Standard Specifications

and

Standard Details

for construction of

Public Improvements

in

Rolla, Missouri

Prepared by

Rolla Public Works Department

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TECHNICAL SPECIFICATIONS

2101 CLEARING, GRUBBING AND DEMOLITION

2101.1 SCOPE

This section governs the furnishing of all labor, tools, and materials, and the performance of all work for clearing, grubbing, and demolition wholly, or in any part or location shown on the plans, as provided for in Special Provisions.

2101.2 MATERIALS, DEFINITIONS AND EQUIPMENT

A. CLEARING

Clearing shall consist of removing all vegetation, such as trees, brush, down timber, rotten wood, rubbish, and other objectionable combustible materials found on or above the surface of the site. It shall include removing wood buildings, fences, lumber, waste dumps, and trash, and the salvaging of such materials as may be specified, and disposing of the debris.

B. GRUBBING

Grubbing shall consist of removing all stumps, roots, buried trees and brush, wood piling, wood curb planking, wood culverts, wood catch basins and drains, and wood stains appearing on or below the surface of the ground which has not been included in Section 2102.2A entitled "Clearing".

C. DEMOLITION

Demolition shall consist of demolishing and removing or incorporating into embankment all non-vegetable matter appearing above, on, or below the ground surface. This shall include all material derived from demolition of portland cement concrete items such as base courses, curbs, curb and gutters, sidewalks, floors, steps, such as foundations or walls of any sort, and iron or steel items; and shall include all asphaltic items such as pavement and base courses.

2101.3 CONSTRUCTION DETAILS - LIMITS OF WORKS

A. IN DEVELOPED AREAS

In developed and semi-developed areas where streets exist, the limits for clearing, grubbing, and demolition shall extend to the limits of the right-of-way, Owner property lines, or easement unless otherwise indicated on the plans or covered in the special provisions.

B. PROTECTION OF EXISTING FACILITIES

The Contractor shall be responsible for protecting any improvement of any agency, public or private, in the vicinity of clearing, grubbing or demolition operations. When necessary the contractor shall enlist the assistance of the affected agencies in the locations of their utilities. The Contractor will not be responsible for the cost to any agency for assistance in the location of its facilities, but shall be responsible for the cost of all damage to such facilities arising because of carelessness or negligence.

2101.4 PROGRESS OF CLEARING

Clearing shall be carried well in advance of the construction operation so as not to delay the progress of the work. The refuse resulting from clearing may be hauled to a waste site secured by

the Contractor or shall be burned or buried in such a manner as to meet all requirements of the State, County and Municipal regulations regarding health, safety, and public welfare. When authorized by the Fire Department the Contractor may dispose of such refuse by burying on the site of the project provided all requirements set forth by the Fire Chief are met. In all cases, the authorization to burn on the site shall not relieve the Contractor in any way from damages which may result from his operations. In no case shall any materials be left on the project site, shoved onto abutting properties, or be buried in embankments or trenches on the site.

2101.5 **PROTECTION OF TREES AND SHRUBS**

The Contractor shall leave in place and protect from damage during his operations all trees, shrubbery and flower beds designated by the Public Works Director. Where trees existing on the project site are not to be removed, it shall be the Contractor's responsibility to trim low limbs which will interfere with the normal operation of his equipment. The trimming shall be performed in a professional manner, prior to his machine operation as ordered by the Public Works Director.

2101.6 **PROGRESS OF GRUBBING**

Grubbing shall be kept abreast the "Clearing" as nearly as the sequence of operations will permit. Except as specified below, all stumps, roots, and other objectionable matter within the construction area shall be removed to a depth of at least twelve (12) inches below the sub-grade or the original ground whichever is lower. All stumps, roots, and other objectionable matter within the right-of-way but outside the limits of the construction area shall be cut off flush with the ground.

2101.7 **SHALLOW EMBANKMENT AREAS**

Within the specified limits of embankments which are two (2) feet or less in depth, all stumps, roots, and planking of all sorts shall be removed and disposed of. Piling and butts of utility poles within the limits shall be removed to a minimum depth of two (2) feet below the sub-grade or the original ground, whichever is lower.

2101.8 **EXCAVATION AREA**

All stumps, roots, and other objectionable matter found within the side walls or bottoms of excavations and trenching areas shall be removed to a depth of not less than twelve (12) inches below the respective sidewalls, and completely removed from the respective bottom areas.

2101.9 **BORROW AREAS**

All stumps, roots, and other objectionable matter shall be removed from the borrow material which is to be used for embankment or fill material.

2102.10 **PROGRESS OF DEMOLITION**

Demolition work shall be carried on well in advance of the construction operation. Miscellaneous foundations, masonry and concrete walls of all sorts, or other objects extending below ground shall be removed to a minimum depth of twelve (12) inches below sub-grade or the original ground, whichever is lower.

The demolition of existing asphaltic concrete and base course shall be carried out as to minimize the period of time existing streets will be closed to traffic. The scheduling of this demolition shall be approved by the Public Works Director prior to demolitions operations.

In removing items such as portland cement, concrete, asphalt, concrete pavement, base courses, curbs, curb and gutters, gutters, or sidewalks, floors, and similar objects where portions of these objects are to be left in place they shall be removed to an existing joint or to a new joint sawed to a

minimum depth of one (1) inch with a true line and vertical face. Sufficient portions of such objects shall be removed to provide for the proper grade and connection to the new work.

When explosives are used in demolition, the Contractor shall use the utmost care to prevent injury to persons and property, and shall meet all requirements of the Owner for handling explosives.

2101.11 **BACKFILLING THE SITE**

The trenches, holes, and pits other than basement areas resulting from the operations of clearing, grubbing and demolition on the site shall be backfilled with suitable material, placed and compacted as specified in Section 2102 entitled "Grading". Backfilling of basement areas is included under Section 2102.5 entitled "Embankment-Grading".

2102 GRADING

2102.1 SCOPE

This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work required for grading the project in coordination with all previous work performed, or the locations shown on the plans, in accordance with the requirements of applicable sections as provided for in the Special Provisions.

2102.2 MATERIALS AND DEFINITION

A. GRADING

Grading as used herein shall be construed to mean the performance of all excavation, embankment, and backfill in connection with the construction of all improvements.

B. EXCAVATION

Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.

1. UNCLASSIFIED EXCAVATION

Unclassified excavation is defined as the removal of all material encountered regardless of its nature.

C. EMBANKMENT

Embankment is defined as the placing and compacting of material in the construction area to the lines and grades shown on the plans.

D. SUITABLE EMBANKMENT MATERIAL

Material suitable for use as embankment materials shall be entirely imperishable and shall be judged acceptable by the Public Works Director on the site. It is recommended that the portion of such material passing the No. 40 sieve has a liquid limit not exceeding forty (40) and a plastic index not exceeding twenty-five (25).

1. EARTH MATERIALS

Materials suitable for earth embankment shall be free of waste material, contain less than ten (10) percent by volume of rock and gravel, and contain no particles having a maximum dimension greater than three (3) inches.

E. UNSUITABLE OR WASTE MATERIAL

Material not suitable for use as embankment material shall include excess excavation material and waste material including mulch, frozen material, organic material, topsoil, rubbish and rock larger than twenty-four (24) inches, maximum dimension.

F. STRUCTURES

Structures as used herein refers to bridges, culverts, basins, street drainage structures, headwalls, retaining walls, and similar construction.

2102.3 CONSTRUCTION DETAILS - GENERAL

The Contractor shall be notified of the location of all existing utilities and facilities as shown on the plans, or as confirmed as a result of a preconstruction conference attended by contractor representatives, public utility organization, and other interested persons and concerns. Having been so notified, the Contractor shall be responsible for the protection and preservations of such utilities and facilities.

Grading, excavation and backfilling for roadways, roadway intersections, sidewalks, shoulders, parking areas, airports, playgrounds, or other such improvements shall be made to the lines, grades, and cross-sections shown on the plans. During construction, the areas shall be maintained in such condition that it will be well drained at all times.

Waste materials including organic material, trees, stumps, rubbish, and debris shall be removed from the site and disposed of as an incidental part of the grading work.

2102.4 EXCAVATION - GRADING

This section covers all work in landscaping roads and streets, runways, parking areas, playgrounds and other improvements.

All suitable material removed by excavation shall be used as far as practicable in the formation of embankments as required to complete the work. The contractor shall sort all excavated material and stockpile when necessary, so as to provide suitable materials for embankments. The cost involved in sorting, stockpiling or wasting of such material shall be included in the cost for embankment.

Excavated material in excess of the amount needed to complete the grading shall be considered as waste material which shall be removed from the site, except that when and as permitted by the Public Works Director a portion of the waste which is suitable for embankment may be disposed of at the site by equitable distribution of the material to specified areas within the project limits. The disposition of all waste material shall be considered as incidental to the performance of grading work.

In areas at the point of transition from cut to embankment, the excavation shall be made to the depth and extent shown, or as provided for the Special Provisions. Excavations shall be well drained at all times.

2102.5 EMBANKMENT - GRADING

This section covers all embankment work in landscaping, roads and streets, runways, parking areas, playgrounds and other similar improvements.

The embankments shall be formed with suitable materials, as herein defined, procured from excavations made on the project site, or from borrow pits as required to complete the grading work.

A. PLACING EARTH EMBANKMENT

Earth shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed nine (9) inches in thickness (loose state) and shall be compacted to not less than the required density before the next layer is placed thereon. As the compaction of each layer progresses, continuous grading will be required to level the surface and to insure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen or a blanket of snow prevents proper compaction.

2102.6 EXCAVATION UNDER-GRADE

Where by virtue of changed conditions, materials are encouraged below grade which are deemed unsatisfactory by the Public Works Director for use in the work, they shall be removed to the lines and grades he may order. When the resulting space underlays a specified embankment section, it shall be filled with the same material specified for the embankment. When the resulting space is made in an excavation section, under a roadway it shall be backfilled with crushed stone of the size and gradation ordered by the Public Works Director.

2102.7 **FINISHING**

Finishing shall be started when the construction has progressed sufficiently to permit the finishing operation to be continuous. The entire project area shall be left in a finished and neat appearance and condition.

The graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish, and shall be finished to the lines, grades, and cross-section shown on the plans, including shoulder, berm and sidewalk spaces.

The Contractor shall repair any damaged surface, and shall not use any finishing equipment that will leave a marred surface.

The sub-grade preparation is included as part of the finishing, the work shall be performed according to the requirements of Section 2201 entitled "Sub-Grade Preparation", and shall be considered incidental to the completion of the grading work.

2102.8 **CLEANUP**

Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The Contractor shall remove from the site of the work all equipment, tools, and discarded materials, and other construction items. The entire right-of-way or easement shall be left in a finished and neat condition. Cleanup shall be considered as incidental to the completion of the grading work.

2102.9 **MEASUREMENT**

Grading is a lump sum bid item. No measurement will be made to determine the amount of work governed by this section.

2201 SUB-GRADE PREPARATION

2201.1 SCOPE

This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work for the sub-grade preparation, complete, at locations shown which have been previously graded in accordance with the requirements of Section 2102 entitled "Grading", preparatory to constructing pavements for streets, alleys, runways, parking, or sidewalks, and the construction of curb, curb and gutters, as provided for in this Special Provisions.

This section does not include the construction of any base courses.

2201.2 MATERIALS, DEFINITIONS AND EQUIPMENT

A. SUB-GRADE

Sub-grade is defined as a well graded and compacted surface, constructed as specified herein to the grades, lines, and cross-section shown, graded and compacted to the specified density, preparatory to constructing pavements, or other improvements thereon.

B. SUB-GRADE PREPARATION

Sub-grade preparation is the repeated operation of fine-grading and compacting the sub-grade until the specified lines, grades, and cross-section are obtained, and the materials are compacted to the specified depth and density.

C. EQUIPMENT

The sub-grade preparation shall be completed by the use of motor graders, steel wheel rollers or other approved method as furnished by the Contractor.

2201.3 CONSTRUCTION DETAILS

A. GENERAL

All underground work contemplated, including clearing, grubbing and demolition, shall be completed in accordance with the requirement of Section 2102 entitled "Grading", prior to commencing any sub-grade work.

The sub-grade surface shall be brought to the specified lines, grades, and cross-section by repeatedly adding or removing material and compacting to the specified density with a suitable roller to perform these operations. Tolerance allowed on all lines, grades, and cross-sections shall be plus or minus 0.05 foot.

B. COMPACTING THE SUB-GRADE FOR PAVEMENTS

The sub-grade for pavements, except sidewalk pavement, shall be compacted to a density of at least ninety-five (95) percent of the maximum density for the material used as determined by ASTM Designation D-698 for a depth of at least six (6) inches below the finished sub-grade elevation, and within the tolerance of the moisture for the type of material at ninety-five (95) percent of maximum density as shown on the moisture-density curve obtained. Any further compacted layers shall be accomplished in the same manner as specified. After density is achieved the subgrade shall tested for stability by proof rolling with a loaded truck to ensure that the subgrade is stable. Any unstable areas must be removed and replaced with suitable material. The unstable areas must pass density and stability testing prior to approval.

C. **COMPACTING THE DISTURBED SUB-GRADE FOR SIDEWALKS**

The sub-grade for sidewalk pavements shall be compacted to a density equivalent to the density of the immediately surrounding undisturbed soil for the material used determined by ASTM Designation D-698 for a depth of at lest six (6) inches.

D. **PROTECTION AND MAINTENANCE OF SUB-GRADE**

The newly finished sub-grade shall be repaired from action of the elements. Any settlement or washing that occurs prior to the acceptance of the work shall be repaired and the specific lines, grades, and cross-section re-established.

Then Contractor shall protect all pavements, curbs, curb and gutters, gutters, and sidewalks from his sub-grade operation with an earth cushion, timber planking, or both where tractors, grades, rollers, or other equipment are required to pass, or turn around. All resulting damages shall be repaired. Any damaged work which cannot be repaired to the satisfaction of the Public Works Director, shall be replaced by the Contractor at his own expense.

E. **TESTING**

All testing procedures shall be paid by the Owner but scheduled by Contractor.

2201.4 **CLEANUP**

Cleanup shall follow the work progressively. Final cleanup shall follow immediately behind the completion of the sub-grade. The Contractor shall remove from the project site all rubbish, equipment, tools, and surplus or discarded material, and temporary construction items. Debris from cleanup shall be removed from the project site.

2201.5 **MEASUREMENT**

No measurement will be made to determine the amount of sub-grade preparation as governed by this section.

2202 UNTREATED COMPACTED AGGREGATE

2202.1 SCOPE

This section covers the materials for the construction of the specified base course.

2202.2 MATERIAL

The base course material shall consist of crushed stone aggregate free from lumps or balls of clay and other soft and objectionable material. The abrasion loss shall be no more than 40% when subjected to 500 revolutions in a Los Angeles abrasion machine as determined by ASTM designation C-131. That fraction passing the one inch screen and retained on the No. 4 screen will have a loss not greater than 15% by weighted average at 5 cycles at ASTM Standard C-88 soundness test. The specific gravity shall not be less than 2.54 (S.S.D. Bulk). That fraction of the material passing the one inch screen and retained on the No. 4 screen shall contain less than 20% by weight of flat and elongated particles (flat being a ratio of 1/3 between thickness and least width). The material shall consist of angular particles with not less than 90% of particle count having two or more fractured surfaces. The gradation in percentages by weight passing square mesh screens shall be as follows:

Type 4 aggregate for base shall consist of a uniform mixture of washed sand and gravel, crushed stone, or chat. Aggregates shall consist of sound durable particles. When tested in accordance with AASHTO T 96, the percentage of wear shall not exceed 55. The percentage of deleterious substances shall not exceed the following values and the sum of these percentages shall not exceed eight percent.

Percent by Weight

Deleterious Rock	8.0
Shale and Mudballs	4.0

The material shall at all times during loading, hauling, and placing, contain sufficient moisture to prevent segregation and to aid in obtaining compaction.

Washed sand and gravel mixture shall meet the following gradation requirements:

Passing 1-inch sieve	100 percent
Passing 1/2 inch sieve	55-90 percent
Passing No. 10 sieve	25-50 percent
Passing No. 40 sieve	10-30 percent
Passing No. 100 sieve	0-10 percent
Passing No. 200 sieve	0-3 percent

2202.3 PLACEMENT

A. SUBGRADE

Prior to placement of base course material the previously prepared sub-grade shall be inspected and approved by the Public Works Director. The surface shall be cleared of all foreign substances and restored in shape, tolerance and density as specified in Section 2201 entitled "Sub-grade preparation".

B. MATERIAL PLACEMENT

Immediately in advance of spreading the mixture, the sub-grade shall be inspected and approved by the Public Works Director. After sprinkling the sub-grade, the mixture shall be uniformly spread by blades in successive layers of courses to such depth that when compacted, the base will have the minimum thickness specified or as otherwise directed by the Public Works Director. The Contractor may construct the base in any number of layers that he chooses except that in no case shall any individual layer have a compacted thickness of more than four (4) inches. Each layer shall be compacted as hereinafter specified before any succeeding layer is placed. The top one-half inch of the base may be constructed of material having a maximum size of one-half inch with 14 to 50 percent passing the No. 40 sieve and not more than 35 percent passing the No. 200 sieve. Compaction of such a top course shall be obtained by rolling with pneumatic-tired or flat wheeled rollers, or both, as may be required to obtain the specified density.

After spreading a layer of mixture, water in an amount sufficient to insure the desired compaction shall be added and uniformly mixed with the aggregate in a manner to prevent segregation. Excess moisture resulting in run-off shall be avoided. If, for any reason, the mixture or sub-grade becomes too wet to permit satisfactory work, they shall be allowed to dry to a moisture content which will permit satisfactory work.

The mixture shall meet the required specifications immediately before compaction operations are commenced. If, for any reason, segregation occurs in excess of 10 percent variation from the gradation required under the above paragraph "Material" or the material becomes contaminated, such segregation or contaminated materials shall be removed and replaced with suitable materials at the expense of the Contractor. The limited segregation of 10 percent variation will be ascertained by a sieve analysis made of a maximum of 100 pound sample taken from in-place base course. However, when crushed stone is used, segregated surface areas may be corrected by adding limestone screedings of such gradation and quantity as required to fill the surface voids and firmly bind the loose material in place. Screeding so used in correcting segregated surface areas will be measured and paid for as a part of the aggregate base material.

Compaction of aggregate base material shall be secured by rolling with pneumatic-tired, smooth-wheeled rollers or vibratory equipment is required. Shaping and compacting shall be carried on continuously until a true, even and uniform surface and proper grade and cross section is obtained, and until the density of the complete base is at least ninety-five (95) percent of maximum density as determined by the Tentative Methods of test for Moisture-Density Relations of Soils Using 5.5 lbs. Rammer and 12 inc. Drop (ASTM Designation D-698, Method D). The proper moisture content shall be maintained by wetting the surface as required during shaping and compacting operation. Final rolling shall be accomplished by use of a self-propelled smooth-wheeled roller weighing two (2) to five (5) tons.

All testing procedures as directed by the Public Works Director or his representative shall be the Contractor's responsibility.

2209 CONCRETE CURB AND GUTTER

2209.1 SCOPE

This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work necessary to construct curb and gutter, complete, including all necessary incidental work done in accordance with the applicable requirements of Sections 2102 and 2201 entitled "Grading" and "Sub-grade Preparation" at the locations shown on the plans, as provided for in the Special Provisions and by authorized Change Orders.

2209.2 MATERIALS, EQUIPMENT AND DEFINITIONS

A. CONCRETE MIX

The concrete used in the construction of curb and gutter shall be air-entrained with 4 to 6% air, 6 bag mix with 2 to 4 inch slump developing 4000 PSI 28 day strength. Aggregate gradation shall conform to ASTM 33 with 1-1/2 inch maximum size aggregate.

B. CALCIUM CHLORIDE

The use of Calcium Chloride in concrete mixtures will not be permitted.

2209.3 CONSTRUCTION DETAILS

The incidental work of clearing, grubbing, demolition, grading, and sub-grade preparation shall be carried well in advance of the construction herein specified.

The curb and gutter shall be constructed to the configuration and to the lines and grades shown on the plans. The curb and gutter section shall be placed prior to placement of pavement or sidewalk sections.

A. GRADING AND SUB-GRADE PREPARATION

All excavation required in the grading and sub-grade preparation shall be considered as "Unclassified Excavation" as defined in the section entitled "Grading and "Sub-grade Preparation".

B. FORMS

All forms shall be in good condition, with not more than one-fourth (1/4) inch variation in horizontal and vertical alignment for each ten (10) feet in length. The forms shall be set true to line and grade and shall be adequately supported to stay in position while depositing and consolidating the concrete. They shall be designed and constructed so as to permit their removal without damage to the concrete.

2209.4 JOINTS

The joints shall be formed at right angles to the alignment of the curb and gutter.

A. EXPANSION JOINTS

Expansion joints shall be formed by a one-half inch thick preformed joint filler, cut to the configuration of the full size of the curb and gutter section, so that they are not moved by depositing and compacting the concrete at these joints. The edges of these joints shall be rounded

with an edging tool of one-eighth inch radius. The joints do not require sealer when constructed as shown on the plans and shall be placed every 100 feet.

B. **CONTRACTION JOINTS**

Contraction joints shall be removed by a one-quarter inch thick template and cut to the configuration of the curb section. These templates shall be secured so they are not moved by depositing and compacting the concrete. Contraction joints shall placed every ten feet.

Unless otherwise shown on the plans, and as soon as the concrete has hardened sufficiently, the template shall be removed from all contraction joints. The edges of the joint shall be rounded with an edging tool of one-eighth inch radius.

2209.5 **CONCRETE WORK**

A. **FINISHING**

The curb shall be tooled to the required radius as soon as possible after the concrete takes its initial set. After the forms and templates are removed the joints shall be tooled and curb surface shall be finished with a broom to remove all imperfections without additional mortar and dryer. In all cases the resulting surface shall be smooth and of uniform color with all rough spots, projections and form stakes removed. No plastering of the concrete will be allowed. The finished curb shall have a true surface, free from sags, twists, or warps, and shall have a uniform appearance, and shall be true to the specified lines, grades, and configurations shown on the plans.

B. **CURING**

Exposed surfaces of concrete shall be protected from premature drying caused by the hot sun, drying winds, or other causes. Freshly placed concrete shall be protected from damage from rain. The concrete shall be kept continuously wet for a period of not less than five days after pouring. Curing compounds or other methods of curing may be considered by the Public Works Director.

If concrete is placed while the air temperature is less than 40 degrees F. or when freezing is probable within 48 hours, all sand, aggregate, and water shall be heated, and the concrete, when being placed, shall have a temperature of not less than 50 degrees nor more than 100 degrees F. Care must be taken to prevent too rapid drying of the concrete when it is heated. During freezing weather suitable means shall be provided for maintaining the temperature of the concrete at not less than 50 degrees F. for a period of five days for normal concrete curing.

Before placing concrete during cold weather, forms shall be free from frost, snow and ice. After the concrete is placed, it shall be protected on all exposed sides by tarpaulins or other suitable means. The methods of heating the materials protecting the concrete shall be approved by the Public Works Director. Salts, chemicals or other materials shall not be used in the concrete for the purposes of preventing freezing or for lowering the freezing point of the concrete.

2209.6 **MEASUREMENT**

Measurement will be made to determine the number of linear feet of each type of portland cement concrete curb and gutter that are constructed in accordance with the specified Standard Drawings and plans.

2210 CONCRETE DRIVEWAY AND PAVEMENT

2210.01 SCOPE

This section governs the furnishing of all labor, equipment, tools and material, and the performance of all concrete driveway work necessary to construct, complete, including all the necessary incidental work done in accordance with the applicable requirements of the Section 2102 and 2201 entitled "Grading" and "Sub-grade Preparation" respectively, at the locations shown on the plans, as provided for in the Special Provisions and by authorized Change Orders.

2210.2 MATERIALS, EQUIPMENT AND DEFINITIONS

A. CONCRETE MIX

The concrete used in the construction of driveways shall be air-entrained with 4 to 6% air, 5 bag mix with 2 to 4 inch slump developing 4000 PSI 28 day strength. Aggregate gradation shall conform to ASTM 33 with 1 1/2 inch maximum size aggregate.

B. CALCIUM CHLORIDE

The use of Calcium Chloride in concrete mixtures will not be permitted.

2210.3 CONSTRUCTION DETAILS

The incidental work of clearing, grubbing, demolition, grading, and sub-grade preparation shall be carried on well in advance of the driveway construction as herein specified.

The driveway shall be constructed after the curb and gutter has been done and completed.

A. GRADING AND SUB-GRADE PREPARATION

All excavation required in the grading and sub-grade preparation shall be considered as "Unclassified Excavation" as defined in Section 2102 entitled "Grading". All grading shall be done in conformance with Sections 2102 and 2201 entitled "Grading" and "Sub-grade Preparation" respectively.

B. FORMS

All forms shall be in good condition, with not more than one-fourth inch variation in horizontal and vertical alignment for each ten feet in length. The forms shall be set true to line and grade shall be adequately supported to stay in position while depositing and compacting the concrete. They shall be designed and constructed so as to permit their removal without damage to the concrete.

2210.4 EXPANSION JOINTS

Expansion joints constructed on the location shown on the plans, shall be formed one-half inch wide and shall extend the full depth of the slab. All of the joint except for the top one-quarter of an inch below the surface of the driveway slab shall be filled with the expansion material.

The Contractor when applying sealer shall follow the manufacturer's instructions for applying the joint sealer. Contractor shall use the equipment that is suitable for the purpose. The compounded

sealer material shall be poured into the joint to the level of the adjacent concrete surfaces. Joints must be clean and dry before the sealer is poured.

2210.5 CONCRETE WORK

Joints shall be constructed at the locations shown on the plans. The pre-molded joint filler shall be supported so as to prevent its displacement while depositing concrete at the expansion joints. Pre-molded joint filler shall be positioned to true alignment at right angles on the line of the driveway and be normal to the surface of the concrete.

A. FINISHING

DRIVEWAYS - After the concrete has been thoroughly consolidated and leveled, and the initial set has taken place, the surface shall be finished with a broom with no other mortar than that contained in the concrete. The resulting surface shall be uniform in color with all imperfections removed. The edges shall be rounded with an edging tool having a radius as shown on the plans. Special care shall be taken to insure a straight, neat appearance along the edges of the driveway and at the joints.

PAVEMENT - After the concrete has been thoroughly consolidated and leveled the concrete the pavement shall be finished with a ten foot straight edge to ensure a smooth pavement. After the initial set has taken place, the surface shall be finished with industry standard tine or burlap drag. The edges shall be rounded with an edging tool having a radius as shown on the plans. Special care shall be taken to insure a straight, neat appearance along the edges of the driveway and at the joints.

B. CURING

Exposed surfaces of concrete shall be protected from premature drying caused by the hot sun, drying winds, or other causes. Freshly placed concrete shall be protected from damage from rain. The concrete shall be kept continuously wet for a period of not less than five days after pouring. Curing compounds or other methods of curing may be considered by the Public Works Director.

If concrete is placed while the air temperature is less than 40 degrees F. or when freezing is probable within 48 hours, all sand, aggregate, and water shall be heated, and the concrete, when being placed, shall have a temperature of not less than 50 degrees nor more than 100 degrees F. Care must be taken to prevent too rapid drying of the concrete when it is heated. During freezing weather suitable means shall be provided for maintaining the temperature of the concrete at not less than 50 degrees F. for a period of five days for normal concrete curing.

Before placing concrete during cold weather, forms shall be free from frost, snow and ice. After the concrete is placed, it shall be protected on all exposed sides by tarpaulins or other suitable means. The methods of heating the materials protecting the concrete shall be approved by the Public Works Director. Salts, chemicals or other materials shall not be used in the concrete for the purposes of preventing freezing or for lowering the freezing point of the concrete.

2210.6 MEASUREMENT

Measurement will be made to determine the number of square feet of portland cement concrete driveway placed and accepted, for the purpose of making payments.

2300 SIDEWALK

2300.1 SCOPE

This section governs the furnishing of all labor, equipment, tools and material, and the performance of all work necessary to construct sidewalks, complete, including all necessary incidental work done in accordance with the applicable requirements of Section 2102 and 2201 entitled "Grading" and "Sub-grade Preparation" respectively, at the locations shown on the plans, as provided for in the Special Provisions, and by authorized Changed Orders.

2300.2 MATERIALS, EQUIPMENT AND DEFINITIONS

A. CONCRETE MIX

The concrete used in the construction of sidewalks shall be air-entrained with 4 to 6% air, 6 bag mix with 2 to 4 inch slump developing 4000 PSI 28 day strength. Aggregate gradation shall conform to A.S.T.M. 33 with 1½ inch maximum size aggregate.

B. FORMS

Forms shall be steel or wood, in good condition, and acceptable to the Public Works Director.

C. CURING

Exposed surfaces of concrete shall be protected from premature drying caused by the hot sun, drying winds, or other causes. Freshly placed concrete shall be protected from damage from rain. The concrete shall be kept continuously wet for a period of not less than five days after pouring. Curing compounds or other methods of curing may be considered by the Public Works Director.

If concrete is placed while the air temperature is less than 40 degrees F. or when freezing is probable within 48 hours, all sand, aggregate, and water shall be heated, and the concrete, when being placed, shall have a temperature of not less than 50 degrees nor more than 100 degrees F. Care must be taken to prevent too rapid drying of the concrete when it is heated. During freezing weather, suitable means shall be provided for maintaining the temperature of the concrete at not less than 50 degrees F. for a period of five days for normal concrete curing.

Before placing concrete during cold weather, forms shall be free from frost, snow and ice. After the concrete is placed, it shall be protected on all exposed sides by tarpaulins or other suitable means. The methods of heating the materials protecting the concrete shall be approved by the Public Works Director. Salts, chemicals, or other materials shall not be used in the concrete for the purposes of preventing freezing or for lowering the freezing point of the concrete.

2300.3 CONSTRUCTION DETAILS

The incidental work of clearing grubbing, demolition, grading, and sub-grade preparation shall be carried on well in advance of the sidewalk construction as herein specified.

The sidewalks shall be constructed after the curb and gutter has been done and completed.

A. GRADING AND SUB-GRADE PREPARATION

All excavation required in the grading and sub-grade preparation shall be considered as "Unclassified Excavation" as defined in Section 2102 entitled "Grading". All grading shall be done in conformance with Sections 2102 and 2201 entitled "Grading and "Sub-Grade Preparation" respectively.

B. **FORMS**

All forms shall be in good conditions, with not more than one-fourth (¼) inch variation in horizontal and vertical alignment for each ten (10) feet in length. The forms shall be set true to line and grade shall be adequately supported to stay in position while depositing and compacting the concrete. They shall be designed and constructed so as to permit their removal without damage to the concrete.

2300.4 **EXPANSION JOINTS**

Expansion joints constructed on the locations shown on the plans, shall be formed one-half (½) inch wide and shall extend the full depth of the slab. All of the joints except for the top one-quarter (¼) of an inch below the surface of the sidewalk slab shall be filled with expansion material. Expansion joints shall be placed every fifty (50) feet.

The Contractor when applying sealer shall follow the manufacturer's instructions for applying the joint sealer. He shall use the equipment that is suitable for the purpose. The compound sealer material shall be poured into the joint to the level of the adjacent concrete surfaces. Joints must be clean and dry before the sealer is poured.

2300.5 **CONTRACTION JOINTS**

The sidewalk surface shall be marked off into square stones by contraction joints as shown on the plans. The joints shall be one-eighth (1/8) inch wide by one (1) inch deep, and may be formed either by inserting a fiber strip, tooling, or by use of a concrete saw. Contraction joints shall be cut every five (5) feet.

2300.6 **CONCRETE WORK**

Construction joints shall be constructed at the locations shown on the plans and pre-molded expansion joints shall be constructed as shown on the plans. The pre-molded joint filler shall be supported so as to prevent its displacement while depositing concrete at the expansion joints. Pre-molded joint filler shall be positioned in true alignment at right angles to the line of the sidewalk and be normal to the surface of the concrete.

A. **FINISHING**

After the concrete has been thoroughly consolidated and leveled, and the initial set has taken place, the surface shall be finished with a soft wood or cork float and either burlap or broom finished with no other mortar than that contained in the concrete. The resulting surface shall be uniform in color with all imperfections removed. The edges shall be rounded with an edging tool having a radius as shown on the plans. Special care shall be taken to insure a straight, neat appearance along the edges of the sidewalk and at the joints.

2300.7 **MEASUREMENT**

Measurement will be made to determine the number of square feet of portland cement concrete sidewalk placed and accepted, for the purpose of making payments.

2400 **SEEDING**

2401.1 **SCOPE**

This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work for seeding, complete, as specified in the Special Provisions and/or as shown on the plans.

2401.2 MATERIALS, DEFINITIONS AND EQUIPMENT

A. SEEDS

Seeds for cover crops shall comply with the requirements of the applicable state Seed Law and shall be of the kind of mixture of seeds specified herein. Seeds shall be free of prohibited weed seeds and shall not have more than one (1) percent of noxious weed seeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trade name, or trade mark and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified.

B. PURE LIVE SEED

The following formula shall be used to determine the amount of commercial seed required to provide for each kind of seed the specified quantities of pure live seeds.

Pounds of Commercial Seed Required =
$$\frac{10{,}000 \times \text{Rate of Pure Live Seed (lbs per acres)}}{\text{Purity \%} \times \text{Germination \%}}$$

C. FERTILIZER

Fertilizer shall be inorganic 12-12-12 or 13-13-13 grade, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in convenient containers, each fully labeled, conforming to the applicable state Fertilizer Laws bearing the name, trade mark or trade name, and a warranty of the producer.

D. MULCH

Mulch shall be of the vegetative type. Such vegetative type shall be the cereal straw from stalks of oats, rye, wheat or barley and shall be free of prohibited and noxious weed seeds.

E. EQUIPMENT

The seeding operation shall be accomplished with equipment suitable for preparing the seed bed, sowing the seed and fertilizer, and spreading the vegetative type mulch in accordance with the applicable requirements of the following subsection entitled “Construction Details”.

2401.3 CONSTRUCTION DETAILS

A. APPLICATION OF FERTILIZER

Before tilling of the soil, the fertilizer shall be distributed uniformly at the rate of six hundred (600) pounds per acre, and incorporated into the soil to a depth of at

least two (2) inches by discing or harrowing methods. (Fertilizing rate is equivalent to 7 pounds to 500 square feet.)

B. **TILLING THE SEED BED**

Areas shown on the plans or specified to be seeded shall be cleared and graded as required preparatory to tilling the surface for seeding. The surface shall be tilled to a depth of at least two (2) inches by digging or other approved methods until the soil is suitable for seeding. Areas tilled shall be maintained until seeding and mulching is complete to insure a smooth area with no gullies or depressions.

C. **PLANTING SEEDS**

The kinds of seeds and the rate of sowing pure live seed shall be as specified on the plans or in the Special Provisions, but shall be one of the following mixtures:

1. Type "A" Seed: This seeding mixture will normally be used where seeding is required in areas of established yards, shoulders and slopes in street right-of-way, and any other areas where a high-type seeding is deemed necessary. The seed mixture will be as follows:

Kind of Seed	Minimum Pure Live Seed (%)	Rate (lbs per acre)
Alta Fescue or Kentucky 31 Fescue (Festuca Elatior Var. Arundinces)	75	25
Rye Grass (Lolium Peyrenne or L. Multiflorum)	80	25
Kentucky Blue Grass (Poa. Pratensis)	75	20
Creeping Red Fescue (Festuca Rubra)	85	10
Total		80# / acre

2. Type "B" Seed: This seeding mixture will normally be used to seed areas off street right-of-way that are not maintained.

Kind of Seed	Minimum Pure Live Seed (%)	Rate (lbs per acre)
Alta Fescue or	75	90

Kentucky 31 Fescue (Festuca Elatio Var. Arundinces)			
Rye Grass (Lolium Perenne or L. Multiflorum)	80	50	
Total			140# / acre

Sowing shall be accomplished by use of an approved mechanical seeder or drill (hand spreader can be used in small areas), making sure that successive seed strips overlap to provide uniform coverage. Seed should be drilled to a depth of one-half (1/2) inch.

D. **COMPACTION**

Immediately following the completion of seeding operations, if in the judgement of the Public Works Director the seed bed is either too loose or contains clods which would reduce the seed germination, the entire area shall be compacted by means of a roller weighing at least sixty (60) but not more than ninety (90) pounds per linear foot of roller.

E. **MULCHING**

Mulching shall be done within 24 hours following the seeding operation.

F. **VEGETATIVE TYPE MULCH**

Vegetative mulch shall be spread over all areas that are seeded. Mulch shall be uniformly spread at a rate of two (2) tons per acre by means of a mechanical spreader or other means approved by the Public Works Director. The mulch must be spread in a loosened condition so that there are no lumps of compacted material.

As soon as the mulch is spread it shall be anchored to the soil by use of a heavy disc harrow, set nearly straight, or a similar approved tool. Discs of the anchoring tool shall be set approximately nine (9) inches apart. Anchoring shall be accomplished by not more than two (2) passes of the tool. The operation shall be such that it will anchor the mulch, not cut it.

G. **WATERING**

Immediately following the application of the mulch, the seeded area shall be given one watering in sufficient amount to penetrate the seed bed to a depth of at least two (2) inches. Watering shall be done in such a manner as not to cause erosion or damage to the seeded surface, and shall be repeated as required to obtain a flourishing coverage.

H. **PROTECTION AND REPAIR**

The seeded area shall be kept free of traffic. If at any time before acceptance of the completed work any portion of the seeded surface becomes gullied or otherwise damaged, or the seeding has been damaged or destroyed, the affected portion shall be repaired to re-establish the specified condition prior to the acceptance of the work.

I. **MEASUREMENT**

Measurement shall be made to establish the area or areas to be seeded to the nearest one-tenth (1/10) of an acre.

2600 STORM SEWERS

2600.1 DESCRIPTION

Storm sewer construction shall consist of furnishing all labor, materials and equipment for the complete installation of sewers and appurtenances in accordance with the standards, drawings, General Conditions and Detail Specifications. Unless otherwise specified in these specifications, the work "Sewer" shall refer to pipe, sewers, box culvert sewers, or paved channels.

2600.2 MATERIALS FOR CURB INLETS, INLET BOXES AND HEADWALLS

Curb inlet frame, grate and curb box shall be of the type and size manufactured by Neenah Foundry Company, Neenah, Wisconsin, R-3067 or approved equal.

Inlet boxes and headwalls shall be constructed as shown on the plans. The inlet box shall be either cast-in-place, precast or concrete blocks. The inlet boxes shall be constructed upon foundations of concrete and shall be not less than eight (8) inches in thickness below the bottom of the pipes. Headwalls shall be poured in place. Concrete shall conform to Section 2209.2 of these specifications. Excavation and backfill shall be in accordance with these specifications.

2600.3 MATERIAL FOR STORM SEWERS

Except as otherwise shown on the Drawings, or modified in subsequent paragraphs, storm sewer materials shall conform to requirements of standard or tentative specifications, latest revisions, as follows:

Reinforced Concrete Culvert, Storm Drain and Sewer Pipe - A.S.T.M. Designation C76, Class III reinforced concrete pipe with bituminous joints.

2600.4 EXCAVATION

The sewer trenches shall be excavated for the entire length thereof and made on the lines indicated, and of such width and depth as shall be necessary to lay the pipe to the grade line as indicated on the accompanying plan and profile. No deviation from straight lines will be permitted except under special direction of the Pubic Works Director. Horizontal curves will not be allowed.

The materials to be excavated are to be deposited on the sides of the trenches and excavations, and beyond the reach of slides, or transported to the soil banks or for backfilling.

2600.5 PIPE LAYING

A. The laying of pipe in the finished excavation of the trenches should be commenced at the lowest point so that the spigots point in the direction of flow. All pipes shall be laid with ends abutting and true to line and grade. They should be filled and matched so that when laid in the work they will form a storm sewer with a smooth and uniform invert. Bells must be carefully cleaned before the pipes are jointed. The pipes shall be lowered so as to avoid unnecessary handling in the trench. The pipes shall be set firmly according to line and grade, and the joints carefully adjusted.

B. The Contractor shall keep pipe laying as close to the excavation as possible during the execution of the work. The Public Works Director reserves the right to stop excavation at any time when in his opinion, the excavation is opened too far in advance of the pipe laying.

C. Pipe bedding shall be Class C, ordinary bedding. The pipe shall be placed with care in an earth foundation shaped to fit the lower part of the pipe exterior for a width of at least one-half its external diameter.

D. The ditch shall be backfilled with approved granular material and compacted to a height of 6" above the top of the pipe.

E. Should any excess material be removed from the ditch bottom, the space shall be filled, shaped and compacted with an approved material.

2600.6 **BACKFILLING**

A. All trenches and excavations should be backfilled immediately after the pipes have been laid and inspected.

B. The backfilling material should be selected and deposited with sufficient reference to the future safety of the pipe. Clean earth, clay or sand should be solidly tamped about the pipes up to a level of at least one foot above the top of the pipe.

C. The material should be carefully deposited in uniform twelve inch layers. Each layer shall be carefully and solidly tamped or rammed with proper tools so as not to injure or disturb the pipe line.

D. Wherever excavations are necessary beyond the external line of inlet boxes, these spaces shall be refilled with a suitable material and shall be thoroughly tamped.

E. In those locations where a roadbed is being backfilled, crushed limestone aggregate should be placed and compacted to a density of 95% maximum density for the full depth of backfill.

2700 SHEETING, SHORING AND BRACING

2700.7 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall provide in place and maintain all sheeting, shoring and bracing required to support sides of excavation and prevent all movement which can in anyway injure the sewers, diminish necessary width of excavation and otherwise damage or delay the work or endanger adjacent pavements, buildings and structures. If, in the Public Works Director's opinion, sufficient or proper supports are not provided in certain locations, he may order additional supports installed at the Contractor's expense and without extra cost to the City.

B. Unless otherwise directed, removing sheeting and bracing.

No separate payment shall be made for installing, maintaining and removing sheeting, bracing and similar items. The Contractor shall include compensation therefore in his price per linear foot of excavation and backfill.

C. Leave in place (to be embedded in backfill or trench), certain sheeting, bracing and shoring when directed by the Public Works Director. The Public Works Director may direct that said timber sheeting and bracing be cut off at any specified elevation, in which case the Contractor will be paid for a quantity equal to that left in the ground.

The Contractor will not be paid for sheeting and bracing which, for his convenience and to serve his interest, he elects to leave in place.

D. The right of the Public Works Director to order sheeting and bracing left in places does not imply any obligation on his part to issue such orders and his failure to exercise his right shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the sewer construction work occasioned by the Contractor's negligence or failure to prevent moving or caving of ground adjacent to same.

2700.8 PIPE

Pipe shall be measured by the lineal feet of the various sizes and types installed. This unit shall include trenching, installation, pipe materials, bedding, backfill, compaction, restoration of private property, and all other items required to complete the installation of the pipe.

2700.9 DRAINAGE STRUCTURE AND APPURTENANCES

Drainage structures shall be measured as a unit, complete and in place of the various types constructed.

2700.10 CONNECTION TO EXISTING STRUCTURES

The connections to existing structures required during construction shall be measured as a unit, complete. Grade shall be as shown on the plans.

SANITARY SEWERS TECHNICAL SPECIFICATIONS

2000 GENERAL

The standards and requirements of this section are for the materials and construction of sanitary sewers within the City of Rolla, Missouri. These specifications cover materials for sanitary sewers and service connections, sewer fittings, manholes and all appurtenances normally used for sanitary sewer collection systems.

2000.1 SANITARY SEWERS

All sanitary sewage consisting of domestic and other water-borne waste shall be collected and conveyed in a sanitary sewer pipe system to a point of discharge into an existing sewer system. No sanitary sewage shall be allowed to enter any storm sewer system or discharged onto the ground or into receiving streams without first being treated.

2000.2 PIPE MATERIALS

When reference is made to a Standard Specification (ASTM, AWWA, MCIB, etc.) the specification referred to shall be understood to mean the latest revision of said specification. The following materials are approved for use as sanitary sewer pipe:

I. Reinforced Concrete Pipe: Conform to ASTM C76, C361, C443, C497, C506 and C507, except as otherwise specified herein.

A. Materials: Cement shall not contain tricalcium aluminate in excess of five per cent (5%). Fine aggregate shall be natural sand conforming to the requirements of MCIB Bulletin No. 1.

B. General: Furnish maximum lengths manufactured by the supplier, except for fittings, closures and specials. Moisture absorption by boiling test shall not exceed five per cent (5%).

C. Joints: Flexible gasketed joints in concrete pipe shall be made with continuous ring, compression type rubber gaskets.

D. Fittings and Specials: Fabricate as one of the following types:

a) Steel cylinder segments not less than U.S. No. 16 gauge, lined with 3/4-inch concrete or mortar and reinforced concrete exterior coating.

b) Concrete pipe sections cut while still green, reinforcing exposed and welded together at junctions and miters. Splice shall be built up to nominal wall thickness with mortar or concrete.

II. Vitrified Clay Pipe: Conform to ASTM C700, except as otherwise specified herein.

A. General: Furnish maximum pipe lengths manufactured by the supplier, except for fittings, closures and specials.

B. Design: Provide ASTM C700 Extra Strength pipe and fittings in sizes 18-inch and smaller. Provide either ASTM C700 Standard Strength or Extra Strength pipe and fittings in sizes 21-inch and larger as specified by the Public Works Director.

C. Joints: Flexible gasketed joints for bell and spigot clay pipe shall be compounded of high quality polyurethane plastic bounded to both the bell and spigot ends of the pipe and properly molded and cured to a uniform hardness and compressibility to form a tight compression joint. All bell and spigot joints shall conform to ASTM C425. 4. Fittings: Provide fittings defined as tee or wye connections suitable for assembly to house or building sewers similar to W.S. Dickey Clay Company "Perma-T" and "Perma-Y".

III. Ductile-Iron Pipe:

A. Ductile iron pipe shall be installed according to the manufacturer's recommendations and these specifications. Pipe from 4" to 12" shall be manufactured in accordance with Federal Specifications WW-P-421C in nominal lengths of 18 to 20 feet. Pipe design shall be in accordance with AWWA Specifications C150-76 ANSIA21.50, 2-5 foot cover, trench condition "B" flat bottom, no blocks, tamp backfill, except higher strength iron up to 21,000 pounds per square inch tensil-45,000 pounds per square inch modules of rupture may be used to compute design. Pipe to be manufactured in accordance with AWWA Specifications C151-76 metal molds.

Pipe and fittings shall be lined with an approved thin cement lining, sealed with an approved bituminous seal coat in accordance with ANSI A21.51 1976, wherever applicable, and as further specified herein. All pipe sizes, slope, and location shall be as shown on plans and profiles.

B. Joints for ductile iron shall conform to either Type II (push-on joints) or Type III (mechanical joint) in accordance with Federal Specification WW-P-421B and furnished with complete accessories. Ductile iron fittings shall be class 250 short body mechanical joints, conforming to ANSI Specifications A21.10 and A21.11. All fittings shall have a bituminous coating inside and outside. Metal thickness, class, net weight of pipe without lining, length of pipe and name of manufacturer shall be clearly marked on each length of pipe.

IV. Poly Vinyl Chloride (PVC) Sewer Pipe: Conform to ASTM D 3034, except as otherwise specified herein.

A. General: Furnish maximum pipe lengths manufactured by the supplier, except fittings, closures and specials.

B. Design: The minimum wall thickness for PVC Pipe shall conform to SDR-35 for pipe sizes 6" diameter and larger. Schedule 40 pipe shall be used for pipe diameters 4" or smaller.

C. Joints: Flexible gasketed joints shall be compression type with a gasket confirmed in a machined groove in the spigot end of the pipe. Rubber gasket rings shall conform to the requirements of ASTM D 2689. Gaskets shall be neoprene or other synthetic material. Natural rubber gaskets will not be acceptable. Joint shall not be greater than 20 feet.

D. Fittings: Fittings defined as tee connections suitable for assembly to 4-inch or 6-inch house or buildings sewers shall be injection molded fittings of PVC plastic.

V. Plastic Closed Profile Pipe (bid alternate 1a.): Shall meet or exceed ASTM-794 and all other applicable ASTM guidelines and specifications for PVC large diameter closed profile gravity sewer pipe.

2000.3 REINFORCING STEEL

Reinforcing steel shall be placed as shown on the plans or as on City Standard drawings and shall conform to ASTM specifications as follows:

I. Bars and rods shall be deformed billet-steel conforming to ASTM A615, Grade 40.

II. Welded wire fabric shall conform to ASTM A 185, Grade 40.

III. Fabricated steel bar and rod mats shall conform to ASTM A 184. Bar material shall conform to ASTM A615, Grade 40.

IV. Smooth bars shall be round carbon steel bars conforming to ASTM A306, Grade 60.

2000.4 MANHOLE MATERIALS

I. General: Manholes shall conform to the applicable City Standard Drawings.

II. Concrete: Concrete used in manholes shall have a compressive strength of not less than 4,000 pounds per square inch after 28 days and shall be composed of the aggregate specified and not less than six bags of Portland cement per cubic yard. Coarse aggregate shall be used in the greatest amount consistent with required workability. Concrete rings shall conform to Federal Specification SS-P-375 except that the length of the sections may be shorter as conditions require, and that the total circumferential reinforcing steel may be 50 percent of that required for pipe per foot and may be placed as one circumferential ring.

The manholes are to have a neoprene rubber gasket installed in the walls where every pipe enters. It shall be a gasket as manufactured by Press-Seal Gasket Corporation, Fort Wayne, Indiana, or an approved equal.

III. Jointing: The manholes shall have tongue and groove type joint between vertical risers sections. The joints shall be constructed using (ram neck) neoprene gasket for joint sealant material. The strip shall overlap a minimum of three inches at splices. The gasket shall be kept at sufficient temperatures during cold weather construction procedures to provide the required flexibility as determined by the Engineer or his representative. Care should be taken to insure that a watertight joint has been obtained before backfilling commences to warrant any extraneous material from entering the joint and preventing the compaction of the joint which is necessary for properly sealing the joint. Before the backfilling procedures, the exterior surface of the joints should be liberally coated with soft mastic sealant material.

IV. Waterproofing: The entire exterior surface of the manholes shall be water proofed before backfilling is commenced. The waterproofing material shall be Kopper Super SVC. black, Tnemec 450 heavy Tnemecol, or approved equal.

2000.5 MANHOLE CASTINGS

I. General: Cast-iron rings and covers shall conform to the applicable City Standard Drawings. The castings shall meet or exceed the following minimum requirements.

II. Iron Castings: Frames and Covers. Cast iron frames and covers shall conform to the drawings in all essentials of design. Approved standard castings differing in nonessential details will be acceptable. The frames and covers shall be so set that the top of the cover will be flush with or higher than finished grade as directed. Minimum weight of frame and cover shall be 380 pounds. The minimum clear opening diameter for manhole frames and covers shall be 24 inches. The covers shall have a rubber gasket for self-sealing.

III. Rings and Covers:

A. Rings and covers shall be of the type R-1642, manufactured by Neenah Foundry of Neenah, Wisconsin or approved equal.

B. Bearing surfaces between the ring and cover shall be machine finished or ground to assure nonrocking fit in any position, and interchangeability.

C. Provision shall be made for opening, such as a pick hole.

2000.6 **GRADING, CLEARING, EXCAVATION AND TRENCHING:**

I. General: This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work for clearing, grubbing, demolition, excavation and trenching wholly or in any part, at locations shown on the plans or as provided for in the Special Provisions. Clearing, grubbing, and demolition shall be done only to that extent which is necessary for the prosecution of the construction of sewers.

II. Definitions:

A. Clearing: Clearing shall consist of removing all vegetable matter, such as trees, brush, down timber, rotten wood, rubbish and other objectionable combustible materials, found on or above the surface of the site. It may include removing fences, lumber, waste dumps and trash, and the salvaging of such of the materials as may be specified. This item shall include the disposal of the debris resulting from the clearing operations.

B. Grubbing: Grubbing shall consist of removing and disposing of stumps, roots, buried trees and brush, wood piling, wood curb planking, wood culverts, wood basins and drains, and wood stairs appearing on or below the surface of the ground which has not been included in section entitled "Clearing".

C. Demolition: Demolition shall consist of demolishing, removing, disposing, or incorporating into backfill all non-vegetable matter appearing above, on, or below the ground surface. This shall include all material derived from the demolition or Portland Cement items such as base courses, curbs, curbs and gutters, sidewalks, floors, steps, driveways, drainage structures of all sorts, fences, and other miscellaneous items such as foundations or walls of any sort, and iron or steel items; and shall include all asphaltic items such as pavement and base courses.

D. Excavation-Earth: Earth excavation is defined as the removal of all material not defined as rock.

E. Excavation-Rock: Rock excavation is defined as the removal of material that can not be excavated without drilling and blasting, wedging, sledging or boring.
All stone and boulders less than eight (8) cubic feet in volume, all earth, soft shale, hard pan, soft sandstone, loosely cemented gravel or loose rock is defined as earth excavation.

F. Trenching: Trenching is defined as excavation for the entire length thereof and made on the lines indicated, and of such width and depth as shall be necessary to lay the pipe to the grade line as indicated on the City Standard Drawings and plans.

III. Construction Details:

A. Limits of Work: The limits for clearing, grubbing, and demolition shall, in no case, extend beyond the limits of the right-of-way, city property lines, or easements, unless otherwise specified on the plans or special provisions.

B. Protection of Existing Facilities: The Contractor shall be responsible for protecting any improvement of any agency, public or private, in the vicinity of clearing, grubbing or demolition operations. When necessary the Contractor shall enlist the assistance of the affected agencies in the location of their

facilities. The Contractor will not be responsible for the cost of any agency for assistance in the location of its facilities, but he shall be responsible for the cost of all damage to such facilities arising because of his carelessness or negligence.

1. Private Sewer Facilities: The Contractor shall make every reasonable effort to protect private sewer facilities. They are not shown on the plans. When these facilities are disturbed or damaged by the work, the Contractor shall make necessary repairs to the facilities for continuous service prior to the close of the work day.

2. Property Pins: All property or lot corner pins or stakes shown on the plans and disturbed by this construction will be properly referenced by the Contractor prior to removal, and reset by the Contractor upon completion of the project.

3. Existing Utilities: The relocation and /or protection of any utility lying within a utility easement that is shown on the plans and that is endangered by this construction shall be the responsibility of the Contractor.

IV. Clearing: Clearing shall be performed in advance of the construction operation so as not to delay the progress of the work. The refuse resulting from clearing shall be hauled to a waste site secured by the Contractor, or if permitted by the special provisions may be burned in the areas indicated on the plans in such a manner as to meet all applicable requirements of the Federal, State, County, and Municipal regulations concerning health, safety and public welfare.

V. Grubbing: Grubbing shall be kept abreast of the "Clearing" as nearly as the sequence of operations will permit. All stumps, roots, and other objectionable material within the disturbed area shall be removed to a depth of at least twelve (12) inches below the finished grade elevation. Disposal of debris from grubbing shall be as described in "Clearing" above.

VI. Demolition: If portions of existing improvements are to be left in place, the limits of pavement removal shall be laid out as neat, straight lines a minimum distance of six inches beyond the anticipated edges of excavation. If the pavement removal limits are approximately parallel to and three (3) feet or less from an existing pavement joint, previous cut, or curb, the limits of removal shall be extended to the point, cut, or curb. Sufficient portions of the pavement shall be removed to provide for the proper grade and alignment of the new construction. Pavement restoration shall conform to Section 2012. Disposal of debris from demolition shall be as described in "Clearing" above.

VII. Open Burning of Debris: The special provisions of each particular job will indicate if open burning will be permitted.

VIII. Environmental Protection Procedures:

A. General: Compliance with the following procedures for protection of existing greenery is required.

B. Trees: All reasonable effort shall be made to save as many trees as possible. If trees can be saved by trimming, this shall be done in accordance with acceptable pruning practices.

All trees within 10 feet of either side of sewer center line which are specifically to be saved have been marked on the plans with an "S" notation.

C. Shrubbery: All shrubbery that is endangered by this sewer construction shall be saved or replaced with like species of nursery stock.

D. Small plants and Flowers: Prior to the start of construction, property owners will be notified of the proposed starting date.

One purpose of this notification is so that the property owners may remove any small plants or flowers that they, they property owners, desire to save.

2000.7 PIPE LAYING, JOINTING AND TESTING

I. Scope: This section governs the furnishing of all labor, equipment, materials, and tools for the installation of all pipe, fittings, specials, and appurtenances as shown on the plans, City Standard Drawings or as provided for in the Special Provisions.

II. Handling:

A. Handle pipe materials and fittings in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements and coatings. In handling plastic pipe of ten (10) feet in length or greater, a double sling will be required unless otherwise approved by the Public Works Director.

B. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

III. Installation:

A. All work shall be in accordance with the following standards: ASTM C 12- Installing Vitrified Clay Sewer Pipe, ASTM D 2321-Underground Installation of Flexible Thermoplastic Sewer Pipe, conform to ASTM C76, C361, C443, C497, C506 and C507, installation of reinforced concrete pipe.

B. Utilize equipment, methods and materials insuring installation to lines and grades indicated.

1. Maintain the following tolerances from true alignment and grade:

Alignment 3 inches
Grade +/-1 inch

Joint deflection shall not exceed the maximum allowable deflection per joint according to ASTM C 425, ASTM C 594 and AWWA C 600. Only one correction for alignment and/or grade shall be made between adjacent manholes.

2. Except where pipe sections are being encased in concrete, no pipe is to be supported by blocks, bricks, rocks, etc.

3. Accomplish curb alignments with bends, bevels, and open joints. Limit join opening in concrete pipe to 3/8-inch in laying schedule and 1/2-inch in actual installation. Limit joint deflection with clay, cast iron or ductile iron pipe to not exceed the maximum allowable deflection per joint according to ASTM C 594 and AWWA C 600.

C. Install pipe of size, material, strength class, and joint type with embedment as shown on the plans.

Reinforced concrete pipe with elliptical reinforcement shall b installed and positioned in accordance with the pipe manufacturer's pipe markings indicating top and bottom of pipe.

D. Insofar as possible, commence laying at downstream end of line and install pipe with spigot or tongue end downstream.

E. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation. Close open ends of pipe with snug fitting closures. Do not let

water fill trench. Include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

F. Install pipe only when weather and trench conditions are suitable. Do not lay in water. Brace or anchor pipe as required to prevent displacement after establishing final position.

G. 1 Horizontal Separation of Water Mains and Sewers. Whenever possible the sewer lines shall be laid ten feet, horizontally, from any existing or proposed water line. Should local conditions prevent a lateral separation of ten feet, sewer lines may be laid closer than ten feet to a water main, provided that the water main is laid in a separate trench, or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. When it is impossible to obtain the proper horizontal or vertical clearance as stipulated above, both the water main and the sewer shall be constructed of a slip-on or mechanical joint cast iron pipe and shall be pressure tested to assure water tightness before backfilling.

2 Vertical Separation of Water Mains and Sewers. Whenever sewer lines must cross house water lines or water mains, the water main must be laid at such an elevation that the bottom of the water main is 18 inches above the top of the sewer line. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer line it crosses, said 10 feet to be measured as the normal distance from the water main to the sewer. Where conditions prevent this minimum vertical separation from being maintained, or where it is necessary for the water main to pass under a sewer line, the water main shall be laid with slip-on or mechanical joint cast iron pipe and the pipe shall extend on each side of the crossing until the normal distance from the water main to the sewer line is at least 10 feet. In making such a crossing, it is preferable to center a length of water main pipe over the sewer to be crossed, so that the joints will be equi-distant from the sewer. Where a water main must cross under a sewer, a vertical separation of 18 inches between the bottom of the sewer and top of the water main shall be maintained, with adequate support for the larger-sized sewer line to prevent them from settling on and breaking the water main.

3 Separation of Water Mains and Sewer Manholes. No water pipe shall pass through, or come into contact with, any part of a sewer manhole.

IV. Bedding

A. Pipe Bedding Shall Conform To ASTM Class I Materials. Carefully prepare bedding so that the pipe after installation will be true to line and grade. Surface the grade fill material to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. Compact fill material beneath the pipe. After each pipe has been brought to grade, aligned, and placed in final position, deposit and compact sufficient bedding material under the pipe haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe jointing. Deposit bedding material uniformly and simultaneously on each side of the nine to prevent lateral displacement. The pipe shall be bedded in crushed stone or rounded gravel passing a 1" sieve, 95% passing a 3/4" sieve and 95% retained on a number 4 sieve. The bedding material shall be laid to a minimum depth of 4" beneath the pipe, or 1/8 of the pipe diameter, whichever is greater. The bedding material shall be laid alongside the pipe and to a minimum depth of six inches above the pipe as shown on the detailed drawings.

B. Pipe Clearance In Rock. A minimum clearance to rock of at least six inches shall boulders, ledge rock and other large stones shall be removed to provide a minimum of six inches clearance.

All bedding material shall be approved by the Public Works Director prior to start of work.

V. Jointing:

A. General Requirements:

1. Locate joints to provide for differential movement at changes in type of pipe abedment, concrete collars, and structures. Support pipe from wall of manhole to first joint in normal sewer trench with concrete cradle structurally continuous with base slab or footing.

2. Clean and lubricate all joint and gasket surfaces with lubricant recommended by pipe manufacturer.

3. Utilize methods and equipment capable of fully homing or making up joints without damage.

4. Check joint opening and deflection for specification limits.

5. Examine each piece of pipe prior to installation for soundness and specification compliance.

B. Provisions for Jointing Clay Pipe:

1. Conform with ASTM C 12.

2. Handle pipe having premolded joint rings or attached couplings so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material.

C. Provisions for Jointing Concrete Pipe: Check gasket position and condition after assembly with feeler gauge prior to installation of next section.

D. Provisions for Ductile Iron Pipe:

1. Conform with AWWA C150-76 ANSI A21.50.

2. Paint suspected damaged portions with turpentine and dust with cement to check for cracks. Remove turpentine and cement by washing when crack test is satisfactorily completed. If cracks are found, the pipe shall be rejected.

3. Check gasket position and condition after assembly prior to installation of next pipe section.

E. Provisions for Jointing PVC Pipes: Check gasket position and condition after assembly prior to installation of next pipe section.

VI. Cutting: Cut in neat workmanlike manner without damage to pipe. Observe specifications regarding joint locations. Smooth cut by power grinding to remove burrs and sharp edges. Repair lining as required and approved.

VII. Temporary Plugs:

A. Plugs: Provide and install plugs as manufactured by pipe supplier or as fabricated by Contractor of approved Construction. Plugs shall be watertight against heads up to 20 feet of water. Secure plugs in place in a manner to facilitate removal when required to connect pipe.

B. Location: Plugs shall be installed as specified or where shown on plans. Also the open end of the sewer shall be plugged at the end of the work day with a suitable mechanical plug to prevent entry of foreign material until work is resumed.

VIII. Connection to Existing Pipelines and Structures:

A. Connect pipe to existing structures and pipelines where indicated. Observe pertinent articles of specifications pertaining to joint locations.

B. Prepare structure by making an opening with at least 2 inches clearance all around fitting to be inserted. Opening between pipe and manhole wall shall be filled with an expansive grout in such a

manner that a watertight condition will result. All pipes entering existing manhole should have a neoprene rubber gasket installed where the grouting will take place.

C. Manholes to be built on an existing sewer shall be constructed in such a manner as will not disrupt service of the existing sewer. The manhole base, walls and invert shall be completed before the top half of the sewer pipe is cut or broken away. Rough edges of the pipe thus exposed shall be covered with expansive grout, in such a manner as to produce a smooth and acceptable finish. Any portion of the existing sewer damaged by the Contractor shall be repaired or replaced at no expense to the City.

D. Connections between different pipe materials shall be made using proper transition coupling, unless otherwise specified on the plans.

IX. Highway Crossings: Where sewer lines are to be constructed along and/or across Township, County, state or federal highways, before commencing any work within the limits of these rights-of-way, the contractor shall have a permit from the governing highway department to construct the proposed sewer lines. The owner will obtain the necessary permits for the contractor but it shall be the contractor's responsibility to give the public works director adequate notice of his need for the permit. Costs of any necessary permits shall be paid for the owner. Unless special permission is given otherwise by the governing highway department, the contractor shall install all sewer lines crossing highways by boring and jacking methods so that the sewer lines will be installed to the lines and grades established in the plans. Casing pipe, if required, will be of the size and type as shown on the plans and/or specified by the public works director, or otherwise a minimum wall thickness of 0.25 inches. The methods of jacking shall be subject to the public works director's approval. The pipe or casing, if required, shall be jacked into the fill as the boring auger drills out the gravel. The ends of the casing pipe shall be sealed with cement grout after installation of the core pipe.

X. Carrier Pipe to be used on state highways and railroad that are bored and cased for sewer line crossings shall be smooth walled welded steel pipe meeting American Petroleum Institute Code Number 1102 and have a minimum wall thickness of 0.344".

2000.8 MANHOLES AND SPECIAL STRUCTURES

I. Scope: This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work incidental to the construction of manholes, drop manholes and special sewer structures complete with covers, fittings, and appurtenances as required in accordance with the plans, Special Provisions, and City Standard Plans.

II. General: As used herein special structures refers to manholes on large sewers, special junction structures, metering stations, siphons and similar structures constructed on the pipeline. Manholes and special structures may be constructed of precast concrete sections, or cast-in-place concrete.

III. Construction:

A. General: Manholes and special structures shall be constructed at locations indicated and in accordance with details as shown on the approved plans or City Standard Drawings.

B. Precast Wall and Reducing Cone Sections: Handle with care to avoid damage to joint ends of each section. Damaged sections may be subject to rejection at the discretion of the Public Works Director.

When using o-ring joints, care shall be exercised in placing the o-ring on the spigot end, and lower the bell section on to the spigot end so that a water tight seal is obtained.

When using bitumastic joints, both spigot and bell end shall be primed with solvent material compatible to the adhesive in the mastic. Approved bitumastic material shall completely fill the joints so that a minimum of one-fourth (1/4) inch bead of material is visible after jointing, to be smoothed off

after completion of the jointing operation. All bitumastic materials or preformed flexible joint sealants shall not be applied to wet or damp surfaces.

C. Cast-in-Place: Consolidate concrete with mechanical vibrators to eliminate entrapped air voids and rock pockets. Forms shall be supported in such a manner as to prevent any movement of forms while concrete is being cured. Any movement of the forms may be cause of rejection.

D. Invert Channels: Alignment of the invert channels shall be as shown on the contract drawings. When no specific details and dimensions are given, changes in flow directions shall be smooth, uniform and made with the longest radius possible. The cross-sectional shape of invert channels shall match the lower halves of the entering and exiting pipes. The surfaces of the channels shall be steel-trowelled to produce a dense, smooth surface.

When filling openings around pipes through the manhole walls, mortar and/or masonry units shall be placed so that the resulting joints are watertight. Mortar used in the joint closure shall not interfere with the invert channel.

IV. Manhole Rings: All rings for manhole covers shall be set to match the existing surfaces, except where the plans indicate that the ring is to be set at an elevation higher than existing ground. Each ring shall be set on a full bed of rams neck or bitumastic material.

V. Waterproofing: Two coats of asphalt or coal-tar pitch waterproof coating shall be applied to the exterior of all manholes and special structures from base to manhole ring. The coating shall be applied in sufficient time to permit proper curing prior to backfilling the excavation. Proper methods and materials shall be used during backfilling to prevent damage to the coating. Any damage to the coating which does occur shall be immediately repaired.

2000.9 PIPE ENCASEMENT AND COLLARS

I. Scope: This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work for the encasement of pipe in concrete or installation of concrete collars at locations shown on the plans.

II. General: Total or partial encasement of pipe in concrete shall be used where the required safe supporting strength cannot be obtained by other bedding methods. Concrete encasement shall also be provided at locations to protect public water supplied or where exists the possibility that standard bedding may be eroded by currents of water under and around the pipe.

III. Materials:

A. Concrete: Concrete, whether reinforced or non-reinforced, shall be MCIB Mix A-550-1-4.

B. Reinforcing: Reinforcing steel used in concrete encasements shall be ASTM A-615, Grade 40.

IV. Construction: Concrete encasement shall be constructed at locations indicated and in accordance with details as shown on the plans or City Standard Drawings. Start and terminate encasement at a pipe joint. Suitably support and block pipe to maintain position and prevent flotation. Form to dimensions in dimensions indicated or construct full width of trench.

A. Joints: If a single section of encasement is not constructed continuously (concrete is not placed in a single deposit), construction joints shall be provided in the encasement to coincide with pipe joints. Construction joints shall be keyed continuously around the encasement. Longitudinal reinforcement shall be continuous through construction joints.

B. Curing: Concrete encasement shall be protect so as to prevent excessive evaporation or freezing.

C. Backfilling: Backfill trench only after concrete encasement has obtained a minimum of 2000 PSI and can sufficiently support the loads imposed by backfill and backfill operations.

2000.10 **BACKFILL**

I. Scope: This section governs the furnishing of all labor, equipment, tools and materials, and the performance of all operations necessary for the proper replacement of backfill material in pipe trenches and around structures as required by the plans of Special Provisions.

II. General:

A. Unless otherwise specified, all sewer trenches and excavations around structures shall be backfilled to the original surface of the ground with earth, earth and rock, or other acceptable material. When earth and rock is used, it shall be placed and thoroughly consolidated with sufficient earth to completely fill all voids between the rocks. The Contractor shall so sort and stockpile the excavated material so that the proper material is available for backfill.

B. The backfill material shall be compacted to a minimum of 95% of optimum density as determined by the Standard Proctor Test or shall be compacted to a density equivalent to the density of the immediate adjoining soil. The top six (6) inches of backfill in street right-of-way shall be compacted to a minimum density of 95% of optimum density as determined by the Standard Proctor Test. Backfill material shall be placed and compacted only when its moisture content is within +/- 2% of optimum moisture content as determined by Standard Proctor Test.

C. The combination of the thickness of the layer, the method of compaction and the type of compaction equipment shall be at the discretion of the Contractor subject to obtaining the densities as specified above.

D. The quality of the compaction shall be subject to compaction tests when deemed necessary by the Public Works Director. It shall be the Contractor's responsibility to make necessary excavation in order to accommodate compaction tests at locations specified by the Public Works Director. The compaction tests will be performed at no cost to the Contractor. If the quality of the compaction does not meet the above requirements, the material will be removed and replaced to meet the above requirements at the expense of the Contractor.

E. Commercial backfill shall not be used.

F. In areas marked "garden" or "flower garden", the top soil as excavated shall be stockpiled and replaced to original elevation, location and depth.

G. Backfill material shall be carefully placed to avoid damage or displacement of the sewer or structures.

H. Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, tress, organic material, rubbish, etc.

III. Backfill of Pipe Trenches:

A. The area below a plane six (6) inches above the top of pipe bell shall be backfilled in accordance with the specifications for "Pipe Bedding".

B. Backfill above a plane six (6) inches above the top of pipe bell shall be backfilled in accordance with the specifications for "Pipe Bedding".

IV. Backfill Around Structures:

A. No backfill shall be placed over or around any structure until the concrete or mortar therein has attained a minimum strength of 2000 PSI and can sufficiently support the loads imposed by the backfill without damage.

B. The Contractor shall use utmost care to avoid any wedging action between the side of the excavation and the structure that would cause any movement of the structure. Any damage caused by premature backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor.

C. Backfill shall be placed and compacted on all sides of the structure simultaneously, and operations shall be so conducted that the backfill is always at approximately the same elevation of all sides of the structure.

D. No excavated rock larger than four (4) inches maximum dimension shall be placed within one (1) foot of the exterior surface of any structure.

2000.11 ACCEPTANCE TESTS FOR SEWERS

I. Scope: This section governs the furnishing of all labor, equipment, tools and materials, and the performance of any or all acceptance tests as required by the plans, Special Provisions, and these specifications.

II. Acceptance Tests for Gravity Sewers:

A. Visual Inspection:

1. Contractor shall clean pipe of excess mortar, joint sealant and other dirt and debris prior to inspection.

2. Sewer will be inspected by City, by flashing a light between manholes and/or by physical passage of TV camera. Determine from illumination and/or physical inspection the presence of any misaligned, displaced, or broken pipe and the presence of visible infiltration or other defects.

3. Correct defects as required prior to conducting leakage tests.

B. Air Leakage Testing:

1. The Contractor shall perform air tests on the full length of all sewer lines prior to acceptance and furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over pressurization, and all miscellaneous items required.

The pipe plug for introducing the air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge indicating internal pressure in the sewer pipe. Additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.

The pressure test gauge shall meet the following minimum specifications:

Size (diameter)
4-1/2 inches
Pressure Rings
0-22PSI

Figure Intervals
1-PSI increments
Minor Subdivisions
.05 PSI
Pressure Tube
Bourbon Tube or Diaphragm
Accuracy
+/-.25% of maximum scale reading
Dial
White coated aluminum with black lettering, 270 degrees Arc and mirror edge
Pipe Connection
Low male 1/2"NPT

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Public Works Director whenever air tests are performed.

Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.

Plug ends of line and cap or plug all connection provided must have two taps for the connection equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If The time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe Size	Required Time per 100 LF	Maximum Required Time
8"	70 sec.	227 sec.
10"	110 sec.	283 sec.
12"	158 sec.	340 sec.
15"	248 sec.	425 sec.
18"	356 sec.	510 sec.
21"	485 sec.	595 sec.
24"	634 sec.	680 sec.
27"	765 sec.	765 sec.
30"	851 sec.	851 sec.
33"	935 sec.	935 sec.

If air test fails to meet above requirements repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance all constructed sewer lines shall satisfactorily pass the low pressure air test.

In areas where ground water is known to exist, install a one-half inch diameter capped pipe nipple, approximately 10" long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water shall be determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The

hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

2000.12 **SEEDING**

I. Scope: This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work for seeding, complete, as specified in the Special Provisions and/or as shown on the plans.

II. Materials, Definitions and Equipment:

A. Seeds: Seeds for cover crops shall comply with the requirements of the applicable state Seed Law and shall be of the kind of mixture of seeds specified herein. Seeds shall be free of prohibited weed seeds and shall not have more than one(1) percent of noxious weed seeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trade name, or trade mark and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified.

B. Pure Live Seed: The following formula shall be used to determine the amount of commercial seed required to provide for each kind of seed the specified quantities of pure live seeds.

$$\text{Pounds of Commercial Seed Required} = \frac{10{,}000 \times \text{Rate of Pure Live Seed (lbs per acres)}}{\text{Purity \%} \times \text{Germination \%}}$$

C. Fertilizer: Fertilizer shall be inorganic 12-12-12 or 13-13-13 grade, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in convenient containers, each fully labeled, conforming to the applicable state Fertilizer Laws bearing the name, trade mark or trade name, and a warranty of the producer.

D. Mulch: Mulch shall be of the vegetative type. Such vegetative type shall be the cereal straw from stalks of oats, rye, wheat or barley and shall be free of prohibited and noxious weed seeds.

E. Equipment: The seeding operation shall be accomplished with equipment suitable for preparing the seed bed, sowing the seed and fertilizer, and spreading the vegetative type mulch in accordance with the applicable requirements of the following subsection entitled "Construction Details".

III. Construction Details:

A. Application of Fertilizer: Before tilling of the soil, the fertilizer shall be distributed uniformly at the rate of six hundred (600) pounds per acre, and incorporated into the soil to a depth of at least two (2) inches by discing or harrowing methods. (Fertilizing rate is equivalent to 7 pounds to 500 square feet.)

B. Tilling the Seed Bed: Areas shown on the plans or specified to be seeded shall be cleared and graded as required preparatory to tilling the surface for seeding. The surface shall be tilled to a depth of at least two (2) inches by digging or other approved methods until the soil is suitable for seeding. Areas tilled shall be maintained until seeding and mulching is complete to insure a smooth area with no gullies or depressions.

C. Planting Seeds: The kinds of seeds and the rate of sowing pure live seed shall be as specified on the plans or in the Special Provisions, but shall be one of the following mixtures:

1. Type "A" Seed: This seeding mixture will normally be used where seeding is required in areas of established yards, shoulders and slopes in street right-of-way, and any other areas where a high-type seeding is deemed necessary. The seed mixture will be as follows:

Kind of Seed	Minimum Pure Live Seed (%)	Rate (lbs per acre)
Alta Fescue or Kentucky 31 Fescue (Festuca Elatior Var. Arundinces)	75	25
Rye Grass (Lolium peyrenne or L. Multiflorum)	80	25
Kentucky Blue Grass (Poa. Pratensis)	75	20
Creeping Red Fescue (Festuca Rubra)	85	10
Total		80# / acre

2. Type "B" Seed: This seeding mixture will normally be used to seed areas off street right-of-way that are not maintained.

Kind of Seed	Minimum Pure Live Seed (%)	Rate (lbs per acre)
Alta Fescue or Kentucky 31 Fescue (Festuca Elatio Var. Arundinces)	75	90
Rye Grass (Lolium Perenne or L. Multiflorum)	80	50
Total		140# / acre

Sowing shall be accomplished by use of an approved mechanical seeder or drill (hand spreader can be used in small areas), making sure that successive seed strips overlap to provide uniform coverage. Seed should be drilled to a depth of one-half (1/2) inch.

3. Compaction: Immediately following the completion of seeding operations, if in the judgement of the Public Works Director the seed bed is either too loose or contains clods which would reduce the seed germination, the entire area shall be compacted by means of a roller weighing at least sixty (60) but not more than ninety (90) pounds per linear foot of roller.

4. Mulching: Mulching shall be done within 24 hours following the seeding operation.

5. Vegetative Type Mulch: Vegetative mulch shall be spread over all areas that are seeded. Mulch shall be uniformly spread at a rate of two(2) tons per acre by means of a mechanical spreader or other means

approved by the Public Works Director. The mulch must be spread in a loosened condition so that there are no lumps of compacted material.
As soon as the mulch is spread it shall be anchored to the soil by use of a heavy disc harrow, set nearly straight, or a similar approved tool. Discs of the anchoring tool shall be set approximately nine (9) inches apart. Anchoring shall be accomplished by not more than two (2) passes of the tool. The operation shall be such that it will anchor the mulch, not cut it.

6. Protection and Repair: The seeded area shall be kept free of traffic. If at any time before acceptance of the completed work, any portion of the seeded surface becomes gullied or otherwise damaged, or the seeding has been damaged or destroyed, the affected portion shall be repaired to re-establish the specified condition prior to the acceptance of the work.

2000.13 PAVEMENT REPLACEMENT

I. Scope: This section covers the furnishing of all labor, equipment, tools, and materials, ad the performance of all work for the replacement of pavement including sidewalks, driveways, and curbing, as specified on the plans and in the Special Provisions.

II. Definitions: Pavements, as used herein, shall include Portland Cement Concrete (PCC), asphaltic concrete, asphaltic and lime or cement treated surface courses, and other similar types of construction, including sidewalks, driveways, and curbing. Replacement, as used herein, shall mean reconstruction of the entire structural section of all pavements, removed in excavated areas, including sidewalks, driveways, and curing, and reconstruction or restoration or damaged pavement surfaces outside of excavation limits.

III. General: In all areas of pavement removal replace pavement upon completion of sewer installation.

All pavement not designated for removal that is damaged by the Contractor's operations shall be repaired, restored or replaced depending upon the degree of damage.

Prior to pavement replacement all edges that were previously cut but have been subsequently damaged, shall be recut, and all adjacent undermined and heaved pavement shall be removed to the edge of the undisturbed trench.

IV. Pavement Replacement:

A. General: Removed pavement shall be replaced in conformance with the typical sections shown on the City Standard Drawings, plans, the "Street Specifications and Standards", the requirements specified in the Special Provisions, and will generally be replaced in kind.

Replacement shall include construction of all courses upon the subgrade for a complete pavement structural section.

Restoration of damaged surfaces shall be as directed by the Public Works Director.

Final pavement joints must be parallel or perpendicular to the street center line.

B. Subgrade Compaction: Subgrade compaction shall conform to Section 2507, "Backfill".

C. Permanent Improved Streets: The structural section of Permanent Improved Streets shall conform to "Street Specifications and Standards", and to the applicable City Standards and Drawings.

D. Unimproved Streets: All unimproved street surfaces disturbed by this construction shall be replaced with six (6) inches of untreated compacted aggregate, conforming to "Street Specifications and Standards". Prior to placing seal coat, a prime coat of approximately 0.15 gallons per square yard of

MC-30 shall be applied. A single bituminous seal coat shall be applied to all disturbed street surfaces using approximately 0.2 gallons per square yard of RC-800 and 15-20 pounds of chips per square yard. In addition to the above pavement replacement, all roadway surfaces within the limits defined by a distance of 25 feet beyond any area disturbed by this construction shall be surfaced with a single bituminous seal coat using approximately 0.2 gallons per square yard of RC-800 and 25 pounds per square yard of uncoated aggregate chips.

E. Curb and Curb and Gutter:

1. Portland Cement Concrete: PCC Curb, and Curb and Gutter shall conform to "Street Specifications and Standards", and to the applicable City Standard Drawings.

2. Asphaltic Concrete: Unless otherwise approved by the Public Works Director, a curb machine shall be used to place asphaltic concrete curb. A type IV asphaltic concrete mix that will produce a satisfactory curb shall be used.

VI. Sidewalks: Portland Cement Concrete sidewalks shall conform to "Street Specifications and Standards", and to the applicable City Standard Drawings.

VII. Driveways:

A. Portland Cement Concrete: Portland Cement Concrete Driveways shall conform to "Street Specifications and Standards", and to the applicable City Standard Drawings.

B. Asphalt Concrete: Asphaltic Concrete Driveways shall conform to the applicable City Standard Drawing.