, dust, oil, vegetation, and other objectionable material.
   2. Do not flush water over cracked Pavements.

G. Existing Roadway Striping: Use reflective tabs to mark roadway striping before apply chip seal.

H. Tack Coat:
   1. Apply tack coat to high-absorbent, polished, oxidized, or raveled asphalt surfaces or to concrete or brick surfaces.
   2. Apply tack coat and pave over concrete Cover Collars.

3.3 APPLICATION

A. Lines:
   1. Mask off end of streets and intersections to provide straight lines.
   2. Make straight lines along lip of gutter and shoulders.
   3. Keep lap lines out of wheel path.
   4. Start and stop on tar paper so there is no over-lap.

B. Asphalt: Keep viscosity between 50 and 100 centistokes, ASTM D 2170 during application.

1. Use a distributer equipped with a hydrostatic system and full circulating spray bar to apply the emulsion at the specified rate maintaining a tolerance of ±0.03 gal./sq.yd.

Use	Emulsion	Application Rate (gal./sq.yd.)
Chipping Oil	LM-CRS-2A	0.4
Flush Coat Oil	CSS-1H	0.1

C. Chips: Apply aggregate within +1 to -2 pounds per square yard of mix design.
1. Use a damp chip but not saturated. (Note. If you see water running out of the haul truck, the chips are too wet).
2. For polymer and latex modified emulsions, apply chips immediately.
3. For other emulsions, maintain a distance of not more than 100 feet between the distributor and the chip spreader.
4. Spread larger particles first.
   a. Use a Flaherty Spread Master or Etayre Spreader, or quipment of equal quality to spread the cover material.

Cover Material	Application Rate (lb./sq.yd.
Type C	25-28

5. Hand broom the cover material, if necessary to distribute the aggregate uniformly over the surface.

D. Blotting: If bleeding occurs, apply a blend of 25 to 50 percent hydrated lime with sand (blotting material). Use sand to cool chips.

E. Expose all Street Fixtures after seal coat operations.

3.4 ROLLING

A. Use a rubber tire roller in longitudinal direction to seat aggregate. Apply at least 2 complete rolling coverages.
1. Roller must have at least 2 rollers in front and 1 roller in back, which serves as a finish roller.

B. Complete rolling before the bituminous material cools or hardens.

C. Keep traffic off at least 4 hours or until moisture leaves the remaining chips. Allow chip seal to cure while allowing reduced speed traffic on the project. Sweep the surface before allowing uncontrolled traffic on the chips.
1. Chips which do not adhere to the roadway surface shall be removed prior to application for the flush coat.
2. Chips shall be swept from the edges of the roadway towards the center and shall be windrowed to allow pickup by vacuum truck equipment.
3. A sufficient number of passes with sweepers and vacuum equipment shall be made to **completely** remove all loose chips.
4. All loose chips shall be picked up and delivered The Vernal City yard located at 1500 East, 450 North, where they become the property of Vernal City

C. Upon approval of sweeping by the Vernal City representative, the flush coat shall be applied.

3.5 FOG SEAL

A. Keep viscosity between 50 and 100 centistokes, ASTM D 2170 during application.

3.6 REPAIR

A. Remove spatter or mar from curb, gutter and sidewalk at no additional cost to Vernal City.

B. Remove any product found defective after installation and install acceptable product at no additional cost to

Vernal City.

C. Fill any joints or cracks that are not covered by chip seal coat. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate the underlying Pavement.

D. Repair collateral damage caused by construction.

END OF SECTION

SECTION 32 01 15
MICRO-SURFACE SEAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Stone and paving asphalt slurry spread in variably thick cross-section as a roadway surface treatment.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

B. ASTM C 117: Standard Method of Test for Amount of Material Finer Than 0.075 mm Sieve in Aggregate.

C. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

D. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

E. ASTM D 36: Standard Test Method for Softening Point of Bitumen (Ring-And-Ball Apparatus).

F. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

G. ASTM D 244: Standard Test Methods for Emulsified Asphalts.

H. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.

I. ASTM D 2170: Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens).

J. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

K. ASTM D 3319: Standard Test Method for Accelerated Polishing of Aggregates Using the British Wheel.

L. ASTM D 3910: Standard Practices for Design, Testing, and Construction of Slurry Seal.

1.4 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

B. After mix has been designed, submit
   1. Date when mix design was completed (to be no more than 60 days old on day of submittal).
   2. Proportions of aggregate, filler, water, additives, and emulsion in the mix.
   3. Results of asphalt stripping test and wet track abrasion test (refer this Section article 2.5).
   4. Type and minimum amount of polymer solids to be incorporated in the asphalt emulsion by the Supplier. (In general, 3 percent based on asphalt weight is considered minimum.)
   5. Identity of additives added to the emulsion mix or to any of the component materials for control of the quick traffic properties.

C. Prior to installing micro-surfacing product, submit:
   1. Aggregate gradation Target (refer to this Section article 2.3).

2. Aggregate hardness, soundness and polishing test results (refer to this Section article 2.3). Aggregate analysis to be no more than 180 days old.
3. Meter settings for micro-surfacing machine. Refer to test strip requirements this Section article 1.4. Previously determined settings for the meters may be submitted providing such determinations are no more than 180 days old and the materials used in such determinations match those specified herein.
4. Certificate by emulsion Supplier identifying
    a. the mix design for which the emulsion is formulated.
    b. the emulsion meets requirements of this Section article 2.1
    c. the type of polymer modifier added to the emulsion.
    d. the amount of polymer modifier added to the emulsion.
5. Test results of 5 day settlement test, ASTM D 244 on emulsions stockpiled longer than 36 hours by the CONTRACTOR. This submittal may be waived, providing the storage unit of the CONTRACTOR has continuous mixing capability, or the emulsion has had additional emulsion blended into it prior to use.

D. After installing product of this section, and if requested by the Vernal City representative, submit a written quality control inspections and testing report describing source and field quality control activities and test results completed by the CONTRACTOR'S Supplier for the CONTRACTOR.

1.5 QUALITY ASSURANCE

A. General:
1. Do not change source of emulsified asphalt or aggregate without supporting changes in mix design data.
2. Reject asphalt emulsion that does not meet requirements of this Section.
3. Remove any product found defective after installation and install acceptable product at no additional cost to Vernal City.

B. Test Strip: On a test strip at least 500 feet long, determine the correct meter settings on the mixing equipment. The settings are to produce a product which complies with the following.
1. 30 minutes maximum initial set time. Initial set occurs when blotting of the micro-surface yields only water (no emulsion).
2. No distress when exposed to traffic 2 hours after placement.

1.6 WEATHER

A. Temperature:
1. Commence paving if air and roadbed temperatures in the shade are 45 deg. F. and rising.
2. Terminate paving if air and roadbed temperature is 55 deg. F. and falling or if the finished product will freeze before 24 hours.

B. Moisture: Do not apply micro-surface during rain, unsuitable weather, or if humidity prolongs curing.

1.7 NOTICE

A. Send written notice to residents and businesses within affected area at least 3 days prior to applying new micro-surface seal.

B. Indicate application time and when new surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on the specified day, send a new notifice.

1.8 ACCEPTANCE

A. General:
1. Acceptance is by Lot. Lot is specified below.
2. Opening micro-surface seal to traffic does not constitute acceptance.

B. Micro-surfacing Materials:
   1. Paving Asphalt: Acceptance is not specified in this Section. Refer to Section 32 12 03 for acceptance.
   2. Aggregate: Lot size is one day's production with 500 tons sub-lots. Collect Sample randomly from mixing equipment and test gradation, ASTM C 136. Lot will be acceptable if,
      a. The average gradation of each sieve for the Lot is within the Target Grading Band for that sieve.
      b. The number of individual aggregate Samples in each sub-lot outside the Target Grading Band does not exceed 2.
      c. No aggregate Sample varies from the Target Grading Band by more than the Target Grading Band limit on any one sieve.

C. Placement:
   1. Accepted on a block-by-block basis.
   2. Installation must survive the following visual examinations.
      a. no free liquid drains out of mat edges, and
      b. no drag marks or streaking, and
      c. no debonding due to road contaminants, and
      d. straight longitudinal edges with proper joints.

PART 2 — PRODUCTS

2.1 PAVING ASPHALT

A. Tack Coat: Use the same emulsion as used in micro-surface seal.

B. Crack Pouring Asphalt: Rubberized asphalt or asphalt rubber hot pour; Section 32 01 17.

C. Emulsified asphalt; Section 32 12 03: CSS-1h quick-traffic type plus the following.
   1. Cement Mixing Test: Waived.
   2. Residue after distillation, ASTM D 244: 62 percent minimum.
   3. Softening point of residue, ASTM D 36: 135 deg. F. minimum.
   4. Kinematic viscosity of residue, ASTM D 2170: 650 cSt/sec. minimum.
   5. Polymer modifier: Type and amount per mix design. Polymer solids are to be milled or blended into the asphalt or emulsifier solution prior to the emulsification process.

2.2 WATER

A. Clean, non-detrimental, free from harmful chemicals.

2.3 AGGREGATE

A. Material: Stone such as gravel, slag or other high quality particle or combination. 100 percent crushed with the following physical properties.
   1. Hardness (toughness): Less than 30 percent wear of aggregate retained on the No. 8 sieve, ASTM C 131.
   2. Weight Loss (soundness): For combined coarse and fine aggregate, ASTM C 88.
      a. less than 15 percent using Na_2SO_4
      b. less than 25 percent using $MgSO_4$
   3. Polishing: More than 38, ASTM D 3319.

B. Grading: Dry weight on a percent passing basis, ASTM C 136.
   1. Gradation must not vary from a high limit on one screen to a low limit on the next.
   2. For heavy-duty surface applications use 100 percent crushed material.
   3. Target Gradation Curve must lie within one of the following Master Grading Bands. Field samples shall not vary from the Target Gradation Curve by more than the Target Tolerance.

Table 1 – Master Grading Band and Target Tolerance Limits			
US Sieve Size	*Master Grading Band Limits*		*Target tolerance, Percent*
	Type II	*Type III*	
1/2 in.	–	100	–
3/8 in.	100	>85	+/- 5
No. 4	70 – 90	60 – 87	+/- 5
No. 8	45 – 70	40 – 60	+/- 5
No. 16	28 – 50	28 – 45	+/- 5
No. 30	19 – 34	19 – 34	+/- 5
No. 50	12 – 25	12 – 25	+/- 4
No. 100	7 – 18	7 – 18	+/- 3
No. 200	5 – 15	4 – 8	+/- 2
NOTES (a) Portion retained on the No. 4 sieve · clean and free of clay coatings. · More than 80 percent of the particles by weight, with at least 1 mechanically fractured face or clean angular face. (b) Portion passing No. 200 sieve includes mineral filler, ASTM C 117.			

2.4 MINERAL FILLER

A. ASTM D 242.

B. Portland cement, hydrated lime, limestone dust, fly ash, or aluminum sulfate to regulate setting time and improve workability.

C. Limestone dust, fly ash, and rock dust to alter aggregate gradation.

2.5 MIX DESIGN

A. Proportioning: Using procedures for mix design developed by the International Slurry Surfacing Association, determine the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), polymer modified asphalt emulsion, and additives in the mix.

B. Set and Cure Time: Select to meet opening to traffic requirements.

C. Stripping: More than 90 percent of bituminous-coated particles retain asphalt coating, ASTM D 1664.

D. Wet Track Abrasion, ASTM D 3910:
1. 50 grams per square foot maximum in a one hour soak, and
2. 75 grams per square foot maximum in a six day soak.

E. The following is provided as a guide in the development of a mix design.
1. Residual Asphalt: 5.5 to 10.5 percent by dry weight of aggregate.
2. Mineral Filler: 0 to 3 percent by dry weight of aggregate.
3. Polymer Based Modifier: less than 3 percent solids based on bitumen weight content.
4. Clay Content: Sand equivalent, ASTM D 2419: 65 minimum prior to adding additives. Note: Sand equivalency controls set time.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Mixing Equipment: The unit is to be a storage and mixing device capable of accurately proportioning and delivering aggregate, emulsified asphalt, mineral filler, additive, and water on a continuous flow basis to a spreader box at a placement rate of at least 15,000 square yards per day. Its proportioning devices are to be based upon either volume or weight control. Its mixer is to be a multi-blade, multi-shaft unit.
   1. For lay downs longer than 600 feet, autonomous mixing equipment is required.
   2. For lay downs less than 600 feet, truck mounted mixing equipment is permitted.

B. Spreader: The spreader is to have a front seal so no loss of the mixture occurs at road contact and an adjustable rear seal to act as a final strike-off device. The spreader is to have a secondary strike off device to improve surface texture.

C. Rut Filling Box: Wide enough to bridge ruts.

3.2 PREPARATION

A. General:
   1. Fat or bleeding Pavements may require two scratch course applications.
   2. Cracked or porous Pavements may require thin, SSI slurry surface treatment per Section 32 01 13.
   3. Asphalt concrete inlay may be required in rut deformations.

B. Protection:
   1. Protect trees, plants and other ground cover from damage.
   2. Prune trees per Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to Vernal Ctiy.
   3. Install invert covers.
   4. Mask Street Fixtures.
   5. Protect curb, gutter, and sidewalk from spatter, mar, or overcoat.

C. Traffic Control:
   1. Control pedestrian and vehicular traffic, Section 01 55 26.
   2. Protect micro surface seal from traffic until seal has cured. Length of time depends on type of asphalt, mixture characteristics and weather.
   3. Do not proceed without flaggers.
   4. Do not apply lane marking tape or paint until layout has been verified with the Vernal City representative.

D. Surface Repair: Patch any holes, raveled areas, and low areas with asphalt concrete.

E. Cleaning:
   1. Remove mud spots, sand, dust, oil, vegetation and other objectionable material.
   2. Remove loose material that may cause drag marks.
   3. Do not water flush cracked Pavements.

F. Crack Repair: Section 32 01 17.
   1. Remove plant materials from cracks, edges and joints.
   2. Blow cracks clean.
   3. Seal cracks with crack pouring asphalt. Remove excess asphalt.
   4. Allow crack seal to dry before surfacing.

G. Tack Coat:
   1. Apply tack coat to high-absorbent, polished, oxidized, or raveled asphalt surfaces or to concrete or brick surfaces. Use the same asphalt emulsion as used in the micro-surfacing seal.
   2. Apply tack coat and pave over concrete Cover Collars.

H. Existing Roadway Striping: Use reflective tabs to mark roadway striping before applying micro-surface seal.

3.3 SPOT LEVELING

A. Where rut deformation is less than 1/2 inch apply only amount of microsurfacing needed to level the surface (scratch course).

B. Where rut deformation exceeds 1/2 inch:
   1. Mill high spots.
   2. Use a rut-filling box.
   3. Use multiple placements when ruts exceed 1-1/2 inches. For every inch of micro surfacing add 1/8th to 1/4 of an inch of material as a crown (allows for compaction under traffic).
   4. Allow 3 days cure time under traffic.

C. Where asphalt concrete pushing or shoving has occurred, provide asphalt concrete inlay as follows.
   1. Mill damaged area at least 3 inches below elevation required for leveling.
   2. Install and compact 3 inches of AC-20-DM-3/4 asphalt concrete, Section 32 12 17.

3.4 APPLICATION

A. General:
   1. After spot leveling, the average application rates are to fall within the following ranges.
   a. Type II Aggregate: 16 to 18 pounds per square yard.
   b. Type III Aggregate: 20 to 25 pounds per square yard.
   2. Machine meter settings must match mix design. Water and mineral filler may be changed per mix design; otherwise, a new mix design is required.
   3. Pre-wet existing pavements surface to prevent premature breaking or to improve bonding.
   4. Wait at least 2 hours if an adjacent pass has broken and started to cure.

B. Mineral Filler: During application, mineral filler (per mix design) may be increased or decreased for better consistency or set time.

C. In the spreader box.
   1. No spreading of material remaining in box when mixer is shut off.
   2. No additional water added to the box.
   3. No lumping, balling or unmixed aggregate.
   4. No segregation of the emulsion and aggregate fines from the coarse aggregate.
   5. No breaking of emulsion.
   6. No overloading. Carry a sufficient amount of slurry in all parts of the spreader for complete coverage.

D. Joints:
   1. Make transverse joints straight-cut butt type, not over-lap type.
   2. Place longitudinal joints on lane lines. Limit overlap to 3 inches maximum.
   3. Tolerance for joint match is 1/4 inch difference in elevation when measured with a 10 feet long straight edge over the joint.
   4. Stop and correct paving operation if longitudinal or transverse joints have uncovered areas or unsightly appearance.

E. Lines:
   1. Make straight lines along lip of gutter and shoulders. No runoff on these areas will be permitted.
   2. Mask off the end of streets and intersections to provide straight lines.
   3. Vary edge lines no more than 2 inches per 100 feet.

3.5 AFTER APPLICATION

A. Leave no streaks caused by oversized aggregate particles or buildup of slurry mix on squeegees.

B. Leave no holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying Pavement.

C. If coarse aggregate settles to the bottom of the mix, remove and replace the application.

D. Expose Manholes, valve boxes, inlets and other service entrances clean after application.

E. Do not permit traffic on micro-surface until surface has cured.

F. Do not apply lane marking tape or paint until layout and placement has been verified with the Vernal City representative.

3.6 FIELD QUALITY CONTROL

A. If ASTM C 136 shows aggregate gradation non-compliance, either remove the material or blend in other aggregates to bring it into compliance. This may require a new mix design. Screening may be required at the stockpile to remove any oversize materials.

3.7 REPAIR

A. Fill any joints or cracks that are not filled by product.

B. Remove overcoat, at no additional cost to Vernal City.

C. Remove micro-surfacing seal from Street Fixtures.

D. Make correction lines straight.

E. Repair collateral damage caused by construction.

END OF SECTION

SECTION 32 01 16
RECYCLED ASPHALT PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Placing RAC in base, leveling, or surface courses.

B. Mix design requirements.

1.2 REFERENCES

A. ASTM D 2950: Standard Test Method for Density of Bituminous Concrete In Place by Nuclear Method.

B. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

1.3 DEFINITIONS

A. RAP (reclaimed asphalt pavement): Product of bitumen and aggregate recovered from milling an asphalt concrete pavement. No roadbase or Subgrade materials are contained in RAP.

B. RAC (recycled asphalt concrete): Product of mixing RAP, new aggregates and asphalt cement or recycle agent or both.

C. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.4 SUBMITTALS

A. Prior to commencing work of this Section, submit.
   1. Traffic control plan, Section 01 55 26.
   2. A list of equipment to be used.
   3. Type of asphalt to be used, Section 32 12 03.

B. RAC Mix Design: Determine the conditions and properties of the existing materials. Identify recycling agent and submit the following data as applicable.
   1. When the amount of RAP is 15 percent or less of the RAC, submit a design mix formula if Supplier does not have a design mix formula at the plant. The formula shall be based on current test data.
   2. When the amount of RAP added to the RAC is over 15 percent, submit a design mix formula.

C. RAC Delivery Tickets: Section 32 12 17.

1.5 QUALITY ASSURANCE

A. Section 32 12 17.

1.6 WEATHER

A. Section 32 12 17.

1.7 NOTICE

A. Section 32 12 17.

1.8 ACCEPTANCE

A. Section 32 12 17.

PART 2 — PRODUCTS

2.1 MATERIAL

A. Recycle Asphalt: RA grade, Section 32 12 03:

B. Tack Coat: Section 32 12 14.

C. Paving Geotextile: Section 31 05 19.

D. Paving Geogrid: Section 31 05 21.

2.2 RECLAIMED ASPHALT PAVEMENT (RAP) AGGREGATE

A. Free of detrimental quantities of deleterious materials, with a minimum sand equivalent value of 50 and graded (on a non-dried basis) as follows.

Sieve	Percent Passing by Weight
1 – 1/2"	100
1"	90

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Laydown Machine: Provide track equipment when operating on fabrics or geogrid, otherwise type of equipment to be provided is the choice of the CONTRACTOR.

B. Compactors: Steel wheeled static or vibratory. Any use of a pneumatic tire roller is for intermediate compaction only.

3.2 PREPARATION

A. General:
1. Coordinate utility location, Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if Pavement recycler machine is not capable of releasing Pavement-cutting mechanism to protect fixtures.
3. Remove plant materials from cracks, edges and joints. Sweep surface clean. Blow cracks clean.
4. Stabilize portland cement concrete Subgrade slabs.
5. Apply tack coat, Section 32 12 14.
6. Verify that surfaces are dry.

B. Trees, Plants, Ground Cover:
1. Protect trees, plants and other ground cover from damage.
2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to Vernal City.

C. Traffic Control:
1. Control pedestrian and vehicular traffic, Section 01 55 26.
2. Protect pavement from traffic until mixture has cooled enough not to become marked.
3. Apply temporary traffic and lane marking tape or paint after layout and placement has been verified with the Vernal City representative.

D. Milling, Section 02 41 14

3.3 PLACING RAC

A. Hot-laid RAC, Section 32 12 17.

B. Cold-laid RAC, Section 32 12 17.

C. Mix and blend milled aggregate, recycling asphalt, virgin asphalt and virgin aggregate per the mix design.

3.4 TOLERANCES

A. Compaction, lift thickness, grade, cross slope, Section 32 12 17.

B. Complete compaction of RAC within 5 minutes of placing RAC and before its temperature drops below 200 deg. F.

3.5 PROTECTION AND REPAIR

A. Section 32 12 17.

END OF SECTION

SECTION 32 01 16.75
HEATER SCARIFYING OF ASPHALT PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. A seamless repair of asphalt concrete pavement by applying evenly distributed heat over the pavement surface, then mixing and compacting the heated pavement in-place. This section is in addition to requirements of other paving sections.

1.2 SUBMITTALS

A. Manufacturer's product data, equipment and material specifications.

B. Traffic control plan, Section 01 55 26.

1.3 PERFORMANCE REQUIREMENTS

A. Use a method that does not burn the pavement surface or burn off any existing asphalt pavement volatiles.

PART 2 — PRODUCTS

2.1 MATERIAL

A. Rejuvenating agent, asphalt concrete mix, tack oil, reclaimed asphalt pavement (RAP), and sealant.

PART 3 — EXECUTION

3.1 PREPARATION

A. Implement traffic control plan requirements.

B. Mark areas in the field that are to be repaired. Mark existing utilities on redline drawings.

C. Use a detector to find hidden (buried) Street Fixtures.

3.2 REPAIRS

A. Heat areas that are to be repaired.
   1. Do not exceed a surface temperature of 350 degrees F.
   2. Follow minimum surface temperature requirements in Section 32 12 16.
   3. Heated area must extend beyond the patch or damaged area.

B. Mechanically scarify and thoroughly mix the repair area. Provide a beveled edge sloping toward area of repair.

C. Add and thoroughly mix additional bituminous material and rejuvenating agent as required to fill depressions, potholes, or to match grade of adjacent pavement surfaces.

D. Screed and level the repair area in preparation for compaction and allow the material to become integral with edges of repair area.

E. Compact surface with a steel drum roller. Match the grade of the adjacent pavement after compaction.

F. Cool repaired area to 150 degrees F. before opening to vehicular traffic.

G. Reapply heat and rework area in the case where bumps and depressions are present in finished surface.

H. Sweep up and dispose of excess material and debris.

I. Repair any damage at no additional cost to Vernal City.

END OF SECTION

SECTION 32 01 17
PAVEMENT CRACK SEAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Filling and sealing cracks in asphalt concrete Pavements.

1.2 REFERENCES

A. ASTM D 36: Standard Test Method for Softening Point of Bitumen (Ring-and Ball Apparatus)

B. ASTM D 977: Standard Specification for Emulsified Asphalt.

C. ASTM D 1190: Standard Specification for Concrete Joint Sealer, Hot-Poured Elastic Type.

D. ASTM D 2397: Standard Specification for Cationic Emulsifed Asphalt.

E. ASTM D 3381: Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

F. ASTM D 3405: Standard Specification for Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.

G. ASTM D 5078: Standard Specification for Crack Filler for Asphalt Concrete and Portland Cement Concrete Pavements.

H. ASTM D 5329: Standard Test Methods for Sealants and Fillers, Hot-Applied for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.

I. AASHTO M 301: standard for High Performance, Hot Applied Sealant.

1.3 DEFINITIONS

A. Crack Filling: The placement of materials into cracks to substantially reduce infiltration of water and to reinforce the adjacent Pavement. All cracks to be cleaned using hot compressed air lance.

B. Crack Sealing: The placement of specialized materials in cracks or above to prevent the intrusion of incompressibles and water into the crack. All cracks shall be cleaned using a heat lance and compressed air.

C. Pothole: Loss of surface material in a Pavement to the extent that a patch is necessary to restore Pavement ride quality.

1.4 SUBMITTALS

A. Product Data sheets.

1.5 QUALITY ASSURANCE

A. Do not use crack repair product that has been over-heated, suffered prolonged heating or which ravels or can be pulled out by hand after placement.

B. Do not mix different manufacturer’s brands or different types of crack repair material.

C. Do not depress crack repair product temperature at the wand tip below the manufacturer’s recommended application temperature when loading product into product tank.

D. Rework Defective Work.

1.6 NOTICE

A. Send written notice to residents and businesses within affected area at least 3 days before application of new Crack Filling or Crack Sealing material.

B. Indicate application time and when pavement surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on the specified day, send a new notice.

1.7 ACCEPTANCE

A. Visually inspect areas for adhesion Failure, damage to crack repair product, missed cracks, foreign objects in the product, or other problems that indicate the Work is not acceptable.

PART 2 — PRODUCTS

2.1 FILLER AND SEALER MATERIAL

A. Crack treatment materials as follows.

Table 1 – Thermoplastic Filler and Sealer Materials

Material Type	*ASTM*	*Application*
Hot-applied Thermoplastic Materials		
Asphalt Rubber	D 5078	Sealing (possibly filling)
Rubberized Asphalt	D 1190 D 3405	Sealing
Low Modulus Rubberized Asphalt	(a)	Sealing
Asphalt Cement	D 3381	Filling
Mineral-filled Asphalt Cement	D 3381 (b)	Filling
Fiberized Asphalt Cement	D 3381 (b)	Filling
Chemically Cured Thermosetting Materials		
Silicone	(c)	Sealing
Cold Applied Thermoplastic Materials		
Asphalt Emulsion	D 977 D 2397	Filling
Polymer-modified liquid asphalt	D 977 D 2397	Filling (possibly sealing)

NOTES
(a) ASTM D 3405 or ASTM D 5078 except as follows.
· Softening point, 85 deg. C. minimum, ASTM D 36.
· Resilience, 30 percent recovery minimum at 25 deg. C plus or minus 1 deg. C, ASTM D 5329.
(b) Additives such as mineral fillers and fibers provide minimal elasticity to asphalt and do not significantly affect temperature susceptibility.
(c) Manufacturer's recommended specification.

1. The sealing material shall comply with the requirements of ASTM D 3405-78 and AASHTO M 301-85. The Contractor shall submit a certificate of compliance signed by the manufacturer certifying that the material meets these requirements. The certificate shall be submitted prior to the use of the material in the work.

B. Selection of Sealer: Hot applied asphalt rubber or hot applied rubberized asphalt, unless specified otherwise.

C. Selection of Filler: Asphalt emulsion, unless specified otherwise.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Sealant Heating Equipment: Indirect heating using double boiler or circulating hot oil heat transfer for heating the product. Do not use direct heat transfer units (tar pots). Unit must have means of constant agitation.

B. Hot Compressed Air Lance: Provide clean, oil-free compressed air at a temperature of 1800 degrees Fahrenheit and a minimum of 3000 feet per second velocity.

3.2 PREPARATION

A. Allow at least one week for repaired cracks to cure and harden before placing thin overlays.

B. Repair Potholes full depth.

C. The filler material shall not be applied when it is raining, excessive moisture is present, or either atmospheric or pavement temperature is 45 degrees Fahrenheit and falling. Filler material may be applied when moisture is not present and either the atmospheric or pavement temperature is 40 degrees Fahrenheit and rising.

3.3 CRACK FILLING AND SEALING

A. Blow cracks clean. Remove foreign matter, loosened particles, and weeds.

B. Use a hot air lance when surfaces are wet or when air temperature is less than 40 deg. F. Do not burn the surrounding Pavement. Fill cracks immediately after heating with the air lance or reheat.

C. Fill each crack to within 1/4 inch of the existing surface.
1. Filling of cracks and voids shall not commence until they are clean and dry. Filling should closely follow cleaning. The cracks shall be sealed from the bottom up. The filler material shall be placed within 1/8-inch of the top of the crack. If settlement of the filler material occurs, the cracks shall be refilled until they are again within 1/8-inch of the finished surface. No excess build up of filler material will be permitted. Any spillage or loose material shall be removed from the surface.

D. If a thin Pavement (chip seal, slurry seal, micro-surface) is to be applied, remove crack overfill by squeegee.
1. Any excess material shall be leveled flush to the surface with a "V" shaped squeegee device. The excess material will be squeegeed so as not to exceed 1 ½-inches on each side of the crack. Excess material remaining in the squeegee at the end of the crack will be distributed over the crack in a return motion.

3.4 PROTECTION

A. Place sand on surface of crack repair product if traffic or construction activities are likely to cause pull out. Replace pulled out product at no additional cost to the OWNER.

B. Repair vehicles or other property damaged by crack repair operation.

END OF SECTION

SECTION 32 01 18
PAVEMENT RESTORATION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Aggregate base restoration.

B. Concrete base restoration.

C. Surface restoration.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

B. MORATORIUM ROAD: A road that has been reconstructed or had an overlay of greater than one inch of asphalt within the last 5 years.

1.3 REFERENCES

A. ACI 305: Hot Weather Concreting.

B. ACI 306: Cold Weather Concreting.

C. ASTM C 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading).

E. ASTM C 928: Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

F. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.

G. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

1.4 SUBMITTALS

A. Mix design for,
   1. Temporary patching material.
   2. Permanent cold weather patching material.

B. Manufacturer's chemical additive data sheets.

1.5 WEATHER

A. Asphalt Concrete Pavement Patch:
   1. Provide temporary or permanent cold weather asphalt patching material when air and roadbed temperature in the shade are less than 40 deg. F.
   2. Remove any temporary patching and provide permanent patching material when temperatures exceed 40 deg. F. The CONTRACTOR may complete work after cold weather season if authorized in writing by the Vernal City representative.

B. Portland Cement Concrete Pavement Patch: Comply with hot and cold weather requirements, ACI 305 or ACI 306.

1.6 ACCEPTANCE

A. Aggregate base compaction.

B. Asphalt concrete compaction.

C. Grade and cross slope of pavement surface.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Untreated Base Course: Section 31 05 13.

B. Flowable Fill Base: Section 31 05 15.

C. Portland Cement Concrete Base: Class 4000, Section 03 30 04.

D. Tack Coat: Section 32 12 14, Grade SS-1.

E. Permanent Warm Weather Asphalt Concrete Patching Material: Section 32 12 05, AC-20-DM-1/2 unless indicated otherwise.

F. Permanent Cold Weather Asphalt Concrete Patching Material: MC-250-FM-1, Section 32 12 05 modified as follows.
1. Asphalt Cement:
   a. Kinematic viscosity at 140 deg F: 350 to 4000 cSt.
   b. Flash Point: 200 deg F.
   c. Water: 0.2 percent maximum.
   d. Distillate Test:
      To 437 deg F: None.
      To 500 deg F: 0 - 15 percent.
      To 600 deg F: 15 - 75 percent.
      To 680 deg F: 75 percent minimum.
   e. Residue Tests:
      Penetration at 77 deg F: None.
      Ductility at 77 deg F: 100 cm minimum.
      Solubility in Trichloroethylene: 99 percent minimum.
2. Composition of Mixture:
   a. Minimum Mix: 115 pounds asphalt cement per finished ton (5.75 percent).
   b. Maximum Mix: 135 pounds asphalt cement per finished ton (6.75 percent).
   c. Stripping: Not more than 5 percent, ASTM D 1664, after mixing.
   d. Workability: Material stockpiled for 1 year shall be capable of being shoveled, raked, spread and compacted.
3. Chemical Additives: Capable of coating wet aggregates without stripping and maintains adhesive qualities in damp or wet applications.

G. Temporary Cold Weather Asphalt Concrete Patching Material: Type MC-250-DM-1/2, Section 32 12 05 with hydrated lime or anti-stripping agent as indicated in the mix design.

H. Pavement Sealing:
1. Slurry seal Type RS-1-SS-II, Section 32 01 13.
2. Chip seal Type MC-250-CS-A, Section 32 01 14.
3. Others as specified by Vernal City

I. Portland Cement Concrete Patching Material: Class 4000, Section 03 30 05.

J. High Early Strength Portland Cement Concrete Patching Material:
   1. Concrete compressive strength of 3,000 psi minimum in 4 hours.
   2. Cementatious Material: Rapid hardening or very rapid hardening, ASTM C 928.
   3. Cement content of mix, per cement manufacturer's recommendations or approved mix design.
   4. Non-reactive aggregates in applications subjected to wetting, extended exposure to humid atmosphere, or contact with moist ground.

K. Pavement Marking: Tape or paint, Section 32 17 23.

PART 3 — EXECUTION

3.1 PREPARATION

A. At site, post name, address and telephone number of the CONTRACTOR to contact in emergencies as specified in Section 01 31 00.

B. Notify the Vernal City representative 24 hours prior to commencing work of this section.

C. Provide worker and public safety; Section 01 55 26.

D. Cutting Pavements: Cut full depth and straight, Section 02 41 14. Remove all bonding inhibitors.

3.2 AGGREGATE BASE OR FLOWABLE FILL BASE

A. Match depth of existing aggregate base or 8 inches thick minimum.

B. Place crushed aggregate base in lifts not exceeding 8 inches before compaction. Compact per Section 31 23 26 to a Modified Proctor Density of 96 percent or greater.

C. When providing controlled low strength material (CLSM as specified in 31 05 15) match depth of existing aggregate base. Use fill that flows easily and vibration is not required. Cure the fill before placing surface patch.

3.3 CONCRETE SUBSTRATE

A. Apply concrete bonding compound, Section 03 30 10, to edge of existing concrete. Place concrete, Section 03 30 10.

3.4 ASPHALT CONCRETE PATCH

A. Match existing Pavement thickness, or 3 inches thick minimum.
   1. When restoring paving on a MORATORIUM ROAD in Vernal City, refer to Section 01 31 00.
   2. On Vernal City Streets that are not complemented by curb, gutter, or sidewalk, an asphalt Safety Edge is to be installed. A Safety Edge consists of tapering the edge asphalt at a 30 degree angle from the full thickness of asphalt to ½ inch thick at the asphalt-soil interface. See Standard Drawing 6 - Typical Road Cross Section.

B. Clean all vertical surfaces that butt against new patchwork. Provide full coverage spray tack coat. Do not spray tack coat on surfaces exposed to public view. Do not apply tack coat by brush.
   1. Crafco Pavement Joint Adhesive is to be applied according to the manufacturer’s specifications at all vertical joints

C. Place asphalt concrete in lifts not exceeding 3 inches after compaction.

D. Compaction: 96 percent of ASTM D 2041 (Rice) plus 2 percent or minus 1 percent.

E. Match adjacent surface slopes.
   1. Plane off surface distortions that exceed 1/4-inch vertical deviation in 10 feet.
   2. Coat planed surfaces with a cationic or anionic tack emulsion that complies with Section 32 12 03. Cover tack with sand.

3.5 PORTLAND CEMENT CONCRETE PATCH

A. Full Depth restorations:
   1. Clean vertical surfaces in patchwork. Install dowels in vertical load bearing joints. Apply concrete bonding compound, Section 03 30 10.
   2. Match adjacent surface slopes. Apply membrane forming compound, Section 03 39 00 immediately to protect work from hot or cold weather.
   3. After concrete cure, plane off surface distortions that exceed 1/4 inch deviation in 10 feet. Use a water repelling product, Section 07 19 00 to water proof planed surfaces.
   4. Do not allow traffic on the repaired area until concrete strength is achieved.

B. Partial Depth Patching:
   1. Chip, hydro-blast or saw cut concrete to a minimum depth of 1 inch.
   2. Make surfaces free of frost, ice, mud, water, grease, dirt and other materials that hamper bonding.
   3. Install bonding agent per manufacturer's recommendations.
   4. Apply membrane forming compound, Section 03 39 00 immediately to protect work from hot or cold weather.
   5. After concrete cure, plane off surface distortions that exceed 1/4 inch deviation in 10 feet. Use a water repelling product, Section 07 19 00 to water proof planed surfaces.
   6. Do not allow traffic on the repaired area until concrete strength is achieved.

3.6 CONCRETE PAVERS

A. Screed Bedding with a notched and cambered screed board to achieve a crown between existing pavers. Use graded aggregate, geotextile, and bedding sand, Section 32 14 13.

B. In asphalt concrete or portland cement concrete surfaces place pavers against Pavement cuts to form a border course, i.e. the short side of the paver against the cut except at corners.

C. After placement, use a plate-type vibrating compactor to compact pavers. Size compactor to provide at least 5,000 lbf. force. Sweep sand into the joints and vibrate until joints are full. Remove excess sand.

D. Match adjacent surface grades with no more than 1/4 inch vertical deviation in 10 feet.

3.7 PAVEMENT MARKINGS

A. Unless indicated otherwise, repair all damaged Pavement markings with matching type of materials and installation.

END OF SECTION

SECTION 32 01 26
WHITE TOP INLAY

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete inlays in existing asphalt pavements.

1.2 REFERENCES

A. ASTM C 1116: Standard Specification for Fiber-Reinforced Concrete and Shotcrete.

B. ASTM C 1399: Standard Test Method for Obtaining Average Residual Strength of Fiber-Reinforced Concrete.

1.3 DEFINITIONS

A. Inlay: A volume with sides and a bottom located within an existing roadway pavement surface.

B. Moderate Exposure Condition: Exposure in a climate where freezing is expected but where the concrete will not be continually exposed to moisture or free water for long periods prior to freezing and will not be exposed to deicing agents or other aggressive chemicals.

C. Severe Exposure Condition: Exposure to deicing chemicals or other aggressive agents or where the concrete may become highly saturated by continued contact with moisture or free water prior to freezing.

1.4 SUBMITTALS

A. Section 32 13 13.

1.5 WEATHER

A. Section 32 13 13.

1.6 NOTICE

A. Section 32 13 13.

1.7 ACCEPTANCE

A. Section 32 13 13.

PART 2 — PRODUCTS

2.1 CONCRETE

A. Cast-in-place Concrete: Class 4000, Section 03 30 04.

B. Aggregate: Maximum size one-third of white top thickness.

C. Fiber: Synthetic, ASTM C 1116 with a minimum strength of 80 psi, ASTM C 1399.
   1. 3 pounds per cubic yard
   2. 1.5 inches long.

D. Slump: Over 4 inches requires Vernal City representative acceptance.

E. Air Content: Use severe exposure unless specified otherwise.

Nominal Maximum Aggregate Size, (in.)	*Total Air Content, Percent*		
	Mild Exposure	*Moderate Exposure*	*Severe Exposure*
1	3.0	4.5	6.0
3/4	3.5	5.0	6.0
1/2	4.0	5.5	7.0
3/8	4.5	6.0	7.5

PART 3 — EXECUTION

3.1 PREPARATION

A. Mill asphalt surface to depth specified. Remove debris or loose particles. Pressure wash exposed surface. Allow surface to dry before proceeding.

B. Do not place concrete when the asphalt surface temperature is less than 35 deg. F.

C. Cool hot asphalt pavement surfaces to 100 deg. F. or less. Allow surface to dry before proceeding.

D. Do not allow traffic on pavement once final cleaning is performed.

3.2 FORMWORK

A. Section 03 11 00.

3.3 PLACEMENT

A. Section 03 30 10 and as follows.
   1. Do not move concrete hoziontally with vibrator.
   2. 1/8 inch in 10 feet tolerance
   3. Uniform and sharp corners. Do not use excess mortar to build up slab edges or round slab corners.

3.4 FINISH

A. For Speed Less than 45 mph: 1/16 inch deep burlap drag, turf drag, or broom.

B. For Speed greater than 45 mph: 1/8 inch deep 80 degrees to the crown line and randomly spaced between 3/8 and 1-1/2 inches.

3.5 CURE

A. Section 03 39 00.

B. Use Type II Class A or B (white pigmented) membrane forming compound applied in two directions for total white coverage on all exposed surfaces after texturing. Apply curing compound at 2 times manufacturer's recommendation.

C. Eliminate thermal shock by keeping ground and air temperature close to cure temperature.

3.6 JOINTS

A. General:
   1. Construction joints at the locations, depths and dimensions indicated or match alignment of joints in adjacent panels.

2. Minimum angle between any two intersecting joints is 80 degrees.
3. Joints must intersect pavement free edges at a 90 degree angle and extend straight for a minimum of 1-foot from the free pavement edge.

B. Contraction Joints:
1. Single saw cut 1/8 inch wide, 1/3 slab depth.
2. Saw transverse joints first.
3. Saw only when concrete is hard enough to prevent raveling and finish sawing before conditions favor uncontrolled cracking.
4. The larger dimension of any panel shall not exceed 125 percent of the smaller dimension. If Drawings do not indicate joints spacing, provide the following.

White Top thickness, (in.)	Approximate Spacing (ft.)
2	2 – 3
2.5	2.5 – 3.5
3	3 – 4
3.5	3.5 – 5.0
4	4 – 6

C. Isolation Joints: 1/2 inch thick sheet filler type F1, Section 32 13 73. Use this joint where pavement abuts building, manholes and other fixed objects.

D. Joint Sealing: Not required.

3.7 PROTECTION AND REPAIRS

A. General: All expenses are at no cost to Vernal City.

B. Protection: Immediately after placement, protect concrete from graffiti or other types of mechanical injury.

C. Repair:
1. Remove and replace cracked panels.
2. Patch spall with Section 03 61 00 shrinkage resistant grout.
3. Remove graffiti.

3.8 OPENING TO TRAFFIC

A. Not sooner than 3,000 psi.

END OF SECTION

SECTION 32 01 29
CONCRETE PAVING RAISING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Raising settled concrete flat work to grade.

1.2 REFERENCES

A. ASTM C 150: Standard Specification for Portland cement.

1.3 SUBMITTALS

A. Plan for containing mud in the jacking process.

B. Data sheet for shrinkage resistant grout.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Grout Mix: Shrinkage resistant, Section 03 61 00.

B. High Density Polyurethane (HDU)

C. Concrete Patch:
1. Portland cement, Type I or II ASTM C 150.
2. Silica sand.
3. Shrinkage compensating agent with plasticizing and water reducing agents.

PART 3 — EXECUTION

3.1 JACKING

A. Raise slabs to be level with existing surfaces.

B. Contain grout or HDU during the jacking process. If containment is lost, implement remediation procedures immediately. Do not permit displacement of adjacent surfaces.

C. Raising adjacent slabs or structures not scheduled for raising is considered damage.

D. Repair or restore damaged item.

3.2 CLEANING

A. Do not permit rain or sprinkler system water to wash away dust.

END OF SECTION

SECTION 32 01 90
PLANT MAINTENANCE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Landscape maintenance and replacement.

B. Guarantees.

1.2 GRASS MAINTENANCE

A. General: Maintain surfaces until Work is accepted, but in any event for a period of not less than 60 days after planting. Supply additional topsoil where necessary, including areas affected by erosion or settlement.

B. Watering: Water to ensure uniform seed germination and to keep surface of soil damp. Apply water slowly so soil will not puddle and crust. Unless indicated otherwise.

C. Fertilizing: Fertilize during seeding and 2 weeks after seeding and sodding.

D. Mowing: Cut grass first time when it reaches a height of 2-1/2 inches and maintain to minimum height of 2 inches. Do not cut more than 1/3 of blade at any one mowing. Remove clippings. After first mowing, water to moisten soil from 3 inches to 5 inches deep. Allow a minimum of 5 days between mowings.

E. Grading: Roll when required to remove minor depressions or irregularities.

F. Control Growth of Weed: When using herbicides, apply in accordance with manufacturer's recommendations. Remedy damage from improper use.

G. Protection: Protect planted areas with warning signs during maintenance period. Erect when necessary, temporary fences, or barriers, to control pedestrians.

1.3 TREES, PLANTS, AND GROUND COVER MAINTENANCE

A. General: Care for planted areas. Maintain, water, weed, repair, and protect until Work is accepted, but in any event for a period of not less than 60 days after planting. Supply additional topsoil where necessary, including areas affected by erosion or settlement.

B. Watering: After planting, keep ground continuously moist until healthy growth is established. Thereafter, thoroughly water once a day until Work is accepted. Prevent erosion.

C. Weeding: Uproot and remove weeds completely. Do not allow growth and germination of weed seeds. Fill in large holes caused by weeding with topsoil and rake smooth.

D. Protection: Protect planted areas against traffic by erecting barricades and warning signs. Replant damaged planted areas.

E. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep wires tight. Repair or replace accessories when required.

1.4 REPLACEMENTS

A. When any portion of surface becomes gullied or otherwise damaged and planting has failed to grow, repair and replant.

B. At conclusion of maintenance period, replant areas showing root growth Failure, bare or thin spots, and eroded

or settled areas with materials of like kind and size as specified for original planting.

C. Throughout the maintenance period, replace any unsatisfactory or dead plants within 10 days of written notice.

1.5 ACCEPTANCE

A. Seeded areas will be accepted at end of maintenance period when seeded areas are established and have been mowed at least 3 times.

B. All other areas will be accepted not less than 60 days after planting and successful growth.

1.6 GUARANTEE

A. Guarantee covers plant material establishment 1 year from date of acceptance.

B. Replace plant materials found dead or not in a healthy growing conditions with plant materials of same size and species with a new guarantee commencing on date of replacement.

C. At end of guarantee period if landscaped surfaces have settled causing poor drainage conditions, correct grade deficiencies. Make corrections after receiving approval of corrective methods and schedules.

D. Perform corrective work at no additional cost to Vernal City.

PART 2 — PRODUCTS Not Used

PART 3 — EXECUTION Not Used

END OF SECTION

SECTION 32 01 91
TREE ROOT CUTTING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Cutting and removing tree roots of trees that remain.

B. Protecting surface improvements from future tree root growth.

1.2 REFERENCES

A. International Society of Arboriculture. (ISA).

1.3 PROJECT CONDITIONS

A. Provide written watering instructions to neighbors in property abutting the tree root cuts to advise them of the tree's watering requirements.

1.4 QUALITY ASSURANCE

A. Provide an ISA certified arborist to observe tree root cutting. Upon request of the Vernal City representative, provide a copy of the arborist's ISA certificate and registration number on file with the State Division of Commercial Code.

PART 2 — PRODUCTS

(Not Used)

PART 3 — EXECUTION

3.1 AVOIDING ROOT CUTS

A. When placing or replacing concrete sidewalk;
   1. Adjust alignment to curve around, over or away from tree trunks. Do not proceed in this work until alignment has been reviewed by the Vernal City representative.
   2. Adjust thickness and concrete contraction score marks.

B. When replacing concrete curb and gutter.
   1. Adjust thickness and concrete contraction score marks over tree roots.
   2. Do not vary gutter invert from straight grade.

3.2 CUTTING TREE ROOTS

A. Never cut buttress roots [i.e. roots at the broadened base of the tree trunk] without written authorization of arborist. Avoid injury to trunk.

B. Keep root cutting at least 4 feet away from tree trunk. Limit cutting to one side of tree unless authorized otherwise in writing by arborist.

C. Cut roots clean and straight (no ragged or torn edges). Use an axe, saw, or appropriate equipment that properly cuts roots. Do not make partial root cuts.

D. Do not injure roots to remain.

E. Cut roots back to root laterals.

3.3 BACKFILLING

A. Backfill all cut and exposed roots the same day of root cutting, or cover with wood chips, mulch and water until backfilling is accomplished.

B. Place soil below root cut.

C. To prevent vertical root growth, place an impermeable membrane over root cuts. Bend membrane edges to plane below cut root. Place backfill materials adjacent to and above impermeable membrane.

3.4 PROTECTION

A. After cutting roots of tree.
   1. Immediately water tree after backfilling.
   2. Apply a minimum of 1 inch of water over the entire area under the tree canopy and well beyond over a period of 4 hours.
   3. Restrict water runoff.

END OF SECTION

SECTION 32 01 93
PRUNING TREES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Pruning branches of existing trees.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ANSI A 300: Tree Care Operation- Tree, Shrub, and Other Woody Plants.

B. ANSI Z 133.1: Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush- Safety Requirements.

C. International Society of Arboriculture. (ISA) - Current Standards for Pruning.

D. OSHA 1910.269: Electrical Power Generation, Maintenance, and Distribution Standard.

D. Utah Community Forest Council: Utah Shade Tree Pruning Standards

1.4 SUBMITTALS

A. Tree protection plan that identifies trees to be pruned and reasons for pruning.

B. Upon request of the Vernal City representative, submit a copy of the arborist’s certificate from ISA and registration number on file with the State Division of Commercial Code.

1.5 QUALITY ASSURANCE

A. Provide an ISA certified arborist to observe tree pruning. Upon request of the Vernal City representative, provide a copy of the arborist's ISA certificate and registration number on file with the State Division of Commercial Code.

PART 2 — PRODUCTS

2.1 PRUNING PAINT

A. Formulated for horticultural application to cut or damaged plant tissue.

2.2 DISINFECTANT

A. Chlorine based.

PART 3 — EXECUTION

3.1 PREPARATION

A. Pruning work in any publicly owned right of way requires that the CONTRACTOR notify the adjacent property owner and provide to them a brief description of why and how the work will be done. Notification needs to be given at least 2 weeks before any work is done so the property owner has a chance to respond if they choose to

do so. The arborist selected to provide pruning service shall provide the notices. A written record of delivery dates of notices by address is required of the arborist. A standard Vernal City tree form must be signed and given to the Vernal City representative prior to any pruning taking place in the Vernal City right of way.

B. Pruning trees on private property requires tree owner approval. The Vernal City representative and the CONTRACTOR shall jointly contact the owners for approval prior to performing any work.

3.2 TREE PRUNING

A. Adhere to safety requirements, ANSI Z 133.1

B. Conform to ANSI A300 and the Utah Shade Tree Pruning Standards when pruning.

C. Conform to OSHA 1910.269 if there are power or communication lines within the area occupied by the tree's branches or adjacent to the tree.

D. Remove tree branches extending over the roadway to provide a clear height of
1. 16 feet over the travel lane.*
2. 14 feet over the Driveway.
3. 12 feet over finished grade.
4. 6 feet over street light.
5. 12 feet over signal light.

* The travel lane means the lane vehicles typically use for travel which is different than the parking lane which is the lane adjacent to the street along the curb normally used for parking.

E. The contracted arborist may need to reduce the above referenced clearances based on tree size, species, or location.

F. Remove dead, diseased, damaged, broken, hanging, obstructing, crossing or weak branches.

G. Prune trees to make them shapely, symmetrical, and typical of the natural form of the species being pruned. Thin no more than 25 percent of the live canopy. Do not remove branches that would deform the appearance of the tree.

H. Cut deadwood back to existing callous growth. Do not remove callous growth.

I. Reduce length of limbs as ordered by the Vernal City representative.

J. Do not remove any live branch larger than 6 inches in diameter unless authorized by the Vernal City representative.

K. Pre-cut branches to reduce weight of final cut. Select final cuts by the location of the branch bark ridge and branch collar.

L. No intermodal final cuts permitted unless authorized by the Vernal City representative.

M. The use of climbing spurs (gaffs) are prohibited.

N. Disinfect pruning equipment that comes in contact with diseased plant material. Remove disinfectant from equipment prior to proceeding with work.

O. Use the "Natural Target" or "Drop Crotch" pruning method when removing limbs.

P. Do not top, pollard, stub or dehorn any tree.

Q. Make all pruning cuts sufficiently close to the trunk or parent limbs without cutting into or removing the "branch

collar" or the "branch bark ridge".

3.3 BRANCH DISPOSAL

A. Remove branches from site.

B. Remove all wood chips.

END OF SECTION

SECTION 32 12 03
PAVING ASPHALTS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Performance graded asphalt, asphalt cement, cutback asphalt, emulsified asphalt, recycle asphalt, and crack patch asphalt.

B. Requirements for accepting non-complying paving asphalts.

1.2 REFERENCES

A. ASTM D 113: Standard Test Method for Ductility of Bituminous Materials.

B. ASTM D 977: Standard Specification for Emulsified Asphalt.

C. ASTM D 2026: Standard Specification for Cutback Asphalt (Slow-Curing Type).

D. ASTM D 2027: Standard Specification for Cutback Asphalt (Medium-Curing Type).

E. ASTM D 2028: Standard Specification for Cutback Asphalt (Rapid-Curing type).

F. ASTM D 2397: Standard Specification for Cationic Emulsified Asphalt.

G. ASTM D 3381: Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

H. ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.

I. ASTM D 5710: Standard Specification for Trinidad Lake Modified Asphalt.

J. ASTM D 6373: Standard Specification for Performance Graded Asphalt Binder.

1.3 SUBMITTALS

A. Submit bill of lading for each shipment of paving asphalt from vendor. Identify the following.
   1. Source of product (manufacturer);
   2. Type and grade of asphalt, And
   3. Type and amount of additives in the product.

1.4 QUALITY ASSURANCE

A. Reject paving asphalts which are not uniform in appearance and consistency or which foam when heated to mixing temperature.

B. Do not use storage containers contaminated with other types or grades of Petroleum products.

C. Do not use Petroleum product that does not comply with contract requirements.

1.5 ACCEPTANCE

A. General:
   1. Acceptance is by Lot. One Lot is one day’s production.

B. Performance Graded Asphalt Binder (PGAB): Sub-lot size is 20,000 gallons. Collect sub-lot Sample randomly from oil storage unit.

1. Refer to limits identified in Section 209 of UDOT's "Manual of Instruction Part 8 Materials". Pay factors are as follows.
    a. If none of the critical properties are outside rejection limit a composite price adjustment of 25 percent or less is allowed.
    b. If one or more of the critical properties falls outside the rejection limit or if a composite price adjustment is more than 25 percent, paving asphalt will be rejected.

C. Asphalt Cement (AC) Binder: Sub-lot size is 20,000 gallons. Collect sub-lot Sample randomly from oil storage unit.
1. Ductility: Meet this Section's requirements, or
2. Viscosity or Penetration: Meet graphics published in Section 955 of UDOT's "Manual of Instructions, Part 8 Materials".

D. Cut-back Binder: Meet this Section's requirements for ductility.

E. Trinidad Lake Modified Asphalt: Supplier's certificate for ASTM compliance.

F. Emulsified Asphalt: Supplier's certificate for ASTM compliance.

G. Recycle Asphalt: Identity of source (asphalt cement or tar products).

H. Crack Patch: Meet material requirements in Section 32 01 17.

PART 2 — PRODUCTS

2.1 PERFORMANCE GRADE ASPHALT BINDER (PGAB)

A. Petroleum asphalt that complies with ASTM D 6373. Blending the paving asphalt with polymers or natural asphalts is CONTRACTOR's choice.

2.2 ASPHALT CEMENT (AC)

A. Petroleum asphalt that complies with Table 2 of ASTM D 3381 except as follows:
1. Replace ductility at 77 deg. F. (25 deg. C.) with ductility at 39.2 deg. F. (4 deg. C.). Use the following values.
    · AC-5: greater than 25.
    · AC-10: greater than 15.
    · AC-20: greater than 5.
2. Delete the loss on heating requirement on residue from "Thin-Film Oven Test".

B. AC-5 Latex Additive: Anionic emulsion of butadiene-styrene lowtemperature copolymer consisting of 2 percent by weight (solids basis), stabilized with fatty-acid soap for storage stability.

2.3 TRINIDAD LAKE MODIFIED ASPHALT (TLA)

A. Petroleum asphalt that complies with ASTM D 5710 (a blend of natural asphalts).

2.4 SLOW CURE CUT-BACK ASPHALT (SC)

A. Petroleum asphalt that complies with ASTM D 2026 (fluxed with a light oil) except if penetration of residue is more than 200 and its ductility at 77 deg. F (25 deg. C) is less than 100 cm., the material will be acceptable if the ductility at 59 deg. F. (15 deg. C) is greater than 100.

2.5 MEDIUM CURE CUT-BACK ASPHALT (MC)

A. Petroleum asphalt that complies with ASTM D 2027 (fluxed or blended with a kerosene-type solvent, non-foaming when heated to application temperature) except if penetration of residue is more than 200 and its

ductility at 77 deg. F. (25 deg. C) is less than 100 cm., the material will be acceptable if the ductility at 59 deg. F. (15 deg. C) is greater than 100.

2.6 RAPID CURE CUT-BACK ASPHALT (RC)

A. Petroleum that complies with ASTM D 2028 asphalt (fluxed or blended with a naphtha-solvent, non-foaming when heated to application temperature).

2.7 EMULSIFIED ASPHALT

A. Petroleum asphalt uniformly emulsified with water, homogeneous throughout, and when stored, shows no separation within 30 days after delivery. Frozen emulsions not accepted.
   1. Anionic, ASTM D 977 (breaks by evaporation).
   2. Cationic, ASTM D 2397 (breaks chemically).

2.8 RECYCLE ASPHALT (RA)

A. Petroleum asphalt that complies with ASTM D 4552 (homogeneous, free-flowing at pumping temperature made from maltene fractions of asphalt cement for surface revitalization or from tar products to make Pavements resistant to fuel spillage.
   1. RA-1, RA-5, RA-25 or RA-75 for recycling RAP when less than 30 percent virgin aggregate is added.
   2. RA-250 or RA-500 when more than 30 percent virgin aggregate is added to the RAP.

PART — 3 EXECUTION

3.1 INSTALLATION

A. Prime coat, Section 32 12 13.

B. Tack coat, Section 32 12 14.

C. Plant mix paving, Section 32 12 16.

D. Cold mix paving, Section 32 12 17.

E. Seal coating, Section 32 01 13.

F. Crack patch, Section 32 01 17.

END OF SECTION

SECTION 32 12 05
ASPHALT CONCRETE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Composition of asphalt - aggregate mix.

B. This specification does not apply to polymer modified asphalt concrete. Refer to Section 32 12 06.

1.2 REFERENCES

A. AI Manual Series No. 2: Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

B. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).

C. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.

D. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

E. ASTM C 117: Standard Test Method for Materials Finer Than 0.075mm (No. 200) Sieve in Mineral Aggregates by Washing.

F. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

G. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregate.

H. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

I. ASTM D 75: Standard Practice for Sampling Aggregates.

J. ASTM D 140: Standard Practice for Sampling Bituminous Materials.

K. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

L. ASTM D 979: Standard Methods for Sampling Bituminous Paving Mixtures.

M. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

N. ASTM D 3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

O. ASTM D 3381: Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

P. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

Q. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

R. ASTM D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

S. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

T ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.

U. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.

V. ASTM D 4867: Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.

W. ASTM D 5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate.

X. ASTM D 5581: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6-inch_Diameter Specimen)

Y. ASTM D 5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

Z. ASTM D 6307: Standard Test Method for Determining Asphalt Content of Hot-Mix Asphalt by Ignition Method.

AA. ASTM D 6373: Standard Specification for Performance Graded Asphalt Binder.

1.3 DEFINITIONS

A. Asphalt-Aggregate Designator: Alpha-numeric code that indicates type and grade of asphalt, and type and grade of aggregate in an asphalt-aggregate mix. For example;
   1. "*AC-20-DM-3/4*" means asphalt-aggregate mix shall be composed of AC-20 type and grade asphalt cement and DM-3/4 type and grade aggregate.
   2. "*RA-1-DM-1*" means asphalt-aggregate mix shall be composed of RA-1 type and grade asphalt recycling agent and DM-1 type and grade aggregate.
   3. "*RS-1-SS-II*" means asphalt-aggregate mix shall be composed of RS-1 type and grade asphalt emulsion and SS-II type and grade aggregate.

B. Mean of Deviations: Defined in Section 31 05 13.

C. CONTRACTOR: Any person, private business, public business, government agency or municipal agency that is performing work within the Vernal City right of way.

1.4 SUBMITTALS

A. Quality Assurance: Submit names, certification levels, and years of experience of testing agency's field technicians that are assigned to the Work. Verify laboratory complies with ASTM standards.

B. Mix Design: Submit.
   1. Date of mix design. If older than 365 days, recertify mix design.
   2. Asphalt cement source, type and chemical composition.
   3. Aggregate gradation target.
   4. Asphalt cement target, dust to asphalt ratio, moisture sensitivity (tensile strength) stability, flow and voids in the bituminous mix.
   5. Paving asphalt grade if RAP is used in the mix.
   6. RAP, mineral filler, antistrip, and recycle agent percentages.

C. Pre-approved mix design, submit name and address of Supplier.

D. Before changing mix design, submit a new design and give the Vernal City representative 10 days to evaluate the changes.

E. Source Quality Control Inspections and Testing Report: If requested, submit report describing quality control activities and test results form the CONTRACTOR and the Supplier.
   1. Result of Gradation Test
   2. Wear Test

3. Marshall Flow Test
4. Density Test
5. Other tests and information necessary to check the mix design.

1.5 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with ASTM D 3666.

B. Do not change aggregate source or paving asphalt source without written approval from the Vernal City representative.

C. Do not use non-complying sources.

1.6 ACCEPTANCE

A. General:
1. Acceptance is by Lot. One Lot is one day's production.

B. Installation: Accepted as specified in Section 32 12 16.

C. Materials:
1. At the Source:
a. Aggregate: Verify gradation. Collect sample from conveyor belt or stockpile if belt is not accessible.
b. Paving Asphalt: See Section 32 12 03 provisions.
c. Mix: 325 deg. F. maximum in transport vehicle.
2. At the Site:
a. One sub-lot is 500 tons.
b. Sampling: Two random samples per sub-lot. Location as follows.
i. Behind paver before compaction, or
ii. Where sub-lot exhibits non-uniform appearance.
3. At the Laboratory:
a. Air Voids:
i. Basis of evaluation is laboratory compacted samples (not field compacted samples).
ii. If test results are not within this Section's limits, options include correction of production procedures or alternate mix design acceptable to the Vernal City representative.
b. Dust to asphalt ratio.

PART 2 — PRODUCTS

2.1 PAVING ASPHALT

A. Asphalt Cement: Section 32 12 03. Substitutes for asphalt cement are as follows.

ASTM D 3381	ASTM D 6373
AC 10	PG 64-22 or PG 70-28
AC 20	PG 70-28

B. Recycled Asphalt: Section 32 12 03.

2.2 AGGREGATE

A. Material: Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.
1. All aggregates shall be free from organic matter or other detrimental substances.
2. The plus #4 sieve fraction shall have a least 50 percent of all particles with a fractured angular face.

B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.

1. Coarse Aggregate:
    a. Angularity (fractured faces), ASTM D 5821: 50 percent maximum by weight of particles with at least 2 fractured faces.
    b. Hardness (toughness), ASTM C 131: 40 percent minimum wear of aggregate retained above the No. 4 sieve unless specific aggregates having higher values are known to be satisfactory.
    c. Flat or Elongated Particles, ASTM D 4791: 20 percent maximum retained above 3/8 inch sieve has a 3:1 length to width ratio.
2. Fine Aggregate:
    a. Friable Particles, ASTM C 142: 2 percent maximum passing No. 4 sieve.
    b. Plasticity, ASTM D 4318: Aggregate passing No. 40 sieve is non-plastic even when filler material is added to the aggregate.
        i. Liquid limit: Less than 25.
        ii. Plastic limit: Less than 6.

2.3 ADMIXTURES

A. Reclaimed Asphalt Pavement (RAP) Aggregate: Restrictions include.
1. 15 percent by weight maximum providing grading and voids in the bituminous mix are met.
2. Greater than 15 percent requires separate mix design.

B. Mineral Filler: ASTM D 242.

C. Recycle Agent: ASTM D 4552.

D. Antistrip: Heat stable cement slurry or lime slurry.

2.4 MIX DESIGN

A. Selection of Materials:
1. Paving Asphalt, Section 32 12 03:
    a. AC-10 or AC-20: Light traffic pavement.
    b. AC-20: Medium traffic pavement.
    c. RA: For hot-laid recycled asphalt pavement. Choice by the CONTRACTOR.
2. Aggregate: This Section Article 2.2.

B. Selection of Design Aggregate Structure:
1. Gradation: All pavement in the Vernal City right-of-way must use one of the 3/4" Master Grading Bands in the following table unless written authorization from Vernal City is obtained.
    a. If acceptable to the Vernal City representative, use fractionated proportioning to select or adjust gradation and obtain written permission prior to paving activities.

Table 2 – Master Grading Bands

Sieve Size	*Dense*				*Open*	*Friction*	
	DM-1	*DM-3/4N*	*DM-3/4*	*DM-1/2*	*OM-1/2*	*FM-1*	*FM-2*
1 inch	100	–	–	–	–	–	–
3/4 inch	–	100	100	–	–	100	–
1/2 inch	75 – 91	74 – 99	–	100	100	90 –100	100
3/8 inch	–	69 – 91	75 – 91	–	93 – 100	60 – 100	90 – 100
No. 4	47 – 61	49 – 65	46 – 62	60 – 80	36 – 44	15 – 40	30 – 50
No. 8	–	33 – 47	–	–	14 – 21	4 – 12	5 – 15
No. 16	23 – 33	21 – 35	22 – 34	28 – 42	–	–	–
No. 50	12 – 22	6 – 18	11 – 23	11 – 23	–	–	2 – 5
No.200	3 – 7	2 – 6	3 – 7	3 – 7	2 – 4	2 – 5	–

NOTES
(a) Gradation expressed in percent passing by weight, ASTM C 136.
(b) It is assumed fine and coarse aggregate have same bulk specific gravity.
(c) Friction Mixture: See ASTM D 3515.
(d) DM -3/4N is 100% crushed.
(e) Percentage of fines passing No. 200 sieve determined by washing, ASTM C 117.

2. Aggregate Blend:
   a. Dry-rodded Unit Weight, ASTM C 29: 75 pounds per cubic foot minimum.
   b. Weight Loss (soundness), ASTM C 88: 16 percent maximum using sodium sulfate.
   c. Clay Content (cleanliness), ASTM D 2419: Sand equivalent value after going through the dryer or prior to the drum mixer.
      i. 45 percent minimum if Medium Traffic Classification.
      ii. 60 percent minimum if Heavy Traffic Classification.
      The sand equivalent requirement is waived for the RAP aggregate but applies to the remainder of the aggregate blend.

C. Selection of Admixture: Choice of the CONTRACTOR.
   1. RAP: Adjust paving asphalt grade to account for RAP binder viscosity.
   2. Cement or Hydrated Lime: Add if mix is moisture sensitive.

D. Selection of Mix Properties: Use AI Manual Series No. 2 procedure for stability, flow and voids.
   1. Stability, Flow Voids: If traffic classification is not specified elsewhere, use Medium Traffic Classification.

Table 3 – Stability, Flow, Voids Limits

Criteria	*Traffic Classifications*		
	Light	*Medium*	*Heavy*
Number of compaction blows each end of specimen	50	75	112
Stability, lbs., min.	750	1200	1800
Flow, in 0.01 inch units	10 – 18	10 – 18	10 – 18
Voids in Mineral Aggregate (VMA), percent min.			
1" nominal maximum particle size	13	13	13
3/4" nominal maximum particle size	14	14	14
1/2" nominal maximum particle size	15	15	15
3/8" nominal maximum particle size	16.5	16.5	16.5
Voids in Bituminous Mix, percent	3 – 5	3 – 5	3 – 5

NOTES
(a) Traffic Classifications:
Light:
Class I: Parking lots, Driveways, light traffic residential streets, light traffic farm roads.
Medium:
Class II: Residential streets, rural farm and residential roads.
Class III: Urban minor collector streets, rural minor collector roads.
Heavy:
Class IV: Urban minor arterial and light industrial and light industrial streets, rural major collector and minor arterial highways.
Class V: Urban major arterial and heavy industrial streets, freeways, expressways, arterial highways, rural interstate and other principal arterial highways.
(b) Stability, Flow, Voids: ASTM D 5581.
(c) VMA: ASTM D 3203
(d) Nominal maximum particle size is the largest sieve size listed in this Section upon which any material is retained.

2. Dust to Asphalt Ratio: 0.8 to 1.6.
3. Moisture Sensitivity, ASTM D 4867: Tensile strength ratio less than 0.80 using freeze-thaw conditioning. Test specimen shall be 150 mm in diameter and 95 mm in height and compacted at 7 percent plus or minus 1 percent air voids.
4. Rut Susceptibility, AASHTO T 324: Maximum rut depth is 10 mm at 20,000 passes.

2.5 SOURCE QUALITY CONTROL

A. General: Collect samples, ASTM D 3665. Do not change sampling points.
1. Aggregate sampling, ASTM D 75.
2. Paving asphalt sampling, ASTM D 140. Test for viscosity and penetration.

B. Asphalt-Aggregate Mix: Sample, ASTM D 979. Test for the following.
1. Air voids, ASTM D 3203 or ASTM D 5581.
2. Paving asphalt content, ASTM D 6307.
3. Aggregate gradation, ASTM D 5444.
4. Tensile strength of bitumen-aggregate mixtures, ASTM D 4867.

C. Mixing Plant: ASTM D 3515.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Roadway paving, Section 32 12 16 or 32 12 17.

B. Patching, Section 32 01 18.

END OF SECTION

SECTION 32 12 06
SUPERPAVE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Composition of performance grade asphalt - aggregate mix.

1.2 REFERENCES

A. AASHTO T304: Uncompacted Void Content of Fine Aggregate

B. AASHTO T312: Standard Method of Test for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.

C. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).

D. AI SP-2: Superpave Series No. 2.

E. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.

F. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

G. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

H. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

I. ASTM C 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

J. ASTM D 75: Standard Practice for Sampling Aggregates.

K. ASTM D 140: Standard Practice for Sampling Bituminous Materials.

L. ASTM D 979: Standard Methods for Sampling Bituminous Paving Mixtures.

M. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.

N. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

O. ASTM D 3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

P. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

Q. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

R. ASTM D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

S. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

T. ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.

U. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.

V. ASTM D 4867: Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.

W. ASTM D 5444: Standard Method for Mechanical Size Analysis of Extracted Aggregate.

X. ASTM D 5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

Y. ASTM D 6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method.

1.3 DEFINITIONS

A. Asphalt-Aggregate Designator: Alpha-numeric code that indicates nominal maximum size of aggregate, and type and grade of asphalt in aggregate-asphalt mix. For example; "*12.5 PG70-28*" means aggregateasphalt mix shall be composed of an aggregate gradation with a 12.5 mm nominal maximum size and a performance grade asphalt binder designed to perform between temperatures of 70 deg C. and –28 deg C.

B. ESAL (acronym for equivalent single axle load): Number used in designing Pavement thickness. It relates axle load of any mass and number to an equivalent number (18,000 lb).

C. Mean of Deviations: Defined in Section 31 05 13.

D. Nominal Maximum Size: One sieve size larger than first sieve size retaining more than 10 percent of the Sample. The nominal maximum size sieve will retain a minimum of 0 and a maximum of 10 percent of the sample. Maximum size is one sieve size larger than the nominal maximum size.

E. CONTRACTOR: Any person, private business, public business, government agency or municipal agency that is performing work within the Vernal City right of way.

1.4 SUBMITTALS

A. Quality Assurance: Submit names, certification levels, and years of experience of testing agency's field technicians that are assigned to the Work. Verify laboratory complies with ASTM standards.

B. Mix Design: Submit.
1. Date of mix design. If older than 365 days, recertify mix design.
2. Paving asphalt source, type, and chemical composition.
3. Nominal maximum size of aggregate.
4. Temperature of mix at plant and in the field for for optimum field compaction.
5. Paving asphalt target, dust to asphalt ratio, rut susceptibility, moisture sensitivity (tensile strength), voids in the mineral aggregate (VMA) and voids filled with asphalt (VFA).
6. RAP, mineral filler, antistrip, and recycle agent percentages.
7. Compaction at Nmax.

C. Pre-approved mix design, submit name and address of Supplier.

D. Before changing mix design, submit a new design and give the Vernal City representative 10 days to evaluate the changes.

E. Source Quality Control Inspections and Testing Report: If requested, submit report describing quality control activities and test results from the CONTRACTOR and the Supplier.

1.5 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with ASTM D 3666.

B. Do not change aggregate source or paving asphalt source without written approval from the Vernal City representative.

C. Do not use non-complying sources.

1.6 ACCEPTANCE

A. General:
   1. Acceptance is by Lot. One Lot is one day's production.

B. Installation: Accepted as specified in Section 32 12 16.

C. Materials:
   1. At the Source:
      a. Aggregate: Verify gradation prior to the drum mixer or after going through the drier.
      b. Paving Asphalt: See Section 32 12 03 provisions.
      c. Mix: 325 deg. F. maximum in transport vehicle.
   2. At the Site:
      a. One sub-lot is 500 tons.
      b. Sampling: Two random samples per sub-lot. Location as follows.
         i. Behind paver before compaction, or
         ii. Where sub-lot exhibits non-uniform appearance.
   3. At the Laboratory:
      a. Air Voids:
         i. Basis of evaluation is laboratory compacted samples (not field compacted samples).
         ii. If test results are not within this Section's limits, options include correction o f production procedures or alternate mix design acceptable to the Vernal City representative.
      b. Dust to asphalt ratio.

PART 2 — PRODUCTS

2.1 PAVING ASPHALT

A. Performance Grade Asphalt Binder (PGAB): Section 32 12 03.
   1. Blending with polymers or natural asphalts is the choice of the CONTRACTOR.
   2. Do not use acid blends without documentation supporting need.
   3. As a rule of thumb, if the two numbers in an asphalt binder designation are added together and are greater than 90, then the binder will most likely contain a polymer or natural asphalt.

B. Recycled Asphalt: Section 32 12 03.

2.2 AGGREGATE

A. Material: Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.

B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.
   1. Coarse Aggregate:
      a. Angularity (fractured faces), ASTM D 5821: At least one fracture as follows.
         i. 55 percent minimum if ESALs are less than 0.3 million.
         ii. 85 percent minimum if ESALs are more than 0.3 million.
      b. Hardness (toughness), ASTM C 131: Retained above 2.36 mm sieve.
         i. 40 percent maximum if ESALs are less than 0.3 million.
         ii. 35 percent maximum if ESALs are more than 0.3 million.
      c. Flat and Elongated Particles, ASTM D 4791: 20 percent maximum retained above the 9.5 mm sieve has a 3:1 length to width ratio.
   2. Fine Aggregate:

a. Angularity, AASHTO T304: 45 percent minimum uncompacted void content.
b. Friable Particles, ASTM C 142: 2 percent maximum by weight passing 4.75 mm sieve.
c. Plasticity, ASTM D 4318: Aggregate passing 4.75 mm sieve is non-plastic even when filler material is added to the aggregate.
    i. Liquid limit: Less than 25.
    ii. Plastic limit: Less than 6.

2.3 ADMIXTURES

A. Reclaimed Asphalt Pavement (RAP) Aggregate: Restrictions include.
1. 15 percent by weight maximum providing grading, Voids in Mineral Aggregate (VMA) and Voids Filled with Asphalt (VFA) are met.
2. Greater than 15 percent requires separate mix design.

B. Mineral Filler: ASTM C 242.

C. Recycle Agent: ASTM D 4552.

D. Antistrip: Heat stable, cement slurry, or lime slurry.

2.4 MIX DESIGN

A. Selection of Materials:
1. Paving Asphalt. Section 32 12 03.
    a. PG70-28: Less than 3 million EASLs.
    b. PG70-28: 3 million to 30 million EASLs.
2. Aggregate: This Section Article 2.2.

B. Selection of Design Aggregate Structure.
1. Gradation: Maximum particle size is 1/4 compacted lift thickness.
    a. Target Gradation Curve must lie within one of the following Master Grading Bands. It must lie below the restricted zone in traffic class IV and traffic class V (Table 3 Section 32 12 05). In all other classes it may lie above, below, or pass through the zone.
    b. If acceptable to the Vernal City representative, use fractionated proportioning to select or adjust gradation.

Table 2 – Master Grading Bands

Sieve Size (mm)		*Aggregate Grade*			
				12.5	*9.5*
Restricted Zone	37.5	100	–	–	–
	25	90 – 100	100	–	–
	19	< 90	90 – 100	100	–
	12.5	–	< 90	90 – 100	100
	9.5	–	–	< 90	90 – 100
	4.75	–	–	–	< 90
	2.36	19 – 45	23 – 49	28 – 58	32 – 6
	0.075	1 – 7	2 – 8	2 – 10	2 – 10

Control Sieves	4.75	39.5	–	–	–
	2.36	29.8 – 30.8	34.6	39.1	47.2
	1.18	18.1 – 24.1	22.3 – 28.3	25.6 – 31.6	31.6 – 37.6
	0.6	13.6 – 17.6	16.7 – 20.7	19.1 – 23.1	23.5 – 27.5
	0.3	11.4	13.7	15.5	18.7

NOTES
(a) Gradation in percent passing by weight, ASTM D 4759.
(b) It is assumed fine and coarse aggregate have same bulk specific gravity.
(c) Percentage of fines passing 0.075 mm control sieve determined by washing per ASTM C 117.

2. Aggregate Blend:
   a. Dry-rodded Unit Weight, ASTM C 29: 75 pounds per cubic foot minimum.
   b. Weight Loss (soundness), ASTM C 88: 16 percent maximum using sodium sulfate.
   c. Clay Content (cleanliness), ASTM D 2419: Sand equivalent value after going through the dryer or prior to the drum mixer.
      i. 45 percent minimum if ESALs are less than 0.3 million.
      ii. 60 percent minimum if ESALs are more than 0.3 million. The sand equivalent requirement is waived for the RAP aggregate but applies to the remainder of the aggregate blend.

C. Selection of Admixture:
   1. RAP: Adjust pavement asphalt grade to account for RAP binder viscosity.
   2. Cement or Hydrated Lime: Add if mix is moisture sensitive.

D. Selection of Mix Properties: Use AI SP-2 volumetric procedure.
   1. Compaction:

Table 4 – Compaction Parameters

20 Year design ESALs (Million)	$N_{initial}$ / *% of* G_{mm}	$N_{initial}$ / *% of* G_{mm}	$N_{initial}$ / *% of* G_{mm}
Less than 0.3	6 / ≤ 91.5	50 / 96	75 / ≤ 98
0.3 to <3	7 / ≤ 90.5	75 / 96	115 / ≤ 98
3 to <30	8 / ≤ 89	100 / 96	160 / ≤ 98
30 or more	9 / ≤ 89	125 / 98	205 / 98

NOTES
(a) N = Number of gyrations.
(b) Gmm = maximum specific gravity of mix, ASTM D 2041 (Rice method)
(c) Specific gravity of specimen: AASHTO T 312.
(d) 20 year design ESALs defined as follows.
· Less than 0.3 = parking lots, light traffic, residential streets
· 0.3 to 3 = collector roads (most county roads)
· 3 to 90 = city streets, state routes
· 30 or more = interstate, weigh stations.

2. Voids in the mineral aggregate (VMA) at Ndesign:

Nominal

Maximum Size	*Voids (VMA)*
37.5 mm	11 to 13 percent
25.0 mm	12 to 14 percent
19.0 mm	13 to 15 percent
12.5 mm	14 to 16 percent
9.5 mm	16 percent minimum

3. Voids filled with asphalt (VFA) at Ndesign:

20 Year Design ESALs (million)	*Voids Filled with Asphalt (VFA)*
Less than 0.3	70 – 80 percent
0.3 to <3	65 – 78 percent
3 to <30	65 – 75 percent
30 or more	65 – 75 percent

   a. For 9.5 mm nominal maximum size mixtures, the specified VFA range is 73 percent to 76 percent for design traffic levels 3 million ESALs or greater.
   b. For 25.0 mm nominal maximum size mixtures, the specified lower limit of the VFA is 67 percent for design traffic levels less than 0.3 million ESALs.
   c. For 37.5 mm nominal maximum size mixtures, the specified lower limit of the VFA is 64 percent for all design traffic levels.
4. Dust to Asphalt Ratio:
   a. 0.6 to 1.2 if aggregate gradation passes through or over the restricted zone.
   b. 0.8 to 1.6 if aggregate gradation passes under the restricted zone.
5. Moisture Sensitivity, ASTM D 4867: Tensile strength ratio less than 0.80 using freeze-thaw conditioning. Test specimen shall be 150 mm in diameter and 95 mm in height and compacted at 7 percent plus or minus 1 percent air voids.
6. Rut Susceptibility, AASHTO T 324: Maximum rut depth is 10 mm at 20,000 passes.

2.5 SOURCE QUALITY CONTROL

A. General: Collect Samples randomly, ASTM D 3665. Do not change sampling points.
   1. Aggregate sampling, ASTM D 75.
   2. Paving asphalt sampling, ASTM D 140.

B. Asphalt-aggregate mix sampling, ASTM D 979. Test for
   1. Air voids, ASTM D 3203.
   2. Paving asphalt content, ASTM D 6307.
   3. Aggregate gradation, ASTM D 5444.
   4. Tensile strength of bitumen-aggregate mixtures, ASTM D 4867.

C. Mixing Plant: ASTM D 3515.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Pavement placement, Section 32 12 16 or 32 12 17.

B. Pavement restoration, Section 32 01 18.

END OF SECTION

SECTION 32 12 13
PRIME COAT

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Application of liquid asphalt to aggregate base prior to placing asphalt concrete or portland cement concrete Pavement.

B. Placing sand on areas that are over-primed.

1.2 SUBMITTALS

A. Certificate showing asphaltic material complies with Section 32 12 03.

1.3 WEATHER

A. Apply prime coat only when air and roadbed temperatures in the shade are greater than 40 deg. F. The temperature restrictions may be waived only upon written authorization from the Vernal City representative.

B. Do not apply prime coat during rain, fog, dust, or other unsuitable weather.

PART 2 — PRODUCTS

2.1 ASPHALT MATERIAL

A. Select from the following:
1. Slow Cure Cutback Asphalt: Grade SC-70, or SC-250, Section 32 12 03.
2. Medium Cure Cutback Asphalt: Grade MC-30, MC-70, or MC-250, Section 32 12 03.
3. Rapid Cure Cutback Asphalt: Grade RC-1, RC-2, or RC-250, Section 32 12 03.

2.2 SAND

A. Clean natural aggregate passing the No. 4 sieve and retained on the No. 200 Sieve.

PART 3 — EXECUTION

3.1 PREPARATION

A. If aggregate base course to be primed contains an appreciable amount of loose material or is excessively dusty; moisten, blade, roll, and recompact to make the surface dense.

B. Do not start priming until all free surface moisture has disappeared.

C. Notify residents and business owners 24 hours prior to applying prime coat.

D. Provide pedestrian access across prime coat if required.

3.2 APPLICATION

A. When Pavement surface under Pavement overlay is loosely bonded, apply prime coat at 0.10 to 0.50 gallons per square yard to penetrate and seal. Do not flood surface.

B. Cure and dry as long as necessary to attain penetration and evaporation of volatile.

C. Blot over-primed surface by spreading a light, uniform layer of sand.

D. Prime under-primed areas with additional asphalt.

3.3 PROTECTION

A. Protect all structures and utilities, including manholes, valve boxes, curb and gutter, sidewalks, guardrails and guide posts from being spattered or marred. Remove any spattering, over-coating, or marring at no additional cost to Vernal City.

B. Do not discharge bituminous material into borrow pits or gutters.

C. Prevent tracking of prime coat onto adjacent surfaces.

3.4 OPENING TO TRAFFIC AND MAINTENANCE

A. Do not permit traffic to travel over freshly primed surface until prime coat has cured. If detours cannot be provided, restrict operations to a width suitable at least for one-way traffic over the remaining portion of the road. If one-way traffic is provided, control traffic by flagging or pilot car operation.

B. After prime coat application, leave work area undisturbed. If prime coat is tacky or tends to pick up under traffic after 4 hours, blot excess prime coat with blotter sand. Prime coats can be opened to traffic after blotting.

C. Clean and maintain primed surfaces until surface Pavement course is placed. Maintenance includes spreading any necessary additional blotter material, replacing all portions of prime coat that have been destroyed, and patching any break in primed surfaces.

END OF SECTION

SECTION 32 12 14
TACK COAT

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Application of asphaltic material to existing asphalt concrete or portland cement concrete surfaces preparatory to placing an asphalt concrete Pavement.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Certificate showing asphaltic material complies with Section 32 12 03.
   1. Identify water/asphalt dilution ratio.
   2. Identify tack coat application rate.

B. Identify asphalt material recommended by fabric manufacturer.

1.4 WEATHER

A. Apply tack coat only when air and roadbed temperatures in the shade are greater than 40 deg. F. The temperature restrictions may be waived only upon written authorization from VERNAL CITY REPRESENTATIVE.

B. Do not apply tack coat during rain, fog, dust, or other unsuitable weather. Do not apply coat to wet surfaces.

1.5 NOTICE

A. Send written notice to residents or business owners 24 hours prior to applying coat.

PART 2 — PRODUCTS

2.1 ASPHALT MATERIAL

A. Select from the following.
   1. Emulsified Asphalt: Grade MS-1, SS-1 or SS-1h, Section 32 12 03.
   2. Cationic Emulsified Asphalt: Grade CSS-1 or CSS-1h, Section 32 12 03.
   3. Rapid Cure Cutback Asphalt: Grade RC-70, Section 32 12 03.

PART 3 — EXECUTION

3.1 PREPARATION

A. Select and advise VERNAL CITY REPRESENTATIVE of the type of tack material to be used.

B. Clean the surface to be treated free of dust and other foreign material. If flushed, allow surface to dry. If leaves from trees, blow clean.

C. Provide surface for pedestrian access across tack coat.

D. Prevent pedestrians, vehicles, pets, etc., access to tack surfaces.

3.2 APPLICATION

A. General:
   1. Triple coverage by spray bar required. Stop application if any nozzle is not working properly.
   2. Apply tack only to area covered with asphalt concrete in the same day.

B. Application rate: Typically as follows.
   1. Emulsions, 0.05 to 0.15 gallons per square yard.
   2. Cutback, choice of CONTRACTOR.

C. Tack Substrate for Fabric Application: Comply with manufacturer's recommendation. If none, then as follows.
   1. Dry Pavement surface, 0.20 to 0.30 gallons per square yard. Within street intersections, on steep grades and in zones where vehicle speed changes are commonplace reduce the application rate to no less than 0.20 gallons per square yard.
   2. Heavy duty fabrics, 0.30 to 0.40 gallons per square yard.

3.3 PROTECTION

A. Protect all surfaces exposed to public view from being spattered or marred. Remove any spattering, over-coating, or marring at no additional cost to Vernal City.
   1. Protect all structures and utilities, including manholes, valve boxes, curb and gitter, sidewalks, guardrails and guide posts from being spattered or marred.

B. Do not discharge bituminous material into borrow pits or gutters.

3.4 OPENING TO TRAFFIC AND MAINTENANCE

A. Do not permit traffic to travel over the tacked surface until bituminous tack coat has cured or is not picked up by traffic.

B. If detours cannot be provided, restrict operations to a width suitable at least for one-way traffic over the remaining portion of the road.

C. If one-way traffic is provided, control traffic appropriately.

END OF SECTION

SECTION 32 12 16
PLANT-MIX - ASPHALT PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Place Superpave or plant-mix asphalt concrete in base, leveling and surface courses, or overlay.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).

B. ASTM D 979: Standard Practice for Sampling Bituminous Paving Mixtures.

C. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.

D. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

E. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

F. ASTM D 5581: Standard Test Method for Resistance to Plastic Flow of Bituminus Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen).

G. ASTM E 950: Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.

H. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph.

1.4 SUBMITTALS

A. Before Delivery:
   1. Traffic control plan, Section 01 55 26.
   2. Type and number of rollers.
   3. Manufacturer's certificate of compliance for paving geotextiles, Refer to Section 31 05 19.
   4. Location and name of asphalt concrete production facility.
   5. Proof of profilograph and profilograph operator certification.

B. At Delivery: Supply batch ticket identifying.
   1. Serial number of ticket.
   2. Date and truck number.
   3. Job name, location, and mix identification.
   4. Type, grade, and weight of asphalt.
   5 Type, grade, and weight of aggregate.
   6. Mix design method.

C. After Delivery:
   1. Profile deviation report.
   2. Profile roughness index report.
   3. Quality Control Inspections and Testing Report: Upon request of the Vernal City representative, submit

report describing source and field quality control activities and test results performed by the CONTRACTOR and their Suppliers.

1.5 QUALITY ASSURANCE

A. Do not change asphalt or aggregate sources until the Vernal City representative accepts new source and new mix design.
   1. Small quantities of materials may be accepted without sampling or testing when they conform to the following requirements and procedures:
      a. Vernal City may accept small quantities on the basis of visual inspection of material. This shall be limited to only those materials being furnished from sources of supply which have recently been found satisfactory under normal testing and sampling procedures.
      b. Small quantities of materials may be accepted on the basis of submittal of a satisfactory certificate of compliance. This certificate must be in possession of and approved by Vernal City prior to the incorporation into the work of the affected materials.
      c. Maximum quantities that apply are as follows:
         1. Aggregates - Not to exceed 300 tons per day nor more than 1,500 tons per project.
         2. Asphalt Concrete Mixes - not to exceed 1,000 tons (600 cubic yards) per day nor more than 1,500 tons (900 cubic yards) per project
         3. Asphalt Material - not to exceed 9 tons per day nor more than 45 tons per project.

B. Reject product and work that does not meet requirements of this Section.

C. Remove product found defective after installation and install acceptable product at no additional cost to Vernal City.

D. Foreman of paving crew has completed at least three (3) projects of similar size and nature.

1.6 WEATHER

A. Do not pave until air temperature is 45 deg F. and rising.

B. Cease paving if air temperature falls below 50 deg F.

C. Do not pave if surface is wet or weather is unsuitable.
   1. Do not pave if base materials are saturated.

D. Do not pave if wind or ground cools mix material before compaction.

1.7 NOTICE

A. Send written notice to residents and businesses within affected area at least 3 days before start of paving.

B. Indicate paving time and when new surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on specified day, send a new notice.

1.8 ACCEPTANCE

A. General:
   1. Acceptance is by Lot. Lot size is specified below.
   2. Opening a paved surface to traffic does not constitute acceptance.

B. Mix: Accepted as specified in Section 32 12 05, or Section 32 12 06.

C. Installation:
1. Mix Temperature:
a. Reject mixes exceeding 325 deg F. in transport vehicle.
b. Dispose of cold mix in paver hopper as thin spread underlay.
2. Compaction and Thickness:
a. Lot size is 1,000 square yards or part thereof.
b. Verify with at least 2 tests per Lot. If Lot includes longitudinal joints provide one additional test per longitudinal joint.
c. Select test locations by ASTM D 3665 and sample per ASTM D 979 after compaction.
d. Compaction determinations are full core depth or overlay depth in overlay construction.
e. Thickness measurement will not apply in overlay construction.
3. Grade, Cross Slope: Verify tolerance is not exceeded.
4. Roughness: Verify "must grind" bumps are removed and tolerance for profile roughness index is not exceeded.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Asphalt concrete, Section 32 12 05.
1. Asphaltic concrete pavement shall be mixed at a central batching plant (or commercial supplier). The batch plat shall accurately control temperature, mix ingredient proportions, mix rate, and mix time. The aggregate shall be thoroughly and uniformly coated with asphaltic cement.

B. Superpave, Section 32 12 06.

C. Prime coat, Section 32 12 13.

D. Tack coat, Section 32 12 14.

E. Paving geotextile, Section 31 05 19.

F. Paving geogrid, Section 31 05 21.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Lay Down Machine: Use track equipment when operating on fabrics, geogrids or Pavement mats hotter than 180 deg. F.
1. The paver shall be a self propelled screed unit which applies a smooth steady pull on screed arms. The screed shall strike off, partially compact and iron the surface of the mat. The screed shall automatically control the grade with a 20 foot long (minimum) ski-type device. Paver width shall be at least 12 feet wide and adjustable.

B. Compactors: Steel wheel static or vibratory. Use pneumatic tire roller for intermediate rolling only.

3.2 PREPARATION

A. General:
1. Coordinate utility location, Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if paving machine is not capable of passing over the fixtures.
3. Remove vegetation from cracks, edges and joints. Sweep surface clean. Blow cracks clean. Remove leaves.
4. Fill cracks and fix Potholes, Section 32 01 17.
5. Stabilize concrete subgrade slabs.

B. Trees, Plants, Ground Cover:
   1. Protect trees, plants and other ground cover from damage.
   2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to Vernal City.

C. Traffic Control:
   1. Provide worker and public safety, Section 01 55 26.
   2. Apply temporary traffic and lane marking tape or paint after layout has been verified with the Vernal City representative.

D. Aggregate Base Course:
   1. Verify base course is placed to grade and compacted.
      a. The base material shall be free from surface moisture and shall not be saturated. The base shall be uniform and firm.
   2. If indicated, follow Section 31 25 00 for herbicide treatment or Section 32 12 13 for prime coat.

E. Tack Coat: Apply tack coat, Section 32 12 14 if inlay or subbase Pavement surface is dirty or older than 24 hours.
   1. Edges of existing asphaltic pavements shall be sprayed with a thin coating of specified coating material. Edges shall be straight, square, and vertical.

3.3 TEMPORARY SURFACING

A. Place, roll, maintain, remove and dispose of temporary surfaces.

B. In sidewalk areas construct temporary Pavements at least 1 inch thick and in all other areas at least 2 inches thick. At major intersections and other critical locations a greater thickness may be required.

3.4 PLACE PAVING FABRIC

A. Section 31 05 19.

3.5 PLACE PAVEMENT MIXTURE

A. General:
   1. Provide continuous forward movement such that minimum temperature 10 feet behind paver is as follows.

Table 3 – Minimum Temperature, Degrees F.

Air Temperature Deg F.	*Compacted Mat Thickness*					
	3/4"	*1"*	*1-1/2"*	*2"*	*3"*	*4"+*
45 – 50	–	–	–	–	280	265
50 - 59	–	–	–	280	270	255
60 - 69	–	–	285	275	265	250
70 - 79	285	285	280	270	265	250
80 - 89	280	275	270	265	260	250
90 +	275	270	265	260	250	250

   2. Do not leave unsafe butt joints if paving operation stops.
   3. Barricade or eliminate fall off edges.

B. Overlays or Subsequent Lifts:
   1. Allow new base Pavement or new inlay Pavement to harden (cure) prior to placing overlays.
   2. Apply tack coat per Section 32 12 14 if inlay or sub-base pavement surface is dirty or older than 24 hours.

C. Irregular Areas: Handwork is acceptable if specified grades, slopes, compaction and smoothness is achieved.
   1. The mix shall be hand raked into areas unaccessible to the paver. Longitudinal seams between successive passes of the paver shall be smooth and meet compaction requirements. To prevent joints that are starved of material, material shall not be broadcast from the longitudinal joint area across the mat surface.

D. Compaction:
   1. Do not over compact or under compact.
   2. Complete compaction before temperature drops to 180 deg. F.

E. Joints:
   1. Construct joints to have same texture, density and smoothness as other sections of new Pavement course.
   2. Clean contact surfaces and apply tack coat. Ensure continuous bond between old and new Pavements, or between successive day's work.
   3. Offset longitudinal joints 6 to 12 inches and transverse joints at least 6 feet in succeeding courses to avoid a vertical joint through more than one course. In the top course restrict longitudinal joint to 1 foot either side of lane lines.
   4. Prevent traffic, including construction traffic, from crossing vertical edges. Apply tack coat to vertical edges prior to making another pass with the paver if the mix has cooled to 90 deg. F.
   5. Overlap longitudinal joints at the seams
   6. Cold longitudinal joints are not permitted. Lay asphalt in such a way as to leave no unfinished longitudinal joints exposed at the end of the construction day in which they were began.

3.6 TOLERANCES

A. Compaction: 96 percent plus or minus 2 percent of theoretical maximum specific gravity, ASTM D 2041 (Rice Method).
   1. The screeded mat shall be compacted immediately, when the mix temperature is maximum, to a minimum density of 96% of the design density as determined by ASTM D 5581. Vibratory, pneumatic tire, and steel wheel rollers of sufficient size to obtain the specified density shall be utilized in proper combination to achieve a smooth, uniform surface. The surface shall be free of marks left by the rollers.

B. Lift Thickness:
   1. Not less than 2 times the maximum aggregate size in compacted asphalt concrete mixes.
   2. Not less than 4 times the nominal maximum aggregate size in compacted SUPERPAVE mixes.
   3. Not more than limits established by pneumatic or vibratory compactor equipment manufacturer.
   4. The thickness of the uncompacted mat after screeding shall be of such depth that the compactor rolled layer is at least that specified or shown on the drawings. For hot mix asphalt thicknesses greater than 3 inches, the hot mix asphalt shall be placed in at least two equal lifts. Mat depth shall be checked behind the screed at intervals not exceeding 100 feet.

C. Grade: 1/8 inch in 10 feet parallel to centerline.

D. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.

E. Roughness:

Table 4 – Roughness Tolerance

Speed and Traffic Class		*Profile Roughness Index, (PRI) Inches / Mile*				*Profile Deviation Inches/25 feet Maximum*
		IRI		*PI*		
		Min	*Max*	*Min*	*Max*	
0 to 29 mph	I or II	–	–	–	–	0.4

	III or IV	129	177	46	66	0.4
30 to 44 mph	I or II	90	115	35	50	0.4
	III or IV	70	90	21	35	0.4
45 mph +	All Classes	–	70	–	21	0.3

NOTES
(a) Use a zero blanking band.
(b) As a minimum, trace right wheel path in direction of travel
© Traffic class is defined in Table 3 of Section 32 12 05.
(d) IRI (International Roughness Index), ASTM E 950
(e) PI (Profile Index), ASTM E 1274.

1. Profile Deviation: Begin traces 50 feet before edge of new pavement and end traces 50 feet after edge of new pavement. Areas exceeding profile deviation tolerance are "must grind" areas.
2. Profile Roughness Index: (PRI)
   a. Lot is 0.1 lane mile (528 feet long one lane wide). Add segments shorter than 250 feet to preceding Lot. Treat partial segments longer than 250 feet as a Lot.
   b. Exclude from the Lot are turn lanes, parking lanes, medians, Street Fixtures, crowns of intersecting streets, bridge decks, grades greater than 8 percent, and vertical curves less than 1,000 feet radius (including super-elevation transitions).

3.7 PROTECTION AND REPAIR

A. General: All expenses are at no cost to Vernal City.

B. Protection.
1. Protect all structures and utilities, including water valves, man holes, curb, gutter, sidewalks, guard rails and guide posts.
2. Remove spatter, over-coat, or mar.
3. Do not discharge bituminous materials into borrow pits or gutters.
4. Protect hot pavement from traffic until mixture has cooled enough not to become marked.
5. Protect neighborhood, storm drains and down-stream fish habitat.

C. Repair.
1. Corrective Action for Profile Deviations ("Must Grinds"): Grinding is acceptable, Section 02 41 14. Apply Section 32 12 03 cationic or anionic emulsion and sand friction blotter over grind areas.
2. Corrective Action for Profile Roughness Index: Grinding is acceptable. Skin patch for depressions is not acceptable. Raise depressions by milling and inlay. Re-profile corrected segments to verify index meets tolerance. Apply a Section 32 12 03 cationic or anionic emulsion and sand friction blotter over grind areas.
3. When thickness is deficient, place additional material over deficient areas. DO NOT skin patch. Mill for inlay if necessary.
4. Defective Joints, Seams, Edges: Repair.
5. Unacceptable Paving: Remove and replace.

END OF SECTION

SECTION 32 12 17
COLD-MIX - ASPHALT PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Placing cold mix asphalt concrete in base, leveling, and surface courses.

B. Asphalt concrete material is not specified in this Section. Refer to Section 32 12 05 or 32 12 06.

1.2 REFERENCES

A. ASTM D 1461: Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures.

B. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.

C. ASTM D 2170: Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens).

D. ASTM D 2399: Standard Practice for Selection of Cutback Asphalts.

E. ASTM D 3628: Standard Practice for Selection and Use of Emulsified Asphalts.

F. ASTM D 5581: Standard Test Method for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen).

1.3 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

B. Laboratory mix design, Section 32 12 05.

C. Batch Delivery Tickets: Submit ticket for each batch delivered to the Work site. Include information specified in Section 32 12 16.

1.4 WEATHER

A. Do not pave if base materials are saturated.

1.5 NOTICE

A. Section 32 12 16

1.6 ACCEPTANCE

A. Section 32 12 16.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Paving asphalt, Section 32 12 03: Emulsified asphalt or medium curing cutback asphalt.
   1. Emulsified Asphalt, ASTM D 3628.
   2. Cutback Asphalt, ASTM D 2399.

B. Aggregate, Section 32 12 05: Use an aggregate containing not more than the 2 percent moisture. If more, dry

before asphalt is applied. An exception may be made for unusually porous material, when laboratory tests indicate excess moisture will not produce an unstable mix.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Laydown Machine: Use track equipment when operating on fabrics or geogrid.

B. Compactors: Steel wheeled static or vibratory. Any use of a pneumatic tire roller is for intermediate compaction only.

3.2 PREPARATION

A. Trees, Plants, Ground Cover:
   1. Protect trees, plants and other ground cover from damage.
   2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to Vernal City.

B. Traffic Control:
   1. Control pedestrian and vehicular traffic, Section 01 55 26.
   2. Apply temporary traffic and lane marking tape or paint after layout and placement has been verified with the Vernal City representative.

3.3 PREPARATION OF AGGREGATE

A. On unpaved surfaces, prime coat whole roadway surface receiving coldmix application, Section 32 12 13.

B. Place aggregate to be mixed with bitumen on the prepared base in a uniform windrow or windrows.

C. Notify the Vernal City representative 48 hours in advance of applying the bituminous material to permit check of the aggregate with respect to volume, moisture content, and unit weight, and the proper amount of bituminous material to be used.

3.4 PROPORTIONING AND MIXING

A. Unless specified otherwise, method of mixing may be selected from a traveling mixer method, stationary mixer method, or blade mixing method.

B. Traveling Mixer Method:
   1. Accomplish mixing by means of mixer that will thoroughly blend the aggregate and bitumen. Use metering devices that will accurately introduce required quantity of bitumen during the mixing process. Produce a satisfactory mixture that is uniform in appearance, texture and bitumen content, and free from pockets of segregated aggregates.
   2. When necessary, supplement travel plant mixing with blade mixing to obtain the desired degree of aeration of the mix. Continue mixing until not more than 50 percent of the original volatiles present in the bituminous material remain in the mix, ASTM D 1461.

C. Blade Method:
   1. Spread the windrowed aggregate on the prepared base, after which, uniformly apply the bituminous material over the aggregate.
   2. Apply the bituminous material in 2 or more applications over a section of definite limits. Limit the amount of bitumen spread in any 1 application to 0.50 gallon per square yard. Exercise care to avoid overlapping of spreads onto adjoining sections. Immediately after each application, partially mix the bituminous material with the aggregate.
   3. After the last application of bituminous material and partial mixing, windrow the entire mass of bitumen and aggregate and mix by blading the material from side to side of the roadway. Blade to produce a

satisfactory mixture that is uniform in appearance, texture, and bitumen content, and free from pockets of segregated aggregates and continue until not more than 50 percent of the original volatiles present in the bitumen remain in the mix, ASTM D 1461. While mixing, take care to avoid cutting into the underlying base course or contaminating the bituminous mixture with earth or other foreign matter.

D. Stationary Mixer Method:
   1. Dry the aggregate to the optimum moisture content prior to mixing. Use the same application of bituminous material and mixing as required for traveling mixer.
   2. After mixing, haul and place the material on the roadway surface in windrows. All requirements as to uniformity, percent of volatiles, and textures are as required for traveling mixer which may require supplemental blade mixing.

3.5 TEMPERATURE CONTROL

A. Maintain the temperature range of the asphalt road mix material at the time of application so that the viscosity will be between 50 and 200 centistokes, ASTM D 2170.

3.6 PLACING PAVEMENT MIXTURE

A. At the end of each day's work or when the work is interrupted by adverse weather conditions, blade all loose material into a windrow, whether mixing is completed or not. Do not leave material spread on the roadbed overnight.

B. When mixing has been completed, form the mixture in a windrow or windrows and spread in such a manner that the finished surface conforms to the elevations, grades, and cross-sections indicated.

3.7 TOLERANCES

A. Section 32 12 16.

3.8 PROTECTION AND REPAIR

A. Section 32 12 16.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Concrete base course and concrete surface course.

B. Concrete product is not specified in this Section. Refer to Section 03 30 04.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ACI 305: Hot Weather Concreting.

B. ACI 306: Cold Weather Concreting.

C. APWA Plan No. 261: Manual of Standard Plans for Concrete Pavement Joints.

D. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

E. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

F. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

G. ASTM C 150: Standard Specification for Portland Cement.

H. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.

I. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

J. ASTM D 5249: Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement and Asphalt Joints.

K. ASTM E 950: Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.

L. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph.

1.4 SUBMITTALS

A. Before delivery.
   1. Traffic control plan, Section 01 55 26.
   2. Joint layout plan.
   3. Curing plan. Describe method to prevent excessive concrete temperatures and water evaporation that could impair strength or serviceability of the concrete. Refer to ACI 305.
   4. Proof of finisher's ACI certification.
   5. Make and model name of paving machine.
   6. Concrete mix design and number, Section 03 30 04.
   7. Proof of profilograph calibration and profilograph operator certification.

8. Manufacturer's recommended installation procedures for joint sealing material which, when accepted by the Vernal City representative, will become the basis for accepting or rejecting actual installation procedures used in the Work.

B. At Delivery: Batch ticket, Section 03 30 10.

C. After delivery.
1. Profile deviation report.
2. Ride index report.
3. Upon request of the Vernal City representative, submit a written quality control inspections and testing report describing source and field quality control activities and test results conducted by the CONTRACTOR and their Supplier.

1.5 QUALITY ASSURANCE

A. Do not change concrete Supplier until the Vernal City representative accepts new source and new mix design.

B. Reject product that does not meet requirements of Section 03 30 04.

C. Remove product found defective after installation and install acceptable product at no additional cost to Vernal City.

D. Foreman of paving crew has completed at least three (3) projects of similar size and nature.

1.6 WEATHER

A. Hot weather, ACI 305.

B. Cold weather, ACI 306.

1.7 NOTICE

A. Send written notice to residents and businesses within affected area at least 3 days before start of paving.

B. Indicate paving time and when new surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on specified day, send a new notice.

1.8 ACCEPTANCE

A. General:
1. Acceptance is by Lot. Lot size is specified below.
2. Opening a paved surface to traffic does not constitute acceptance.

B. Concrete Mix:
1. Testing Frequency: Section 03 30 05. Sample per ASTM C 172.
2. Temperature, Slump, Air: Lot size is 1 random batch. Reject noncomplying batches until 2 consecutive batches are compliant then continue in random batch testing for acceptance.

C. Installation:
1. Placement, finishing and protection, Section 03 30 10.
   a. Verify grade, cross slope, finish and dimensions.
   b. No standing water in curb and gutter.
2. Thickness. Lot size is 1,000 square yards.
   a. Thickness will be determined on ASTM D 3549 cored or sawed specimens. Acceptance will be

based on the average of all Lot thickness tests.

b. When any thickness measurement is less than specified by more than 1 inch, the actual thickness of the Pavement will be determined by taking additional cores at intervals less than 10 feet parallel to the centerline in each direction from the affected location, until in each direction a core is found which is not deficient by more than 1 inch.

c. Payment will not be made for areas deficient in thickness by more than 1 inch. Deficient areas shall be removed and replaced.

3. Roughness: "Must grind" bumps are removed and tolerance for profile roughness index is not exceeded.

PART 2 — PRODUCTS

2.1 CONCRETE

A. Compression Design:
1. Cast-in-place: Class 4000, Section 03 30 04.
2. Slump per accepted mix design.

B. Flexure Design.
1. Tensile Strength: 650 psi per ASTM C 78.
2. Cement Content: 6.5 bags.
3. Water Cement Ratio: 0.44 maximum by weight (prior to pozzolan exchange), ACI 318.
4. Entrained Air: 5 to 7 percent, ASTM C 231 (pressure).
5. Slump per accepted mix design

2.2 MISCELLANEOUS MATERIALS

A. Reinforcement: Grade 60 ksi galvanized or epoxy coated steel, Section 03 20 00.

B. Hook Bolts: Steel, ASTM A 307 Grade A nuts and bolts, internally and externally threaded.

C. Expansion Joint Filler: F1 sheet, Section 32 13 73.

D. Contraction Joint Filler (Backer Rod): Type 1 round, closed cell, ASTM D 5249.

E. Contraction Joint Sealant: HAS1, HAS4, or CAS6, Section 32 13 73.

F. Curing Compound: Liquid membrane, Section 03 39 00.

G. Bond Breaker: Wax based compound.

H. Grout: Epoxy adhesive, Section 03 61 00.

I. Evaporative Reducer: Water-based mono-molecular polymer liquid at application rates recommended by the manufacturer. Not to be used as a finishing aid.

PART 3 — EXECUTION

3.1 PREPARATION

A. General:
1. Coordinate utility location, Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if paving machine is not capable of passing over fixtures.
3. Coat surface of Street Fixtures with oil to prevent bond with concrete Pavement.
4. Remove sand, leaves and other objectionable materials prior to placing the paving course.
5. Notify the Vernal City representative a minimum of 24 hours prior to commencement of concreting operations.

B. Trees, Plants, Ground Cover:
   1. Protect trees, plants and other ground cover from damage.
   2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to Vernal City.

C. Traffic Control:
   1. Provide worker and public safety, Section 01 55 26.
   2. Apply temporary traffic and lane marking tape or paint after placement layout has been verified with the Vernal City representative.

D. Base Course:
   1. Follow Section 31 25 00 for herbicide treatment.
   2. Verify base course is placed to grade, compacted and dampened.
   3. If indicated, apply prime coat, Section 32 12 13.

E. Cement Treated or Lean Concrete Base: Remove loose material from surface of cement treated or lean concrete base course immediately before placing concrete surface course. Moisten the surface but do not place concrete over puddled water. Apply a double coat of bond breaker prior to placing surface concrete.

3.2 FORM CONSTRUCTION

A. Section 03 11 00.

B. Check formwork for grade and alignment variance from the following tolerances:
   1. Top of forms not more than 1/4 inch from true grade.
   2. Vertical face on longitudinal axis not more than 1/4 inch from true line.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.3 REINFORCEMENT PLACEMENT

A. Section 03 20 00.

B. Interrupt reinforcement at expansion joints.

C. Use load transfer bars on longitudinal construction and transverse construction joints.

D. Use smooth dowel in expansion joints.

E. Keep load transfer bars and dowels in vertical center of concrete and perpendicular to the joint during concrete placement.

F. Position mats on bar chair supports and properly tie before any concrete is poured. Keep mats clean, free from rust, flat, and free of distortions. Straighten bends, kinks, and other irregularities or replace units before concrete placement. Provide a minimum of 2 inch overlap to adjacent mats.

3.4 JOINTS

A. General:
   1. Review joint layout with the Vernal City representative.
   2. Follow Section 32 13 73 requirements.
   3. Follow joint requirements in APWA Plan No. 261.

B. Construction Joint: Construction joints (contact joints) (cold joints) are those made by placing concrete against cured concrete.
   1. The contact joint between separately laid lanes cannot deviate from a true line by more than 1/4 inch in any direction at any point.

2. Tie both sides of longitudinal and transverse construction joints together with tie bars or key-way. Before placing concrete in adjoining slab, straighten tie bars to 0.1 feet of straight position.
3. Do not cause edge slump when placing tie-bars or by over-working edge of slab.

C. Contraction Joints: Contraction joints (crack control joints) are scorelines made to force crack joint locations in concrete. Keep a minimum of 3 working power saws on the Project when concrete operations are underway. Saw all joints before uncontrolled shrinkage cracking takes place. Do not tear or ravel concrete during sawing.
1. Joint spacing measured in feet = twice the slab thickness measured in inches or a maximum of 15 feet.
2. Joint Depth = T/3.
3. Use of a mechanical control joint-void former in lieu of saw cutting or tooling is acceptable.
4. Longitudinal Joints: Make longitudinal joints the same dimension as transverse joints.
5. Make transverse joints across width of the Pavement full length and meet curb and gutter joints.
6. Leave forms in place until paving operations are resumed on the other side of the joint.

D. Volunteer Crack Joint:
1. If a volunteer crack joints falls within 5 feet of the location of proposed contraction joint, omit the contraction joint.
2. Rout volunteer crack joints to a 1-1/4 inch depth by 3/8 inch width. Clean and fill crack joint with backer rod and joint sealant.
3. When crack joints occur within 2 feet of expansion or construction joints, replace panel. Use saw cuts and tie-bars or dowels in cut planes.

E. Expansion Joints:
1. If a deformed rebar is used in an expansion joint, provide sleeve for movement.
2. Secure fillers to prevent movement. When butted together, do not leave voids or gaps between filler units.
3. Set joint fillers full depth if no joint sealant is specified.
4. Recess joint fillers if backer rods and joint sealant are specified or provide a plastic cap.

F. Joint Sealing: Section 32 13 73.

G. If the CONTRACTOR chooses to open the roadway to construction or public traffic prior to final sawing and sealing, install backer rod in the initial (green) cut to prevent entrance of incompressibles.

3.5 CONCRETE PLACEMENT

A. Section 03 30 10.

B. At the beginning of concrete placement, test slump and air. If corrections are necessary, placement may proceed after 2 subsequent and consecutive batches pass testing.

C. Any delay in excess of 15 minutes from placing to start of finishing operations is cause for stopping placement work.

D. Do not place concrete until concrete sub base and surface course forms have been checked for line and grade. Moisten sub base if required to provide a uniform dampened condition at time of concrete placement. Do not place concrete around Manholes or other structures until they are at required finish elevation and cross-slope.

E. Prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

F. Do not place concrete in a longitudinal section until test specimens from the adjacent lane have attained an ASTM C 78 flexural strength (modulus of rupture) of 450 psi.

G. Deposit and spread concrete in a continuous operation between transverse joints. If interrupted for more than 1/2 hour, place a construction joint.

H. Place the concrete to the full width of the Pavement in a single construction operation unless indicated otherwise.

3.6 FINISHING

A. Section 03 35 00.

B. Any delay in excess of 30 minutes for completing the finishing operation is cause for stopping concrete placing to correct the difficulties.

C. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

D. After floating, test slab for trueness with a straight edge. Distribute concrete as required to remove surface irregularities. Refloat repaired areas to provide a continuous smooth finish.

E. Round edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool. Eliminate tool marks.

F. Surface Texture: After floating when excess moisture or surface sheen has disappeared.
1. For speed less than 45 mph: 1/16 inch deep burlap drag, turf drag, or broom.
2. For speed greater than 45 mph: 1/8 inch deep groove placed 80 degrees to center line and randomly spaced between 3/8 and 1-1/2 inches.

G. Do not remove forms for at least 24 hours after concrete has been placed. After form removal, clean ends of joints and patch any minor honeycombed areas. Remove and replace areas or sections with major defects.

3.7 CURING

A. Section 03 39 00.

B. Type II Class A or B (white pigmented) membrane forming compound applied in two directions for total white coverage on all exposed surfaces after texturing.

C. Eliminate thermal shock of concrete by keeping cure temperature close to ground and air temperature.

3.8 TOLERANCES

A. Grade: 1/8 inch in 10 feet parallel to centerline.

B. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks. Cross slopes for sidewalks and ADA landings must be between 1.5% and 2.0%.

C. Thickness: Not less than 1/4 inch deficient.

D. Roughness:

Table 1 – Roughness Tolerance

Speed and Traffic Class	*Profile Roughness Index, (PRI) Inches / Mile*				*Profile Deviation Inches/25 feet Maximum*
	IRI		*PI*		
	Min	*Max*	*Min*	*Max*	

0 to 29 mph	I or II	–	–	–	–	0.4
	III or IV	129	177	46	66	0.4
30 to 44 mph	I or II	90	115	35	50	0.4
	III or IV	70	90	21	35	0.4
45 mph +	All Classes	–	70	–	21	0.3

NOTES
(a) Use a zero blanking band
(b) As a minimum, trace right wheel path in direction of travel
(c) Traffic class defined in Table 3, Article 32 12 05
(d) IRI (International Roughness Index), ASTM E 950
(e) PI (Profile Index), ASTM E 1274

1. Profile Deviation: Begin traces 50 feet before edge of new pavement and end traces 50 feet after edge of new pavement. Areas exceeding profile deviation tolerance are "must grind" areas.
2. Profile Roughness Index: (PRI)
   a. Lot is 0.1 lane mile (528 feet long one lane wide). Add segments shorter than 250 feet to preceding Lot. Treat partial segments longer than 250 feet as a Lot.
   b. Exclude from the Lot are turn lanes, parking lanes, medians, Street Fixtures, crowns of intersecting streets, bridge decks, grades greater than 8 percent, and vertical curves less than 1,000 feet radius (including super-elevation transitions).

3.9 OPENING TO TRAFFIC

A. Not less than 3,000 psi compressive or 400 psi flexure strength.

3.10 PROTECTION AND REPAIR

A. General: All expenses are at no cost to Vernal City.

B. Protection: Section 03 30 10 and as follows.
   1. Do not allow steel wheel rollers or steel wheel vehicles on the concrete Pavement. Keep traffic and construction equipment off at least 10 days after concrete placement or until 100 percent of the design strength has been achieved and verified by either
      a. Maturity meter.
      b. Concrete cylinders.
   2. If construction traffic is permitted, keep Pavement clean. Remove surface stains and spillage of materials as they occur.
   3. Remove saw-cut dust immediately. Protect neighborhood, storm drains and down-stream fish habitat.

C. Repair: Section 03 30 10.
   1. Corrective Action for "Must Grinds": Grinding per Section 02 41 14 is acceptable after concrete cure.
   2. Corrective Action for Profile Roughness Index: Grinding is acceptable. Re-profile corrected segments to verify ride index meets tolerance.
   3. Corrective Action for Cracks: Consider repair options published in Guidelines by the American Concrete Pavement Association (ACPA). Do not begin corrective work until the Vernal City representative agrees with the repair option. Drill test cores when necessary to determine magnitude. Fill holes with Portland cement concrete bonded to Pavement with epoxy adhesive.

END OF SECTION

SECTION 32 13 73
CONCRETE PAVING JOINT SEALANTS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Joints and joint sealants in horizontal traffic surfaces for concrete sidewalks, curb, gutter and Pavement slabs.

1.2 REFERENCES

A. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.

B. ASTM D 545: Standard Methods of Testing Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types).

C. ASTM D 994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

D. ASTM D 1190: Standard Specification for Concrete Joint Sealer, Hot-Poured Elastic Type.

E. ASTM D 1191: Standard Method for Testing Concrete Joint Sealers.

F. ASTM D 1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

G. ASTM D 1752: Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

H. ASTM D 1850: Standard Specification for Concrete Joint Sealer, Cold-Application Type.

I. ASTM D 1851: Standard Methods of Testing Concrete Joint Sealers, Cold-Application Type.

J. ASTM D 2240: Standard Test Method for Rubber Property - Durometer Hardness.

K. ASTM D 2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

L. ASTM D 3405: Standard Specification for Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.

M. ASTM D 3406: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.

N. ASTM D 3407: Standard Methods of Testing Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.

O. ASTM D 3408: Standard Methods of Testing Joint Sealants, Hot-Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.

P. ASTM D 3542: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges.

Q. ASTM D 3569: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements.

R. ASTM D 3575: Standard Test Method for Flexible Cellular Materials Made from Olefin Polymers.

S. ASTM D 3581: Standard Specification for Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements.

T. ASTM D 3582: Standard Methods for Testing Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements.

U. ASTM D 3583: Standard Methods of Testing Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements, or Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type, for Portland Cement Concrete Pavements.

V. ASTM D 5249: Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement and Asphalt Joints.

W. ASTM D 5893: Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

X. FS SS-S-200: Sealants, Joint, Two Component, Jet-Fuel Resistant, Cold-Applied, for Portland Cement Concrete Pavement.

1.3 SYSTEM PERFORMANCES

A. Pavement joints include longitudinal and transverse expansion joints, contraction joints, construction joints, and crack control joints.

B. Provide joint sealants that maintain watertight and airtight continuous seals.

1.4 SUBMITTALS

A. Manufacturer's certification that product was manufactured, tested and supplied per source quality control requirements specified herein, together with a report of the test results and the date each test was completed.

B. Manufacturer's instruction for joint preparation, type of cleaning and installation.

C. Manufacturer's Product Data and Samples for each joint sealant product required.

D. Safety data sheets.

1.5 QUALITY ASSURANCE

A. Installation of joint systems are to follow manufacturer’s published directions.

B. For cold applied joint sealant installation, use installers approved by the joint sealant Supplier.

C. Obtain joint sealing materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 — PRODUCTS

2.1 GENERAL

A. Compatibility: Provide joint fillers, sealant backings, sealants, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by

sealant manufacturer based on testing and field experience.

2.2 JOINT VOID - FORMER

A. Plastic with a water stop.

B. 1/4 depth of concrete structural section.

2.3 JOINT FILLER - SHEET TYPE

A. F-1: Bituminous (asphalt or tar) mastic, ASTM D 994. Formed and encased between 2 layers of bituminous saturated felt or 2 layers of glass-fiber felt.

B. F-2: Cane or other cellulosic fiber, ASTM D 1751. Saturated with asphalt.

C. F-3: Granulated cork, ASTM D 1751. In an asphalt binder; encased between 2 layers of asphalt saturated felt or 2 layers of glass-fiber felt.

D. F-4: Sponge rubber fully compressible, ASTM C 1752. With resiliency recovery rate of 90 percent minimum.

E. F-5: Cork, ASTM C 1752. Impregnated and bound with asphalt, compressible with resiliency recovery rate of 90 percent if not compressed more than 50 percent of original thickness.

F. F-6: Plastic foam (for cold-applied sealants only). Preformed, compressible, resilient, non-waxing, non-xtruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 30 lb/ft3 density maximum, And of size and shape to control sealant depth and performance.

2.4 JOINT FILLER - BACKER ROD, TAPE, POURED FILL TYPE

A. Backer material, ASTM D 5249 for cold- and hot-applied joint sealant in portland cement concrete or asphalt Pavements joints.
   1. Type 1: Round rods.
   2. Type 2: Sheets or strips, laminated or skived.
   3. Type 3: Poured fills which completely fill Pavement joint.

2.5 JOINT SEALANT - GENERAL

A. Color of exposed joint sealant indicated, or if not, as selected from manufacturer's standard colors.

2.6 JOINT SEALANT - HOT-APPLIED

A. HAS-1: Asphalt base type, ASTM D 3405.

B. HAS-2: Thermoplastic type, ASTM D 3581. Jet-fuel resistant without rubber unless indicated otherwise.

C. HAS-3: Elastic type, ASTM D 1190.

D. HAS-4: Elastomeric type, ASTM D 3406. One component, for Portland cement concrete Pavements.

E. HAS-5: Elastomeric type, ASTM D 3569. One component, jet-fuel resistant, for Portland cement concrete Pavements.

2.7 JOINT SEALANT - COLD-APPLIED

A. CAS-1: Elastomeric type, ASTM C 920. Chemically curing, for vehicular or pedestrian use, and types of construction other than highway and airfield Pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O.

1. Self leveling.
2. Shore A Hardness: 40 " 5 ASTM D 2240.
3. Final cure: 4 days maximum.
4. Service range: -10 to 150 deg. F.

B. CAS-2: Mastic type, ASTM D 1850. Single or multiple component; for joints having a minimum width of 1/2 inch.

C. CAS-3: Coal-tar modified urethane, FS SS-S-200. One part, jet fuel resistant; Type H.

D. CAS-4: Elastomeric preformed polychloroprene type with lubricant adhesive and indicated movement ratio.
1. For concrete Pavement seal, ASTM D 2628.
2. For concrete bridge seals, ASTM D 3542.

E. CAS-5: Silicone type, ASTM D 5893. Single component, non-sag or self leveling, chemically curing sealant based on polymers of polysiloxane structure intended for use in portland cement concrete Pavements.

F. CAS-6: Asphalt base meeting ASTM D 3405.

G. CAS-7: Olefin polymer, ASTM D 3575 as follows.
1. Tensile elongation 255 percent plus or minus 20 percent, Suffix T.
2. Tensile strength 115 psi minimum, Suffix T
3. Density 2.9 plus or minus 3 lbs/cf, Suffix W, Method A
4. Water Absorption 0.025 lbs/sf maximum, Suffix L.

2.8 SOURCE QUALITY CONTROL

A. Preformed Expansion Joint Fillers: Nonextruding and resilient types, ASTM D 545.

B. Hot-Applied Joint Sealants:
1. Elastic type used in concrete Pavements, bridges, other structures, ASTM D 1191.
2. Bituminous type for hydraulic and asphaltic concrete Pavements, ASTM D 3407.
3. Elastomeric type for hydraulic concrete Pavement, ASTM D 3408.

C. Jet-Fuel-Resistant Joint Sealant: Hot-applied, ASTM D 3582 and ASTM D 3583.

D. Cold-Applied Mastic Joint Sealant: Cold-applied, ASTM D 1851.

PART 3 — EXECUTION

3.1 PREPARATION

A. Remove oil, grease, wax, form-release-agents, curing compounds, bitumens, laitance and old chalking material by sandblast, or water blast as recommended by manufacturer of sealant. Maximum sand blast angle, 25 degrees plus or minus 5 degrees.

B. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants.

C. Remove frost and moisture in concrete joint substrates before commencing sealing.

D. Install bond breaker tape where needed or required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

3.2 JOINT SEALING

A. General:
1. Install sealants in uniform, continuous ribbons without gaps or air pockets, with complete bonding of

joint surfaces on opposite sides.
2. Except as otherwise indicated, fill sealant rabbet flush with surface.
3. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

B. Depths: Saw cut joints if necessary to provide the required sealant thickness and depth. Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:
1. For sidewalks, Pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but not more than 5/8 inch deep nor less than 3/8 inch deep.
2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/4 inch deep.
3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints full depth.

C. Spillage: Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.

D. Heating: Do not use overheated hot-applied sealants.

E. Edges: Unless indicated otherwise, recess exposed edges of gasket and exposed joint fillers slightly behind adjoining surfaces so compressed units will not protrude from joints.

3.3 CURING AND CLEANING

A. Cure sealants and caulking compounds per manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

B. Clean off excess sealants or sealant smears adjacent to joints as work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of products in which joints occur.

C. Remove protective coating and oil from metals with solvent recommended by the sealant manufacturer.

3.4 PROTECTION

A. Protect joint sealant during and after curing period from contact with contaminating substances or from damage resulting from deterioration or damage at time of Substantial Completion.

B. If damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work at no additional cost to Vernal City.

END OF SECTION

SECTION 32 14 13
PRECAST CONCRETE UNIT PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Mortarless interlocking concrete pavers for sidewalks, roadways and similar pavings.

1.2 REFERENCES

A. ASTM C 33: Standard Specification for Concrete Aggregates.

B. ASTM C 67: Standard Method of Sampling and Testing Brick and Structural Clay Tile.

C. ASTM C 136: Standard Method for Sieve Analysis for Fine and Coarse Aggregates.

D. ASTM C 140: Standard Method of Sampling and Testing Concrete Masonry Units.

E. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar.

F. ASTM C 150: Standard Specification for Portland Cement.

G. ASTM C 936: Standard Specification for Solid Interlocking Concrete Paving Units.

H. ASTM C 979: Coloring Agents for Concrete.

I. ASTM D 1557: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 10 lb (4.54-kg) Rammer and an 19-In. (457-mm) Drop.

J. ASTM D 3786: Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics Diaphragm Bursting Strength Tester Method.

K. ASTM D 4751: Standard Test Method for Determining Apparent Opening Size for a Geotextile.

L. ICPI: Interlocking Concrete Paver Institute.

1.3 SUBMITTALS

A. Data sheets for
   1. Bedding sand gradation.
   2. Joint sand gradation.
   3. Joint sand stabilizer.
   4. Paver strength and absorption. Test results not older than 365 days.

B. Certification that paver unit complies with ASTM C 936.

1.4 QUALITY ASSURANCE

A. Installer must have successfully completed at least 3 unit paver applications of similar size and scope and will assign mechanics from these earlier applications to the Project, of which one will serve as lead mechanic.

B. Installer will have on site during the course of paving personnel who is knowledgeable of ICPI technical bulletins.

1.5 PRODUCT HANDLING

A. Protect unit pavers against soilage. Protect sand against intermixture with earth or other types of materials.

B. Do not build on frozen Subgrade or setting beds.

C. Remove damaged pavers.

PART 2 — PRODUCTS

2.1 CONCRETE PAVERS

A. Solid interlocking units per ASTM C 936 with spacer bars.
   1. Cement: ASTM C 150 hydraulic cement.
   2. Aggregates: ASTM C 33 sand and natural aggregates (washed and graded with no expanded shale or light weight aggregates).
   3. Average Compressive Strength: Greater than 8,000 psi with no individual unit test less than 7,200 psi.
   4. Average Absorption: Less than 5 percent with no individual unit greater than 7 percent, ASTM C 140.
   5. Freeze-Thaw: Resistance to 50 cycles, ASTM C 67.
   6. Efflorescence Prevention: Admixture per recommendation of manufacturer.

B. Shape: 200 mm x 100 mm unless specified elsewhere.

C. Thickness:
   1. Sidewalks: 60 mm.
   2. Roadways: 80 mm.
   3. Crosswalks: 80 mm.
   4. Driveway Approaches: 80 mm.

D. Color: Reddish brown using an inorganic mineral oxide.

2.2 BEDDING AND JOINT SAND

A. Clean, non-plastic, naturally occurring silica sand conforming to ASTM C 33 or ASTM C 144, with no more than 5 percent acid soluble material.

B. Gradation must not vary from the high limit on one sieve to the low limit on the next. Graded by dry weight to pass sieves per ASTM C 136 as follows.

	Bedding Sand	*Joint Sand*
Sieve	*ASTM C 33*	*ASTM C 144*
3/8 inch	100	--
No. 4	95 to100	100
No. 8	85 to 100	95 to 100
No. 16	50 to 85	50 to 100
No. 30	25 to 60	40 to 100
No. 50	5 to 30	20 to 40
No. 100	2 to 10	10 to 25
No. 200	0 to 1	0 to 10

2.3 JOINT SAND STABILIZER

A. Water based polymer sealer capable of penetrating the joint sand to a depth of 1/2 inch prior to polymerization.

B. No significant discoloration.

C. No significant static coefficient of friction reduction.

2.4 GEOTEXTILE FILTER FABRIC

A. Non-woven with the following properties.
   1. Apparent Opening Size (OAS): ASTM D 4751, 70 sieve.
   2. Puncture: ASTM D 3786, 65 lbs minimum.
   3. Thickness: 60 mils average.

B. Consult fabric manufacturer if,
   1. Subgrade CBR less than 2, or
   2. Surfaces are subject to highway or industrial loads.

2.5 SOURCE QUALITY CONTROL

A. ICPI member manufacturer.

B. Concrete masonry units, ASTM C 140.

PART 3 — EXECUTION

3.1 INSPECTION

A. Verify Subgrade is compacted, ready to receive substrate materials, and is sloped to drain.

3.2 PREPARATION

A. Layout: Check final elevations and patterns for conformance to Drawings.

B. Installation over soil base.
   1. Place specified base course over compacted Subgrade at specified thickness.
   2. Compact to greater than 96 percent ~~ASTM D 1557.~~
   3. Soil base surface tolerance is 3/8 inch in 10 feet.

C. Installation over concrete base.
   1. Fill drainage holes in concrete base with bedding sand.
   2. Cover filled drainage holes with geotextile.

3.3 INSTALLATION

A. Bedding Sand:
   1. Place and screed allowing for paver height and compaction.
   2. After screeding, do not disturb or compact. Fill screed rails voids with loose sand.
   3. Remove all compressions in the bedding sand.
   4. Remove from bedding sand any concrete dust or waste from the paver cutting operation

B. Cutting Pavers:
   1. Point up joints to provide a neat, uniform appearance.
   2. Minimum cut length is 3/4 paver, or 1/2 paver providing adjacent paver is also reduced no more than 1/2 its original length.
   3. Cut vertical faces with masonry saw.
   4. No chipping or breaking for shaping.
   5. No modification of top or bottom face of paver.

C. Pavers:
   1. Do not install paver over saturated or dry sand. Sand should be damp.
   2. Paver surface to be 1/8 to 3/16 inch above grade or edge restraints after compaction.

3. Keep paver lines straight, true, and square.
4. Use a low amplitude, high frequency plate vibrator capable of at least 5,000 lbf at a frequency of 75 hz to 10 hz.
5. Do not vibrate within 6 feet of an unrestrained edge of pavers.

D. Joint Width:
1. 1.5mm–4mm.
2. Maximum 50 percent between 2mm–3mm and 10 percent between 3mm–4mm in any 3 feet square area.

E. Joint Sand and Stabilizer:
1. After setting pavers, sweep joint sand into joints and vibrate again until joints are full.
2. Bedding sand may be used for joint sand, however, extra effort in sweeping and compacting the pavers may be required in order to completely fill the joints.
3. After final vibration remove excess sand and debris.
4. Apply joint sand stabilizer within 1 week of installing joint sand.

3.4 TOLERANCES

A. Lippage: 1/16 inch maximum elevation difference unit to unit.

B. Cross Slope: 1/8 inch in 10 feet.

C. Longitudinal:.
1. Sidewalks: 1/8 inch in 10 feet.
2. Roadway:
   a. 1/8 inch in 10 feet parallel to centerline.
   b. 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.

3.5 PROTECTION AND REPAIR

A. Provide final protection and maintain conditions in a manner acceptable to installer.

B. Repair:
1. Remove and replace non-matching pavers or pavers which are chipped, broken, stained or otherwise damaged. Fill joints with joint sand and compact with plate compactor.
2. Remove excess sand.

END OF SECTION

SECTION 32 14 16
BRICK UNIT PAVING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Handling and installation procedures for paving brick.

B. Material requirements and tolerances.

1.2 REFERENCES

A. ANSI: American National Standards Institute.

B. ASTM C 33: Standard Specification for Concrete Aggregates.

C. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C 150: Standard Specification for Portland Cement.

E. ASTM C 207: Standard Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C 902: Standard Specification for Pedestrian and Light Traffic Paving Brick.

G. BIA: Brick Institute of America.

1.3 SUBMITTALS

A. Test Reports: Submit control testing reports as requested verifying compliance with specified standards.

B. Brick Samples: Prior to commencing work, obtain approval of representative Samples of the brick specified.

1.4 PRODUCT HANDLING

A. Handle and store paving brick in a manner to avoid chipping, breakage, intrusion of foreign matter, and staining.

B. Handle, store, mix and apply proprietary setting and grouting materials in strict compliance with the manufacturer's instructions.

C. Take precautions to protect the mortar and grout admixtures from freezing or from excessive heat.

PART 2 — PRODUCTS

2.1 PAVING BRICK

A. ASTM C 902 classification Type SX (freeze resistant), Traffic Type 1 (extensive abrasion), application PX (without mortar joints) unless indicated otherwise.
   1. Nominal Size: 3-5/8 inches x 7-5/8 inches x 2 inches for roadway or Driveway areas, 3-5/8 inches x 7-5/8 inches x 1 inch for sidewalk areas.
   2. Color: Reddish brown if not elsewhere specified.
   3. Friction Test: 0.5 minimum for wet leather and wet brick.

2.2 MORTAR AND GROUT

A. Mixture of water, ASTM C 150 type I Portland cement, ASTM C 207 type S lime, ASTM C 144 mason's sand, ASTM C 33 concrete sand to provide the following.

1. Compressive Strength: Thick bed mortar, 3,000 psi minimum.
2. Compressive Strength: Thin bed, bonding, grouting mortars, 5,000 psi minimum.
3. Tensile Strength: Thin bed, bonding, grouting mortars, 500 psi minimum.
4. Bond Strength: Thin bed, bonding, grouting mortars, 500 psi minimum.
5. Water Absorption: 4.0 percent maximum.
6. Ozone Resistance: 200 hours at 200 ppm. No loss of strength.
7. Smoke Contribution Factor: 0
8. Flame Contribution Factor: 0

B. Resistant to urine, dilute acid, dilute alkali, sugar, brine, and food waste products.

C. Additives compatible from one manufacturer, non-toxic, non-flammable, and non-hazardous during storage, mixing, application, and when cured. The addition of water or other materials to dilute the mortar additive on the job site will not be permitted.

2.3 REINFORCING MESH

A. 6 x 6 x 10 gage galvanized welded wire mesh, Section 03 20 00.

2.4 WATER REPELLANT

A. Penetrating compound, Section 07 19 00.

2.5 JOINT SEALING COMPOUND

A. CAS1 polyurethane, Section 32 13 73 unless indicated otherwise.

PART 3 — EXECUTION

3.1 INSPECTION

A. Inspect surfaces scheduled to receive brick paving for:
1. Defects that will affect the execution and quality of the Work.
2. Deviations beyond allowable tolerances over the substrate.

B. Correct unsatisfactory conditions.

3.2 PREPARATION

A. Clean surfaces as required to remove materials which will affect installation.

B. Place concrete base to nominal finish grade, minus paving brick thickness and setting bed mortar.

C. Wet cure concrete base. Remove curing compounds by sandblast prior to placing setting bed mortar.

3.3 INSTALLATION

A. Install per ANSI and BIA recommendations.

B. Cut units with powered masonry saw.

C. Lay units out so that fields or patterns center in areas.

D. Lay units out to minimize pieces smaller than 1/2 brick.

E. Set units into setting bed while mortar is still plastic or set in thin set mortar over prepared setting bed.

F. Tap each unit firmly into place to assure full adhesion.

G. Set units with nominal 3/8 inch joints between units.

H. Force grout between units to fill joints completely.

I. Remove surplus grout and leave faces clean.

J. Flood brick paving to determine any areas of standing water. Remove and replace any area where ponding is found to stand more than 3/8 inch deep.

K. Provide sealant joints where brick abuts vertical surfaces, around penetrations, and over expansion or control joints where indicated.

L. Apply surface sealer per manufacturer's recommendation.

3.4 TOLERANCES

A. For finish surface of paving, do not exceed 1/16 inch unit to unit offset to flush, and a tolerance of 1/8 inch in 2 feet and 1/4 inch in 10 feet from level or slope indicated.

3.5 PROTECTION

A. Protect installed pavers from damage.

B. Do not allow vehicular traffic on brick paving for 14 days or until the mortar and underlying concrete has reached a strength of 3,000 psi.

C. Provide alternate access to adjacent properties.

3.6 CLEANING

A. Remove protective coverings.

B. Clean entire surface with cleaning compound.

C. Protect adjacent surfaces from damage due to cleaning operations.

END OF SECTION

SECTION 32 16 13
DRIVEWAY, SIDEWALK, CURB, GUTTER

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Concrete flatwork such as but not limited to waterways, waterway transition structures, sidewalks, curbs, gutters, Driveway Approaches.

1.2 REFERENCES

A. Vernal City Standard Drawings.
   1. Plan 1: Curb, Gutter and 48" sidewalk.
   2. Plan 2: Flared Drive Approach With Park Strip.
   3. Plan 3: Flared Drive Approach No Park Strip.
   4. Plan 4: Typical Corner Ramps
   5. Plan 5: Special Corner Ramps
   6. Plan 11: Typical Waterford.
   7. Plan 12: Covered Approach.
   8. Plan 13: Concrete Ditch.

B. ASTM A 36: Standard Specifications for Structural Steel.

C. ASTM C 39. Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

D. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.

1.3 DEFINITIONS

A. Driveway: A paved or unpaved vehicular thoroughfare outside of, but connected to a public road right-of-way or highway right-of-way.

B. Driveway Approach: (1) A vehicular thoroughfare connecting a public road or highway to a driveway. (2) A concrete structure composed of sidewalk, apron and any curb and gutter abutting the apron. When an apron is built as a bridge over curb and gutter, the bridge is included in this definition.

C. CONTRACTOR: Any person, private business, public business, government agency or municipal agency that is performing work within the Vernal City right of way.

1.4 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

B. Concrete mix design, Section 03 30 04.

C. Batch ticket, Section 03 30 10.

D. Quality Control Inspections and Testing Report: Upon request of the Vernal City representative, submit a report describing source and field quality control activities and test results completed by the CONTRACTOR and their Suppliers.

1.5 NOTICE

A. Send written notice to residents and businesses within affected area at least 3 days before work starts.

B. Indicate when concrete work will take place and when driveway approach can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on specified day, send a new notice.

1.6 ACCEPTANCE

A. General:
   1. Acceptance is by Lot. One Lot is one day's production.

B. Concrete Mix:
   1. Testing Frequency: Section 03 30 05. Sample per ASTM C 172.
   2. Temperature, Slump, Air: Lot size is 1 random batch. Reject noncomplying batches until 2 consecutive batches are compliant then proceed in random batch testing for acceptance.
   3. Strength: ASTM C 39. Lot size is 50 cubic yards.

C. Placement, finishing and protection, Section 03 30 10
   1. Verify line, grade, cross slope and finish.
   2. No standing water in curb and gutter.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Concrete Mix.:
   1. Cast-in-place: Class 4000, Section 03 30 04.
   2. Maximum slump per mix design.

B. Reinforcement: Grade 60 ksi galvanized or epoxy coated steel per Section 03 20 00.

C. Expansion Joint Filler: F1 sheet 1/2 inch thick per Section 32 13 73.

D. Contraction Joint Filler (Backer Rod): Closed cell, Type 1 round Section 32 13 73.

E. Contraction Joint Sealer: HAS1 or HAS4 hot applied per Section 32 13 73.

F. Curing Compound: Membrane forming compound per Section 03 39 00.

G. Plate Steel: ASTM A 36 galvanized per Section 05 05 10.

PART 3 — EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Slip Form Machines.
   1. Placement must produce required cross-section, lines, grades, finish, and jointing as specified for formed concrete.
   2. If results are not acceptable, remove and replace work with formed concrete.

3.2 PREPARATION

A. Control pedestrian and vehicular traffic, Section 01 55 26.

B. Examine surfaces scheduled to receive concrete formwork for defects.

C. Do not start work until defects are corrected.

D. Check slopes on each side of the work to ensure drainage. Failure to check and verify will result in the

CONTRACTOR repairing any drainage deficiencies at no additional cost to Vernal City.

3.3 LAYOUT

A. Curb and Gutter: Plan 1.
   1. Line: Less than 1/2 inch variance in 10 feet and not more than 1 inch from true line at any location.
   2. Grade: Not more than 1/4 inch variance in 10 feet. Flood curb and gutter with water after final cure has been reached. Remove and replace any area where ponding is found.

B. Sidewalk: Plan 1, 4, 5.
   1. Cross slope 2 percent maximum toward gutter.
   2. Landing slope 2 percent maximum in any direction.
   3. Ramp slope, Section 32 16 14.

C. Driveway Approaches: Plan 2, 3, 12.

3.4 CONCRETE PLACEMENT

A. Section 03 30 10.

B. Make sure base course is uniformly damp at time of concrete placement.

C. Obtain Vernal City representative review of base course and forms before placing concrete.

D. Do not use methods that segregate the mix.

E. Place concrete so time between end of placement and beginning of finishing is less than 15 minutes.

F. Consolidate concrete with vibrator or other acceptable method. Do not use mechanical vibrators. Prevent dislocation of inserts.

3.5 CONTRACTION JOINTS

A. Geometrics:
   1. Tooled Joints (Score Lines):
      · Depth = T/4. T is the depth of the concrete slab in inches.
      · Top radius = 1/2 inch.
   2. Saw Cut Joints: Saw joints before uncontrolled shrinkage cracking occurs. Do not tear or ravel concrete during sawing.
   3. Template Joints: 1/8 to 3/16 inch wide 1/4-depth of slab.

B. Sidewalks.
   1. At 5-foot intervals or equal to the width of the sidewalk (which ever is greater) and transverse to the line of walk.
   2. Radial at curbs and walk returns.
   3. Place longitudinal joints in walks when width of walk in feet is greater than 2 times the walk thickness in inches. (e.g. maximum width of a 4 inch thick walk before placement of a longitudinal contraction joint is 8 feet). Make longitudinal joints parallel to, or concentric with, the lines of the walk.
   4. In walk returns make 1 joint radially midway between the beginning of curb returns (BCR) and end of curb returns (ECR). Match longitudinal and traverse joints with the adjacent walks.

C. Curb, Gutter, Waterway.
   1. Place joints at intervals not exceeding 12 feet.
   2. At curb radius and walk returns make the joints radial.
   3. Where integral curb and gutter is adjacent to concrete Pavement, align the joints with the Pavement joints where practical.

D. Additional Contraction Joint Requirements: Section 32 13 73.

3.6 EXPANSION JOINTS

A. Geometrics: 1/2 inch wide full depth filler that is flush with concrete surface. Do not place seal over top of filler.

B. Sidewalks, Sidewalk Ramps.
   1. Place expansion joints to separate sidewalk from back of curb, utility poles, hydrants, Manhole frames, buildings and abutting sidewalks.
   2. Place expansion joints between the sidewalk and the back of curb returns, between the sidewalk and sidewalk ramps and on the back side of drive approaches.
   3. Do not place expansion joints in sidewalk ramp surfaces.

C. Curb, Gutter, Waterway.
   1. Do not place longitudinal joints in drain gutter flow-lines.
   2. Where drain gutter transitions extend beyond the curb return, place expansion joints at the ends of the drain gutter transition.
   3. Place expansion joints at beginning of curb radius (BCR) and end of curb radius (ECR).

D. Driveway Approach: Place expansion joints in curb returns.

E. Street Intersection Corner: Place expansion joints at BCR and ECR.

F. Additional Expansion Joint Requirements: Section 32 13 73.

3.7 FINISH

A. Section 03 35 00.

B. Round edges exposed to public view to a 1/2 inch radius.

C. Apply broom finish longitudinal to curb and gutter flowline.

D. Apply broom finish transverse to sidewalk centerline as follows.
   1. Fine hair finish where grades are less than 6 percent.
   2. Rough hair finish where grades exceed 6 percent.

E. Remove form marks or irregularities from finish surfaces.

3.8 CURING

A. Section 03 39 00.

B. Cure and seal concrete with a water or solvent based, resin, membrane-forming product that effectively controls moisture loss during the curing process and provides a long-lasting seal on the concrete surface. Product meets ASTM C309, Type 1, Classes A & B; ASTM C1315, Type 1, Class A.

C. Eliminate thermal shock of concrete by keeping cure temperature even throughout extent and depth of concrete slab.

3.9 PROTECTION AND REPAIRS

A. General: All expenses are at no cost to Vernal City.

B. Protection: Section 03 30 10.
   1. Protect concrete work from deicing chemicals during the 28 day cure period.
   2. Immediately after placement, protect concrete from graffiti or other types of mechanical injury.

C. Repair: Section 03 30 10.
   1. Correct all humps or depressions.
   2. Correct all graffiti, mechanical injury or damage.
   3. Secure Vernal City representatives acceptance of method of correction.

END OF SECTION

SECTION 32 16 14
CURB RAMP

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Concrete flatwork for curb cut assemblies.

1.2 REFERENCES

A. American Public Works Association (Utah Chapter).
   1. Plan 4: Typical Corner Wheel Chair Ramp Radius less than 15'.
   2. Plan 5: Special Corner Wheel Chair Ramp Radius less than 15'.

B. Work Zone Traffic Control Guide: Publication of the Utah LTAP Center.

C. Uniform Federal Accessibility Standards (UFAS) for ADA requirements.

1.3 DEFINITIONS

A. Clear Space: A 4 feet minimum by 4 feet minimum surface located within the width of the crosswalk and adjacent to a curb cut.

B. Cross Slope: Grade perpendicular to the direction of pedestrian travel usually expressed in vertical:horizontal format.

C. Running Slope: Grade parallel to the direction of pedestrian travel usually expressed in percent.

D. Ramp: A flat surface with a maximum Running Slope of 1:12 (8.33 percent) and a maximum Cross Slope of 1:48 (2 percent) with sides perpendicular to its ends and ends parallel to each other.

E. Curb Ramp: A Ramp that cuts through a curb.

F. Detectable Warning Surface: A surface of truncated domes aligned in a square or radial grid pattern.

G. Cross Width: Distance perpendicular to the direction of pedestrian travel usually expressed in lineal measure.

H. Running Width: Distance parallel to the direction of pedestrian travel usually expressed in lineal measure.

I. CONTRACTOR: Any person, private business, public business, government agency or municipal agency that is performing work within the Vernal City right of way.

1.4 SUBMITTALS

A. Traffic control plan, Section 01 55 26.

B. Concrete mix design, Section 03 30 04.

C. Batch ticket, Section 03 30 10.

D. Detectable Warning Surface product data sheet.

1.5 ACCEPTANCE

A. Clear Space: Running Slope.

B. Flow-line: No standing water, no trip hazard.

C. Detectable Warning Surface:
   1. Color contrast, dome geometry, joints between units.
   2. Cross Width, Running Width.

D. Curb Cut: Cross Width (appropriate to number of crosswalks served).

E. Landing: Running Slope, Cross Slope, dimensions.

F. Ramp: Running Slope, Cross Slope, Cross Width, transition ends.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Cast-in-place Concrete: Class 4000, Section 03 30 04.

B. Pavers:
   1. Concrete, Section 32 14 13.
   2. Brick, Section 32 14 16.

C. Detectable Warning Surface must be cast iron and uncoated to allow natural rust color to form.

D. Other Materials: Choice of the CONTRACTOR.

PART 3 — EXECUTION

3.1 PREPARATION

A. Refer to Work Zone Traffic Control Guide.

B. Refer to Plan 4 and 5.

C. All work must be in accordance to current ADA standards.

3.2 TRAFFIC CONTROL

A. Provide safe passage for pedestrians and vehicles.

B. Assist visually impaired and wheel chair users.

C. Provide continuous access to fire hydrants.

D. Keep passage ways free of construction materials, trash and debris.

E. Remove graffiti immediately.

3.3 LAYOUT

A. Curb Cut (excluding flare or curb radius measurement):
   1. Cross Width at Curb Ramp.
      a. 4 feet minimum serving one crosswalk.
      b. 8 feet minimum serving two or more crosswalks.
   2. Cross Slope at Curb Ramp: 2 percent maximum and 1.5 percent minimum.

B. Detectable Warning Surface:

1. Running Length: 2 feet minimum.
2. Cross Width:
    a. 4 feet minimum serving one crosswalk.
    b. 8 feet minimum serving two or more crosswalk.
3. Joint Between Units: 3/16 inch maximum or manufacturer's recommendation.

C. Landing: Determine landing position and elevation so ramps that slope to and from the landing meet ramp slope requirements.

D. Ramp:
1. Do not exceed maximum slope for 15 feet length.
2. It may be necessary to include a transition zone between a curb cut and ramp.

E. Curb Wall: Set top of curb wall equal to elevation of extended lateral lines of sidewalk.

3.4 INSTALLATION

A. Pour concrete, Section 03 30 10.

B. Install Detectable Warning Surface full length and full width across the pedestrian access route.

END OF SECTION

SECTION 32 17 24
PAVEMENT MARKING PAINT
(ADAPTED FROM UDOT SPECIFICATION)

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Furnish Acrylic Water Based pavement marking paint. Refer to this Section, article 2.02 for resin requirement.

B. Apply to hot mix asphalt or portland cement as edge lines, center lines, broken lines, guidelines, contrast lines, symbols, and other related markings.

C. Removing pavement markings.

1.2 RELATED SECTIONS – Not Used

1.3 REFERENCES

A. AASHTO M 247: Standard Specification for Glass Beads Used in Traffic Paints

B. ASTM D 562: Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer

C. ASTM D 2205: Standard Guide for Selection of Tests for Traffic Paints

D. ASTM D 2743: Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography

E. ASTM D 2805: Standard Test Method for Hiding Power of Paints by Reflectometry

F. ASTM D 3723: Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing

G. ASTM D 3960: Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings

H. ASTM D 4451: Standard Test Method for Pigment Content of Paints by Low-Temperature Ashing

I. ASTM D 5381: Standard Guide for X-Ray Fluorescence (XRF) Spectroscopy of Pigments and Extenders

J. ASTM E 1347: Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

K. Federal Standards

L. Manual on Uniform Traffic Control Devices (MUTCD)

M. UDOT Materials Manual of Instruction, Part 8

N. UDOT Minimum Sampling and Testing Requirements

O. UDOT TC Standard Drawings

1.4 DEFINITIONS – Not Used

1.5 SUBMITTALS – Not Used

1.6 ACCEPTANCE

A. Provide documentation of the manufacturer and production batch identification for the paint used.

B. Provide fixtures such as ball valves, gate valves, or others on paint truck for the purposes of obtaining field samples.

C. Agitate the paint to allow for thorough mixing. Follow paint manufacturer's recommendation for agitation and mixing times.

D. Stop all agitation before sample is drawn.

E. Calibrate all meters on the paint truck annually and certify for application rate verification.
1. Use the following calibration tolerances for meters:
   a. Paint: ± 0.1 gal
   b. Beads: ± 0.5 lb/gal
2. Keep a clean, legible copy of calibration report with the paint truck.
3. Provide a copy of certification at the Vernal City representative's request.

F. The Vernal City representative will:
1. Visually inspect lines, legends, symbols, and messages to verify compliance with the required dimensions.
2. Inspect at a minimum at the end of each production day.
3. Verify quantities applied by either of the following methods:
   a. Measuring both paint and bead tanks prior to and after application.
   b. Witnessing the meter readings prior to and after application.
      1) A printout of meter readings, in lieu of witnessing, may be accepted at the Vernal City representative's discretion.
4. Sample in accordance with the UDOT Materials Manual of Instruction, Part 8-932 and the UDOT Minimum Sampling and Testing Requirements.

G. Repaint any line or legend failing to meet bead adherence and dimensional requirements.

PART 2 — PRODUCTS

2.1 PAINT

A. Meet the requirements for Acrylic Water Based Paint as listed in Table 4:

Table 4 - Paint Requirements

Property	White	Yellow (lead free)	Black	Test
Pigment: Percent by weight	63.0	63.0	63.0	ASTM D 3723
Total Solids: Percent by weight, minimum	79.0	79.0	79.0	ASTM D 2205
Nonvolatile vehicle: Percent by weight vehicle, minimum	43.0 The nonvolatile portion of the vehicle is 100% acrylic crosslinking resin as determined by infrared spectral analysis. The acrylic emulsion is a 100% CROSSLINKING EMULSION.			ASTM D 2205
Viscosity, KU @ 77 degrees F	80 - 95	80 - 95	80 - 95	ASTM D 562
Density, lbs/gal	14.1 ± 0.3	14.1 ± 0.3	14.1 ± 0.3	ASTM D 2205
Volatile Organic Content (VOC): lbs/gal, maximum	1.25	1.25	1.25	ASTM D 3960

Titanium Dioxide Content, lbs/gal	1.0 min	0.2 max	N/A	ASTM D 5381
Directional Reflectance : Minimum	90.0	50.0	N/A	ASTM E 1347
Dry Opacity: Minimum (5 mils wet)	0.95	0.95	N/A	ASTM D 2805

* Binder: 100 percent acrylic cross-linking polymer, by weight, as determined by infrared analysis and other chemical analysis available to Vernal City Corporation. Refer to ASTM D 2205.

B. No-Pick-Up Time
   1. Paint may not smear or track three minutes after application to the roadway using standard application equipment, at the mil thickness required, and with an ambient shaded temperature of at least 50 degrees F.

C. Additional requirements:
   1. Free of lead, chromium, or other related heavy metals. Refer to ASTM D 5381.
   2. Refer to ASTM D 2743, ASTM D 4451 and ASTM D 5381: Tests used to verify paint samples meet ASTM requirements.

2.2 GLASS SPHERES (BEADS) USED IN PAVEMENT MARKING PAINT

A. Specific Properties: Meet AASHTO M 247 with the following exceptions.
   1. Gradation:
      Passing a No. 14 sieve, percent 95 - 100
      Passing a No. 16 sieve, percent 80 - 95
      Passing a No. 18 sieve, percent 10 - 40
      Passing a No. 20 sieve, percent 0 - 5
      Passing a No. 25 sieve, percent 0 - 2
   2. Beads: Silane adhesion coating.
   3. Roundness - The glass beads will have a minimum of 80 percent true spheres.

B. Beads used in Temporary Pavement Markings meet the above or AASHTO M 247 Type II uniform gradation.

PART 3 — EXECUTION

3.1 PREPARATION

A. Line Control.
   1. Establish control points at 100 ft intervals on tangent and at 50 ft intervals on curves.
   2. Maintain the line within 2 inches of the established control points and mark the roadway between control points as needed.
      a. Remove paint that is not placed within tolerance of the established control points and replace at no expense to Vernal City. Refer to this Section, article 3.4.
      b. Maintain the line dimension within 10 percent of the width and length dimensions defined in Standard Drawings.

B. Remove dirt, loose aggregate and other foreign material and follow manufacturer's recommendations for surface preparation.

3.2 APPLICATION

A. Apply Pavement marking paint at the following wet mil thickness requirements.
   1. 20 – 25 wet mils for all longitudinal markings.
      Example Calculation: (Verify wet mil thickness)
      Wet Mils = $\frac{(0.133681 \text{ ft3/gal}) * 12000 \text{ mil/ft}}{(X \text{ ft/gal})(Z \text{ ft})}$

Where
X = application rate. (Meter readings or dipping tanks).
Z = line width measured in feet.
12000 = conversion from ft to mil
0.133681 = conversion from gallons to cubic feet.

For information only: Approximate application rate for required mil thickness requirements.

a. 4 inch Solid Line: From 190 to 240 ft/gal
b. 4 inch Broken Line: From 760 to 960 ft/gal
c. 8 inch Solid Line: From 95 to 120 ft/gal

2. 23 – 40 wet mils for all painted legends as determined by a wet mil gauge.

B. No additional payment for pavement markings placed in excess of required wet mils in thickness or exceeding dimensional requirements outlined in this Section, article 3.1 paragraph A.

C. Glass Sphere (Beads): Apply a minimum of 8 lb/gal of paint, the full length and width of line and pavement markings.
1. Do not apply glass beads to contrast lines (black paint).

D. Begin striping operations no later than 24 hours after ordered by the Vernal City representative.

E. At time of application apply lines and pavement markings only when the air and pavement temperature are:
1. 50 degrees F and rising for Acrylic Water Based Paint.

F. Comply with UDOT TC Series Standard Drawings.

3.3 PERSON PERFORMING WORK QUALITY CONTROL

A. Application Rate: Verify that the paint and beads are being applied within specified tolerances prior to striping.

B. Curing: Protect the markings until dry or cured. In the event that the uncured marking is damaged the marking will be reapplied and track marks left on the pavement will be removed at no additional cost to Vernal City.

3.4 REMOVING PAVEMENT MARKINGS

A. Use one of these removal methods:
1. High pressure water spray,
2. Sand blasting,
3. Shot blasting,
4. Grinding.

Grinding is not allowed on the final surfacing unless the Vernal City representative grants prior written approval.

B. Do not eliminate or obscure existing striping, in lieu of removal, by covering with black paint or any other covering.
1. The Vernal City representative may grant prior written approval for use of black paint or other obscuring material for work durations shorter than “long term stationary” as defined in the Temporary Traffic Control section of the MUTCD.

C. Use equipment specifically designed for removal of pavement marking material.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Chain link fabric, posts, braces, anchorage, gates, miscellaneous hardware and appurtenances.

1.2 REFERENCES

A. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated, Welded and Seamless.

B. ASTM A 121: Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

C. ASTM A 392: Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

D. ASTM A 491: Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.

E. ASTM A 585: Standard Specification for Aluminum-Coated Steel Barbed Wire.

F. ASTM A 641: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

G. ASTM F 567: Standard Practice for Installation of Chain-Link Fence.

H. ASTM F 573: Standard Specification for Residential Zinc-Coated Steel Chain-Link Fence Fabric.

I. ASTM F 626: Standard Specification for Fence Fittings.

J. ASTM F 654: Standard Specification for Residential Chain-Link Fence Gates.

K. ASTM F 668: Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric.

L. CLFMI: Chain Link Fence Manufactures Institute Product Manual for Chain Link Fence Installation.

1.3 SUBMITTALS

A. Drawings: Indicate plan layout, grid, size and spacing of components, accessories, fittings, anchorage, and post section.

B. Data: Submit manufacturer's installation instructions and procedures, including details of fence and gate installation.

C. Submit sample of fence fabric and typical accessories.

PART 2 — PRODUCTS

2.1 GENERAL

A. Galvanizing: Class 3, ASTM A 121.

B. Aluminizing: Class 2, ASTM A 585.

C. Polyvinyl Chloride (PVC): With PVC coated materials, paint all posts, fittings, hardware and accessories as indicated to match PVC color. The fabric shall be hot dipped galvanized steel wire complying with ASTM A 392 and coated with a continuous PVC bonding process (minimum 15 mil thickness) in accordance with ASTM

F 668. Color of PVC coating as indicated and applied free of voids, cracks, tears and to have a smooth and lustrous surface.

D. Steel: Schedule 40, ASTM A 53.

E. Cast-in-place Concrete: Class 3000 minimum, Section 03 30 04.

2.2 CHAIN LINK FABRIC

A. 11 gage steel wire fabric for all fences less than 60 inches in height and 9 gage for fences over 60 inches coated as follows.
   1. Zinc coating, ASTM A 392.
   2. Aluminum coating, ASTM A 491.
   3. Polyvinyl chloride coating, ASTM F 668.

B. For residential fabric, provide zinc coated fabric, ASTM F 573 requirements.

C. Unless indicated otherwise use chain link fabric that has approximately 2 inches square mesh and coated after fabrication.

D. Knuckle finish top edge and twist and barb bottom edge on fabric less than 60 inches wide. For fabric 60 inches or greater in width, twist and barb finish on both edges. Provide fabric that barbing has been done by cutting the wire on the bias.

E. If indicated, insert slats in fabric.

2.3 BARBED WIRE

A. Two strand, 12-1/2 gage wire with 14 gage, 4 point round barbs spaced approximately 5 inches on center.

2.4 TENSION WIRES AND FABRIC TIES

A. Tension Wires: 7 gage galvanized coil spring steel wire, ASTM A 641.

B. Fabric Fasteners: 9 gage galvanized or 6 gage aluminum wire, or approved non-corrosive metal bands, for ties to fasten fabric to posts, rails, and gate frames. Fasten fabric to bottom tension wire spaced 24 inches on center.

2.5 TRUSS OR TENSION BARS

A. Galvanized steel rod 3/8 inch diameter for truss or tension bars used in trussing gate frames and line posts adjacent in end, corner, slope, or gate posts. When used in trussing line posts, provide adjustment by means of galvanized turnbuckles or other suitable tightening devices.

B. Tension Bars:
   1. Galvanized high carbon steel bars not smaller than 3/16 inch x 3/4 inch for tensions bars to fasten fabric to end and corner posts and gate frames. Provide 1 tension bar for each end post and 2 for each corner and pull post per section of fabric.
   2. Use tension bar bands made from heavy pressed galvanized steel spaced on 15 inch centers to secure tension bars to posts.

2.6 POSTS, CAPS, RAILS, COUPLINGS

A. Posts, Frames, Stiffeners, Rails:

Table 1 – Posts, Frames, Stiffeners, Rails

Proposed Use	*Nominal Type and Size*
End, corner, slope and gate posts for single gates 6 feet or less in width and double gate 12 feet or less in width for 1. Fence less than 72 in. high 2. Fence 72 inches or higher	 2" pipe 2-1/2" pipe
Gate posts for single swing gates over 6 feet, but not over 13 feet in width and double swing gates over 12 feet, but not over 26 feet in width or for all slide gates with leaves larger than 6 feet	3-1/2" pipe
Gate posts for single swing gates over 13 feet, but not over 18 feet in width and double swing gates over 26 feet, but not over 36 feet in width	6" pipe
Gate posts for single swing gates over 18 feet in width and double swing gates over 36 feet in width	8" pipe
Frame for gates	1-1/2" pipe
Stiffeners for gates	1-1/4" pipe
Line posts for fence 72 in. or higher	2" pipe
Line posts for fences less than 72 in. high	1-1/2" pipe, or 1-1/8" x 1-5/8" H
Top rail	1-1/4" pipe, or 1-1/2" x 1-1/4" H
Bottom rail	6-gage, coiled spring steel tension wire

B. Posts: Galvanized steel, at the indicated length.

C. Caps: Pressed galvanized steel or malleable iron designed to fit securely over post ends forming a weather tight closure. Where top rail is used, provide cap to permit passage of top rail. "H" section posts do not require caps.

D. Top, Intermediate and Bottom Rails: Galvanized steel, in lengths as required. Provide joint couplings to connect rails securely. Provide means for attaching top rail securely to each end, corner, line, slope and gate posts.

E. Joint Coupling: Galvanized steel, 6 inches long minimum for each joint. 1 coupling in 5 shall have expansion spring. Couplings shall be outside sleeve type with bore of sleeve true to maintain adjacent lengths of rail in alignment.

2.7 FITTINGS AND HARDWARE

A. Unless indicated otherwise, galvanize fittings and hardware.

B. Rivets: Make all hardware attachments with galvanized steel rivets.

2.8 SUPPORT OR EXTENSION ARM

A. Use support or extension arms for barbed wire that are of a type that can be attached to the tops of the posts and carry the number of wires indicated.

B. Use only support arms on the fence for barbed wire that are capable of supporting a 250 pound vertical load at the end of the arm without causing permanent deflection.

C. Single support arms are to be integral with a top post weather cap and have a hole for passage of the top rail when required.

2.9 GATES

A. Residential gates: Refer to ASTM F 654 requirements.

B. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories.

C. Assemble gate frames and attach hardware by welding or by using fittings and rivets to make rigid connections. Use same fabric as for fence. Install fabric with stretcher bars to gate frame at not more than 15 inch on center.

D. Provide diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where necessary to prevent frame from sagging or twisting.

2.10 GATE HARDWARE

A. Hinges: Pressed steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide minimum of one pair of hinges for each leaf.

B. Latch: Forked steel type or plunger-bar steel type to permit operation from either side of gate. Provide locking device and padlock eye as integral part of latch.

C. Keeper: Provide keeper for all vehicle gates which automatically engages the gate leaf and holds it in the open position until manually released.

D. Gate Stops: Mushroom type or flush plate with anchors set in concrete to engage the center drop rod or plunger bar.

E. Sliding Gates: Manufacturer's standard heavy-duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, steel wheel or rubber wheel, and accessories as required.

PART 3 — EXECUTION

3.1 PREPARATION

A. Identify utility location, Section 01 31 13.

B. Excavation, Section 31 23 16.

C. Refer to ASTM F 567 and CLFMI products manual for chain link fence installation.

D. Protect roots and branches of trees and plants to remain.

E. Limit the amount of clearing and grading along the fence line to permit proper installation.

3.2 LAYOUT OF WORK

A. Accurately locate and stake locations and points necessary for installation of fence and gates.

B. General arrangements and location of fence and gates are indicated. Install except for minor changes required by unforeseen conflicts with work of other trades.

3.3 INSTALLATION OF POSTS

A. Space line posts as follows:
   1. Tangent sections to 500 feet radius: 10 feet maximum.
   2. 200 feet radius to under 500 feet radius: 8 feet maximum.
   3. 100 feet radius to under 200 feet radius: 6 feet maximum.
   4. Under 100 feet radius: 5 feet maximum.

B. Provide pull posts at 500 feet maximum intervals. Changes in line of 30 degrees or more are considered corners.

C. Set all posts to true line and grade in concrete bases or in approved pipe sleeves or sockets. Check for vertical and horizontal alignment.

D. Construct concrete bases for posts at least 10 inches in diameter. Place a minimum of 6 inches concrete below each post. Depth of post in concrete as follows.
   1. Line Posts: 18 inches.
   2. End, Pull, Corner and Gate Posts Less Than 6 inches Diameter: 24 inches
   3. Gate Posts: 30 inches.

E. Where posts are required to be set in concrete walls or masonry, set sockets for the posts to a depth of at least 18 inches. Use sockets that consist of lengths of 0.048 inch galvanized metal pipe sleeves, with an inside diameter sufficient to allow the posts to fit loosely therein. Coat the inside of the socket and outside of the posts with an approved bituminous paint. Caulk the posts securely in place with lead wool.

3.4 INSTALLATION OF BRACE ASSEMBLIES

A. Attached brace rail from end, pull, corner or gate posts to first ensuing line post. Install braces so posts are plumb when diagonal truss rod is under proper tension.

3.5 INSTALLATION OF RAILS

A. Install rails level and plumb with grade between posts and attached to posts before stretching fabric. Top rails shall form continuous brace from end-to-end of each run of fence.

3.6 INSTALLATION OF FENCE FABRIC

A. Place fence fabric on security side of posts unless otherwise specified. Place fabric approximately 1 inch above the ground. Maintain a straight grade between posts by excavating high points of the ground. Filling depressions with soil will be permitted only upon approval of the Vernal City representative.

B. Stretch the fabric taut and securely fasten to posts. Fasten to end, gate, corner, and pull posts. Secure stretcher bars with metal bands spaced at 15 inch intervals. Cut the fabric and fasten each span independently at all pull and corner posts. Fasten to line posts with tie wire, metal bands, or other approved methods at 15 inches intervals. Attach the top edge of fabric to the top rail or tension cable at approximately 24 inches intervals. Attach bottom tension wire to fabric with tie wires at 24 inches intervals and secure to the end of pull posts with brace bands.

C. Draw barbed wire to assure minimum sag at high temperature and no breakage at low temperature. Connect the wires and arms by means of 0.142 gauge galvanized wire stays.

3.7 INSTALLATION OF GATES

A. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation.

3.8 REPAIR DAMAGED COATING

A. Grind smooth and wire brush all welds made after galvanizing to remove loose or burned zinc coating, after which neatly coat the areas with 50-50 solder or as otherwise directed by the Vernal City representative. Make repairs to abraded or otherwise damaged zinc coating in a similar manner. Replace PVC coating.

END OF SECTION

SECTION 32 31 16
WELDED WIRE FENCES AND GATES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Wire fences and gates for roadway right-of-way lines.

1.2 REFERENCES

A. AASHTO M 133: Standard Specification for Preservatives and Pressure Treatment Process for Timber.

B. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A 116: Standard Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

D. ASTM A 121: Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

E. ASTM A 585: Standard Specification for Aluminum-Coated Steel Barbed Wire.

F. ASTM A 641: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

G. ASTM A 702: Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought.

H. NFPA 70: National Electric Code.

1.3 SUBMITTALS

A. Drawings: Indicate plan layout, grid, spacing of components, accessories, fittings, and anchorage.

B. Data: Submit manufacturer's installation instructions and procedures, including details of fence and gate installation.

PART 2 — PRODUCTS

2.1 GENERAL

A. Galvanizing: Class 3, ASTM A 121.

B. Aluminizing: Class 2, ASTM A 585.

C. Polyvinyl Chloride (PVC): With PVC coated materials, paint all posts, fittings, hardware and accessories as indicated to match PVC color. The fabric shall be hot dipped galvanized steel wire complying with ASTM A 392 and coated with a continuous PVC bonding process (minimum 15 mil thickness) in accordance with ASTM F 668. Color of PVC coating as indicated and applied free of voids, cracks, tears and to have a smooth and lustrous surface.

D. Steel Pipe: Schedule 40, ASTM A 53.

E. Cast-in-place Concrete: Class 3000 minimum, Section 03 30 04.

2.2 WIRE MESH FENCING

A. Class II, ASTM A 116, nominal 0.099 inch Farm Grade with a 6 inch vertical wire spacing with wire mesh and spiral stays having a Class 1 zinc coating.

2.3 BARBED WIRE

A. Two strand, 12-1/2 gage wire with 14 gage, 4 point round barbs spaced approximately 5 inches on center.

2.4 UNTREATED WOOD POSTS FOR LINES, GATES, ENDS AND CORNERS

A. Line posts: 10 inches minimum circumference Juniper or acceptable alternate approved by the Vernal City representative.

B. Gate, Brace, and Corner Posts: 12 inches minimum circumference minimum Juniper or acceptable alternate approved by the Vernal City representative.

C. Use only sound straight posts that are free from decay or defects.

2.5 TREATED WOOD POSTS AND WOOD BRACE RAILS

A. Douglas Fir, Hemlock, or Pine as follows.
   1. Line Posts: 10 inches minimum circumference.
   2. Gate, Brace, and Corner Posts: 12 inches minimum circumference.
   3. Rectangular Posts: 12 square inches minimum normal cross-section area. Square members may be rough sawn or finished.

B. Treat timber according to AASHTO M 133. Pressure treat wood members prior to fabrication.

C. Prior to painting, treat lumber per AASHTO M 133 requirements using pentachloro-phenol solution.

D. Sawing or field drilling of holes is allowable if all exposed untreated surfaces of members are field treated with 2 coats of the same material originally treated.

2.6 METAL POSTS AND BRACES

A. Steel posts, ASTM A 702.

B. The anchor plate may be omitted provided posts are set in a concrete footing with a minimum cross-sectional dimension of 6 inches and a depth equal to full penetration of the post plus 6 inches.

C. Galvanized posts may be used in the place of the painted posts. Use posts galvanized by the hot-dipped process.

2.7 TUBULAR STEEL FRAME GATE WITH WIRE FABRIC

A. Gate frames manufactured with steel pipe 1 inch nominal diameter steel pipe minimum.

B. Place steel pipe braces vertically in each drive gate to provide uniform size panels. Provide one vertical support for 10 and 12 feet wide gates and 2 vertical supports for 14 to 16 feet wide gates.

C. Gate dimensions are the minimum clear openings between gate posts. Provide a gate with fittings to fill the opening.

D. Provide galvanized woven wire fabric of the same type and quality as indicated for the fence and space the horizontal wires corresponding to that of the fence. Provide an adjustable steel truss rod of 3/8 inch minimum diameter to prevent sagging on gates 10 feet or more in length.

E. Galvanize steel fitting and hardware, Section 05 05 10.

F. For 10 feet wide and wider gates use pintles not less than 5/8 inch diameter.

G. For fasteners for single gates furnish an 18 inches length of galvanized chain secured to the gate at one end and

fitted with a snap fastener on the loose end. For all double drive gates use a center latch in lieu of a chain fastener with a pin that fits in a socket embedded in concrete.

H. For sliding gates use a frame made from 1-1/4 inch steel tubing with fence fabric equal to the adjoining fence. Support the opening end on a set of 6 inches minimum diameter wheels. Provide a 1-1/2 inch minimum schedule 40 pipe to support the other end with a steel wheel that rides on the support pipe. On gates wider than 12 feet use 2 support pipes. If a pre-manufactured gate is to be used, submit details for review.

2.8 STAPLES

A. Galvanized steel No. 9 wire 1-1/2 inches long minimum with an ASTM A 641, Class I coating.

PART 3 — EXECUTION

3.1 PREPARATION

A. Identify utility location, Section 01 31 13.

B. Excavation, Section 31 23 16.

C. Limit the amount of the clearing and grading along the fence line to permit proper installation.

3.2 INSTALLATION

A. Install permanent end braced posts for existing cross fences which are intersected by the new fence alignment. Place all end braced posts in position in existing cross fence to serve as line posts for connection to he new fence. Space fence posts at intervals and depth indicated. Install all posts in a vertical position.

B. After wood post has been set, cut off top to height indicated at an angle of approximately 30 degrees from horizontal.

C. Brace corner and end post in two directions.

D. Set metal corner, end, gate, and brace posts in concrete footings that are 12 inches larger in diameter than the post and at least 24 inches deep. Crown top to shed water. Install no materials on posts or place strain on guys until 7 days after placing concrete.

E. Draw wire mesh fabric tight to remove all sag.

F. Excavate high points along the ground surface that interferes with placing of wire mesh. Provide a minimum clearance of 1 inch and 4 inches maximum.

G. Draw barbed wire to assure minimum sag at high temperatures and no breakage at low temperatures. Connect the lateral wires between the posts by means of 0.142 inch diameter galvanized wire stays of the length indicated.

H. Fasten the top and bottom wires and every alternate lateral wire in the mesh fabric and each strand of barbed wire to each post by means of the staple or clamp.

I. Connect wood braces to adjacent posts with 3/8 inch x 4 inch galvanized steel dowels and tension the brace wires until the installation is rigid.

J. Fasten metal braces to the metal post by the use of a securely bolted assembly or butt welding.

K. Provide double diagonal wire bracing at each timber bracing consisting of two 0.192 inch diameter galvanized wires securely fastened to wood posts.

L. Construct gates to operate freely without sag. Provide fittings and locks.

M. At each location where an electric transmission distribution or secondary line crosses any fence with wood posts, install an electric ground conforming to NFPA 70 requirements.

END OF SECTION

SECTION 32 84 23
UNDERGROUND IRRIGATION SYSTEMS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Underground Irrigation System complete with heads, valves, controls, and accessories.

1.2 REFERENCES

A. NFPA 70: National Electric Code.

1.3 DEFINITIONS

A. Lateral Pipe: That system of pipes downstream of a pressure valve. Lateral pipe feeds water to sprinklers and emitters.

B. Irrigation System: The arrangement of valves, controls, heads and accessories including lateral and mainline pipe systems.

C. Mainline Pipe: That system of pipes upstream of a pressure pipe valve.

1.4 PERFORMANCE REQUIREMENTS

A. Design Pressure: As indicated from connection to supply system to last head in circuit.

B. Location of Heads: Design location is approximate. Make adjustments as necessary to avoid plantings and other obstructions.

C. Water Coverage: Turf and other planting areas, 100 percent. Modify layout to obtain coverage and rate of application and to suit manufacturer's standard heads. Do not decrease number of heads indicated unless acceptable to the Vernal City representative.

D. Pipe Testing Schedule: Section 33 08 00.

E. Leave system dry if Work is Substantially Completed after October 15 unless directed otherwise by the Vernal City representative.

1.5 SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions.

B. Layout Drawings: Plan layout and details illustrating piping layout to water supply location and type and coverage of heads, valves, piping circuits, controls, landscaping features, list of fittings and accessories.

C. Pipeline Test Report: Section 33 08 00.

D. Operation and Maintenance Data: Section 01 78 23.
   1. Submit instructions covering full operation, care, and maintenance of system (and controls) and manufacturers parts catalog.
   2. Include year-to-year schedule showing length of time each valve is to be open to provide determined amount of water, drain procedures, cleanout features, etc.
   3. Instruct Vernal City’s maintenance personnel how to operate controller and adjust sprinkler heads.

E. Manual Valve Key Operator: Furnish 3 valve keys, 3 feet long with tee handle and key end to fit each type of valve assembly.

PART 2 — PRODUCTS

2.1 PIPE, FITTINGS, OTHER

A. Material: PVC, Section 33 05 07.

B. Pressure Pipe: Schedule 40.
   1. Solvent weld smaller than 3 inches.
   2. Mechanical joint 3 inches and larger

C. Lateral Pipe: Schedule 40 through 1-1/4” then Class 200, solvent welded.

D. Fittings: Schedule 40, solvent welded or threaded.

E. Risers: Schedule 80, threaded.

F. Water Valve Assemblies: Schedule 80, threaded.

2.2 VALVES

A. Manual Valve: Gate type with cast bonze body, resilient integral taper seat, non-rising stem, and fitted for key operation.

B. Automatic Valve: Globe type operated by low-power replaceable solenoid, normally closed, and fitted for manual flow adjustment

C. Automatic Drain Valve: Designed to open for drainage when line pressure drops below 3 psi. (NOT for use on mainline pipe.)

2.3 DRAIN SUMP

A. Sewer rock or pea gravel, Section 31 05 13.

2.4 BACKFLOW PREVENTER

A. Manufacturer's standard, to suit sprinkler system and the following.
   1. Double check valve.
   2. When underground Irrigation System is designed for liquid fertilizer, provide a reduced pressure backflow prevention device. The drain to daylight must be a minimum of 12 inches below the bottom of the release valve for devices 4 inches in diameter and smaller, or 12 inches plus the nominal diameter of the devices over 4 inches in diameter.

2.5 SPRINKLER HEADS

A. Manufacturer's standard unit designed to provide uniform coverage over entire area of spray indicated at available water pressure, as follows:
   1. Flush Surface: Fixed pattern, with screw-type flow adjustment.
   2. Bubbler: Fixed pattern, with screw-type flow adjustment.
   3. Shrubbery: Fixed pattern, with screw-type flow adjustment.
   4. Pop-Up Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.
   5. Pop-Up Rotary Spray: Gear driven, full circle and adjustable part circle type.
   6. Pop-Up Rotary Impact: Impact driven, full circle and part circle as indicated.
   7. Above-Ground Rotary Impact: Impact driven, full circle and part circle as indicated.

2.6 VALVE BOX

A. Precast concrete or plastic with adequate hand room to operate small tools and provisions for locking cover to

frame.

B. For drain pockets, No. 2 gravel (2-1/2 inch) Section 31 05 13.

2.7 AUTOMATIC CONTROL SYSTEM

A. General: Furnish low voltage system manufactured expressly for control of automatic circuit valves of underground Irrigation Systems. Provide unit of capacity to suit number of circuits.

B. Control Enclosure - External Applications: Manufacturer's standard weatherproof enclosure with locking cover, complying with NFPA 70.

C. Control Enclosure - Internal Applications: Manufacturer's standard with locking cover, complying with NFPA 70.

D. Transformer: To convert service voltage to control voltage and in accordance with manufacturer's recommendations.

E. Circuit Control: Each circuit variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each circuit.

F. Timing Device: Adjustable, 24 hour and 14 day clocks to operate any time of day and skip any day in a 14 day period. Allow for manual or semiautomatic operation without disturbing preset mechanical operation.

G. Wire:
1. Provide wire for connecting remote control valves to the automatic controllers that is Type "UF", 600 volt, stranded or solid copper, single conductor wire with PVC insulation and bearing UL approval for direct underground burial feeder cable. Make all connections with UL approved type seal to make a waterproof connection. Bury wires in the same Trench as the pipe where possible.
2. Provide wire with 4/64 inch insulation, minimum covering of ICC-100 compound for positive weatherproofing protection. For wire sizes 14, 12, 10, and 8 use a single conductor solid copper wire, and for sizes 6 and 4 use stranded copper wire. Make control or "hot" wires red and all common or "ground" wires white.
3. Verify wire types and installation procedures conform to local codes.

Table 1 – Valve Wire Sizing Chart

Voltage at Controller	*Wire Control Common*	*Maximum Allowable Length in Feet from Controller to Valves*			
		No. of Valves (Solenoids)			
		1	2	3	4
14	14	2765	1309	846	549
14	12	3393	1608	1039	673
14	10	3962	1877	1213	783
12	12	4394	2082	1346	6872
12	10	5397	2557	1652	1071
12	8	6364	3018	1949	1263
10	10	6986	3311	2140	1387

PART 3 — EXECUTION

3.1 EXCAVATION

A. Section 31 23 16.

B. Excavate Trenches for sprinkler system pipe to provide 18 inches of cover over main lines and 10 inches over lateral lines. Before excavating, establish the location of all underground utilities and obstructions.

C. Trench for sprinkler system to ensure proper grades and slopes to drain points.

3.2 INSTALLATION

A. General: Plans are diagrammatic. Proceed with installation in accordance with the following:
   1. Run all circuit and pressure lines as indicated. Within planting areas avoid conflict with trees. Where Trenching is required in proximity to trees which are to remain, do not damage roots.
   2. Install stop and waste valves, isolation valves, vacuum breakers, pressure reduction valves, and other equipment required by local authorities according to Laws and Regulations in order to make system complete.
   3. Slope Circuit Pipe to drain.
   4. After completion of grading, seeding or sodding, and rolling of grass areas, adjust heads to be flush with finished grades.

B. Piping:
   1. Assemble all circuit and pressure pipe in accordance with manufacturer's recommendations and assure positive drainage.
   2. At wall penetrations, pack the opening around the pipe with Section 03 61 00 non-shrink grout. At exterior face, fill perimeter slot with backer rod and sealant. Repair below grade waterproofing and make penetration watertight.
   3. Install PVC pipe in dry weather above 40 deg. F. Allow joint to cure a minimum of 8 hours before testing.

C. Sleeves:
   1. Install sleeves before concrete work.
   2. Under roadway, install PVC sleeve if cover over sleeve exceeds 2 feet, otherwise use cast iron or ductile iron sleeve.

D. Control Valves:
   1. Install remote control valves to manufacturer's recommendation.
   2. Use Schedule 80 PVC pipe for nipples on valve header, length as necessary. Install valves one per each plastic valve box and provide 12 inches of expansion loop slack wire at all connections inside valve box.

E. Automatic Drains: Install in accordance with manufacturer's recommendations at the low point of circuit lines. Do not use this valve on pressure pipe systems.

F. Manual Drains:
   1. Install per manufacturer's recommendations on upstream and downstream side of backflow preventers and at lowest point along main pressure pipe.
   2. Install by teeing down to 3/4 inch drain valve. Provide a drainage sump sized to receive volume of drain water.
   3. Make manual drain valves accessible by installing an adjustable pipe sleeve to meet finished grade with locking valve marker lid flush with finish grade.

G. Quick-Coupling Valves:
   1. Install using 3/4 inch flexible lateral with galvanized elbow and riser. Locations as indicated.

H. Backflow Preventers:
   1. Install assembly complete for sprinkler systems with 2 drain valves and 2 shut off valves per local Laws and Regulations, and manufacturer's specifications.
   2. In below grade installations install assemblies with drain valves. Provide open box floor with gravel drain sump.

I. Valve Access Boxes:
   1. Install over all remote control valves, manual control valves, zone shutoff valves, gate valves or globe valves. Valves to be installed using valve markers will not require access boxes.
   2. Install boxes on level Subgrade to proper grade and proper drainage.
   3. Provide boxes with proper length and size extensions.

J. Automatic Controller:
   1. Mount the panel enclosure so adjustments can be conveniently made by the operator.
   2. Ground controller per local Laws and Regulations.
   3. Make all control wire connections to automatic controllers.
   4. Coordinate controller installation with electrical work.

K. Wire and Electrical Work:
   1. Use electrical control and ground wire suitable for sprinkler control cable of size indicated.

L. Sprinkler Heads, Emitters, Bubblers, Small Rotators (less than 10 gallons per minute).
   1. Install with flexible lateral and spiral barged PVC elbows and riser (length as required).
   2. Install shrub spray heads a minimum of 12 inches above finished grade of plantings.
   3. Install tree bubblers 1/2 inch below crown of tree roots.
   4. Flush circuit lines thoroughly. Remove all foreign materials prior sprinkler head installation.

M. Large Rotator Heads (10 gallons per minute or more): Install pressurized swings joints with O-ring seals.

N. Swivel Hose Elbows:
   1. Install brass swivel hose elbows, accurately machined pipe with hose threads and "O" ring seals.

3.3 BACKFILLING OPERATION

A. Section 31 23 24.

B. Backfill to 6 inches above pipe with soil free of rocks over 1 inch diameter, debris, or organic matter. Backfill final 4 inches with soil of like quality to adjacent areas.

C. Compact backfilled Trenches thoroughly to prevent settling damage to grades or plant materials. Repair at no additional cost to Vernal City.

D. Piping may be tested in sections to expedite backfilling.

3.4 SURFACE RESTORATIONS

A. Protect existing landscaping.

B. Refer to Sections 32 92 00 and 32 93 13. Replace damaged plants and lawn areas with new to match existing.

END OF SECTION

SECTION 32 91 19
LANDSCAPE GRADING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Landscaping grading requirements.

B. Backfill materials.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
   1. Subgrade material, and
   2. Each type of fill to be used.

B. Upon Vernal City representative's request, submit a written quality control Inspections and testing report describing source and field quality control activities performed by the CONTRACTOR and its Suppliers.

1.4 QUALITY ASSURANCE

A. Do not change material sources, or aggregate without the Vernal City representative's knowledge.

B. Reject backfill material that does not comply with requirements specified in this section.

C. Landscape grading is aesthetic by nature and subject to continual monitoring and modification during the backfilling process. Work closely with the Vernal City representative particularly when grading and construction berms, channels, or other aesthetic considerations.

1.5 STORAGE

A. Safely stockpile backfill materials.

B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

C. Avoid displacement of and injury to Work while compacting or operating equipment.

D. Movement of construction machinery over Work at any stage of construction is solely at the risk of the CONTRACTOR.

1.6 SITE CONDITIONS

A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to Vernal City.

B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.

C. Reshape and compact damaged structural section to required density.

1.7 ACCEPTANCE

A. Native material may be wasted if there is no additional cost to substitute material acceptable to the Vernal City representative.

B. For material acceptance refer to.
   1. Common fill, Section 31 05 13.
   2. Crushed aggregate base, Section 31 05 13.
   3. Cement treated fill, Section 31 05 15.

1.8 WARRANTY

A. Any settlement noted in landscaped surfaces will be considered to be caused by improper compaction methods and shall be corrected at no cost to Vernal City.

B. Restore incidentals damaged by settlement at no additional cost to Vernal City.

PART 2 — PRODUCTS

2.1 BACKFILL MATERIALS

A. Common fill, Section 31 05 13.

B. Crushed aggregate base, Section 31 05 13.

C. Cement treated fill, Section 31 05 15.

2.2 ACCESSORIES

A. Water: Make arrangements for sources of water during construction and make arrangements for delivery of water to site. Comply with local Laws and Regulations at no additional cost to Vernal City when securing water from water utility company.

PART 3 — EXECUTION

3.1 PREPARATION

A. Identify required line, levels, contours, and datum.

B. Stake and flag locations of underground utilities.

C. Upon discovery of unknown utility or concealed conditions, notify the Vernal City representative.

D. Verify stockpiled fill meets gradation requirements, areas to be backfilled are free of debris, snow, ice or water, and ground surface is not frozen.

E. If subgrade is not readily compactable secure written authorization for extra excavation and backfill. Refer to Section 31 23 16.

3.2 PROTECTION

A. Protect existing trees, shrubs, lawns, existing structures, fences, roads, sidewalks, paving, curb and gutter and other features.

B. Protect above or below grade utilities. Contact utility companies to repair damage to utilities. Pay all cost of repairs.

C. Protect Subgrade from desiccation, flooding and freezing.

D. Do not fill adjacent to structures until Excavation is checked by the Vernal City representative.

E. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-tressed or moved from alignment.

F. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in Trenches.

G. Restore any damaged structure to its original strength and condition.

3.3 LAYOUT

A. Maintain all benchmarks, control monuments and stakes, whether newly established by surveyor or previously existing. Protect from damage and dislocation.

B. If discrepancy is found between Contract Documents and site, the Vernal City representative shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to the CONTRACTOR or Vernal City.

3.4 GRADING

A. Grading Intent: Spot elevations and contours indicated are based on the best available data. The intent is to maintain constant slopes between spot elevations. If a spot elevation is determined to be in error, or the difference in elevation between points change, then the minimum percentage of slope as a result of field adjustment of specific spot elevations is as follows:
   1. Pavement Areas: 1 percent.
   2. Concrete or Brick Areas: 0.30 percent.
   3. Lawn or Planted Area: 0.75 percent.

B. Conduct Work in an orderly manner. Do not create a nuisance. Do not permit soil accumulation on streets or sidewalks. Do not allow soil to be washed into sewers and storm drains.

C. Grade slopes to provide adequate drainage after compaction. Do not create water pockets or ridges. Use all means necessary to prevent erosion of freshly graded areas during construction until surfaces have been constructed and landscaping areas have taken hold.

D. Remove surface stones greater than 1 inch from finished grading.

E. In planting areas, provide a finished grade that conforms to Section 32 92 00 and Section 32 93 13.

3.5 COMPACTION

A. Compact backfill, Section 31 05 13.

3.6 SURFACE RESTORATION

A. Restore paved surfaces, Section 32 01 18.

B. Finish landscaped surfaces with grass, Section 32 92 00 or with other ground cover, Section 32 93 13.
   1. Backfill areas to contours and elevations indicated. Do not use frozen materials.
   2. Make smooth changes in grade. Blend slopes into level areas.
   3. Remove surplus backfill materials from site.
   4. Leave stockpile areas completely free of excess fill materials.
   5. Slope grade away from building at a minimum of 3 inches in 10 feet unless specified otherwise.

3.7 CLEANING

A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Seed and sod requirements.

B. Soil preparation and fertilizers.

1.2 REFERENCES

A. FS O-F-241: Fertilizers, Mixed, Commercial.

B. ASPA: Guideline Specifications for Sodding.

1.3 SUBMITTALS

A. Submit name of sod Supplier or location.

B. Submit laboratory analysis of top soil, if requested by the Vernal City representative.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date and location of packaging. Damaged packages are not acceptable.

B. Strip sod no more than 24 hours prior to laying.
   1. During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling. During dry weather, protect sod from drying before installation. Water as necessary to insure vitality and to prevent excess loss of soil in handling. Sod which dries out before installation will be rejected.
   2. Do not deliver small, irregular or broken pieces of sod.

C. Deliver fertilizer in containers showing weight, chemical analysis, and name of manufacturer. Store fertilizer in a weatherproof location.

PART 2 — PRODUCTS

2.1 SEED

A. Furnish grass seed that is fresh, clean, and new crop composed of varieties indicated and tested to have minimum of 90 percent purity and minimum of 80 percent germination.

B. Use seed that conforms to applicable Laws and Regulations.

C. Do not use wet, moldy or otherwise damaged seed.

2.2 SOD

A. Obtain all shipments of sod from approved sources.
   1. Sod must be grown from certified, high quality, seed, either from new seed planting or from over-seed planting. Sod re-grown from rhizomes only is not acceptable.
      a. Assure satisfactory genetic identity and purity.

B. Mowed regularly and carefully maintained from planting to harvest to assure reasonable quality and uniformity.

C. Free of grassy and broadleaf weeds, and bare or burned spots.
   1. Assure over-all high quality and freedom from noxious weeds or an excessive amount of other crop and weedy plants at time of harvest.

D. Clean, strongly rooted sod of variety indicated.
   1. Sod shall be composed of three varieties minimum of Kentucky Bluegrass and be 180 days old minimum when cut.

E. Cut sod in pieces not exceeding 1 square yard. Limit depth of cut to ½ inch minimum and 1 inch maximum.

2.3 TOP SOIL

A. Section 31 05 13.

2.4 ACCESSORIES

A. Fertilizer: Uniform in composition, dry and free flowing. Comply with FS O-F-241. Provide nutrients required by soil analysis.

B. Mulching Material: Wood or wood cellulose fiber free of growth or germination inhibiting ingredients.

PART 3 — EXECUTION

3.1 PREPARATION

A. Protect existing underground improvements from damage.

B. Do not place turf and grasses until existing weeds have been removed and soil has been prepared.

C. Do not sow immediately following rain, when ground is too dry, too hard, or during windy periods without first loosening the surface.

3.2 GRADING

A. Establish finished grades after settling to provide adequate drainage so no water pockets or ridges will be created.

B. Till soil to a depth of 4 inches and remove rocks and debris over 2 inches diameter and any vegetation and weeds. Fine grade entire site to a smooth, loose, and uniform surface. Use native or approved imported topsoil and plant after proper preparation.

C. When Subgrade has been established, roll areas to remove ridges and depressions so surface is parallel with finished grade. Limit weight of rolling equipment to 110 pounds minimum or 250 pounds maximum per square foot.

D. Site tolerances.
   1. Total topsoil depth for lawns or grasses: 5 inches.
   2. Elevation of topsoil relative to walks, hard surfaces or edges.
      a. Seed Areas: 1/2 inch below.
      b. Sod Areas: 1-1/2 inch below.
   3. Slope away from building 5 percent for 10 feet minimum. Fill low spots and pockets. High point of finish grade shall be at least 6 inches below finish floor level.

3.3 FERTILIZING

A. Apply fertilizer in formulation and quantity required by soil analysis.

B. Apply after fine grading and mix thoroughly into upper 2 inches of topsoil.

C. Do not apply grass seed and fertilizer at same time in same machine unless one step hydro seeding is used.

D. Lightly water to aid breakdown of fertilizer and to provide moist soil for seed.

3.4 SEEDING

A. Unless indicated otherwise, apply seed at a rate of 5 pounds per 1,000 square feet evenly in 2 intersecting directions. Rake in lightly.

B. Apply fine spray water immediately after each area has been sown.

3.5 ONE STEP HYDRO SEEDING

A. Unless indicated otherwise, on lawn areas apply seed at the rate of 5 pounds per 1,000 square feet and fertilizer at the rate of 15 pounds per 1,000 square feet of area.

B. Mix the seed and fertilizer with a specially prepared dyed wood cellulose fiber and water to form a slurry.

C. Mix the slurry in tanks having continuous agitation so that a homogenous mixture is discharged hydraulically on the area to be seeded.

D. Apply the wood fiber mulch in suspension at a rate of 2,000 pounds per acre or as indicated otherwise.

3.6 TWO STEP HYDRO SEEDING

A. Make soil surface smooth, loose and of uniformly fine texture prior to seeding. Do not prepare more ground than can be seeded in a work day period.

B. Mix fertilizer at a rate of 15 pounds per 1,000 square feet, with wood fiber mulch and water to form a slurry.

C. Maintain a well mixed fertilizer slurry in the mix tank.

D. Spray the fertilizer mixture at the rate of 2,000 pounds per acre.

E. Sow seed on fertilized areas at the rate of 5 pounds per 1,000 square feet of area, in 2 directions with a cyclone seeder or other approved mechanical seeder.

3.7 SEED PROTECTION ON SLOPES

A. Blankets: Section 31 25 00.

3.8 LAYING SOD

A. Maintain the sod moist, live, and in good condition to encourage immediate growth.

B. Comply with ASPA guidelines for sodding.
   1. Lay sod during growing season. Sodding during dry summer period, at freezing temperatures, or over frozen soil is not acceptable.
   2. Lay sod in rows with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife.
   3. Lay sod flush with adjoining existing sodded surfaces.

C. Lay the sod on smooth, moist topsoil, working off planks if required. Rake topsoil to loosen and level prior to placing each course of sod. Ensure that sod is not stretched or overlapped and that all joints are butted tight. Place sod to break joints on ends. Keep length seams in a straight line.

D. Roll sod immediately after placing. Thoroughly water with a fine spray to a depth sufficient that the underside of the new sod and soil immediately below the sod are thoroughly wet.
   1. Repair and re-roll areas with depressions, lumps or other irregularities. Heavy rolling to correct irregularities in grade will not be permitted.

E. On slopes 2 horizontal to 1 vertical and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at 2 feet maximum on center. Drive pegs flush with soil portion of sod.

F. Sodded areas will be accepted at final inspection if
   1. Sodded areas are properly established.
   2. Sod is free of bare and dead spots and without weeds.
   3. No surface soil is visible when grass has been cut to height of 2 inches.
   4. Sodded areas have been mowed a minimum of twice.

3.9 RESTORATION

A. Restore Pavement, concrete, grassed areas, planted areas, and other improvements damaged during execution of work of this section to a condition equal to original conditions.

3.10 MAINTENANCE

A. Section 32 01 90.

B. Remove from site foreign materials collected during cultivation.

C. Dispose of cleanings.

END OF SECTION

SECTION 32 93 13
GROUND COVER

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Plants, and ground cover requirements.

B. Bedding, topsoil, and temporary support.

1.2 REFERENCES

A. AAN: American Associations of Nurserymen, Inc.

B. ANSI Z60.1: American Standard for Nursery Stock.

C. FS O-F-241: Fertilizers, Mixed Commercial.

1.3 QUALITY ASSURANCE

A. Perform work in conformity with applicable requirements of AAN.

B. Obtain nursery stock and other plant materials from acceptable sources prior to order and delivery.
   1. Provide plant materials from licensed nursery or grower.

C. Provide plants free of disease and insects.

1.4 SUBMITTALS

A. Prior to planting submit samples of fertilizers and a complete listing of all plantings, origins and sizes.

B. All necessary inspection certificates for each shipment of plants as required by Laws and Regulations.

C. Schedule of planting times.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Exercise care in digging, transporting, handling, and packing of all plants.
   1. Deliver healthy and vigorous plant materials.
   2. Do not prune before delivery.
   3. Protect bark, branches and root systems from sun scald, drying, sweating, whipping and other handling and tying damage.
   4. Do not bend or bind-tie shrubs in such a manner as to destroy natural shape.
   5. Provide protective covering during delivery.

B. Handle plants so roots are protected at all times. If delivery is in open vehicles, cover entire load without causing over heating.

C. Deliver plant materials immediately prior to placement. Keep plant materials moist.
   1. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
   2. Do not remove container-grown stock from containers before time of planting.
   3. Water root systems of trees and shrubs stored on site with fine mist spray. Water as often as necessary to maintain root systems in moist condition.

D. Protect balls from sun and wind by covering with soil or other suitable material if not planted immediately on

delivery.

E. Store fertilizer in a weatherproof location such that its effectiveness will not be impaired.

1.6 ACCEPTANCE

A. Ball of earth surrounding roots has not been cracked or broken.

B. Burlap, staves, and ropes required in connection with transplanting are installed.

C. Heeled in stock from cold storage not accepted.

1.7 WARRANTY

A. Warrant plantings through one year plus one continuous growing season. Replace any unsatisfactory or dead plantings within 10 days of written notice. Make corrections at no additional cost to Vernal City.

PART 2 — PRODUCTS

2.1 GENERAL

A. Provide plants of normal growth and uniform height, according to species, with straight canes and well developed leaders, roots, and tops.
   1. Conform to requirements of Plant List and Key on Drawings and to ANSI Z60.1
   2. Nomenclature - Plant names used in Plant List conform to 'Standardized Plant Names' by the American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of 10 percent minimum of each species delivered to site.
   3. Plant materials shall be symmetrical or typical for variety ans species and conform to measurements specified in Plant List.
   4. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3 height.

B. Provide plants of sizes indicated, Size stated in each case being interpreted to mean dimensions of plant as to stands in its natural position in nursery without straightening of any branches or leaders.
   1. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Drawings or Plant List.
   2. Measurement should be average of plant, not greatest diameter. For example, plant measuring 15 inches in widest direction and 9 inches in narrowest would be classified as 12 in stock.
   3. Plants properly trimmed and transplanted should measure the same in every direction.
   4. Plant materials larger than those specified may be supplied, with prior written approval of the VERNAL CITY REPRESENTATIVE and:
      a. If complying with Contract Document requirements in all other respects.
      b. If at no additional cost to Vernal City.
      c. If sizes of roots or balls are increased proportionately.

C. Provide legible labels attached to all plants, specimens, bundles, boxes, bales, or other containers indicating botanical genus, species, and size of each.

D. Plants cut back from larger sizes to meet Specifications shall be rejected.

E. Container growth deciduous shrubs will be acceptable in lieu of bailed and burlapped deciduous shrubs subject to limitations for container grown stock.

2.2 NATIVE GRASSES AND WILDFLOWERS

A. Mixture: 77 percent Festuca ovina duriuscula (Hard Fescue) and 23% Wildflower seeds of equal proportioned

quantities of the following, Aster alpinus (Alpine Aster), Campanual carpatica 'Jacqueline' (Bluebells), Coreopsis grandiflora 'Sunray' (Dwarf Coreopsis), Eschschlzia californica (California Poppy), linum Lewisii (Blue Flax), Primula (While Primrose), Tagetes (Marigold), Viguiera Multiflora (Showy golden eye).

B. Purity of all seed types: 90 percent.

C. Germination of all seed types: 90 percent.

2.3 ORGANIC MULCH

A. Horticultural grade Class A decomposed plant material, elastic and homogeneous, free of decomposed colloidal residue, wood sulphur, and iron.

B. pH value of 5.5 to 7.5.

C. 60 percent organic matter by weight, moisture content not exceeding 15 percent, and water absorption capacity of not less than 300 percent by weight on oven dry basis.

2.4 ACCESSORIES

A. Fertilizer: Comply with FS O-F-241. Provide nutrients required by soil analysis. The fertilizer will be uniform in composition, dry and free flowing.

B. Wrapping Materials: Quality burlap tightly tied around plant root system.

C. Weed Barrier:
1. Dewitt PRO-5 Weed Barrier
2. Equal as approved by the Vernal City representative before bidding.

D. Pre-Emergent Herbicide:
1. Elanco XL
2. Ronstar
3. Surflan

E. Bark or Wood Top Dressing Mulch
1. ‘Walk-on-Bark’ Fir Bark
2. Medium or large size Redwood bark.
3. Shredded pine bark.
4. Shredded Cedar

F. Planting Tablets
1. 21 gram Agriform 20-10-5

PART 3 — EXECUTION

3.1 PREPARATION

A. Plan to install materials during normal planting seasons for each type of landscape work required. Correlate planting time with specified maintenance periods and guarantee.

B. Verify area to receive plants is to grade, all work is completed in the area, and that topsoil has been placed. Follow Section 31 23 23grading requirements.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Examine grade, verify elevations, observe conditions under which work is to be performed, and notify the Vernal City representative of unsatisfactory conditions.

E. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and Site to the Vernal City representative before proceeding with work of this Section.

F. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Drawings. All planting indicated on Drawings is required unless indicated otherwise.

3.2 GRADING

A. Site tolerances.
   1. 12 inches minimum total topsoil depth.
      a. Do not use excavated materials for topsoil unless excavated material meets topsoil specifications of Section 31 23 24
   2. 2 inches below walks, hard surfaces or edges.

B. Do not expose or damage existing shrub or tree roots.

C. Slope landscape away from building for 12 feet minimum at ½ inch per foot minimum. Fill low spots and pockets. High point of finish grade shall be at least 6 inches below finish floor level.

3.3 INSTALLATION

A. Place plant materials for orientation approval by the Vernal City representative prior to installation.

B. Set all shrubs slightly lower than finished grade. Use plant mix consisting of 3 parts topsoil and 1 part organic mulch. Do not fill around stems. Carefully place and tamp plant mix soil to fill all voids.

C. Spread excess soil from excavated plant pits in surrounding planting beds.

D. Sow seed at the rate of 78 pounds per acre. Rake seed into soil and top-dress all seeded areas with 1/4 inch topsoil. Do not let seed installation be subject to damage by climatic conditions.

E. Restore Pavements, grassed areas, planted areas, and other improvements damaged to a condition equal to original conditions.

F. Excavation:
   1. If underground construction work or obstructions are encountered in excavation of planting holes, the Vernal City representative will select alternate locations.
   2. Plant Excavation Size:
      a. Diameter - Three times the diameter of the root ball or container, minimum.
      b. Depth - 4 inches below root ball depth.
   3. Unless excavated material meets topsoil requirements of section 31 05 13, remove from landscape areas and do not use for landscaping purposes.
   4. Roughen sides and bottoms of excavations.
   5. Fill holes to receive shrubs with tamped planting mix sufficient to bring plant to proper elevations after watering and settling.

G. Planting:
   1. Before planting, fill hole with water and verify that water drains away within two hours. Inform the Vernal City representative in writing if water does not drain properly. Do not plant trees or shrubs in holes that do not properly drain.
   2. Removing Binders and Containers:
      a. Remove wire basket, burlap, plastic and twine binders from around root ball.
      b. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.
   3. Plant immediately after removing binding material and containers. Place shrubs in holes so, after watering and settling, top of root ball shall be approximately one inch higher than finished grade.
   4. Properly cut off broken or frayed roots.

5. Center plant in hole and backfill with specified planting mix. Except in heavy clay soils, make ring of mounded soil around hole's perimeter to form watering basin.
6. Add planting tablets in plant pit as follows. Place tablets in relation to root ball as recommended by Manufacturer.
   a. One Gallon Shrub - 1 Tablet
   b. 5 Gallon Shrub - 3 Tablets
7. Settle by firming and watering to bring top of ball down to one inch higher than surrounding soil.
8. Do not use muddy soil for backfilling.
9. Thoroughly water trees and shrubs immediately after planting.
10. At base of each tree, leave 36 inch diameter circle free of any grass.

H. Post Planting Weed Control:
1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
2. Areas shall be free of existing weed growth prior to application of herbicide.

I. Weed Barrier Fabric:
1. After planting and application or herbicide in shrub beds, apply covering of specified weed barrier fabric with fuzzy side down.
2. Achieve 100 percent coverage over ground areas.
3. Overlap 6 inches minimum.

J. Mulching:
1. After application of herbicide, mulch shrub and ground cover planting areas with 2 inch deep layer of specified top dressing mulch.
2. Cover grass-free area at tree bases with weed barrier and 2 inches of top dressing mulch.
3. Place top dressing mulch to uniform depth and rake to neat finished appearance.

3.4 FERTILIZING SEEDED AREAS

A. Apply fertilizer in formulation and quantity required by soil analysis.

B. Apply after fine grading and mix thoroughly into upper 2 inches of topsoil.

C. Do not apply seed and fertilizer at same time in same machine unless one step hydro seeding is used.

D. Lightly water to aid breakdown of fertilizer and to provide moist soil for seed.

3.5 CLEANING AND MAINTENANCE

A. Section 32 01 90.

B. Remove from site foreign materials collected during cultivation.

C. Dispose of cleanings.

D. Provide written instructions covering maintenance requirements by Vernal City for the first 60 days of guarantee period beyond Contract maintenance period.

END OF SECTION

SECTION 32 93 43
TREE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Supply and install tree.

B. Site preparation and backfill requirements.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. American Public Works Associations (Utah Chapter).

B. American National Standards Institute.
1. A300: Tree, Shrub and Other Woody Plant Maintenance Practices.
2. Z60.1: American Standard for Nursery Stock.

C. International Society of Arboriculture. (ISA).

1.4 SUBMITTALS

A. Copy of the notice to property owner from the CONTRACTOR. Format to be substantially as follows:

NOTICE TO PROPERTY OWNER
Your new tree is a: (*Name of tree*)
How to take care of your new tree.
- Water thoroughly once ever seven to ten days during the spring, summer and fall for at least 2 years. Put your hose by the base of the tree and run water gently for about 20 minutes. Then as tree matures, water at the drip line (straight down under the tips of the branches) every 3 to 4 weeks.
- Do not fertilize until second year and only then if needed.
- Do not use weed killer near new trees.
- Protect new tree from damage by cars, lawn mowers, grass trimmers, bikes, vandals, etc.
- Maintain a mulch cover at the base of the new tree.

1.5 QUALITY ASSURANCE

A. Provide an ISA certified arborist to observe tree planting. Upon the Vernal City representative's request, provide a copy of the arborist's ISA certificate and registration number on file with the State Division of Commercial Code.

B. Nursery: Use a company specializing in growing and cultivating trees with minimum 3 years experience.

C. Installer: Use a company specializing in installing and planting trees.

D. Planting Plan: Correlate planting time with specified maintenance periods and guarantee.

E. Rejection: Reject any tree upon the following basis.
1. Tree has cracked or broken ball of earth surrounding roots preparatory to or during process of planting.
2. Tree was cut back from a larger plant to meet Specifications.
3. Tree is not the specified size.
4. Tree has been pruned improperly.
5. Tree has disease or insect infestations.
6. Tree was damaged during transplant.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Exercise care in digging, transporting, handling, and packing of all plants.
1. Deliver healthy and vigorous plant materials.
2. Do not prune before delivery.
3. Protect bark, branches and root systems from sun scald, drying, sweating, whipping and other handling and tying damage.
4. Do not bend or bind-tie trees in such a manner as to destroy natural shape.
5. Provide protective covering during delivery.

B. Handle plants so roots are protected at all times. If delivery is in open vehicles, cover entire load without causing over heating.

C. Deliver plant materials immediately prior to placement. Keep plant materials moist.
1. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of trees stored on site with fine mist spray. Water as often as necessary to maintain root systems in moist condition.

D. Protect balls from sun and wind by covering with soil or other suitable material if not planted immediately on delivery.

1.7 ACCEPTANCE

A. Tree will be accepted not less than 60 days after planting, watering and successful growth.

1.8 WARRANTY

A. Warrant tree planting through one year plus one continuous growing season. Include coverage of trees from death, unhealthy conditions, or if tree dies from poor planting practice. Replace any unsatisfactory or dead tree within 10 days of written notice.

B. Replacements: Provide tree of same size and species, planted in the next growing season, with a new warranty commencing on date of planting.

C. Additional Cost: All corrective work will be at no additional cost to Vernal City.

1.9 MAINTENANCE

A. Period is until acceptance.

B. Maintain tree health immediately after placement.

C. Notify property owner of tree watering practice.

D. Trim off dead or broken branches. Remove clippings and dead branches from the site.

E. Control disease.

PART 2 — PRODUCTS

2.1 GENERAL

A. Provide plants of normal growth and uniform height, according to species, with straight canes and well developed leaders, roots, and tops.
   1. Conform to requirements of Plant List and Key on Drawings and to ANSI Z60.1
   2. Nomenclature - Plant names used in Plant List conform to 'Standardized Plant Names' by the American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of 10 percent minimum of each species delivered to site.
   3. Plant materials shall be symmetrical or typical for variety ans species and conform to measurements specified in Plant List.
   4. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3 height.

B. Provide plants of sizes indicated, Size stated in each case being interpreted to mean dimensions of plant as to stands in its natural position in nursery without straightening of any branches or leaders.
   1. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Drawings or Plant List.
   2. Measurement should be average of plant, not greatest diameter. For example, plant measuring 15 inches in widest direction and 9 inches in narrowest would be classified as 12 in stock.
   3. Plants properly trimmed and transplanted should measure the same in every direction.
   4. Plant materials larger than those specified may be supplied, with prior written approval of the the Vernal City representative and:
      a. If complying with Contract Document requirements in all other respects.
      b. If at no additional cost to Vernal City
      c. If sizes of roots or balls are increased proportionately.
   5. Measure caliper of trees 6 inches above surface of the ground

C. Provide legible labels attached to all plants, specimens, bundles, boxes, bales, or other containers indicating botanical genus, species, and size of each.

D. Plants cut back from larger sizes to meet Specifications shall be rejected.

E. Container growth deciduous shrubs will be acceptable in lieu of bailed and burlapped deciduous shrubs subject to limitations for container grown stock.

2.2 TREE MATERIALS

A. Species and size specified, grown in climatic conditions similar to those in locality of the Work with branching configuration and cane requirements indicated in ANSI Z60.1.

B. Provide tree of normal growth and uniform height, according to species, with straight trunk and well developed leaders, laterals and roots. Heeled in stock from cold storage not accepted.

C. Provide tree size indicated, Size being interpreted to mean dimension of tree as its stand in its natural position in nursery without straightening of any branches or leaders.

D. Provide legible labels attached to tree indicating botanical genus, species, and size.

2.3 SOILS

A. Backfill of Root Ball Pit: Native soil if not excessively rocky, compactable or clayey; otherwise amend at a rate of 2 parts native soil to 1 part topsoil. Mix together thoroughly.

B. Topsoil: Section 31 05 13.

2.4 ORGANIC MULCH

A. Horticultural grade class A decomposed plant material, elastic and monogenous, free of decomposed colloidal residue, wood sulphur, and iron.

B. pH value of 5.5 to 7.5.

C. 60 percent organic matter by weight, moisture content not exceeding 15 percent, and water absorption capacity of not less than 300 percent by weight on oven dry basis.

PART 3 — EXECUTION

3.1 PREPARATION

A. Plan to install materials during normal planting season.

B. Verify area to receive plants is to grade, all work is completed in the area, and that topsoil has been placed. Follow Section 31 23 23grading requirements.

C. Notify the vernal City representative of unsatisfactory conditions.

D. Do not proceed with work until unsatisfactory conditions have been corrected.

E. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and Site to the Vernal City representative before proceeding with work of this Section.

F. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Drawings. All planting indicated on Drawings is required unless indicated otherwise.

3.2 EXCAVATION

A. Excavate 12" min. below depth of root ball.
   1. After tree planting holes are excavated to proper depth, auger 8 inch diameter hole 6 feet deep in center of each excavation and fill with tamped planting mix.
   2. If underground construction work or obstructions are encountered in excavation of planting holes, the Vernal City representative will select alternate locations.
   3. Unless excavated material meets topsoil requirements of section 31 05 13, remove from landscape areas and do not use for landscaping purposes.
   4. Roughen sides and bottoms of excavations.
   5. Fill holes to receive shrubs with tamped planting mix sufficient to bring plant to proper elevations after watering and settling.

B. In park strips adjacent to paved thoroughfares, the traditional round hole barely big enough to accommodate the root ball is not permitted. Excavate the site in the shape of a rectangle. Make excavated area width at least twice the diameter of the tree root ball and the length at least 3 times the diameter.
   1. Compact both sides of the planting site that are parallel to the street.
   2. Loosen the sides of the planting site that are perpendicular to the street.

C. In other landscaped areas, excavated area for tree planting at least 3 times the diameter of the root ball.

D. Place plant materials for final orientation review by the Vernal City representative prior to backfilling the root ball.

3.3 INSTALLATION

A. Remove wire baskets and twine from around root ball. If possible, remove all burlap material, or remove top 1/3

from root ball.

B. Maintain plant in vertical position. Eliminate voids and air pockets.

C. Remove all cardboard and twine from tree trunks.
   1. Remove wire basket, burlap, plastic and twine binders from around root ball.
   2. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.

D. Follow arborist's instructions.
   1. Place plant materials for orientation approval by VERNAL CITY REPRESENTATIVE prior to installation.
   2. Before planting, fill hole with water and verify that water drains away within two hours. Inform VERNAL CITY REPRESENTATIVE in writing if water does not drain properly. Do not plant trees or shrubs in holes that do not properly drain
   3. Plant immediately after removing binding material and containers. Place shrubs in holes so, after watering and settling, top of root ball shall be approximately one inch higher than finished grade.
   4. Properly cut off broken or frayed roots.
   5. Center plant in hole and backfill with specified planting mix. Except in heavy clay soils, make ring of mounded soil around hole's perimeter to form watering basin.
   6. Add planting tablets in plant pit as follows. Place tablets in relation to root ball as recommended by Manufacturer.
      1. 5 Gallon Tree - 3 Tablets
      2. 15 Gallon Tree - 4 Tablets
      3. 24 inch Box Tree - 6 Tablets
   7. Settle by firming and watering to bring top of ball down to one inch higher than surrounding soil.
   8. Do not use muddy soil for backfilling.
   9. Thoroughly water trees and shrubs immediately after planting.
   10. At base of each tree, leave 36 inch diameter circle free of any grass.

E. Restore Pavements, grassed areas, planted areas, and other improvements damaged to a condition equal to original conditions.

3.4 PRUNING

A. Comply with ANSI A300 and directions of arborist.

3.5 PROTECTION

A. Do not touch directly or indirectly any overhead wire, cable, or power line.

B. Shelter the root ball. Do not let the root ball dry out.

C. Do not damage any irrigation line or emitter system.

D. Do not lift or maneuver the tree by the trunk.

E. Do no add gravel to the bottom of the hole.

F. Do not stake the tree unless carefully monitored by the Vernal City representative.

G. Do not compact the backfill.

H. Do not use grass clippings as mulch.

I. Do not over water, under water, over prune, paint or wrap the trunk, or fertilize during planting.

J. Do not forget to watch for people using the street or sidewalk while planting.

K. Do not over prune.

L. Do not allow grass, flowers, or vines to grow next to the trunk.

M. Protect roots and branches of existing trees.

N. Do not permit heavy equipment or stockpiling of materials or debris within the drip line. Do not permit earth surface within the drip line to be changed in any way except as specified.

O. Replace existing trees damaged by construction operations at no additional cost to Vernal City.

END OF SECTION

Division 33

Utilities

SECTION 33 05 01
ACRYLONITRILE-BUTADIENE-STYRENE (ABS) PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. ABS Pipe, fittings and joint materials.

B. Related work includes but is not limited to,
   1. Excavation, Section 31 23 16.
   2. Trench backfill, Section 31 23 24.
   3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
   4. Pavement restoration, Section 31 01 18.

1.2 REFERENCES

A. ASTM C 443: Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

B. ASTM D 1527: Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.

C. ASTM D 1788: Standard Specification for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Plastics.

D. ASTM D 2235: Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Stryene (ABS) Plastic Pipe and Fittings.

E. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

F. ASTM D 2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

G. ASTM D 2468: Standard Specification for Acrylonitrile-Butadiene-Stryene (ABS) Plastic Pipe Fittings, Schedule 40.

H. ASTM D 2469: Standard Specifications for Acrylonitrile-Butadiene-Stryene (ABS) Plastic Pipe Fittings, Schedule 80.

I. ASTM D 2680: Standard Specification for Acrylonitrile-Butadiene-Stryene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.

J. ASTM D 2751: Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

K. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.

PART 2 — PRODUCTS

2.1 GRAVITY PIPE SYSTEMS

A. Material: Rigid ABS plastic conforming to ASTM D 1788 and based on short term tests.
   1. Type I, Grade 1, cell (322).
   2. Type IV, Grade 1, cell (133).

B. Pipe: ASTM D 2751 for 2 inches to 12 inches ABS pipe and ASTM D 2680 for 8 inches to 15 inches ABS composite sewer pipe.

C. Fittings, ASTM D 2751.

D. Joints: Bell and spigot with solvent cement which complies with ASTM D 2235 or mechanical-seal joint with gasket complying to ASTM C 443.

E. Flattening: No evidence of splitting, cracking, or breaking, ASTM D 2412.

2.2 PRESSURE PIPE SYSTEMS

A. Material: Rigid ABS, ASTM D 1788 and based on short-term tests.
   1. Type I, Grade 2, cell (522).
   2. Type I, Grade 3, cell (355).
   3. Type II, Grade 1, cell (445).

B. Pipe: ASTM D 1527 for 1/8 inch to 12 inch pipe for schedule 40 or 80 sizes and pressure rating as indicated.

C. Joints:
   1. Socket type with Iron Pipe Size (IPS) outside diameter, ASTM D 2468 for Schedule 40 pipe and ASTM D 2469 for Schedule 80 pipe.
   2. Bell and spigot with solvent cement, ASTM D 2235 or mechanical-seal joint with gasket, ASTM C 443.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install pipe per manufacturer's instructions, ASTM D 2321 for gravity pipe systems, ASTM D 2774 for pressure pipe systems.

B. Water distribution and transmission, Section 33 11 00.

C. Gravity water systems, Section 33 31 00 or Section 33 41 00.

D. Irrigation System, Section 32 84 23.

END OF SECTION

SECTION 33 05 02
CONCRETE PIPE AND CULVERT

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Reinforced and non-reinforced concrete pipe and culvert, fittings and joint materials.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24 .
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. ASTM C 14: Standard Specification for Concrete Sewer, Storm Drain, Culvert Pipe.

B. ASTM C 76: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

C. ASTM C 118: Standard Specification for Concrete Pipe for Irrigation or Drainage.

D. ASTM C 150: Standard Specification for Portland Cement.

E. ASTM C 361: Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.

F. ASTM C 412: Standard Specification for Concrete Drain Tile.

G. ASTM C 443: Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

H. ASTM C 444: Standard Specification for Perforated Concrete Pipe.

I. ASTM C 497: Standard Methods of Testing Concrete Pipe, Sections, or Tile.

J. ASTM C 505: Standard Specification for Non-Reinforced Concrete Irrigation Pipe with Rubber Gasket Joints.

K. ASTM C 507: Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.

L. ASTM C 654: Standard Specification for Porous Concrete Pipe.

M. ASTM C 655: Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe.

N. ASTM C 985: Standard Specification for Non-reinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe.

O. ASTM C 1433: Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

P. ASTM C 1479: Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.

Q. ASTM C 1504: Standard Specification for Manufacture of Precast Reinforced Concrete 3 Sided Structures for Culverts and Storm Drains.

R. AWWA C302: AWWA Standard for Reinforced Concrete Pressure Pipe, Non-cylinder Type, for Water and

Other Liquids.

1.3 SUBMITTALS

A. Precast box culvert design summary.

B. Manufacturer's proof of certification.

1.4 QUALITY ASSURANCE

A. Manufacture: Certified per Section 03 40 00.

B. Transporter: Acceptable to manufacturer.

PART 2 — PRODUCTS

2.1 PIPE AND FITTINGS

A. Provide type, class, strength and size of pipe and fittings indicated.

B. Concrete:
1. Use ASTM C 150 or C 1157 cement unless specified otherwise.
2. Admixtures and pozzolans may be used only with approval.

C. Gravity Pipe System:
1. Reinforced Concrete Pipe: ASTM C 76 or ASTM C 655.
2. Non-reinforced Pipe: ASTM C 14 in sizes up to 36" diameter and ASTM C 985 for pipe up to 60" diameter. Minimum pipe diameter for non-reinforced concrete pipe shall be 12".
3. Irrigation or Drainage Pipe: ASTM C 118 or ASTM C 505.
4. Drainage Tile: ASTM C 412.
5. Perforated Pipe: ASTM C 14 Type 1 Class 2 or ASTM C 444.
6. Elliptical Pipe: ASTM C 507.
7. Porous Concrete Pipe: ASTM C 654.
8. Perforated Concrete Pipe: ASTM C 444.
9. Precast Box Section: ASTM C 1433.
10. Three Sided Culvert: ASTM C 1504.

D. Low Head Pressure Pipe Systems: ASTM C 361 or AWWA C302.

2.2 JOINTS

A. Use ASTM C 443 rubber gasket bell and spigot type joints.

B. For box sections use tongue and groove joints with bituminous mastic joint sealant.

C. For elliptical sections use tongue and groove joints with bituminous mastic joint sealant.

D. Mortar: Portland cement.

2.3 SOURCE QUALITY CONTROL

A. Pipe and tile, ASTM C 497.

B. Box sections, ASTM C 1433.

C. Three sided culverts, ASTM C 1504.

PART 3 — EXECUTION

3.1 FACTORY FITTINGS

A. Fit all service tees and other miscellaneous fittings with an expanding plug.

B. Grout all fittings to provide a smooth interior and exterior surface.

C. When providing pipe or box sections specifically manufactured with branch connections, carefully shape and fit adjoining pieces to facilitate grouting. Grout all fittings to provide a smooth interior and exterior surface. Lateral pipe or sections shall not project beyond the inner surface of pipe.

D. Use Section 03 61 00 epoxy bonding compound as interface between new and existing concrete and piping materials.

3.2 INSTALLATION - PIPE AND FITTINGS

A. Install per ASTM C 1479 and manufacturer's instructions.

B. Place circular concrete pipe that contains elliptical reinforcing so that the reference lines designating the top of the pipes will not be more than 5 degrees from the vertical plane through the longitudinal axis of the pipe.

C. Water distribution and transmission, Section 33 12 19.

D. Gravity water systems, Section 33 31 00 or Section 33 41 00.

E. Irrigation System, Section 32 84 23.

3.3 INSTALLATION - BOX SECTIONS

A. Install per manufacturer’s instructions.

B. Provide a leveling course under box section. Use Sewer Rock unless specified otherwise.

C. Pull sections together using internal winches or tugger. Do not push box section together. Pushing causes joint misalignment.

D. Limit joint gap to maximum specified by manufacturer. Remove excess bituminous mastic joint sealant from box wall, floor, and ceiling.

END OF SECTION

SECTION 33 05 03
COPPER PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Copper pipe, couplings, fittings, and joint materials for buried water utility applications.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24 .
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. ASTM B 88: Standard Specification for Seamless Copper Water Tube.

B. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.

1.3 QUALITY ASSURANCE

A. Reject any pipe that does not conform to Contract Documents or is cracked, chipped, crushed, dented, kinked, or otherwise unacceptable.

PART 2 — PRODUCTS

2.1 PIPE

A. Type K copper, ASTM B 88 Table 3, "Dimension, Weight and Tolerances," and capable of connecting to AWWA standard water service taps and fittings.

B. Outside diameter greater than 2 inches requires acceptance by the Vernal City representative.

C. Smooth surface free from bumps, flexible enough to be coiled.

2.2 CONNECTIONS

A. Flared or compression.

B. Dielectric insulating unions for dissimilar connections.

C. Fittings, AWWA C800.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install pipe per manufacturer's instructions.

B. Water distribution and transmission, Section 33 11 00.

C. Irrigation System, Section 32 84 23.

END OF SECTION

SECTION 33 05 04
CORRUGATED METAL PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Corrugated metal pipe, fittings, and joining materials.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24.
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18

1.2 REFERENCES

A. AASHTO M 36: Standard Specification for Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

B. AASHTO M 167: Standard Specification for Structural Plate for Pipe, Pipe-Arches, and Arches.

C. AASHTO M 190: Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

D. AASHTO M 196: Standard Specification for Corrugated Aluminum Alloy Culverts and Underdrains.

E. AASHTO M 197: Standard Specification for Clad Aluminum Alloy Sheets for Culverts and Underdrains.

F. AASHTO M 218: Standard Specification for Zinc Coated (Galvanized) Steel Sheets For Culverts and Underdrains.

G. AASHTO M 219: Standard Specification for Aluminum Alloy Structural Plate for Field Bolted Conduits.

H. AASHTO M 245: Standard Specification for Precoated, Galvanized Steel Culverts and Underdrains.

I. AASHTO M 246: Standard Specification for Precoated Galvanized Steel Sheet For Culverts And Underdrains.

J. AASHTO M 274: Standard Specification for Steel Sheet, Aluminum-Coated (Type 2) by the Hot-Dip Process For Sewer And Drainage Pipe.

K. AASHTO M 289: Specification for Aluminum-Zinc Alloy Coated Sheet Steel for Corrugated Steel Pipe.

L. ASTM D 1187: Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

M. FS TT-P-636: Paint, Coating, Alkyd, Wood and Ferrous Metal.

1.3 DEFINITIONS

A. Nominal Diameter: Nominal diameter of metal pipe shall be from inside crest to inside crest of corrugations.

1.4 QUALITY ASSURANCE

A. Reject pipe and fittings that do not meet any of the requirements of this section including elliptical shaping; variation from a straight centerline; ragged edges; unevenly lined or spaced bolt holes; illegible brands, Abraided or scaled or broken spelter coatings; dents; bends in the metal; or uneven laps.

PART 2 — PRODUCTS

2.1 CORRUGATED PIPE

A. Corrugated Steel Pipe: AASHTO M 36 steel with AASHTO M 218 annular or helical corrugations using lap joints with riveted or spot welded seams, or with helical corrugations using continuous helical lock seams or ultra high-frequency resistance butt-welded seams.
   1. Type I: Circular Section.
   2. Type II: Noncircular Section.
   3. Type III: Underdrain With or Without Perforations.

B. Corrugated Aluminum Pipe: AASHTO M 196 or AASHTO M 197 pipe as applicable. Select type of pipe corrugations, unless indicated.

C. Gage:
   1. Circular Section Pipe: 16 minimum.
   2. Arch Pipe: 14 minimum.

2.2 STRUCTURAL PLATE PIPE

A. Galvanized Steel: Thickness, AASHTO M 167.

B. Aluminum Alloy: Gage and tolerances, values in AASHTO M 219.

C. Pitch and Depth of Corrugations: AASHTO M 167 or AASHTO M 219. Select pitch and depth unless indicated.

2.3 COUPLING BANDS

A. Same base metal and coating as the pipe, AASHTO M 36.

B. Provide circumferential and longitudinal strength to preserve the pipe alignment, to prevent separation of pipe, to prevent infiltration of site fill material and to provide water tight joints.

2.4 COATINGS AND LININGS

A. Zinc Coating: AASHTO M 218.

B. Galvanized Coating: AASHTO M 245.

C. Bituminous Coating and Lining:
   1. AASHTO M 190. Coating thickness to be 0.05 inch measured on the crest of the corrugations. Linings, a minimum coating of 1/8 inch thickness above the crest of each corrugation.
      a. Coating A. Fully bituminous coating.
      b. Coating B. Half bituminous coating with paved-invert lining.
      c. Coating C. Fully bituminous coating and paved-invert lining.
      d. Coating D. Fully bituminous coating and 100 percent lining.
   2. When fiber bonded bituminous coating is specified, embed fiber in the molten galvanizing before bituminous coating.

D. Polymer Coating: 10 mils thick minimum, AASHTO M 245 or AASHTO M 246.
   1. Coating A. One side polymeric coating.
   2. Coating B. Two side polymeric coating.

E. Aluminum Coating: AASHTO M 274.

F. Aluminum-Zinc Coating: AASHTO M 289.

2.5 FITTINGS AND ACCESSORIES

A. All fittings and bolts shall meet applicable specifications of the pipe being joined. Use accessories and gaskets recommended by manufacturer.

B. When providing pipe specifically manufactured with branch connections, extend fittings to but not beyond inner surface of pipe.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install pipe as per manufacturer's instructions.

B. Tighten joint bands evenly.

C. Install elliptical pipe so the major or minor axis coincides with the proposed pipe alignment.

D. Do not cut coated pipe with a welding torch.

E. Coat aluminum pipe to prevent direct contact with concrete with an ASTM D 1187 bituminous coating or an FS TT-P-636 zinc chromate primer.

3.2 REPAIR

A. Repair damaged coatings, Section 05 05 10.

END OF SECTION

SECTION 33 05 05
DUCTILE IRON PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Ductile iron pipe, couplings, fittings, and joint materials.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24 .
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. AWWA C104: American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

B. AWWA C110: American National Standard for Ductile-Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.

C. AWWA C111: American National Standard For Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

D. AWWA C115: American National Standard for Flanged Ductile-Iron and Gray Iron Pipe with Threaded Flanges.

E. AWWA C150: Thickness of Ductile Iron Pipe

F. AWWA C151: American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

G. AWWA C153: Compact Fittings for Water Services.

H. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

PART 2 — PRODUCTS

2.1 PIPE AND FITTINGS

A. General:
Ductile iron pipe and fittings shall be provided in accordance with AWWA C110, AWWA C150, AWWA C151 and AWWA C153. Minimum wall thickness shall be in accordance with the Pressure Class or Thickness Class shown on the drawings.

Unless otherwise specified, pipe and fittings shall be lined with asphaltic material as specified in AWWA C151

B. Buried Applications:
1. Class 52 or pressure class 350 psi ductile iron pipe, AWWA C151 with push-on joints, AWWA C111.
2. Cement lining for all pipe and fittings, AWWA C104.
3. Class 250 fittings, AWWA C110.
4. Coupler with mechanical joint fittings, AWWA C104, C110, and C111.
5. Rubber gasket slip-on pipe joints, AWWA C111 with gasket lubricant.
6. Bronze wedges with current capacity of 400 amps each for each joint as follows:

Pipe Diameter	*Number of Wedges*
Less than 10"	2
10"	3
12"	4
Greater than 12"	6

C. Above Ground Applications: As buried applications, except use bolted flanged fittings, AWWA C104, C110, and C115.

D. Connections:
Connections shall be push-on rubber gasket joints, restrained mechanical joints, or flanged joints as shown or specified on the drawings as follows:

1. Push-on and restrained Mechanical Joints: The plain ends of push-on pipe and mechanical joint pipe shall be marked with paint to show the required depth of penetration for making the joint.

   Mechanically restrained joints shall be designed to prohibit separation of the joint after installation. Internal restraints are not acceptable.

   Gasket stock shall be a synthetic rubber compound in which the elastomer is neoprene. The compound shall contain not less than 50 percent by volume neoprene and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall, in addition, comply with AWWA C111.

2. Flange Assemblies: Corrosion-resistant bolts and nuts for use with ductile iron joints are an acceptable substitute for alloyed bolts and nuts. Galvanized or cadmium-plated steel bolts and nuts are not acceptable substitutes for stainless steel.

E. Bell Joint Restraints:
Restraint devices for bell joints shall consist of a split ring installed on the spigot, which is connected by threaded bolts to a solid back-up ring seated behind the bell. The split restraint ring shall incorporate a series of machined serrations on the inside diameter to provide positive restraint, exact fit, and 360°contact and support of the pipe wall. The solid back-up ring shall have a beveled leading edge to assure exact fit behind the pipe bell. Restraint devices shall be ductile iron, ASTM A536 Grade 65-45-12. Connecting bolts shall be high strength, low alloy materials in accordance with AWWA C111.

2.2 COVERINGS

A. Buried Mechanical Joints: Grease and 8 mil vinyl wrap plastic cover.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install pipe per manufacturer's instructions and AWWA C600.

B. Water distribution and transmission, Section 33 11 00

C. Gravity water systems, Section 33 31 00 or Section 33 41 00.

D. Irrigation Systems, Section 32 84 23.

END OF SECTION

SECTION 33 05 06
POLYETHYLENE PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Polyethylene pipe, couplings, fittings and joint materials.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24.
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. AASHTO M 252: Standard Specification for Corrugated Polyethylene Drainage Pipe.

B. AASHTO M-294: Standard Specification for Corrugated Polyethylene Drainage Pipe 300-1200 mm Diameter.

C. AASHTO MP7-97: Standard specification for Corrugated Polyethylene Pipe – 1350 and 1500 mm Diameter.

D. ASME B1.1: Unified Inch Screw Threads (UN and UNR Thread Form), Supplement.

E. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

F. ASTM D 2239: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter.

G. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

H. ASTM D 2657: Standard Recommended Practice for Heat Joining of Thermoplastic Pipe and Fittings.

I. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.

J. ASTM D 3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

K. ASTM D 3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

L. ASTM F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F 1055: Standard Specification for Electofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

1.3 DEFINITIONS

A. Standard Dimension Ratio (SDR): Average diameter of pipe divided by the minimum wall thickness. The diameter may be either inside or outside measurement depending upon which standard is referenced.

B. Code Designation: A rating system by the Plastic Pipe Institute for smooth wall polyethylene pipe materials. The designation PE 3408 designates the type of plastic pipe (PE), the grade (34), and the hydrostatic design stress measured in units of 100 psi (08) at 23 deg C.

PART 2 — PRODUCTS

2.1 SMOOTH WALL PIPE SYSTEMS

A. Material: PE 3408 per ASTM D 2239 with a minimum cell classification of 345434C per ASTM D 3350.

B. Pipe: Smooth wall inside and out with an SDR or working pressure rating indicated or accepted by the Vernal City representative. Exterior markings as follows.
   1. ASTM Standard Number.
   2. Pipe Size.
   3. Class and profile number.
   4. Production code.
   5. Standard dimension ratio.

C. Fittings:
   1. Resin same as pipe.
   2. Working pressure same or greater than pipe.

D. Joints:
   1. Thermally welded butt fusion, ASTM D 3261.
   2. Flanged, ASTM D 2657.
   3. Ultra high molecular weight electo-fusion tape with a polyethylene coupler meeting ASTM F 1055 requirements.

2.2 CORRUGATED WALL PIPE SYSTEMS

A. Material: Polyethylene, ASTM D 3350 with a cell class as required in AASHTO M 252, AASHTO M 294 or AASHTO MP7-97

B. Pipe: Type S or D unless specified otherwise. Corrugations may be either annular or helical.

Type	Description
C	Circular pipe with a corrugated surface inside and out.
CP	Type C pipe with perforations
S	Circular pipe with an outer corrugated wall and a smooth inter wall
SP	Type S pipe with perforations
D	Circular pipe with a corrugated wall sandwiched between a smooth outer wall and a smooth inner wall.

C. Fittings:
   1. Blow molded with cell class 335420C, ASTM D 3350.
   2. Rotational molded with cell class 213320C, ASTM D 3350.
   3. Shop or field remanufactured of the same material as the pipe

D. Joints:
   1. Bell and spigot with gaskets, ASTM F 477. Foam type weather stripping not allowed.
   2. Split corrugated couplings with plastic or stainless steel ties and leak resistant neoprene gasket.

2.3 NUTS AND BOLTS

A. Stainless steel machined heavy hex heads, Type 304 or Type 316 alloy, ASTM F593 / ASTM F594.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install pipe as per manufacturer's instructions, ASTM D 2321 or ASTM D 2774.

B. Water distribution and transmission, Section 33 11 00.

C. Gravity water systems, Section 33 31 00 or Section 33 41 00.

D. Irrigation Systems, Section 32 84 23.

E. Tape wrap steel materials for protection against corrosion after piping installation.

END OF SECTION

SECTION 33 05 07
POLYVINYL CHLORIDE (PVC) PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Polyvinyl chloride pipe, couplings, fittings and joint materials.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24.
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. ASTM D 1784: Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

B. ASTM D 2241: Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR - Series).

C. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

D. ASTM D 2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

E. ASTM D 2564: Standard Specification for Solvent Cement for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

F. ASTM D 2729: Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

G. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.

H. ASTM D 2855: Standard Practice for Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

I. ASTM D 3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

J. ASTM D 3139: Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

K. ASTM D 3212: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

L. ASTM F 477: Standard Specification for Elastomeric Seals (Gaskets) for joining plastic pipe.

M. ASTM F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

N. ASTM F 679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

O. ASTM F 949: Standard Specification for Poly(vinyl Chloride) (PVC) Corrugated sewer Pipe with a Smooth Interior and Fittings.

P. AWWA C900: AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water

Distribution.

1.3 DEFINITIONS

A. Standard Dimension Ratio (SDR): Outside diameter of pipe divided by wall thickness.

PART 2 — PRODUCTS

2.1 GRAVITY PIPE SYSTEMS

A. Pipe:
1. Solid smooth wall, 4 to 15 inch diameter, ASTM D 3034.
2. 18 to 27 inch diameter, ASTM F 679.
3. 4 to 10 inches diameter corrugated wall with a smooth interior, ASTM F 949.

B. Fittings: ASTM D 1784.

C. Stiffness: 50 psi minimum when measured at 5 percent deflection, ASTM D 2412.

D. Additives and Fillers: Not to exceed 10 parts by weight; 100 parts of resin in the compound.

E. Joints: Bell and spigot with flexible elastomeric seals, ASTM D 3212.
1. Rubber gaskets shall be factory installed and conform to ASTM F477.

F. Flattening: No visual evidence of splitting, cracking, or breaking when flattened to 60 percent deflection, ASTM D 2412.

2.2 PRESSURE PIPE SYSTEMS

A. Pipe: Dimensions, class, SDR, and tolerances per ASTM D 2241.

B. Compounds: Type 1, Grade 1, Class 12454A, ASTM D 1784.

C. Joints:
1. Bell and spigot with flexible elastomeric seals, ASTM D 3139. Use non-toxic lubricant.
2. Solvent weld, ASTM D 2564.

2.3 PERFORATED PIPE SYSTEMS

A. Pipe: Refer to gravity pipe products above.

B. Perforations: ASTM D 2729.

C. Joints: Push-on, solvent weld or other.

2.4 SOLVENT WELDS

A. Primer, ASTM F 656.

B. Glue, ASTM D 2564.

PART 3 — EXECUTION

3.1 INSTALLATION

A. All pipe installed in the ground must have all open ends of any pipe physically connected to the system plugged, capped or protected from debris entering the pipe. This is required at all times: as sections of pipe are laid, at the

end of the day, etc.

B. Install pipe per manufacturer's instructions, ASTM D 2321 for gravity systems, AWWA C900 or ASTM D 2774 for pressure systems, and ASTM D 2855 for underground Irrigation Systems.

C. Water distribution and transmission, Section 33 11 00.

D. Gravity water systems, Section 33 31 00 or Section 33 41 00.

E. Irrigation System, Section 32 84 23.

END OF SECTION

SECTION 33 05 08
FUSIBLE POLYVINYL CHLORIDE (FPVC) PIPE

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Fusible polyvinyl chloride pipe, couplings, fittings and joint materials for direct bury application.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24.
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. AWWA C605: Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

B. AWWA C900: Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100mm through 300mm), for Water Distribution

C. AWWA C905: Standard for Polyvinyl Chloride (PVC Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350mm-1200mm), for Water Distribution

D. AWWA M23: AWWA Manual of Supply Practices PVC Pipe—Design and Installation, Second Edition

E. ASTM D1784: Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

F. ASTM D1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

G. ASTM D2241: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)

H. ASTM D2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

I. ASTM D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

J. ASTM F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe

K. ASTM F679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings

L. NSF-61: Drinking Water System Components--Health Effects

M. UNI-PUB-08: Tapping Guide for PVC Pressure Pipe

1.3 DEFINITIONS

A. Standard Dimension Ratio (SDR): Outside diameter of pipe divided by wall thickness.

PART 2 — PRODUCTS

2.1 GRAVITY PIPE SYSTEMS

A. FUSIBLE POLYVINYL CHLORIDE PRESSURE PIPE FOR WASTEWATER

1. Pipe:
   A. Fusible polyvinylchloride pipe shall conform to ASTM D3034 or ASTM F679.

   B. Fusible polyvinylchloride pipe may instead conform to AWWA C900 or AWWA C905, and/or ASTM D2241 or ASTM D1785 for IPS standard dimensionality, if applicable. Testing shall be in accordance with AWWA standards for any of these pipe types.

   C. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.

   D. Fusible polyvinylchloride pipe shall be green in color for wastewater use.

   E. Pipe generally shall be marked per AWWA C900, AWWA C905, ASTM D 2241 or ASTM D 1785 and shall include as a minimum:
      1. Nominal pipe size
      2. PVC
      3. Dimension Ratio, Standard Dimension Ratio or Schedule
      4. AWWA pressure class or standard pressure rating for non-AWWA pipe
      5. AWWA Standard designation number or pipe type for non-AWWA pipe
      6. Extrusion production-record code
      7. Trademark or trade name
      8. Cell Classification 12454 and/or PVC material code 1120 may also be included.

   F. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2. Fittings: ASTM D 1784

3. Stiffness: 50 psi minimum when measured at 5 percent deflection, ASTM D 2412

4. Additives and Fillers: Not to exceed 10 parts by weight; 100 parts of resin in the compound.

5. Joints: Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

6. Flattening: No visual evidence of splitting, cracking, or breaking when flattened to 60 percent deflection, ASTM D 2412.

B. FUSIBLE POLYVINYLCHLORIDE NON-PRESSURE PIPE FOR SURFACE WATER

1. Pipe:
   A. Fusible polyvinylchloride pipe shall conform to ASTM D3034 or ASTM F679.

   B. Fusible polyvinylchloride pipe may instead conform to AWWA C900 or AWWA C905, and/or ASTM D2241 or ASTM D1785 for IPS standard dimensionality, if applicable. Testing shall be in accordance with AWWA standards for any of these pipe types.

   C. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.

   D. Fusible polyvinylchloride pipe shall be white in color for surface or storm water use.

E. Pipe generally shall be marked per AWWA C900, AWWA C905, ASTM D 2241 or ASTM D 1785 and shall include as a minimum:
   1. Nominal pipe size
   2. PVC
   3. Dimension Ratio, Standard Dimension Ratio or Schedule
   4. AWWA pressure class or standard pressure rating for non-AWWA pipe
   5. AWWA Standard designation number or pipe type for non-AWWA pipe
   6. Extrusion production-record code
   7. Trademark or trade name
   8. Cell Classification 12454 and/or PVC material code 1120 may also be included.

F. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2. Fittings: ASTM D 1784

3. Stiffness: 50 psi minimum when measured at 5 percent deflection, ASTM D 2412

4. Additives and Fillers: Not to exceed 10 parts by weight; 100 parts of resin in the compound.

5. Joints: Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

2.2 PRESSURE PIPE SYSTEMS

A. FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR POTABLE WATER

1. Pipe:
   A. Fusible polyvinylchloride pipe shall conform to AWWA C900 or AWWA C905, and/or ASTM D2241 or ASTM D1785 for IPS standard dimensions if applicable. Testing shall be in accordance with AWWA standards for all pipe types.

   B. Fusible polyvinylchloride pipe shall be blue in color for potable water use.

   C. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.

   D. Pipe generally shall be marked per AWWA C900, AWWA C905, ASTM D 2241 or ASTM D 1785 and shall include as a minimum:
      1. Nominal pipe size
      2. PVC
      3. Dimension Ratio, Standard Dimension Ratio or Schedule
      4. AWWA pressure class or standard pressure rating for non-AWWA pipe
      5. AWWA Standard designation number or pipe type for non-AWWA pipe
      6. NSF-61 mark verifying suitability for potable water service
      7. Extrusion production-record code
      8. Trademark or trade name
      9. Cell Classification 12454 and/or PVC material code 1120 may also be included

   E. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2. Compounds: Type 1, Grade 1, Class 12454A, ASTM D 1784.

3. Joints: Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be

square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

B. FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR NON-POTABLE WATER

1. Pipe: Fusible polyvinylchloride pipe shall conform to AWWA C900 or AWWA C905, and/or ASTM D2241 or ASTM D1785 for IPS standard dimensions if applicable. Testing shall be in accordance with AWWA standards for all pipe types.

A. Fusible polyvinylchloride pipe shall be purple in color for reclaim, reuse, or other non-potable distribution or conveyance. Fusible polyvinylchloride pipe shall be white in color for raw water collection and transmission, or other non-potable resource or irrigation water uses.

B. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.

C. Pipe generally shall be marked per AWWA C900, AWWA C905, ASTM D 2241 or ASTM D 1785 and shall include as a minimum:
1. Nominal pipe size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio or Schedule
4. AWWA pressure class or standard pressure rating for non-AWWA pipe
5. AWWA Standard designation number or pipe type for non-AWWA pipe
6. Extrusion production-record code
7. Trademark or trade name
8. Cell Classification 12454 and/or PVC material code 1120 may also be included
9. For reclaim water service, the wording: "Reclaimed Water, NOT for Potable Use"

D. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2. Compounds: Type 1, Grade 1, Class 12454A, ASTM D 1784.

3. Joints: Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

2.3 FUSION JOINTS

A. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's guidelines for this procedure. All fusion joints shall be completed as described in this specification.

PART 3 — EXECUTION

3.1 DELIVERY AND OFF-LOADING

A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Owner or VERNAL CITY REPRESENTATIVE.

B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify Owner or VERNAL CITY REPRESENTATIVE immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color and type.

C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier's guidelines shall be followed.

D. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.

F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

3.2 HANDLING AND STORAGE

A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the Owner or VERNAL CITY REPRESENTATIVE.

B. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the Owner or VERNAL CITY REPRESENTATIVE.

C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.

E. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

3.3 FUSION PROCESS

A. GENERAL

1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

A. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.

B. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

B. HEAT PLATE - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly, cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

1. CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

2. GENERAL MACHINE - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

C. OTHER EQUIPMENT - Other equipment specifically required for the fusion process shall include the following:

1. PIPE ROLLERS Pipe rollers shall be used for support of pipe to either side of the machine

2. CANOPY - A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and /or windy weather.

3. FUSION MACHINE - Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

4. FACING BLADES - Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

3.4 INSTALLATION

A. FUSION AND LAYOUT

1. Whenever possible, pipe lengths shall be fused in their entirety and staged prior to installation in the trench. Fused pipe lengths shall be determined by Contractor preference, pipe supplier's guideline and site constraints.

2. The allowable length and width of open trench or excavation shall adhere to all applicable jurisdictional standards and the construction documents.

B. PIPE INSTALLATION

1. Fused lengths of pipe shall be installed by lowering into the trench or excavation, using approved strapping per the construction documents and the pipe supplier's guidelines. The lowering operation, once initiated shall proceed until the entire length of the fused section of pipe is installed.

2. Coordination of lifting equipment shall ensure that the fused pipe does not exceed the bending and buckling limitations of the pipe, per the pipe supplier's guidelines.

A. Equipment shall be utilized and staged per the pipe supplier's guidelines.

B. Under no circumstances will the pipe be "dropped" or "rolled" into the trench or excavation.

3. If the length of the fused pipe is longer than what the available equipment can lower into the trench

or excavation at one time, equipment shall be staged so that lowering shall begin at one end of the installation, and proceed along the trench or excavation, so that the entire fused length is installed without exceeding the minimum bend radius of the fused pipe.

4. Pipe may also be installed by pulling it into the end of the trench via a sloped section that is constructed so as not to exceed the minimum bending radius of the pipe. Pipe may be pulled by the use of a pull head and winch or piece of equipment as recommended by the pipe supplier.

5. Fused pipe shall be bedded and backfilled per the construction documents and all applicable standards. Initial lengths of installed fused polyvinylchloride pipe shall be bedded and backfilled before any connections are made between adjacent lengths. Initial lengths of installed fused polyvinylchloride pipe shall be allowed to come to thermal equilibrium with the temperature at burial depth, by waiting at least 24 hours after installation prior to making connections such as service lines and laterals.

C. FUSIBLE POLYVINYLCHLORIDE PIPE CARE

1. The fusible polyvinylchloride pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks on the pipe directly will not be permitted.

2. Sections of the fusible polyvinylchloride pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and then rejoining per the construction documents and the pipe supplier's guidelines.

3.5 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS

A. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the Contractor shall:

1. Field verify location, size, piping material and piping system of the existing pipe.

2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.

3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.

B. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

3.6 PIPE SYSTEM CONNECTIONS

A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

3.7 TAPPING FOR POTABLE AND NON-POTABLE WATER APPLICATIONS

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for Saddle Tapping per Uni-Pub-08.

B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:

1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.

2. Manually operated or power operated drilling machines may be used.

3. Taps may be performed while the pipeline is filled with water and under pressure ('wet' tap), or when the pipeline is not filled with water and not under pressure ('dry' tap).

END OF SECTION

SECTION 33 05 09
STEEL PIPE - CEMENT LINED AND COATED

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Cement mortar lined and coated steel pipe, couplings, fittings, and joint materials in sizes 4 inches through 120 inches.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24.
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. ASTM A 82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 283: Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

C. ASTM A 370: Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

D. ASTM A 569: Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.

E. ASTM A 570: Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

F. ASTM C 33: Standard Specification for Concrete Aggregates.

G. ASTM C 150: Standard Specification for Portland Cement.

H. AWWA C200: AWWA Standard for Steel Water Pipe 6 In. and Larger.

I. AWWA C205: AWWA Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.

J. AWWA C208: AWWA Standard for Dimensions for Fabricated Steel Water Pipe Fittings.

K. AWWA C303: AWWA Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pre-Tensioned, for Water and Other Liquids.

1.3 SUBMITTALS

A. Design Summary: Prior to any fabrication, submit a design summary for each size and class of pipe and line layout drawings or line schedules that show the location of each section of pipe and each special fitting to be furnished.

B. Shop Drawings of special fitting and outlets.

1.4 QUALITY ASSURANCE

A. Perform quality assurance tests required by AWWA C303.

1.5 DELIVERY, STORAGE AND HANDLING

A. Attach end covers to pipe stored either in the yard or in the field to prevent drying out of concrete.

B. Stalls: Remain in place during storage.

C. Gaskets: Store in a cool, well ventilated place and protect from direct sunlight.

PART 2 — PRODUCTS

2.1 STEEL CYLINDERS

A. Fabricated from either:
1 Hot-rolled Carbon Steel Sheets: Conform to ASTM A 570, Grades B, C, D, or E, or ASTM A 569 except that the maximum carbon content may be 0.25 percent and a minimum yield strength of 33,000 psi.
2. Plates: Conform to ASTM A 283, Grade C or D.

B. Seams: Fabricate sheets or plates into cylinders with longitudinal seams. Produce welds with a tensile strength at least equal to the specified minimum tensile strength of the sheet or plate. Cut test specimens from the cylinder and test per ASTM A 370 when specified.

C. Specified Diameter: The inside diameter of the concrete section.

D. Circumference of Steel Cylinders: Not to deviate from the design value by more than +3/16 inch for pipe sizes 16 inches and smaller or more than +1/4 inch for larger sizes.

E. Test Steel Cylinders: Test hydrostatically to a minimum hydrostatic pressure which develops a fiber stress equal to 75 percent of the specified minimum yield strength of the steel. Reweld cylinders that show any Leakage under test at the points of Leakage and subject them to another hydrostatic test. Continue procedure until completely watertight under the required test pressure.

2.2 JOINTS

A. General: As indicated using one of the following procedures.

B. Bell and Spigot for Rubber Gasket: Fabricate the bell and spigot ends by either forming integrally with the steel cylinder or welding steel joint rings to the cylinder. Make the bell and spigot ends circular in shape and fabricated so that when the pipe is laid the joint will be self centering with a gasket of sufficient size and cross-section to seal the joint. The difference in circumferential measurement between the outside circumference of the spigot and the inside circumference of the bell must not exceed 0.200 inch.

C. Belled Ends for Welding: Form a bell on the cylinder to accommodate the spigot. Make the spigot stub approximately 1-1/2 inches. Remove weld beads on the outside of the spigot and the inside of the bell to permit easy entry.

D. Plain Ends for Welding: Make both ends of pipe section plain and remove edge burrs.

E. Ends for Mechanical Couplings: Make ends of pipe section plain, grooved, or banded. Grind any weld beads on exterior of pipe flush with the pipe for a sufficient distance from the ends of the pipe to accommodate the coupling. Prepare grooved or banded ends to fit the type of mechanical coupling to be used.

2.3 CEMENT MORTAR

A. Cement: Type I or II, ASTM C 150.

B. Sand: "Fine aggregate", ASTM C 33, except the gradation may be modified to provide a lining of optimum density.

C. Cement-Mortar Mix: One part cement to not more that 3 parts of sand by weight. Control water content to obtain dense, workable, durable mortar. Rebound may be reclaimed and used as aggregate.

2.4 RUBBER GASKETS

A. Shape: Circular cross-section.

B. Gasket Compounds: Conform to the requirements of AWWA C200 consisting of first-grade natural rubber, synthetic rubber, or a suitable combination thereof. Form and cure to be dense and homogenous with a smooth surface free from blisters, pits, and other imperfections.

2.5 INTERIOR LINING

A. Use gage rings at the ends of the pipe to control the spinning thickness. Spin the lining in the cylinder to obtain nominal thickness as follows:
   1. 5/16 inch for pipe sizes 4 inches through 12 inches.
   2. 3/8 inch for pipe sizes 14 inches through 18 inches.
   3. 1/2 inch for 20 inches and larger.
   4. Other lining thickness, as specified in AWWA C205 or indicated.

B. After the mortar has been placed in the cylinder, revolve at a speed which will cause the cement-mortar to level out to a uniform thickness throughout the cylinder. Continue the spinning until the lining is thoroughly compacted and surplus water removed, and the finished lining is smooth and uniform throughout.

C. Lining Thickness Tolerance: Not more than 1 percent less or 25 percent more than the specified nominal thickness.

2.6 EXTERIOR COATING

A. Apply cement mortar exterior coating by mechanical means producing a dense, uniform finished coating adhering tightly to the pipe. Additional coating thickness may be specified to resist excessive external loads. Provide a minimum nominal coating applied over the cylinder as follows.
   1. 1/2 inch for pipe sizes 4 inches through 12 inches.
   2. 5/8 inch for pipe sizes 14 inches pipe through 18 inches.
   3. 3/4 inch for pipe sizes 20 inches and over.

B. Cement Slurry Coating: One bag of cement to not more than 10 gallons of water applied concurrent with the coating application to coat the steel assembly surface and the mortar-coating leading edge.

C. Steel Reinforcement: 14 gage cold-drawn steel wire conforming to ASTM A 82, helically wound and embedded in middle third of the coating.

D. Suitably support the pipe during handing and curing to prevent damage to the lining coating.

2.7 CURING

A. Moist cure the lining for a minimum period of 24 hours after spinning. This may be accomplished by tightly sealing the ends of the cylinder with a waterproof membrane to retain the moisture in the mortar. Steam curing may be used in lieu of or in combination with moist curing on a time ratio basis of 1 hour steam curing to 4 hours moist curing.

B. Moist cure the completed pipe for 6 days minimum. Steam curing may be used in lieu of moist curing.

C. Protect the mortar lining from temperatures below 40 deg. F. during the application and curing.

2.8 PIPE LENGTHS

A. 40 feet except where shorter lengths are required for fittings, curves, or closures.

2.9 BENDS AND SPECIFIC FITTINGS

A. Fabricate short radius bends or special fittings such as wyes, tees and crosses from previously tested steel cylinders, AWWA C208. Fabricate bends or special fittings at least equal in strength to the abutting pipe sections and line and coat with the same material as the pipeline. Obtain approval of design prior to fabrication.

B. Test all seams of bends or special fittings, except those seams previously tested as cylinders. Test seams by the air soap method or by the dye-check method. Repair any leaks by welding and retest the seam and recoat if required.

2.10 OUTLETS

A. Build outlets into the wall of the pipe, prior to testing, for blow-offs, branches, air valves, access manholes, etc. Provide cast or fabricated steel fittings of suitable design and securely weld to the cylinder before being coated. Reinforce the pipe cylinder, as necessary, for the required opening. Obtain approval of the design of such outlets prior to fabrication.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install pipe per manufacturer's instructions and Section 33 11 00.

B. Provide a maximum joint deflection on curved alignment by means of unsymmetrical closure of spigot into bell as per manufacturer's recommendation but not greater than the following:
1. 3/4 inch for pipes 12 inches through 24 inches.
2. 1 inch for pipes 27 inches through 72 inches.

C. Joints to be grouted inside and outside as per manufacturer's recommendations.

END OF SECTION

SECTION 33 05 14
UTILITY GRADE ADJUSTMENT

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Raise, lower, or change slope of Street Fixtures.

B. Install Cover Collars.

C. This section is NOT APPLICABLE to raising and lowering Street Fixtures that withstand internal pressure.

1.2 DEFINITIONS

A. Box: A structure such as a valve box, meter box, monument box, fire hydrant box, electrical pull box, cleanout box or other like structure not intended for human entry.

B. Cover Collar: A concrete filled annular space between metal frames and the adjacent Pavement structural section.

C. Extension Ring: A concrete or metal ring used to adjust surface elevations and surface cross slopes of Street Fixture covers. Metal rings are used between metal frames and metal covers or grates. Concrete rings are used below metal frames or in the concrete structure below.

D. WHIRLyGIG: Products and procedures from Whirlygig, Inc. used for riser and collar installation.

E. Manhole: A structure designed to permit human entry and working space inside and to confine and control the flow of pipe-conveyed fluids. These structures are collectively referred to as manholes regardless of composition, design, type or depth.

F. Street Fixture: The top of existing structures such as but not limited to Manholes, catch basin, sumps, inlets, valve boxes, meter boxes, monument boxes, and similar structure in a thoroughfare surface.

G. Vault: A structure intended for human entry containing electrical/telephone facilities or other like utilities.

H. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

I. OR EQUIVALENT: At any time in these specifications when products are specified and an OR EQUIVALENT option is given, decisions of equivalency will be at the sole interpretation of Vernal City. A blanket statement that equipment or materials proposed will meet all requirements will not be sufficient to establish equivalence. Those wishing to establish equivalence must furnish Vernal City all descriptive literature, manufacturer's compliance certificates and all other data on the items proposed as equivalent.

1.3 STREET FIXTURE MAINTENANCE

A. Owner of street fixtures within the Vernal City right of way are to have an ongoing program to maintain street fixtures between 1/4 and 3/8 inch below the asphalt surface. When street surfaces are changed (e.g. with an overlay) the owner of street fixtures must adjust their fixtures to maintain the specified tolerance.

PART 2 — PRODUCTS

2.1 PAVEMENT

A. Asphalt Concrete: AC-20-DM-1/2, Section 32 12 05.

B. Cast-in-place Concrete: Class 4000, Section 03 30 04.

2.2 GROUT

A. Hydraulic cement, Section 03 61 00.

2.3 EXTENSION RINGS

A. WHIRLyGIG risers.

B. Metal: Cast iron or steel, Section 05 56 00.

C. Cast-in-place Concrete: Class 4000, Section 03 30 04.

PART 3 — EXECUTION

3.1 PREPARATION

A. Determine condition of existing incidental structure. Any item not reported damaged prior to construction shall be considered unbroken and must be replaced by the CONTRACTOR at no additional cost to Vernal City.

B. Provide invert cover over pipe in cleanout box to prevent gravel, concrete, or debris from entering pipeline.

C. Unless indicated otherwise, arrange for utility companies to adjust their own structures.

D. Coordinate all adjustments with requirements of affected utility company.

3.2 ADJUST STRUCTURE TO GRADE

A. Restrict excavation around the structure to a minimum area.

B. Core hard surface around structure using a diameter between 40 and 60 inches. Provide a 12" annular space between structure and core edge. If a larger core is required, obtain written permission from Vernal City before work begins.

C. Install WHIRLyGIG OR EQUIVALENT grade adjusting riser on top of cone section and adjust to match existing surface. Follow manufacturer’s recommendations.

D. Fill entire excavation with concrete up to 3 inches below finished surface if working in asphalt. If finished surface is concrete, fill excavation to grade with concrete. Trowel finish concrete.

E. Place bituminous paving over concrete to match lines and grades of existing road surface.

F. If the cone is cracked during construction, re-stack the Manhole with shorter Manhole sections and install a new cone at no additional cost to the OWNER.

3.3 ADJUST COVER IN PAVEMENT SURFACE

A. Method A - Metal Extension Rings:
   1. Use only with an overlay of 2 inches or less.
   2. Use rings that lock together.
   3. Seal joints between Pavement and ring, Section 32 01 17.

B. Method B - Concrete Extension Rings:
   1. Use only in non hard surface locations (landscape, etc.).
   2. Place concrete grade rings under frame or in structure riser shaft.
   3. Set frame at desired elevation and cross-slope.

4. Provide 100 percent concrete support under frame. Do not use wood, bricks, concrete fragments, blocks or particles as support.
5. Grout seams between concrete rings and between frame and concrete rings.

3.4 INSTALLING COVER COLLAR ON VALVE BOXES

A. Open an annular space between pavement and Street Fixture cover. Unless indicated otherwise, provide 12 inches of annular space.

B. Set concrete collar to 1/4 inch minimum to 3/8 inch maximum below asphalt concrete pavement surface and 1/4 inch below portland cement concrete pavement surface.

C. Trowel finish, Section 03 35 00.

3.5 PAVEMENT SURFACE RESTORATION

A. In new streets or overlays, adjust Street Fixture cover after bituminous paving is complete.

B. Pavement restoration, Section 32 01 18.

END OF SECTION

SECTION 33 05 23
TRENCHLESS UTILITY INSTALLATION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Boring or jacking pipe or box culvert.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

1.4 SUBMITTALS

A. Details of jacking pit bracing, casing or conduit, and jacking head to be used.

B. Dimensions and support of pilot tunnel (if used).

C. Details of steel rails in pilot tunnel (if used), including true line and grade.

D. Copy of applicable permits from agency having jurisdiction.

1.5 PERFORMANCE REQUIREMENTS

A. Jack conduit to line and grade indicated. Modify the jacking operation to correct any deviation. Correct any misalignment in line or grade at no additional cost to Vernal City.

B. The methods and equipment used in jacking casing or conduit are the choice of the CONTRACTOR.

C. Use workers experienced in jacking operations.

PART 2 — PRODUCTS

2.1 STEEL CASING

A. ASTM A 53, Grade B steel pipe for jacking operations, minimum wall thickness of 0.375 inch, minimum yield stress of 42,000 psi. Use a casing with a diameter equal to the outside bell diameter of the pipe plus a minimum 4 inches.

B. Fillet weld joints continuous around casing and reinforce joints to withstand jacking operations.

2.2 CONCRETE PIPE

A. Section 33 05 02. When concrete pipe is to be jacked, use a pipe section designed to support the superimposed loads and the loads that may be placed upon the pipe during jacking operations. Use pipe sections that have a watertight joint.

2.3 SOIL CEMENT

A. Portland cement treated fill, Section 31 05 15.

B. Grout: Cement, Section 03 61 00.

PART 3 — EXECUTION

3.1 PREPARATION

A. Coordinate utility locations, Section 01 31 13.

3.2 JACKING PROCEDURE

A. When casing is to be jacked through a plastic clay, continue uninterrupted operations until the casing has been jacked between specified limits.

B. Equip leading section of casing with a jacking head securely attached to prevent any wobble or variation in alignment during the jacking operation.

C. Protect the driving end against spalling or other damage, and install sufficient bearing shims to intermediate joints to properly distribute jacking stresses. Remove and replace any section showing signs of Failure.

D. No Excavation in excess of the outer dimensions of the conduit being jacked will be allowed unless approved. Avoid any loss of earth outside the jacking head.

E. Upon completion of jacking operations, pressure grout voids around outside face of the conduit. Grouting around jacked conduit must be started immediately after jacking operations have finished.

F. During the jacking operation, backpack with soil cement any annular space occurring outside of conduit that could affect any surface structure or facility.

3.3 PILOT TUNNEL

A. Construct tunnel where casing 60 inches or greater inside diameter is to be jacked for a distance greater than 32 feet.

B. Remove supports for tunnels as jacking progresses.

3.4 PIPE SUPPORT IN CASING TUNNEL

A. Unless indicated otherwise, use redwood skids throughout the length of the pipe tied at every pipe diameter length to brace pipe installed in casing to prevent shifting or flotation during backfilling of annular ring between the casing and carrier pipe.

B. Backfill annular ring with Section 03 61 00 hydraulic cement grout except when indicated otherwise.

C. Install pipe barrels to rest upon support blocks with the pipe bells clearing the casing invert by at least 1/2 inch.

D. Whenever clay pipe is installed in a casing, use mechanical compression joints.

END OF SECTION

SECTION 33 08 00
COMMISSIONING OF WATER UTILITIES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Testing requirements for potable and non-potable water piping systems.

B. Warning: DO NOT use hydrostatic pressures described in this section for air-pressure testing.

1.2 DEFINITIONS

A. Leakage: The quantity of water required to maintain the specified hydrostatic test pressure after the pipeline has been filled with water and the air expelled.

B. Non-rigid Pipe: Any pipe that requires Bedding and backfill material for structural support.

C. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 SUBMITTALS

A. Pipeline Test Report: Submit.
   1. Type of test.
   2. Identification of pipe system.
   3. Size, type, location and length of pipe in test section.
   4. Test pressure and time.
   5. Video and log of visual examination.
   6. Amount of Leakage versus allowable.
   7. Date of test approval.
   8. Signature of test supervisor.
   9. Signature of Resident Project Representative witnessing and accepting the test.

1.4 PROJECT CONDITIONS

A. Repair pipeline system at no additional cost to Vernal City until it passes specified commissioning tests.

1.5 WARRANTY

A. At the end of the One Year Correction Period repeat any test requested by the Vernal City representative to verify warranty of pipeline performance.

PART 2 — PRODUCTS

2.1 TESTING MATERIALS

A. Medium: Water, air.

B. Recording Equipment (pressure systems):
   1. Supply all equipment and power to perform pressure testing.
   2. Secure approval of pressure gages.
   3. Locate all gages and recording equipment away from affect of sunshine or unsuitable weather conditions.
   4. Place, vents, pressure taps and drains for the test. Repair pipeline at completion of test at no additional cost to Vernal City.

PART 3 — EXECUTION

3.1 PREPARATION

A. Notify the Vernal City representative 48 hours in advance of test.

B. Carry out tests as pipeline construction progresses to ensure construction methods are producing satisfactory results.

C. Remove debris, sediment and other material from installed pipe prior to testing. Do not discharge or flush sand, gravel, concrete, debris or other foreign material into any existing pipeline system. Flushing with clean water only will be allowed but with minimal flows to eliminate exceeding capacities of the existing gravity systems. Flushing into existing pressurized water systems will not be allowed.

3.2 ALIGNMENT AND GRADE TEST

A. Do not allow line and grade of pipe to vary more than 1/2 inch in 10 feet and not more than 1 inch variance from true line at any location.

B. Do not allow grade of pipe to vary more than 1/4 inch in 10 feet for all design grades less than or equal to 1 percent and not more than 1/2 inch total variance from true grade at any location. Also, do not allow grade of pipe to vary more than 1/2 inch in 10 feet for all design grades greater than 1 percent and not more than 1 inch total variance from true grade at any location. Theses tolerances shall be acceptable provided that such variation does not result in a level or reverse sloping invert.

C. The variation in the invert elevation between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surfaces shall not exceed 1/64 inch per inch of pipe diameter, or 1/4 inch maximum.

3.3 PRESSURE TEST

A. Air Test: Per pipe manufacturer's recommendation.
   1. The pipeline shall be filled slowly to prevent possible water hammer, and care shall be exercised to allow all of the air to escape during the filling operation.

B. Low Pressure Air Test: Per pipe manufacturer’s recommendation
   1. Testing Apparatus:
      a. Apparatus for low pressure air testing shall have gauges of size and accuracy to indicate pressure to 0.1 psig.
      b. The apparatus shall have pressure relief and regulating features to limit pressure to 8 psig maximum.
      c. The apparatus shall have a leak proof shut-off valve to isolate the compressor from the pressurized pipe.
   2. All service laterals shall be capped with air-tight fittings. The pipe shall be blocked with air-tight seals at the manhole at each end of the pipe reach being tested. The pipe shall initially be pressurized to 5 psig, and allowed to stabilize for 10 minutes prior to the test. The pressure shall then be adjusted to 4 psig, and the isolation valve closed. Pressure drop shall be monitored by time. The time for the pressure to drop from 3.5 to 3.0 psig shall not be less than indicated in the following table:

Pipe Diameter (Inches)	Minimum Time (Min:Sec)	Length for Minimum Time (Feet)	Time for Longer Length* (Seconds)
4	1:53	597	0.190 L
6	2:50	398	0.427 L
8	3:47	298	0.760 L
10	4:34	239	1.187 L
12	5:40	199	1.709 L
15	7:05	159	2.671 L
18	8:30	133	3.846 L
21	9:55	114	5.235 L
24	11:20	99	6.837 L

Low pressure air testing shall be performed in the presence of the VERNAL CITY REPRESENTATIVE
*L = Length of pipe reach being tested, in feet

C. Hydrostatic test:
   1. Provide 225 psi test pressure for 2 hours unless specified otherwise.
   2. Provide air release taps at pipeline's highest elevations and expel all air before the test. Insert permanent plugs after test has been completed.
   3. No piping installation will be acceptable until the leakage is less than the amount allowed by industry standards for the type of pipe material being tested or if no standard prevails than the number of gallons per hour as determined by the formula:

      $Q = (L \times D \times P^{1/2}) / 133{,}200$

      Where
      Q = allowable leakage, in gallons per hour.
      L = length of pipe under test in feet.
      D = nominal diameter of pipe in inches.
      P = average test pressure, in pounds per square inch (gage).

   4. The hydrostatic test shall be conducted after backfilling is complete.

   5. All testing shall be performed prior to the acceptance of the waterline by Vernal City.

D. Locate and repair defective joints and retest until the leakage rate is less than allowable.

E. Repair any noticeable leakage even if total leakage is less than allowable.

3.4 OBSTRUCTION AND DEFLECTION TEST

A. Obstructions: Maximum protuberance is 1 inch.

B. Deflections:
   1. Do not use mechanical pulling equipment when pulling mandrels through pipe.
      a. If the deflection test is run using a rigid ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe.
   2. Maximum reduction of internal diameter in any plane measured full length of installation and not less than 30 days after installation as follows.
      a. No pipe shall show a deflection in excess of 5 percent.
   3. Recommend an alternate method of measurement if mandrel testing would cause damage to internal pipe coating.

3.5 VIDEO CAMERA INSPECTION

A. Prior to air testing, the pipe shall be inspected by a video camera specifically designed for pipe inspection. The inspection shall note the shape of the pipe for the deflections, bulges, breaks, misalignments, open joints, infiltration, and other defects. Video records of the inspection shall be provided to the Vernal City.
   1. At the option of the CONTRACTOR, air testing of each joint may be performed with the camera device, if equipped to perform this function.

3.6 PIPE TESTING SCHEDULE

A. Irrigation - Gravity System:
   1. Grade test: All circuits drain.

B. Irrigation – Pressure System:
   1. Grade test: All circuits drain.
   2. Pressure test.

3. Operational Testing:
    a. Perform operational testing after hydrostatic test is complete; backfill is in place and sprinkler heads adjusted to final coverage.
    b. Demonstrate system meets coverage requirements and automatic controls function properly.
    c. Coverage requirements are based on operation of 1 circuit at a time.

C. Sanitary Sewers:
1. Alignment and grade test.
2. Obstructions and deflection test.
3. Low pressure Air Test for Sewer Pies 8-inches and larger in diameter.
4. Pressure test for pressure pipeline systems.
5. Video inspection.

D. Subdrains:
1. Grade test: All pipelines drain.
2. Obstructions and deflection test.

E. Storm Drains:
1. Alignment and grade test.
2. Obstructions and deflection test.
3. Pressure test for pressure pipeline systems.
4. Video inspection.

F. Potable Water System:
1. Obstruction and deflection test.
2. Pressure test.
3. Disinfection (Section 33 13 00).

END OF SECTION

SECTION 33 11 00
WATER DISTRIBUTION AND TRANSMISSION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Water distribution and transmission system identification, valves, boxes, service connections and accessories.

B. This section is applicable to potable and non-potable water pressure systems.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ACPA: American Concrete Pipe Association.

B. Applicable water company requirements.

C. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

D. AWWA C605: AWWA Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

E. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.

F. AWWA M11: AWWA Manual for Steel Pipe - Design and Installation.

G. CDA: Copper Development Association.

1.4 PERFORMANCE REQUIREMENTS

A. Depth of Cover: As specified on drawings

B. Remove any section of pipe already placed that is found to be defective or damaged. Relay or replace without additional cost to Vernal City.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions.

B. Commissioning: Submit testing data indicated in Section 33 08 00.

C. Record Documents: Submit documents, Section 01 78 39. Include details of underground structures, connections, thrust blocks and anchors. Show interface and spatial relationship between piping and adjacent structures.

1.6 SITE CONDITIONS

A. Minimize neighborhood traffic interruptions. Barricade stockpiles.

B. Secure acceptance of pipeline lateral tie-in work.

C. Repair public and private facilities damaged by the CONTRACTOR.

D. Do not turn on or turn off any valve outside of the Work prior to securing the Vernal City representative's or water company's permission.

PART 2 — PRODUCTS

2.1 PIPES AND FITTINGS

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities indicated. Use only NSF approved products in drinking water systems. All such products shall be appropriately stamped with the NSF logo.

B. Where not indicated, provide proper selection as determined by installer and acceptable to the Vernal City representative to comply with installation requirements.

C. Provide sizes and types of equipment connections for fittings of material that matches pipe material used in the piping system. Where more than one type of material or product Option is indicated, selection is installer's choice.

D. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.

2.2 VALVES

A. Section 33 12 16.

2.3 VALVE BOX

A. Buried Valves In Traffic Areas: Slip type of height required for the installation. 5 - 1/4 inch shaft, with a drop lid.

B. Buried Valves in Non-traffic Areas: Slip type of height required for the installation. 5 - 1/4 inch shaft, with a drop lid.

C. Markings: On cover of valve box, cast the appropriate utility lettering.

D. Mud plug required on all valve boxes.

2.4 VALVE CHAMBER

A. General: Refer to applicable design criteria requirements explained in Laws and Regulations.

B. Basin: Class 4000 concrete floor and walls.

C. Steps: Plastic, cast into sidewalls greater than 4 feet deep.

D. Top: Flat slab class 4000 concrete.

E. Frame and Cover: Scoriated asphalt coated, heavy duty ductile iron conforming to Section 05 56 00 with flat top design and appropriate utility lettering. Shape and size as indicated.

2.5 MORTAR, GROUT, AND CONCRETE

A. Mortar: Portaland Cement

B. Grout: Cement, Section 03 61 00.

C. Concrete:

1. Cast-in-place: Class 4000, Section 03 30 04.
2. Precast: Class 5000, Section 03 40 00.

2.6 TAPPING SADDLES

Tapping Saddles will be specified in the drawing details.

2.7 SERVICE CONNECTION

A. Polyethylene pipe; Section 33 05 06 with flare type 200 psi compression fittings in accordance with AWWA C800.

2.8 ACCESSORIES

A. Bolts, Nuts, Washers: Steel, Section 05 05 23.

B. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

C. Corporation Stops: All bronze with tapered threads.

D. Hydrant and Valve: Dry barrel, Section 33 12 19.

E. Water Meter and Valve: Section 33 12 33.

F. Grease: Non-oxide.

G. Polyethylene Sheet: 8 mil thick.

PART 3 — EXECUTION

3.1 EXAMINATION

A. Verify Trench Excavation is ready to receive work, and dimensions, and elevations are as indicated.

B. Commencing installation means acceptance of existing conditions.

3.2 PREPARATION

A. Excavation, Section 31 23 16. Hand trim to required elevations. Correct over excavations.

B. Remove stones or other hard matter that could damage pipe embedment or impede backfilling or compaction.

C. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.

D. Clearly identify and promptly set aside defective or damaged pipe.

E. Use pipe cutting tool acceptable to pipe manufacturer.

3.3 LOCATING POTABLE WATER PIPE

A. Comply with Utah Drinking Water Act. As a minimum locate potable water pipe at least 18 inches vertical and 10 feet horizontal edge to edge between water and sewer lines. Place water lines above sewer line.

B. If conditions arise where the waterline is within 10 feet horizontally or 18" vertically of a sewer pipe, stop work

in the area and notify the Vernal City representative.

C. Do not put potable water lines in the same Trench with sewer lines, storm drains or electric wires.

3.4 INSTALLATION - PIPE AND FITTING

1. Steel Pipe: AWWA M11.
2. Ductile Iron Pipe: AWWA C600.
3. Copper Tube: CDA "Copper Tube Handbook".
4. Polyethylene Pipe: For 3 inches and smaller pipe follow AWWA C901. Install all other sizes per manufacturer's installation instructions.
5. Polyvinyl Chloride Pipe: AWWA C605.
6. Concrete Pipe: ACPA "Concrete Pipe Handbook".
7. Wedges: Install metal wedges on all metal pipe systems.

3.5 INSTALLATION – CONCRETE THRUST BLOCKS

A. Do not make hydrostatic tests of Section 33 08 00 until thrust block concrete has cured for at least 5 days.

B. Provide thrust blocks on all plugs, caps, tees, hydrants and vertical or horizontal bends.
   1. Concrete thrust blocks used for anchoring pipe bends and fittings shall be cast of ready-mix concrete from a commercial batch plant. Concrete shall have a minimum of 4.5 bags of cement per cubic yard and shall have a minimum 28-day compressive strength of 2500 psi.

C. Unless otherwise indicated or directed by the Vernal City representative, place the base and bearing sides of thrust blocking directly against undisturbed earth.

D. Sides of thrust blocking not subject to thrust may be placed against forms. Place thrust blocking so the fitting joints will be accessible for repair.

3.6 INSTALLATION - VALVES AND VALVE BOXES

A. Valves:
   1. Ensure all parts are in working order.
   2. Set location of valves outside of sidewalk limits, Driveway Approaches and other pedestrian or vehicular interference.
   3. Install plumb with stems pointing up.
   4. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap.

B. Valve Boxes:
   1. Set over valve nut so operator's key is plumb with clearance in valve box when opening and closing the valve.
   2. Adjust box to finish grade.
   3. Clean all dirt or foreign material out of box.

3.7 INSTALLATION – TAPS

A. Apply for and pay for applicable permits from water company for the indicated size and location of tap to water main. Comply with all connection requirements of water company.

B. Make all service taps with a tapping machine acceptable to the water company. Use teflon tape on all taps unless indicated otherwise.

C. The minimum distance between taps is 24 inches, with a 5 degree stagger. Do not make service taps within 24 inches of the end of pipe. Install taps at 60 degress from vertical, or authorized by the Vernal City representative.

D. Service saddles are required on all taps except, 3/4 inch or 1" taps to new ductile iron pipe

E. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap.

3.8 INSTALLATION – SERVICE LINES

A. Replacing Existing Water Service Line:
   1. Follow AWWA C800, Utah public drinking water regulations and Utah plumbing code requirements.

B. Looping Existing Water Service:
   1. Minimum pipe diameter 3/4 inch.
   2. Pinching tools used to close and open service lines may be used only if allowed by . When service line pinches cannot be returned to previous shape or flow, remove and replace damaged portion of pipe.
   3. Soldered joints or connections not allowed.
   4. For copper to iron connections use a brass pack joint compression coupling with joint locking device.
   5. For copper- to- copper connections use a brass flare coupling.
   6. Follow details shown in the Drawings.

C. Meter Box: Install meter boxes back of the curb, outside of sidewalks and Driveway Approaches and outside of other pedestrian and vehicular interference.

3.9 INSTALLATION – WATER MAIN LOOP (SYPHON)

A. Existing water mains may not match standard size. Excavate to obtain actual pipe diameter and match size.

B. Do not shutdown pipeline until couplings and fittings are on site. Coordinate shutdown with water company.

C. Connections to steel or transite pipe requires transition couplings or sleeves with transition gaskets.

D. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap

E. Provide thrust blocks except where joints are welded. Follow details shown on the Drawings.

3.10 DISINFECTION

A. Section 33 13 00.

B. After disinfection, legally dispose of disinfection water.

3.10 BACKFILLING

A. Prior to Backfilling:
   1. Secure VERNAL CITY REPRESENTATIVE's acceptance of brass wedge installations and concrete thrust block installations.
   2. For pressure pipe testing follow Section 33 08 00 requirements and for disinfection follow Section 33 13 00 requirements.

B. Trenches: Section 31 23 24.

C. Landscapes: Section 33 05 20.

3.11 SURFACING RESTORATION

A. Roadway Trenches and Patches: Section 32 01 18.

B. Landscapes: Section 32 92 00 or Section 32 93 13 as applicable.

END OF SECTION

SECTION 33 11 11
RELOCATE WATER METERS AND FIRE HYDRANTS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Relocate existing water meters or fire hydrants which may be necessary because of changes in grade or installation of new improvements which conflict with existing meter and hydrant locations.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. AWWA C203: AWWA Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied.

B. AWWA C502: AWWA Standard for Dry-Barrel Fire Hydrants.

1.4 JOB CONDITIONS

A. Secure utility company permit to do relocation work and pay applicable fees.

B. Secure utility company approval of joints, connections, and pipe installations prior to commencing backfill operations.

PART 2 — PRODUCTS

2.1 HYDRANTS

A. Use existing hydrant unless Vernal City or the CONTRACTOR will provide a new unit.

B. Use the same type of pipe material as used for existing hydrant piping unless indicated otherwise.

C. Use mechanical and flange joint fittings unless indicated otherwise. Use only new tees, fittings, and bends.

D. Coat all weld connections and damaged areas of metal piping with coal tar enamel. Follow AWWA C203 requirements. Tape wrap coatings.

2.2 WATER SERVICE METERS

A. Use existing water meter and yoke unless Contract Documents specify Vernal City or the CONTRACTOR will provide a new unit.

B. When relocating meters, use polyethylene pipe (Section 33 05 06) from main to meter yoke.

2.3 CONCRETE

A. Cast-in-place: Class 3000 or 4000, Section 03 30 04.

PART 3 — EXECUTION

3.1 PREPARATION

A. Before commencing work, coordinate location and shutdown of utility lines with utility company and residents; Section 01 31 13.

B. Protect existing hydrants and meters from damage.

C. Control ground water, surface water, and storm water.

D. Control pedestrian and vehicular traffic, Section 01 55 26.

E. Provide all excavation backfill, compaction, connections, testing, and surface restorations to make the installation complete.

3.2 MOVING EXISTING HYDRANTS

A. Relocate to locations indicated.

B. Do not disturb location of hydrant lateral tee at water main.

C. The method of harnessing the hydrant (reshackling or reblocking) shall match existing conditions or approval of the Vernal City representative.

D. Install hydrant so base flange is even with or less than 4 inches above grade of surrounding surface.

3.3 RECONNECTING EXISTING HYDRANTS

A. Hydrant reconnections shall meet new work requirements indicated in Section 33 12 19.

B. When existing tee on water main is to be moved to new location, seal and shackle old tee.

3.4 HYDRANT BARREL EXTENSIONS

A. Follow AWWA C502 to extend barrels, operating stems and flanged adapters in design material and workmanship so hydrant base flange is even with or less than 4 inches above grade of surrounding surface.

3.5 RESETTING WATER METERS

A. Follow Section 33 12 33 to relocate water meters and service connections to locations indicated.

B. Follow Section 33 05 14 to adjust meter boxes to grade in paved surfaces.

3.6 FIELD QUALITY CONTROL

A. Hydrostatic tests, Section 33 08 00.

B. Disinfection, Section 33 13 00.

END OF SECTION

SECTION 33 12 16
WATER VALVES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Gate, butterfly, plug, check, pressure reducing, pressure relief, control valves and their installation.

B. Related work includes but is not limited to,
   1. Excavation, Section 31 23 16.
   2. Trench backfill, Section 31 23 24.
   3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
   4. Pavement restoration, Section 32 01 18.

1.2 REFERENCES

A. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

B. AWWA C504: AWWA Standard for Rubber-Seated Butterfly Valves.

C. AWWA C508: AWWA Standard for Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS.

D. AWWA C509: AWWA Standard for Resilient-Seated Gate Valves for Water and Sewerage Systems.

E. AWWA C515: AWWA Standard for Reduced Wall Resilient-Seated Gate Valves for water supply service.

F. AWWA C550: AWWA Standard for Protective Interior Coatings for Valves and Hydrants.

G. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Provide technical information as required for evaluating the quality of the valve. As a minimum include dimensions, weights, materials lists and operation charts.

PART 2 — PRODUCTS

2.1 VALVES - GENERAL

A. Underground:
   1. Less than 3 inches: Screwed ends.
   2. 3 inches and larger: Flanged or mechanical joint ends as specified. Non-rising stem. Two inches square operating nut. Low alloy steel bolts, AWWA C111.
   3. Valve boxes and covers shall be supplied for each valve which extend from the valve bonnet to the ground surface.

B. Submerged or Above Sewage or Water:
   1. Valve body bolts to be stainless steel.
   2. For joining valve to piping system use stainless steel nuts and bolts, Section 05 05 23.

C. Below an Operating Deck: Provide shaft extension from the valve to 36" above the deck level.

D. Above Ground: Non-rising stems equipped with a hand wheel.

E. Manually Operated Valves Over 6 feet Above Operating Level: Provide chain operated handles.

F. Clearance: Install so that handles clear all obstruction when moved from open to closed.

G. Rated Working Pressure: 150 psi unless indicated.

H. Coating: Interior, AWWA C550. Exterior per manufacturer’s recommendation.

2.2 GATE VALVES

A. Material: Cast or ductile iron body, bronze mounted. Furnish valves 3 inches through 48 inches that conform to the requirements of AWWA C509 or AWWA C515, non-rising stem design with "O" ring seals.

B. Operating Direction: Open counterclockwise.

C. Buried Valves: Flanged, mechanical joint, or as indicated.
   1. Buried valves shall be wrapped in polyethylene conforming to AWWA C 105.
   2. Valve boxes shall be centered over the operating nuts and shall be straight and plumb.

2.3 BUTTERFLY VALVES

A. Butterfly valves are not allowed except with written permission from Vernal City.

2.4 ECCENTRIC PLUG VALVES

A. Material: Cast iron body, bronze mounted, non-lubricated, eccentric, quarter-turn type with resilient face plugs, ductile iron discs with upper and lower shafts integral.

B. Markings: Indicate open and close position.

C. Port Areas: At least 82 percent of full pipe area.

D. Resilient Seat Seals: Buna N, field replaceable.

2.5 CHECK VALVES

A. Material: AWWA C508.

B. Valves 2-1/2 inches in Size and Smaller: 200 psi working pressure Y-pattern, bronze, regrinding, swing check valve with screwed ends.

C. Valves 3 inches in Size and Larger: Iron body, bronze mounted, flanged end, swing valves with stainless steel hinge pins.

D. Outside Weight and Lever: Required.

2.6 PRESSURE REDUCING VALVES - SERVICE LINE

A. Operation: Capable of reducing a varying higher upstream pressure to an adjustable constant lower downstream pressure.

B. Spring and nylon reinforced diaphragm type construction.

C. Equip with Y-strainer upstream of valve.

2.7 PRESSURE REDUCING VALVES - MAIN LINE

A. Operation: Capable of maintaining an adjustable constant downstream pressure regardless of upstream pressure.

B. Type: Hydraulically operated using a direct-acting, spring-loaded, normally open, pilot valve controlled diaphragm.

C. Provide a single removable seat and a resilient disc. No "O" ring type discs permitted. No external packing glands permitted. No pistons operating the main valve or pilot controls permitted.

D. Equip with Y-strainers on the pilot controls, variable closing and opening speed controls and a valve position indicator.

E. Rating: 250 psi working pressure with flanged connections.

F. Include an upstream and downstream pressure gage capable of accurately measuring system pressures.

2.8 PRESSURE RELIEF VALVES

A. Operation: Maintain a constant upstream pressure by passing or relieving excess pressure.

B. Closed Valves: Drip-tight.

C. Type: Hydraulically operated, pilot control using a diaphragm with a single removable seat and resilient disc.

D. Pilot Controls: Direct acting, adjustable between 20 and 200 psi, spring loaded diaphragm valve.

E. Rating: 250 psi working pressure with flanged connections.

2.9 CONTROL VALVE

A. Types: Diaphragm actuated, single seated, composition disc, hydraulically operated globe valve.

B. Pilot Controls: Externally mounted, four-way, solenoid pilot valve with self cleaning strainers and diaphragm type check valves.

C. Equip with a limit switch for pump control.

D. Equip with a built-in lift check valve to prevent flow reversal.

E. Rating: 250 psi working pressure with flanged connections.

F. Solenoids and the Limit Switch: Supplied with operating voltage as indicated.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Flush all lines before valve installation.

B. In ductile iron water mains install valves, AWWA C600.

END OF SECTION

SECTION 33 12 19
HYDRANTS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Dry-barrel fire hydrants, valves, piping and accessories.

1.2 REFERENCES

A. AWWA C110: American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
B. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
C. AWWA C209: AWWA Standard for Cold-Applied Tape Coatings for the Exterior of Special Section, Connections, and Fittings for Steel Water Pipelines.
D. AWWA C210: AWWA Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
E. AWWA C213: AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel water Pipelines.
F. AWWA C214: AWWA Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines.
G. AWWA C502: AWWA Standard for Dry-Barrel Fire Hydrants.
H. AWWA M17: AWWA Manual for Installation, Operation, and Maintenance of Fire Hydrants.

1.3 PRODUCT HANDLING

A. Package fire hydrants, gate valves, and valve boxes for protection against dirt and damage during shipment and storage.
B. Do not plug drain hole.

1.4 SUBMITTALS

A. Product Data: Manufacturer's technical product data and installation instructions.
B. Shop Drawings: Show interface and spatial relationship between piping and adjacent structures.
C. Field Quality Control Reports: For system commissioning.

1.5 JOB CONDITIONS

A. Notify appropriate fire department as soon as hydrant is removed or placed in service.

PART 2 — PRODUCTS

2.1 DRY-BARREL FIRE HYDRANT

A. Cast iron compression type, AWWA C502, opening against pressure and closing with pressure, base valve design, 150 psi working pressure, with 1/4 inch diameter minimum tapping and bronze plug in standpipe.
    1. Size: 5-1/4 inch valve opening.
    2. Direction to Open Hydrant: Counterclockwise.
    3. Size and Shape of Operating and Cap Nuts: Pentagon. 1-1/2 inch point to flat.
    4. Hose Nozzles: Two 2-1/2 inch National Standard Thread, cap, gasket and chain.
    5. Pumper Nozzle: One 4-1/2 inch National Standard Thread, cap, gasket and chain.
    6. Depth of Burial: 48 inches or consistent with main depth.
    7. Connection to Main: 6 inches flanges or mechanical joint.
    8. Pressure: 150 psi working pressure and 300 psi hydrostatic pressure.
    9. Inlet Bottom Connection: 6 inches mechanical joint or flanged in accordance with AWWA C110 and AWWA C111, designed to allow separation at the sidewalk level when hydrant is sheared off.
    10. Automatic Drain: Opens as the hydrant is closed.

2.2 PIPE AND FITTINGS

A. Ductile iron, Section 33 05 05. Standard drilling, AWWA C110.
B. PVC, Section 33 05 07.
C. Steel, Section 33 05 09. Standard drilling, 150 lb.
D. Spool, Schedule 40 steel, epoxy lined, exterior wrapped with minimum 60 mil thick tape wrap, AWWA C210 or C213 and C209 or C214 with two welded in place 150 lb. steel ANSI B 16.5 slip on flanges.

2.3 VALVES

A. Gate valve. Section 33 12 16.
B. If indicated, furnish an auxiliary 6 inch diameter valve with end connections as required.

2.4 ACCESSORIES

A. Bolts, Nuts, Washers: Stainless steel, Section 05 05 23.
B. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
C. Thrust Blocks: Cast-in-place concrete, Class 2000 minimum, Section 03 30 04
D. Valve Box, Valve Chamber: Section 33 11 00.

PART 3 — EXECUTION

3.1 PREPARATION

A. Excavation, Section 31 23 16.

3.2 INSTALLATION

A. Install hydrants, valves, and valve boxes as indicated and located in accordance with AWWA M17. Hydrants shall not be connected to or lacted within 10 feet of a sanitary sewer or storm drain.
B. Install so bottom of hydrant base flange is even with or less than 4 inches above grade.
C. Point 4-1/2" pumper nozzle to face the street.
D. Drain holes at base of hydrant to remain clear with a minimum of 1/2 cubic yard of clean 1-1/2" Drain Rock (Section 31 05 13) placed around hydrant base and drain. Place sheet plastic over gravel to prevent silting.
E. Coal tar and tape wrap steel pipe.
F. Grease all buried nuts and bolts and wrap with 8 mil polyethylene sheet and tape.
G. Install thrust blocks, Section 33 11 00.

3.3 BACKFILLING

A. Secure water company permission to commence backfilling operation.
B. Trenches, Section 31 23 24.
C. Structures and landscaping, Section 31 23 23.
D. Pavements, Section 32 01 18.

3.4 PAINT

A. Paint buried portion of hydrant with two coats of coal tar enamel or asphalt.
B. Paint hydrant barrel and caps with one coat primer and final coat per water company paint standards.

3.5 FIELD QUALITY CONTROL

A. Commissioning, Section 33 08 00.
B. Disinfection, Section 33 13 00.

END OF SECTION

SECTION 33 12 33
WATER METER

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Water meters, service connections, materials.

B. Related work includes but is not limited to,
1. Excavation, Section 31 23 16.
2. Trench backfill, Section 31 23 24.
3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
4. Pavement restoration, Section 32 01 18.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. AWWA C704: AWWA Standard for Cold-Water Meters - Propeller Type for Main Line Applications.

B. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.

1.4 SUBMITTALS

A. Manufacturer's test records on the range and accuracy of the meter being furnished.

B. Equipment material diagram and parts schematic.

PART 2 — PRODUCTS

2.1 METERS FOR SYSTEM PIPING

A. Meters must be Sensus brand with Touch Read technology.

B. Materials and Construction: AWWA C704
1. Cast or Ductile iron bodies with 175 psi working pressure flanged connections.
2. Built-in straightening vanes.
3. Working pressure 150 psi.
4. Polyethylene plastic propeller.
5. Stainless steel shaft with stainless steel ball bearings, lubricated by means of a single pressure fitting.

C. Accuracy: Plus or minus 2 percent of scale for velocities over 1 foot per second.

D. Totalizer: Six digits reading in units indicated.

2.2 METERS FOR SERVICE PIPING

A. Provided by Vernal City unless indicated otherwise.

B. Must be Sensus 3/4" or 5/8" meters with Touch Read technology and 1000 Gallon Read.

2.3 SERVICE LINE, VALVES, AND FITTINGS

A. Service Pipe: Provide polyethylene pipe, (Section 33 05 06). The service pipe between the main and the meter and to a point not less than 1 foot from the public way side of the property line cannot exceed the meter size.

B. Service Valves and Fittings: AWWA C800.

C. Meter Setters: Brass, with angle fittings, saddle nuts and gaskets.

D. Corporation Stops and Angle Valves: Invert key design.

E. Bypasses: Not allowed on any service installation without approval of the Vernal City Representative.

2.4 METER BOXES

A. Meter Boxes shall be as indicated in the drawings.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install meter box, meter setters, valves, etc. at indicated locations. If not indicated, install in street right-of-way parking strip or at a location approved by the Vernal City Representative.

B. Install meter setters level and horizontal. Provide suitable pipe lengths to prevent stress.

C. Do not operate any of the utility agency's main line valves. Contact agency if valves are to be operated. If required by water utility agency notify affected water users, Section 01 31 13.

D. Vernal City Supplied Meters: Installed by the CONTRACTOR unless indicated otherwise.

END OF SECTION

SECTION 33 13 00
DISINFECTION

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Disinfection of potable water system.

B. Test and report results.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. AWWA A100: AWWA Standard for Water Wells

B. AWWA B300: AWWA Standard for Hypochlorites.

C. AWWA B301: AWWA Standard for Liquid Chlorine.

D. AWWA C651: AWWA Standard for Disinfecting Water Mains.

E. AWWA C652: AWWA Standard for Disinfection of Water-Storage Facilities.

F. AWWA C654: AWWA Standard for Disinfection of Wells.

G. State of Utah: Public Drinking Water Regulations, Part 2, Section 12.

1.4 DEFINITIONS

A. Disinfectant Residual: The quantity of disinfectant in treated water.

B. ppm: Parts per million.

1.5 SUBMITTALS

A. Evidence of experience in disinfection for the CONTRACTOR.

B. Bacteriological laboratory's evidence of certification if laboratory is not Vernal City’s laboratory.

C. Disinfection Report: 3 copies containing:
1. Date issued.
2. Project name and location.
3. Treatment contractor's name, address and phone number.
4. Type and form of disinfectant used.
5. Time and date of disinfectant injection started.
6. Time and date of disinfectant injection completed.
7. Test locations.
8. Initial and follow-up disinfectant residuals in ppm for each outlet tested.
9. Time and date of flushing start.
10. Time and date of flushing completion.
11. Disinfectant residual after flushing in ppm for each outlet tested.
12. Flush water disposal location and acceptance by local agency.

D. Bacteriological Report: 3 copies including:
   1. Date issued.
   2. Project name and location.
   3. Laboratory's name, certification number, address, and phone number.
   4. Time and date of water Sample collection.
   5. Name of person collecting Samples.
   6. Test locations.
   7. Time and date of laboratory test start.
   8. Coliform bacteria test results for each outlet tested.
   9. Certification that water conforms or fails to conform to bacterial standards of State of Utah public drinking water regulations.
   10. Bacteriologist's signature.

1.6 QUALITY ASSURANCE

A. Bacteriological Laboratory: Certified by State of Utah if laboratory is other than Vernal City's laboratory.

1.7 PRODUCT HANDLING

A. Store and protect disinfectant in accordance with manufacturer's recommendations to protect against damage or contamination. Do not use unsuitable disinfectant.

B. Follow all instruction labeling for safe handling and storage of disinfectant materials.

1.8 REGULATORY REQUIREMENTS

A. Conform to State of Utah public drinking water regulations.

PART 2 — PRODUCTS

2.1 DISINFECTANT

A. Liquid Chlorine: AWWA B301 with chlorine 99.5 percent pure by volume.

B. Sodium Hypochlorite: AWWA B300 with not less than 100 grams per liter available chlorine.

C. Calcium Hypochlorite: AWWA B300 with 65 to 70 percent available chlorine by weight in granular form.

D. Powder, tablet, or gas according to manufacturer's specification.

2.2 ALKALI

A. Caustic Soda or Soda Ash.

2.3 ACID

A. Hydrochloric (Muriatic) type.

PART 3 — EXECUTION

3.1 PREPARATION

A. Provide necessary signs, barricades, and notices to prevent accidental exposure to disinfecting materials, consuming disinfecting water, or disturbing the system being disinfected.

B. Make sure the potable water system is complete, clean, and that the system to be disinfected is not connected to the existing system.

3.2 DISINFECTION OF WATER LINES

A. Use one method defined under AWWA C651 that is acceptable to the Vernal City representative.

B. After pressure testing per Section 33 08 00, flush system through hydrants or if a hydrant does not exist, install a tap of sufficient size to provide 2.5 feet per second flushing velocity in the line.

C. Starting at outlet closest to water source, bleed water from each outlet until chlorine residual reaches outlet. Repeat process at each outlet throughout system.

D. Collect a bacteriological water sample at end of line to be tested. If sample fails bacteriological test, flush system and retest. Continue flushing and retesting until a good sample is obtained.

E. If flushing does not produce a passing bacteriological test disperse disinfectant throughout system to obtain 10 to 25 ppm of free chlorine residual.

F. Flush the chlorinated water from the main until chlorine measurements show the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.

G. After a negative bacteriological sample is obtained, let the system relax for 24 hours. Flush and collect a subsequent bacteriological sample for testing. If the subsequent test is negative then water line is acceptable.

3.3 DISINFECTION OF CULINARY WELLS

A. Use one method defined under AWWA A100 that is acceptable to the Vernal City representative.

B. Do not start disinfection until well is thoroughly cleaned.

C. Use a disinfecting solution containing a minimum of 50 ppm residual chlorine.

D. Flush system after disinfection.

3.4 DISINFECTION OF WATER STORAGE RESERVOIRS

A. Use one method defined under AWWA C652 that is acceptable to the Vernal City representative.

B. Do not start disinfection until water storage tank is thoroughly cleaned.

C. Provide and use necessary safety equipment for workers in contact with disinfectant or gasses.

D. Flush system after disinfection.

3.5 FIELD QUALITY CONTROL

A. Bacteriological Test:
   1. Collect Samples for testing no sooner than 16 hours after system flushing.
   2. Analyze water samples per State of Utah requirements.
   3. If bacteriological test proves water quality to be unacceptable, repeat system treatment.
   4. Do not place water systems into service until a negative bacteriological test is made. Provide a copy of the negative bacteriological test to the Vernal City representative.

B. Disposal of Disinfectant:
   1. Legally dispose of disinfecting water and ensure no chlorine buildup or damage to the environment.

END OF SECTION

SECTION 33 31 00
SANITARY SEWERAGE SYSTEMS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Gravity sanitary sewerage systems.

B. Pressure systems are indicated in Section 33 11 00.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

B. OR EQUIVALENT: When products are specified and an OR EQUIVALENT option is given, Vernal City shall determine whether or not the proposed substitution is acceptable.

C. OR EQUIVALENT: At any time in these specifications when products are specified and an OR EQUIVALENT option is given, decisions of equivalency will be at the sole interpretation of Vernal City. A blanket statement that equipment or materials proposed will meet all requirements will not be sufficient to establish equivalence. Those wishing to establish equivalence must furnish Vernal City all descriptive literature, manufacturer's compliance certificates and all other data on the items proposed as equivalent.

1.3 REFERENCES

A. ASTM A 48: Standard Specification for Gray Iron Castings.

B. ASTM A 536: Standard Specification for Ductile Iron Castings.

C. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Section.

D. ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.

E. ASTM C 923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.4 PERFORMANCE REQUIREMENTS

A. Vertical Cover: See the project drawings.

B. Remove any section of pipe already placed that is found to be out of alignment tolerance indicated, defective, or damaged. Relay or replace at no additional cost to Vernal City.

1.5 PROJECT CONDITIONS

A. Minimize neighborhood traffic interruptions. Barricade stockpiles.

B. Provide access to adjacent properties for local traffic and pedestrians, Section 01 31 13.

C. Repair public and private facilities damaged by the CONTRACTOR.

D. Prior to Backfilling: Commission pipeline per Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

1.6 ACCEPTANCE

A. Each sanitary sewer system component must pass applicable requirements in Section 33 08 00.

PART 2 — PRODUCTS

2.1 PIPING AND FITTINGS

A. Provide piping materials and factory fabricated piping products of sizes, types, and classes indicated.

B. Where not indicated, provide proper selection acceptable to the Vernal City representative to comply with installation requirements.

C. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.

D. Provide stainless steel shear rings wherever a flexible coupling is used.

2.2 MORTAR, GROUT AND CONCRETE

A. Mortar: Cement.

B. Grout: Cement, Section 03 61 00.

C. Concrete:
1. Cast-in-place: Class 4000, Section 03 30 04.
2. Precast: Class 5000, Section 03 40 00.

2.3 MANHOLES

A. Basin: Precast concrete, ASTM C 478.

B. Steps: The base section, barrel sections, and cone sections shall have corrosion resistant steps aligned vertically up the side of the section. Maximum spacing between steps shall be 12".

C. Top: Eccentric cone.

D. Grade Adjustment: Use WHIRLyGIG OR EQUIVALENT system to align manhole lid with existing asphalt.

E. Frame and Cover: D & L Foundry & Supply part # A-1180 or approved equal. Use vented cover unless otherwise specified. Flat top design meeting load rating H-20 and appropriate utility lettering. Shape, size and lifting device as indicated.

1. Castings shall be smooth and cleaned by sandblasting. Rings and covers shall have machined surfaces to insure a no-rock and no-rattle fit, and no binding or wedging of the cover within the ring seat

E. Pipe Connectors: Resilient, ASTM C 923. Sand mortar grout pipe connections.

1. A flexible rubber pipe-to-manhole connector shall be used to attach the sanitary sewer pipe to the precast manhole base. The rubber connector shall be EPDM or other elastomer resistant to ozone, weather elements, acids, alkalis, animal and vegetable fats, oils and petroleum products. The connector shall be of the sole element relied upon to assure a flexible watertight seal of the pipe to the manhole. No adhesives or lubricants shall be used in the installation of the connector into the manhole. All stainless steel elements of the connector shall be totally non-magnetic Type 304 or 305 stainless steel.

F. Joints in Sections: Bituminous mastic gasket-type sealant unless indicated otherwise.

PART 3 — EXECUTION

3.1 PREPARATION

A. Verify Trench Excavation is ready to receive work, and dimensions, and elevations are as indicated.

B. Hand trim Excavations to required elevations. Backfill over excavations and compact, Section 31 23 24.

C. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.

D. Clearly identify and promptly set aside defective or damaged pipe.

E. Use pipe cutting tool acceptable to pipe manufacturer.

3.2 INSTALLATION - PIPE AND FITTINGS

A. Place bell end facing upstream.

1. Continuous pipe shall be assembled in the trench.

B. Install gaskets per manufacturer's recommendations.

C. Plug leakproof such pipeline branches, stubs or other open ends which are not to be immediately connected.

D. Clean interior of pipe of dirt and debris as work progresses. The interior of the pipe shall be clean prior to lowering into the trench.

E. Meet line and grade tolerance specified in Section 33 08 00.

3.3 INSTALLATION - MANHOLES

A. Form bottom of Excavation clean and smooth to correct elevation.

B. Place structures in location indicated.

C. Install precast units, ASTM C 891.

D. Provide elevations and pipe inverts for inlets and outlets indicated.

E. When structures occur in Pavements, mount frame and cover 3/8 inch below finished surface. Use WHIRLyGIG OR EQUIVALENT system to align manhole lid with existing asphalt. Follow manufacturer’s recommendations and procedures to install grade-adjusting thermoplastic concrete form. Pour concrete to three inches below asphalt surface. After concrete has cured sufficiently, place 3 inches of asphalt paving over concrete to match lines and grades of existing road surface.

F. When structures occur in non-hard surfaces, set frame and cover 3 inches above finished grade.

3.4 ABANDONED UTILITIES

A. Plug and cap with concrete all open ends of abandoned underground utilities which are to remain in place.

B. Provide closure to withstand hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.

3.5 TAP CONNECTIONS - 6 INCHES AND SMALLER

A. Field cutting into new or existing piping will not be permitted unless written permission is obtained from the Vernal City representative.

B. Make connections to existing pipe and underground structures, so connections will conform as nearly as practicable to requirements specified for new work.

C. Use commercially manufactured wyes for branch connections. Spring wyes into existing line and encase entire wye, plus 6 inches overlap, with not less than 6 inches of concrete.

D. For taps into existing 24 inches or larger piping, or to underground structures, cut opening into unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut ends of connection passing through pipe or structure wall to conform to shape of and parallel with inside wall, unless otherwise indicated. Grout connection to provide smooth transition inlet into pipe.

3.6 TAP CONNECTIONS - LARGER THAN 6 INCHES

A. Not allowed. Provide a Manhole structure.

3.7 JOINTS

A. Join pipe per manufacturer's recommendation or as indicated.

B. Joining Pipe of Different Sizes: At Manholes only.

C. Use neoprene couplings with stainless steel bands and stainless steel shear rings to make connections between dissimilar pipe, or where standard pipeline joints are impractical.

3.8 BACKFILLING

A. Prior to Backfilling: Commission pipeline, Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

B. Trenches: Section 31 23 24.

C. Structures or Landscapes: Section 31 23 23.

3.9 CLEANING

A. Remove debris, concrete, or other extraneous material which accumulates in existing pipes or structures.

B. Clean all pipelines after testing. Do not flush sand, gravel, concrete, debris or other materials into existing piping system.

3.10 SURFACE RESTORATIONS

A. Provide temporary paved surfaces where Trenches pass through roadways, Driveways, or sidewalks.

B. Restore paved surfaces, Section 32 01 18.

C. Finish landscaped surfaces:
   1. With grass, Section 32 92 00 or
   2. Other ground cover, Section 32 93 13.

END OF SECTION

SECTION 33 41 00
STORM DRAINAGE SYSTEMS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Gravity systems such as irrigation, sub-drains, and storm drains.

B. Pressure systems are indicated in Section 33 11 00.

1.2 DEFINITIONS

A. CONTRACTOR: Any person, private business, public business, utility company, or government agency that is performing work within the Vernal City right of way.

1.3 REFERENCES

A. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Section.

B. ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.

C. ASTM C 923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.4 PERFORMANCE REQUIREMENTS

A. Vertical Cover: See the project drawings.

B. Remove any section of pipe already placed that is found to be out of alignment tolerance indicated, defective, or damaged. Relay or replace without additional cost to Vernal City.

1.5 PROJECT CONDITIONS

A. Minimize neighborhood traffic interruptions. Barricade stockpiles.

B. Provide access to adjacent properties for local traffic and pedestrians, Section 01 31 13.

C. Repair public and private facilities damaged by the CONTRACTOR.

D. Prior to Backfilling: Commission pipeline per Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

1.6 ACCEPTANCE

A. Each storm drain system component must pass applicable requirements in Section 33 08 00.

PART 2 — PRODUCTS

2.1 PIPING AND FITTINGS

A. Provide piping materials and factory fabricated piping products of sizes, types, and classes indicated.

B. Where not indicated, provide proper selection acceptable to the Vernal City representative to comply with installation requirements.

C. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated

or recommended by manufacturer.

2.2 IN-PLANE WALL DRAINAGE

A. Drainage Core: Manufacturer's standard three-dimensional non-biodegradable, plastic designed to effectively conduct water to foundation drainage system.

B. Filter Fabric: Manufacturer's standard non-woven geotextile fabric of polypropylene or polyester fibers, or combination.

2.3 SUB DRAIN FILL MATERIALS

A. As specified on the drawings.

2.4 MORTAR, GROUT AND CONCRETE

A. Mortar: Cement

B. Grout: Cement, Section 03 61 00.

C. Concrete:
1. Cast-in-place: Class 4000, Section 03 30 04.
2. Precast: Class 5000, Section 03 40 00.

2.5 CLEANOUTS AND MANHOLES

A. Basin: Concrete floor with cast in place concrete walls or ASTM C 478 precast requirements.

B. Steps: None.

C. Top: Eccentric Cone.

D. Grade Adjustment: Use WHIRLyGIG OR EQUIVALENT system to align manhole lid with existing asphalt.

E. Frame and Cover: D & L Foundry & Supply part # A-1180 or approved equal. Flat top design meeting load rating H-20 and appropriate utility lettering. Shape, size and lifting device as indicated.

F. Pipe Connectors:
1. Precast Bases: Resilient, ASTM C 923. Sand mortar grout pipe connections.
2. Cast in Place or Connections to Existing Manhole with Plastic Pipe: Use rubber Manhole adapter gasket for precast sections. Grout; Section 03 61 00 for cast in place sections.

G. Joints in Sections: Bituminous mastic coating unless indicated otherwise.

2.6 INLETS AND CATCH BASINS

A. Basin: Concrete floor and walls.

B. Frame and Grate:
1. Asphalt coated, heavy duty, cast iron: Section 05 56 00. Shape and size as indicated.

C. Pipe Connectors: Resilient, ASTM C 923. Sand mortar grout.

2.7 OUTFALLS

A. Cast-in-place or precast concrete with reinforced headwall, apron, and tapered sides. Provide riprap, Section 31 15 13, if indicated.

2.8 DRAIN PIPE JOINT SCREENS

A. Heavy mesh burlap, coal-tar saturated felt, 18 to 14 mesh copper screening or synthetic drainage fabric.

B. Plastic or corrosion resistant metal bands.

PART 3 — EXECUTION

3.1 PREPARATION

A. Verify Trench Excavation is ready to receive work, and dimensions, and elevations are as indicated.

B. Hand-trim Excavations to required elevations. Backfill over excavations and compact, Section 31 23 24.

C. Remove stones larger than 2 inches or other hard matter that could damage pipe or impede backfilling or compaction.

D. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.

E. Clearly identify and promptly set aside defective or damaged pipe.

F. Use pipe cutting tool acceptable to pipe manufacturer.

3.2 INSTALLATION - PIPE AND FITTINGS

A. Place bell end facing upstream.

B. Install gaskets per manufacturer's recommendations.

C. Plug pipeline branches, stubs or other open ends which are not to be immediately connected.

D. Clean interior of pipe of dirt and debris as work progresses.

E. Insulate dissimilar metals from direct contact with each other using neoprene gaskets or asphalt coatings.

F. Meet line and grade tolerance specified in Section 33 08 00.

3.3 INSTALLATION - CLEANOUTS AND MANHOLES

A. Form bottom of Excavation clean and smooth to correct elevation.

B. Place structures in location indicated.

C. Install precast units, ASTM C 891.

D. Provide elevations and pipe inverts for inlets and outlets indicated.

E. When structures occur in Pavements, mount frame and cover 3/8 inch below finished surface. Use WHIRLyGIG OR EQUIVALENT system to align manhole lid with existing asphalt. Follow manufacturer’s recommendations and procedures to install grade-adjusting thermoplastic concrete form. Pour concrete to three inches below asphalt surface. After concrete has cured sufficiently, place 3 inches of asphalt paving over concrete to match lines and grades of existing road surface.

F. Where structures outside of Pavements, mount frame and cover 3 inches above finished grade.

3.4 INSTALLATION - INLETS OR CATCH BASINS

A. Form bottom of Excavation clean and smooth to correct elevation.

B. Construct with all connecting piping and appurtenances in their final position.

C. Cut all piping parallel to interior surface wall. Grout connection to provide smooth transition inlet into pipe.

3.5 INSTALLATION - SUB DRAIN SYSTEMS

A. Install pipe and fittings per manufacturer's instruction.

B. Open Joint Systems: Loosely butt pipe ends. Place 12 inches wide filter fabric around pipe circumference, centered over joint.

C. Mechanical Joint Perforated Pipe System: Place pipe with perforations facing down.

D. Place drainage pipe on bedding specified on the drawings.

3.6 ABANDONED UTILITIES

A. Use concrete to plug and cap open ends of abandoned underground utilities that are to remain in place.

B. Provide closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.

3.7 TAP CONNECTIONS

A. Not allowed. Provide a cleanout or Manhole structure.

3.8 BACKFILLING

A. Prior to Backfilling: Commission pipeline, Section 33 08 00. Provide sizes and types of equipment connections and fittings which match pipe materials when pressure testing system.

B. Trenches: Section 31 23 24.

C. Structures or Landscapes: Section 31 23 23.

3.9 CLEANING

A. Remove debris, concrete, or other extraneous material that accumulates in existing piping or structures.

B. Clean all pipelines after testing. Do not flush sand, gravel, concrete, debris or other materials into existing piping system.

3.10 SURFACE RESTORATION

A. Provide temporary paved surfaces where Trenches pass through roadways, Driveways, or sidewalks.

B. Restore paved surfaces, Section 32 01 18.

C. Finish landscaped surfaces as applicable.
   1. With grass; Section 32 92 00 or
   2. Other ground cover; Section 32 93 13.

END OF SECTION

SECTION 33 47 00
PONDS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Clearing pond site and disposal of debris and unsuitable material.

B. Materials for dikes.

1.2 REFERENCES

A. ASTM D 3282: Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

1.3 SUBMITTALS

A. Laboratory analysis and control testing reports of fill to be used in dikes.

B. Sample of geosynthetics to be installed.

C. Quality assurance test results within 24 hour of completed test results.

1.4 PERFORMANCE

A. Protection: Do not contaminate Embankment materials with debris or unsuitable material. Protect existing improvements, trees, structures or other items from damage during construction.

B. Dust Control: Refer to Section 01 57 00. Prevent dust being a nuisance to the neighborhood, and concurrent performance of separate work.

1.5 QUALITY ASSURANCE

A. Perform density tests to assure compacted backfills comply.

B. Do not interrupt surface drainage systems at site without VERNAL CITY REPRESENTATIVE's approval.

C. Control erosion during construction and correct any damage caused by runoff.

PART 2 — PRODUCTS

2.1 BACKFILL SOILS

A. Section 31 23 16, Excavation.

B. Section 31 05 13, Fill Materials.

C. Section 31 05 13, Fill Materials.

D. Section 31 05 15, Cement Treated Fill.

E. Impermeable Embankment: A-4, or A-6 material, ASTM D 3282, with a plasticity index of at least 10, and a coefficient of permeability less than 7 x 10-6 cm/sec.

F. Obtain approval of the material to be supplied prior to beginning construction.

2.2 GEOSYNTHETIC MATERIALS

A. Impermeable, non-biodegradable sheet material that is inert to soil chemicals, resistant to molds, mildew, acids and alkalis, and within a pH range of 3 to 12.

PART 3 — EXECUTION

3.1 CONSTRUCTION

A. Remove and stockpile all topsoil material for later placement on the outer dike surfaces.

B. Excavation: Section 31 23 16. Level areas where dikes are to be constructed.

C. Subgrade: Scarify the top 12 inches and compact Subgrade soils to a Standard Proctor Density of 96 percent or greater, Section 31 23 26.

D. Embankments: Place Embankment materials in lifts consistent with the compaction equipment used. Compact backfill soils to a Standard Proctor of 96 percent or greater. Do not construct Embankment with frozen or unapproved material.

E. Shape dikes to the slopes indicated.

3.2 TOLERANCES

A. Dike Surface: 1 inch plus or minus from true grade.

B. Dike Width: 3 inches plus or minus from design dimension.

C. Dike Alignment: 6 inches plus or minus from true line.

3.3 FINISHING

A. After dikes have been constructed to the lines and grades indicated, spread topsoil on dikes and grade to uniform slope.

B. Dispose of excess or unsuitable materials and smooth grade all affected areas.

C. Leave site free of debris.

END OF SECTION

SECTION 33 71 73
ELECTRICAL UTILITY SERVICES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Under ground and above ground electrical service systems.

1.2 REFERENCES

A. NFPA 70: National Electrical Code.

B. UL: Underwriters' Laboratories Inc.

1.3 RELATED WORK

A. Inspect, splice, and test continuity for all special telemetry cables prior to backfilling Trenches.

B. Related work includes but is not limited to,
   1. Excavation, Section 31 23 16.
   2. Trench backfill, Section 31 23 24.
   3. Landscape restoration, Section 32 92 00 or Section 32 93 13.
   4. Pavement restoration, Section 32 01 18.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to.
   1. NFPA 70.
   2. Electrical authority having jurisdiction.

PART 2 — PRODUCTS

2.1 COMPONENTS

A. Conduit: Section 26 05 33.

B. Concrete: Class 3000 minimum, Section 03 30 05 with No. 67 aggregate or larger and dye additive to give permanent red color.

C. Conductors: As indicated.

D. Cable Lugs: Suitable for application.

E. Duct Spacers: Fabricated plastic, UL approved.

F. Meter Sockets: Provide meter sockets which comply with requirements of power utility company.

G. Metering: Size metering to capacity of main switch or buss as applicable.

2.2 BACKFILL

A. Sand fill, Section 31 05 13.

B. Crushed aggregate base, Section 31 05 13

PART 3 — EXECUTION

3.1 PREPARATION

A. Coordinate utility locations, Section 01 31 13.

B. Excavate, Section 31 23 16.

3.2 INSTALLATION

A. Provide adaptation from conduit to PVC duct.

B. Slope service to drainage point.

C. Terminate service conduit in main panel and transformer with grounding bushings. Make suitable ground connection from bushing to distribution center ground bus.

D. Install on undisturbed soil where possible. Backfill and compact, Section 31 23 24.

3.3 DUCTBANK

A. Place concrete so that voids around ducts are filled.

B. Provide minimum concrete thickness between ducts of 2 inches.

C. Adjust final slopes on site to coordinate with existing utilities.

D. Install drain assembly with saddle cutouts for each conduit. Tape drain assembly to each conduit to prevent entrance of concrete. Band drain assembly with 1/2 inch stainless steel straps to conduit assembly to prevent mechanical displacement. Connect to piping drain.

E. After installation, clean and swab ducts.

F. Install galvanized steel pull wires in spare ducts. Cap spare ducts.

3.4 DIRECT BURIAL

A. Level Trench with 3 inches minimum layer of sand. Cover conductors with 6 inches layer of sand. Provide physical protection acceptable to electrical authority having jurisdiction.

3.5 SERVICE INSTALLATION

A. Provide ductbank from property line or supply authority's pole to transformer or building as required.

B. Coordinate with utility company to install conductor from source to meter. Coordinate Trenching, supplying and placing of sand and backfilling with power utility company.

END OF SECTION