

TECHNICAL SPECIFICATIONS

This project shall be built in accordance with the New Mexico State Department of Transportation Standard Specifications for Highway and Bridge Construction State Construction Bureau, Current Edition and all applicable Supplemental Specifications and Revisions to the New Mexico State Department of Transportation Standard Specifications for Highway and Bridge Construction State Construction Bureau, as published by the New Mexico Department of Transportation except as modified by the City of Alamogordo "Specifications," and "Special Provisions to the Contract Documents."

The Contract Documents will govern in the following order of importance:

1. City of Alamogordo Front End Documents, Section 1 thru Section 13
2. City of Alamogordo Specifications
3. Special Provisions to the City of Alamogordo Specifications
4. Project Plan Drawings
5. NMDOT Standard Specifications, Division 200 thru Division 900
6. NMDOT Supplemental Specifications
7. NMDOT Standard Drawings

CITY OF ALAMOGORDO SPECIFICATION STANDARDS

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Article 01-002.1 GENERAL REQUIREMENTS

1.0 DEFINITIONS AND TERMS

Abbreviations

AASHTO ..	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGC	Associated General Contractors of America, Inc.
ANSI	American National Standards Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BM	Bench Mark
FH	Fire Hydrant
G	Gas Line
ID	Inside Diameter
Inv.	Invert
MH	Manhole
mg/l	Milligrams per Liter
MUTCD	Manual on Uniform Traffic Control Devices
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NMDOT ..	New Mexico Department of Transportation
NMSA	New Mexico Statutes Annotated--1978 Compilation as Amended
OHP	Overhead Power
OHP&T ...	Overhead Power & Telephone
OHT	Overhead Telephone
OSHA.....	Occupational Safety and Health Association
PC	Point of Curvature

ppm	Parts per Million
PRC	Point of Reverse Curvature
psf	Pounds per Square Foot
psi	Pounds per Square Inch
PT	Point of Tangency
PVC	Polyvinyl chloride Pipe
Pvmt. ...	Pavement
Q	Rate of Flow
RCP	Reinforced Concrete Pipe
SCCP	Steel Cylinder Concrete Pipe
Sec	Section
Sta.	Station
Std.	Standard
UGT	Underground Telephone
UL	Underwriters' Laboratories, Inc.
V	Velocity

Definitions

Alley – A minor public way intended for secondary service access to the rear side of a lot or piece of property.

City - The City of Alamogordo and all assigned representatives.

City Engineer – The City of Alamogordo’s Engineer.

Contract Documents - The written AGREEMENT between the CONTRACTOR and the OWNER setting forth the obligations of the parties thereunder, including but not limited to the performance of the Work and the Basis of Payment. The Contract Documents include: the Advertisement for Bids, Addenda (whether issued prior to the opening of Bids or the execution of the Agreement), Instructions to BIDDERS, CONTRACTOR's Bid, the Performance Bonds and Labor and Payment Bond (for both CONTRACTOR and SUBCONTRACTOR, if applicable to SUBCONTRACTOR), the Certificate of Insurance, the Statement of BIDDER’s Qualifications, the Campaign Contribution Disclosure Form, the Notice of Award, the Notice to Proceed, these General Conditions, the Contract Specifications, any Special Conditions, any referenced Specifications or Standards, Drawings and Plans, and all Modifications to the above, including Change Orders and extensions of Contract Time, all of which constitute one instrument.

CONTRACTOR - The person, firm, or corporation with whom an owner has executed the AGREEMENT.

Cul-De-Sac – A local street with only one (1) outlet having an appropriate terminus for the safe and convenient reversal of traffic movement.

Drawings or Plans - The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by an ENGINEER.

Driveway, Private – A vehicular way not serving more than one (1) lot or parcel of land.

Driveway, Common – A vehicular way serving more than one (1) lot or parcel of land.

ENGINEER - The person or firm designated by an owner, who is responsible for providing engineering services.

Easement, Private – A right-of-use granted for the limited use of private land owners and where general use and maintenance of such area is governed by an agreement which runs with the land. This easement is serviceable only by mutual consent of all of the parties that benefit from the Easement.

Easement, Public – An easement dedicated for use by the public, which is included within the dimensions or areas of lots or parcels of land.

Field Order - A written order issued by an ENGINEER or Public Works Inspector which clarifies or interprets the Plans and Specifications.

Frontage Road – Used to relieve Major Arterial streets of side traffic.

Grade – The slope of any surface specified in percentage terms or in terms of elevation.

Grading – Any disturbance of the surface of the land with earth moving equipment.

Intersection – the location where two (2) or more streets cross at grade.

Median – A strip that separates the opposing flows of traffic on a street.

OWNER – The City of Alamogordo's representatives.

Pedestrian Way – A specifically designated place, means, or way by which pedestrians shall be provided safe, adequate and usable circulation; normally provides access through the interior of a property or development. Does not include street or vehicular easement or right-of-way or required sidewalk along a street or vehicular way.

Property Line – The line(s) of record bounding a lot or other parcel of land.

Project - The entire construction to be performed as provided in the Plans and Specifications.

Project Manager – The OWNER'S representative who is delegated the responsibility for administration of the Project and who is the primary point of contact for the CONTRACTOR.

Public Works Inspector – Inspector representing the City of Alamogordo responsible for inspection of all Work done and all materials furnished. He is authorized to call to the attention of the CONTRACTOR any failure of the Work or materials to conform to the City's Standards, Plans and Specifications. He shall have the authority to reject materials or suspend Work until any questions at issue can be resolved.

Reference Specifications, Test Methods, and Applicable Codes - All Standard Specifications and test methods of any society, association, or organization, referred to herein, are hereby made a part of these Technical Standards the same as if written in full. (Any reference to a paragraph or subparagraph within an article shall include all general provisions of the article to which reference is made.) References to such Standards refer to the latest published issues as of the date of the development or Project is approved, unless otherwise specified. Reference to local or state codes and laws shall mean the latest adopted and published codes as of the date of the development or Project is approved, unless otherwise specified.

Service Connections - Service Connections shall be construed to mean all or any portion of the pipe, conduit, cable, or duct which connects a utility main or distribution line to a building, home, residence, or property.

Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by CONTRACTOR, a Subcontractor, manufacturer, Supplier, or distributor which have been approved by OWNER and/or the City Engineer and which illustrate the equipment, material, or some portion of the Work.

Special Conditions - Conditions which modify any article or paragraph of these Technical Standards.

Specifications (also Technical Specifications) - A written technical description of materials, equipment, construction systems, standards and workmanship as applied to the Work.

Street – A right-of-way dedicated to the use of the public by which vehicles and pedestrians shall have lawful and usable ingress and egress, which has been accepted for maintenance and control by the City, County or State. See Section 3 of the Detail Drawings for street classifications.

Street, Stub – A street that has been designed to allow for the future extension of the street through subsequent developments.

Subcontractor - An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site, and who has a current City of Alamogordo Business Registration.

Utility - Overhead or underground wires, pipes, conduits, ducts, or structures, operated and maintained in or across a public right-of-way or easement or private easement operated and maintained to supply such commodities as water, gas, power, telephone, cable television, or sewer.

A. Public Utility - Owned and operated by a municipality or another political subdivision of the state.

B. Private Utility - Owned and operated by a private company or corporation.

Work - Any and all obligations, duties, and responsibilities necessary to the successful completion of the Project assigned to or undertaken by CONTRACTOR, including all labor, materials, equipment, incidentals, and the furnishing and installation thereof.

1.1 DESCRIPTION

2 The work will consist of installing 6-inch, 8-inch and 10-inch water line, valves, water connections, new water services and fire hydrants, remove and replace concrete sidewalk, driveway aprons, curb/gutter, and concrete paving, construct accessible (ADA) curb ramps, earthwork, asphalt milling, asphalt paving, asphalt paving patch work, pavement marking and traffic control and appurtenances, as specified and/or shown on the construction documents, complete, in place, all within the city limits of Alamogordo, New Mexico.

The CONTRACTOR is required to locate all existing utilities prior to commencing Work on the Project. It shall be the CONTRACTOR's sole financial and legal responsibility to field verify locations and depths of all existing utilities and coordinate any relocation Work required.

The CONTRACTOR shall be required to maintain adequate temporary access for the private residences and the businesses and facilities within the construction area, to the satisfaction of the City Engineer and/or Public Works Inspector.

At the end of each Work day, or as required during each day, or as required due to weather conditions, the CONTRACTOR shall perform grading, shaping, and cleanup, to maintain an acceptable site condition, as determined by the ENGINEER.

2.0 WORKMANSHIP AND MATERIALS

These standards are prepared with the intention that only first-class workmanship and materials of the best quality will be provided. Materials and workmanship of less than best quality will not be acceptable. In the event that these Standards may not completely describe each and every part, item and detail, it will not relieve the CONTRACTOR of the full responsibility for providing the necessary part, item or Work necessary to complete the Project satisfactorily for proper operation, as intended.

The materials and equipment specified are considered the minimum standard of quality necessary to produce a satisfactory Project. Substitutions for the materials and equipment that have been specified will not be permitted except on written approval of the City Engineer.

Any materials that are found to be damaged either before or after installation shall be removed promptly and replaced with new materials. The Public Works Inspector's inspection of the materials before they are installed shall not relieve the CONTRACTOR from any responsibility to furnish and install good quality materials, totally undamaged.

3.0 WATER FOR CONSTRUCTION

The CONTRACTOR will be responsible for purchasing all of the reclaimed water needed for construction from the City of Alamogordo. The cost will be determined in accordance with the current reclaimed water rates. It shall be the CONTRACTOR's responsibility to transport and apply the reclaimed water as specified or as ordered by the ENGINEER.

Reclaimed Hydrant Locations

Purple Hydrants

1. Airport Pivot Hydrant, 3500 Airport Road
2. Airport Hydrant, 3500 Airport Road
3. LaVelle Hydrant, East of LaVelle Pump Station on Bypass Hwy.
4. Michel Street Hydrant, 2150 US Highway 54 South.
5. Civic Center Automated Fill Stand, 800 E. First Street
6. 26th Street Hydrant, 2518 Puerto Rico Avenue
7. Walker Ball Fields, 2143 S. Walker Avenue

The CONTRACTOR shall meter the reclaimed water used at the fire hydrant from which the reclaimed water is taken. The CONTRACTOR shall furnish the meter or obtain a meter from the City for which he will have to pay a deposit, to be refunded when the meter is returned in good working order.

The CONTRACTOR shall furnish and maintain the piping and/or equipment necessary to connect to the reclaimed water source and to convey the reclaimed water into the CONTRACTOR's reclaimed water tank. CONTRACTOR shall not allow reclaimed water to go to waste during the tank filling operations, and he shall not allow his piping and equipment to leak water.

The tank filling equipment shall be placed and maintained in such a way as to provide prevention against accidents of any nature to CONTRACTOR personnel or the public in general.

The CONTRACTOR is required to connect the fill stand or fill equipment to the fire hydrant, and leave the fire hydrant valve open. CONTRACTOR shall install a valve in the fill stand piping to control the water flow.

The hydrant valve shall not be closed except when water will not be needed over a weekend or a period of two (2) or more days.

4.0 QUALITY ASSURANCE MATERIALS TESTING (GEOTECHNICAL)

A materials testing laboratory shall be retained by the City for Quality Assurance testing. The frequency of the Quality Assurance testing shall be as determined by the OWNER.

The CONTRACTOR shall notify the Project Manager and the Public Works Inspector 24-hours prior to requested

thru e-mail when ready for each Quality Assurance test and cooperate fully in making way for the laboratory technician to make the required tests. The CONTRACTOR shall notify If any of the Work fails to meet the standards specified, the CONTRACTOR shall correct such failures in a manner acceptable to the ENGINEER and/or the Public Works Inspector. The CONTRACTOR shall pay for the cost of all Quality Assurance re-testing necessary due to failure to meet Specification requirements on previous Quality Assurance testing. If the CONTRACTOR requests the testing laboratory to obtain density tests and the area to be tested is not ready when the technician arrives at the job site, the CONTRACTOR shall pay for all trip charges or stand-by time assessed. All cost for failed test and stand-by time will be deducted from the amount due on the Contract.

CONTRACTOR shall give Geotechnical Testing Lab a minimum of twenty-four (24) hours notice of readiness of the Work for Quality Control tests.

CONTRACTOR shall be responsible for providing to the OWNER the Proctor, Gradation and Liquid Limits of Subgrade material and Base Course material.

Material testing as referenced in this Section is for the OWNER's, Quality Assurance. The CONTRACTOR is responsible for Quality Control of material, process and method. Neither observations by ENGINEER nor inspections, tests or approvals by persons other than CONTRACTOR shall relieve CONTRACTOR from CONTRACTOR's obligations to perform the Work in accordance with the requirements of the Contract Documents

5.0 SURVEYING AND STAKING

The CONTRACTOR shall be responsible for all horizontal and vertical control required to build the Project, basic survey control will be provided by the City of Alamogordo. Any field adjustments made by the ENGINEER will be accepted as if incorporated herein and shall not make any claims for additional surveying or surveying expenses resulting therefrom.

6.0 SANITARY FACILITIES

The CONTRACTOR shall provide the necessary number of sanitary toilet units for all of the workers on the work site. The chemical toilets shall be moved along the Project routes so that they will be convenient for the workers.

Adequate potable drinking water shall be provided on the work site as well as drinking cups, for the benefit of all employees.

7.0 TRUCK BED COVERS

All trucks or other conveyances hauling any loose materials, including hot-mix bituminous materials, on public streets, highways and detours shall be of an approved type, and shall be covered in such a manner as to prevent such materials from dropping, sifting, leaking, or otherwise escaping therefrom. Coverings for trucks or other conveyances hauling loose materials as herein provided shall be securely fastened so

as to prevent said covering or load from becoming loose, detached, or in any manner a hazard to public traffic. Any vehicles in violation of this provision will not be permitted to operate.

8.0 METHOD OF BIDDING

The Bid Schedule has been prepared for a Unit Price Contract procedure. All of the quantities shown in the Bid Schedule are estimated, and are not purported to be exactly correct. CONTRACTOR shall be required to furnish more or less of each estimated quantity that may be required to satisfactorily complete all of the Work. The CONTRACTOR will be paid on the unit basis for all of the material that is actually furnished and installed in the construction of the Project to plan dimensions. In no case shall the CONTRACTOR claim extra compensation for building any portion of the Project beyond plan dimensions.

9.0 UNDERGROUND AND OVERHEAD UTILITIES

Any interference with, or damage to, either underground or overhead utilities of any nature shall be the CONTRACTOR's legal and financial responsibility, saving the OWNER harmless from any or all claims resulting from damage to these utilities by reasons of his operations.

The CONTRACTOR shall contact New Mexico One-Call at 1-800-321-2537 or by cell phone at 811 to request field utility locates forty-eight (48) hours prior to digging

10.0 CONTRACTOR COMMUNICATIONS

The CONTRACTOR shall contact the OWNER, ENGINEER and the Department of Public Safety to provide information related to traffic control impacts, as well as to obtain any new requirements or restrictions for traffic control procedures.

11.0 SEQUENCE OF WORK

The Work shall be carried out with the intent of causing as little disruption as possible to the public. The CONTRACTOR shall perform clean up operations on a continuous basis. Any area requested to be cleaned up by the OWNER, ENGINEER and/or Public Works Inspector shall be cleaned immediately.

CONTRACTOR shall be responsible for advising the businesses, residents and occupants along each street as to when Work will be done in that particular area. CONTRACTOR will notify the businesses, residents and occupants not less than two (2) days in advance of doing the Work. CONTRACTOR will request businesses, residents and occupants to move their vehicles out of the way of construction if required. If a problem develops with any resident or occupant, the CONTRACTOR shall report it to the OWNER and ENGINEER. The OWNER will assist in solving the resolution.

12.0 AUTHORITY AND DUTIES OF PUBLIC WORKS INSPECTOR(S)

Certified Inspectors representing the City of Alamogordo shall be authorized to inspect all Work done and all materials furnished. Such inspection may extend to all or any part of the Work and to the preparation, fabrication or manufacture of the materials to be

used. The Public Works Inspector (Inspector) is not authorized to revoke, alter, or waive any requirements of the Specifications. The Public Works Inspector is authorized to call to the attention of the CONTRACTOR any failure of the Work or materials to conform to the Technical Standards and/or the Plans and Specifications, whichever is more strict. The Public Works Inspector shall have the authority to suspend the Work when an imminent hazard condition is known to exist, or when the CONTRACTOR either delays in correcting or permits repeated occurrences of a hazardous condition. This authority to suspend Work does not relieve the CONTRACTOR of the legal responsibility for safety at the jobsite.

The Public Works Inspector shall have the authority to suspend Work due to rejected materials or rejected Work only at the direction of the City Engineer or Project Manager. Any questions at issue as to quality of materials and/or Work installed may be referred to the OWNER and/or ENGINEER. If the CONTRACTOR refuses to suspend operations on verbal order, the Inspector shall issue a written order giving the reason for suspending the Work. After placing the order in the hands of the CONTRACTOR's man-in-charge, the Inspector shall immediately leave the job. Work done during the absence of the Inspector will not be accepted.

The Public Works Inspector shall in no case act as foreman or perform other duties for the CONTRACTOR, nor interfere with the management of the Work by the CONTRACTOR. Any advice which the Inspector may give the CONTRACTOR shall not be construed as binding the City in any way or releasing the CONTRACTOR from fulfilling all of the required Contract terms.

13.0 SANITARY LANDFILL

All waste and recyclable materials shall be disposed of or stockpiled in approved locations per EPA regulations.

14.0 SIGN REMOVAL AND REPLACEMENT

The CONTRACTOR shall be responsible for removing and replacing all existing signs that are in the way of the Project construction. The existing sign location and height shall be indexed before removal. Removed signs shall be properly and adequately stored. When replaced, signs shall be in existing or better condition, in all respects, than before removal. The CONTRACTOR shall replace any signs that are damaged due to negligence, mishandling, or inadequate storage.

15.0 PROTECTING THE WORK

The CONTRACTOR shall be responsible for protecting all portions of the Work against any and all damage including but not limited to: vandalism, accidents and weather conditions, until accepted. No additional payment will be allowed for rebuilding any portion of the Project caused by such damage.

16.0 FENCING

The CONTRACTOR shall be responsible for removing and rebuilding any and all existing fencing that is damaged or is in the way of the Project construction. This Work

shall be considered incidental to the Project and no payment will be allowed for this Work.

17.0 EXISTING WATER VALVE BOXES

The CONTRACTOR shall reference the location of all existing water valve boxes within the construction areas. Any valve boxes that are damaged during construction shall be replaced with no additional Payment. After the new paving has been installed and approved, the CONTRACTOR shall neatly saw-cut a two (2) foot by two (2) foot square opening in the new pavement, centered on the valve, and the CONTRACTOR shall install a new reinforced concrete collar, as provided in the Contract Documents.

18.0 EXISTING MANHOLES

The CONTRACTOR shall reference the location and carefully remove and store manhole rings and lids within the construction areas. Any manhole rings and lids damaged shall be replaced by the CONTRACTOR. The top portion of the manhole shall be removed to a depth below the limits of Work, and a steel plate covering over the manhole shall be provided. After the new PMBP has been installed and approved, the CONTRACTOR shall neatly saw cut a four (4) foot by four (4) foot square opening in the new pavement, centered on the manhole.

The CONTRACTOR shall provide concrete adjustment rings as required to reconstruct the top of the manhole to the proper elevation so that the manhole frame and lid are flush with the new PMBP surface. Each manhole shall receive a new reinforced concrete collar, as provided in the Contract Documents.

19.0 WATER SHUT-OFFS

All water shut-offs shall be done by the City. The CONTRACTOR shall notify the City Water Shop forty-eight (48) hours prior to the time of the required shut-off. The CONTRACTOR shall also notify, at least twenty-four (24) hours in advance, each household, office, business and/or other affected water user that a shut-off will be made.

END OF ARTICLE 01-002.1

Article 01-002.2 TRAFFIC CONTROL AND MANAGEMENT

1.0 DESCRIPTION

This Work shall consist of providing Traffic Control and Traffic Control management in accordance with the Contract and the Manual on Uniform Traffic Control Devices (MUTCD), current edition, including supervision of personnel and the installation, inspection, and maintenance of all traffic control devices on the Project.

Complex traffic control Plans shall be development and stamped by a registered professional Engineer prior to submittal to the Project Manager;

2.0 REQUIREMENTS

The Contractor may assign more than one (1) traffic control supervisor (TCS) to provide traffic control management for the Project provided that a schedule is submitted to the ENGINEER and PROJECT MANAGER.

If assigning more than one (1) TCS to provide traffic control management, submit to the Project Manager a weekly schedule identifying who shall be in charge of providing traffic control management each Day.

The TCS shall possess, at all times, a set of APPROVED traffic control plans and a current copy of the MUTCD.

Traffic Control shall be required when construction interferes with thoroughfare traffic. Traffic Control shall also be required to prevent through-traffic, where new development meets existing streets, until all utilities, new streets, and infrastructure have been completed.

Where more than one contractor is working in an area requiring Traffic Control, the CONTRACTOR shall coordinate all Traffic Control operations.

If the CONTRACTOR is using a subcontractor to provide traffic control management, the CONTRACTOR shall ensure that the TCS is in accordance with the Contract.

The Contractor may assign one (1) or more traffic control technician (TCT) to assist the TCS in inspection and maintenance of traffic control devices.

2.1 CERTIFICATION

Before commencing Work that requires traffic control management, submit to the Project Manager a copy of the "Work Zone Safety Supervisor" certificate for the TCS (wallet size card) issued by the American Traffic Safety Services Association (ATSSA), the Associated Contractors of New Mexico (ACNM), or an agency or firm approved by the Department.

The Department will accept the TCS certification by ATSSA, ACNM, or any agency or firm only if the following requirements are met:

1. Successful completion of a Department-approved Work-zone traffic control course;

2. Passing a written examination on a Work-zone traffic control course;
3. At least one (1) year of full-time field experience, verified by the agency or firm, in Work zone traffic control; the Department may verify the experience at its discretion.

The TCT must only satisfy requirements 1 and 2, above.

Before commencing Work that requires flagger traffic control, submit a copy of the "Flagger Training" certificate (wallet sized card) issued by ATSSA, ACNM, FHWA, or an agency or firm approved by the Department.

2.2 RE-CERTIFICATION

Renew the TCS's certification every four (4) years through the ATSSA, ACNM, or a Department-approved agency or firm.

Re-certify in the fourth year, before the expiration date of the current certification.

Flaggers must obtain refresher training which meets the requirements of ATSSA, ACNM, FHWA, or agency or firm approved by the Department prior to the fourth anniversary date shown on the current certificate.

2.3 DUTIES

The TCS's only responsibility is traffic control management. The ENGINEER and/or OWNER may allow exceptions to this rule if the Project is small and requires limited traffic control. The Project Manager and the City Engineer will determine approval of the exception at the preconstruction conference.

The TCS's primary duties include the following:

1. Providing management and supervision services at the Project site;
2. Preparing revisions requested by the Contractor to the traffic control plan in the Contract and submitting the new traffic control plan, in CAD format or hand drafted on a 12 inch x 18 inch piece of 20-pound paper using current drafting standards, to the Project Manager for approval. Complex traffic control Plans shall be development and stamped by a registered professional Engineer prior to submittal to the Project Manager;
3. Coordinating the flagging and signing personnel training;
4. Supervising the flagging and signing personnel;
5. Coordinating traffic control operations for the duration of the Contract, including those of Subcontractors, utility companies, and Suppliers, to ensure that traffic control is in place and fully operational before the commencement of Work. When dealing with utility companies, the TCS shall coordinate concurrent utility traffic control with other construction traffic control to avoid conflicts;

6. Coordinating, in writing, Project activities with the appropriate individual traffic control, law enforcement, and fire control agencies;
7. Preparing and submitting statements concerning Road closures, Delays, and other Project activities to the news media, as necessary. Before submittal to the news media, the Contractor shall submit news releases to the Project Manager for review and approval;
8. Notifying the Project Manager of accidents related to the Project traffic control;
9. Recording time and date of accident notification in accordance with Section 2.4, "TRAFFIC CONTROL DIARY".
10. Attending the preconstruction conference;
11. Maintaining, cleaning, and replacing traffic control devices in use per the current traffic control plan during working and non-working hours

The TCS(s) shall provide management and supervision services at the Project site.

The City recognizes that the CONTRACTOR does not have direct control over the Traffic Control operations of the utility companies. The coordination provided by the TCS when dealing with utility companies is for the purpose of coordinating concurrent utility Traffic Control with any other construction Traffic Control to avoid conflicts.

The TCS(s) shall coordinate all Project activities with the appropriate individual Traffic Control law enforcement, fire control agencies and emergency service providers (Police, Fire and Ambulance).

The TCS(s) shall prepare and submit statements concerning road closures, delays, and other Project activities to the news media, as necessary. News releases shall be submitted to the ENGINEER and/or OWNER for review and approval prior to the CONTRACTOR's submittal to the news media.

The TCS(s) shall be responsible for notifying the ENGINEER of all accidents related to the Project. The time and date of any accidents shall be documented, as well as any other pertinent information.

2.4 TRAFFIC CONTROL DIARY

The TCS shall maintain a Project traffic control diary in a bound book. Obtain the diary from the ACNM.

The TCS shall keep the traffic control diary current each Day and sign each daily entry.

The TCS shall make entries in ink, in a format approved by the Project Manager, without erasures or white-outs. The TCS shall strike out unacceptable entries and replace with acceptable ones. The TCS may use photographs to supplement the written text.

Ensure that the traffic control diary is available for inspection by the Project Manager at all times and submit a copy of the diary to the Project Manager at the end of each week. The traffic control diary shall be kept on site during construction activities.

The traffic control diary will become the property of the Department at the completion of the Project. If the Contractor fails to submit the diary, the Department may withhold final payment until it is submitted.

2.5 INSPECTION OF TRAFFIC CONTROL

The TCS shall inspect traffic control devices every Day that traffic control devices are in use at least once a week during nighttime periods. The TCS shall provide for the immediate cleaning, repair, or replacement of traffic control devices that are not functioning as required to ensure the safety of the motorists and construction personnel.

The TCS shall conduct inspections of the traffic control devices at the beginning and end of each Day that traffic control devices are in use, and as scheduled or directed by the Project Manager during the Work Day.

The TCS shall inspect the traffic control devices during working and non-working hours on a schedule approved in writing by the Project Manager.

The TCT shall inspect Traffic Control devices and shall provide for the immediate repair, cleaning, or replacement of Traffic Control devices not functioning as required or not meeting MUTCD Standards to ensure the safety of the public and construction personnel.

2.6 AVAILABILITY OF TCS

Provide traffic control management under the supervision and direction of the TCS on a 24-hour-per-day basis throughout the duration of the Project.

The TCS shall be on the Project whenever Work is in progress, and available by telephone to be on the Project within 1 hour at all other times.

The provisions for availability of the TCS will also apply during times of Partial or full Project Suspension.

3.0 COMPLIANCE

3.1 FAILURE TO COMPLY

If the Contractor fails to comply with the approved traffic control plan or fails to immediately correct unsafe traffic conditions after written notification of the problem, the Project Manager may suspend all or part of the Contractor's operations.

In the event that the Contractor does not take appropriate action to bring the deficient Traffic Control into compliance with the approved Traffic Control Plan – or to correct the unsafe traffic conditions – the City may proceed with the corrective action and charge the Contractor for the additional cost incurred

If the Department suspends the Contractor's operations, the Department will include the period necessary to correct these unsafe conditions and traffic control deficiencies in the normal assessment of Contract Time.

The Department will not relieve the Contractor of the responsibility to provide traffic control safety to the traveling public, if the Department fully or Partially Suspends the Project.

If the Department suspends the Project due to the Contractor's failure to comply with this Section, or the Contract is in liquidated damages, the Contractor shall continue to provide traffic control management, at no additional cost to the Department.

If the Contractor requests full or Partial Suspensions, the Contractor shall perform the additional traffic control management at no additional cost to the Department.

3.2 ENGINEER MODIFICATION

The provisions included in the Plans and Specifications for handling and controlling traffic during construction may be changed by the ENGINEER due to actual field conditions encountered. Such changes will be made by written instruction to the CONTRACTOR and shall be considered an amendment to the Plans and Specifications as of the date of change.

4.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

Traffic Control shall be measured by the Lump Sum. A Lump Sum Breakdown shall be provided to the ENGINEER at the Pre-construction Conference.

No separate measure shall be made for Traffic Control. Traffic Control shall be incidental to the project.

5.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

Payment for accepted Traffic Control shall be paid for by the Lump Sum. A Lump Sum Breakdown shall be provided to the ENGINEER at the Pre-construction Conference.

No separate payment will be made for Traffic Control. Payment for Traffic Control shall be made under the item with which it is associated.

The Department will negotiate payment for additional traffic control management resulting from an increase in Work beyond the scope of the Project. Do not start Work until agreement on payment for additional Traffic Control Management.

For normal increases in Contract Items resulting in extensions of the Contract Time, the Department will increase the original Lump sum amount based on the ratio of actual additional Days used to the original Contract Time.

END of ARTICLE 01-002.2

Article 01-002.3 CLEANUP

1.0 DESCRIPTION

This Work shall consist of cleanup, in accordance with this Specification, the Project Plans, and all applicable specification items in these documents. CONTRACTOR shall furnish all the labor, equipment and materials necessary to perform all of the Work required.

2.0 PROJECT CLEANUP

Cleanup of debris, trash and waste materials shall be performed on a continuous basis by the CONTRACTOR in such a way that will keep the work site(s) clean and neat at all times.

The CONTRACTOR shall be responsible for cleaning up the Project. All areas disturbed shall be left in excellent condition, free of any debris, trash, and the like. All trees that were limbed during construction shall be neatly and properly coated with the approved coating so as to protect the cut face, in accordance with good tree surgery practices.

All areas disturbed shall be graded smooth and shall be free of ruts and uneven places.

All excess materials, trash, dirt and rocks shall be disposed of at an approved site or at a place approved by the New Mexico Environment Department.

3.0 FINAL INSPECTION CLEANUP

Immediately before the final inspection tour is to be conducted, the CONTRACTOR shall cleanup the Project site in its entirety, removing all debris, waste, trash, excess materials and equipment. CONTRACTOR shall review the entire Project before the final inspection and shall have it neat and clean in appearance.

4.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

No separate measure shall be made for Project Cleanup. Project Cleanup shall be considered incidental to the Project Work.

5.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

No separate payment will be made for Project Cleanup. Payment for Project Cleanup shall be considered incidental to the Project Work.

END OF ARTICLE 01-002.3

Article 02-022.1 EARTHWORK

1.0 DESCRIPTION

This Work consists of equipment, materials, labor, and performing operations required for excavation, borrow, embankment, and backfill required to bring the existing ground to subgrade elevation.

2.0 TESTING FOR COMPACTION

Compaction testing requirements:

Determine the density of soil in place by use of the sand cone method, ASTM D 1557 or by nuclear methods, ASTM D 2922 and D 3017.

Determine the laboratory moisture-density relationship of soils by ASTM D 698.

Determine the relative density of cohesionless soils by ASTM D 4253 and D 4254.

Sample backfill materials by ASTM D 75.

Compaction tests shall be performed every five hundred (500) feet each lift or a minimum of one (1) location as designated by the Public Works Inspector.

3.0 GENERAL

Work shall consist of excavation, providing borrow, constructing embankment, hauling, disposal, placement and compaction of all materials not covered under some other item which is encountered within the limits of the Work necessary for the construction of the improvements in substantial compliance with the Specifications and the lines, grades, thickness, and typical cross sections shown on the Plans or established by the ENGINEER. All excavation will be classified as "unclassified excavation".

Unclassified Excavation: Unclassified excavation shall consist of the excavation and disposal of all materials of whatever character encountered in the Work.

Borrow: Borrow shall consist of approved material required for the construction of embankments or for other portions of the Work and shall be obtained from approved sources.

Embankment: Embankment shall consist of construction of embankments and miscellaneous fill with suitable materials, containing specified moisture, from unclassified excavation, structure excavation, and borrow, placed and compacted in place.

Backfill: Backfill shall consist of suitable materials from unclassified excavation and borrow, containing specified moisture and placed around or under pipes, culverts, and minor concrete structures to the density specified in the Project Plans or as specified in these Technical Standards, whichever is more strict.

Existing utilities, services, facilities, and pipelines on, above, or under the surface of the area where earthwork operations are to be performed shall be carefully protected from damage.

4.0 CONSTRUCTION REQUIREMENTS

The excavation and embankments for the Project improvements shall be finished to reasonably smooth and uniform surfaces. Excavation operations shall be conducted so that materials outside of the limits of slopes will not be needlessly disturbed.

Prior to beginning excavation, grading, trenching, and embankment operations in any area, all necessary clearing and grubbing in that area shall have been performed.

When the CONTRACTOR's excavating operations encounter remains of prehistoric people's dwelling sites or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. The City Engineer will contact archeological authorities to determine the handling and disposition thereof. The CONTRACTOR shall cooperate with the archeological authorities in the preservation and removal of such artifacts.

5.0 EXCAVATION

5.1 GENERAL

Excavations shall be made to the lines and grades and at the locations shown on the Plans, in accordance with these Technical Standards and all other applicable specification items. Cut sections resulting from excavation shall be finished to a reasonably smooth and uniform surface. The final surface of excavations which shall serve as subgrade for concrete Work shall not vary more than 0.00 foot above or 0.05 foot below the established grade or elevation. Other areas shall be ± 0.1 foot. The CONTRACTOR shall be required to remove unsuitable materials and refill the excavated area to the finished graded section with suitable material. CONTRACTOR shall conduct operations for the removal of such unsuitable material in such a way that the ENGINEER and/or Public Works Inspector can make all necessary observations and measurements to determine the extent of such removal before any suitable material is placed. All unsuitable material shall be properly disposed of.

Excavations shall be performed insofar as practicable in the dry. Proper drainage for the excavated areas shall be maintained to prevent the ponding of water. Excavated areas shall be kept dry by pumping, dikes or other suitable means. Where excavated material which is to be incorporated into the permanent embankment, fill or backfill is found to have excessive moisture content, CONTRACTOR shall dry such excavation to achieve the proper moisture content before placement.

Sheeting and shoring shall be used when necessary for personnel safety and work protection. Sheeting and shoring shall conform to OSHA requirements.

5.2 PIPES AND CONCRETE STRUCTURES

Excavation for pipes and concrete structures shall be made to the lines, grades, and cross sections shown in the Project Plans.

CONTRACTOR shall provide all trench wall sloping, shoring, sheeting and bracing, and incidentals required to provide safe working conditions, in compliance with OSHA requirements.

The width of excavations shall be sufficient to allow for proper jointing of pipes and for working with forming materials for concrete structures and to the dimensions indicated in the Project Plans and/or the Contract Documents.

Unsuitable foundation material encountered at the bottom of the excavation shall be removed and backfilled with suitable material, compacted at optimum moisture, to ninety-five (95) percent density (ASTM D 1557).

The bottom of the completed excavation shall be firm and smooth for its entire width and length. CONTRACTOR shall notify the ENGINEER when the excavation, or section thereof, is completed and the ENGINEER shall approve the excavation before any bedding material, refill or backfill material is placed.

6.0 BORROW

Borrow shall be obtained from the places indicated in the Project Plans or as approved by the ENGINEER.

Borrow shall consist of approved gravelly material excavated for the purpose of blending and mixing with finer excavated materials to provide suitable material for fill, backfill, and embankment.

7.0 EMBANKMENT AND FILL AREAS

7.1 GENERAL

Prior to the placement of suitable material for embankment or fill areas, all necessary clearing and grubbing, excavation, and installation of pipes and appurtenances shall have been performed, all in accordance with the Project Plans and/or these Technical Standards.

7.2 MATERIAL CLASSIFICATION

Embankment and fill materials shall conform to the following classifications:

The materials used in the embankment and fill shall not be uniformly fine grained materials. The fill materials shall be classified as SC, SM-SC, GC, GM, or GM-GC according to the Unified Soil Classification System. No soils in the embankment material shall have a median grain size (D50) finer than #200 USA Standard Sieve. Proper mixing and blending of materials will be required.

7.2.1 Placement of Embankment and Fill

Areas of natural ground to receive embankment or fill not already at optimum moisture shall be scarified to a depth of eight (8) inches, wetted or dried to bring the moisture content to within plus two percent (+2%) to minus one percent (-1%) of optimum and re-compacted to the specified percent of the maximum density, tested and approved before the first layer of suitable embankment material is placed.

Only suitable material for embankment and fill will be allowed in the permanent Work at locations shown on the Project Plans.

After areas to receive embankment or fill have been properly prepared, suitable material shall be placed and spread in loose eight (8) inch lifts across the entire fill or backfill section. The ENGINEER may authorize roadway fill materials to be placed in layers in excess of eight (8) inches thickness if the CONTRACTOR can demonstrate that the required compaction can be achieved for the full depth of the lift. Lesser thickness shall be used if necessary to achieve specified compacted density. Suitable material shall then be windrowed, disked, or manipulated by other suitable means to achieve a homogeneous mixture of proper moisture content, free of hard lumps of soil or frozen material, and compacted to the required density.

Rocks larger than two and one-half (2-1/2) inches shall not be placed within twelve (12) inches of the subgrade for paving.

Compacting shall begin only after the suitable material has been properly placed and the material to be compacted is at optimum moisture, not to exceed plus two percent (+2%) or minus one percent (-1%) of optimum. All materials used for embankments shall be compacted to a minimum of ninety (90) percent of maximum dry density, modified proctor, (ASTM D 1557). Embankment within eight (8) inches from subgrade shall be compacted to a minimum of ninety-five (95) percent of maximum dry density (ASTM D 1557).

If the suitable material to be compacted contains excessive moisture, such material shall be processed to reduce the moisture to the specified content. If the suitable material has less than the specified moisture content, or is likely to lose enough moisture to bring the moisture content below requirements before completion of compaction, water shall be added and the lift thoroughly mixed before compacting.

Subsequent layers of suitable material for embankment shall be placed as described above in generally horizontal layers of loose thickness not to exceed eight (8) inches, unless otherwise approved, and shall extend across the full width of the embankment area.

After compacting of the material, in place density tests shall be made. If the compacted material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified density.

Embankment, of fill, adjacent to structures such as concrete walls, culverts, boxes or similar structures shall not be compacted with heavy equipment but shall be compacted with hand operated equipment to a distance of four (4) feet or greater, beyond the sides of the structure.

7.2.2 Finishing

The final surface of compacted embankments, berms, or fills shall be carefully trimmed to the cross sections, lines, grades, and elevations indicated on the Project Plans.

Embankment or fill shall not vary more than 0.05 foot below or 0.00 foot above the established plan grades and cross sections where it is to serve as subgrade for concrete Work. Other areas shall be ± 0.1 foot.

8.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

Unclassified Excavation shall be measured by the Cubic Yard for all Work associated with excavation, hauling, and disposal of unsuitable material and surveying for the purpose of payment.

Borrow shall be measured by the Cubic Yard for all Work associated with placement, and compaction of approved material required for construction, embankments, and/or backfill and surveying for the purpose of payment.

No separate measure shall be made for Earthwork, which shall be incidental to the associated item(s).

9.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

Unclassified Excavation shall be paid by the Cubic Yard for all Work associated with excavation, hauling, and disposal of unsuitable material and surveying for the purpose of payment.

Borrow shall be paid by the Cubic Yard for all Work associated with placement, and compaction of approved material required for construction, embankments, and/or backfill required to perform the Work and surveying for the purpose of payment.

No separate payment shall be made for Earthwork, which shall be incidental to the associated item(s).

END OF ARTICLE 02-022.1

Article 02-022.2 TRENCHING AND BACKFILLING

1.0 DESCRIPTION

1.1 General

This work shall consist of the excavation and backfill of trenches for the accommodation of substructures including, but not limited to electrical conduits, telephone conduits, television cable, traffic signal conduits, gas lines, sewer lines, water lines, and storm drains. All trenching within the roadway limits, including private utility trenching, shall conform to these specifications.

The Contractor shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this Section. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material. Other sidewall material type shall be given special consideration for minimum trench widths, the use of Controlled Low Strength Materials (CLSM), or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

1.2 Definitions

Foundation: Over-excavation and backfill of the foundation is required only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.

Bedding: In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.

Haunch Zone: The backfill under the lower half of the pipe (haunches) distributes the superimposed loadings.

Initial Zone: The backfill from the springline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.

Final Zone: Backfill above the pipe zone to the top of subgrade.

1.3 Trench Backfill

The backfilling of the trench differs in each zone due to the complexity of providing a secure support for the pipe as well as ensuring that all voids are filled to prevent nuisance water flow under the pipe. The zones are foundation, bedding, haunch, initial, and final as illustrated in the **UTILITY TRENCH CROSS SECTION (PAVED)** detail.

2.0 MATERIALS

2.1 General

Maximum size of particles in the pipe zone is 3/4 inch.

One of two methods of compaction of the trench pipe zone shall be used and shall be specified in the Construction Documents and approved by the Engineer prior to construction:

Method A: The use of CLSM as defined in this section.

Method B: The use of aggregate materials as described in this section as associated with either Rigid or Flexible designed pipe shall be as specified in this subsection below.

Prior to construction, the materials and method type shall be submitted and approved by the Engineer.

2.2 NATIVE BACKFILL

Native backfill may be used only in trenches outside the roadway area. Trenches within the limits of any roadway must be backfilled with import material conforming to specifications elsewhere in this Section (Tables 3 and 4).

Native backfill shall be of a quality acceptable to the Engineer and shall consist of suitable material from the excavation complying with Tables 1 and 2. It shall be free from sod, frozen earth, organic materials, rubbish, or debris. Material not complying with these Tables shall not be used as backfill material in any area of the project unless specifically approved by the Engineer.

Table 1 – Native Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
6-inch	100
3-inch	80-100
No. 4	35-100

Table 2 – Native Backfill Maximum Plastic Index Requirement

Percentage by Weight Passing No. 200 Sieve	Plasticity Index Maximum
0 - 20.0	12
20.1 - 50.0	10
50.1 - 80.0	8
80.1 - 100.0	6

The liquid limit of the material shall not exceed 50 percent maximum.

Stones or lumps exceeding 3-inches shall not be used within 12-inches of the structure.

2.3 TYPE I AGGREGATE BASE BACKFILL

This aggregate shall conform to the following requirements:

Table 3 – Type I Aggregate Base Gradation and requirements

Sieve Sizes	Percentage of Dry Weight Passing Sieve
2-Inch	100
1-1/2-Inch	90 - 100
1-Inch	70 - 90
No. 4	30 – 65
No. 10	30 - 40
No. 16	15 - 20
No. 200	10 - 20
Plastic Index	12 MAX
Liquid Limit	35 MAX
Fractured Faces	70% Minimum
Total Available Water Soluble Sulfates	Less than 0.3% by dry weight of soil.

2.4 TYPE II AGGREGATE BASE BACKFILL

This aggregate shall conform to the following requirements:

Table 4 – Type II Gradation Acceptance Limits and Requirements

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	85- 95
No. 4	40 - 70
No. 10	35 - 45
No. 16	25 - 35
No. 200	6 - 18
Plastic Index	12 MAX
Liquid Limit	35 MAX
Fractured Faces	70% Minimum
Total Available Water Soluble Sulfates	Less than 0.3% by dry weight of soil.

Type II aggregate base material shall be used for trench backfill as outlines below.

2.5 Foundation

Trench foundation shall be stable prior to placing bedding material. If the Engineer determines that unsuitable materials exist at the trench foundation, the Contractor shall remove and replace the material as directed by the Engineer and as specified in this Specification.

2.6 Pipe Bedding

Except as otherwise provided herein, or elsewhere in the contract documents, or as otherwise shown on the plans, the trench shall be excavated to a depth of 4 inches to 6 inches below the bottom of the pipe barrel and to a depth that will be sufficient to provide 2 to 4 inches of clearance under the pipe bell (where applicable).

Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings. The middle of the bedding equal to 1/3 the pipe outside diameter may be loosely placed (see Figure 1) to allow for the pipe bell and other protruding features. Alternatively, the compacted bedding material may be excavated slightly to allow for continuous lines and grades of the pipe structure.

The material for use as bedding shall be Type II Aggregate Base Backfill or CLSM complying with this section. Bedding shall be backfilled to the required grade of the bottom of the pipe. The compaction shall provide a density minimum equal to 95 percent of the maximum density as determined by test method AASHTO T180 with exception of the middle uncompacted area equal to one-third the pipe diameter.

All pipes shall be placed directly on the compacted bedding material unless otherwise required or approved by the Engineer.

2.7 Haunch Zone Backfill

After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II, Aggregate Base Backfill, or CLSM.

Compaction of the haunching material can best be accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of 6 inches. The Contractor shall take care to not disturb the pipe from its line and grade while compacting the backfill. Material suitably distant from the pipe shall be compacted to a minimum of 95 percent of the maximum density as determined by test method AASHTO T180.

While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

2.8 Initial Backfill Zone

After the pipe or conduit is laid, the initial backfill areas shall be backfilled with Type II Aggregate Base Backfill, or CLSM. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained.

Table 5 - Initial Zone Material Depths

Pipe or Conduit	Initial Zone
2-inch or less diameter	6 inches above the top of pipe
Greater than 2-inch diameter	12 inches above top of the pipe

2.9 Final Backfill Zone

The remaining backfill shall consist of Granular, Type I or Type II Aggregate Base Backfill or CLSM shall be used as backfill. The material shall be compacted to a minimum of 95 percent of the maximum density as determined by test method AASHTO T180.

If CLSM is used, CLSM backfill shall be placed from the top of the initial backfill zone to the bottom of the bituminous pavement (replaces aggregate road base in the pavement section over the trench).

CLSM Cap: A CLSM Cap may be required in the upper portion of the Final Zone for all non-residential roadways with a minimum thickness of 12 inches for all minor collectors and 18 inches for all major collectors and arterials.

2.10 Compaction

Compaction shall be performed by mechanical means except in the haunch zone where compaction may be required by hand tamping. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as indicated in Table 6 – Compaction Lift Thickness. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 6 - Compaction Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone Backfill	8	12

Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.

Compaction minimum shall be 95 percent of the maximum density as determined by test method AASHTO T180.

2.11 Controlled Low Strength Material (CLSM)

CLSM shall consist of a low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregate, water, and chemical admixtures. CLSM shall have a design compressive strength at an age of 28 days within the ranges required below for the specified class:

1. Class I - (50 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease.
2. Class II – (100 to 300 psi): Specified where the minimum strength is of primary concern for pipe support.
3. Class Special (as shown in project specifications or drawings): Specified where project unique criteria, such as erosion control, are the primary concern.
4. Class I and II CLSM:
 - a. The mix shall result in a product having a slump in the range of 6 to 10 inches at the time of placement.
 - b. The Source of Contractor shall submit a mix design for approval by the Engineer prior to placement.
 - c. The mix design shall be supported by laboratory test data verifying the potential of the mix to comply with the requirements for these specifications.

CLSM shall be proportioned in general compliance with the methods outlined in ACI 211.1-91, reapproved 1997, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." Types of hydraulic cement as defined by ASTM C150, ASTM C595 and ASTM C1157 shall be used. Unless otherwise provided, the cement will be used for all Hydraulic cement concrete, mortar, cement treated base, and cement treated subgrade. The type of cement used shall be as listed in Table 7 with the minimum sack requirements stated in the NMDOT specifications.

Table 7 - Types of Cement

Type of Cement Permitted
Type II & Fly Ash
Type MS & Fly Ash
Type IP (MS)
Type V
Type HS
Type V & Fly Ash
Type HS & Fly Ash

1. Fly ash shall conform to ASTM C618 for Class F with the following exceptions:
 - a. The maximum loss of ignition shall be 6 percent.
 - b. The sulfate resistance factor, R, shall not exceed 1.5, where

$$R = \frac{(\% \text{ CaO} - 5)}{\% \text{ Fe}_2\text{O}_3}$$

A recent Certification that the fly ash used in Portland cement concrete conforms to ASTM C618 shall be provided by the supplier of the fly ash.

2. Water for use with cement concrete curing shall be free from excessive amounts of acids, alkali, oil, and other substances which cause damage to the mixture.
3. Aggregates shall have 100 percent by total weight of the aggregate passing the 1 inch screen and 15 percent or less passing the No. 200 sieve. The aggregate shall meet the plastic limits requirements of Table 5 - Plastic Limits.
4. Chemical admixtures shall comply with ASTM C494 and shall be clearly identified as Type A, B, C, D, E, F, or G.
5. Air-entraining admixtures shall conform to ASTM C260.
6. Other admixtures specifically approved for CLSM may be used if approved by the Engineer.
7. All materials proportions shall be measured and the CLSM mixed in accordance with NMDOT specifications.
8. Other proportion measuring and CLSM mixing systems are acceptable, if control can be demonstrated to be satisfactory to the Engineer.
9. These other methods include continuous feed, volumetric measurement of proportions, and pug mill and continuous mixing plants.

If the CLSM mix does not produce a flowable consistency or exhibits excessive bleeding, the mix shall be adjusted.

1. Excessive bleeding is considered to occur when water flows from the CLSM in a manner that causes disturbance or displacement of the exposed surface of the CLSM.
2. Mix adjustments shall include, but not be limited to: aggregate gradation, cementitious material content, admixtures, water content, or a combination of adjustments.

The testing procedures for approval of CLSM mix designs if required shall be as follows:

1. The material Source, which may be the Contractor, shall cast one set of six each 4-inch diameter by 8-inch high specimens in split cylinders.
2. No rodding method shall be used for the placement of the CLSM into the cylinders.
3. All field curing and environmental protection shall conform to AASHTO T23, "Test Methods for Making and Curing Concrete Test Specimens in the Field."
4. The cast specimens shall then be laboratory-cured in a 100 percent humidity, temperature-controlled concrete cure room (cure tanks shall not be used).
5. Compressive strength testing shall be performed in accordance with AASHTO T22 and T23 with samples from each set at the ages of 7, 28, and 90 days.
6. A report of the results shall be submitted to the Engineer.

Class Special: The compressive strength testing procedures shall be as specified in the project specifications or on the project drawings.

2.11 Use of Controlled Low Strength Material (CLSM)

CLSM may be placed in all installations. However, for flexible pipe, in the pipe zone region, either full CLSM or full aggregate backfill is required. A mixture of CSLM and aggregate backfill shall not be applied in the pipe zone due to the different stresses that can occur on the pipe at the interface of both types of products.

CLSM shall be placed directly into the space to be filled. The placement of CLSM shall include "spading" under the pipe haunches and into the corrugations or other difficult areas around a structure. Care shall be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other designed and approved means of restraint as per the manufacturer's recommendation. Material may be placed in stages equally on both sides of the pipe to prevent movement or flotation of pipe.

3.0 CONSTRUCTION

3.1 Trench Excavation , General

Excavation including the manner of supporting excavation and provisions for access to trenches, shall comply with the current regulations as determined by OSHA. Excavation shall include, without classifications, the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grade shown. Excavation for pipe, wire, or conduits shall be by open trench unless otherwise specified or shown on the plans. However, should the Contractor elect to tunnel, jack or bore any portion not so specified, he shall first submit a design by a New Mexico Professional Engineer to and obtain an approval from the Engineer. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavation, and all pumping, ditching, or other approved measures for

the removal or exclusion of water, including storm water and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. The Contractor shall be responsible for any damage to persons or property due to interruption or diversion of storm or wastewater because of his operations. The Engineer may require the Contractor to backfill the excavation if left open for more than a reasonable time period as determined by the Engineer to protect the integrity of the excavation foundation. No additional cost to the project will be allowed to re-excavate the site and backfill to the permanent condition following resolution of issues that prevented the excavation from being completed before. This condition is most usually due to delays in delivery of materials but could be for other reasons.

Except as otherwise shown or provided herein, excavation shall be open cut trenches with vertical sides up to the top of the pipe zone.

3.2 Minimum Trench Width

Excavation of pipe trench for flexible and rigid pipe is as required in Table 8. In all cases, the trench width shall be wide enough to allow for the compaction equipment.

Table 8 - Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outside diameter plus 12 inches
Rigid Pipe	Minimum shall be not less than the outside diameter plus the outside diameter times 0.33

For pipe backfill using CLSM, the minimum trench width may be reduced to the pipe diameter plus 12 inches and enough room needed to allow for the proper placement of the CLSM using tools to "spade" the material under the pipe haunches

3.3 Maximum Trench Width

The maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus 2 feet when working along side the pipe or culvert.

3.4 Maximum Length of Open Trench

The maximum amount of open trench permitted in any one location shall be 100 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater, unless otherwise approved by the Engineer. A trench shall be considered open until backfilled to the top of subgrade.

3.5 Street Crossings

Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation and a temporary or permanent asphalt pavement patch or CSLM cap shall be installed as directed by the Engineer to protect the integrity of trenches within the roadway limits from excessive moisture.

Substantial bridging, properly anchored, capable of carrying the vehicle loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during

regular working hours as directed and approved by the Engineer. Safe and convenient passage for pedestrians and access to all properties shall be provided.

3.6 Trench over excavation

Except when otherwise specified or ordered by the Engineer, the bottom of the trench shall be excavated uniformly to the grade or depth indicated on the drawings. Wherever the excavation is made below the grade shown on the drawings, or below the grade ordered by the Engineer, it shall be refilled to the required grade with suitable backfill and bedding material at no additional cost to the Project.

When ordered by the Engineer due to unsuitable materials encountered, trench over-excavation below the specified level of bedding material shown in the plans shall be paid for by field order and an adjustment will be made to the contract price due the Contractor.

3.7 Disposal of Unsuitable Excavated Materials

Excess material and excavated material unsuitable for backfill shall be removed from the site of the work by the end of each working day unless otherwise approved by the Engineer and disposed of by the Contractor in an environmentally responsible manner at no cost to the project.

When unsuitable material is encountered that is not shown in the plans, the Engineer shall order the removal of the material by the Contractor and issue a field order to change the contract price due the Contractor for removal of the material.

3.8 Portable Trench Shield

Portable trench shields or boxes that provide a moveable safe working area for installing pipe may be used for the installation of pipe. After placing the pipe in the trench, backfill material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.

3.9 Minimum Pipe Spacing

If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then CLSM shall be used.

3.10 Transition Installations

When differential conditions of pipe support might occur, such as in transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

3.11 Minimum Depth of Cover

The minimum cover shall be as stated on the plans and/or contract Special Conditions or as directed by the Engineer. Compaction equipment used shall allow realization of the required density without damage to the pipe.

3.12 Testing

Where tests reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the Engineer.

4.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

No separate measure shall be made for Trenching and Backfill.

Trenching and Backfill shall be included in the item(s) with which it is associated.

5.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

No separate payment will be made for Trenching and Backfill.

Payment for Trenching and Backfill shall be included in the item(s) with which it is associated.

END OF ARTICLE 02-022.2

Article 02-022.3 SUBGRADE PREPARATION

1.0 DESCRIPTION

This Work covered consists of compacting and finishing the subgrade in compliance with the Specifications to the lines, grades, and typical cross-sections shown in the Contract prior to the placement of subbase or base material, pavement, curbs and gutters, driveways, sidewalks, or other structures.

2.0 MATERIALS

Materials shall be free from detrimental quantities of organic material such as leaves, grass, roots and sewage.

3.0 CONSTRUCTION

Subgrade preparation shall consist of preparing native materials by excavations, scarifying, watering and rolling to achieve the required compacted state.

All soft and unstable material and other portions of the subgrade which will not compact readily or serve the intended purposes shall be removed and replaced with suitable material from excavation or borrow or suitable materials shall be added and, by manipulations, be incorporated into the subgrade to produce a material meeting subgrade density requirements.

The top eight (8) inches of embankments and the bottom of excavations which form the subgrade under all paved areas, including the areas under sidewalks, driveways, and curbs and gutters shall be scarified and compacted to not less than ninety-five (95) percent density, modified proctor, as determined by ASTM D 1557.

Subsurface soils below the prepared subgrade thickness shall provide uniform support for the subgrade. Subsurface soils that are found to contain excessive moisture or other unacceptable conditions, as determined by the ENGINEER, shall be completely removed to the required depth and replaced to the satisfaction of the ENGINEER.

No payment will be allowed for removing, replacing, re-handling or manipulating material deemed unsuitable by the ENGINEER.

Subgrade shall not vary more than one-half (1/2) inch per ten (10) foot in any direction from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

4.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

Subgrade Preparation shall be measured by the Square Yard for accepted Work necessary to compact and finish the subgrade.

No separate measure will be made for Subgrade Preparation, which shall be incidental to the associated item(s).

5.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

Subgrade Preparation shall be paid by the Square Yard for accepted Work necessary to compact and finish the subgrade.

No separate payment will be made for Subgrade Preparation, which shall incidental to associated item(s).

END OF ARTICLE 02-022.3

Article 02-025.1 BASE COURSE

1.0 DESCRIPTION

This Work consists of furnishing and placing base course aggregate in compliance with the specifications and the lines, grades, dimensions and typical sections.

2.0 MATERIALS

Base course aggregate shall be composed of materials consisting of crushed stone, crushed or screened gravel, caliche, sand or a combination of such materials. Base course shall be free from vegetable matter and all other deleterious materials.

Base course aggregate materials shall be combined in such proportions that the resulting composite blend meets the requirements of the following table:

Base Course Classification: Class II-B

SIEVE SIZE	PERCENT PASSING (%)
1"	100
3/4"	85-100
No. 4	40-70
No. 10	30-55
No. 200	4-12

The following requirements must be met:

Soundness	18 or less
L.A. Abrasion	50 or less
L.L.	25 or less

When base course material is produced from pits or quarries, all oversize material up to and including rocks and boulders ten (10) inches in greatest dimension, shall be crushed and mixed with other material.

Fifty (50) percent by weight of all plus No. 4 materials shall have a minimum of two (2) mechanically fractured faces. When base course is to be treated with cement or asphalt, the requirement for mechanically fractured faces shall not apply unless otherwise indicated on the plans.

3.0 CONSTRUCTION

General: The subgrade, sub-base, or base course, upon which base course is to be placed, shall be cleaned of all loose and deleterious materials, shall be free from frozen material, and the top six (6) inches shall have a moisture content not exceeding optimum (plus or minus two (2) percent) as determined by AASHTO T 99 for subgrade and AASHTO T 180 for subbase or base course, Method C or D.

Mixing and Placing: Mixing shall provide a homogenous mixture of un-segregated and uniformly dispersed materials as placed in position for compacting. Plant and equipment shall be adequate in all respects.

Testing: The CONTRACTOR shall spread and compact base course in layers which will permit the required density to be obtained. Density requirements will be determined by ASTM D 1557. Unless otherwise provided, base course shall be compacted to not less than ninety-five (95) percent of the laboratory established density. Field density tests will be performed every five hundred (500) linear feet, each lift, or a minimum of two (2) locations as designated by the Public Works Inspector. Densities will be determined in accordance with AASHTO T 205, or through nuclear methods in accordance with AASHTO T 238 and T 239, or other approved methods. Where compaction tests indicate a failure to meet the specified compaction and the CONTRACTOR chooses not to rework the entire area, the CONTRACTOR will take additional tests every one hundred (100) feet in each direction until the extent of the failing area is identified and will rework the entire area between locations that have passed the tests until the specified compaction has been achieved. No additional compensation shall be made for additional testing required to identify the extent of the failing areas.

Surface Tolerance: The top surface of base course shall not deviate in excess of three-eighths (3/8th) inch when tested with a ten (10) foot straight-edge in any direction. All deviations from this tolerance shall be corrected by the CONTRACTOR. No additional compensation shall be made for Work necessary to correct the surface tolerance.

4.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

Base Course shall be measured by the Square Yard of Base Course used in the accepted Work.

No separate measure shall be made for Base Course.

Base Course shall be included with the item with which it is associated.

5.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

Base Course shall be paid for by the Square Yard of Base Course used in the accepted Work.

No separate payment will be made for Base Course.

Payment for Base Course shall be made under the item with which it is associated.

END OF ARTICLE 02-025.1

Article 02-026.1 WATER SUPPLY SYSTEMS

1.0 DESCRIPTION

This Work consists of furnishing all of equipment, materials and labor to perform all operations in connection with the installation of potable and reclaimed water lines and appurtenances. This section defines required characteristics and properties of Poly Vinyl Chloride (PVC), High Density Polyethylene (HDPE), and Ductile Iron Pipe (DIP), valves, valve boxes, adapters, couplings, fire hydrants, materials, fittings, appurtenances and construction practices.

CONTRACTOR shall provide, in place, all valves, adapters, couplings, and appurtenances necessary to meet the requirements of this Project, whether shown in the Project Plans or not.

At all times, the new main shall be isolated from the active distribution system by physical separation until disinfecting water has been flushed out and satisfactory bacteriological testing has been completed in accordance with AWWA standard C651. Water needed to fill the new main for testing and flushing purposes shall only be potable City water supplied through a temporary connection protected by a backflow device.

The backflow device must be tested and certified after installation on-site. A copy of the Certification shall be given to the ENGINEER and a copy shall be kept on-site with the device. Testing must be completed by a certified testing facility.

2.0 MATERIALS

2.1 GENERAL

Pipe and accessories shall be new and unused. Pipe shall be color-coded (blue for potable water, green for sanitary sewer, purple for reclaimed water). Detectable Marking Tape shall be installed as provided in the Contract Documents.

When PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of the pipe can occur. This is an indication of reduced pipe impact strength, and any particular length of pipe that is discolored will be rejected. All pipe rejected will be removed from the job site.

2.2 PVC PIPE

PVC pipe four (4) inches through twelve (12) inches shall be not less than DR18, Class 235 and in conformance with AWWA C900, latest revision. Pressure class of PVC pipe shall be as required by Appendix A of AWWA C900. PVC pipe over twelve (12) inches shall be no less than DR25, Class 165 and in conformance with AWWA C905, latest revision.

All PVC pipe shall be approved for use in potable water systems by an agency such as NSF Testing Laboratory.

Joints: For pipe six (6) inches through twelve (12) inches, elastomeric gasket bell push-on type ends shall be used in accordance with ASTM F 477.

Specials and Fittings: For pipe six (6) inches through twelve (12) inches, specials and fittings for PVC pipe shall conform to the requirements of AWWA C153 and shall be cement mortar lined in accordance with AWWA C04. Fitting types shall include restrained mechanical joints and concrete thrust block where required. Restraining, standard mechanical joints, and fittings shall be submitted for ENGINEER approval.

2.3 DUCTILE IRON PIPE

Ductile iron pipe shall be in accordance with ANSI/AWWA C151/A21.51 and Federal Specification WW-P-421d, latest revision. All ductile iron pipe shall be minimum class 150, unless otherwise indicated in the Contract Documents. Ductile iron pipe fittings shall be pressure rated at three hundred fifty (350) psi and be in accordance with ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11.

All ductile iron pipe and fittings shall be internally mortar lined in accordance with ANSI A21.4, latest revision, and shall have an exterior coating in accordance with ANSI A21.6, A21.8, or A21.51.

All ductile iron pipe and ductile iron fittings shall have a polyethylene encasement in accordance with ANSI/AWWA C105/A2 1.5, latest revision.

The ductile iron pipe shall be push-on type joints, unless indicated otherwise on the plans, and the fittings shall conform to the requirements of AWWA C153 and shall be cement mortar lined in accordance with AWWA C104. Fitting types shall include standard flange fittings and mechanical joints.

2.4 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

HDPE pipe shall not be less than DR11.0, Class 160 and in conformance with AWWA C901 or AWWA C906.

Joints: Pipe shall be joined together by heat fusion method and shall be performed as per manufacturer's safety instructions.

Specials and Fittings: Specials and Fittings for HDPE shall conform to the requirements of AWWA C906 and used in accordance with ASTM D 3350, and F 714. Fitting types shall include restrained mechanical joints where required. Transition gaskets for HDPE pipe shall be used when mechanical joints are used. Restraining, standard mechanical joints, and fittings shall be submitted for ENGINEER approval.

2.5 ADAPTERS AND COUPLINGS

All adapters, pipe couplings, tap and sleeves, or mechanical type couplings required for any of the piping systems shall be of the type manufactured for the specific purpose of the use intended, and shall be installed in strict compliance with the manufacturer's specifications, and to the satisfaction of the ENGINEER and/or Public Works Inspector. Factory-made adapters shall be furnished for connecting transition material to the mechanical joint fittings and valves, where required, including plastic to steel and plastic to DIP.

Mechanical and/or flexible couplings shall be manufactured by Romac, or approved equal, and shall be sized and styled in accordance with the requirement for the particular coupling, and used in accordance with the manufacturer's recommendations for the diameter, thickness and type of pipe to be connected. The mechanical and/or flexible couplings shall be provided with an acceptable joint harness to prevent separation of the joint where required due to pressure or change in direction of fittings. Couplings shall be polyethylene wrapped.

2.6 GATE VALVES: FOUR (4) INCH AND LARGER

All gate valves shall be resilient seated gate valves conforming to AWWA C515 rated for one hundred fifty (150) psi working pressure. Valves shall have a standard two (2) inch operating nut that opens counter clockwise. The wedge shall be constructed of ductile iron and shall be fully encapsulated in synthetic rubber except for the guide and wedge nut areas. The wedge shall seat against seating surfaces that are inclined to the vertical at a minimum angle of thirty-two (32) degrees when stem is in vertical position to eliminate abrasive wear. The non-rising stem shall be sealed by at least two (2) O-rings. The waterway shall be smooth and shall have no depressions or cavities. The valve body and bonnet shall be epoxy coated, inside and out, and wrapped with polyethylene sheet encasement. Joints shall be restrained mechanical joint ends. Valve shall be as manufactured by Waterous Company, or approved equal.

2.7 VALVE BOXES

Valve boxes shall be deep skirted, adjustable cast iron two (2) piece screw type, Series 6850 as manufactured by Tyler Pipe, Tyler Corporation, or approved equal. The valve boxes shall be five and one-quarter (5-1/4) inch diameter and the two (2) pieces shall overlap at least six (6) inches. The drop lid shall have a depth of two (2) inches, shall weigh thirteen (13) pounds, and shall have the word "WATER" embossed on top.

2.8 FIRE HYDRANTS

Fire hydrants and extensions shall be in accordance with AWWA C502, traffic type, Fire hydrants shall have two (2) two and one-half (2-1/2) inch hose nozzle connections, and one (1) four and one-half (4-1/2) inch steamer nozzle. All nozzle connections shall be National Standard Fire Hose Coupling screw threads. Fire hydrants shall have a bronze or cast iron pentagon operating nut. The main inlet shall be six (6) inch restricted mechanical joint type. All fire hydrants shall be rated for one hundred fifty (150) psi working pressure. Any marks or scratches on new fire hydrants shall be corrected to the satisfaction of the City Engineer and/or Public Works Inspector. Extensions will be used, when required, to bring the bottom of the break-off flange three (3) to six (6) inches above the top of the surrounding finished grade. All fire hydrants shall be American Darling Model 62B or Mueller Centurion, Model A-423, or approved equal. All fire hydrants shall be fire engine red.

2.9 WATER SERVICES

Polyethylene Service Lines: Polyethylene water service line tubing shall be fabricated from new polyethylene, PE 3406, SDR-9, 200 psi, manufactured in accordance with ASTM D 2737, latest revision, and be the size called for in the Project Plans.

Water Meter: Water meter shall be positive displacement (compound), reading in cubic feet (cf) and acceptable for use with **ZENNER STEALTH READER SYSTEM (NO SUBSTITUTIONS)**. It is the sole responsibility of the Contractor to verify compatibility of the water meters with the **ZENNER STEALTH READER SYSTEM**.

Prior approval is a part of these specifications and any bidder or manufacturer wishing to obtain approval to use unspecified products shall submit a written request. The request shall be received, by the ENGINEER, not later than **seven (7) days** prior to the bid opening date.

Request shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. If the product is acceptable, the ENGINEER will approve it in an Addendum issued to all plan holders. Otherwise, the specified product or item shall be used. The burden of proof is the sole responsibility of the Contractor.

Meters shall comply with **AWWA C700 Standard** for Cold-Water Meters, Displacement Type, Bronze Main Case, of the latest revision. Meters shall also comply with the Safe Drinking Water Act and ANSI/NSF 61 requirements.

Meter Register housing and lid shall be plastic and the main case, bottom, shall be non-breakable plastic.

The size, model, and direction of flow through the meter shall be cast permanently into the outer case of the meter. The manufacturer's meter serial number shall be imprinted on the outer case and lid.

The meter connections shall be; 5/8" x 3/4" or the size called for in the Project Plans or Contract Documents, and shall have standard male meter thread. Meter connections 1-1/2" and larger shall have flanged ends.

Registers shall be an Encoder-Type register for use in AMR, drive-by or fixed network systems. They shall meet the requirements of the **AWWA C707 Standard**, for Encoder-Type remote registers, of the latest revision. The encoded register shall be preassembled to the meter and supplied with a wire assembly, at least 16-inches in length. The wire assembly connections to the register will be sealed to prevent any water/moisture damage. The pigtail supplied must have enough leads to interface with **ZENNER STEALTH READER SYSTEM** unit. Each encoded register must have its own unique identification number, either external or internal.

All encoded registers will have a 6 wheel odometer.

A letter of certification from the meter manufacturer, certifying that the product supplied will work properly with the **ZENNER STEALTH READER SYSTEM** units.

Existing water meters will be salvaged to OWNER.

Service (Tapping) Saddles: Service (tapping) saddles shall be pre-approved by City. Acceptable saddles shall have two (2) double straps or one (1) large, wide, single strap secured by four (4) bolts and shall be the size called for in the Project Plans.

Corporation Stops: Corporation stops shall be ball valve type, rated for 150 p.s.i. (minimum) working pressure. Corporation stops shall be per the size called for in the Project Plans or Contract Documents, CC or IP threaded inlet with compression fitting or Mueller Insta-Tite connection, or pre-approved equal.

Curb stop: Curb stop shall be ball valve type, rated for 150 p.s.i. (minimum) working pressure. Corporation stops shall be per the size called for in the Project Plans or Contract Documents.

Copper meter resetters (meter yoke): Copper meter resetters (meter yoke) shall be pre-approved by City. Acceptable coppersetters shall be 5/8" x 3/4" copper or the size called for in the Project Plans or Contract Documents, with a lock wing and angle dual check backflow preventers/device.

Existing copper meter resetters (meter yoke) will be salvaged to OWNER.

Water Meter Cans: All water meter cans for this Project shall be the size called for in the Project Plans or Contract Documents. The diameter and height for each installation shall be as shown in the Project Plans. Cutouts for the water service lines shall be neatly cut and trimmed to allow one (1) inch clearance on all sides of the water service line.

Temporary Service: CONTRACTOR shall maintain service to all connections during construction to minimize time water will be unavailable. CONTRACTOR shall complete Work on new services and testing and disinfecting of new waterlines prior to removing service from existing waterline. CONTRACTOR shall submit a plan for temporary service for City approval prior to construction of new waterline.

2.10 STAINLESS STEEL TAPPING SLEEVE

Body: 18-8 Type 304 Stainless Steel. All welds shall be fully passivated to restore stainless characteristics.

Bolts: 18-8 Type 304 Stainless Steel. Heavy hex nuts and washer are coated to prevent galling.

Flange: 18-8 Type 304 Stainless Steel Flange with recess per MSS-SP60 to accept standard tapping valve. Flange conforms to AWWA C207 Class D ANSI 150 lb. drilling.

Outlet: 18-8 Type 304 Stainless Steel. Scheduled 10 for 3" and 4" outlets. Scheduled 5 for all outlets larger than 4".

Test Plug: 18-8 Type 304 Stainless Steel in test outlet.

Gasket: Sleeve shall have a full wide gasket of Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000 with hydromechanical activated lip, captured in a recessed groove around the outlet. Gasket shall be suitable for water, salt solutions, mild acids, bases, and sewage.

Service Rating: 2"-12" outlets: 175 p.s.i.

2.11 DETECTABLE (UNDERGROUND) WARNING TAPE

Detectable warning tape shall be 6" wide, 5 mil overall thickness, with a .35 mil solid foil coil. A.P.W.A. Color coded with imprint of underground utility installed.

Wire shall be 14 Ga. Solid copper tracer wire for non-metal pipe, A.P.W.A. color code.

3.0 CONSTRUCTION REQUIREMENTS

3.1. TRENCH EXCAVATION

Pipe trenches shall be excavated along straight lines to the dimensions shown in the Project Plans. All trenching Work shall be done in a safe manner, and the trenches shall be rendered safe for the workmen by complying with the applicable safety standards, and by practicing safety measures consistent with good construction methods.

All excavations shall be adequately barricaded and secured in accordance with current New Mexico Department of Transportation Standards.

Unless trench banks are cut back on a stable slope, sheet and brace the trenches as necessary to prevent caving or sliding, to provide protection for the workmen and the pipe. All trenching Work shall comply with OSHA safety requirements.

If over excavation occurs the area shall be refilled with suitable material at optimum moisture and compacted to ninety (90) percent density per ASTM D 1557 in unpaved areas and ninety-five (95) percent density in paved areas.

Access shall be maintained for all residences within the Project area. CONTRACTOR shall submit a construction plan that presents the sequence of construction that will allow for residential access to the ENGINEER for approval before beginning construction.

3.2. BEDDING

Trenches shall be excavated to the depth indicated in the Project Plans. The trench bottom shall be smooth and hand graded uniformly throughout. If rock or other unyielding material is encountered or if the trench is over excavated, pipe bedding material complying with Technical Specification, ARTICLE 02-022.2., TRENCHING AND BACKFILL shall be added, compacted, and graded to a smooth uniform surface. The compacted bedding shall support the pipe throughout its entire length, except at bells or couplings which shall not rest on the bedding. After the bell or coupling holes are excavated and after the pipe pieces are connected and properly aligned and graded, successive layers of backfill material complying with Technical Specification, ARTICLE 02-022.2., TRENCHING AND BACKFILL shall be placed and compacted, until the pipe is covered, as shown in the Contract Documents. CONTRACTOR shall use due care to maintain proper alignment and grade during the bedding process. Any bent, cracked, chipped or damaged pieces of pipe shall be removed and replaced at CONTRACTOR's expense. Compaction tests on the pipe bedding will be required.

3.3 PIPE LAYING

Pipe shall be laid true to the line and grade indicated in the Project Plans or as established by the ENGINEER.

The pipe shall be protected during handling against impact shocks and free fall. Do not permit hooks, chains, cables, or handling equipment to come in contact with the pre-molded or pre-formed end surfaces.

Handle the pipe having pre-molded end surfaces or pre-formed end surfaces so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material or surfaces. Do not drag the end of the pipe on the ground or allow them to be damaged by contact with gravel, crushed stone, or any other hard objects.

No damaged or deformed pipe will be incorporated in the Work.

The interior of the pipelines shall be kept free from dirt and other foreign material as the Work progresses and shall be clean upon its completion. Tight stoppers or bulkheads shall be securely placed in the ends of all pipelines when the Work is stopped temporarily, or at the end of the work day.

Immediately prior to jointing, both pipe ends shall be thoroughly cleaned and a lubricant shall be applied according to the manufacturer's recommendations. For push-on type joints, sufficient pressure shall be applied in making up joints to insure proper seating of the joints.

The full length of each section of pipe shall rest solidly upon the bed, with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the Work except by permission of the ENGINEER. Minimum depth of cover over top of pipe shall be three feet, unless otherwise approved by the ENGINEER.

All nuts and bolts utilized in underground pipe connections shall be stainless steel, high strength cast iron or high strength wrought iron. Carbon steel nuts and bolts may be used except that they shall be protected by "cocoon" type protective coating of coal-tar and felt in accordance with AWWA Standard C 203.

Where connections are made between new work and existing lines, the connections shall be made using specials and fittings as recommended by pipe manufacturer and approved by the ENGINEER. Couplings may be either cast iron or steel with bolts as stated above. If steel couplings are used, they will be cocoon wrapped as specified herein.

Water lines shall not be laid closer along horizontal dimensions than TEN (10) feet from sewer lines, and with the water line at a higher elevation than the sewer. If this is not possible, and if concurrence from the ENGINEER is obtained by the CONTRACTOR, separate trenches will be required and the water line shall be at least two (2) feet above the sewer or concrete encased. When water and sewer lines cross each other, the water line shall be at least two (2) feet above the sewer or concrete encased, with no joint closer than three (3) feet of the crossing.

Water lines shall not be constructed under walkways, sidewalks, curbs and gutters, drive pads, or similar concrete structures by tunneling underneath. The CONTRACTOR will cut these concrete structures by using a concrete saw to the closest control joint or, at his option, may remove the section of the concrete structure to the nearest full expansion joint or edge.

Encasement shall be performed as shown in the Contract Documents at shallow crossings or other instances in which piping may be exposed or susceptible to excessive surface loading. DIP shall be used for these crossings with push-on or M.J. type connections, blocked with curved / conforming cinder blocks underneath, installed in prepared trench of adequate width to house pipe diameter and encasement. Trench excavation shall have ninety-five (95) percent relative compaction or shall be in freshly excavated native material, and as approved by the ENGINEER may suffice with adequate dimensions to omit use of form Work for encasement concrete placement. Encasement concrete shall be aggregate and Type II cement meeting or exceeding 3000 psi compressive strength. Rebar shall be placed as shown in the Contract Documents, shall be new and unused, and tied with minimum six (6) inch lap distances, with minimum two (2) inches of concrete cover on outside dimensions.

All valves shall be set true, level, vertical and plumb. All valves shall have and be supported by a concrete thrust block, have retainer rods, and shall comply with the details shown in the Project Plans. Backfill shall be compacted to ninety-five (95) percent density under pavement, ninety (90) percent in unpaved areas, ASTM D 1557.

The CONTRACTOR shall remove the valve box from all existing valves that are to be abandoned. The resulting excavation shall be backfilled and compacted to ninety-five (95) percent density, ASTM D 1557. The top six (6) inches of the excavation shall receive new base course placed to the above stated density. The pavement shall be sawcut to form a square opening. The cut faces of the existing asphalt shall be thoroughly coated with prime coat and new asphalt pavement shall be placed and densified to ninety-five (95) percent density, ASTM D 1557.

Cast iron valve boxes shall be set vertical and plumb centered over the operating nut. All valve boxes shall be adjusted to proper elevation, providing the minimum overlap of six (6) inches of the two (2) pieces, and a concrete collar shall be built around the top of each valve box. The concrete collar shall be of the size, shape, and dimensions shown in the Detail Drawings. The concrete shall be 3000 psi at twenty-eight (28) days with one (1) inch aggregate and finished with a light broom finish. All concrete shall be removed from the top of the valve box and lid while it is still wet and they shall be left clean. Backfill shall be compacted to ninety-five (95) percent density under pavement, ninety (90) percent in unpaved areas, ASTM D 1557.

Adapters and couplings shall be installed in strict compliance with the manufacturer's recommendations. CONTRACTOR shall provide, in place, all additional straps, rods, and harness required to make a secure water-tight connection.

Fire Hydrants within the project, there are existing fire hydrants to be removed and salvaged. The existing fire hydrant valve and lateral shall be abandoned in place. The existing valve box shall be removed and the resulting excavation backfilled. There will be new fire hydrants installed at places shown on the Project Plans. The existing sidewalk, curb and gutter shall be removed and replaced to facilitate installation and

insure proper compaction. The edges of the sidewalk, curb and gutter, to be removed, shall be saw-cut, along pre-marked lines. In no case shall the CONTRACTOR be allowed to tunnel under the existing curb and gutter or sidewalk (if applicable)

The ENGINEER and/or Public Works Inspector shall have the privilege of checking the pipe for line and grade by any method that he wants to use after the pipe is laid, and before backfilling begins. The ENGINEER and/or Public Works Inspector shall also have the privilege of checking each pipe joint with a gauge or by any means that he deems necessary in order to be assured that the gaskets are in place and properly seated. Any run of pipe that is found to be appreciably off of line or grade shall be removed from the trench, the trench bedding shall be re-graded and compacted, and the pipe shall then be laid accurately on line and grade. Any joint that is found to be improperly gasketed and/or seated shall be un-jointed and correctly reassembled. If any gasket is found to be damaged, the entire pipe section containing the damaged gasket shall be replaced with a new one.

CONTRACTOR shall furnish any tools, gauges, and all items required for the checking of the gaskets and joints, and he shall check every joint to be sure that the gaskets are seated and located in the correct place to avoid leakage at the joints.

3.4 THRUST BLOCKS

Thrust blocks shall be poured at all bends, valves, tees, reducers and fittings, where changes in pipe diameter, alignment or grade occur, and as indicated in the Contract Documents or as required by ENGINEER. The minimum size of concrete thrust blocks shall be as shown in the Contract Documents or as directed by the ENGINEER. The material of thrust blocks shall be concrete composed of concrete aggregates and shall have a compressive strength of no less than two thousand five hundred (2,500) psi in twenty eight (28) days for standard cement Type II and shall be placed between solid, undisturbed ground and the fitting to be anchored. The area of bearing on the fitting and on the ground shall in each instance be that required by the ENGINEER. Unless otherwise directed by the ENGINEER the thrust blocks shall be placed so that the pipe and fitting joints will be accessible for repair. Metal harness or tie rods, of the size and type shown in the Project Plans, shall be used.

3.5 BACKFILLING TRENCHES

After the pipe has been laid and bedded, it shall be inspected and approved by the ENGINEER and/or Public Works Inspector. Refer to Technical Specification ARTICLE 02-022.2, TRENCHING AND BACKFILL.

4.0 FLUSHING AND DISINFECTION

4.1 DESCRIPTION

This Work includes materials and procedures for flushing and disinfection of water mains by the continuous feed method and by the slug method. The tablet method to disinfect pipelines shall not be used. Disinfect piping in accordance with AWWA C651 as modified below.

At all times, the new main shall be isolated from the active distribution system by physical separation until disinfecting water has been flushed out and satisfactory bacteriological testing has been completed in accordance with AWWA Standard C651. Water needed to fill the new main for testing and flushing purposes shall only be potable City water supplied through a temporary connection protected by a backflow device.

The backflow device must be tested and certified after installation on-site. A copy of the certification shall be given to the ENGINEER and a copy shall be kept on-site with the device. Testing must be completed by a certified testing facility.

4.2 JOB CONDITIONS

Disposal of the chlorinated disinfection water and the flushing water is the CONTRACTOR's responsibility. The chlorinated disinfection water shall be properly disposed of by either pumping the water into a tank truck or directly into the sewer system. An air gap of two (2) times the hose diameter must be provided to prevent cross contamination. The CONTRACTOR shall notify Public Works and the Waste Water Treatment Plant twenty-four (24) hours prior to disposal into the sewer system. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with the City. Use potable water for chlorination. Submit request for use of water from waterline of the City forty-eight (48) hours in advance.

4.3 MATERIALS

Liquid Chlorine: Inject with a solution feed chlorinator and a water booster pump. Use an experienced operator and follow the instructions of the chlorinator manufacturer.

Calcium Hypochlorite (Dry): Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

Sodium Hypochlorite (Solution): Further dilute in water to desired concentration and pump into the pipeline at a metered rate.

Chlorine Residual Test Kit: For measuring chlorine concentration, supply and use a medium range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. Products: Hach Chemical or Helliege. Maintain kits in good working order available for immediate test of residuals at point of sampling.

4.4 EXECUTION

Continuous Feed Method for Pipelines: Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/1. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

Slug Method for Pipelines: Introduce the water in the pipeline at a constant measured rate. At the start of the test section, feed the chlorine solution into the pipeline at a measured rate so that the chlorine concentration created in the pipeline is three hundred (300) mg/1. Feed the chlorine for a sufficient period to develop a solid column or "slug"

of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least three hundred (300) mg/1 for at least three (3) hours.

Disinfection of Valves and Appurtenances: During the period that the chlorine solution or slug is in the section of pipeline, pen and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances.

Disinfection of Connections to Existing Pipelines: Disinfect per AWWA C651, Section 9. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a one (1) percent sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

After the chlorine solution applied by the continuous feed method has been retained in the pipeline for twenty-four (24) hours. Confirm that a chlorine residual of fifty (50) mg/1 minimum exists along the pipeline by sampling at air valves and other points of access.

With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline. After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is within 0.5 mg/1 of the existing potable water system.

Pipeline Flushing: After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is within 0.5 mg/l of the replacement water.

Bacteriologic Tests: Collect two (2) samples, deliver to a certified laboratory within six (6) hours of obtaining the samples, and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline after chlorination and refilling. The Public Works Inspector shall observe while samples are taken.

Repetition of Procedure: If the initial chlorination fails to produce required residuals and bacteriologic tests, repeat the chlorination and retesting until satisfactory results are obtained.

Test Facility Removal: After satisfactory disinfection, replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

5.0 HYDROSTATIC TESTS

The CONTRACTOR shall be required to test all piping and other lines and appurtenances in the presence of the Public Works Inspector. Test reports shall be required for each test and submitted to the Public Works Inspector. Testing of lines shall be done without being connected to existing lines. If such connections are allowed it is with the understanding that the CONTRACTOR assumes any and all responsibility in case of damage, failure and/or contamination to the existing system. The new water pipe will be tested before the backfilling is done. After the pipe is laid, earth cover shall be placed over the middle of the pipe joints, leaving the corp stops, valves, service taps and laterals uncovered. The pipe will be filled with water, and the pressure in the pipeline shall be raised by means of a motor-driven water pump to a hydrostatic pressure of one hundred fifty (150) psi at the lower end of the pipe section. This pressure shall be

maintained for a period of at least two (2) hours for pipe sizes up to eight (8) inches, four (4) hours for pipe sizes ten (10) inches to twenty (20) inches, pipe sizes above twenty (20) inches shall be determined by the ENGINEER. If any leaks appear in the pipe they shall be repaired to the satisfaction of the Public Works Inspector, and the test shall be performed until the pipe holds the prescribed pressure. As an alternative, the CONTRACTOR may opt to test the pipeline in sections between mainline valves or as approved by the ENGINEER.

All testing shall be conducted in accordance with AWWA Standard C600 and those portions of the above standard related to hydrostatic tests shall apply to any type of water main construction. Test pressure shall be one hundred fifty (150) psi.

All taps, gauges and necessary equipment shall be provided by the CONTRACTOR; however, the Public Works Inspector may utilize gauges provided by the City at his discretion.

Leakage Defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. If the pressure drops more than five (5) pounds in thirty (30) minutes, the pipe has failed to pass the test. If the pressure drop is less than five (5) pounds in thirty (30) minutes, water shall be added to the pipe section to maintain the one hundred fifty (150) psi test pressure and the volume of water added shall be duly recorded. This procedure shall be repeated at each thirty (30) minute interval for the test period. The total volume of water added to the pipe section to maintain the one hundred fifty (150) psi test pressure shall represent the total leakage during the test

Allowable leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

where L is the allowable leakage, in gallons per hour, N is the number of rubber gasketed joints in the test section; D is the nominal diameter of the pipe, in inches, and P is the average test pressure during the leakage test, in pounds per square inch gauge.

When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/h/in. (0.0012 L/h/mm) of nominal valve size shall be allowed.

When hydrants are in the test section, the test shall be made against the closed hydrant.

Acceptance of Installations: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid disclosed leakage greater than specified the CONTRACTOR shall, at the CONTRACTOR's expense, locate and make repairs as necessary until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

The CONTRACTOR shall be notified of any leaks that may occur during the two (2) year warranty period, and shall make immediate arrangements after he is notified to return to the job site and repair any leaks that may develop in the pipeline.

6.0 METHOD OF MEASUREMENT (REFER TO SECTION 3, BID SCHEDULE FOR MEASUREMENT)

New water lines shall be measured per Linear Foot including adapters, fitting, and/or couplings.

New water services lines shall be measure per Each, in place.

Valves not associated with new fire hydrants and waterline connections as called for in the Project Plans shall be measured per Each, in place, including valve box and concrete collar.

All existing valves to be abandoned shall be measured. The removal shall be measured per Each of the existing valve box and concrete collar.

New fire hydrants shall be measured per Each, in place, including removal and replacement of the sidewalk, curb and gutter, valves, valve box, concrete collar, pavement patching, pipe, fittings, appurtenances, and couplings.

Existing fire hydrants to be removed shall be measured per Each including valve, valve box, concrete collar and the required patch.

No separate measurement shall be made for adapters, fittings, or couplings, which shall be incidental to the associated item(s).

7.0 BASIS OF PAYMENT (REFER TO SECTION 3, BID SCHEDULE FOR PAYMENT)

New water lines shall be paid per Linear Foot including adapters, fitting, and/or couplings.

New water services lines shall be paid per Each, in place.

Valves not associated with new fire hydrants and waterline connections as called for in the Project Plans shall be paid per Each, in place, including valve box and concrete collar.

All existing valves to be abandoned shall be paid per Each. The removal of the existing valve boxes, including the required pavement patch, shall be considered incidental to the associated item(s).

New fire hydrants shall be paid per Each, in place, including removal and replacement of the sidewalk, curb and gutter, valve, valve box, concrete collar, pipe fitting, appurtenances and couplings.

Existing fire hydrants to be removed shall be paid per Each including valve, valve box, concrete collar and the required patch.

No separate payment shall be made for adapters, fittings or couplings, which shall be incidental to the associated item(s).

END OF ARTICLE 02-026.1

Article 03-032.1 STEEL REINFORCEMENT

1.0 DESCRIPTION

This Work consists of furnishing all equipment, materials and labor and performing all operations required for the providing and placing all steel reinforcement in substantial compliance with these Specifications and all other applicable specification items.

2.0 MATERIALS

All steel reinforcement shall conform to the requirements herein provided.

2.1 BAR REINFORCEMENT

Shop Bending: Bent bar reinforcement shall be cold shop bent around a pin to the shapes shown on the Project Plans. Unless otherwise provided, bends shall have a radius measured on the inside of the bar of not less than two and one-half (2 ½) bar diameters.

Bundling and Tagging: Bar reinforcement shall be shipped in standard bundles, tagged, and marked in accordance with the Code of Standard Practice of the Concrete Reinforcement Steel Institute. The CONTRACTOR shall furnish, from the fabricator, a certificate of compliance. Two (2) copies shall accompany all shipments of reinforcing steel to the Project. The certificates of compliance shall show the name of the manufacturer, pounds shipped, heat numbers, laboratory test report numbers, and grade of steel.

Bar reinforcement shall be deformed bars of Grade 60 and shall conform to the requirements of ASTM A 615. Field bending of Grade 60 bars will not be permitted.

Bar mat reinforcement shall conform to the requirements of ASTM A 184, billet steel, Grade 60.

Welded wire fabric shall conform to the requirements of AASHTO M 55.

Metal chairs or other metal supports for reinforcement which contact the exposed surfaces of the concrete shall be galvanized and bond breaker provided between metal chairs and reinforcement.

Wire for reinforcement shall conform to the requirements of AASHTO M 32.

Dowel bars for load transfer in concrete shall: be plain, straight, with ends square, and free from burrs; and shall conform to the requirements of ASTM A 306, Grade 80. Expansion caps for one (1) end of the dowel bars shall be close fitting and shall be a minimum length of three (3) inches. The enclosed end of the expansion cap shall contain a suitable stop to hold the end of the dowel bar one (1) inch from the end of the cap.

3.0 CONSTRUCTION REQUIREMENTS

Before concrete is placed, the reinforcement shall be clean of dirt, mortar, oil, loose rust, loose mill scale and any other analogous material that would reduce or destroy the bond.

Reinforcing bars shall be placed as shown on the Project Plans and shall be securely tied in position with 0.080-inch diameter or 0.0624-inch diameter wire at all intersections, except

where the spacing is less than one (1) foot in either direction. Where the spacing is less than one (1) foot in either direction, alternate intersections shall be tied. Metal spacers, chairs, hangers, and other approved devices of adequate strength to prevent crushing under full load shall be used to hold the reinforcing in position. The use of concrete blocks to support reinforcement will not be permitted, except that dense, rectangular concrete blocks may be used to support the bottom mat of reinforcement in slabs which are cast on earth. Such concrete blocks shall meet the following requirements:

1. Have compressive strength and density equal to or greater than the concrete to be placed,
2. Occupy a small area,
3. Be free from subjection to deterioration,
4. Contain embedded tie wires to provide for the attachment of reinforcement to the block,
5. Reinforcement other than lower mats in slabs cast on earth shall be supported with metal spacers, chairs, or hangers,
6. Wooden spacers or supports shall not be used to hold reinforcing in position.

Bars shall be placed with a variation in spacing between adjacent bars of not to exceed one-half (1/2) inch or one-twenty-fourth (1/24th) of the spacing dimension shown on the Project Plans, whichever is greater. With the exception of slabs cast on earth, the clear coverage of the reinforcement shall not vary more than one-fourth (1/4th) inch or one-eighth (1/8th) of the dimension shown on the Project Plans, whichever is the greater. The clear coverage of reinforcing cast on earth shall not vary more than minus one-fourth (1/4th) inch to plus one-half (1/2) inch from the position shown on the Project Plans.

Reinforcement shall be furnished in the full length indicated on the Project Plans, unless otherwise approved by the ENGINEER. Splicing of bars will not be permitted, except when shown on the Project Plans as allowable. Bars in lapped splices shall be placed and securely tied in a manner to maintain not less than the minimum distance to the surface of the concrete shown on the Project Plans.

Welded wire fabric and bar mat reinforcement shall be lapped as shown on the Project Plans, but not less than two (2) mesh in width, and securely tied at the ends and edges.

Reinforcing steel shall be welded only when shown on the Project Plans or authorized in writing by the ENGINEER. Welding shall conform to the requirements of AWS Specification D12.1-Reinforcing Steel Welding Code.

The minimum cover from the surface of the concrete to the face of any reinforcement bar shall be not less than shown below, unless otherwise shown on the Project Plans.

Minimum cover shall be as follows:

1. Concrete cast against and permanently exposed to earth-two (2) inches.
2. Concrete exposed to earth or weather:

Principal reinforcement – two (2) inches

Stirrups, ties, and spirals - one and one-half (1-1/2) inches

3. Concrete not exposed to weather or in contact with the ground:

Principal reinforcement - one and one-half (1-1/2) inches

Stirrups, ties, and spirals – one (1) inch

For bar bundles, minimum concrete cover shall be equal to the lesser of the diameter of a single bar of equivalent area or two (2) inches, but not less than the minimum cover given in item 1 above.

Exposed reinforcing bars, inserts, and plates intended for bonding with future extensions shall be protected from corrosion.

Inspection: No concrete shall be placed until the ENGINEER has inspected the reinforcing steel in place and has authorized the CONTRACTOR to place the concrete. Acceptance of the reinforcing steel will not relieve the CONTRACTOR of responsibility for coverage and position control of the steel.

4.0 METHOD OF MEASUREMENT (SEE SECTION 3 – BID SCHEDULE, FOR MEASUREMENT)

Steel Reinforcement shall be measured by the Pound (Lb.) as specified by a nominal unit weight.

No separate measure will be made for Steel Reinforcement, which shall be incidental to the associated item(s).

5.0 BASIS OF PAYMENT (SEE SECTION 3 – BID SCHEDULE, FOR PAYMENT)

Steel Reinforcement shall be paid by the Pound (Lb.) as specified by a nominal unit weight.

No separate payment will be made for Steel Reinforcement, which shall be incidental to the associated item(s).

END OF ARTICLE 03-032.1

Article 03-033.1 PORTLAND CEMENT CONCRETE

1.0 DESCRIPTION

This Work consists of furnishing and placing Portland cement concrete in substantial compliance with the Specifications and the lines, grades, and dimensions in accordance with the Contract Documents and all other applicable specification items.

1.1 CLASSIFICATION

The following classes of concrete are included in these Specifications and shall be used where required by the Project Plans:

**Table 03-033-A
Concrete Classes for Design of Concrete Mixtures**

Class	Use	** Compressive Strength at 28 Days (Production)	Maximum Allowable Design Slump	Percent Air Content
A	Cast-in-Place Structural	3000 psi	4.5 in	6% ±2
AA		4000 psi	4.5 in	
D	Non-Structural	2500 psi	4.5 in	---
E	Slip Form Structural	2500 psi	2.5 in	6% ±2
F		3000 psi	2.5 in	
HPD	Bridge Decks	Submit per Project	-	-

** Maximum over design strength is 50%. Maximum under design strength is 5%.

1.2 CLASS SUBSTITUTION

Any structural class of concrete approved for a specified compressive strength requirement in excess of that called for in the Project Plans and Specifications may be substituted for a lower strength mixture, as long as the design slump characteristics remain the same (i.e. Class AA for Class A, Class F for Class E). Class A or Class AA shall not be substituted for a Class E or Class F concrete mix.

2.0 CONCRETE MIX DESIGN

2.1 MIX DESIGN SUBMITTAL

A request for concrete mixture design(s) approval shall be submitted to the ENGINEER. Each request shall have the Stamp of the Professional Engineer, who is currently registered by the State of New Mexico, who is principally responsible for the concrete mixture design Work. All concrete mix designs must be submitted for review and re-approval on an annual basis, unless an extension is granted in accordance with the provisions contained herein. The mix design submittal shall accompany the requester's written request for review and approval, and shall include, at a minimum, the following:

1. Comprehensive list of all materials used in the mixtures, and the properties of each of the components, including:
 - a. Aggregates
 - i. Coarse and fine aggregate source name(s)

- ii. Specific location of coarse and fine aggregate source(s)
- iii. For new sources a complete ASTM C 295 "Petrographic Examination of Aggregates for Concrete" and an ASTM C 294 "Constituents of Natural Mineral Aggregates" for both the coarse and fine aggregate material must be submitted after all processing and manufacturing procedures have been completed and the aggregate is ready for use in a concrete mixture design. The report must include the geologic origin of the material. The analysis is to be performed and certified by an approved petrographer.
- iv. Soundness loss (coarse and fine aggregates) with calculations
- v. Percent of fractured faces for the coarse aggregate
- vi. Gradations for the coarse and fine aggregate, including AASHTO T 11
- vii. Bulk saturated surface dry (SSD) specific gravities (coarse and fine aggregates)
- viii. Los Angeles wear abrasion
- ix. Fineness modulus (fine aggregate)
 - x. Aggregate absorption (coarse and fine aggregate)
 - xi. Aggregate correction factor
 - xii. Sand equivalent of fine aggregate
 - xiii. Dry-rodded unit weight of the coarse aggregate
 - xiv. Clay lumps content of the fine aggregate
 - xv. Organic impurities content, including soft fragments, coal and lignite, flat or elongated pieces and other deleterious substances
- b. Cement
 - i. ASTM C 150 Analysis
 - ii. Chemistry and physical properties of the cement, including the amount of C3S, C2S, C3A, the amount finer than No. 325 sieve and the Blaine Fineness
 - iii. Cube strengths
- c. Fly Ash
 - i. ASTM C618 Analysis
 - ii. Specific gravity
 - iii. Material retained on the No. 325 sieve
 - iv. Moisture content
 - v. Loss on ignition
 - vi. Magnesium oxide content
 - vii. Calcium oxide content
- d. Blended Cement
 - i. ASTM C 595/C 1157 Analysis
 - ii. Chemistry and physical properties of the cement, including the percentage of C3S, C2S, C3A, the amount finer than No. 325 Sieve and the Blaine Fineness

- iii. Total alkalis
 - iv. ASTM C 618 Analysis
 - v. Documentation of percent of fly ash added to cement
 - e. Admixtures
 - i. Documentation of compliance with appropriate ASTM requirements
 - ii. Verification of supply availability
 - f. Water
- 2. Concrete mixture proportions for each class of concrete for which approval is being requested. If the supplier is submitting under the combined gradation provisions, this must be clearly stated on the submittal.
- 3. Water/cementitious ratio for each concrete mixture design
- 4. Type and amount of admixtures used in each mixture design (admixtures must be on the approved materials list).
- 5. Water source and location (including pH, available alkalies, and a full chemical analysis, if the water source is not a certified NMED public potable water supply)
- 6. Material test results documenting the required properties of the fresh and hardened concrete, including:
 - a. Plastic concrete
 - i. Ambient air temperature
 - ii. Concrete temperature
 - iii. Slump (in the case where super-plasticizer is used, the slump before and after addition of the super-plasticizer)
 - iv. Unit weight
 - v. Air content measured in accordance with AASHTO T 152 "Air Content of Freshly Mixed Concrete by the Pressure Method" or AASHTO T 196 "Air Content of Freshly Mixed Concrete by the Volumetric Method" (if super-plasticizer is used, show the measured air content before and after the super-plasticizer has been added)
 - b. Hardened Concrete (for new mixes)
 - i. Compressive strength tests (the average of three cylinders tested at the ages of 7, 28 and 56 days, except for Class E and Class F which will have two cylinders tested at 7, 14, 28 and 56 days)
 - ii. Type of fracture of each cylinder
 - iii. Durability factor (for structural mixes only)
 - iv. Hardened air void analysis (for structural mixes only)
 - v. Rapid chloride penetrability (for structural mixes only)
 - vi. Expansion data from AASHTO T 303
 - c. Hardened concrete (for existing mixes)
 - i. Consecutive compressive strength data with individual specimen test results from 7, 28 and 56 days (at least 15 tests required). This data will be presented in chronological order

- ii. Type of fracture of each cylinder
 - iii. Durability factor (for structural mixes only)
 - iv. Hardened air void analysis (for structural mixes only)
 - v. Rapid chloride penetrability (for structural mixes only)
 - vi. Expansion data from AASHTO T 303
7. Incidental concrete mixes defined as concrete mixes intended for Projects for which less than three hundred (300) cubic yards of each class of concrete is anticipated, but not more than seven hundred fifty (750) cubic yards for all concrete used on the Project:
- a. Compressive strength data (field performance data if the mix has been used within the previous twelve (12) months, or laboratory mix performance data if it has not been used in the field)
 - b. Air content, as measured by the pressure method or the volumetric method. If perplasticizer is used, show the air before and after the superplasticizer has been added

After all of the documentation has been received by the City Engineer, a minimum of ten (10) working days shall be allowed for the review of the mixture design submittal packages. If the documentation verifies compliance with the City's requirements, the designs will be approved for a period of one (1) year from the date of issuance. A minimum of thirty (30) days before the anniversary of an approved mixture design issuance, the Supplier may request that the mixture design(s) be reissued. The Supplier must provide test reports showing that the mixture design(s) met all Specification requirements during the issue period. The ready-mix concrete Supplier may request that existing mixture designs be re-issued for an additional two (2) years, so that the total approval period for any individual mix design does not exceed three (3) years. This approval period will be granted if documentation is provided to prove that:

- 1. All constituent materials and the material's properties remain the same.
- 2. The compressive strength performance criteria described in Section 1.1, "Classification", are satisfied.
- 3. All other fresh and hardened properties are met on all projects that the mixture has previously been used on.
- 4. The coefficient of variation (CV), determined in accordance with ACI 214, for all concrete produced from any production facility used to supply concrete is less than twelve (12) percent. If field performance data shows that the Coefficient of Variation exceeds twelve (12) percent, the supplier must submit a written Comprehensive Operations QC/QA Manual that will reduce the variability of his production process and improve the dependability.

If the constituent materials change, it will be the Supplier's responsibility to provide the necessary documentation to the City Engineer describing resolution to the problem. Either the Supplier will return the affected material to the approved condition, or a new concrete mixture design package must be submitted for approval. If the compressive strengths do not comply with City requirements, the Supplier will adjust the quality control system, the concrete mixture proportions, the mixture ingredients, or a combination of the above. A written summary of the Supplier's resolution will be submitted for approval. The subject concrete mixture may not be used until written approval from the City Engineer is received by the Supplier. Simply adding additional

cement will not be considered a sufficient explanation or resolution without additional documentation explaining why other measures are not required.

3.0 MATERIALS

All materials shall be tested in accordance with applicable AASHTO and ASTM methods or other test procedures designated by the City Engineer. All questions pertaining to the interpretation of test procedures shall be decided by the City Engineer. Material that is improperly graded or segregated, or fails to meet the requirements herein provided, shall be corrected or removed and disposed of immediately as directed by the ENGINEER and/or Public Works Inspector.

The CONTRACTOR shall use pre-approved materials. No change in the source or character of the materials shall be made without due notice and written approval from the City Engineer.

3.1 PORTLAND CEMENT CONCRETE

Portland cement concrete shall be "low-alkali" and shall meet the requirements of ASTM C 150 for the type required. Unless otherwise approved Type II, Low-Alkali cement shall be furnished.

Acceptance of Portland cement will be based on certification of approved sources and satisfactory test results on project verification samples. Cement from a particular source or Supplier must be pre-approved by the City Engineer before being used in Portland cement concrete. The request for source approval shall include the following information:

1. The name of the Supplier or company
2. Location of the cement plant
3. Type and capacity of storage facilities
4. Average and maximum production capabilities
5. Production procedures
6. Details regarding the in-house Quality Control Program, including the following:
 - a. Routine sampling and testing frequency
 - b. Documentation that the laboratory responsible for the certified ASTM C 150, ASTM C 595, and ASTM C 1157 test results is currently participating in the Cement & Concrete Reference Laboratory (CCRL) proficiency sample and the pozzolanic inspection programs. Additionally, the laboratory shall submit a copy of their letter authorizing CCRL to send a copy of their inspection programs and proficiency result reports directly to the City.
 - c. Measures taken to ensure that cement not meeting Specification requirements is kept separated from other cement meeting these Specifications.
7. Copies of test reports showing results obtained in the Quality Control Program for the previous six (6) months, including at least one (1) comprehensive ASTM C 150 analysis for each month.
8. Sources approved by the New Mexico Department of Transportation Materials Bureau will be accepted as approved materials.

3.1.1 Withdrawal of Source Approval

Source approval may be revoked for any of the following reasons:

1. If there is a change in equipment or production procedures from those shown in the original request for approval.
2. If a Project sample fails to comply with Specification requirements.
3. If the chemistry and/or physical properties vary more than allowed, per this Specification.
4. If a source becomes inactive for a period of three (3) months or more.

All cement for any given structure shall be manufactured at the same production facility unless otherwise approved by the ENGINEER. Source changes in cement will only be allowed upon written request by the Supplier to the Engineer for written approval. Compliance with ASTM C 150 is not sufficient documentation to verify equivalence of the proposed cement. Proof that the proposed cement produces concrete in which all of the hardened properties are equal to, or better than, the original cement must be provided before approval can be issued.

3.2 BLENDED PORTLAND FLY ASH CEMENT

Blended Portland fly ash cement shall meet the requirements of ASTM C 595 and ASTM C 1157 and shall consist of Portland cement uniformly blended with fly ash, either by inter-grinding the Portland cement and fly ash or by blending the Portland cement and the fly ash. The Portland cement and the fly ash shall meet the requirements of their individual respective Specifications. The cement producer shall provide proof that the blended Portland fly ash cement contains a minimum twenty (20) percent and maximum twenty-five (25) percent of fly ash (by weight of the cement only).

3.2.2 Approval of Blended Portland Fly Ash Cement Source

The prospective blended Portland fly ash cement Supplier shall furnish acceptable test data showing that the blended Portland fly ash cement does impart satisfactory strength and durability to the concrete per the requirements of Table 03-033-A and Section 2.0, "Concrete Mix Design".

3.3 PACKAGING

When Portland cement and blended Portland fly ash cement are delivered in packages, the packages shall plainly state the name brand, the source manufacturing facility, and the cement type. When cement is delivered in bulk, the same information shall be contained in the shipping documents accompanying the shipment.

3.4 STORAGE

All cement shall be well protected from rain, condensation and all other sources of moisture. Cement of different brands or types, or which comes from different production facilities shall be stored separately. Separate, readily identifiable storage shall be furnished for blended Portland fly ash. Portland cement and Portland fly ash cement shall not be mixed or intermingled.

3.5 REJECTION

All cement which has come in contact with moisture, fly ash or other cements or which has partially set, contains lumps, or fails to meet the specified requirements shall be rejected by the ENGINEER and/or Public Works Inspector.

3.6 ADMIXTURES

The total chloride content (both soluble and insoluble) of any admixture or combinations of admixtures shall not exceed one thousand (1000) ppm. All admixtures used must be submitted for approval.

Air-entraining admixtures for concrete shall conform to the requirements of AASHTO M 154.

Chemical Admixtures: Water-reducing and set-controlling admixtures (including all normal, middle, and high-range water reducers), set-retarding admixtures, and non-chloride set-accelerating admixtures, or combinations thereof shall conform to the requirements of Paragraph 3.6, "Admixtures" and AASHTO M 194.

3.7 CURING MATERIALS

Liquid Membrane Forming Compounds: Unless otherwise specified, liquid membrane-forming compounds for curing concrete shall conform to the requirements of Type 1-D or Type 2 when tested in accordance with AASHTO M 148.

Linseed Oil Emulsion: Linseed oil emulsion-curing agent shall not be used on any Projects.

Sheet materials for curing concrete shall meet the requirements of AASHTO M 171 except that only white reflective type shall be permitted.

Water: Testing of potable water from municipal or other sources approved by the New Mexico Environmental Department (NMED) is not required. Water from other sources must have prior approval from the ENGINEER before incorporating into any Work. Water shall be sampled and tested in accordance with AASHTO T 26. Water used in mixing and curing concrete or for washing concrete aggregates shall be clear and free from injurious amounts of acid, oil, alkali, organic matter, or other deleterious material. Water shall have a pH value of not less than 6.0 or more than 8.5, as determined by AASHTO T 26, prior to its use. The sulfate content and the chloride content each shall not exceed one thousand (1000) ppm. Where a source of water is relatively shallow, the intake shall be enclosed and the level of water shall be maintained at such a depth to exclude silt, clay, vegetable matter and other foreign material. Residual water, wash water, or recycled water generated from any equipment, mixer trucks or central mixers shall not be used as all or any part of the water added to any concrete mixture used.

3.8 AGGREGATE

The combining of materials from two (2) or more approved material sources to produce aggregate will be permitted as follows:

The blended material meets all requirements, including the gradation requirements.

All aggregates shall be evaluated for reactivity by AASHTO T 303 or by ASTM C 1293. The initial "Proof-of-Reactivity-Potential" test will be performed utilizing standard Rio Grande Type I-II low alkali cement from the Rio Grande Cement Plant located at Tijeras, New Mexico. This cement shall have an alkali content between 0.5% to 0.6%. Aggregates that exhibit mean mortar bar expansions at fourteen (14) days greater than 0.10% shall be considered potentially reactive. Aggregates will be considered innocuous if their maximum expansion is less than 0.10% at fourteen (14) days unless ASTM C 1293 is used, then the aggregate shall be considered to be innocuous if the average expansion measured at the end of one (1) year is less than 0.04%. A current list of reactive, potentially reactive and non-reactive (innocuous) aggregate sources tested to date may be obtained from the NMDOT Materials Bureau.

Combined Gradation: At the option of the Supplier, the aggregates used in any concrete mixture may be evaluated in accordance with the combined gradation resulting from the addition of specified weights of individual coarse and fine aggregates. The gradation of the combination of all the proposed aggregates shall be evaluated in accordance with the following parameters:

1. Each individual source complies with all material requirements except the gradation;

$$\text{Coarseness Factor (CF)} = Q / (Q + I) \quad \text{Equation (3)}$$

Where:

Q = the percentage of the combined gradation, by weight of total aggregate retained on or above the 3/8 inch sieve; and

I = the percentage of the combined gradation, by weight of total aggregate, passing the 3/8 inch sieve, but retained on the No. 8 sieve.

2. Workability Factor (W) that is defined as the percentage of the combined gradation, by weight of the total aggregate, passing the No. 8 sieve,
3. Mortar Factor that is defined as the percentage of the total volume of the entire concrete mixture occupied by cement, fly ash, water, air, all other pozzolans and W; and
4. Paste Factor that is defined as the percentage of the total volume of the entire concrete mixture occupied by cement, fly ash, water, air and all other pozzolans (W is not included in this factor).

All aggregates shall be graded and/or combined to produce a uniform gradation, from the coarsest to the finest particle sizes. If the combined gradation protocol is chosen, all aggregates used shall be in compliance with the individual physical and chemical properties required below. Only the individual gradation requirements will not apply. Concrete mixtures designed on the combined gradation basis should use a target for the coarseness factor of between fifty-five (55) and sixty-five (65) with a workability factor between thirty-three (33) and thirty-five (35). The gradations for the individual aggregate stockpiles used to achieve these factors should be realistically maintainable in the field so that the Supplier can maintain these designated factors during production.

Coarse Aggregate: Coarse aggregate shall be crushed stone, crushed gravel, or natural washed gravel, conforming to the requirements herein provided. Unless otherwise specified below, or by other special provisions, at least fifty (50) percent by weight of the plus three-eighths (3/8) inch sieve size particles shall have a minimum of one (1) fractured face. A face will be considered fractured when at least one-half (1/2) of the

projected particle area exhibits a rough, angular, or broken texture with well defined edges.

Deleterious Substances: The amount of deleterious substances shall not exceed the limits shown in Table 03-033-B when tested in accordance with the procedures shown in Table 03-033-F.

**Table 03-033-B
Coarse Aggregate Deleterious**

Substance Tolerances Substance	Percent by Weight (Maximum)
Soft Fragments	2.0%
Coal and Lignite	0.25%
Clay Lumps	2.5%
Materials Passing No. 200 Sieve	1.0%
Flat and Elongated Pieces	* see note

*The plus 3/8 inch material shall contain a maximum of 15.0% flat, elongated particles with a dimensional ratio of 3:1 or greater as determined by ASTM D 4791.

Concrete aggregate shall be free from all sticks, roots and other organic matter. Aggregate contaminated with sticks, roots, and other organic matter shall be rejected.

Fine Aggregate: Fine aggregate shall consist of natural sand or manufactured sand conforming to the requirements herein.

Deleterious Substances: The amount of deleterious substances shall not exceed the limits shown in Table 03-033-C:

**Table 03-033-C
Fine Aggregate Deleterious Substance
Tolerances**

Substance	Percent by Weight (Maximum)
Soft Fragments	2.0%
Coal and Lignite	1.0%
Clay Lumps	3.0%
Materials Passing 75µm (No. 200) Sieve	1.0%

3.9 FLY ASH

Fly ash shall conform to the physical and chemical requirements of ASTM C 618, including the optional requirements for available alkalis and reactivity with cement alkalis, as modified with the exceptions shown in Table 03-033-D. The Supplier shall use Class F fly ash if either the coarse aggregate or the fine aggregate is reactive. If both the coarse aggregate and the fine aggregate are non-reactive, then the Supplier may choose to use a C/F blend fly ash or a Class C fly ash, maximum twenty-five (25) percent by weight of the cement.

**Table 03-033-D
Fly Ash Requirements**

Characteristic	Class C	Class F
Sum of Al ₂ O ₃ , SiO ₂ , and Fe ₂ O ₃	---	> 85%
Moisture Content, Maximum %	1.0	1.0
Loss on Ignition, Maximum %	3.0	3.0
Magnesium Oxide (MgO), Maximum %	5.0	5.0
Available Alkalis, Maximum % *	1.5	1.5
Calcium Oxide (CaO), Maximum % **	50.0	8.0

*When the autoclave expansion or contraction limit is not exceeded when combined with the cement, an MgO content above five (5.0) percent will be acceptable.

**Fly ash meeting the requirements of ASTM C 618 and containing more than ten (10) percent by weight of bulk CaO may not be used in concrete exposed to sulfate environments or with potentially reactive or known reactive aggregate.

If fly ash is supplied in bags, the bags must be waterproof and the name brand, the manufacturer, type, and source shall be clearly identified thereon. Each fly ash shipment shall be accompanied by a copy of a properly executed certificate of compliance. Source changes in fly ash may be allowed only after a written request by the Supplier is made to the City Engineer for review and written approval once the equivalency of the proposed material has been verified. Compliance with ASTM C 618 is not sufficient documentation to permit a change of sources. Information must be provided verifying the equivalence in performance of the proposed source to the original source. Blending of Class C and Class F fly ash is permitted. However, the blended fly ash must be approved by the City Engineer before its actual use. Blended fly ash shall meet all requirements of ASTM C 618, and may only be used in concrete mixes in which both the coarse and the fine aggregate is non-reactive (innocuous).

Source Approval and Acceptance: Acceptance of fly ash will be based on certification of approved sources and satisfactory test results on verification samples. Fly ash from a particular source or Supplier must be approved before being used in Portland cement concrete. The request for source approval shall include the following information:

1. The name of Supplier or company
2. Location of the source power plant
3. Coal type and origin
4. Combustion process
5. Storage facilities and capacity
6. Production procedures
7. Details regarding the Supplier's Quality Control Program including the following:
 - a. Routine sampling and testing frequency;
 - b. Evidence that the laboratory responsible for the certified ASTM C618 test results is currently participating in the Cement & Concrete Reference Laboratory (CCRL) proficiency sample and pozzolanic inspection programs. Additionally, the laboratory shall submit a copy of their letter authorizing CCRL to send a copy of their inspection and proficiency reports directly to the City.
 - c. Measures taken to ensure that fly ash not meeting Specification requirements are kept separated from material meeting the requirements.

Copies of test reports showing results obtained in the quality control program for the previous six months including at least one complete ASTM C 618 analysis for each month.

Sources for fly ash approved by the NMDOT's State Materials Bureau does not allow substitution for an approved source.

3.10 FIBROUS CONCRETE REINFORCEMENT

Fibers used in the concrete mix shall be used at a minimum dosage rate of 1.5 lb/yd³ of concrete. All fibers shall be one hundred (100) percent virgin polypropylene fibrillated fibers, containing no reprocessed olefin materials, and specifically manufactured for use in Portland cement concrete. Fibers shall be added to all concrete used in driveways and alley aprons.

3.11 LITHIUM NITRATE

The CONTRACTOR may use lithium nitrate (LiNO₃) as an admixture to control expansion caused by reactive aggregate. Lithium shall be used in the form of a solution consisting of thirty (30) percent, by weight, lithium nitrate (LiNO₃). If used, it shall be used at a dosage rate of 0.55 gallon of solution for each pound of sodium equivalent, as determined from the cement mill certificate. For each liter (gallon) of lithium nitrate solution used, 0.2 gallons of water shall be subtracted from the total design water in the concrete mixture design. The lithium solution used shall be certified to comply with the following characteristics as shown in Table 03-033-E:

**Table 03-033-E
Lithium Solution Requirements**

Characteristics	Requirement
Lithium Nitrate, Weight %	29.5 minimum
NaOH, Weight %	0.1 maximum
Cl, Weight %	0.2 maximum
SO ₄ , Weight %	0.1 maximum
Heavy Metals, ppm	250 maximum
Elemental Mercury, ppm	0.8 maximum

3.12 AGGREGATE TESTING

Coarse and fine aggregate will be tested in accordance with AASHTO methods as shown in the Table below and such other methods as may be required by the City Engineer. Approval of a concrete mixture design using the designated aggregate source will remain in effect for the duration of the designated approval period as long as the results of tests for specific gravity, absorption, gradation and sand equivalent (for fine aggregate only) performed on representative samples on a semi-annual basis comply with all requirements contained herein.

**Table 03-033-F
Aggregate Test Methods**

Aggregate Test	Method
Sampling	AASHTO T 2
Clay Lumps	AASHTO T 112
Amount of Material Passing No. 200 Sieve	AASHTO T 11
Sieve Analysis	AASHTO T 27
Soundness with Magnesium Sulfate	AASHTO T 104
Sand Equivalent	AASHTO T 176
Soft Fragments	AASHTO T 112
Flat and Elongated Pieces	ASTM D 4791

3.12 CONTROL OF ALKALI-SILICA REACTIVITY (ASR)

If the Supplier elects to use an aggregate source which has been designated as potentially reactive or known reactive, a combination of one (1) or more of the following ASR inhibiting admixtures, per the Table below, shall be used to provide a concrete mixture that meets the maximum expansion requirements below:

**Table 03-033-G
ASR Inhibiting Admixtures**

Fly Ash (Class F)	Section 3.9
Blended Cement	Section 3.2
Ground Granulated Blast Furnace Slag (GGBFS), Grade 100 and 200	AASHTO M 302
Silica Fume	AASHTO M 307
Lithium Nitrate (LiNO ₃)	Section 3.11
Heavy Metals, ppm	250 maximum
Elemental Mercury, ppm	0.8 maximum

Unless it is determined that a larger dosage is required to properly mitigate ASR, the admixture(s) shall be incorporated into the concrete per the Table below:

**Table 03-033-H
ARS Mitigation Dosage Rate Requirements**

Fly Ash (Class F)	20 % minimum 25% maximum by weight of cement only for binary blends; 12% minimum by weight for ternary blends as long as the total pozzolan dosage is at least 20%
Blended Cement	20% minimum by weight of cement only
GGBFS	25% to 30% by weight of cement only
Silica Fume	5% to 12% by weight of cement only
Lithium Nitrate	4.6 Liter/meter ³ (0.55 gallons/yard ³) of solution for each kg (pound) of cement sodium equivalent

ASR Mitigation Requirements: The effectiveness of the admixture(s) in controlling deleterious expansion shall be determined by mortar bars made and tested in accordance with AASHTO T 303-96 using the cement, fly ash, other mitigating admixtures and the proposed aggregate intended for use in the proposed concrete mixture.

ASR Mitigation Evaluation Criteria: An admixture shall be considered effective in controlling deleterious expansion due to ASR when the mean mortar bar expansion at fourteen (14) days is less than or equal to 0.10%, when tested in accordance with Section 2.0, "Concrete Mix Design". Aggregates that are classified as reactive shall be retested each time the comprehensive mix evaluation is performed to verify the effectiveness of the mitigation measures being exercised. If the Supplier feels that the coarse and the fine aggregates are innocuous although the test results generated from AASHTO T 303 or ASTM C 1293 indicate either potentially reactive or reactive material, the following documentation can be submitted for proof that the coarse and the fine aggregates are innocuous:

1. A letter prepared and signed by a registered Professional Engineer in New Mexico who is familiar with ASR stating that he/she has direct knowledge of ASR and its manifestations in concrete and that the subject aggregates have never been observed to be associated with any ASR deterioration of concrete.
2. At least two (2) core samples shall be obtained from completely different structures, each of which is at least fifteen (15) years old, and which used the subject aggregates in a cement-only mixture (no fly ash). These cores will be submitted to a petrographer for evaluation of the presence of ASR gel.
3. Upon receipt of the stamped letter from the Registered Professional Engineer, if there is no evidence of ASR gel found in either of the cores, then the aggregate sources will be considered as innocuous.

4.0 CONSTRUCTION REQUIREMENTS

City Engineering Representatives and CONTRACTOR personnel performing field testing of concrete shall be certified by ACI or TTCP as a Concrete Field Testing Technician.

The CONTRACTOR shall be responsible for providing a concrete mixture that has been reviewed and approved by the City Engineer.

If it is found that the approved mixture design will not work, the Testing Laboratory who designed the mixture and the City Engineer will be contacted immediately. The Testing Laboratory will work directly with the City Engineer to determine why the approved mixture design will not work. The Testing Laboratory will make the necessary changes to resolve any problems with the concrete mix design.

4.1 BATCHING

Measuring and batching of material shall be done at a batching facility or by continuous volumetric batching in a continuous mixer. Any facilities or equipment used to batch concrete shall comply with the requirements in Chapters 9-11 of AASHTO M 157. If the Coefficient of Variation for the batch facility shown on the mix design submittal exceeds twelve (12) percent, then a comprehensive Plant Operations and Quality Control Manual shall be submitted to and approved by the City Engineer before any facilities and/or equipment can be approved or used on the Project. Methods and equipment for adding air-entraining agent or other admixtures to the batch must be included in the Plant Operations and Quality Control Manual.

Batching plants shall include clearly separated aggregate bins or clearly separated stockpiles, silos for cement and fly ash, weighing hoppers, and scales. They shall also be equipped to proportion aggregates, bulk cement and fly ash by means of properly calibrated weighing devices. Aggregate scales and hoppers may provide for weighing each aggregate on a separate scale or for accumulative weighing on a single scale for all aggregates. If cement is used in bulk, a bin, hopper, and separate scale for cement shall be included. Fly ash may be weighed in the same hopper with the Portland cement, however, the cement shall be weighed first, with the fly ash weighed only after all the cement has been placed onto the scale. The weighing hoppers shall be properly sealed and vented to preclude dusting during operations. The batch plant operator shall have a direct view of each of the individual scales and admixture sight tubes from the normal operating position while preparing each individual batch of concrete. The batch plant shall:

1. Accurately weigh and batch materials for Portland cement or Portland cement/fly ash concrete within the tolerances specified.
2. Provide a means of removing an overload of any one material prior to contamination by any other material when more than one material is weighed in one hopper.
3. Provide scale dials or instrumentation devices for admixture bottles, beam scales and load cells, which are readily visible to both the operator and the inspector, regardless of whether a computer is utilized to prepare the batch.
4. Incorporate weighing hopper or hoppers of sufficient size to contain the material without loss or spillage.
5. Properly combine and re-combine the various mixture components to obtain the required uniformity and consistency.

The weighing hopper or hoppers shall be so designed to efficiently discharge all weighed materials for each batch. The material charging equipment shall deliver the batch to the mixer without loss or spillage of any of the components. Scales for weighing aggregates, cement, water and fly ash shall be inspected and certified annually or each time the scales are relocated. Scales shall be accurate within tolerances prescribed by state law.

4.3 PORTLAND CEMENT AND FLY ASH

Either sacked cement or bulk cement and fly ash may be used. No fraction of a sack shall be used in a batch of concrete unless the cement or fly ash is weighed. Cement and fly ash shall be measured by weight. Fly ash may be weighed cumulatively with the Portland cement. However, the cement shall be weighed before the fly ash. All bulk cement and fly ash shall be weighed on an approved weighing device, except when continuous proportioning and mixing equipment is used. The accuracy of batching shall be such that the weight of cement, and the combined weight of cement plus fly ash is within $\pm 1\%$ of the required weights. All other cementitious materials, such as silica fume, GGBFS, metakaolin, etc., shall also be weighed within $\pm 1\%$ of the required weight. If a load of concrete arrives on the Project with a cement or total cementitious weight which exceeds the target weight by more than $\pm 1.0\%$, the Supplier will be notified immediately of the discrepancy by the Public Works Inspector so that corrective actions can be taken by the Supplier. However, at the discretion of the Public Works Inspector, if this target weight is not exceeded by no more than $+2.0\%$ or not less than -1.5% , no more than five (5) individual loads of such out-of-specification concrete may be accepted, regardless of whether the excesses are for the same material or for other

target batch weights. Any subsequent loads, past the five (5) individual loads if they were allowed by the Public Works Inspector, of concrete that exceed the specified target weights for any of the batch constituents shall not be used, and shall be immediately rejected by the Public Works Inspector. If silica fume is used in a slurry form, it shall be properly agitated to insure the mixture has not settled. The dosage of silica fume shall be based on the weight of solids only. The water in the slurry shall be included in the total water amount used to determine water/cementitious ratio. The water in the slurry shall be subtracted from the total water content shown on the approved mix design (along with the water contained in the aggregates) to determine the total amount of free water to be added to the mix. Scales and hoppers shall be used for weighing the cement and fly ash with a device to indicate complete discharge of the batch of cement and fly ash into the mixer. Cement and fly ash supplied in bulk shall be contained in weather tight bins and weighing hoppers. Discharge chutes shall not be suspended from the weighing hoppers and shall be arranged so that cement and fly ash will not lodge in, or leak from them.

4.4 WATER

Mixing water shall consist of water added to the batch, ice added to the batch, and water occurring as surface moisture on the aggregates. The added water shall be measured by weight or volume such that the maximum amount of total water shown on the approved mix design is not exceeded. Added ice shall be measured by weight. In the case of truck mixers, the wash water shall be completely discharged before loading the next batch of concrete.

4.5 AGGREGATES

Aggregates for all concrete shall be handled from stockpiles, or other sources, to the batching plant in such a manner as to secure a uniform grading of the material. Aggregates that have become segregated or mixed with earth or other foreign materials shall not be used. Methods of handling aggregates that result in segregation, degradation, contamination or excessive breakage of particles will not be permitted. No aggregate in the form of frozen lumps shall be used in the manufacture of concrete. The gradation of the stockpiles shall be maintained unless the mixes have been approved under the combined gradation protocol. If the mix is approved under the combined gradation protocol, then the on-site gradation of the stockpiles shall be arithmetically combined in the proportions shown on the approved mix design. The coarseness factor must be within $\pm 4\%$ of the approved coarseness factor shown on the approved mix design, and the workability factor must be within $\pm 3\%$ of the value shown on the approved mix design. If the concrete mixture being used has been approved under the combined gradation protocols, then at the discretion of the concrete Supplier, the actual gradation of the aggregate stockpiles can be determined immediately before the concrete placement. If the existing gradations cannot be adjusted to re-create the original gradation, those stockpiles shall not be used until the gradations have been corrected sufficiently to provide a combined gradation within the designated tolerances. Fine aggregate and individual sizes of coarse aggregate shall be separately stored and accurately weighed in an adequate hopper or hoppers in the respective amounts required by the approved mixture design. Batching shall be so conducted as to provide the weights of material required, within a tolerance of $\pm 2\%$. If a load of concrete arrives on the Project with a fine aggregate or coarse aggregate weight which exceeds the target weight by more than $\pm 2\%$, but not more than $\pm 3\%$, the supplier will be notified of the discrepancy, but the subject load of concrete may be used, at the Public Works Inspector's discretion. However, no more than five (5) individual loads which exceed the maximum allowable batch tolerances for any of the batch constituents, as described

herein will be permitted, regardless of whether the excess are for the same material or for other target batch weights. Any subsequent loads of concrete that exceed the specified target weights for any of the batch constituents shall not be used and shall be immediately rejected by the Public Works Inspector. Any loads that exceed the target aggregate weights by more than $\pm 3\%$ shall be immediately rejected by the Public Works Inspector. Aggregates that do not comply with the specified gradations shall be recombined to bring them within the specified limits or they shall be rejected.

4.6 STOCKPILES

Fine and coarse aggregates from different sources of supply shall not be mixed or stored in the same stockpile or used alternately in the same Work without prior approval. All aggregates shall be stockpiled in such a manner that segregation of coarse and fine particles of each size is avoided. Aggregates from different sources and of different gradings shall not be stockpiled together. The quantity of material in the stockpile shall be adequate to provide all of the concrete required for the section or sections to be constructed during a scheduled operation. The Supplier shall take necessary measures to prevent intermingling of the different sizes of stockpiled aggregates. The Supplier shall take necessary measures to prevent contamination of aggregates by contact with the ground and stockpiled aggregates shall be protected from dust and other foreign matter.

4.7 MOISTURE CONTROL

The moisture content of the fine aggregate shall be continuously monitored by the Supplier, in the case of an operation which uses moisture sensing equipment, or it shall be checked at least once daily by the Supplier, in the case of a manually operated facility. The moisture content of the coarse aggregate shall be checked by the Supplier at least once per day. Operations which utilize moisture sensing equipment will also have the moisture content of the aggregates measured manually by the supplier at least once per day. This moisture determination shall be performed immediately preceding the preparation of the first load of concrete and compared to the moisture determination made by the moisture sensing equipment. If the moisture content determined by the moisture sensing equipment differs from the manually determined moisture content by more than 0.5%, the computer will be adjusted immediately, and rechecked. A certificate will be prepared by the batch operator and submitted to the Project with the first load of concrete showing the following:

1. Pan weight (it is not acceptable to tare out the pan weight on scales equipped to do so),
2. Wet weight of the pan and the sample,
3. First dry weight of the pan and the sample,
4. Second dry weight of the pan and the sample,
5. Third dry weight of the pan and the sample (if necessary),
6. The absolute moisture content of the sample,
7. The actual reading of the moisture probe from the same sample that was actually tested,

8. The calculated difference between the actual moisture content test and the moisture content shown by the moisture sensing equipment.

Moisture content determinations for the purposes of calibrating and/or checking the moisture content of aggregates used in the batching operation shall be performed in accordance with one of the following procedures and shown to the nearest 0.5%:

1. AASHTO T 217 "Determination of Moisture in Soils by means of a Calcium Carbide Gas Pressure Moisture Tester": The shelf life of the calcium carbide is relatively short. The age of the calcium carbide shall be closely monitored, and replaced in strict accordance with the manufacturer's recommendations.
2. AASHTO T 255 "Total Moisture Content of Aggregate by Drying": The hot-plate method may be used for this purpose, as long as no material is lost and the pan is continuously agitated during the drying process.

All aggregates produced or handled by hydraulic methods and washed aggregates shall be stockpiled or binned for draining at least twelve (12) hours before being batched. Rail shipments requiring more than twelve (12) hours will be accepted as adequate binning only if the car bodies permit free drainage. If the aggregates contain high or non-uniform moisture contents, storage or stockpile periods in excess of twelve (12) hours may be required.

4.8 AIR-ENTRANING AND CHEMICAL ADMIXTURES

Admixtures shall be stored in separate containers and in a manner that will avoid contamination, evaporation, and damage. Liquid admixtures shall be protected from freezing and from temperature changes that adversely affects its characteristics. Methods and equipment for adding air-entraining agent or other admixtures to the batch shall be approved by the City Engineer prior use. For admixtures used in the form of suspensions of non-stable solutions, agitating equipment shall be provided to ensure thorough distribution of the ingredients. Volumetric measures for each batch shall be marked in ounces, and shall be constructed so that the quantity of admixture required can be readily determined before being injected into the batch. All liquid admixtures shall be measured into the mixer within $\pm 3\%$ of the required amount.

4.9 MIXING

Concrete may be mixed at the site of the Work, in a central mix plant, or in agitating truck mixers. The uniformity of the concrete mixture shall be in accordance with the criteria presented in AASHTO M 157 Section 10.2. The mixer shall be of a type and capacity approved by the Public Works Inspector except that the central plant mixer shall have a rated capacity of at least three (3) cubic yards. Continuous mixed concrete shall be mixed at the placement site. Mixers shall be completely cleaned before the start of the Project and at suitable intervals thereafter. The pick-up and throw-over blades in the mixing drum shall be repaired or replaced when worn down 0.75 inches or more. The CONTRACTOR shall provide permanent marks on blades to show points of 0.75 inches wear from the original new conditions. Drilled holes of 0.25 inches diameter near the end and at the midpoint of each blade are recommended.

4.10 PRODUCTION REQUIREMENTS

The production of ready-mixed concrete and the production of site-mixed concrete shall meet the applicable requirements of AASHTO M 157, as well as the following requirements:

1. All production facilities shall be certified to comply with National Ready Mix Concrete Association (NRMCA) criteria for concrete production facilities.
2. Addition of Materials: There shall be no water in the drum before initiating batching of concrete. When initiating batching operations, the batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of the cement and aggregates. Introduction of the unmixed materials (cement, coarse aggregate, fine aggregate, admixtures, and the remainder of the water) shall then be performed by a uniform and simultaneous flow into the mixer, with all water introduced into the drum by the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum. When the concrete is delivered in transit mixers or agitators, additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements. Any water added to the concrete in the field shall be noted by the field inspector. The maximum amount of water shown on the approved mix design sheet shall not be exceeded under any circumstances.
3. Slump Requirements: Concrete that is not within the specified slump limits at the time of placement shall not be used.
4. Mixing Speed: The mixer shall be operated at a drum speed not to exceed the maximum speed shown on the manufacturer's name plate.
5. Mixer Capacity: The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer. An overload of up to ten (10) percent above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place. The volume of concrete mixed or transported shall not be less than one (1.0) cubic yard.
6. Mixing Time: For purposes of these Specifications, the term "mixing time" shall be defined as the time elapsed from the time the cement comes in contact with the aggregates until the concrete is deposited in place at the site of the Work. Concrete mixed less than the minimum specified time shall not be used. When the concrete is hauled in truck mixers or truck agitators, the mixing time shall not exceed one and a half (1.5) hours. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 80° F or above for all superstructure concrete, or 85° F for all other concrete, the mixing time shall not exceed sixty (60) minutes.

When the concrete is hauled in non-agitating trucks, the time elapsed from initial mixing to completion of the final finish of the concrete at the project shall not exceed forty five (45) minutes. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 80° F or above, the allowable placement time shall not exceed thirty (30) minutes.

4.11 TRANSPORTING

Mixed concrete from a central mix plant may be transported in non-agitating trucks only when the slump is less than two (2) inches. Concrete with a slump in excess of two (2) inches shall only be transported in properly certified revolving-drum mixer trucks. Concrete produced in a dry-batched concrete plant shall only be transported in revolving-drum mixer trucks.

Non-Agitator Trucks: Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation. Covers shall be provided when needed for protection.

Truck Mixers and Agitators: All agitator trucks shall be equipped with a plate directly attached to the truck in a readily visible location, designating specific properties regarding that truck, including, but not limited to the designated mixing speed of the drum. The truck mixers or agitators shall have been inspected and found to comply with the National Ready Mix Concrete Association Guidelines within the last twelve (12) months. A copy of the inspection for each unit shall be on file and available for review upon request. When the truck arrives at the Project site, the site tube on the water tank will be immediately checked. If there is any water missing from the tank, the truck will be immediately rejected unless the missing water can be properly accounted for.

On-Site Mixing: Upon arrival at the Project site, Agitator Trucks shall re-mix the concrete in accordance with the following criteria:

1. If the concrete was mixed in a central mix plant, the concrete shall be mixed at the designated mixing speed for a minimum of two (2) minutes, before discharging any concrete;
2. If the concrete was mixed inside the Agitator Truck, then the concrete shall be mixed at the designated mixing speed for a minimum of five (5) minutes, before discharging any concrete;
3. If any water, water reducing admixtures, entrained air or other ingredient is added to the concrete, the additional material shall be mixed at the designated mixing speed for at least five (5) minutes before discharging any concrete.

Weather and Temperature Limitations: Concrete shall have a temperature of at least 50° F and not more than 90° F at time of placement.

1. **Hot Weather Concrete:** When concrete is placed during high ambient temperatures, low humidity, and/or windy conditions precautions shall be taken to reduce the rate of evaporation and control the temperature of the concrete per ACI 305, latest revision.
2. **Cold Weather Concrete:** When concrete is placed at or below an atmospheric temperature of 35° F, the water or aggregates, or both, shall be heated, and suitable enclosures and heating devices shall be provided. The mixed concrete shall have a temperature of at least 50° F and not more than 90° F at the time of placing. The heating equipment or methods shall be capable of heating the water and aggregates uniformly, and these materials shall not be heated to a temperature exceeding 150° F. Concrete shall not be placed on frozen ground.

3. Protection of Concrete: After any concrete is placed, the CONTRACTOR shall provide suitable measures to maintain a concrete surface temperature of 40° F or above for a period of not less than twenty-four (24) hours.

4.12 CONCRETE SAMPLING AND TESTING

Slump, unit weight, air content tests and compressive strength test cylinders shall be prepared with concrete obtained from the point at which the concrete is placed by certified personnel. All results for the tests performed in accordance with this unit will be provided to the CONTRACTOR and the concrete Supplier immediately upon completion of the final compressive strength test. If a super-plasticizer is used, the slump shall be measured before and immediately after the addition of the super-plasticizer. The slump specifications defined on the approved mix design shall not be exceeded before introduction of the super-plasticizer. The slump shall not exceed eight (8) inches after the super-plasticizer has been added. Super-plasticized concrete shall be checked for segregation before being placed and during the course of the placement. Segregated concrete shall not be placed. Concrete cylinders for compressive strength tests by the CONTRACTOR's certified personnel are to be molded and cured in accordance with AASHTO T 23 "Making and Curing Concrete Test Specimens in the Field" using four (4) inch by eight (8) inch single use plastic cylinder molds with plastic lids or six (6) inch by twelve (12) inch cylinder molds and air content tests cast from slip-form concrete shall be accomplished with a vibrator. The CONTRACTOR is responsible for providing all vibratory equipment and all equipment required to operate the vibratory equipment. Rodding of slip-form concrete will not be permitted. Responsibility for transporting the test specimens to a certified testing lab shall belong to the party who originally prepared the test specimens.

Concrete Testing: At least one (1) sample shall be taken from each of the first three (3) concrete loads delivered to the Project site. Each of these loads shall be tested for slump, air content, and unit weight. Additionally, a set of compressive strength test cylinders will be cast from one of these three loads, determined on a random basis. Beginning with the fourth (4th) load of concrete delivered to the Project, one (1) randomly selected load from each sub-lot of six (6) trucks. All tests and cylinders shall be tested and handled in accordance with proper procedures.

Concrete Strength: Concrete compressive strength shall be determined from the average of two (2) or more concrete cylinders made from the same sample of concrete and tested at the specified age. The cylinders will be made, handled, and stored in accordance with AASHTO T 23 "Making and Curing Concrete Test Specimens in the Field" and tested in accordance with AASHTO T 22 "Compressive Strength of Cylindrical Concrete Specimens".

Individual Strength Test: Unless otherwise specified, an "individual strength test" will be determined by testing two (2) or more cylinders at twenty-eight (28) days (or at fourteen (14) days for slip-formed concrete). At least four (4) cylinders shall be made for each set. The first cylinder shall be tested at seven (7) days for use as an indicator of the early concrete compressive strength. The second and third cylinders shall be tested to determine the "Individual Strength Test" result. The fourth cylinder shall remain available for testing if the Within-Test-Coefficient-of-Variation (WTCV) exceeds five (5) percent, as determined by ACI 214.3.4.1. If the fourth cylinder is tested, the "Individual Strength Test" result will be the average of all of the cylinders tested at that age, unless one (1) or more of the following conditions exist:

1. There is a visible defect in the cylinder or the capping, and/or orientation of the cylinder with respect to its perpendicularity or the parallelism of the ends.
2. A significant irregularity occurred while loading the test specimen to failure, such as a sudden load burst, cyclic or pulsating loads, or a loading rate not in accordance with AASHTO T 22.

In-Place Concrete Strength Measurements: The CONTRACTOR may request to measure the in-place strength of the concrete for construction-related purposes. The equipment to perform the requested test shall be furnished by the CONTRACTOR. Field-cured cylinders will be tested by the City's Representative. The method of measuring the in-place strength of the concrete shall be one of the following procedures:

1. Core Testing: This method shall be performed in accordance with AASHTO T 24, and as further defined in Subsection 510.514, Investigation of Low Strength Cylinder Test Results.
2. The Maturity Method: This method integrates the heat of hydration and the time since the concrete was batched. It shall be correlated for the specific concrete mix before being used in the field.
3. The Windsor Probe: This method measures the depth of penetration of a specially fabricated probe into the concrete. This method must be calibrated for the specific concrete mix before being used in the field.
4. The Pull-Out Test: This method measures the pull-out resistance of a specially fabricated plug cast into the concrete in question. This method must be calibrated to the specific concrete mix before being used in the field.
5. The Match-Cure Method: This method places additional cylinders into a specially controlled chamber which maintains the temperature to that of the concrete being represented.
6. The Cast-in-Place Cylinder Method: This method tests a cylinder, which is actually cast into the concrete being evaluated. The hole remaining after the cast-in-place-cylinder is removed must be filled with a non-shrink grout or a Type K cement.
7. Field Cured Cylinders: All field cured cylinders shall be cast in accordance with AASHTO T 23, and cured in strict accordance with AASHTO T 23, Section 9.4.1.

The method of measuring in-place strength chosen, with the exception of Method G (Field Cured Cylinders), must be submitted to the City Engineer for approval, with complete supporting documentation before it can be used in the field.

Field cured cylinders will not be considered appropriate measurements of in-place strength for any superstructure considerations. In-place strength measurements for construction related purposes or for acceptance of concrete including, but not limited to removal of forms, post-tensioning, shoring, or vertical supports shall be performed by one of the methods outlined above. Core testing, pull-out test or cast-in place cylinder methods will not be allowed on bridge decks.

Unless less stringent requirements are specified in the Contract, forms may be stripped or traffic permitted on the structure or pavement when the correlated in-place

compressive strength is at least equal to the strength required for the intended application.

Acceptance of Concrete Based on Cylinders: The concrete will be accepted with respect to compressive strength indicated by cylinder tests, when both of the following requirements are met:

1. The running average of three (3) consecutive individual strength tests meets or exceeds the specified strength.
2. No individual strength test falls below the specified strength by more than five hundred (500) psi; and,

When the cylinder based acceptance requirements are not met, the City Engineer will review the strength tests and notify the CONTRACTOR in writing whether the concrete will be accepted, or shall be removed and replaced by the CONTRACTOR. Only that area of concrete represented by the individual strength test failing to meet any one (1) of the cylinder based acceptance requirements, shall be subject to investigation or removal. When the cylinder-based acceptance requirements are not met, steps shall be taken by the CONTRACTOR to resolve the problem. The proposed resolution will be submitted in writing to the City Engineer. The mere addition of extra cement will normally not be considered a sufficient resolution.

Investigation of Low Strength Cylinder Test Results: The CONTRACTOR may use one (1) of the in-place strength test methods outlined in Section 4.12 "In-Place Concrete Strength Measurements" if the normal acceptance tests do not comply with Section 4.12, "Acceptance of Concrete Based on Cylinders", above. Core tests may not be used for any investigation involving bridge decks.

1. If cores are used to determine the in-place compressive strength, all cores shall be obtained by the CONTRACTOR in accordance with AASHTO T 24 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". The cores will be tested in accordance with AASHTO T 22 "Compressive Strength of Cylindrical Concrete Specimens";
 - a. If the concrete in the structure will be dry under normal service conditions, the cores will be air dried at a temperature range of 60° F to 80° F, and at a relative humidity of less than sixty (60) percent for seven (7) days before testing. The cores will be tested dry.
 - b. If the concrete in the structure will be more than superficially wet under service conditions, the cores will be cured in lime-saturated water for at least forty (40) hours before testing. The cores will then be tested wet.
2. Procedure for Coring of Non-Bridge Structures: If the CONTRACTOR elects to core, the CONTRACTOR must core, within forty-two (42) calendar days of the initial concrete placement. A core-set consisting of at least three (3) cores shall be taken for each individual strength test falling below the specified strength, and a minimum of one (1) core-set will be obtained for each lot of twenty-five hundred square yards (2500 yd²) for PCCP or for each lot of five hundred cubic yards (500 yd³) for any other structures. The ENGINEER will determine the locations to be cored.
3. As an alternative to paragraph 2 above, or to investigate any bridge decks, the CONTRACTOR may request in writing to the City Engineer that he be allowed to use

one of the in-place strength test methods described in Section 4.12 "In-Place Concrete Strength Measurements", to determine the actual in-place strength of the concrete. Approval in writing from the ENGINEER must be received before the requested test method can be used in the field.

4. Acceptance of Concrete Based on Measurement of In-Place Strength: The concrete will be accepted with respect to the compressive strength indicated by core tests, when the average of all core sets is at least eighty-five (85) percent of the specified strength, and if the average of any core set is no less than seventy-five (75) percent of the specified strength. If alternate in-place strength test methods are used, the concrete will be accepted with respect to the compressive strength determined when the average of all tests is equal to or greater than the specified strength, and no individual strength is five hundred (500) psi less than the specified strength.

5.0 METHOD OF MEASUREMENT (SEE SECTION 3– BID SCHEDULE, FOR MEASUREMENT)

No separate measurement shall be made for Portland cement concrete, which shall be incidental to the associated item(s).

6.0 BASIS OF PAYMENT (SEE SECTION 3– BID SCHEDULE, FOR MEASUREMENT)

No separate payment will be made for Portland cement concrete, which shall be incidental to the associated item(s).

END OF ARTICLE 03-033.1

Article 03-033.2 CONCRETE CURBS, GUTTERS, WALKS, DRIVEWAYS, APRONS, CURB RETURNS, FILLETS, VALLEY GUTTERS AND SLOPE PAVING

1.0 DESCRIPTION

This Work consists of new or replaced concrete curbs, gutters, walks, driveway aprons, curb returns, fillets, slope paving, and valley gutters placed on a prepared surface in accordance with these Specifications and in conformance with the lines, grades, thickness and typical cross-sections shown in the Contract Documents.

2.0 GENERAL

Portland cement concrete curbs, walks, gutters, valley gutters, and driveway aprons constructed of concrete having a minimum twenty-eight (28) day compressive strength of 3,000 psi, unless otherwise noted on the Plans.

Subgrade preparation for concrete curbs, gutters, walks, driveways, alleys, intersections, and slope paving shall conform to the requirements of Article 02-022.3.

Unless otherwise specified or indicated on the Plans, the minimum thickness of walks shall be four (4) inches. The minimum thickness of gutters, driveway aprons, and alley intersections shall be six (6) inches unless otherwise shown on the Plans. The height and thickness of the curb section including other details of construction for items in this section will be shown in the Contract Documents.

3.0 FORMS

Form material shall be free from warp, with smooth and straight upper edges and, if used for the face of curb, shall be surfaced on the side against which the concrete is to be placed. Timber forms may be used for forming curved section but shall not be used for straight work unless authorized in writing by the ENGINEER. Metal forms for such work being of a gauge that will provide proper rigidity and strength for the purpose for which they are intended. Wood forms used on curb returns shall be not less than three-quarter (3/4) of an inch in thickness, cut in the length and radius as shown on the Plans and held rigidly in place by the use of metal stakes and clamps. The curb face forms shall be cut to conform exactly with the curb face batter, as well as being cut to the required length and radius. In every case, however, the forms shall be of sufficient rigidity and strength and shall be so supported as to adequately resist springing or deflection as a consequence of the placing and tamping of the concrete.

All curb and combined curb and gutter shall be divided into blocks or stones in lengths of five (5) feet or ten (10) feet long using metal templates not less than one-sixteenth (1/16th) inch nor more than one-fourth (1/4th) inch thick cut to the same cross section as the curb or curb and gutter being constructed. Templates shall be securely attached to forms to prevent movement during concrete placement.

Form material shall be thoroughly clean at the time it is used and shall be given a coating of light oil or other suitable material immediately prior to the placing of the concrete.

Forms, except curb block planks, shall be set with the upper edges thereof flush with the specified grade of the finished surface of the adjacent portion of the work and shall be not less than a depth equivalent to the full specified depth of thickness of the concrete to be supported thereby.

Back forms shall be held securely in place by means of stakes driven in pairs, one at the front form and one at the back, at intervals not to exceed four (4) feet; clamps, spreaders, and braces being used in connection therewith to such extent as may be necessary to insure proper rigidity of the forms. Forms for walks, gutters, and similar work shall be firmly secured by means of stakes driven flush with the upper edge of the forms at intervals not to exceed five (5) feet. The stakes shall be of sufficient size and shall be so driven as to properly and adequately support the forms.

Form clamps, specifically designed and manufactured for the curb and gutter to be constructed, may be used if, in to opinion of the ENGINEER, they fulfill the requirement herein above specified for curb and gutter forms.

4.0 PLACING CONCRETE

The concrete shall be placed on a thoroughly dampened subgrade sufficiently moist to insure that no moisture will be absorbed from the fresh concrete.

Surfaces of structures in sidewalks, curbs, and gutters shall be adjusted as necessary prior to placing of concrete to meet the contiguous sidewalk surfaces.

Concrete shall be placed in horizontal layers not to exceed six (6) inches each in thickness, each layer being spaded along the forms and thoroughly tamped. However, if the section is more than six (6) inches in depth, the concrete may be placed to provide the thickness shown or specified, if mechanical internal vibrators are used.

After the concrete for walk has been placed between the side forms, a strike-off shall be used to bring the surface to the proper section to be compacted. It shall then be spaded along the form faces and tamped with appropriate tampers not less than two (2) times, in order to assure a dense and compact mass, forcing the larger aggregate into the body thereof and bringing to the surface sufficient free mortar for finishing.

After the concrete has been placed and tamped, the upper surface shall be struck off uniformly smooth and true to the specified grade.

5.0 EXPANSION JOINTS

Expansion joints shall be constructed in curbs, walks, and gutters as hereinafter specified, being filled with pre-molded joint filler strips. No such joints shall, however, be constructed in cross gutters, alley intersection, or driveway aprons.

Unless otherwise shown on the plans, one-half (1/2) inch joints shall be constructed in curbs and gutters at the end of all returns except where cross gutters are being constructed. They shall be at the ends of the cross gutter transitions and also along the line of the Work at regular intervals not to exceed fifty (50) feet, joints in gutter being continuous with those in adjacent curb. No joints shall be constructed in returns. Where continuous curb and gutter is constructed adjacent to cement concrete pavement, weakened plane joints shall be installed continuous with alternate joints installed in the adjacent pavement, in which case expansion joints for sidewalks shall be placed at intervals not to exceed twenty (25) feet with joint filler strips.

Expansion joint filler strips shall be placed in walks at the PT and PC of all walk returns, between walk and a building or structure, in walk returns between the walk and the back of the curb returns, and around all utility poles encountered along the line of the work. Joint

filler strips shall extend the full depth of the concrete being placed. Joint filler strips between walk and curb shall be the full depth of the walk with the top of the filler strip set flush with the top of the concrete. Expansion joint filler strips including those around utility poles shall not be less than one-half (1/2) inch in thickness.

Expansion joint filler strips shall be vertical and shall extend to the full depth and width of the Work in which they are installed, being constructed at right angles or radial to the line of the curb or gutter, as the case may be. The filler strips shall completely fill these joints at least to within one-fourth (1/4th) of an inch of any surface of the concrete that will be exposed upon completion of the Work and must fully extend at least to those surfaces that will not be exposed. However, before the Work will be accepted, any joint filler that protrudes beyond a surface that will not be exposed or beyond one-fourth (1/4th) of an inch below a surface that is exposed shall be trimmed off to the specified dimension in a neat and workmanlike manner. During the placing and tamping of the concrete, the filler strip shall be held rigidly and securely in proper position.

6.0 FINISHING

Surfaces of the various items of Work shall be finished as specified. Edges of concrete at expansion joints shall be rounded to one-fourth (1/4th) inch radius. Upon completion, the finished surface shall be true to line and grade and free from irregularities.

6.1 CURB

The front forms may be stripped as soon as the concrete has set sufficiently but must be removed before the expiration of six (6) hours after pouring. Immediately following the stripping of these forms, mortar, as thinned to the consistency of grout, shall be applied to the curb face. If monolithic curb and gutter is being constructed, this mortar shall be applied to the full-exposed face; otherwise, it shall extend for an additional two (2) inches below the gutter.

The face and top of the curb shall then be carefully troweled to a smooth and even finish, the top being finished to a transverse slope of one-fourth (1/4th) of an inch toward the front, with both edges rounded to a radius of three-fourth (3/4th) of an inch. The troweled surface shall be finished with a fine hair broom parallel with the line of the Work.

Contraction joints or control joints shall not exceed intervals of five (5) feet. Joints shall be made at regular intervals along the line of the Work. On straight work, the joints shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be long lines concentric with and radial to the proportion of the work in which they are placed. The markings shall be made with jointed tools that will round the edges of the scoring lines to a radius of one-eighth (1/8th) of an inch, with a depth of not less than one (1) inch. The finished joint opening, excluding of radii, shall not be wider than one-eighth (1/8th) inch. The CONTRACTOR will be required to have a sufficient number of jointed tools on the job to accomplish the above specified requirements.

6.2 WALK

Following the placing of concrete, the surface shall be worked to a true and even grade, free from waves and irregularities. After the preliminary troweling, the initial scoring for the block marking shall be made to a depth of one (1) inch in order to insure the scoring depth required. The Work shall then be carefully troweled to a smooth and even finish, with the edges rounded to a radius of one-half (1/2) inch, the scoring markings made to the required

depth following which it shall be given a fine hair broom finish, applied transversely and remarked when required to insure a new uniform joint. Troweling may be done with a long handled trowel or "Fresno."

Contraction joints or block joints shall not exceed intervals of five (5) feet. Joints shall be made at regular intervals along the line of the Work. On straight work, the joints shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be long lines concentric with and radial to the proportion of the work in which they are placed. The markings shall be made with jointed tools that will round the edges of the scoring lines to a radius of one-eighth (1/8th) of an inch, with a depth of not less than one (1) inch. The finished joint opening, excluding of radii, shall not be wider than one-eighth (1/8th) inch. The CONTRACTOR will be required to have a sufficient number of jointed tools on the job to accomplish the above specified requirements.

The side forms shall remain in place after completion of the work until the concrete is sufficiently set but must be removed before the Work will be accepted.

6.3 GUTTER

After the concrete has been thoroughly tamped in such manner and to such extent as to force the larger aggregates into the body thereof and bringing to the top sufficient free mortar for finishing, the surface shall be worked to a true and even grade by means of a float, troweled with a long handled trowel or "Fresno" and then longitudinally broom finished, following which the flow line of the gutter shall be troweled smooth for a width of approximately three (3) inches and the outer edge rounded to a radius of one-half (1/2) inch.

Side forms shall remain in place until the concrete is sufficiently set, after completion of the gutter, but must be removed before the Work will be accepted.

Reinforcement shall be included as shown on the Plans.

Construction joints and one-half (1/2) inch pre-molded expansion joints and other details of construction shall be as specified in the details. The finished surface shall conform to the required roadway section as to both line and grade. The gutter sections will not be opened to traffic until specimen beams have attained a flexural strength of not less than five hundred (500) pounds per square inch (AASHTO T 97). When such tests are not conducted, the gutter shall not be opened to traffic until determined by the City Engineer.

6.3 SLOPE PAVING

All subgrade preparation required for this item shall be done in accordance with applicable provisions of Article 02-022.1, Earthwork, with the exception that minimum density requirements will be ninety (90) percent of maximum density as determined by ASTM D 1557 in all cases, instead of ninety-five (95) percent of maximum in the top six (6) inches or twelve (12) inches of compacted fill.

Reinforcement shall be included as shown on the Plans.

Thickness of concrete shall be as specified in the Contract Documents. Concrete shall be screeded and finished with wood float or equivalent to a plane surface having no variation when measured with a ten (10) foot straight-edge in excess of one-fourth (1/4th) inch, unless a curvilinear surface is designated for a particular job. All concrete shall be in accordance with Article 03-033.1 Portland Cement Concrete.

7.0 CURING

After the completion of the finishing operations, all curbing shall be sprayed with concrete curing compound. The surface of the concrete shall be kept thoroughly damp between the completion of the finishing operations and the application of the curing compound.

The curing compound shall be applied under pressure, by means of a spray nozzle, in such manner and quantity as to entirely cover all exposed surfaces of the concrete with a uniform film. The preparation so used shall be Type 2 as specified in ASTM C 309.

8.0 DRIVEWAY PAD AT ENTRANCES

Driveway entrances shall be provided in new curbs at all existing driveways along the line of the work and at locations shown on the plans or as directed by the ENGINEER.

The location and construction details for driveways shall conform to the Contract Documents.

Reinforcement shall be included as shown on the Plans.

Where walk is to be constructed across driveway, the thickness of the walk shall be not less than six (6) inches, unless otherwise specified or shown on the Plans.

9.0 MISCELLANEOUS TYPES OF CURB, GUTTERS, SIDEWALKS

Extruded type concrete curb and gutter, precast curb and gutter sections, cut stone curbs, brick sidewalks, flagstone sidewalks, etc. will be permitted where approved by the City Engineer and in accordance with the Contract Documents.

10.0 REPAIRS AND REPLACEMENT

New Work that is found to be defective or damaged prior to the acceptance or existing Work damaged by the CONTRACTOR's operation shall be repaired or replaced by the CONTRACTOR with no additional compensation. Sidewalk that is to be replaced shall be neatly saw-cut to the next control joint on either side of the defective or damaged portion. The minimum size slab that is removed and replaced shall be five (5) feet long and for the full width of the walk. Curb and gutter shall be saw-cut on a neat line at right angles to the face of the curb to the next control joint of curb and/or gutter on either side of defective or damaged portion.

11.0 TESTS

The number of compression test cylinders to be taken shall be three (3) cylinders for the first ten (10) yards poured, and three (3) cylinders for every one hundred (100) cubic yards poured thereafter, minimum.

12.0 BACKFILLING AND CLEANUP

Backfilling to the finished surface of the newly constructed improvement must be completed before acceptance of the Work.

Upon completion of the Work, all earth or burlap covering shall be removed, the surface of the concrete thoroughly cleaned, and the site left in a neat and orderly condition, including disposal of excess materials and earth.

13.0 METHOD OF MEASUREMENT (SEE SECTION 3 – BID SCHEDULE, FOR MEASUREMENT)

Concrete curbs and gutters will be measured by the Linear Foot, in place, for accepted Work.

Concrete sidewalks will be measured by the Square Yard, in place, for accepted Work.

Concrete paving and slope paving will be measured per Square Yard, in place, for accepted Work.

Concrete curb returns with fillets will be measured per Each, in place, for accepted Work.

Accessible ADA corner ramps and drive way aprons will be considered incidental to 6-inch thick concrete with reinforcement measurements.

Detectable warnings will be measured by the Square Foot, in place, for accepted Work.

No separate measure will be made for concrete curbs and gutters. Concrete curbs and gutters shall be included with the item with which it is associated.

No separate measure will be made for concrete sidewalks. Concrete sidewalks shall be included with the item with which it is associated.

No separate measure will be made for concrete paving and slope paving. Concrete paving and slope paving shall be included with the item with which it is associated.

No separate measure will be made for concrete curb returns with fillets. Concrete curb returns with fillets shall be included with the item with which it is associated.

14.0 BASIS OF PAYMENT (SEE SECTION 3 – BID SCHEDULE, FOR PAYMENT)

Concrete curbs and gutters will be paid per Linear Foot, in place, for accepted Work.

Concrete sidewalks will be paid per Square Yard, in place, for accepted Work.

Concrete paving and slope paving will be paid per Square Yard, in place, for accepted Work.

Concrete curb returns with fillets will be paid per Each, in place, for accepted Work.

Accessible ADA corner ramps and drive way aprons will be paid per Square Yard, in place, for accepted Work.

Detectable warnings will be paid per Square Foot, in place, for accepted Work.

Such payment shall constitute full compensation for furnishing and placing all materials required to complete the concrete Work, including all grading and subgrade preparation, cleaning of surfaces upon which the concrete is placed, providing forms, equipment, tools, backfilling and cleanup, and labor required to complete the Work in conformity with the Plans and Specifications.

No separate payment will be made for concrete curbs and gutters. Concrete curbs and gutters shall be included with the item with which it is associated.

No separate payment will be made for concrete sidewalks. Concrete sidewalks shall be included with the item with which it is associated.

No separate payment will be made for concrete drive aprons and slope paving. Concrete drive aprons and slope paving shall be included with the item with which it is associated.

No separate payment will be made for concrete curb returns with fillets. Concrete curb returns with fillets shall be included with the item with which it is associated.

END OF ARTICLE 03-033.2