

WELLSVILLE CITY

Design Standards & Construction Specifications



Prepared by

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February 2012



DESIGN STANDARDS
AND
CONSTRUCTION SPECIFICATIONS

for

Wellsville, Utah

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&
CONSTRUCTION SPECIFICATIONS

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1.1 INTRODUCTION: The following Wellsville City "Design Standards and Construction Specifications" were developed to establish practical, uniform design and construction of public works facilities and utilities in Wellsville City. These criteria are not intended to cover extraordinary situations, and in such instances, deviations from the criteria may be allowed where justified, upon approval of the City.

1.2 DEFINITIONS

AAN - American Association of Nurserymen

AAR - Association of American Railroads

AASHTO - American Association of State Highway and Transportation Officials

ACI - American Concrete Institute

AGC - Associated General Contractors of America

ACPA - American Concrete Pipe Association

AI - Asphalt Institute

AISC - American Institute of Steel Construction

ANSI - American National Standards Institute

ASA - American Standards Association

ASCE - American Society of Civil Engineers

ASLA - American Society of Landscape Architects

ASTM - American Society for Testing and Materials

AWA - American Wire Gauge

AWS - American Welding Society

AWWA - American Water Works Association

EQWQ - Environmental Quality, Water Quality

IEEE - Institute of Electrical and Electronic Engineers

MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways

NEC - National Electrical Code

PPI - Plastic Pipe Institute

SAE - Society of Automotive Engineers

UDOT - Utah Department of Transportation

UL - Underwriters Laboratories Incorporated

WPCA - Water Pollution Control Association

Approved Drawings - Final construction drawings approved by the City.

Base Course - The layer or layers of specified or selected material of designated thickness on a sub-base or a subgrade to support a surface course.

Channel - A natural or artificial water course

City - Wellsville City Corporation

Culvert - Any structure not classified as a bridge which provides an opening under the roadway.

Contractor - The person, company or firm performing the construction work.

Developer - The owner, builder or person sponsoring the construction.

City Engineer - The engineer, including such assistants as are authorized to represent him, who represents Wellsville City.

Project Engineer - The company or firm and its employees providing the engineering services for the project through the developer.

Guarantee Bond - The approved form of security executed by the Contractor and his surety or sureties guaranteeing the work against defect and failures.

Inspector - The authorized agent of the City assigned to make detailed inspections of any or all portions of the water line system construction.

Lateral - The sewer line and appurtenances extending from the building to the public sewer line.

Materials - Any substances specified for use in the construction of the project and its appurtenances.
Pavement Structure - The combination of base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Plans - The approved project plans and Standard Drawings, profiles, typical cross sections, working drawings and supplemental drawings or exact reproductions thereof, which show the location, character, dimensions and details of the work to be performed.

Profile Grade - The trace of a vertical plane intersecting the top surface of the proposed structural section as shown on the plans. Profile grade means either elevation or gradient of such trace according to the context.

Project - The specific improvement to be constructed together with all appurtenances and construction to be performed thereon.

Project Engineer - The licensed person designated as the Owner's representative and agent for the construction contract.

Public Sewer - The sewer line, 8" or larger, (and not designated as a lateral) which collects and transports sewage and owned by the City.

Right of Way or Easement - A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to a highway or other improvements.

Road - A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Roadway - The portion of a highway within limits of construction.

Service Line - The water line and appurtenances extending from the building to the public water main.

"Shall"/"Should" - Where the term "shall" is used, it is intended to mean a mandatory requirement. Other terms such as "should" and "recommend", indicate discretionary use.

Shoulder - The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk - That portion of the roadway primarily constructed for the use of pedestrians.

Specifications - The directions, provision and requirements contained in the Standard Specifications and supplemental specifications as modified by the Special Provisions. Whenever the term "these specifications" is used in this book, it means the provisions set forth in this book.

Street - A general term denoting a public way for purposes of vehicular travel, including the entire area within the right of way.

Subcontractor - Any individual, firm or corporation to whom the Contractor, with the consent of the Contracting Agency, sublets any part of the contract.

Subgrade - The top of a roadbed upon which the base courses and/or pavement structure and shoulders are constructed.

Surety - The corporation, partnership or individual, other than the Contractor, executing a bond furnished by the Contractor.

Surface Course - The top layer of an improvement.

Traffic Lane - The portion of a traveled way for the movement of a single line of vehicles.

Utility - Tracks, overhead or underground wires, pipe lines, conduits, ducts or structures, sewers or storm drains owned, operated or maintained in or across a public right of way or private easement.

Water Main - The water line, 8" or larger, and not designated as a service line which provides water to an area and is owned by the City.

1.3 REVISIONS OF STANDARDS AND SPECIFICATIONS

When reference is made to the Standard Specification (ASTM, ANSI, Utah Department of Transportation, Utah State Division of Drinking Water, etc), the specification to which referred shall be understood to mean the latest revision of said specification.

These specifications may be modified or deleted by appropriate notes on Approved Drawings.

1.4 CONTRACTORS

All Contractors performing street improvements within Wellsville City shall possess a valid Utah Contractors License and shall be licensed to perform the field of construction in which they are working.

Design Requirements

DIVISION 2

2.1 DESIGN PROCESS

2.1.1 Description: The "Design Process" shall consist of a Preliminary Design, a Final Design, and "As-Constructed" Drawings.

All street and/or utility construction projects within Wellsville City shall follow the procedures for design and approval as outlined below:

- A. The Developer contacts the City and explains the proposed project. The City reviews the proposed project and outlines the following procedures. Sewer and water service availability are reviewed. The City shall make available copies of the Wellsville "Design Standards and Construction Specifications" for purchase or review in their offices.
- B. The Developer shall submit to the City four (4) copies of preliminary plats or site plans with sufficient information to complete a preliminary review.
- C. The Project Engineer prepares a preliminary design of the project. The Developer is notified by the City of any required modifications in the preliminary design.
- D. The Developer shall submit four (4) prints of the final approved plat or site plan and one (1) set of prints of the improvement drawings which shall show sufficient data for the final design.
- E. The Developer then shall have his Project Engineer complete final improvement drawings to submit for review and approval at the Developer's expense.
- F. The Developer provides, at Developers expense, all public easements required for the development, which easements shall be in a recordable form satisfactory to the City.
- G. Developer shall stake the centerline control and all front lot corners in a subdivision and all building corners in a residential or commercial development prior to notifying the City of the need for setting grades.
- H. The Project Engineer shall set cut and fill stakes upon the Developer's readiness and so notify the City. Water service line and meter locations shall be staked. The locations for sewer manholes and a set point for the location of the main 50 feet beyond the manhole should also be staked.
- I. A pre-construction meeting is held on site to establish construction schedules and to resolve any questions regarding the requirements of the Drawings and Specifications. The installing Contractor, being the individual who will actually be performing the work, must be present. The Developer shall obtain any necessary construction permits, at Developer's expense, before starting any work.
- J. The Project Engineer shall provide the City with four (4) copies and the Developer's Contractor with copies of the profile for the approved construction.

- K. The Developer will cause Best Management Practices, as per the approved Storm Water Pollution Prevention Plan, to be implemented prior to any site clearing, excavation or grading on site.
- L. The Developer causes the utilities to be installed according to all applicable requirements. During construction the Developer shall cause satisfactory tests to be performed on the utilities pursuant to the City's Design Standards and Construction Specifications.
- M. The City Inspector and/or the City Engineer shall visit the construction site on an intermittent basis as the representative of the City to observe the Contractor's work and endeavor to guard the City against deficiencies in the work.
- N. Upon completion of the utility construction, the Developer causes the subbase of street to be graded, compacted, tested for compaction and prepared for placement of the pit-run gravel coarse. The City shall be notified and allowed to inspect the subbase prior to placement of the gravel.
- O. Following placement, grading and compacting the gravel the Developer causes the gravel base coarse to be placed, graded, compacted and tested for compaction. The City shall be notified and allowed to inspect and perform check compaction tests prior to paving.
- P. When curb and gutter is required by the City, the Developer causes the curb and gutter to be installed prior to paving.
- Q. Upon completion of the construction, prior to paving, the City shall be notified and allowed to inspect the utility line.
- R. Upon completion of paving, a final "punch list" is prepared by the City and forwarded to the Developer, his Engineer, and his Contractor.
- S. Upon completion of the final "punch list," verification of satisfactory tests, "As-Constructed" and any revised easements, the City Engineer recommends approval of the street construction to Wellsville City.
- T. Final acceptance of the improvements into the City shall be subject to the Developer guaranteeing the construction for a period of two (2) years following the date of final approval of the street construction by the City. The Developer shall be responsible for all repairs and related expenses during the two (2) year probation period.

2.1.2 Preliminary Design: Four (4) sets of preliminary design plans shall be submitted to the City Engineer. The requirements for the Preliminary Design Plans shall include:

- A. Site Location Map - The development shall be shown on a vicinity map of Wellsville City or Cache County area.
- B. Topographic Map - A topographic map on the area to be served shall be included. This may be shown upon the subdivision or development preliminary plat.

- C. The Preliminary Design Information will include the estimated maximum number of units to be served, number of levels per building, zoning, project acreage, and estimated peak and average flows.
- D. All existing streets shall be labeled.
- E. Preliminary plans submitted to the City should be 24" x 36" in size.
- F. The Preliminary Design should be completed by the Project Engineer before the Final Design is begun.
- G. The City shall use the submitted preliminary information to review the preliminary plan and prepare a recommendation to the City after all required information or plats are submitted to the City Engineer.

2.1.3 Final Design: The Final Design plans shall be completed by the Developer's Engineer in accordance with these City Standards and Specifications. After the Developer's Engineer completes the final design, four (4) sets of final plans shall be submitted to the City. The final design requirements shall include:

- A. The Final Design of the streets shall meet the "guidelines" of the Preliminary Design and shall be in accordance with these Wellsville City Standards and Specifications.
- B. The Final Design shall include those items on the "Approval Checklist" as submitted by the City and the Final Design must be approved by the City prior to construction.
- C. All executed easements shall be reviewed and approved with the Final Design Plans.
- D. A copy of the dedication plat showing utility easements shall be submitted with the Final Design Plans. The City will require a signature block on the original plat and must sign prior to recordation.
- E. Final Design Plans submitted to the City shall be 24" x 36" in size. Plans submitted on sizes other than 24" x 36" will not be accepted.

2.1.4 "As-constructed" Drawings: One (1) set of "As-Constructed" mylar drawings together with two (2) sets of prints shall be submitted to Wellsville City Manager. The requirements for "As-Constructed" drawings shall include:

- A. "As-Constructed" drawings shall be 24" x 36" mylar, plan and profile construction drawings with the horizontal and vertical scale noted.
- B. Service stationing and relation to lot lines shall be indicated.
- C. Changes in grade and alignment shall be indicated.
- D. Type of utility pipes installed and exact location shall be indicated.

- E. The location of "As-Constructed" utilities within easements or platted ROW's shall be verified. If revised easements are required, a signed copy of easements shall be submitted with the "As-Constructed."

2.2
WATER DESIGN CRITERIA

2.2.1 Design Regulations:

- A. All water system improvements or extensions shall comply with the design and operation rules prepared by the State of Utah, Division of Drinking Water, Department of Environmental Quality and the City Standards. If there is a conflict between Standards; the most stringent shall rule.
- B. Preliminary design shall be submitted to Wellsville City and to the City Engineer at least two weeks prior to the next regularly schedules meeting of the Planning and Zoning Commission.
- C. A pipe network analysis shall be required for developments consisting of 200 equivalent residential lots or more that will indicate the water consumption anticipated and the pressures at each intersection of main lines. The network analysis must be provided to the City and must be in EPA Net format.
- D. Construction of the project shall not begin until complete plans and any modifications to these specifications have been approved, in writing, by the City.
- E. No new drinking water facility shall be put into operation until approval to do so has been given in writing by the City.
- F. Plans shall be stamped, signed and dated by a professional engineer, registered in the State of Utah, who has experience in designing public drinking water projects and who will be responsible for the design.

2.2.2 Service Lines: Service lines connected to the public water system shall meet the following criteria:

- A. Service lines shall be installed by a General Utility Contractor licensed and bonded in Utah.
- B. Service lines will be polyethylene Class 200 I.P.S. tubing.
- C. Service lines shall have a nominal inside diameter of not less than (3/4") three-quarters inches nor greater than 2 inches unless approved by the City.
- D. Each dwelling unit shall be served by an individual service line. Multi-family dwelling units may be served otherwise where approved by the City to be master metered.
- E. Service lines shall be located 5-feet from the uphill property line, but should not be located under driveways.
- F. Maintenance of the line from the home to the meter shall be the responsibility of the property owner.
- G. New water mains must be backfilled, flushed and tested prior to installing individual service lines.

2.2.3 Design Period: The water system shall be designed to serve the ultimate service area and shall be based on the best information available, including area master plans, current zoning regulations and approved planned and zoning reports when available.

2.2.4 Design Capacity:

- A. General Requirements: The distribution system shall be designed to insure that a minimum of 20 psi exists at all points within the system during peak instantaneous demand conditions. A minimum of 20 psi shall exist at all points within the system when needed fire flows are imposed upon the peak daily flows of the system. At the time of final approval, the City Council may require a higher pressure that would be consistent with pressure throughout the City.
- B. Indoor Use-Assumed Peak Instantaneous Demand: The peak instantaneous demand to be assumed for indoor use shall be $Q = 10.8 N^{0.64}$, where N equals the total number of equivalent residential connections (ERC) and Q equals the total flow in gallons per minute (gpm) delivered to these connections.
- C. Outdoor Use, Peak Instantaneous Demand: The peak instantaneous demand for outside use shall be determined by multiplying the irrigated acreage by 7.92 (gpm) for each acre irrigated.
- D. Fire Flow: The Design Engineer shall consult with the local fire suppression authority regarding needed fire flows in the area. Generally, fire flows shall be as required by Table B-105.1 of the 2000 International Fire Code. According to this table, minimum fire flow for a one or two family dwelling, not exceeding 3,600 square feet, is 1,000 gpm. Required fire flows for other types of buildings and one or two family dwellings exceeding 3,600 square feet or higher is not less than 1,500 gpm.

2.2.5 Water Main Size: All public water mains shall be 8-inches in diameter or larger provided that the instantaneous peak flows meet the requirement of paragraph 2.2.4. Dead end lines with fire hydrants and larger mains may be larger; as required to meet fire flow demands or to provide adequate service to adjacent areas.

2.2.6 Water Main Depths: Water lines shall be installed to a minimum depth of four feet to the top of the pipe.

2.2.7 Fire Hydrants: Fire hydrants shall be installed in accordance with the regulations of the Fire Department and these standards. Fire hydrants shall also be placed at all dead end lines. Fire hydrants shall be either Mueller Centurion or Clow Medallion. Spacing of fire hydrants must conform to UAC R309-550-5 which states that fire hydrants must be spaced at an average of no more than 500 ft.

2.2.8 Blow-Offs: Blow-offs are not allowed.

2.2.9 Valves: Valves shall be placed in the system so that sections of the pipe no longer than six hundred feet may be isolated and shut off from the rest of the system so repair may be made with a minimal amount of water connections put out of service. When connecting to existing or new lines at tees,

a minimum of three valves shall be installed. Where crosses are used, a minimum of four valves shall be used.

2.3
SEWER DESIGN CRITERIA

2.3.1 **Design Regulations**

- A. All sanitary sewer systems shall be designed to exclude all storm water and water from underdrain systems, roofs, streets, and other paved areas.
- B. Downspout connections, foundation and basement drains, sumps and storm drain connections shall be prohibited from discharging into the sanitary sewer system.
- C. Each dwelling unit shall be served by an individual lateral. "Stacked" dwelling units may be served otherwise with City approval.
- D. Sewer lines including laterals shall be designed for at least 10 feet horizontal separation, measured edge to edge from any water line.
- E. Sewer lines crossing water mains shall be laid to provide a minimum vertical distance of 18 inches between the outside wall of the water main and the outside wall of the sewer line.

2.3.2 **Laterals:** Laterals connected to the public sewers shall meet the following requirements:

- A. Laterals will be of PVC, ductile iron, or other material approved by the City.
- B. Laterals shall have a nominal inside diameter of not less than 4 inches nor greater than 6 inches.
- C. Each dwelling unit shall be served by an individual lateral. "Stacked" dwelling units may be served otherwise with approval of the City.
- D. Laterals shall be laid at a minimum slope of 1/4-inch per foot (2%).
- E. Laterals should not be located under driveways.
- F. Cleanouts shall be installed at 50-foot intervals for 4" laterals, 75-foot intervals for 6" laterals, and at all changes in direction. Cleanouts shall also be placed at the property line with a metal cap.
- G. In all cases where a lateral is under pressure, the section of lateral from the street right-of-way or easement line to the main sewer line shall be gravity. Maintenance for the line from the home to the main line shall be the responsibility of the property owner.
- H. Laterals shall conform to these Wellsville City "Standards and Specifications."

2.3.3 **Design Period:** The sewer system shall be designed to serve the estimated ultimate tributary area and shall be based on the best information available, including area master plans, current zoning regulations and approved planning and zoning reports when available.

2.3.4 Design Capacity: Design average flow shall be estimated at not less than 100 gallons per capita per day, including infiltration at 200 gallons per diameter inch per mile per day. To accommodate peak flows, sewers shall be designed, flowing full, to carry not less than the following contributions:

- A. (1) 4-inch and 6-inch laterals: 400 gallons per capita per day.
- (2) 8-inch thru 15-inch sewers: 400 gallons per capita per day.
- (3) Larger than 15-inch sewers: 250 gallons per capita per day.
- B. Flow from commercial, municipal and industrial connections.
- C. Additional ground water infiltration, if applicable.

2.3.5 Alternate Methods of Design: If use is made of methods of sewer design other than those described above, a complete description of methods used shall be presented to the City Engineer for approval.

2.3.6 Sewer Size: All public sewers shall be 8 inches in diameter or larger.

2.3.7 Sewer Depth: Sewers shall be placed deep enough to serve all basements, assuming a 2% grade on house sewers. They shall be well below frost line at all points and also the top of the sewer line shall be 2 feet lower than the bottom of any water lines placed in the same street. Minimum cover shall be 60 inches from the top of the pipe. Sewers at depths greater than 16 feet shall be given special design considerations.

2.3.8 Sewer Slopes: All sewers shall be designed and constructed for mean flow velocities, when flowing full, of not less than 2.0 feet per second, based on Kutter's formula using an "n" value of 0.013. The following are the minimum slopes which shall be provided; however, slopes greater than these are desirable, especially in the upper reaches of sewer systems.

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100'</u>
8"	0.40
10"	0.28
12"	0.22
14"	0.17
15"	0.15
16"	0.14
18"	0.12
21"	0.10
24"	0.08

Sewers on slopes 20 percent or steeper shall be anchored immediately downstream from bells with concrete anchors or approved equal as follows:

- A. Not over 36 feet center-to-center on grades 20 percent and up to 35 percent.

- B. Not over 24 feet center-to-center on slopes 35 percent to 50 percent.
- C. Not over 16 feet center-to-center on slopes steeper than 50 percent.

2.3.9 Sewer Alignment

- A. Sewers shall be designed on straight alignment between manholes.
- B. Sewer lines shall not be designed to run parallel to and within 5 feet either side of the curb and gutter. Special cases and variances to the standard may be approved upon recommendation by the City Engineer.

2.3.10 Pipe Transitions: At manholes, where sewer diameters change, the flow energy gradient shall be continuous. The 0.8 depth point of the two sewers shall be placed at the same elevation, with proper allowance for any manhole head loss or as required to provide proper flow.

2.3.11 Manholes:

- a. *Location:* Manholes shall be installed at the end of each line, at all changes in pipe size or changes in alignment or grade; and at intervals not to exceed 400 feet for lines 15 inches and smaller and 500 feet for lines exceeding 15-inches diameter.

Manholes shall be provided at street intersections.

Watertight, seal-down covers shall be provided in areas subject to flooding.

Manholes shall not be positioned in waterways, such as gutters.

Manholes shall not be placed within 10 feet of storm drains, catch basins or in low points where catch basins are located.

- b. *Inverts:* Flow channels through manholes shall be shaped to conform to cross-sections and slopes of connecting sewers. Floors and channels shall be shaped such that television camera access will not be impeded.

The minimum drop through manholes shall be 0.2 feet if an alignment change of more than 45 degrees is designed. The drop should be 0.1 feet in all other manholes.

- c. *Drop Connections:* Shall be used whenever the elevation difference between the flowlines of the inflow pipe and the outflow pipe exceed 18 inches. All drop connections shall conform to the Standard Detail Drawing for "Drop Manholes." Only outside drop connections will be permitted.

- d. *Diameters:* Manhole diameters shall be at least 48 inches.

Manholes on sewer lines 15 inches and greater shall be 60 inches in diameter.

Manholes with three or more main lines connecting shall be 60 inches in diameter.

Manholes where the deflection is greater than 45 degrees shall be 60 inches in diameter.

Manholes deeper than 16 feet shall be specially designed and approved by the City Engineer.

- e. *Shallow Manholes:* Shallow manholes shall be required for depths less than 6 feet. See Standard Detail Drawing.

2.3.12 Cleanouts: Cleanouts are not allowed. Manholes shall be used at all dead end sewer lines.

2.3.13 Protection of Water Supplies: It is generally recognized that sewers and appurtenances must be kept remote from public water supply wells and other water supply sources and structures. The following specific requirements shall be observed at all times:

- A. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenances thereto, which could permit the passage of any wastewater or polluted water into the potable supply.
- B. Sewers shall be laid at least 10-feet horizontally from any existing or proposed water main. Separation distances shall be measured pipe edge to pipe edge.
- C. Where the 10-foot separation stated above is not achieved, the water line shall be located above the sewer either in a separate trench, or on a bench of undisturbed earth with at least 18 inches of vertical depth between bottom of the water main and top of the sewer pipe except as specified in paragraph "D" below.
- D. Where sewer and water mains must cross and the vertical separation mentioned above is not possible, both mains should be constructed of mechanical-joint ductile iron pipe, or equivalent for a distance of at least 10 feet on either side of the point of crossing.
- E. The above requirements shall apply to building sewers and water service lines to buildings except that copper tubing service laterals (not plastic) may pass under sewer mains or laterals. This copper tubing must pass at least 18 inches under the sewer.

2.3.14 Easements:

- A. Easements shall be required on all public sewer not located in dedicated roadways.
- B. All easements shall be 20 feet wide minimum.
- C. Easements shall extend 10 feet beyond the last manhole on a line.
- D. When a sewer is located in an easement, not abutting a street right-of-way, access easements shall be provided.
- E. Signed easements shall be submitted to the City along with Final Design Plans. Easements should be recorded on the Final Plat where applicable.

2.3.15 Wastewater Pumping Stations: Use of wastewater pumping stations shall be avoided whenever possible. Pumping stations are subject to approval and review by the City Council and the City Engineer. Wastewater pumping stations shall conform to Utah Division of Water Quality, Department of Environmental Quality Rules and to Wellsville City Requirements.

The Project Engineer shall submit pump curves and calculations along with the design of the lift station for Wellsville City's review.

Pump stations for residential subdivisions shall consist of a single wet well with submersible pumps, see standard drawings. Pump manufacturer must be "Gould" and shall consist of non-clog sewage pumps capable of passing a three-inch solid. Pumps shall be mounted on a 2-inch galvanized rod with lifting chains for removal.

Pump station design will include a control panel with two alarms; flashing red light and audible high water alarm. Pump station must include a pump-around to facilitate temporary pumping equipment in case of pump station failure.

The pump station must be surrounded by a split block wall enclosure with a color chosen by the City. The enclosure must include lock-able, architectural iron gates, wide enough for maintenance vehicles to access the pump station.

A backup generator is required on all pump stations. The generator must be natural gas powered and manufactured by "Generac"; substitutes must be approved by the City. The generator must be housed separately from the pump station and surrounded by a split block wall enclosure matching the pump station. The enclosure must include a lock-able, architectural iron gate, wide enough for a forklift to remove the generator. An eve must be constructed over the door to prevent snow from obstructing the door way.

The pump station design must include telemetry/SCADA consistent with Wellsville City’s existing infrastructure monitoring equipment. Telemetry supplier must be “Remote Control” (no substitute).

Although a duplex system is required, a third stand alone pump must be given to the City to install when one of the duplex pumps need to be removed for maintenance. This will ensure the pump station will be able to meet peak demands at all times.

Access must be provided for maintenance vehicles to service the booster station and must include an access road and a concrete pad in front of the entrance to the building.

2.3.16 Borings

- A. Borings shall be designed and constructed in accordance with the applicable City, County, State, Federal and Railroad Standards, permits, and/or as designated on Approved Plans.
- B. Steel casings for bored construction shall be steel pipe conforming to ASTM A-53 Grade B. Steel pipe shall have a minimum wall thickness of 0.375" minimum yield stress of 42,000 psi. Minimum wall thickness shall be in accordance with the following:

Diameter of Casing (Inches)	Nominal Wall Thickness (Inches)	
	<u>Under Railroads</u>	<u>All Other Uses</u>
12" - 18"	0.375	0.375
Over 18" - 22"	0.375	0.375
Over 22" - 28"	0.438	0.375
Over 28" - 34"	0.500	0.375
Over 34" - 42"	0.562	0.500
Over 42" - 48"	0.625	0.562

- C. Casings under interstates shall extend from right-of-way to right-of-way. When installed with more than 15 feet of cover, the casing shall be designed to carry the extra load.
- D. Casing material, size, length and invert elevations shall be shown on Final Design plans.
- E. Sewer pipe material shall be shown on Final Design plans.
- F. Use redwood skids or approved prefabricated plastic casing skids throughout the length of the pipe tied at every pipe diameter length to brace pipe installed in casing

to prevent shifting or flotation during backfilling of annular ring between the casing and carrier pipe.

- G. The annular space between the casing and sewer pipe may require filling with sand, "pea" gravel, or Portland Cement grout.
- H. The ends of the casing shall be sealed and watertight as specified on Final Design plans.
- I. Install pipe barrels to rest upon support blocks with the pipe bells clearing the casing invert by at least 1/2".
- J. The bored portion of the sewer should be completed before construction of the adjacent portions to allow for discrepancies in alignment and grade which may occur during the boring operation.

2.3.17 Prevention of Groundwater Migration: The design engineer shall consider methods to prevent the continuous migration of groundwater along the trench line.

Chapter 2.4 STORM WATER HYDROLOGY

Sections:

- 2.4.005 Definitions.
- 2.4.010 Rainfall Hydrology.
- 2.4.015 Conveyance.
- 2.4.020 Basins.
- 2.4.025 Discharge.
- 2.4.030 Permits / Practices.

This chapter represents the construction standards for private and public construction as it relates to storm drainage within the City. All efforts have been made for this chapter to conform with the requirements of the Clean Water Act phase II and the Storm Water Management Plan of the City.

The following information is organized in such a way to follow the natural flow of storm water, from the initial rainfall hydrology (section 2.4.010), to conveying the rain water (section 2.4.015) to a basin (section 2.4.020), then discharging to a natural outlet location (section 2.4.025). Definitions (section 2.4.005) and Permits and Practices (section 2.4.030) are also discussed.

2.4.5 Definitions:

Detention Basin. A depression designed to detain or slow down storm water runoff until downstream storm sewer resources are less heavily taxed. A detention basin contains an inlet and an outlet, allows debris to settle out, and regulates water flow.

Development. Any man-made change to improved or unimproved real estate, including but not limited to site preparation, filling, grading, paving, excavation, and construction of buildings or other structures.

Disturb. To alter the physical condition, natural terrain or vegetation of land by clearing, grubbing, grading, excavating, filling, building or other construction activity.

Drain Inlet. A point of entry into a sump, detention basin, or storm drain system.

Drinking Water Source Protection Zone. Zones determined by Geo-Hydrology designed to protect groundwater aquifers of a well in a Culinary Water System.

Percolation. The ability of a soil to absorb water. Typically measured by a Standard Percolation Test in units of minute per inch.

Retention Basin. A depression or cavity designed to retain or hold back all storm water runoff from flowing downstream. A retention basin contains an inlet with no outlet other than percolation or evaporation. A retention basin allows debris to settle out.

Storm Drain System. The system of conveyances (including sidewalks, roads with drainage systems, streets, catch basins, detention basins, curbs, gutters, ditches, man-made channels, sumps, storm drains, and ground water) owned and operated publically or privately, which is designed and used for collecting or conveying storm water.

2.4.10 Rainfall Hydrology: All storm drain systems shall be designed to carry the one hundred (100) year storm.

1. **Storm Specification:** Local storm drain piping shall be designed for the ten (10) year storm where the road or other above ground conveyance will carry the difference to the one hundred (100) year storm. Local Storm Detention Basins shall be designed for the one hundred (100) year storm. Regional Storm Detention Basins shall also be designed for the one hundred (100) year storm. The intensity used for the sizing of basins shall be based upon the worst case scenario and not the time of concentration.
2. **Intensity-Duration-Frequency (IDF):** For the use of the Rational Method, an IDF curve shall be obtained from the City Engineer for the project location.

For single site plans and small subdivisions (forty (40) acres max.) the rational equation may be used. For larger sites a City Engineer-approved computer model shall be used.

3. **Rainfall Pattern:** For the use of computer models one of the following rainfall patterns shall be used.
 - a. Farmer-Fletcher Storm - This pattern is based upon the Farmer-Fletcher Distribution. This pattern is for a one (1) inch storm and must be modified for storms of other magnitudes. The rainfall is expressed in inches of rainfall for the given time unit. The Farmer Fletcher distribution can be adjusted for storms from thirty (30) minutes to two (2) hours based on the time unit chosen. The storm duration must be chosen on a worst case scenario.

time	inches	time	inches	time	inches	time	inches	time	inches	time	inches
1	0.000	11	0.004	21	0.033	31	0.052	41	0.012	51	0.005
2	0.000	12	0.005	22	0.034	32	0.045	42	0.011	52	0.005
3	0.002	13	0.008	23	0.035	33	0.040	43	0.010	53	0.004
4	0.002	14	0.009	24	0.038	34	0.035	44	0.009	54	0.004
5	0.002	15	0.009	25	0.039	35	0.030	45	0.009	55	0.004
6	0.002	16	0.013	26	0.045	36	0.022	46	0.008	56	0.003
7	0.002	17	0.017	27	0.052	37	0.020	47	0.006	57	0.003
8	0.002	18	0.020	28	0.054	38	0.018	48	0.006	58	0.002
9	0.003	19	0.024	29	0.054	39	0.016	49	0.005	59	0.002
10	0.003	20	0.029	30	0.054	40	0.014	50	0.005	60	0.001

- b. SCS - Type II storm

4. **Rainfall Total:** For the use of the above rainfall pattern, a rainfall total from the NOAA Atlas for the site must be obtained. This total shall be based upon the storm

duration that produces the highest flow or basin size. Currently the 10 year - 60 minute storm is 0.81 inches of rainfall, and the 100 year - 60 minute storm is 1.57 inches of rainfall.

5. ***Time of Concentration Calculation:*** The time of concentration must be calculated using one or a combination of the following: (1) TR-55 equations for overland flow, (2) FHWA equations for overland flow, (3) Manning's equation for open channel flow, or (4) Hazen-Williams equation for open channel flow.

The sheet flow distance may not exceed one hundred (100) feet. After one hundred (100) feet, sheet flow is to be considered shallow concentrated flow or open channel flow depending on the topography.

6. ***Directly Connected Impervious Area:*** The storm water modeling method used must account for areas directly connected to the storm drainage system independently from landscaped grounds.

2.4.15 Conveyance: The City requires that storm waters not be carried in irrigation ditches, nor that irrigation water be conveyed in storm drain systems.

Local pipes shall be sized for the ten (10) year storm where above ground facilities can control the difference to the one hundred (100) year storm.

1. ***Piping:*** Storm drain lines shall be concrete pipe (NRCP or RCP) or corrugated high density polyethylene pipe, of appropriate class. Subsurface drains shall be PVC or reinforced concrete pipe or PVC pipe. Minimum size for storm sewer mains shall be fifteen (15) inch diameter, eight (8) inch for land drain mains and 4-inch for land drain laterals. Pipe specifications are included in the Public Works Standards. Where determined by the City Engineer, larger drain lines shall be installed to accommodate future development. The cost to provide adequate storm drainage to a development shall be paid for by the Developer
2. ***Access:*** Drain lines shall have clean-out boxes, inlets or manholes installed at all changes in grade or alignment, with a maximum distance of four hundred (400) feet between accesses. Structures shall be installed in accordance with the standard drawings.

Requirement: As Groundwater is involved with the Waters of the State, they are not the responsibility of the City's. The City may or may not choose to address them.

3. ***Ground Water:*** Where adverse groundwater conditions exist, the City may choose to allow the installation of a subsurface land drain. Laterals may be installed to each lot for clear groundwater only (no surface water permitted). Subsurface lines shall be installed with a slope adequate for proper drainage. Some type of backflow

control may be required at the confluence of the land drain pipe and storm drain system as determined by the City Engineer.

2.4.20 Basins:

Requirement: The City requires storm drainage basins for all developments (site plans or subdivisions). Exception may be allowed where there is sufficient downstream storm drain capacity or where additional local storm drainage control is not needed as determined by the City Engineer.

1. **Locations:** Sites less than one (1) acre are generally not required to have detention unless otherwise determined by the City Engineer for reasons stated herein. Storm water detention design is critical for developments that are in close proximity to a Stream or River or within Drinking Water Source Protection Zones one or two as defined by the State Division of Drinking Water Rules. All detention basin designs and calculations shall be reviewed and approved by the City Engineer.
2. **Ownership:**
 - a. Private Basins: Where the development will have a Home Owners Association or in commercial applications, local detention basins shall be owned and maintained by the owner, or owning association.
 - b. Local Public: In subdivisions, local detention basins shall be constructed by the developer. Following acceptance of the construction, the ownership, operation and maintenance may either be conveyed to and maintained by the City, or may be owned and maintained by a third party such as an individual land owner or an H.O.A. Decisions regarding the ownership and maintenance of basins will be made by the City during the approval process.
 - c. Regional Detention Basins: Regional basins shall be owned and maintained by the City and constructed according to the criteria given herein and approved of the City Engineer. Actual ownership and responsibility shall be specifically defined in the Owners Dedication Certificates or Development Agreements or by Deed.
3. **Percolation:** No reduction due to percolation for detention basins volumes shall be permitted in design, due to the nature of basins silting in over time and also possible frost conditions during a storm.
4. **Basin Construction:** Basins must be construction to enhance safety, health and aesthetics of the area.
 - a. **Engineering:** Basins, whether detention or retention, must be designed and stamped by a Licensed Civil Engineer.
 - b. **Location:** Detention basins shall be located with convenient access for maintenance and repair by maintenance personnel. This means that the basin

property has frontage along a public roadway and easements where necessary. Volume in ditches or roadside swales shall not be considered in the volume calculation.

- c. *Depth:* If unfenced and open to general public, the maximum depth of water should not exceed three (3) feet for detention basins and two and a half (2.5) feet for retention basins. Basins greater than three (3) feet in depth may be allowed, but only by special permission from the Land Use Authority.
- d. *Side slopes:* Side slopes should not exceed 3:1 (horizontal to vertical) (4.5:1 is desirable) for ease of mowing and access.
- e. *Bottom Slope:* The basin floor shall be designed so as to prevent the permanent ponding of water. The slope of the floor of the basin shall not be less than one (1) percent to provide drainage of water to the outlet grate and prevent prolonged wet, soggy or unstable soil conditions.
- f. *Freeboard:* There should be at least one foot of freeboard (berm above the high water mark).
- g. *Spillways:* Spillways must be considered and a path with a maintained swale and drainage easement to a safe location. Attention should be given to the design of the spillway to avoid erosion. Overflow spillways are intended to introduce flows back into the main pipe and are typically downstream of the outlet control. Emergency Spillways are intended to carry flows beyond the capacity of the overflow spillway to a safe downstream location. All spillways shall be designed to protect adjacent embankments, nearby structures and surrounding properties.
- h. *Outlet Control:* Small, local, private detention basins may be allowed to have calculated fixed orifice plates mounted on the outlet of the basin. Large, regional, public detention basins shall have movable screw-type head gates (Waterman C-10 O.A.E.) set at a calculated opening height for the discharge and with a chain to fix the position.
- i. *Grates:* All grates on inlets and outlets must be hot dipped galvanized (not painted) with bars at spacing to prohibit feet from falling in and yet avoid clogging with debris. Generally bar spacing should never exceed 3" spacing.
- j. *Low Flow Piping:* The inlet and outlet structures may be located in different areas of the basin, requiring a buried pipe to convey any base flows that enter and exit the basin. (Rather than a cross gutter or surface flow.) The minimum pipe size and material for the low flow shall be as approved by the City Engineer.
- k. *Ground Covers:* The surface area of the basin may either be seeded, sodded, or covered with cobbles, as specified by the City. If seeded, measures shall be taken to eliminate erosion until grasses are established. A minimum of four (4) inches of top soil must be installed prior to sod or seed placement. Cobble sizes shall be eight (8) inches or greater in size overlying a city-approved weed barrier. A sprinkler irrigation system is required for all grassed basins.

- l. *Embankment (Fill) Construction:* If a raised embankment is constructed for a basin (constructed with granular materials), it shall be provided with a minimum of six (6) inches of clay cover on the inside of the berm to prevent water passage through the soil.
 - m. *Excavation (Cut) Construction:* If the basin is constructed primarily by excavation, then it may be necessary to provide an impermeable liner and land drain system when constructed in the proximity of basements or other below grade structures as determined by a Geotechnical evaluation.
 - n. *Multi-Use Basins:* Basins may be designed as multi-use facilities when appropriate precautions are incorporated into the design. If Parks & Recreation amenities are to be constructed within the water detention area of a basin they shall be designed appropriately. Structures shall be designed for saturated soil conditions and bearing capacities are to be reduced accordingly. Restrooms shall not be located in areas of inundation. Inlet and outlet structures should be located as far as possible from all facilities. No wood chips or floatable objects may be used in the area that will be inundated.
 - o. *Fencing:* Fencing may be required for any basin over three (3) feet in depth. If a fence is required, six foot chain link fencing is desired and in accordance with these Public Works Standards and conform to City Zoning Requirements.
5. ***Detention Volume:*** Detention basins shall be sized based upon the criteria set forth in Section 2.4.20. Detention Basins are designed to allow a pre-determined amount of flow to discharge during and after a storm event as discussed above. Detention Basins are preferred over Retention Basins or Groundwater Injection.
6. ***Retention Basins:*** The City does not permit Retention basins for developments unless certain criteria is met. Regional Retention basins shall not be permitted by the City.
- a. ***Retention Basin Criteria:*** Retention Basins (basins which hold all water coming to them) shall not be permitted for developments unless the following conditions are all met:
 - 1. The Basin is greater than five-hundred (500) feet or fifty (50) feet times the number of lots in the entire development (whichever is greater) from the City storm drain system or water way, and is topographically capable of draining to the City System;
 - 2. The Basin is not located within a Hazardous Area (such as a steep slope) or some other fragile area (such as a Drinking Water Source Protection Zone); and
 - 3. The Basin is temporary in nature, meaning that a master planned storm drain pipe is eminent and a funding vehicle, (Special

Improvement District (SID), Impact Fees, or Pioneering Agreement) is in place.

- b. *Retention Basin Design Volume:* If permitted, local storm retention basins shall be designed for 1.84 inches of total rainfall (the one hundred (100) year-three (3) hour storm as determined by the NOAA Atlas 14). The infiltration vs runoff quantity shall be determined using a weighted C-value as determined using the rational method.
 - c. *Percolation Rate for Retention Basins:* Due to the silting in potential, no percolation rate may be used in the calculation of volume.
 - d. Retention basins shall not be permitted within a zone 1,2, or 3 of any Drinking Water Source Protection Zone of any drinking water source.
7. ***Standing Water:*** Standing water is to be eliminated wherever possible as an effort to minimize a mosquito problem and associated viruses. Low flow bypass pipes may be required.
8. ***Ground Surface Improvements:*** The finished surface of the basin shall be improved to eliminate erosion and dust and to enhance the aesthetics of the area. The Planning Commission will determine the finishing requirements on a case by case basis for new detention/retention ponds.
- a. *Grass, Sod, Top Soil and Hydro seeding:* All grass or hydro-seeding on all basins shall be installed in accordance with the Public Works Standards. The basin shall be provided with an automated sprinkler irrigation system previously approved by the City Engineer. Drought tolerant grass may be used in lieu of Public Works Standard upon approval by the City.

2.4.25 Discharge: Storm water is to be controlled at the source and minimize the potential for flooding downstream. Storm Drainage leaving a site or subdivision shall not exceed, as much as practicable, the pre-developed quantities and qualities at a maximum rate.

1. ***Allowable Discharge:*** The allowable discharge from any non-regional basin shall not exceed the pre-hard surfacing discharge for the entire site for the ten (10) year storm event. This discharge shall not exceed 0.1 cubic feet per second per total acreage within the development draining to the basin. Controlled discharge may be established through an orifice or adjustable gate as approved by the City Engineer.
2. ***Flow Concentration:*** By nature of development, flows are concentrated to one or more locations where historically, sheet flow in lower concentrations may have left the site. Attempts shall be made to minimize the runoff concentrated quantity to the flows stated above by use of detention basins, down stream piping to safe areas or other methods as deemed necessary by the City Engineer.

3. ***Discharge to Irrigation Ditches:*** No discharge shall be permitted to irrigation ditches and canals unless express written permission is obtained from the responsible ditch company or ditch owners.
4. ***Sump Drains (Underground Injection Wells):*** Sump drains are strongly discouraged. Any sump drain used must specifically approved by the City Engineer. Sump Drains shall not be permitted within a zone 1,2, or 3 of any Drinking Water Source Protection Zone. Sumps within a zone 4 must be specially designed to eliminate contaminates and silt to the groundwater including oil separators.
5. ***Basin Overflows:*** Attention shall be given to overflow locations and pathways to safe locations downstream as discussed above. In all new construction, easements shall be obtained and pipes or swales sized to handle the one hundred (100) year flow.

2.4.30 Permits / Practices: Designs shall comply with all State and Federal requirements, this is to include applications, permits, plans and implementation.

1. ***Permits:*** The State requires a Storm Water Activity Permit for all sites greater than 1.0 Acres.
 - a. Utah Pollution Discharge Elimination System (UPDES) Permit. This permit is filed with the Utah Division of Water Quality, Department of Environmental Quality. The permit can be obtained from the internet at: <http://waterquality.utah.gov/updes/stormwater.htm>

Then click on "Online Application Process Notice of Intent". All sites with a total plan to effect greater than 1.0 acre must apply (this area includes staging and stock piling). The appropriate fee must be paid to the state.

A Storm Water Pollution Prevention Plan (SWP3, or Erosion Control Plan or Pollution Prevention Plan) must be prepared and on site for this application. As a minimum, The BMPs discussed herein must be addressed.
 - b. Stream Alteration Permit. A Stream Alteration Permit is filed with the State Department of Natural Resources, Division of Water Rights. This permit overlaps the 404 wetlands permit, discussed below, because it is applicable to the area equal to the stream plus two times the bank full width (up to 30 feet). Any modifications to the stream or banks within this area must comply with the Stream Alteration Permit. Permit information may be obtained online at: <http://nrwrt1.nr.state.ut.us/strmalt/default.asp>

- c. EPA 404 Wetlands Permit this permit is filed with the US Army Corp of Engineers through the Utah Division of Water Rights using the Joint Permit Application Form referenced in Section 6.1.3. It is applicable for all wetlands within a development. This will apply to all wetlands depending upon the presence of water, soils type and vegetation as determined in a Wetlands Delineation Report.

All "waters of the US" are effected to the normal high water mark. No fee is typically required for this permit. A letter of non-regulated wetlands may also be applicable. Any mitigation that may be required must be done prior to recording a Final Plat. Permit information may be obtained at: <http://nrwt1.nr.state.ut.us/strmalt/default.asp>.

2.4.35 Storm Drainage - Retention. Commercial Site Detention / Retention: All commercial, institutional, or industrial development, construction, reconstruction, alteration, or expansion which generates any storm drainage, or any multiple-family housing development containing four (4) or more units shall be required to retain or detain all storm water drainage on its own property., or if able to connect to a public storm drain system providing engineering analysis and approval by the city engineer.

Road Construction And
General Improvements

DIVISION 3

3.1 OVERVIEW

- 3.1.1 Scope:** This section defines the general requirements for all street improvements to be built and installed within the City limits of Wellsville City, Utah and/or improvements which may become the responsibility of the City. In addition to these requirements, all other applicable codes and ordinances remain in effect. These requirements are intended to allow the public officials of Wellsville City to protect the health, safety, and welfare of residents and visitors.
- 3.1.2 Construction Drawings:** Four (4) complete sets of detailed construction plans and drawings of improvements shall be submitted to the City prior to commencing construction. The plan sets shall be required to contain a topographic site survey or orthotopographic mapping certified as to its level of precision by a registered Land Surveyor registered in Utah. No construction shall be started until plans have been approved by the City. One set of plans with the approval mark of the City Engineer shall be kept available at the construction site.
- 3.1.3 Standards for Final Construction Drawings:** The following standards are for the purpose of standardizing the preparation of drawings to obtain uniformity in appearance, clarity, size and style. This level of detail is not necessary at any preliminary approval stage such as Planning Commission approval unless required by City Manager.
- 3.1.4 Revisions:** All revisions to plans shall be noted on the plans. All major revisions shall be corrected on the plans and submitted to the City for approval prior to construction.
- 3.1.5 Required Information:** The plans and design shall meet the standards defined in the Wellsville City Design Standards, Construction Specifications, and Standard Drawings, and other plans and ordinances of Wellsville City. The minimum information required on drawings for improvements is as follows:

All drawings and/or prints shall be clear and legible and conform to good engineering and drafting room practice. Size of drawings shall be 24" x 36" (trim line) with ½" border on top, bottom and right side with left side 1-1/2".

The following items are required on drawings:

- A. North arrow (plan). (North shall be at the top or left side of the drawing).
- B. Vicinity map.
- C. Scale and elevations referenced to City Datum.
- D. Stationing and elevations for profiles.
- E. Title block, located in lower right corner of sheet, to include:
 - 1. Name of City.
 - 2. Project title (subdivision, etc.).
 - 3. Specific type and location of work.
 - 4. Space for approval signature of City Engineer with date.
 - 5. Name of engineer or firm preparing drawings with license number.

- 6. Number all sheets.
- F. Scale should generally be 1" = 20' or 30' horizontal; 1" = 2' or 3' vertical.
- G. Both plan view and profiles must be shown for each side of the street and centerline. Profiles shall extend 300 feet beyond end of work. Maximum finished road slope shall be 10 percent. Minimum is 0.5 percent. Maximum cul-de-sac length shall be 400 feet and 100-foot minimum diameter of asphalt.
- H. When curb and gutter is required the stationing and top of curb elevations with curve data must be shown for all curb returns.
- I. Flow direction and type of cross drainage structures at intersections and adequate flow line elevations.
- J. Benchmark location and elevation.
- K. Type of curb and gutter and distance back of curb to back of curb.
- L. Gradient of roadways. Cross-slope transitions must be shown in detail.
- M. Storm drain pipe size, type, class and gradient.
- N. Calculated amount of storm water flow at each drainage collection structure and in each curb at all intersections shall be shown on an included drainage plan for any project involving more than six (6) residential units and for any commercial or industrial project.
- N. Size and location of water mains, valves, meters and hydrants.
- P. Type of water pipe. Water mains shall be metered unless they are in streets, roads, or road shoulders.
- Q. Minimum cover four (4) feet over water lines.
- R. Each set of plans shall be accompanied by separate sheets of details for all pavement sections and structures which are to be constructed. A note disclosing the completion date of October 15 for all street patching and construction is desirable.
- S. Each set of construction drawings showing a disturbed area greater than one acre must include a Storm Water Pollution Prevention Plan. Plans must show which construction phase Best Management Practices (Bmp's) must be implemented by the Developer. Plans must also include project specific notes and details for guidance in implementing the BMP's
- T. For subdivisions and private streets serving more than six (6) residential units, a computer disk shall be submitted to the City for the City's use in updating their master mapping.

3.1.6 Additional Information: The following is a list of information which may be required for the Fire District's approval:

- A. Legal description of property.

- B. Location: Plot plan, existing adjacent structures.
- C. Occupancy type/load.
- D. Type of construction.
- E. Access roads: grades, widths, parking, turnarounds, cul-de-sac.
- F. Height of building: from fire fighting grade.
- G. Alarm systems: smoke, fire, sprinkler.
- H. Water supply system: source, storage facilities, distribution system, hydrant locations on uphill side of street, if possible.
- I. Fire sprinkler plan.
- J. Floor plans showing: exit signs, panic hardware, location of fire extinguishers, location of hose cabinets, any other fire protection devices.
- K. Information that may be required as determined by the Fire Chief or District Fire Marshall.

3.1.7 **Inspection:** All construction work involving the installation of improvements shall be subject to inspection by the City. Certain types of construction may require continuous inspection while others may have only periodic inspections. All inspection and testing costs are paid by developer or contractor unless Wellsville City contractually assumes this financial burden. No inspections can be made on Saturdays, Sundays or City and federal holidays.

- A. Continuous inspection is required on the following types of work:
 - 1. Laying of street surfacing.
 - 2. Pouring of concrete for curb and gutter, sidewalks and other structures.
 - 3. Laying of sewer pipe, drainage pipe, water pipe, valves, hydrants and testing.
- B. Periodic inspection is required on the following:
 - 1. Street grading and gravel base.
 - 2. Excavations for curb and gutter and sidewalks.
 - 3. Excavations for structures.
 - 4. Trenches for laying pipe.
 - 5. Forms for curb and gutters, sidewalks, and structures.
 - 6. Staking of limits of disturbance.
 - 7. Landscaping and landscape sprinkler information.
- C. Requests for Inspection: Requests for inspection of work requiring continuous inspection shall be made to the City three (3) working days prior to commencement of the work. Periodic inspection will require one (1) day notice.

- 3.1.8 Construction-Completion Inspection:** An inspection shall be made by the City Engineer upon 72 hours notice by developer after all construction work is completed. Any faulty or defective work shall be corrected within a period of thirty (30) days of the date of the City Engineer's Inspection Report defining the faulty or defective work.
- 3.1.9 Two-Year Correction Period:** If within two years after completion any work is found to be defective, the contractor or developer shall promptly, without cost to the City, either correct such defective work or remove it from the site and replace it with non-defective work. If the contractor and developer do not promptly comply, or in an emergency where delay would cause serious risk of loss, injury or damage, the City may have the defective work corrected or the rejected work removed and replaced, and all direct and indirect costs of such removal and replacement, together with (25) twenty-five percent in addition thereto, as and for such failure on the part of the subdivider to make the repairs, shall be collected by the City in the manner most convenient to the City from the developer and contractor. Whatever sharing of cost may be agreed upon between the developer and contractor is strictly a private matter between the developer and the contractor.
- 3.1.10 Required Improvements:** The following improvements are generally required unless waived by the City on the basis of site conditions which make these improvements unnecessary. The design of the improvements will vary depending on site conditions, and on the implementation of the Streets Master Plan, Parks and Trails Master Plan, and other similar planning documents adopted by the City that may cover the site or adjoining public properties. Unless otherwise stipulated all improvements shall be designed and built to generally-accepted engineering standards.
- A. Curb and gutter, culverts, inlet boxes, and other drainage improvements reasonably necessary to provide proper drainage in accordance with good engineering practice and the City's Master Storm Drainage Plan.
 - B. Detention storage of runoff to improve water quality and to delay and reduce peak runoff to a flow rate not exceeding the runoff rate which would have existed prior to any disturbance of the land surface.
 - C. Pavement designed on a site-specific basis by a registered professional civil engineer. Unless otherwise approved by the City Engineer, design traffic loading shall provide for 100 heavy trucks per day both ways (HTPDBW) for residential streets, 300 HTPDBW for collector roads, and 500 HTPDBW for arterial roads, as shown on the City's Master Streets Plan.
 - D. Brass cap intersection monuments for permanent survey control.
 - E. Traffic lights, street signs, and traffic signs and markers. Operation and maintenance of street lights is a City responsibility only when the light is at the intersection of two City streets. Street name signs shall be in accordance with the attached Standard Drawings. Traffic signs and traffic markers (including but not limited to stop signs and pavement striping) shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices.
 - F. Fire hydrants are required at 500-foot intervals measured along public ways or walks or drives which are to be snow plowed. All water mains serving a hydrant shall be a minimum of eight-inch diameter. Each hydrant shall have an auxiliary gate valve located flanged to the tee on the water main.

- G. A metallic tracer wire must be installed with all non-metallic pipes. Brightly-colored utility warning tape must be placed over all underground utility lines.
- H. Both public and private streets shall be built in accordance with cross-sections shown in these Standards, including pavement, gutter and sidewalks. Projects which would create an unreasonable traffic impact, either for construction or for permanent access, whether by vehicles, bicycles, or pedestrians on any City street shall be required to structurally improve those streets in a manner to be determined by the City such that the street is structurally capable of carrying both the temporary and permanent increases in traffic when analyzed by generally-accepted engineering methods.
- I. A study of geological hazards by a geologist or soils engineer may be required to be submitted for all sites unless City Staff specifically omits the requirement. Cuts and fills on each site shall be balanced to minimize hauling.

A percolation test by a qualified soils engineer is required for all onsite retention ponds or underground retention systems.
- J. Right-of-way for public streets may be required to be dedicated to the City for sites adjacent to streets identified by the City as being in need of additional right-of-way.
- K. Regulatory traffic signage may be required if a project creates any traffic impact.
- L. Sidewalks and/or pedestrian trails, with wheelchair ramps at curbs or other obstacles in accordance with the City's requirements and as required to serve the proposed project.
- M. All utilities and meter locations must be shown, including water and sewer laterals, power and phone cables, gas lines, and cable TV. When a proposed project will alter, extend, or abandon sanitary sewer mains, all sewer construction shall be done according to Wellsville City Standards.
- N. All connections to the City water system shall be metered unless otherwise approved by the City Manager. All connections 4 inches in diameter or larger shall also be provided with a valve at the tee or property line and in other locations subject to the approval of the City. All connections, piping, and appurtenances on the consumer's side of the water meter are to be maintained privately, not by Wellsville City.
- O. Any staging area must be identified if requested by the City. Site survey information including detailed horizontal and vertical information relating to existing and future items may be required by the City.
- P. A letter from each appropriate utility company approving all utilities, including but not limited to power and phone cables, gas lines and cable TV can be required by the City prior to Wellsville City approval. All utilities shall be placed underground unless otherwise approved by City.
- Q. Methods of temporary and permanent erosion control on construction sites and along all drainage channels, swales, or streams below construction sites. Methodology is subject to approval by an independent landscape architect and shall be in accordance with generally-

accepted standards of landscape architecture. Limits of disturbance shall be shown on the plans. A landscaping and revegetation plan including irrigation sprinklers may be required.

- R. Wherever possible open channels shall be preserved for all major drainages. Culverting of these channels is not allowed unless approved by the City. Landscaping and revegetating to stabilize soils may be required.
- S. Water system improvements necessary to keep Wellsville City's water storage and distribution system fully in accordance with recommendations from the Insurance Services Office and Utah State Board of Health regulations. Improvements required include but are not limited to: reservoirs and appurtenances, including excess capacity as needed to provide efficient long-term system operation, pressure-reducing stations, pump stations, valves, air release valve vaults, meter vaults, water distribution lines, telemetering, and computer modeling by Wellsville City or the consulting engineer of the City's choice as necessary to determine the impacts of a proposed development on the City water system. The City may require manhole-size valve vaults. A completely-detailed design of each pump house will be required; scope of review includes but is not limited to exterior design and safety issues such as kill switches, ground faulting, and panel locations (2 feet off floor, minimum). Pumps and motors shall have a minimum of 75% wire-to water efficiency unless otherwise approved by City. To simplify parts inventories, water systems equipment manufacturers may be specified by the City.
- T. As-built drawings or record drawings showing the as-built location of all public improvements tied to as-built surface improvements.
- U. Sewer improvements as required by Wellsville City, including excess capacity as agreed upon between the City and the developer. Backfill over sewer lines in City streets or on City property shall be in accordance with these specifications.

3.2
GENERAL REQUIREMENTS

- 3.2.1** **General:** All pavement and street construction within Wellsville City, including pavement patches, on City right-of-ways, or City owned property, and for private projects as determined by City ordinances, shall be constructed in accordance with the requirements of these Specifications. Because of the severity and sudden onset of winter in Wellsville City, all asphalt placement and all street patching and construction shall be completed by 5:00 p.m. on October 15, unless approved otherwise by the City.
- 3.2.2** **Approved Plans:** Pavement and street construction shall be performed in accordance with the Contract Documents for the work, prepared under the direction of a Professional Engineer licensed in Utah and approved by the City. Construction shall conform to the Approved Plans, these Specifications, and the Standard Drawings included in these Specifications.
- 3.2.3** **Licenses and Permits Required:** All paving and street construction, including required cuts and fill on City rights-of-way shall be performed by a Contractor licensed and bonded in Utah. A permit shall be secured by the Contractor from the City at least 48 hours before initiating construction. Wellsville City's inspector shall be notified by the Contractor at least 24 hours before the planned construction is to commence and also before starting whenever construction is delayed for any reason. The Chief of Police must be notified 48 hours in advance of intended closure of any public way.
- 3.2.4** **Inspection:** All work shall be inspected by a City authorized Inspector who shall have the authority to halt construction. Whenever any portion of these Specifications and Contract Documents are violated, the City Manager, by written notice, may order that portion of construction which is in violation of these Specifications and Contract Documents to cease until such violation is corrected. A copy of the notice shall be filed with the Contractor's license application for future review. If deficiencies are not corrected, performance shall be required of the Contractor's Surety.

3.3 CLEARING AND GRUBBING

3.3.1 **Description:** This item shall consist of clearing and grubbing the areas shown on the Approved Plans, or as described in the Special Conditions, of all trees, brush, and other vegetation, down timber, rotten wood, rubbish, and other objectionable material. It shall include, but not be limited to, removing buildings, fences, lumber, trash piles, concrete, asphalt, and other obstructions interfering with the proposed work, and salvaging such of these materials as may be designated in the Special Conditions or otherwise disposing of the debris as directed by the Engineer. All work under this item shall be done in accordance with these Specifications and in conformity with the Approved Plans.

3.3.2 **Construction Details:** The limits of clearing, as well as grubbing operations on sewer and water main projects are dependent to a considerable degree upon the Contractor's operations and it shall be his responsibility to determine these limits, providing he does not go beyond right-of-way or easement lines. The clearing and grubbing shall be to such width as will provide for an excavation storage area alongside the excavation for material excavated such as trench excavation and backfill, an area for pipe and material storage, and for any haul roads which may be necessary. In areas where driveable streets exist and where the project calls for grading and/or paving, the limits of clearing will be outlined in the Approved Plans or in the Special Conditions. When an area is to be cleared prior to landscaping, the limits of the clearing will be outlined on the Approved Plans and will be staked by the Project Engineer.

Within the limits described, all vegetable growth such as trees, shrubs, brush, logs, upturned stumps, roots of down trees, and other similar items shall be removed and disposed of, unless otherwise directed in the Approved Plans. All trees to be felled shall be felled within the area to be cleared. All tree trimming directed by the Project Engineer shall be done by competent personnel and in accordance with good tree surgery practices. All stumps, roots, etc., shall be excavated, or removed to a depth of not less than three feet below the subgrade or embankment slopes. Under no condition shall said trees, stumps, roots, etc., be left above the ground surface. Where excessive excavation is required for removals, the subgrade shall be compacted to at least 90% of the maximum density determined by ASTM D-1557 (Modified Proctor).

No debris of any kind shall be deposited in any stream or body of water, or in any street or alley, or upon any private property without written consent of the City.

The refuse resulting from the clearing and grubbing operation shall be hauled to a waste site secured by the Contractor and shall be disposed of in such a manner as to meet all requirements of State, county and municipal regulations regarding health, safety, and public welfare.

In all cases, the authority to burn shall not relieve the Contractor in any way from damages which may result from his operations. In no case shall any material be left on the project, shoved onto abutting private properties, or be buried in embankments or sewer trenches on the project.

Clearing and grubbing operations shall be carried out well in advance of the construction operations so as to permit a well planned schedule of work.

The Contractor shall be responsible for all damages to trees and shrubbery not designated for removal and existing improvements resulting from his operations. If the Contractor damages or

destroys a tree or shrub not designated for removal, he shall replace it in species and grade with a healthy tree acceptable to the City and guarantee it to live for a period one year. Any damage to trees and shrubs which do not require removal shall be performed by a qualified tree surgeon. Repair work shall be done to maintain the natural shape of the plant.

3.3.3 Cuts and Fills of Embankments: Following the clearing and grubbing operation, the construction of cut slopes will be performed to neat and clean lines in accordance with the cut stakes, showing depth of cut and slope planes as staked. Shoulders of slopes shall be cleared and formed at the highest point and the slopes brought down to the finished subgrade elevations as staked. Loose soil and rocks will be removed from cut slopes during this excavation. Over-excavation of cut slopes shall be replaced with suitable mechanically compacted materials in accordance with the requirements of the City.

The maximum allowable slope on cuts or fills of embankments shall be 2:1 unless justified by specific site tests conducted by a Soils Engineer and approved by the City. Any changes in side slope shall be smoothly graded to avoid abrupt transitions. UBC Chapter 70 and these Erosion Control Guidelines shall be strictly adhered to.

Rock excavations will follow uniform slopes and plains as close as reasonably possible.

3.3.4 Fill Slopes and Embankments: All fill being placed on fill embankments will be placed in level, horizontal, uniform layers of sufficient width to allow thru-passage for working construction equipment. All fill slopes or embankments being constructed on hillside slopes of 10% grade or more shall be horizontally benched into hillside natural ground prior to initial placement of material.

Unless otherwise shown on the Approved Plans, the width of each bench cut or terrace shall be the width of the machine being used to bench. Each bench shall be cut to a minimum of 2' vertically, and the excavated material shall be mixed and compacted with the fill material being placed on the embankment. Unless otherwise shown on the Approved Plans, the standard fill embankment shall consist of a four-foot (vertical) on eight-foot (horizontal) slope followed by a two-foot (horizontal) bench, followed by another four-foot (vertical) on eight-foot (horizontal) slope followed by a two-foot (horizontal) bench, such pattern to be continued as necessary.

3.4
STREET AND DRAINAGE EXCAVATION

3.4.1 **Description:** This item shall consist of excavating and grading the roadway, side streets, alley and driveway approaches, sidewalk, and planting areas, and alleys, and all work necessary for the completion of the cuts, embankments, slopes, roadway ditches, side street approaches, sidewalks, planting areas, alleys and subsidiary work, including disposal of all surplus material. All work shall be performed in accordance with the alignment, grades, and cross-sections shown on the Approved Plans.

3.4.2 **Classification:** Roadway excavation, comprising all materials with the roadway, planting, and sidewalk areas, but excluding trench excavation and borrow pits, will be classified under headings of "Common Excavation," "Solid Rock Excavation," or "Unclassified Excavation" in accordance with the Specifications herein. Any work involving tailings may require special handling procedures.

- A. Common Excavation: "Common Excavation" shall be defined as the excavation of all materials that can be excavated, transported, placed, or stockpiled by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard or more and equipped with attachments (such as shovel, bucket, backhoe, drag line or clam shell) appropriate to the character of the materials and the site conditions.
- B. Solid Rock Excavation: "Solid Rock Excavation" shall cover the removal and disposal of solid rock or concrete, i.e. ledge rock that requires pneumatic drilling and blasting for its removal and also boulders exceeding one cubic yard in volume. Hard pan, hard clay, or glacial till will not be classified as solid rock excavation. Sandstone, silt stone, shale, or other sedimentary rocks which are soft, weathered or extensively fissured will not be classified as solid rock excavation.
- C. Unclassified Excavation: "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in these Specifications shall apply.

Excavation will be classified according to the above definitions by the City Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments smaller than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

3.4.3 **Definitions:** For the purpose of this classification, the following definitions shall apply:

- A. Heavy Ripping Equipment: Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth or multi-tooth, ripping attachment mounted on a tractor having a power rating of 200 or more net horsepower (at the flywheel).

- B. Wheel Tractor-Scraper: Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.
- C. Pusher Tractor: Pusher tractor shall be defined as a track type tractor having a power rating of 200 or more net horsepower (at the flywheel) equipped with appropriate attachments.

3.4.4 Protection of Existing Improvements:

- A. Surface Improvements: The Contractor shall be responsible for the protection of existing surface improvements as directed elsewhere in the various applicable sections of these Specifications and Contract Documents, and any damage resulting from his operations shall be his sole responsibility.

When required for construction approval, the limits of the disturbance area shall be fenced with a 6-foot chain link fence conforming to UDOT Specifications, or approved equal.

- B. Subsurface Improvements:

- 1. General: Utilities of record will be shown on the Approved Plans insofar as it is possible to do so. Failure of the plans to show the existence of subsurface objects or installations shall not relieve the Contractor from his responsibility to make an independent check on the ground, nor relieve him from all liability for damages resulting from his operations unless otherwise provided in the Special Conditions or by exceptions hereinafter mentioned.

It shall be the responsibility of the Contractor to give proper written notification to the agencies that have utilities in place and to cooperate with these agencies in the protection and relocation of the various underground installations. These agencies will give assistance in the location of the various utilities, but this shall not relieve the Contractor from responsibility for any damage incurred, except in case where the installations are not located as closely as is normally possible with electronic pipe locator. In such case, the Contractor will not be liable if he has proceeded with due caution.

Where house sewer services are damaged through no fault of the Contractor, they shall be repaired and payment will be made therefore by force account as the City Engineer may determine.

- 2. Private Utilities: Utilities other than those owned and operated by the City are in streets pursuant to franchises or to rights claimed under the laws of the U.S.A. or the State of Utah, and therefore, the respective utility agencies are responsible for all adjustments and relocations of their facilities. These agencies will locate their facilities for the Contractor and assist him in their protection. The Contractor shall coordinate his work with that of the affected agencies and shall protect them from damage.

The Contractor shall be liable for all damages to private utilities resulting from his operations, and hold the City harmless.

3. **Water Mains and Appurtenances:** The Contractor shall be responsible for any damage to water mains and water facilities caused by his operations and also for the cost of lost water, and also for the cost of City manpower, materials, and equipment costs as determined by the Public Works Director, except under the following conditions: (1) he has not excavated below or beyond the required excavation lines and, (2) he has given proper and timely notice of his work plans, and (3) he has used reasonable care and has cooperated in minimizing the damages.

Any damage to water gates, hydrants, valve chambers, and other surface appurtenances which results from the Contractor's operation shall be his sole responsibility.

3.4.5 Construction Details: Off-highway earth moving equipment will not be allowed to haul on or across any streets not being improved in the contract.

3.4.6 Use of Explosives: Blasting will not be permitted in any case without specific authority of the City, and then only under such restrictions as may be required by the proper authorities. Explosives shall be handled and used in strict compliance with the "Utah Occupational Safety and Health; Rules and Regulations; General Standards" of the Utah State Industrial Commission.

When the use of explosives is necessary for the execution of the work, the Contractor shall have a special clause in his insurance permitting the blasting. He shall use the utmost care so as not to endanger life or property, cause slides or disturb the materials outside the neat lines of the cross-section.

The Contractor shall be responsible for any and all damage or injury resulting from the use of explosives.

The Contractor shall notify the police department and each public utility company having structures in proximity to the site of the work of his intention to use explosives and such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

Blasting shall be completed in the vicinity of new structures before construction on such structures is undertaken. All explosives shall be stored in a secure manner and place in compliance with local laws and ordinances and all such storage places shall be clearly marked "Danger--Explosives." No explosive shall be left in an unprotected manner along or adjacent to any existing highway or public place.

3.4.7 Side Street, Alley and Driveway Approaches: Approaches to the project shall be excavated to the limits indicated on the Approved Plans or to such limits as the Engineer may direct. This excavation shall be made in conjunction with the street excavation and in such a manner as to provide safe access for local and emergency traffic at all times.

Where the Engineer deems subgrade material to be unsatisfactory, excavation below grade will be required to such depths as he may direct. Excavation below grade shall be of the same classification as that above it, provided it is removed in the same operation as the normal excavation. Where the Contractor has completed the excavation and is required to move back to remove unsuitable material, or where the additional depth requires special equipment because of the presence of shallow utilities or other unforeseen conditions, the work shall be performed as directed by the City

Engineer. No materials shall be wasted without permission of the Engineer. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed, unless otherwise directed.

If the excavation below grade is required because of negligence on part of the Contractor, the necessary excavation below grade and the back filling required to restore the surface satisfactorily shall be at the Contractor's expense.

3.4.8 Planting and Sidewalk Areas: The class of excavation as specified shall include all excavation of planting and sidewalk areas and shall extend to the lateral and terminal limits shown on the construction plans. Planting areas shall be defined as those areas existing between the roadway surface and property line, exclusive of the areas occupied by other improvements such as sidewalks. Excavation on planting strips in developed areas, shall be made and be terminated to blend neatly with the existing contours. Planting strips shall be filled with topsoil comparable to existing topsoil and shall conform to the plan grade.

3.4.9 Pavement Removal: Pavement removal shall be accomplished and compensation be made therefor under street excavation. Where existing streets are to be excavated and are presently surfaced with asphalt concrete or bituminous mats on earth or granular base, these surfaces shall be considered as part of the excavation. Where existing street pavements extend beyond the back of the new curb line, the Contractor will also be required to remove the pavement as part of the excavation. For trench excavation, the pavement shall be sawcut one-foot back from the trench edge at its widest point. The saw cut shall slightly undercut the remaining in-place pavement. It shall be the Contractor's responsibility to determine the thickness of such surfaces.

3.4.10 Disposal of Excavated Material: Suitable excavated material shall be used for the making of all required project embankments. The more suitable portions of the excavated material shall be stored on the project as the Contractor elects or off the project in areas approved by the City Engineer and used for backfilling of curbs and dressing up of planting areas. Excavated material in excess of that needed to complete all embankments and for backfilling curbs and dressing planting areas shall be removed as directed by the Engineer. Any remaining excess or unsuitable materials shall be disposed of by the Contractor at his own expense.

The Contractor shall not waste any excavated material until he is certain there is sufficient material to complete all necessary project embankment and plantings. If any undue amount is wasted, the Contractor shall secure and furnish approved borrow material at his own expense.

3.4.11 Ditches and Drainage: All ditches shall be constructed as shown on the Approved Plans and shall be so graded as to conform to the natural flow of the water to inlets, catch basins, culverts, or channels. Ditches from cuts shall be located in such manner as to bypass any part of the adjacent fill so that no damage will be caused thereto by running water. The roadbed and ditches shall be maintained in such condition that the work shall be well drained at all times, including periods of work suspension. Proper protection shall be provided to insure that no erosion takes place.

If it is necessary in the prosecution of the work to interrupt the existing flow of irrigation water, existing surface drainage, sewers, or underdrainage, temporary facilities shall be provided until permanent drainage or irrigation work is completed. All areas where seepage or standing water exists, must be thoroughly drained, if feasible and required, as directed by the Project Engineer. This work must be done in advance of any grading operations.

3.4.12 Selected Granular Borrow Material: When specified in the Contract Documents or by the Project Engineer, all suitable selected material excavated of local borrow, shall be used for finishing the top portion of the subbase. The selected material shall conform with the requirements as outlined in State of Utah Standard Specifications for Road and Bridge Construction.

When the transporting of selected material directly from excavation to its final position on the roadway will be impracticable, the selected material shall be left in place until it can be placed in final position. If, however, the conditions are such that the undisturbed selected material will hamper ordinary grading operations or cause unnecessary movements of equipment, the Engineer may allow the removal of sufficient selected material and the stockpiling thereof to enable practical hauling operations. If excavation and stockpiling of selected material is specified in the Special Conditions or is ordered by the Project Engineer, the excavation and stockpiling shall be at locations designated by the Project Engineer, and thereafter be removed from the stockpile and placed in final position upon the roadbed when directed by the Project Engineer.

3.4.13 Slides: Side slopes in cuts and an embankments shall be constructed as staked or re-established by the Project Engineer. In case a slope finished to the lines as staked or reestablished by the Engineer shall slide back of the established slope onto the roadway prism, or out of an embankment before final acceptance of the work, such slide material shall be removed by the Contractor from the roadway, or be replaced in the embankment by him, at the unit contract price for the class of excavation involved, and the slopes shall be refinished as directed by the Project Engineer.

Rock cut slopes shall be scaled of all loose rocks and fragments, and left in a neat, safe, and workmanlike condition.

Materials to replace embankment slides shall be obtained from sources approved by the Project Engineer. Slopes undercut at the base or destroyed in any manner by act of the Contractor shall be resloped by him parallel to the damaged slope, or as re-established by the Engineer.

3.4.14 Overbreak: In all materials encountered in the performance of the contract, overbreak is any portion of any such material which is excavated, displaced or loosened outside and beyond the slopes, lines, or grades as staked or re-established, with the exception of such material which occurs as slides as described hereinbefore, regardless of whether any such overbreak is due to blasting, to the inherent character of any formation encountered, or to any other cause. All overbreak as so defined shall be removed by the Contractor and shall be disposed of by the Contractor.

Whenever it is agreed to in writing and in advance between the Contractor and the Project Engineer, overbreak may be used in forming any embankment as planned to replace borrow which otherwise would have to be provided for. In this event, payment will be made for the volume of common borrow or solid rock borrow, as the case may be, which the overbreak replaces, at the respective contract prices per cubic yard for such borrow with the additional allowance for haul, if any, on such available borrow; provided, however, that no allowance will be made for overbreak which is placed in the embankment as planned in lieu of available material coming from within the neat lines of the roadway prism.

3.4.15 Embankments:

A. Foundation Treatment: The materials composing the embankments must be entirely imperishable and free of frozen material. Wherever the natural surface upon which the

embankment is to be placed is of such nature as in the judgment of the City Engineer, will impair the stability or usefulness of the street, the natural surface shall be stabilized or removed and disposed of as the Engineer may direct.

Where embankments are to be made on hillsides or where a new fill is to be applied upon an existing embankment, the slopes of the original ground or embankment (except rock embankments) shall be cleared, grubbed, and terraced or stepped by machine cut or by other approved means before filling is commenced. Fills shall be wide enough to accommodate machinery.

When the top layer of the ground underlying the proposed roadway embankment is of loose material, the embankment height is less than 6 feet, the earth remaining in the excavated area shall be loosened to a 4 depth of eight inches or such lesser depth as ordered by the Project Engineer, and then be recompacted to not less than 90 percent maximum density as defined by ASTM D-1557 (Modified Proctor).

Following preparation of the excavated area, the void shall be filled in layers with selected material from adjacent cuts and compacted as provided in the Contract Documents.

- B. Unsuitable Foundation Excavation: When shown in the Contract Documents, unstable natural ground shall be excavated prior to the placement of embankment over the area. The unstable material may consist of peat, muck, swampy or unsuitable materials, including buried roots and stumps. The material shall be excavated by the Contractor as directed by the Project Engineer to give the constructed embankment full bearing on solid ground.
- C. Displacement of Unsuitable Foundation Materials: Where shown on the Approved Plans, the roadway embankments to be constructed across low, swampy ground shall be constructed on solid ground to the elevation as indicated by the roadway section on the plans. To obtain this result the overburden of peat, muck, swampy or other unsuitable material lying above the elevation of solid ground shall be displaced or removed by the Contractor, as directed by the Project Engineer, to give the constructed embankment full bearing on the solid ground, as shown by the Approved Plans and as required by these Specifications.

The Contractor shall displace the overburden of unsuitable materials in constructing the embankment by such methods as the Engineer may approve. The overburden material outside of the new embankment slopes fill shall be leveled off and blended in as directed by the City Engineer, and left in a neat condition.

- D. Embankment Construction: Embankment construction shall be divided into two classes, rock embankments and earth embankments. Rock embankments shall be all, or any part, of an embankment in which the material contains 10% or more by volume of gravel or stone four (4) inches or greater in diameter. Embankments of all other material shall be considered as earth embankments.

When embankments are constructed across wet or swampy ground which will not support the weight of heavy hauling and spreading equipment, the Contractor will be required to choose such methods of embankment construction and to use such hauling and spreading equipment as will least disturb the soft foundation. When soft foundations are encountered, the lower part of the fill may be constructed by dumping and spreading successive vehicle loads in a uniformly distributed layer of thickness not greater than that necessary to support

the vehicle while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified in the Contract Documents.

It is not the policy of the City to allow an increase in the planned depth of embankment material over soft, wet, or swampy ground for the sole purpose of providing support for heavy hauling and spreading equipment, unless the Contractor proves to the satisfaction of the City Engineer that the planned depth is inadequate to support lighter hauling vehicles. If it proves necessary for the Contractor to use smaller hauling vehicles or different methods of embankment construction than he had originally contemplated in order to comply with the foregoing, such shall not be the basis for a claim for extra compensation. The unit contract price for the various pay items involved shall be full compensation for all labor, materials and equipment necessary to perform the work as outlined herein.

At the time of compaction, the moisture content of that portion of embankment material passing a number four (4) sieve shall be not more than three (3) percentage points above or below the optimum moisture. Embankment material which contains less moisture than required for proper compaction with the compacting equipment being used shall be watered in the amount ordered by the Project Engineer.

- E. Rock Embankment Construction: Rock embankments shall be constructed in layers not exceeding twelve (12) inches in depth, except in the case that the average size of the fragments exceeds twelve (12) inches, the layers may be as deep as required to allow their placement subject to approval by the City Engineer. Occasional fragments exceeding the average size shall be disposed of instead of being incorporated in the embankment.

Each layer shall be compacted by routing the loaded and unloaded hauling equipment or through the use of rollers. The roadway shall be compacted to at least 95% of the maximum density determined by ASTM D-1557 (Modified Proctor).

The material shall be placed carefully so that the larger pieces of rock or boulders are well distributed. The intervening spaces and interstices shall be filled with the smaller stone and earth as may be available so as to form a dense, well compacted embankment. Each layer shall be compacted as specified in the Contract Documents.

In making rock embankments, the Contractor will be required to bring the fills to within twelve (12) inches below grade, as designed by the Project Engineer, and to construct the remainder from suitable fine material placed in layers, smoothed and compacted. The finer materials from rock excavations shall be saved as far as practicable for use in topping out rock fills and backfilling over the subgrade excavation in rock cuts.

- F. Earth Embankment Construction: Earth embankment shall be constructed in compacted layers of uniform thickness and moisture. The layers shall be carried up full width from the bottom of the embankment to avoid widening the edges after the center has been brought to grade.
 - 1. Compacting Earth Embankments: Earth embankments shall be compacted with modern, efficient, compacting units satisfactory to the Project Engineer. The compacting units may be of any type provided they are capable of compacting each lift of the material to the specified density. The use of hauling equipment to obtain partial compaction will be allowed but the Contractor will be required to compact

the full width and depth of each layer of material to the required density. The right is reserved for the Project Engineer to order the use of any particular compacting unit discontinued if it is not capable of compacting the material to the required density in a reasonable time.

Embankments normally shall be constructed in successive horizontal layers not exceeding eight (8) inches in loose thickness. If approved by the Engineer, successive horizontal layers up to a maximum depth of twelve (12) inches may be placed, provided the required density is obtained throughout the fill width and depth of each layer.

Each layer of the embankment shall be compacted to at least ninety-five percent (95%) of the maximum density determined by the "Compaction Control Test".

At all locations that are inaccessible to a roller, the embankment shall be brought up in horizontal layers and compacted thoroughly with mechanical tampers. The horizontal layers shall not exceed six (6) inches in loose thickness.

2. Compaction Control Test: Optimum moisture content and maximum density for other than granular materials shall be determined in accordance with the Method of Testing for Moisture-Density Relations of Soils, as defined by ASTM D-1557 (Modified Proctor).
- G. Embankments and Structures, Trestle and Bridge Ends: The work of filling around structures and the ends of trestles and bridges and the constructing of embankments shall be undertaken and completed as soon as possible after each structure is completed, or when ordered by the Project Engineer.

In filling around the structure, trestle and bridge ends, the Contractor shall bring the fill up equally on all sides of the bracing and the columns of the bridge to prevent distortion of the bents and columns. This method shall also be used in bringing up the fill on both sides of the bulkheads as shown on the Approved Plans, or as directed by the Project Engineer. The embankments shall be constructed under the bridge to the height and dimensions as shown on the Approved Plans, or directed by the Project Engineer. Fill shall not be placed against green concrete and wedging it action against walls shall be prevented by stepping or serrating the sides of excavation. All drainage openings or seep holes in the masonry or concrete shall be backfilled one foot in each direction from the opening with coarse concrete aggregate.

The embankment and backfill at both ends of all rigid frame concrete structures which do not have provisions for expansion shall be brought up and compacted simultaneously to prevent lateral displacement of the structure due to unbalanced earth loading. The strength requirements for the closing pour of concrete for frame structures must be met and approved by the City or the pour shall have been completed at least seven days before backfilling.

3.4.16 Borrow: Borrow shall conform to the specifications of Section 3.6.

3.4.17 Compacting Cut Sections: When the density of the natural ground of a graded roadbed in a cut section, upon which a specified layer of surfacing or selected material is to be placed, is less than the requirements herein unto for specified for the method of compaction used, the top two (2) feet

of the graded roadbed shall be compacted in accordance with the requirements of compacted earth embankment, which is specified. If ordered by the City, the material shall be excavated to a depth of sixteen (16) inches and stockpiled temporarily, and the underlying eight (8) inches be then loosened, watered if necessary, and compacted to the required density. The excavated material shall then be replaced in successive layers as required under Section 3.5.15G, watered if necessary, and compacted to the required density.

3.4.18 Revegetation: All exposed cut and fill areas must be revegetated in accordance with the requirements stipulated on the Approved Plans or specified in the Special Conditions.

3.4.19 Snow Removal: Whenever the surface of a cut or the site of an embankment is covered with snow sufficiently deep to impair the utility of the work, the snow must be removed and deposited beyond the slope stakes at the Contractor's own expense. Work of this nature shall be at least one hundred (100) feet in advance of the excavation and placing of the embankment.

3.5

BORROW, GRANULAR BORROW, GRANULAR BACKFILL BORROW AND PIT RUN BORROW

3.5.1 **Description:** This work shall consist of furnishing material obtained outside the right-of-way for use in the construction of the embankment, backfill or for other portions of the work.

"Borrow" shall consist of material conforming to classifications A-1-a through A-4 of AASHTO Designation M-145.

"Granular Borrow", when specified, shall consist of material conforming to Classifications A-1-a through A-4 of AASHTO Designation M-145. The material shall meet the design CBR*; a requirement for suitability of source and not for project control testing.

"Granular Backfill Borrow" shall conform to the requirements of A-1-a Classification of granular materials of AASHTO Designation M-145 modified so as to limit the maximum size to 2 inches and be well graded.

"Pit Run Borrow" shall conform to the requirements of A-1-a classification of granular materials of AASHTO Designation M-145 modified so as to limit the maximum size to 4-inches and be well graded.

3.5.2 Construction Methods: The Contractor shall notify the Project Engineer sufficiently in advance of opening any borrow areas so that cross-section elevations may be taken and the material tested, if necessary, before being used. Clearing out of vegetation and stripping of unsatisfactory material from the pit or blending of materials when required, shall be performed by the Contractor at his expense. When there is a choice in quality of materials in the borrow source, the best material, when directed, shall be placed in the top portion of the embankment. Borrow material shall be placed in the embankment and used for backfill.

Borrow material shall not be placed until after the roadway excavation has been completed, unless approved by the City. If the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste will be deducted from the borrow volume.

3.5.3 **Revegetation:** All borrow and stockpile areas shall be revegetated in accordance with the requirements stipulated on the Approved Plans or specified in the Special Conditions.

* NOTE: CBR here and wherever mentioned herein, shall always be understood to mean "California Bearing Ratio."

3.6 SUBGRADE

3.6.1 Description: The subgrade will be considered as those areas and surfaces of new or existing streets, alleys, driveways, sidewalks, or other public places upon which additional materials are to be placed, under the Contract, or which are to be constructed or prepared for the future placement thereupon of other materials in accordance with these Specifications and Contract Documents, which will be staked for lines and grades by the Project Engineer.

3.6.2 Construction Details:

- A. Subgrade for Base Materials: In advance of setting line and grade stakes, the subgrade area shall be cleared of brush, weeds, vegetation, grass and debris, all of which shall be satisfactorily disposed of as specified by the Project Engineer or by the Contract Documents. All depressions or ruts which contain water shall be drained. The subgrade shall then be bladed, ripped, and compacted to remove inequalities and secure a uniform surface.

After the foregoing requirements have been complied with, the proper alignment and grades will be given by the Project Engineer. Where normal cross-sections are being constructed, stakes will be set at convenient offsets at intervals not to exceed fifty (50) feet or where necessary, such as at street and alley intersections. It shall be the responsibility of the Contractor to set centerline grades which may be needed except in cases where the street grades are warped or otherwise do not conform with the typical section.

The existing subgrade shall be compacted to ninety-five percent (95%) of maximum density determined by ASTM D-1557 (Modified Proctor).

All soft, spongy, or yielding spots shall be entirely removed and the space refilled with granular backfill borrow material, thoroughly compacted, and shaped to grade elevations.

The final finishing shall be to a height above the finished subgrade cross-sections as may be determined, by trial and experience, to be proper to ensure thorough compaction to the grade as staked, by finished grading and rolling.

When ordered by the Project Engineer, the Contractor shall sprinkle the subgrade with water in such quantities as directed.

Grade and line, throughout the stages of constructing the subgrade, shall be secured from the reference stakes. The subgrade shall be maintained by the Contractor, at his expense, at the required compaction and in the finished condition until the first course of surfacing is placed upon it.

3.7 WATERING

3.7.1 Water for Streets: Water for compacting embankment, constructing subgrade, placement of screened gravel and crushing surfacing, and for laying dust caused from grading operations or public travel, if ordered by the Project Engineer, shall be applied in optimum amounts and placed as designated by the Project Engineer.

3.7.2 Source of Water and General Requirements:

- A. **Water Supply:** The Contractor shall make arrangements for and provide all necessary water at his own expense, unless otherwise provided in the Special Conditions.

If the Contractor purchases water from The City at a fire hydrant on or near the project, all arrangements shall be made by him at his own expense and payment be made to the City on basis of the actual quantity of water metered. The City must authorize the opening of any City hydrants. All water usage will be metered. Application for service shall be made to the City Manager located in the City Offices.

- B. **Requirements and Responsibility:** The Contractor shall use only those hydrants designated by the City and in strict accordance with its requirements for hydrant use.

The Contractor shall secure permission from and comply with all requirements of the City before obtaining water from the fire hydrants.

The Contractor shall use hydrant wrenches only to open hydrants. He shall also make certain that the hydrant valve is open "full," since "cracking" the valve causes damage to the valve. An approved auxiliary valve shall be provided on the outlet line for control purposes. Fire hydrant valves must be closed slowly and completely to avoid a surge on the system, which creates undue pressure on the water lines. The Contractor shall carefully note the importance of following these directions.

If one of the Contractor's employees shall knowingly or unknowingly damage any hydrant valve system, the Contractor will be responsible for all resulting costs and damages. He shall immediately notify the City so that the damage can be repaired as quickly as possible.

Upon completing the use of the hydrants, the Contractor shall notify the City, so that the hydrants may be then inspected for possible damage. Any damage resulting from the use of the hydrants by the Contractor will be repaired by the City and the cost thereof shall, if necessary, be borne by the Contractor.

The Contractor shall furnish all connectors, wrenches, valves, and small tools that may be necessary to meet the requirements of the City pertaining to hydrant use.

Violation of these requirements will result in fines and will lay the Contractor liable for damage suits because of malfunctioning of damaged fire hydrants, in the event of fire.

3.7.3 Equipment Requirements:

- A. General: Where hauled water is required, the tank truck and/or trailer shall meet all safety and licensing regulations and shall be provided with a pump of such size and capacity as to provide for a discharge equivalent to that required for hydrant settling water. Adjustable spray heads, front or rear, and spray bar shall provide uniform and controlled application of water without or washing.

An approved pressure pipeline hose nozzle or sprinkling system may be used for applying water in embankment construction or to moisten material before excavation.

The Contractor shall provide sufficient equipment to apply water as directed. Insufficient or inadequate watering equipment shall be cause for closing down those operations affected by such until the Contractor makes proper remedy of the deficiency.

3.8 EXCAVATION FOR STRUCTURES

3.8.1 Description: The provisions of this section of the Specifications concern the removal or excavation of all materials of whatsoever nature that is necessary for the construction of footings, bases, or any other foundation work required to support pump stations, headwalls, water tanks, transmission towers, and similar structures.

This section also includes the construction and subsequent removal of all shoring, cribs, cofferdams or caissons; the pumping which may be necessary for the execution of the work, and the placement and compaction of all necessary backfill.

It is not intended that excavation for culverts, sewers, and water mains and their appurtenances, manholes, inlets, and catch basins, conduits, and miscellaneous work covered elsewhere in these Specifications or in the Special Conditions shall be considered as structure excavation.

A. Classification: Structure excavation will not be further classified into solid rock excavation or common excavation, nor into wet or dry excavation. Structure excavation shall include the necessary grubbing of structure sites which otherwise would not be grubbed, the excavation of any and all formations encountered inside the limits which define structure excavation, and the removal and disposal of all debris, including submerged or buried timber, and all pumping that may be necessary for draining and dewatering the excavation. It shall also include the furnishing of all equipment necessary for the performance of this work, the placement of all necessary backfill inside the limits which define structure excavation, as hereinafter specified, and the disposal of excavated material that is not required for backfill.

3.8.2 Construction Details:

A. Preservation of Channel: When foundations or substructures are to be constructed in or adjacent to running streams, no excavation shall be done outside of cribs, cofferdams, caissons or sheet piling, nor shall the natural stream bed adjacent to the structure be disturbed without the written permission of the City. Care shall be taken to minimize damage to vegetation and to minimize siltation in the stream. Excavation work shall not be done during periods of high snowmelt. If any open pit excavation or dredging is permitted at the site of the structure before the placement of cribs or cofferdams, the Contractor shall, after the foundations are in place, backfill such excavations to the original surface of the stream bed with material satisfactory to the City. The backfilling material shall be of such quality and shall be placed in such a manner that it will offer the same resistance to scour as the material removed.

B. Excavation in Open Pits: When footings can be placed in the dry without the use of cofferdams and when cofferdams are not necessary for the preservation of conditions affecting the safety of the completed structure, the Project Engineer may permit the excavation of open pits without shoring, cofferdams or cribs. Such pits shall be constructed with side slopes sufficiently flat to prevent sliding or caving. The Contractor shall assume full responsibility for the prevention of any such slides adjacent to any such excavation, and in the event of any such slide, the Contractor shall remove the additional material brought down by the slide at his own expense.

In case the material disturbed by a slide lies within an area upon which a portion of the structure is to be constructed, the Contractor shall excavate the disturbed material and backfill the excavated area to the original ground line with material satisfactory to the Project Engineer. This material shall be placed and compacted in the manner specified elsewhere herein. All costs in connection with excavating, backfilling, compacting, and restoring such a slide area to its original position and condition shall be borne by the Contractor.

When water is encountered, ample provision shall be made for draining or pumping, and the excavation shall be accomplished by such means as will prevent stirring up or softening the bottom. Foundation material unduly disturbed or softened by the use of equipment in the bottom of the pit or by inadequate handling of water shall be removed by the Contractor at his own expense. Such material removed shall be replaced with satisfactory material.

- C. Depth of Footings: Foundation for all structures shall be excavated to the depth and lines indicated on the Approved Plans. The Project Engineer may require the Contractor to excavate below the elevations shown on the Approved Plans, or may order him to stop above the elevations shown, depending upon where suitable foundation material is encountered.
- D. Preparation for Placing Foundations: In solid rock or other hard material, the excavation shall be carried at least 6" to 12" into the rock or hard material to form a key for the concrete footing, or to such additional depth as shown on the Approved Plans or directed by the Project Engineer. The bottom of the pit shall be cleaned of all loose material and cut to a firm surface, either level, stepped or serrated. When concrete is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and the final removal of all loose or soft material shall be made just before the concrete is placed.
- E. Shoring, Cribs, and Cofferdams: Except as provided in Section B, all excavations shall be shored, braced, or protected by cofferdams in accordance with approved methods. No excavation or dredging shall be done before shoring, crib, or cofferdams are placed, except with the written permission of the City. If permission is given, it shall not relieve the Contractor of his obligation to anchor or otherwise hold the crib or cofferdam in place and secure it against tipping or displacement. Unless otherwise ordered, all cofferdams, sheeting and bracing shall be removed after serving their purpose.
- F. Inspection: The Contractor shall notify the City before starting any excavation. From time to time during the progress of excavation, the City will examine at their discretion the character of material taken out.
- G. Disposal of Excavated Material: The material obtained from structural excavation shall be used as the Project Engineer may require, either in construction embankments, or for backfilling over and around the structures after they are complete. When the material is unsuitable or not required for either of these purposes it shall be disposed of in a satisfactory manner.
- H. Backfilling: All material used for backfill shall be of a quality acceptable to the Project Engineer and shall be free from large or frozen lumps, wood or other extraneous matter. The backfilling of openings made for structures shall be considered as a necessary part of the excavation, although the Project Engineer may require that the material for use in making a backfilling be obtained from a source entirely apart from the structure. Except as may be

otherwise specified hereinafter, spaces excavated and not occupied by abutments, piers, or other permanent structures shall be backfilled up to the surface of the surrounding ground, with a sufficient allowance for settlement and, in general, the top surface of the backfill shall be neatly graded.

Backfill in existing street areas or in areas that must support roadway embankment or which is a part of any roadway embankment, shall be placed in horizontal layers not more than eight (8) inches thick, and each layer shall be tamped and compacted to 95% of the maximum density as determined by ASTM D-1557 (Modified Proctor).

The use of mechanical tampers may be required for compacting backfill for certain items as shown in the individual specifications for such items, and as may be required in the Special Conditions or on the Approved Plans where greater density than that specified above is to be obtained.

Special precautions shall be taken to prevent any wedging action against abutments and wing walls. If the excavation has sloping sides, the slope shall be broken up by stepping or serrating to prevent wedge action before the backfill is placed. Fill placed around culverts, piers, and other underground utilities shall be deposited on both sides to approximately the same elevation at the same time.

The Project Engineer may order the backfill around piers and in front of abutments and wings to be of stone or lean concrete if the excavation has been in hard material exposed to erosion. Backfill of this nature will be paid for by force account unless otherwise provided for in the proposal. If the material used in making the backfill is too dry to permit proper compaction, the Engineer may require the addition of sufficient water to allow satisfactory compaction. If the material is too wet to permit proper compaction the Engineer may require a more suitable material to be substituted.

3.9
UNTREATED BASE COURSE

3.9.1 **Description:** This item shall consist of the construction of a base course composed of a natural gravel, crushed rock, or crushed slag placed on a prepared subgrade in conformance with the lines, grades, and dimensions shown on the Approved Plans or established by the Project Engineer and in accordance with these Specifications. Each aggregate source shall be tested and the results submitted to the City at least 48 hours prior to hauling any material on-site. In order to facilitate the field testing, the Contractor shall submit single gradation target values along with these test results.

3.9.2 **Mineral Aggregate:** Mineral aggregate shall conform to the following requirements:

- A. On that portion of the aggregate passing the No. 40 sieve, the liquid limit shall not exceed 25, nor shall the plasticity index exceed 6, when tested in accordance with AASHTO T-89 and T-90.
- B. The dry mineral aggregate shall be uniformly graded within one of the gradations specified in subsection 3.10.3, when tested in accordance with AASHTO T-27. The gradation to be used shall be the option of the Contractor, unless otherwise specifically designated in the Special Conditions, none other shall be used, unless authorized in writing by the City. The source of material must be approved by the City.

The total amount of material passing the No. 200 sieve shall be determined by washing in water in accordance with AASHTO T-11.

- C. Aggregate shall have a percentage of wear not exceeding 50, when tested in accordance with AASHTO T-96. This requirement shall be used in determining the suitability of the aggregate source and for routine control testing.
- D. The aggregate shall be of uniform density and quality, and shall have a rodded weight of not less than 75 lbs. per cubic foot, when tested in accordance with AASHTO T-19.

3.9.3 **Gradation:** Acceptance of aggregates with respect to gradation shall be based on the average gradation of 5 samples taken from a test lot. A test lot shall not exceed 5000 tons of aggregate.

Test samples shall be taken as the aggregate is used and shall be obtained from the roadbed immediately behind the spreader or laydown machine, prior to any further processing or compaction. The locations to be sampled shall be chosen on a random basis.

The method of taking the sample shall conform to AASHTO T-2.

A test lot shall be accepted when the average gradation of the 5 samples meets the ideal gradation with the tolerances shown below and when the number of individual samples outside the gradation band and within the specified tolerances does not exceed the following:

1-1/2", 3/4", 1/2" Sieves	not more than 3 samples
No. 4 and No. 16 Sieves	not more than 2 samples
No. 50 and No. 200 Sieves	not more than 1 sample

The dry mineral aggregate shall conform to one of the following gradations:

<u>1-1/2" Gradation</u>		
Sieve Size	Ideal Gradation	Gradation Tolerance
1-1/2"	100	0
3/4"	86	±5
1/2"	72	±5
No. 4	48	±5
No. 16	26	±3
No. 50	17	±2
No. 200	8	±2

<u>1" Gradation</u>		
Sieve Size	Ideal Gradation	Gradation Tolerance
1"	100	0
1/2"	85	±6
No. 4	55	±6
No. 16	31	±4
No. 50	19	±2
No. 200	9	±2

<u>3/4" Gradation</u>		
Sieve Size	Ideal Gradation	Gradation Tolerance
3/4"	100	±0
3/8"	85	±7
No. 4	61	±6
No. 16	33	±5
No. 50	19	±2
No. 200	9	±2

3.9.4 Mixing and Placing: The subgrade on which the sub-base course is to be placed shall be uniformly shaped and firmly compacted.

If the required compacted depth of base course exceeds 6 inches, the base shall be placed in two or more layers of approximately equal depth with no layer exceeding six inches. If vibratory

compacting equipment is used, the compacted depth of a single layer of base course may be increased to 8 inches upon written approval from the City Engineer.

Unless otherwise specified in the Special Conditions, the sub-base course shall be mixed by method (a) or (b). Method (a) shall be used on all projects where more than 50,000 tons of untreated sub-base course are to be produced except method (b) may be used when the total daily production does not exceed 300 tons, and where material is used for miscellaneous construction, such as under sidewalks, curbs, detours, etc. Method (b) may also be used when the total contract amount is less than 50,000 tons.

Method (a): The mineral aggregate shall be mixed with water in a stationary plant. Water shall be added in the amount necessary to obtain the optimum moisture content for compaction plus or minus 2 percentage points. The mixed base material shall be transported to the road in such manner as to retain the proper moisture content and shall be placed on the roadbed by means of an approved spreader.

Method (b): The mineral aggregate shall be placed on the subgrade by an aggregate spreader or windrow sizing device, after which it shall be uniformly mixed in a traveling mixing plant, by motor graded or by other approved equipment. During mixing, water shall be added in an amount sufficient to provide the optimum moisture content for compaction plus or minus 2 percentage points.

The furnished base material shall be uniform in appearance, texture, and moisture content, and shall be free from pockets of segregated material.

3.9.5 Compaction: The base course shall be uniformly compacted over the test area. The material shall have a uniform moisture content within two (2) percent of optimum prior to application of compactive effort. A test area shall not exceed 2500 feet in length and shall be the full width of the course being placed or as conditions require. The location of four test sites within a test area shall be chosen on a random basis. The in-place field density may be determined by ASTM D-1557 (Modified Proctor).

The test area shall be accepted when the average of the four density determinations is not less than 95 percent of maximum laboratory density, as determined ASTM D-1557 (Modified Proctor), and when no one determination is lower than 92 percent of maximum laboratory density.

If an individual test result falls below 92 percent of maximum laboratory density, the base material represented by that test will be considered defective and the Contractor shall further compact the test area. After further compaction, the original test area and one other randomly selected site within the test area shall be tested. The average of these two test results shall be included in determining the mean density of the test area. The original test result shall not be included. If the test area still does not meet the required density, the process of recompacting the retesting may be repeated.

In addition to the above acceptance tests, the Engineer reserves the right to test any area which appears defective and to require further compaction of areas that do not meet at least 92 percent of maximum laboratory density.

If the mean density of the base course placed on any production day does not equal or exceed 96 percent of maximum laboratory density but is not below 92 percent of maximum laboratory density, the test area may be accepted at a reduced price upon written request from the Contractor. The

computation of the adjusted price for the untreated base course with respect to density shall be based upon a pay factor of 0.90. Any test area with a density below 92 percent of maximum laboratory density shall be considered defective. The Engineer may order the correction or removal of any or all of the base course in that test area.

- 3.9.6 Finishing:** The base shall be finished to a smooth uniform line and grade with surface deviations not exceeding 0.5 inch, plus or minus in 10 feet. The determination of compliance with smoothness may be made with a straight-edge, chalk-line, or profilograph.

The thickness of the base shall be reasonably close to that shown in the Contract Documents or as designated by the Project Engineer. Acceptance of the finished base with respect to thickness shall be on the basis of test areas selected by the City Engineer, not to exceed 50,000 square feet in size. Depth analysis shall be made by test holes located in a random pattern with not less than 4 test holes in each test area. Test areas shall be accepted when seventy-five (75) percent of the test holes are not less than 0.5 inch of the designated thickness, and when no individual test hole shows a deficient thickness or more than 1.0 inch.

Test areas that are not acceptable shall be brought into compliance by the addition or removal of base material. Added material shall be blended with the in-place base and recompact to the required density. Excess material shall be removed at the Contractor's expense, and shall be deducted from the pay quantities. If the City permits an excess thickness of base to remain in place, the amount of material in excess of the tolerances specified will not be included in the pay quantity.

The finished sub-base shall be maintained to line and grade, and at the specified density until covered by a base or surface course. Any sub-base that becomes soft, washboarded or distorted under public or construction traffic shall be scarified, watered, remixed, and recompact at the Contractor's expense.

3.10
ASPHALT MATERIALS

3.10.1 Description:

- A. Asphalt Material: Asphalt of the grade specified shall fully comply with all of the requirements hereinafter set forth for each respective grade.

The particular grade or grades of asphalt to be used on any project will be those called for in the Contract Documents. Each shipment of bituminous materials shall be uniform in appearance and consistency, and shall show no foaming when heated to the specified loading temperature. Shipments contaminated with other asphalt types or grades than specified shall be rejected.

- B. Bill of Lading: The vendor of the bituminous material shall prepare a bill of lading for each shipment of material showing the following information:

1. Type and grade of material
2. Whether additives have been used and, if so, the type and amount
3. Destination
4. Consignee's name
5. Date of shipment
6. Railroad car or truck identification
7. Project number for which shipped
8. Loading temperature
9. Net weight (or net gallons corrected to 60°F., when requested)
10. Specific gravity
11. Bill of lading number
12. Source of bituminous material (manufacturer)

The vendor's bill of lading shall be prepared in triplicate, one copy to accompany the shipment to be delivered to the project, one copy to be mailed to the City, and one copy to be mailed to the designated testing laboratory.

- C. Asphalt Cements: Penetration grades of asphalt cement prepared from petroleum shall conform to the requirements of Utah State Road Standard Designation AC-10 or AC-20 when available, except that minimum flash point for all grades shall be 350°F.

- D. Catalytically-Blown Asphalt: Shall be prepared only by the catalytic-blowing treatment of petroleum asphalt. The asphalt shall be homogeneous, free from water and shall not foam when heated to 347°F. Asphaltic materials for which ferric chloride or other compounds of iron have been used as catalysts in the blowing operation will not be acceptable.

Catalytically-blown asphalt shall meet the requirements of the "State of Utah Standard Specifications for Road and Bridge Construction."

- E. Asphalt Emulsions: Emulsified asphalt shall conform to the requirements of ASTM of ISSA Specifications, for type SSlh, CSSlh or QUICK SETTING, MIXED GRADE EMULSION.

- F. Slow Curing Cut Back Asphalt (SC): Shall conform to the requirements of AASHTO—141.
- G. Medium Curing Cut Back Asphalt (MC): Shall conform to the requirements of AASHTO—82.
- H. Rapid Curing Cut Back Asphalt (RC): Shall conform to the requirements o AASHTO—8 , except that RC-4000 shall conform to the requirements shown in the "State of Utah Standard Specifications for Road and Bridge Construction."
- I. Deep Penetration Liquid Asphalt: Requirements of deep penetration liquid asphalt shall meet the "State of Utah Standard Specifications for Road and Bridge Construction."
- J. Road Tars: Shall be derived from gas-house, coke-oven, or water gas tars and shall conform to the requirements of AASHTO—52.
- K. Unauthorized Grades: The use of grades of asphalt other than those called for on the Approved Plans or in the Special Conditions will not be allowed. Any work which proves to be defective because of the use of unauthorized grades of asphalt shall be repaired or removed at the expense of the Contractor, if ordered by the City.

3.11 BITUMINOUS SURFACE COURSE

3.11.1 Description: These Specifications apply to pavements constructed of asphalt concrete in one or more sources and include bases, surface courses and wearing surfaces. The number of courses in the pavement cross section shall be as shown on the Approved Plans or designated in the Special Conditions.

Unless otherwise specified in the Special Conditions, the Contractor shall furnish all asphalt and mineral aggregates, mineral filler and blending sand as may be required and perform all mixing, hauling, spreading, compacting and other work necessary to complete an asphalt concrete pavement in accordance with these Specifications.

All materials to be used in the manufacture of bituminous surface courses shall be tested and the results shall be submitted to the City a minimum of 48 hours prior to incorporating them as part of the contract. Approval by the City of the materials and test results shall be obtained by the Contractor or the work may be rejected by the City.

3.11.2 Materials:

- A. Bituminous Material: The bituminous material shall be the specified asphalt cement conforming to the requirements of Section 3.10. The grade specified in the proposal may be changed one step by the Project Engineer.
- B. Mineral Aggregate: Mineral aggregate shall consist of crushed stone, crushed gravel, or crushed slag conforming to the following requirements:
 - 1. Coarse aggregate, retained on the No. 4 sieve, shall consist of clean, hard, tough, durable and sound fragments, with not more than 3 percent by weight of flat, elongated, soft, or disintegrated particles, and shall be free from vegetable matter or other deleterious substances.
 - 2. In addition, that portion of the aggregate retained on the No. 4 sieve shall have not less than 50 percent of particles by weight with at least one mechanically fractured face, or clean angular face, when tested in accordance with the Utah Department of Transportation Test Procedure 8-929.
 - 3. Fine aggregate passing the No. 4 sieve, may be either a natural or manufactured product. The aggregate shall be clean, hard grained and moderately sharp, and shall contain not more than 2 percent by weight of vegetable matter or other deleterious substances.
 - 4. That portion of the fine aggregate; passing the No. 40 sieve shall be non-plastic when tested in accordance with AASHTO T-90.
 - 5. The weight of minus 200 mesh material retained in the aggregate, as determined by the difference in percent passing a No. 200 sieve by washing and dry sieving without washing shall not exceed 6 percent of the total sample weight.

The portion of the fine aggregate passing the No. 200 sieve shall be determined by washing with water in accordance with AASHTO T-11.

6. The aggregate shall be of uniform density and quality and shall have a rodded weight of not less than 75 lbs. per cubic foot when tested in accordance with AASHTO T-19.
7. The aggregate shall have a percentage of wear not exceeding 40 when tested in accordance with AASHTO T-96.
8. The mineral aggregate, when mixed with the bituminous binder specified for the project, shall have a swell not exceeding 0.030 inch when tested in accordance with AASHTO T-101, Method A. When the mineral aggregate is mixed with SC-250, the swell shall not exceed 0.062 inch, when tested in accordance with AASHTO T-101, Method B.
9. The aggregate shall have a weighted loss not exceeding 16 percent by weight when subjected to five cycles of sodium sulfate and tested in accordance with AASHTO T-104.
10. The aggregate shall be of such nature that when thoroughly coated with the bituminous material specified for the project, not less than 90 percent of the coating shall be retained when tested in accordance with Test Procedure 8-945 of the Manual of Instruction of UDOT. If the aggregate does not meet this requirement, bituminous additive shall be used to increase the percentage of retained bituminous material. The type and percent of additive to be used shall be approved by the Engineer. Bituminous additive shall conform to the requirements of Section 407 of the UDOT Standard Specifications for Road and Bridge Construction. When the aggregate is thoroughly coated with the bituminous material it will have an unconfined compressive strength of not less than 150 psi when tested in accordance with the requirements of Group 2 samples, AASHTO T-165, except that the mixing and compacting temperatures shall be in accordance with ASTM D-1559. Hydrated lime may be used to increase the unconfined compressive strength of the bituminous mix when this strength is below specification. The amount of lime to be used shall be approved by the Engineer.
11. The combined material aggregate plus any specified additives, when mixed with the specified bituminous binder in accordance with ASTM D-1559, shall conform to the following requirements:

Marshall stability	1200-2500 lbs.
Flow (0.01 inch)	10-18
Voids content	3.0% to 5.0%
V.M.A.*	15.0% minimum

The requirements specified in this subsection shall be used to determine the suitability of the aggregate sources and shall not be used for routine project control except for items (a), (b), (c), and (d).

* Note: Voids in V.M.A. shall be determined by use of AASHTO T-209 and methods shown in the Asphalt Institute's Manual Series No. 2 (MS-2).

12. The bituminous surface course material shall have a coefficient of thermal expansion of less than ½ inch per 100 feet. When tested by the UDOT testing procedure, this requirement shall be used to determine the suitability of the aggregate source and shall not be used for routing project control. The Materials and Research Section or District One Materials and Test Unit may be contacted for information regarding this test method and specification.

C. Gradation: The combined dry mineral aggregate shall be uniformly graded and of such size that it meets one of the gradations specified in Subsection D, when tested in accordance with AASHTO T-30. The gradation to be used shall be at the option of the Contractor, unless otherwise specifically designated in the Contract Documents or by the Engineer, except that the top lift of bituminous surface course shall utilize aggregate of which 100% passes the 1/2" sieve, unless otherwise approved by the City. When a specific gradation is designated, none other shall be used, unless authorized in writing by the Project Engineer. The maximum size of aggregate shall not be more than one-half the thickness of the compacted course to be constructed.

The Contractor shall establish a mix gradation, which meets the requirements of the chosen gradation band. At least 10 working days prior to producing bituminous surface course, the Contractor shall submit in writing a job-mix gradation to the Project Engineer for his approval. The job-mix gradation furnished shall be based on the material already stockpiled. The job-mix gradation shall have definite single values for the percentage of aggregate passing each specified sieve based on the dry weight of the aggregate.

Changes in the job-mix gradation may be made prior to a day's production subject to approval by the Project Engineer who, before use, will make necessary adjustments in the amount of bituminous material to be used. The request for change shall be in writing and shall give the City sufficient notice to review the change mix design. For major changes in the job-mix gradation at least three (3) working days notice shall be required. The Project Engineer will be furnished laboratory data to aid in selecting a mix gradation. The established mix gradation curve shall be reasonably parallel to the limits of the chosen gradation band.

The asphalt content of the mix shall be 4.5% to 5% or as approved by the City and shall be maintained with a tolerance of ± 0.4 percentage points.

D. Sampling and Testing: Acceptance of bituminous mixes with respect to gradation and bitumen content shall be based on the average gradation of 5 samples taken from a test lot, determined in accordance with the Utah Department of Transportation Test Procedure 8-947. A test lot shall not exceed 5000 tons of bituminous mix. Test samples shall be taken as the bituminous mix is being placed and shall be obtained from the roadbed immediately behind the paver prior to any further processing or compaction.

The locations to be sampled shall be chosen by the City.

A test lot shall be accepted for gradation when the average gradation of the five samples is within the gradation tolerances specified below, and when the number of individual samples outside the gradation tolerances does not exceed the following:

1", 3/4", 1/2", 3/8" Sieves	not more than 3 samples
No.'s 4, 8, and 16 Sieves	not more than 1 sample
No. 's 50 and 200 Sieves	not more than 1 sample

<u>1" Gradation</u>		
Sieve Size	Ideal Gradation	Gradation Tolerance
1"	100	0
1/2"	83	±8
No. 4	54	±7
No. 16	28	±5
No. 50	17	±5
No. 200	7	±2

<u>3/4" Gradation</u>		
Sieve Size	Ideal Gradation	Gradation Tolerance
3/4"	100	±0
3/8"	83	±8
No. 4	54	±8
No. 16	28	±6
No. 50	17	±6
No. 200	7	±2

<u>1/2" Gradation</u>		
Sieve Size	Ideal Gradation	Gradation Tolerance
1/2"	100	±0
No. 4	70	±10
No. 16	35	±7
No. 50	17	±6
No. 200	7	±2

3.11.3 Construction Details:

A. Preparation of Roadway:

1. Preparation of Asphalt, Concrete or Brick Surfaces: Before construction of an asphalt concrete pavement on an existing surface, all fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement. All excess asphalt joint filler shall be completely removed and all premolded joint filler shall be removed to at least one-half inch ($\frac{1}{2}$ ") below the surface of the existing pavement. All types of existing pavement or bituminous surfaces shall be thoroughly cleaned by sweeping to remove dust and other foreign matter.

When asphalt concrete pavement is to be constructed over an existing paved or oiled surface, in addition to the preparation as outlined hereinbefore, all holes and depressions shall be filled with an appropriate class of asphalt concrete mix by hand shoveling. The surface of the area shall be leveled and compacted thoroughly, to the satisfaction of the City.

2. Preparation of Untreated Roadway: The existing roadway surface, including intersections and side street approaches, shall be shaped to a uniform grade and section shown on the Approved Plans, or as directed by the Project Engineer.

The material on the existing street shall be loosened to a depth of approximately one inch, scarifying if necessary. The material shall be drifted back and forth across the street, evenly distributed and compacted into an unyielding mass by blading, rolling, and watering. The grade shall be shaped so that all frame castings for manholes, monument boxes, gate valve boxes, catch basins, etc. within the roadway section to be treated, will extend one-half to one inch below the finished surface. Where valves boxes or manhole frames must be adjusted in elevation to match the proposed finish asphalt grade, that adjustment must be made prior to placing asphalt unless otherwise approved by City. Where existing oil mats are to be met, they shall be thoroughly swept and cleaned to provide proper connections, as the Project Engineer may direct.

The prime coat shall be applied in accordance with Section 3.13.

After the maintenance, patching or repair work has been completed and immediately prior to placing the bituminous pavement, the surface of the prime coat shall be swept clean of all dirt, dust, or other foreign matter.

3. Removing Existing Pavement: Where shown on the Approved Plans or where designated by the Project Engineer, the existing pavement of the type shown on the Approved Plans shall be broken up, loaded, hauled, and disposed of in accordance with requirements outlined in "Removal of Existing Street Improvements."

- #### B. Connections With Existing Facilities: Where the bituminous pavement is to be connected with an existing roadway surface, bridge, railway crossing or other facility the Contractor will be required to modify the existing roadway profile in such a manner as to produce a smooth riding transition to the existing facility.

Where it is necessary to remove existing asphalt surfaces or oil mat surfaces to provide proper meet lines and riding surfaces, the Contractor shall burn or chip the existing surface so that there will be sufficient depth to provide a minimum of one (1) inch of asphalt concrete, and the waste material shall be disposed of to the satisfaction of the Project Engineer. Prior to placing the asphalt concrete, these areas shall be tacked in accordance with requirements described in Section 3.14. Meet lines shall be straight and the edges be vertical. The edges of meet line cuts shall be painted with diluted cutback asphalt or SS-1 emulsion prior to placing asphalt concrete. After placing the asphalt concrete, the meet line shall be sealed by painting with a cutback asphalt or SS-1 emulsion and immediately covered with clean dry sand.

- C. Construction Methods and Equipment: The methods employed in performing the work, all equipment, tools and machinery and other appliances used in handling the materials and executing the work shall be the responsibility of the Contractor. The Contractor shall make such changes in the methods employed and in the equipment used as are necessary whenever the bituminous surface being produced does not meet these Specifications.
- D. Temperature Control: The viscosity of the asphalt as it is being used in the pugmill shall be between 150 and 300 centistokes, determined in accordance with ASTM D-2170.

The Contractor shall advise the City in writing of the source of the asphalt to be used, who will then approve the temperature limits for the asphalt, aggregate, mixing, and laydown provided all the information required in Section 3.12.1 has been previously submitted and approved.

In the event a dryer-drum mixing process is used, the temperature of the bituminous mixture at discharge from the mixer shall be not less than 230°F. nor more than 260°F. It is necessary to complete compaction of the bituminous mixture before the temperature of the mixture drops below 180°F. It is necessary to cover haul trucks with tarpaulins and to deliver the mixture to the site before the mix temperature drops below 200 °F. unless an exception is approved by the City.

If the source of asphalt is changed during the course of the work, notice shall be given in writing to the City. A new mix design shall be made, and new temperature limits will be specified before asphalt from the new source is used. In no case shall the asphalt from two different sources be intermixed.

- E. Prime Coat or Tack Coat: If a prime coat or a tack coat is required, it shall be placed in accordance with Section 3.13 or Section 3.14, whichever is applicable.
- F. Mixing: The mineral aggregate shall be dried prior to mixing. Drying shall be accomplished in a suitable drier and shall continue until the average moisture content is not more than 1% by weight. Moisture determinations shall be made on samples taken from the drier discharge. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate and to avoid contamination of the aggregate by soot or fuel oil.

The mineral aggregate and bituminous binder shall be mixed at a central mixing plant. The shortest mixing time consistent with satisfactory coating of the aggregate shall be used as approved by the Engineer. The mineral aggregate shall be considered satisfactorily coated

with bitumen when all of the particles passing the No. 4 sieve and 96% of the particles retained on the No. 4 sieve are coated as determined visually by the Project Engineer. The required mixing time, as determined above, shall be used until changed by the Project Engineer.

If a dryer-drum mixing process is used, the dryer-drum mixing system shall be equipped to provide positive control of the cold aggregate feed and automatically regulate the feed gate and permit instant correction of variations in load. The cold feed shall be automatically coupled with the bitumen flow to maintain the required proportions. The system shall be equipped with automatic burner controls and shall provide for temperature sensing of the bituminous mixture at discharge. The mixing system shall be equipped with an adequate and approved surge bin capable of dumping into hauling units. The surge bin shall be loaded in such manner as to prevent segregation of the mix. Dumping on the ground and reloading of the bituminous mix shall not be permitted. A mixing time consistent with satisfactory coating of the aggregate shall be used. The mineral aggregate shall be considered satisfactorily coated with bitumen when all of the particles passing the No. 4 sieve and 98% of the particles are retained on the No. 4 are coated as determined by the Project Engineer. The moisture content of the bituminous mixture sampled behind the laydown machine prior to compaction shall not exceed 1% by weight.

- G. Spreading: Each course of the pavement shall be spread with a mechanical, self-propelled spreading and finishing machine capable of at least a 12-foot width. It shall be equipped with a screed or cutoff device that oscillates in a horizontal motion or vibrates vertically when striking off the course or lift under construction. The mixture shall be spread and stuck-off in such a manner that the finished surface shall conform to the elevations, grades and cross-sections shown on the Approved Plans or as designated by the Project Engineer.

The spreading machine shall be operated in such a manner as to distribute the mixture to proper cross-section, width, and thickness without segregation of aggregates. The spreading machine shall leave the mixture uniformly dense throughout, smooth, and free from inequalities and irregularities.

The spreading machine shall be capable of placing a uniform layer of asphalt mix to the depth shown on the Approved Plans or ordered by the Project Engineer. Unless otherwise designated or directed, bituminous base course more than 3 inches in total compacted thickness shall be spread in two or more courses, with no course exceeding 3 inches in compacted thickness.

The placing and compacting of bituminous base course in any given lane, shall not precede the placing and compacting of bituminous base course in any adjacent lane by more than one hour. When weather or other conditions are unfavorable, the amount of time between placing in adjacent lanes shall be reduced, as required by the Project Engineer.

Longitudinal joints in succeeding courses shall be offset at least 6 inches transversely to avoid a vertical joint through more than one course.

Areas which are inaccessible to the spreading machine may be paved by other methods, as approved by the Engineer. When ordered by the Engineer, motor patrol graders or approved types of truck-attached spreaders shall be used to pave inaccessible or irregularly shaped areas. Hand raking shall be kept to a minimum.

- H. **Compaction:** After the mixture has been spread, the surface shall be rolled in longitudinal direction commencing at the outside edge or lower side and preceding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half the width of the roller. Rolling shall continue until 98% of the laboratory density as determined in accordance with ASTM D-1559 for the bituminous mixture being used has been obtained, except that 97% density is allowable for new road construction subject to the approval of the City.

All rollers shall be in good condition, and the reversing mechanism so maintained that the roller is capable of changing directions smoothly. The roller shall be kept in continuous motion while on the hot mat in such a manner that all parts of the pavement receive equal compression. Reversing should not be done until the roller has completely stopped. Rollers shall be operated by competent and experienced personnel.

The surface of the mixture after compaction shall be smooth and true to established section and grade. Any mixture which shows an excess or deficiency of asphalt, or uneven distribution of asphalt due to insufficient mixing, or which becomes loose, broken, raveled, mixed with dirt, or is in any way defective, shall be removed and replaced with fresh hot mixture at the Contractor's expense, and be immediately compacted to conform with the surrounding area. Areas of one square foot or more showing an excess or deficiency of asphalt shall be removed and replaced.

Areas inaccessible to the roller shall be compacted by tamping with mechanical or hand tampers.

Acceptance of the surface course with respect to density shall be based on the average density of 4 determinations made in a test area. A test area shall not exceed 2500 feet in length and shall be the full width of the course being placed. The location of test sites within a test area shall be chosen on a random basis at the Engineer's discretion. The in-place field density may be determined by any one of the methods selected by the Engineer.

The test area shall be accepted when the average of the 4 density determinations is not less than 97.5% of maximum laboratory density and when no determination is lower than 95% of maximum laboratory density. The maximum laboratory density shall be determined in accordance with Utah Department of Transportation Test Procedure 8-942.

- I. **Finishing:** The surface course shall be finished to a smooth uniform line and grade with surface deviations not exceeding 1/8 inch, plus or minus, in 10 feet. The determination of compliance with smoothness may be made with a straight-edge, chalk line, high-low detector, or profilograph at the option of the Engineer. Surface ridges and irregularities shall be eliminated by rolling or other approved methods. The use of any equipment that leaves defects in the finished surface which cannot be eliminated, shall be discontinued.

When tested longitudinally, parallel to the surface, the surface shall not vary more than the following:

<u>Length of Section</u>	<u>Leveling or First Course</u>	<u>Second or Surface Course</u>
10 feet	1/4 inch	1/8 inch
25 feet	3/8 inch	1/4 inch
50 feet	1/2 inch	3/8 inch

Any variation from specified tolerance shall be corrected, at the expense of the Contractor, in a manner satisfactory to the Project Engineer.

The average thickness of the completed surface course shall be reasonably close to that shown on the typical sections. Acceptance of the completed surface course with respect to thickness shall be on the basis of test areas selected by the Engineer, not to exceed 50,000 square feet in size. Depth analysis may be made by cores located in a random pattern, with not less than 4 cores in each test area. The test area shall be accepted when seventy-five (75) percent of the cores are not more than ½ inch greater nor 3/8 inch less than the specified thickness and when no core shows a deficient thickness of more than 3/4 inch.

Test areas that are not acceptable because of deficient thickness shall be brought into compliance by placing additional surface course as directed by the Engineer.

Test areas that are not acceptable because of excess thickness shall be corrected as directed by the Engineer. Removal of portions of the surface course, if required, shall be at the Contractor's expense, and the amount of material removed shall be deducted from pay quantities. If the Project Engineer permits an excess thickness of surface course to remain in place, the amount of material in excess of the tolerances specified will not be included in the pay quantities.

The thick tolerances established above shall not apply to those areas where additional thickness is required for leveling an existing surface.

- J. Miscellaneous Details of Construction: Construction of one course or lift upon another shall not proceed until the underlying course has completely cooled and set, unless otherwise approved by City.

Where the asphalt concrete is to be placed against a concrete or stone curb or gutter, or against a cold pavement joint, or against any metal surface such as manhole rings or valve boxes, a tack coat shall be applied in advance of the placing. The application shall be thin and uniform, care being exercised to avoid accumulation of asphalt in depressions or upon portions of the curb or gutter not requiring the application. The tack coat shall be in accordance with Section 3.14.

No traffic other than that necessary for construction purposes shall be allowed on any course of the pavement until the course has completely cooled and set.

- K. Weather and Seasonal Limitations: Bituminous surface course shall be placed only between April 15 and October 15 and when the air temperature in the shade and the roadbed temperature are above 50°F and rising. Bituminous surface course shall not be placed during rain, when the roadbed is wet, or during other adverse weather conditions, as determined by the Project Engineer or the City. Bituminous surface course placed after October 15 shall be placed only upon written authorization from the City and then only when a proper review has determined that it is in the best interest of the City and the public.

- L. Seal Coat: If a seal coat is required, it shall be placed in accordance with the requirements of Section 3.15.

- M. Shoulders: The shoulders shall be finished to the lines, grades, and cross-sections shown in the Approved Plans or Special Conditions.

3.12
BITUMINOUS PRIME COAT

3.12.1 General: This item shall consist of an application of liquid or emulsified asphalt to a prepared subgrade or untreated base course preparatory to placing a bituminous base or surface course. The prime coat shall be applied in conformity with the Approved Plans and these Specifications or as designated by the City.

3.12.2 Bituminous Material: Bituminous material shall be MC 70 and shall conform to the requirements of Section 3.11.

The grade may be changed one step by the City Engineer.

3.12.3 Blotter Material: Blotter material, when required, shall consist of granular material that meets the following gradation requirements, when tested in accordance with AASHTO T-27:

<u>Sieve Size</u>	<u>Percentage Passing Sieves</u>
No. 4	90-100
No. 10	25-80
No. 200	0-15

3.12.4 Surface Preparation: If the surface to be primed contains an appreciable amount of loose material or is excessively dusty, it shall be wetted, bladed and rolled as approved by the Project Engineer, to make the surface satisfactorily tight. Priming shall not be started until all free surface moisture has disappeared.

3.12.5 Application of Bituminous Material: The bituminous material shall be sprayed over the prepared surface by means of a pressure distributor. The rate of application shall be approved by the Project Engineer.

The temperature range of the bituminous material at the time of application shall be such that the viscosity will be between 50 and 100 centistokes, as determined in accordance with ASTM D-2170. The exact temperature range shall be approved by the Project Engineer.

Where a surface is overprimed, resulting in a film of free liquid asphalt, it shall be blotted by spreading a light, uniform layer of blotter material applied at a rate approved by the Project Engineer.

Blotter material shall be applied by means of an approved mechanical spreader, capable of depositing a uniform layer of blotter material applied at a rate approved by the Project Engineer. An underprimed surface shall immediately receive another application of bituminous material.

3.12.6 Protection of Structures: During the application of bituminous material, all structures shall be protected from being spattered or marred by covering with building paper or other suitable materials. If any spattering or marring should occur, the condition shall be corrected at the expense of the Contractor.

Bituminous material shall not be discharged into borrow pits or gutters.

3.12.7 Opening to Traffic and Maintenance: If a roadway has been open to traffic at any time, its closure for application of prime coat must be coordinated with the City 48 hours in advance. After the prime coat has been applied, it shall be left undisturbed for at least 4 hours. If after this time the surface is tacky or tends to pick up under traffic, the excess bituminous material shall be blotted with blotter material, before the surface is opened to any kind of traffic. The Contractor shall maintain the primed surface until the next course is placed. Maintenance shall include spreading any necessary additional blotter material, replacing all portions of prime coat that have been destroyed, and patching any breaks in the primed surface. Any primed area that has become fouled by traffic, or otherwise, shall be cleaned before the next course is placed.

Under no circumstances should traffic be permitted to travel over freshly primed surface. If detours cannot be provided, the Contractor shall restrict his operation to a width that will permit at least one-way traffic over the remaining portion of the roadbed. If one-way traffic is provided, the traffic shall be controlled by flagging or pilot car operation.

3.12.8 Weather and Limitations: Prime coat and tack coat shall be applied only when the air temperature in the shade is above 50°F and the roadbed temperature is above 50°F. Prime coat and tack coat shall not be applied during rain, fog, or other adverse weather conditions.

The temperature restrictions may only be waived upon written authorization by the City.

3.13 BITUMINOUS TACK COAT

3.13.1 General: This item shall consist of an application of liquid asphalt or emulsified asphalt to an existing surface applied in conformity with the Approved Plans and these Specifications or as directed by the City.

3.13.2 Materials: Bituminous material shall be RC 70 and shall conform to the requirements of Section 3.11.

3.13.3 Application of Bituminous Material: Prior to applying the material, the surface to be treated shall be swept or flushed free of dust or other foreign material. The material shall then be sprayed over the prepared surface by means of a pressure distributor at the rate approved by the Engineer.

The temperature range of the bituminous material at the time of application shall be such that the viscosity will be between 50 and 100 centistokes, as determined in accordance with ASTM Designation D-2170. The exact temperature range shall be approved by the Project Engineer.

3.13.4 Protection of Structures: Structures shall be protected as provided in Subsection 3.13.6.

3.13.5 Opening to Traffic: Under no circumstances shall traffic be permitted to travel over the tacked surface until the bituminous material has cured so as to not be picked up by traffic. If detours cannot be provided, the Contractor shall restrict his operation to a width that will permit at least one-way traffic over the remaining portion of the road. If one-way traffic is provided the traffic shall be controlled by flagging or pilot car operation.

3.13.6 Weather Limitations: The application of tack coat shall be subject to the conditions outlined in Subsection 3.12.8.

**3.14
BITUMINOUS SEAL COAT**

3.14.1 General: This item shall consist of applying a coat of liquid asphalt to an existing surface course. Within 6 months to 18 months after the road is paved with asphalt, the Contractor shall have a “chip and seal” coat applied to the asphalted road. The “chip and seal” coat will be applied within the 6 to 18 months at a date agreed upon with the City Manager.

3.14.2 Bituminous Material: The contractor shall be responsible to furnish and place the required asphalt emulsion at a uniform rate and application coverage of 0.41 ± 0.03 gallons per square yard or as directed by the City's project representative. The emulsion shall be CRS-2 with a LMCRS2A rubber additive as approved by the City Engineer.

3.14.3 Cover Material: Cover material shall consist of clean, hard, tough, durable, and sound fragments of broken stone' crushed gravel, or crushed lag conforming to the following requirements:

- A. The dry mineral aggregate shall be uniformly graded with one of the gradation limits specified below, as is called for in the bid proposal, when tested in accordance with AASHTO T-27.

Sieve Size	% Passing
1/2"	100
3/8"	90-100
No. 4	10-25
No. 8	0-10
No. 16	0-6
No. 50	0-4
No. 200	0-2

Acceptance of cover material with respect to gradation shall be based on the average gradation of 5 samples taken from a test lot of 500 tons. The samples shall be obtained from the stockpile prior to use. A test lot shall be accepted when the average gradation of the 5 samples is within the specified gradation band and when the number of individual samples in each test lot outside the gradation band does not exceed 2 and when they are not outside the band by more than 2 percentage points on any one sieve.

The total amount of material passing the No. 200 sieve shall be determined by washing with water in accordance with AASHTO T-11.

- B. That portion of the aggregate retained on the No. 4 sieve shall have not less than 90 percent, by weight, of particles with at least two mechanically fractured, or clean angular faces, when tested in accordance with the Utah State Department of Transportation Test Procedure 8-929.
- C. The aggregate shall have a percentage of wear not exceeding 30, when tested in accordance with AASHTO T-96.

- D. The crushed mineral aggregate shall have a weighted percent of loss not exceeding 10 percent by weight, when subjected to five cycles of sodium sulfate and tested in accordance with AASHTO T-104.
- E. The aggregate shall be of such nature that when the particles are thoroughly coated with the bituminous material specified for the project, not less than 90 percent of the coating shall be retained, when tested in accordance with Utah State Department of Transportation Test Procedure 8-945.

3.14.4 Construction Methods:

- A. *Bituminous Additive:* Bituminous additive may be used to improve the coatability of the aggregate. The amount and type of additive to be used shall be approved by the Project Engineer.
- B. *Surface Preparation:* Seal coat operations shall not be started until the surface to be sealed has been thoroughly compacted by traffic. In no event shall seal coat be placed on newly constructed bituminous surfaces within 7 days after such surfaces are laid.

Prior to placing the seal coat, the existing surface shall be cleaned of all dirt, sand, dust, or other objectionable material.

- C. *Application:* The material shall be sprayed over the prepared surface by means of a pressure distributor. The material shall be applied in such a manner that an inspection of the spread can be made and any defects corrected before the cover material is applied. The rate of application shall be approved by the Project Engineer. Application of bituminous material shall not be more than 1000 feet in advance of the placing of cover material.

Joints between applications shall be made by starting and stopping the distributor on building paper. Valve action shall be instantaneous, both in starting and cutoff. The distributor shall attain the proper application speed at the time the spray bar is opened.

The temperature range of the bituminous material at the time of application shall be such that the viscosity will be between 50 and 100 centistokes, as determined in accordance with ASTM D-2170. The exact temperature range shall be approved by the Project Engineer.

- D. *Spreading and Compacting of Cover Material:* Prior to the placing of the cover material, the contractor shall perform a test of the spreading equipment at a location approved by the City. The test shall determine the exact rate of application of the emulsion and cover material and to calibrate the contractors equipment.

The cover material shall be spread immediately after applying the bituminous material by means of an approved spreader which can be adjusted to uniformly spread the required amount of aggregate. Provisions shall be made so that the larger particles will be deposited first. The rate of cover material application, shall be 22 pounds per square yard, or as directed by the City Engineer. Immediately after spreading, the cover material shall be hand broomed, if necessary, to distribute the aggregate uniformly over the surface.

After the cover material has been satisfactorily spread, the surface shall be rolled by pneumatic-tired rollers in a longitudinal direction with a minimum 12 ton pneumatic-tired

rollers. Rolling performed with pneumatic-tire rollers shall adequately seat the cover material and shall consist of at least two complete coverages. Rolling shall be complete the same day the bituminous material and cover material are applied.

On completion of final rolling, traffic shall be permitted to travel over the seal coat.

- E. *Protection of Structures:* Structures shall be protected as provided in Subsection 3.12.6.
- F. *Opening to Traffic:* On completion of final rolling, traffic shall be permitted to travel over the seal coat. Traffic shall be controlled as directed by flagging and pilot car operation.
- G. *Weather Limitations:* Seal coat shall be applied only between June 1 and September 15 and when the air temperature in the shade and the roadbed temperature are above 70° F. Seal coat shall not be applied during rain, fog, or other adverse weather conditions. Seal coat placed after September 15 shall be placed only upon written authorization from the Engineer, and then only when the air temperature in the shade and the roadbed temperature are above 70° F.

The temperature restrictions may only be waived upon written authorization from the City Engineer.

- H. *Supplemental Cover Material:* Cover material shall be stockpiled at the designated places in such quantities as contained in the bid proposal or as the Project Engineer may direct. Prior to stockpiling, the selected sites shall be cleared and leveled.

3.14.5 Flushed Coat Sealing (Fog Seal Coat): Following the application of the bituminous seal coat (chip seal), all areas shall receive a flushed seal coat preferably seven days following the application of the cover material, or as directed by the City Engineer. The sealing shall be done when the ambient temperatures are as recommended by the manufacturer. The flushed coat seal shall conform to the following requirements:

- A. *Materials:*
 - 1. Use one of the following emulsions as agreed upon by the City Engineer. The product shall be diluted two parts concentrates to one part water by the supplier or manufacturer before being delivered to the project.
 - (a) CSS-1
 - (b) CSS-1H
 - (c) SS-1
 - (d) SS-1H
 - 2. All bleeding shall be blotted with sand by the Contractor. The Contractor shall provide suitable equipment to perform the sanding.
 - a. The quantity shown on the plans shall be on the project before spreading cover material.
 - b. Unused blotter material will be removed from the site, or if approved by the City Engineer, left on the site.
- B. *Source Quality Control:* Test mix design in accordance with AIMS-2.

- C. *Preparation:* Clean the surface of all dirt, sand, dust, loose chips, and other objectionable material to the satisfaction of the City Engineer.

- D. *Bituminous Flush Coat Application:*
 - 1. Apply the bituminous flush coat at a rate of 0.12 gal/1.0 s.y., or at a rate directed by the City Engineer. Keep traffic off the flushed surface until the bituminous material has set sufficiently to prevent cracking or pickup.
 - 2. Project vendors bill of lading certifying the material was diluted in accordance to line A of the Materials portion of this specification. The City may sample and test this material for specification compliance.

**3.15
PLANT MIX BITUMINOUS SEAL COAT**

3.15.1 Description: This item shall consist of a mixture of mineral aggregate and bituminous binder, mixed at a central mixing plant, spread and compacted on a prepared surface in reasonably close conformance with the lines, grades and dimensions shown on the Approved Plans and typical sections and in accordance with these Specifications.

3.15.2 Materials:

- A. Bituminous Material: Bituminous material shall be of the type called for in the Approved Plan. The grade specified on the Plan may be changed one step by the Project Engineer. The percentage of bituminous material used shall be approved by the Project Engineer.
- B. Mineral Aggregate:
 - 1. The dry mineral aggregate shall meet one of the gradations shown below when tested in accordance with AASHTO Designation T-30. The gradation to be used shall be designated in the Proposal.

At least ten working days prior to producing plant mix bituminous seal coat, the Contractor shall submit in writing a job-mix gradation to the Engineer for his approval. The job-mix gradation shall have definite single values for the percentage of aggregate passing each specified sieve based on the dry weight of the aggregate. The job-mix gradation shall meet the ideal gradation with the tolerances shown below:

Sieve Size	Type A Ideal Gradation (% passing)	Gradation Tolerance
1/2"	100	0
3/8'	97	±2
No. 4	40	±4
No. 8	17	±3
No. 16	12	±2
No. 50	8	±2
No. 200	3	±1

<u>Type B</u>		
Sieve Size	Ideal Gradation (% passing)	Gradation Tolerance
1/2"	100	0
3/8'	97	±2
No. 4	40	±4
No. 8	17	±3
No. 16	21	±3
No. 50	13	±2
No. 200	4	±1

The total amount of material passing the No. 22 Sieve shall be determined by washing with water in accordance with AASHTO T-11.

Changes in the job-mix gradation may be made prior to a day's production, subject to approval by the Project Engineer who, before use, will make any necessary adjustments in the amount of bituminous material to be used. The request for changes shall be in writing and shall give the Project Engineer sufficient notice to review and approve his mix design. For major changes in the job-mix gradation, at least two working days notice shall be required.

Acceptance of the aggregate with respect to gradation shall be based on the average of the deviations from the job-mix gradation of the samples taken from a lot. A lot shall equal the number of tons of bituminous mix placed each production day. When the daily production exceeds 2,500 tons, a minimum of 5 samples shall be required. When it is between 1,500 and 2,500 tons, a minimum of 4 samples shall be required. When it is less than 1,500 tons, a minimum of 3 samples shall be required. In the event the minimum number of samples required cannot be obtained, the test lot may be evaluated on the basis of fewer samples. The samples shall be taken on a random basis from the bituminous mix after it has been discharged into hauling units. In addition, the samples shall be distributed as uniformly as possible in time throughout the test lot so as to be representative of the material being produced during the entire production day. A lot will be accepted when the average gradation of the 5 samples is within the specified gradation band and when the number of individual samples in each test lot outside the band does not exceed 2 and when they are not outside the gradation band by more than 2 percentage points on any one sieve.

The Contractor shall take steps to bring the plant mix bituminous seal coat into Specifications when the test results show a deviation from the job-mix formula that exceeds the maximum deviation allowed.

2. That portion of the aggregate retained on the No. 4 sieve shall have not less than 90 % of particles with at least one fractured face, or clear angular face, when tested in accordance with UDOT Test Procedure 8-929.

3. The aggregate shall have a percentage of wear not exceeding 30 when tested in accordance with AASHTO T-96.
4. The crushed mineral aggregate shall have a weighted percent of less not exceeding 12% by weight when subjected to 5 cycles of sodium surface and tested in accordance with AASHTO T-104.
5. The aggregate shall be of such nature that when thoroughly coated with the bituminous material specified for the project not less than 90% of the coating shall be retained when tested in accordance-with UDOT Test Procedure 8-945.
6. Before being fed to the drier, the aggregate shall be separated into two or more sizes and stored separately. If two or three sizes are used, the aggregate shall be separated on screens of such size that the quantity drawn from each storage is approximately equal.

The aggregate shall be fed to the drier at a uniform rate. The rate of feed shall be maintained within 10% of the amount set by the Contractor for his operation.

In placing the aggregate in storage or in moving from storage to the cold feed bins, any method which causes segregation, degradation, or the combining of materials of different gradings shall not be permitted. Any segregated or degraded material shall be rescreened or wasted.

Plant mix operations shall not commence until sufficient material for at least two days production has been separated and stockpiled.

7. The plant mix bituminous seal coat material shall have a co-efficient of thermal expansion of less than ½ inch per 100 feet when tested by the UDOT testing procedure. This requirement shall be used to determine the suitability of the aggregate source and shall not be used for routing project control. The materials and Research Section or District One Materials and Test Unit may be contacted for information regarding this test method and specification.
- C. Bituminous Additive: Bituminous additive may be used to improve the coatability of the aggregate. The type and percent of super-concentrated additive to be used shall be approved by the Project Engineer. Bituminous additive shall conform to the requirements of Section 407 of the UDOT Standard Specifications for Road and Bridge Construction.

3.15.3 Construction Methods:

- A. Temperature Control: The viscosity of the asphalt being used in the plant mix bituminous seal coat shall be between 400 and 900 centistokes at the time of mixing as determined in accordance with ASTM D-2170 of the UDOT Standard Specifications for Road and Bridge Construction. The exact temperature range shall be approved by the Project Engineer to be used for the asphalt, aggregate, mixing and laydown after notification as to asphalt source.

If a dryer-drum mixing process is used, the temperature of the bituminous mixture at discharge from the mixer shall be not less than 230°F. nor more than 260°F. Unless otherwise approved by City, the plant mix bituminous seal coat must be covered with a tarpaulin and

delivered to the site before its temperature drops below 200 °F. It is necessary to complete compaction of the bituminous mixture before the temperature of the mixture drops below 180°F. unless otherwise approved by City. If the source of asphalt is changed during the course of work, a new mix design shall be made. In no case shall the asphalt from two different sources be intermixed.

- B. **Mixing:** Mixing shall be performed as specified in Standard Specifications for Road and Bridge Construction, except that the mineral aggregate shall be considered satisfactorily coated with bitumen when all particles are coated.
- C. **Tack Coat:** The placing of the tack coat shall be in accordance with Section 404 of the UDOT Standard Specifications for Road and Bridge Construction.
- D. **Spreading and Compacting:** The bituminous seal coat mixture shall be laid with self-propelled mechanical spreading and finishing equipment capable of laying at least a 12-foot width. The mixture shall be laid in one pass to the elevations, grades, and cross-sections shown on the Approved Plans.

Whenever asphalt slicks appear on the surface of the newly laid seal coat, they shall be raked immediately. Raking will usually cause the excessive asphalt to flow to the bottom of the mat. If a slick spot cannot be removed by raking, it shall be taken out and replaced by material which contains less asphalt. This replacement material shall be raked to conform to the contour of the seal coat. Asphalt slicks which appear after rolling has been completed shall be covered with a light course of fine sand. The slick spots shall then be rolled again.

The seal coat shall be rolled in a longitudinal direction, commencing at the outside edge or lower side and proceeding toward the higher side. Rolling shall be accomplished with a flat-wheel steel roller weighing not more than 10 tons. Each pass of the roller shall overlap the preceding pass by at least one-half the width of the roller. Rolling shall be confined to the amount necessary to consolidate the seal coat and bond it to the underlying surface course. Excessive rolling shall be avoided.

Longitudinal joints shall be located within 6 inches of what will be a traffic lane-line location.

The completed seal coat shall be protected from all traffic until it has hardened and set up sufficiently to resist abrasion as determined by the Project Engineer.

Acceptance of the completed plant mix seal coat with respect to thickness shall be based on the average thickness of the test lot. A test lot shall equal the number of tons of bituminous mix placed each production day. A lot shall be divided into sublots of approximately 3,200 square yards. A minimum of one thickness test, randomly selected by use of a random number table, shall be taken within each subplot. A lot shall be accepted when the average thickness of all sublots is not more than 1/4-inch greater nor 3/8-inch less than the total designated plant mix seal coat thickness.

Lots or sublots that are not acceptable because of deficient thickness shall be brought into compliance by placing a minimum of 3/4-inch additional plant mix seal coat to roadway or lane width at the Contractor's expense. Tapers shall be required on each end of the additional

layer of plant mix seal coat. Tapers shall be constructed to the satisfaction of the Project Engineer.

In lots or sublots where the thickness exceeds the specified tolerance, 50% of the amount of material in excess of the specified tolerances shall be included in the pay quantities.

The Project Engineer will periodically check the depth of the plant mix bituminous seal coat with use of a depth probe. The Engineer, via his Inspector, will inform the Contractor or his laydown foreman/superintendent of any variance from the specified depth which exceeds 1/4-inch as soon as it is discovered. The Contractor will take immediate action to insure the plant mix bituminous seal coat thickness is adjusted to that specified on the Approved Plans.

Should the Project Engineer discover the depth of plant mix bituminous seal coat is less than 5/8-inch, he will direct the Contractor to take corrective action to add more material to the deficient area to produce the specified depth.

If the Contractor elects to overlay while the mat temperature is above 180°F. the total mat thickness must be at least that specified on the Approved Plans. Corrections made after the mat has cooled to below 180°F. require an overlay of at least 3/4-inch.

- E. Weather and Seasonal Limitations: Weather and seasonal limitations shall conform to Section 3.11.3K.

