TABLE OF CONTENTS
TECHNICAL SPECIFICATIONS

DIVISION 3100 – SANITARY SEWER MANHOLES AND SPECIAL STRUCTURES

SECTIONS:

DIVISION 3200 - DESIGN CRITERIA FOR LIFT STATIONS AND FORCE MAINS

SECTIONS:

DIVISION 4000 – STORM SEWERS

SECTIONS:

DIVISION 5000 – EXCAVATION, TRENCHING AND BACKFILLING (Pipeline Construction)

SECTIONS:

DIVISION 5100 – BLASTING

SECTIONS:

DIVISION 6000 – RESTORATION OF SURFACE CONSTRUCTION

SECTIONS:

DIVISION 9000 – SEDIMENT AND EROSION CONTROL

SECTIONS:

DIVISION 10,000 – PAVEMENT MARKINGS

SECTIONS:

DIVISION 1000 – SITE PREPARATION

Section 1001 SCOPE. This section covers the necessary clearing, grubbing, demolition, and other appurtenant work at the locations shown on the contract drawings.

Section 1002 DEFINITIONS.

(a) Clearing. Clearing shall consist of the removal of all vegetable matter, such as trees, brush, down timber, rotten wood, sod, rubbish, and other objectionable combustible materials found on or above the surface of the site. It shall include the removal of wood buildings, fences, lumber, waste dumps, abandoned utilities, and trash, the salvaging of such materials as may be specified, and the disposal of the debris.

(b) Grubbing. Grubbing shall consist of the removal of all stumps, roots, buried trees and brush, and other objectionable combustible materials appearing on or below the surface of the ground which has not been included under the definition of "Clearing" above.

(c) Demolition. Demolition shall consist of the destruction and removal or incorporation into embankment all non-vegetable matter appearing above, on, or below the ground surface. This shall include, but not be limited to, all material derived from the demolition of Portland cement concrete items such as base courses, curbs, curb and gutters, sidewalks, floors, steps, driveways, drainage structures of all sorts, guard fences, and other miscellaneous items such as foundations or walls of any sort, and iron or steel items, and asphaltic items such as pavement and base courses.

(d) Trees. Vegetable growth forty (40) inches or greater in circumference, measured two (2) feet above the ground shall be classified as a tree.

(e) Brush. Vegetable growth less than forty (40) inches in circumference, measured two (2) feet above the ground shall be classified as brush.

Section 1003 UTILITY COORDINATION. The contractor shall determine the exact location of all existing utilities before commencing work. 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 utilities. The contractor shall be responsible for the cost of all damage to such facilities arising from his carelessness or negligence. The contractor shall comply with all relevant laws, rules, and regulations pertaining to the Kansas One Call System, Inc.

Section 1004 LIMITS OF CONSTRUCTION. The limits for clearing, grubbing, and demolition shall be as defined on the plans or specified in the Special Conditions, but in no case shall work extend beyond the limits of the right-of-way, City property lines, easements or beyond defined "Limits of Construction" if shown on the plans.

Section 1005 PROGRESS OF CONSTRUCTION.

(a) Existing Site Conditions. The contractor shall, prior to commencing work, investigate surface and subsurface conditions to be encountered across the project site and notify the Engineer if any discrepancies or changed conditions are noted.

(b) Clearing. Clearing shall proceed 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 laws, regulations, and requirements of any governing authority regarding health, safety, and public welfare. When authorized by the Fire Department and Public Works Department the contractor may dispose of such refuse by burning on the site of the project, provided all requirements as determined by the Fire Chief are met. Under no circumstances will the authorization to burn on the site 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 into abutting properties, or buried in embankments or trenches on the site.

(c) Grubbing. Grubbing shall parallel the clearing as nearly as the sequence of operations will permit. Except for the special circumstances enumerated below, all stumps, roots, and other objectionable matter within the construction area shall be removed to a minimum depth of twelve (12) inches below the subgrade or the original ground, whichever is lower. All stumps, roots, and other objectionable matter outside the limits of the construction area but within the right-of-way shall be cut off flush with the ground.

All stumps, roots, and other objectionable matter within the specified limits of embankments having a depth of two (2) feet or less 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 subgrade or the original ground, whichever is lower.

All stumps, roots, and other objectionable matter found within borrow material to be used for embankment or fill material shall be removed.

All stumps, roots, and other objectionable matter found within the bottoms or sidewalls of excavation and trenching areas shall be completely removed from the respective bottom areas, and removed to a minimum depth of twelve (12) inches below the respective sidewalls.

(d) Demolition. Demolition work shall occur well in advance of the construction operation. Masonry and concrete walls, miscellaneous foundations, or other objects extending below ground shall be removed to a depth of at least twelve (12) inches below the original ground or the subgrade, whichever is lower.

(e) Existing Ponds. Contractor shall remove all sediment and organic material from the bottom of the existing ponds that are to be filled prior to any embankment construction. The site geotechnical engineer shall inspect and approve the mucked out pond bottoms prior to initiating embankment construction in these areas.

When explosives are used in demolition, the contractor shall comply with the provisions of Specification Section 5100 Blasting.

In removing items such as Portland cement concrete pavement, base courses, curbs, curb and gutters, gutters, sidewalks, and similar objects where portions of said 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 these objects shall be removed to provide for the proper grade and connection to the new work.

Section 1006 PROTECTION OF TREES AND SHRUBS. During his construction operation, the contractor shall leave in place and protect from damage all trees, shrubbery, and flower beds unless shown on the drawings to be removed. Where trees existing on the project site are not to be removed, it shall be the responsibility of the contractor to trim low branches which would interfere with the normal operation of his equipment. The trimming shall be performed in a professional manner prior to any machine operation. Extreme care shall be taken to ensure that trees not marked for removal or clearing are not damaged. Contractor will be responsible for replacing all trees damaged through negligent grading operations.

PROTECTION OF SURROUNDING IMPROVEMENTS. Driveways, sidewalks, and other areas outside the construction limits damaged by the contractor shall be restored to a condition equal to or better than that existing before damage occurred. This work will not be paid for directly, but is considered subsidiary.

DISCOVERY OF UNMARKED GRAVESITES. All work is to immediately stop in the event the contractor or any of his subcontractors discover any sign of gravesites during excavation or construction. Contractor shall notify the City of Lansing of such discovery and no work shall resume until authorized by the City of Lansing.

DIVISION 1100 – GRADING

Section 1101 SCOPE. This section covers the performance of all the work and appurtenances required for grading the project in coordination with all previous work performed at the locations shown on the contract drawings.

Section 1102 MATERIALS AND DEFINITIONS.

(a) Grading. Grading shall be defined as meaning the performance of all excavation and embankment 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 as shown on the contract drawings.

Unless otherwise provided for in the Special Conditions and included in the proposal, all excavation shall be unclassified excavation and the contractor shall satisfactorily remove and dispose of all materials encountered regardless of their nature.

When provided for in the contract documents, the excavation may be classified according to the following categories.

1 Common Excavation. Suitable materials shall include all earth free of rock, sod, weeds, roots and other debris, and containing the soil characteristics and moisture content to obtain the required compaction.

2 Rock Excavation. Rock excavation will be so classified when sandstone, limestone, blue shale or other similar material is encountered and, in the opinion of the Engineer, requires hoe-ramming, drilling or blasting to remove the material. Excavatable limestones and shales identified in the geotechnical engineering report, or by the Engineer, shall not be considered for payment as rock excavation.

3 Unclassified Excavation. Any and all material regardless of its physical nature or suitability for a particular purpose.

(c) Embankment. Embankment is defined as the placing and compacting of material in the construction area to the lines and grades as shown on the contract drawings.

Material suitable for use as embankment shall be entirely imperishable and shall be determined as acceptable by the Engineer. Materials noted on the plans or in the geotechnical report as unsuitable shall not be used.

Materials suitable for soil embankment shall be free of waste material, contain less than ten (10) percent by volume of rock and gravel, contain no particles having a dimension greater than three (3) inches, and shall conform to requirements of the Design Criteria section of this document, item Q (DC/3-5).

Materials suitable for rock embankment shall be free of waste material and contain ten (10) percent or greater by volume of rock or gravel containing particles ranging in size from a minimum dimension of three inches (3") to a maximum of twenty-four inches (24").

Material not suitable for use as embankment material shall include, but shall not be limited to, frozen material, organic material, topsoil, rubbish, rock, broken concrete, brick, asphaltic concrete, and other debris and soil not containing the characteristics and moisture content to obtain the required compaction.

(d) Structures. Structures, as used herein, refer to bridges, basins, street drainage structures, headwalls, retaining walls, and similar construction.

Section 1103 CONSTRUCTION – GENERAL. During excavation and embankment grading operations, the work shall be performed in a manner and sequence that will provide drainage at all times. Soft spots or areas that develop during grading

operations shall be removed, the area then backfilled with suitable material and compacted to obtain the required density. No additional payment will be made to the contractor for this work.

Erosion Control. The contractor shall be responsible for control of surface erosion during construction and until the owner accepts the work as complete. The contractor shall install and maintain the erosion control measures as shown in these plans. Additional erosion control measures may be required to control erosion. Contractor is responsible to use whatever methods are required to control erosion. The contractor is responsible for providing berms, silt fences, straw bales, or other means to prevent erosion from reaching the public rights-of-way or existing drainage ways. In the event the prevention measures are not effective, the contractor shall remove any debris and restore areas to original or better condition.

Section 1104 EXCAVATION – GRADING. Excavation of every character and of whatever materials encountered within the construction limits shall be performed to the lines and grades indicated on the contract drawings.

All suitable material removed by excavation shall be used as far as practicable in the formation of embankment or elsewhere when and as directed by the Engineer. It shall be the responsibility of the contractor to handle excavation in any manner he sees fit, provided that suitable materials will be available when required. Care shall be taken to manage the material in a matter that will facilitate compliance with topsoil requirements of Section 1106, and, to provide as much uniformity of material as practical for subgrade preparation (Section 1200). No additional compensation will be allowed for any special sequence of excavating or placing of such materials or any re-handling of materials.

Excavation materials in excess of the amount needed to complete the grading shall be considered as waste material, which shall be removed from the site by and at the expense of the contractor.

Any additional fill material required which is not available from excavation within the construction limits shall be supplied by the contractor as no expense to the owner unless provided for in the proposal and Special Conditions. All such material brought to the site and incorporated in the work shall be subject to the approval of the Engineer.

In the event during grading operations materials are encountered below grade or otherwise which are determined as being unsuitable or unstable by the Engineer or his representative they shall be removed to the depth required to reach stable material. The area involved shall then be backfilled with suitable material as determined by the Engineer and compacted to obtain the required density. The basis of payment on public funded projects for the quantity of excavation of unsuitable material and embankment to replace it shall be the applicable contract unit prices for excavation and embankment.

Section 1105 EMBANKMENT – GRADING. The embankments shall be formed with suitable materials, as herein defined and as identified on the plans and in the geotechnical report, procured from excavations made on the project site, or from borrow pits as required to complete the grading work.

Where embankments, regardless of height, are placed against hillsides or existing embankments, either of which have a slope steeper than one (1) vertical to six (6) horizontal, the existing slope shall be benched or stepped in approximately eighteen (18) inch rises as the new fill is brought up in eight (8) lifts (loose measurement). Both the material bladed out and the bottom of the area cut into, as well as the embankment material being placed, shall be compacted to the required density. Material cut out, bladed into place, and compacted shall not be measured and paid for directly but will be considered as incidental work.

The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material, such as topsoil, peat, mulch, coal seams, disintegrated shale, rubbish, roots, logs or stumps, and unconfined saturated soils, removed to the depths shown before starting the embankment work.

Where embankments two (2) feet or less in depth are to be placed on areas covered by existing pavement, the existing pavement shall be removed and the cleared ground surface shall be compacted at optimum moisture to the specified density. Where embankments greater than two (2) feet in depth are to be placed on areas covered by existing pavement, the existing pavement may be left in place, but shall be broken into pieces not larger than twenty-four (24) inches maximum dimension, with sufficient differential vertical displacement to prevent a slippage plane, left in place and the embankment started thereon.

Embankment shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed eight (8) inches in thickness (loose measurement) and shall be compacted to the density specified in paragraph 1106 before the next layer is placed thereon. As the compaction of each layer progresses, continuous

blading with a motor grader will be required to level the surface and to ensure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen, or a blanket of snow prevents proper compaction.

Successive horizontal layers of rock embankment not exceeding two (2) feet in depth shall be made by placing larger stones uniformly over the embankment area.

Small stone fragments, sand, earth, or gravel shall be placed between the larger stones to fill all voids. Each layer shall be thoroughly compacted before the next layer is placed. The work shall be performed in a manner that eliminates voids or non-uniform compaction of the finer portions of the embankment.

Large rocks shall be withheld from the top one-foot or more of the embankment and only crushed stone (AB-3), or soil used in this layer.

Section 1106 EMBANKMENT – BACKFILL AND COMPACTION. Each successive lift of backfill material shall be rolled with a tamping or sheepsfoot roller and shall be continuously bladed as provided for in Section 1105, paragraph 5, except as provided below for sand and gravel, making a sufficient number of trips over the entire surface to compact all material thoroughly and uniformly. Compaction shall be continued until 95% of maximum density is obtained at the optimum moisture content as determined by ASTM D698, or other test method approved by the Engineer.

Sand and gravel, which cannot be compacted satisfactorily with a sheepsfoot roller, shall be rolled with a pneumatic-tired roller. Each lift shall be rolled until no further consolidation is evident.

All the work involved in either adding moisture to, or removing moisture from embankment materials shall be considered incidental to the completion of the grading operation, unless otherwise provided for in the Proposal and Special Provisions.

Backfilling behind curb or curb and gutter shall be done within seven (7) days after being laid unless otherwise approved by the Engineer. All fill material placed behind the curb and gutter beneath and either side of sidewalks within the right-of-way shall be brought to 95% of maximum density at the optimum moisture content as determined by ASTM D698 or other test method approved by the Engineer. The material used to fill the void behind curb or curb and gutter shall be free of rock and debris and shall be of a type that will leave no voids to pocket water and that will self-compact. Unless otherwise shown on the contract drawings, the finish grading from the back of the curb to the right-of-way line and/or utility easement line or construction easement line shall be performed to provide a smooth transition between existing yard grades at the right-of-way line and/or easement line to the curb so that positive drainage will exist.

The top portion of the backfill within the right-of-way areas but outside the pavement subgrade shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, those underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

Section 1107 STRUCTURE BACKFILL. Backfill around and outside of structures shall be deposited in layers not to exceed eight (8) inches in uncompacted thickness and brought to 95% of maximum density at optimum moisture content as determined by ASTM D698 or other test method approved by the Engineer. Compaction of structure backfill by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of structure backfill by inundation with water will not be permitted.

Material for structure backfill shall be composed of earth only and shall contain no organic materials, broken concrete, stones, trash, or debris of any kind.

No tamped, rolled, or otherwise mechanically compacted backfill shall be deposited or compacted in water.

All backfill material shall consist of loose earth having moisture content such that maximum density of the compacted soil will be obtained. Moisture content shall be distributed uniformly. Water for correction of moisture content shall be added sufficiently in advance so that proper moisture distribution and compaction will be obtained.

Backfill around and outside of structures that will ultimately lie under proposed pavements shall be compacted to the requirements of Section 5017 Number 1 Excavatable Flowable Fill.

Section 1108 SHEETING AND SHORING. Except where banks are cut back on a stable slope, excavation for structures shall be properly and substantially sheeted, braced, and shored, as necessary, to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances. Shoring shall be designed by a qualified professional Engineer and a copy of the resulting Engineering data and drawings furnished to the Engineer prior to use.

Section 1109 FINAL GRADING. After other outside work has been finished and backfilling and embankments completed, all areas on the site of the work, which are to be graded, shall be brought to grade at the indicated elevations, slopes, and contours, including shoulder, berm, and sidewalk spaces. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and conforming to the lines and grades shown on the plans. The contractor shall repair any damaged surface and shall not use any equipment that will leave a marred surface.

Slopes. Unless otherwise noted or shown, slopes shall be graded no steeper than a slope of 3:1 (3 horizontal : 1 vertical), and 4:1 or flatter is preferred where practical.

Section 1110 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 a subsidiary obligation of the grading work.

In the event the contractor does not promptly comply with the terms of such instructions, the City may have the defective work corrected or the rejected work removed and replaced and all direct and indirect cost of such removal and replacement, including compensation for additional professional services, shall be paid by the contractor. The contractor will also bear the expenses of repairing work of others destroyed or damaged by his correction, removal or replacement of defective work.

Section 1111 SETTLEMENT. The contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within two years after final completion of the contract under which the work was performed.

The contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer.

Section 1112 TEMPORARY SURFACING. If during construction activities it is deemed necessary to provide ingress and egress to the public by placement of temporary surfacing, the contractor shall do so at the direction of the Engineer or his authorized representative. Temporary surfacing shall meet the requirements of the Kansas Department of Transportation classification CA-5 or AB-3 for aggregates as directed by the Engineer. Larger aggregates may be used if, in the opinion of the Engineer, additional stabilization is necessary. Temporary surfacing shall be supplied by the contractor at no expense to the owner unless provided for in the proposal and Special Provisions.

DIVISION 1200 – SUBGRADE PREPARATION

Section 1201 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work connected with subgrade preparation, prior to constructing pavements for streets, alleys, parking areas, sidewalks, drive approaches and the construction of concrete curb and curb gutters. This section does not include the construction of any base courses.

Section 1202 DEFINITIONS.

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

(b) Subgrade Preparation. Subgrade preparation is the repeated operation of manipulating, grading, and compacting the subgrade until the specified lines, grades, and cross-sections have been obtained and the materials are compacted to the specified depth and density.

Section 1203 CONSTRUCTION REQUIREMENTS.

(a) General. All clearing, grubbing, demolition, and installation of sewers and other utilities, shall be completed in accordance with the requirements of Section 1100 Grading prior to commencement of any subgrade preparation.

The subgrade surface shall be brought to the specified lines, grades and cross-sections by repeatedly adding or removing material and compacting to the specified density with a suitable roller to perform these operations. To facilitate manipulation and testing, the contractor shall as nearly as practical, manage his operations to provide the most suitable material available from the project to construct a uniform, stable subgrade. Material for subgrade shall conform to the design criteria and any applicable plan notes.

(b) Foundation Treatment. Unless otherwise specified or shown on the contract drawings, the soil below grade line in cut sections shall be scarified, broken up, adjusted to a moisture content within the designated moisture range and compacted to the designated type of compaction.

When the depth of compaction in cut sections is shown to be more than six (6) inches, all material shall be removed to within six (6) inches of the lower limit of the compaction. The layer of material left in place shall be scarified, broken up, adjusted to a satisfactory moisture content and compacted to the designated type of compaction. This process shall be repeated until the cut section is compacted to the grade as shown on the contract drawings.

(c) Moisture Control Requirements. The moisture content of the soil at the time of compaction shall be as necessary to obtain the density as designated on the contract drawings unless it is determined by the Engineer that the soil is unstable with that moisture content.

When the moisture content of the soil is not satisfactory to the Engineer, water shall be added or the material aerated, whichever is needed, to adjust the soil to the proper moisture content.

(d) Compaction Control Requirements. Roadway embankment earth (fill) materials shall be placed in horizontal layers not exceeding eight (8) inches unless otherwise approved by the Engineer and shall be compacted as specified in Section 1205 “Compaction Requirements” before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compaction. Water shall be added or removed on the approval of the Engineer, in order to obtain the required density.

Section 1204 MOISTURE CONTENT REQUIREMENTS. The moisture content of the soil at the time of compaction shall be uniform and shall be such that the soil can be compacted to the requirements of the type of compaction as designated on the contract drawings or as directed by the Engineer.

If Type B compaction is specified with this moisture control, the content shall be sufficient to produce a uniform mixture of the soil and moisture. It will be determined by the Engineer whether or not satisfactory compaction and moisture content is obtained.

Section 1205 COMPACTION REQUIREMENTS.

(a) Pavements. Unless otherwise stated in the approved geotechnical report for the project, the subgrade for pavements shall be compacted to a density of at least ninety-five (95) percent of the maximum density for the material used for a depth of at least six (6) inches below the finished subgrade elevation and within the tolerance of the moisture for the type of material at ninety-five (95) percent of maximum density, as determined by the standard proctor test (ASTM D698) for cohesive soils, and no more than 5% + or – from optimum moisture. Any further compacted layers shall be accomplished in the same manner as specified.

When Type B compaction is specified or shown on the contract drawings, the compacted density is to be such that the tamping or sheepsfoot roller, while rolling the layer or lift will walk out of the material and ride the top portion of the lift.

When Type B compaction is specified for low plasticity or non-plastic, fine-grained material, compaction shall be considered adequate when additional passes of the roller do not bring the tamping feet closer to the surface of the lift, provided the entire weight of the roller is supported on the tamping feet and none by material directly in contact with the drum.

Sand and gravel which cannot be compacted satisfactorily with a sheepsfoot roller shall be rolled with a pneumatic-tired roller. Each lift shall be rolled until no further consolidation is evident.

Introduction of Fly-ash: Sub-grades may be stabilized by using hydrated lime or Class C Fly-ash in accordance with the geotechnical report for the project. All subgrade stabilization shall be completed under the direction of a geotechnical engineer, per design criteria Item Q (DC/3-5).

(b) Sidewalks. The subgrade for sidewalk pavements shall be compacted to a density equivalent to the density of the immediately surrounding soil in areas not requiring fill. In areas where fill is required, the subgrade shall be compacted to ninety-five (95) percent of the maximum dry density as determined by ASTM D698 for cohesive soils or to seventy (70) percent relative density as determined by ASTM D2049 for non-cohesive soils.

(c) Drive Approaches and Concrete Curb and Gutter. The subgrade for drive approaches and concrete curb and gutter shall be compacted to the same requirements as stated above in part a. pavements.

Section 1206 PROTECTION AND MAINTENANCE OF SUBGRADE. The newly finished subgrade 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.

The contractor shall protect all pavements, curbs, curb and gutters, and sidewalks from his subgrade operation with an earth cushion, timber planking, or both where tractors, graders, rollers, or other equipment are required to pass, or turn around. All resulting damage shall be repaired. Any damaged work which cannot be repaired to the satisfaction of the Engineer shall be replaced by the contractor at his own expense.

Section 1207 COMPACTION TESTING. At the option of the Engineer, compaction testing may be performed in the field using a nuclear density-moisture measuring device to determine the density of the subgrade. If, as a result of this field testing, the Engineer determines that further compaction is required, the contractor shall revise his methods or procedures to obtain the specified density.

Section 1208 PROOF ROLLING. Proof rolling will be required prior to paving street or placing curbs. Proof rolling shall be done after specified compaction has been obtained and subgrade has been brought to plan elevation and cross section. Areas

found to be weak (exhibit pumping) and those areas which rut in excess of ¾" (shear strength failure), shall be ripped, scarified, wetted, dried, or modified with lime or fly ash, if necessary, and re-compacted to the requirements for density and moisture, returned to plan grade and cross section, and re-proof rolled at the contractor's expense.

Proof rolling shall be accomplished using a 25 ton fully loaded tandem-axle dump truck. The proof rolling shall consist of at least three cycles of loading over each of at least three separate paths across the roadway (including a path that places wheel loads under all curbs on subgrade as noted above).

DIVISION 1300 – ASPHALTIC CONCRETE PAVEMENT

Section 1301 SCOPE. This section covers asphaltic concrete pavement for roadways and parking areas.

Section 1302 GENERAL. Pavement shall be constructed to the lines, grades, dimensions, and details contained herein or as shown on the plans.

Except as modified herein, asphaltic concrete pavement shall conform to the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition, or latest revision, and shall be as follows:

Surface Course Mix. BM-2
Base Course Mix BM-2B

Alternate mix designs may be used only where approved by the Engineer.

(a) Composition of Mix. Mix designation BM-2 or BM-2B shall be composed of a combination of aggregates and mineral filler supplements meeting the requirements of Table 5, Section 1103 of the referenced state specifications, providing the mix meets the following composition limits. Not more than twenty-five (25) percent of the mineral filler shall be present in uncrushed aggregate. The remaining mineral filler shall be present in crushed aggregate or shall be obtained by adding mineral filler supplements. Not more than 8.0 percent by weight of the total mix shall be volcanic ash.

When specified for use in the surface course, mix designation BM-2 shall contain a natural sand of such grading that the portion passing the No. 8 sieve and retained on the No. 200 sieve will not be less than fifteen (15) percent of the total mix. For this purpose, only sand from an alluvial deposit shall be used.

Immediately prior to the addition of the asphalt, the combined aggregate shall meet the following grading and plasticity requirements:

Sieve Size	Percent Retained Master Grading Limits	Design Job-Mix Tolerances
1”	0*	
3/4”	0---5*	
3/8”	10---30	±6
4	---	±6
8	42---72	±6
16	---	±5
30	64---88	±5
50	---	±4
100	---	±4
200 (Wash & Scr.)	90---97	±2

Plastic Index, Max. 6
Moisture in Final Mix, Max. 7%
Quality of aggregates shall be in accordance with KSS 1103.02 (b) 1.1.
Deletorious substances shall be in accordance with KSS 1103.02 (b) 1.2.
*For base construction only. For surface courses, 100% shall pass the 3/4” sieve.
Certification that crushed limestone meets KDOT Durability Class 1 requirements based on testing current within 180 days shall be filed with the Public Works Director at the contractor’s expense prior to use.

In addition, there shall not be less than three (3) nor more than twenty-three (23) percent material between any two of the following successive sieves:

Numbers 4, 8, 16, 30, and 50.

The asphalt content for each bituminous mix shall be the optimum content plus or minus one-half (1/2) percent, as determined by the Engineer and shall be based on the Marshall Method test property curves for hot-mix design, to be submitted by the contractor a minimum of five days in advance of the paving operation.

Section 1303 SUBGRADE PREPARATION. Subgrade preparation for pavement shall be as specified in Section 1200.

Section 1304 TRANSPORTATION OF MIX. The mix shall be transported to the jobsite in vehicles cleaned of all foreign material which may affect the mix. The inside of the truck beds shall be lubricated with an environmentally safe product to prevent the mix from adhering to the bed. Vehicles shall be provided with covers of sufficient size and weight to protect the load and to prevent cooling of the mix during transportation to the site. The contractor shall provide a sufficient number of haul vehicles of the proper size speed, and condition, and a production source of sufficient capacity dedicated to the project, to ensure an orderly and continuous placement operation. Material shall be loaded, transported and unloaded in a manner that eliminates segregation of the mix.

Section 1305 ASPHALT CEMENT. A performance graded asphalt cement suitable for the anticipated traffic loadings and ambient temperature extremes, as approved by the Engineer, shall be used.

Section 1306 PLACING REQUIREMENTS. The bituminous mixture shall be spread and finished reasonably true to crown and grade by a mechanical, self-propelled paving machine. Bituminous mixtures may be spread and finished by other methods only where machine methods are impractical as determined by the Engineer.

The bituminous mixture shall be placed in a manner that eliminates segregation of the mix. All bituminous mixtures shall be delivered to the paver at a temperature between 250°F and 325°F. Delivery of the material to the paver shall be at a uniform rate and in an amount well within the capacity of the paving and compacting equipment. The paver and its distribution and spreading components shall be operated at a speed that provides for continuous, steady paving with no or few stops between truck loads. No asphaltic concrete shall be placed on frozen or wet subgrade. No asphaltic concrete shall be placed on frozen or wet subgrade.

The maximum depth of any individual base lift shall be five (5) inches. The maximum depth of any individual surface lift shall be two (2) inches. A minimum of one leveling course shall be placed prior to placement of the surface course for asphaltic pavements which consist of a total depth of ten (10) inches or less. A minimum of two (2) leveling courses shall be placed for asphaltic pavements greater than 10 inches.

Surface of newly placed asphalt shall be kept clean and free of debris between each lift. Under no circumstances shall successive lifts of asphalt be placed over any dirt, or debris on previously placed surface. Contractor shall make every effort to ensure that contamination between lifts will be kept to an absolute minimum.

Under no circumstances shall the contractor place and leave base course asphalt for an extended period of time without the proper placement of a surface course asphalt over the base. Base course asphalt shall not be subjected to long term exposure to the elements without approval of the Engineer.

Finish Surface Asphalt course shall be placed and rolled smooth and even, shall be free of excessive scrapes, gouges and debris, and shall exhibit normal accepted quality workmanship for asphalt pavements.

Asphalt shall meet adjoining surfaces flush so as to allow proper drainage (i.e. edge of concrete curb and gutter, concrete driveway entrances, or valley gutters). In the event asphalt is too high to allow proper drainage, it shall be allowable to heat treat and roll edge to obtain flush finish with adjoining surface.

When bituminous materials are being applied, the surface of all structures, curb and gutters, and other roadway appurtenances shall be protected in a satisfactory manner to prevent them from being splattered with bituminous material or marred by equipment operation. In the event that any appurtenances become splattered or marred, the contractor shall, at his own expense, remove all traces of bituminous material and repair all damage, and leave the appurtenances in as good condition as they were before the work began.

All mixed material shall be delivered to the paver in time to permit completion of spreading, finishing, and compaction of the mixture during the daylight hours. Night time work on projects will not be permitted except with prior written permission from the Engineer.

Hot-mix asphalt paving shall not be placed when the ambient temperature is below 40°F for base pavements and 50°F for surface pavements or when there is frost in the subgrade or at any other time when weather conditions are unsuitable for the type of material being placed without the express consent of the Engineer. When the ambient temperature falls below 55°F, precautions shall be taken to compact the mix before it cools too much to obtain the required density. In no case shall successive lifts of asphalt be placed until the previous lift has cooled to 175°F or less.

Section 1307 MECHANICAL PAVING MACHINES. Mechanical pavers shall be capable of spreading the mix, within the specified tolerances, true to the line, grade, and crown indicated on the contract drawings and without segregation of the mix.

Pavers shall be equipped with quick and efficient steering devices and shall be capable of traveling both forward and in reverse. They shall be equipped with hoppers and distributing screws which place the mix evenly in front of adjustable screens. They shall be equipped with either a vibrating screed or with a tamping bar immediately preceding a static screed.

The screed shall include any strike-off device operated by cutting, crowding, or other action which is effective on mixes at workable temperatures without tearing, shoving, or gouging them and which produces a finished surface of an even and uniform texture. The screed shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.

Pavers shall be capable of spreading mixes without segregation or tearing. They shall also be capable of placing courses in thicknesses of from one-half (1/2) inch to at least three (3) inches, and from widths of eight (8) feet to at least thirteen (13) feet. Extensions and cut-off shoes shall permit changes in widths by increments of six (6) inches, or smaller.

Section 1308 COMPACTION REQUIREMENTS. Rollers and other compactive devices shall be operated by competent and experienced roller personnel and shall be kept in operation continuously if necessary so that all parts of the pavements will receive substantially equal compaction. The Engineer shall order the paver and the mixing plant to cease operations at any time proper rolling is not being performed.

After spreading and strike-off and as soon as the temperature and mix conditions permit the compacting to be performed without excessive shoving or tearing, the mixture shall be thoroughly and uniformly compacted.

Compacting equipment shall consist of both steel-wheeled and pneumatic-tired rollers and shall be on the site of the work prior to placement of the pavement. The compaction equipment shall be self-propelled and capable of smooth starting, stopping, and reversing without backlash. Generally, the number and weight of rollers shall be sufficient to compact the pavement mixture to the required density while it is still in a workable condition.

Two-axle tandem steel rollers shall weigh not less than eight (8) tons or more than twelve (12) tons. Three-axle tandem steel rollers shall not weigh less than twelve (12) tons. Three-wheeled steel rollers shall weigh not less than eight (8) tons or more than twelve (12) tons. All rollers shall be equipped with water tanks and sprinkling devices which shall be used for wetting the rolls to prevent adherence of the placed material.

Light pneumatic-tired rollers shall be constructed to allow loading to provide a gross weight of at least two hundred and twenty-five (225) pounds per inch of tire tread. Heavy pneumatic-tired rollers shall be constructed to allow loading to provide a gross weight of not less than eight (8) tons and not more than twelve (12) tons.

The tires on the front and rear axles of all pneumatic-tired rollers shall have smooth treads and shall be staggered to provide complete coverage over the entire area over which the roller travels. All tires shall be kept at a uniform pressure conforming to the manufacturer's recommendation.

The selection of the type of roller to be utilized in breakdown rolling may be varied to suit mix characteristics and shall be acceptable to the Engineer. The final rolling of the top or surface course shall be accomplished with a steel roller unless otherwise approved by the Engineer. In the event a vibratory roller is used for finish rolling, it shall be operated with the vibratory unit in its off position.

During rolling, the roller wheels shall be kept moist with only sufficient water to avoid picking up the material. The speed shall not exceed three (3) miles per hour for steel-wheeled rollers and five (5) miles per hour for pneumatic-tired rollers.

The line of rolling shall not be changed suddenly or the direction of rolling reversed suddenly. If rolling causes displacement of the material, the affected areas shall be loosened at once with lutes or shovels and restored to the original grade of the loose material before being re-rolled. Heavy equipment or rollers shall not be permitted to stand on the finished surface before it has been compacted and has thoroughly cooled.

In laying a surface mix adjacent to any finished area, it shall be placed sufficiently high so that, when compacted the finished surface will be true and uniform.

Any mixture that becomes loose, broken, mixed with foreign material, or which is in any way defective in finish or density, or which does not comply in all other respects with the requirements set forth herein, shall be removed, replaced with suitable material, and finished by and at the expense of the contractor in accordance with these specifications.

Section 1309 BITUMINOUS TACK COAT. Prior to the distribution of bituminous materials, the contractor shall remove all loose materials from the surface by means of approved mechanical sweepers or blowers and/or hand brooms until it is as free from dust as is practicable. Side roads to receive bituminous treatment shall be shaped and bladed at the same time the sub-base is cleaned.

Contact surfaces of curbing, gutters, manholes, and similar structures shall be coated with a thin uniform coating of asphaltic material. The bituminous mixture shall be so placed so that after compaction it will be one-fourth (1/4) inch above the edge of the contact surfaces of such structures.

Joints between old and new pavements or between successive days' work shall be made so as to ensure thorough and continuous bond between the old and new mixtures. All transverse joints and longitudinal joints that have been deformed shall be sawcut. Prior to placing the new pavement against a cut joint or against old pavement, the contact surface shall be sprayed or painted with a thin uniform coat of asphalt material.

The tack coat shall be applied to the areas to be surfaced as soon as practicable after they have been prepared and area sufficiently dry at the rate of from 0.2 to 0.5 gallons/square yard at application temperature, or at a rate approved by the Engineer. Bituminous materials shall be applied by means of approved pressure distributors operated by skilled workmen.

The spray nozzles and spray bar shall be so adjusted and frequently checked that uniform distribution is ensured. The distribution shall cease immediately upon any clogging or interference of any nozzle and corrective measures taken before distribution is resumed. Hand sprays shall be used in tacking small patches or inaccessible areas that have been missed by the distributor.

The asphalt tack shall be entirely fogged over the base course.

The contractor shall maintain the tack coat treatment and the surface of the sub-base intact until it has been covered by the surface course. Areas that have been damaged by traffic shall be repaired and shall receive applications of tack coat material in compliance with these specifications. The maintenance and repair of the tack coat shall be done at the contractor's expense.

Section 1310 DENSITY AND SURFACE REQUIREMENT. The completed asphaltic concrete pavement shall have a density of greater than or equal to ninety-five (95) percent of Standard established by the Marshall Density procedure, using a fifty blow method.

All unsatisfactory work shall be repaired, replaced, or corrected. The surface of the final course shall be of a uniform texture and conform to line and grade shown on the plans.

Both density and thickness shall be carefully controlled during construction and shall be in full compliance with plans and specifications. During compaction, preliminary tests, as an aid for controlling thickness shall be made by means approved by the Engineer.

The surface of the final surface course shall not vary from a ten (10) foot straight edge, applied parallel to the center line, by more than one-fourth (1/4) inch.

Section 1311 PROTECTION OF PAVEMENT. The contractor shall protect all sections of newly compacted base and surface courses from traffic until they have hardened properly, or as directed by the Engineer.

Section 1312 COMPACTION TESTING. At the option of the Engineer, compaction testing may be performed in the field using a nuclear density-moisture measuring device to determine the density of the mixture as placed. If as a result of field or laboratory testing the Engineer determines that further compaction is required, the contractor shall revise his rolling procedure to obtain the density as specified. If the specified density is not achieved, the Engineer may require removal of any work not meeting Specifications. Removal and replacement shall be done by the contractor as his own expense.

DIVISION 1400 – PORTLAND CEMENT CONCRETE PAVEMENT

Section 1401 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct Portland cement concrete pavement.

Section 1402 MATERIALS. Except as modified herein, all materials used for construction of Portland cement concrete pavement shall conform to the requirements stipulated in applicable sections of this Technical Specification for Public Improvement Projects of the City of Lansing.

(a) Concrete. The concrete for the use in construction of Portland cement concrete pavement shall conform to the requirements established in section 2000 – Concrete with the following modifications.

Cement - Portland cement shall conform to ASTM C150, Type II. Type I cement may be used only upon submittal of test results from an independent laboratory that show that the sulfate levels in the soil and water at the project site do not exceed 0.10% and 150 PPM respectfully. Type III cement may be used only upon written approval of the Engineer.

(b) Reinforcing Steel.

Bars – Bars shall conform to ASTM A615, A616, and A617. Welded Steel Wire Fabric ASTM A185.

Supporting Elements Representative samples of supporting elements shall be submitted and approved by the Engineer prior to their use in the project.

(c) Expansion Joint Fillers. Expansion joint fillers shall conform to ASTM D994, D1751 or D1752.

(d) Joint Sealing Compound. Joint sealing compounds shall meet Federal Specification TT-S-1543 and have the following minimum properties:

Durometer, Shore A	15-25	ASTM D 2240
Tensile stress	45 max.	ASTM D 412
@ 150% Elongation,	Die C psi	
Elongation, %	1200 min.	ASTM D 412

(e) Curing Membrane. All material to be used or employed in curing Portland cement concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type and shall conform to ASTM C309.

Section 1403 CONSTRUCTION DETAILS. The Portland cement concrete pavement shall be constructed to the configuration, and to the lines and grades shown on the plans.

(a) Grading and Subgrade Preparation. All excavation or embankment required shall be as defined in Sections 1100 and 1200 of these Technical Specifications entitled “Grading” and “Subgrade Preparation”.

(b) Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than ¼ inch in horizontal and vertical alignment or each 10 feet in length.

1. Material and Size. Forms shall be made of metal and shall have a height equal to or greater than the prescribed edge thickness of the pavement slab.

2. Strength. Forms shall be made of such cross-section and strength, and so secured as to resist the pressure of the concrete when struck off, vibrated, and finished, and the impact and vibration of any equipment which they may support.

3. Installation. Forms shall be set true to line and grade, supported through their length and, joined neatly in such a manner that the joints are free from movement in any direction.

4. Preparation. Forms shall be cleaned and lubricated prior to each use and shall be so designed to permit their removal without damage to the new concrete.

5. Paving Machine. A slip-form paving machine may be used in lieu of forms. The machine must be equipped with mechanical internal vibrators, and be capable of placing the Portland cement concrete pavement to the correct cross-section, thickness, line and grade within the allowable tolerances.

Section 1404 JOINTS. Generally joints shall be formed at right angles to the true alignment of the pavement and to the depths and configuration specified by the standard drawings or as modified by the plans and specifications.

(a) Expansion Joints. Expansion joints shall be placed at all locations where shown on the plans and standard details or as directed by the Engineer.

1. General. Expansion joints shall extend the entire width of the pavement and from the sub-grade to one inch below the surface of the pavement or the material will have a suitable tear strip provided to allow for the application of the joint sealer.

   Under no circumstances shall any concrete be left across the expansion joint at any point.

2. Material. Expansion joints shall be formed by a one piece, one-half inch thick preformed joint filler cut to the configuration of the correct pavement section.

3. Stability. Expansion joints shall be secured in such a manner that they will not be disturbed during the placement, consolidation and finishing of the concrete.

4. Dowels. If expansion joints are to be equipped with dowels they shall be of the size and type specified, and shall be firmly supported in place by means of a dowel basket which shall be installed in such a position that the center line of the joint assembly is perpendicular to the center line of the slab and the dowels lie parallel to the slab surface and parallel the center line of the slab. One-half of each dowel shall be painted in accordance with the directions shown on the Plans, and then thoroughly coated with hard grease, or an approved lubricant, to prevent the concrete from bonding to that portion of the dowel. As an option, a dowel sleeve of the dimensions shown on the plans or standard drawings may be used in lieu of grease.

(b) Contraction Joints. Contraction joints shall be of the type and dimensions and at the spacing shown on the Plans or standard drawings.

1. Templates. The templates shall be removed as soon as the concrete has attained its initial set and finished as outlined for tooling joints.

2. Sawing. Sawed contraction joints shall be cut by means of wet sawing with an approved concrete saw. The joints shall not be sawed until the concrete has hardened to the extent that tearing and raveling is precluded.

All joints shall be sawed during the initial curing period and the sawing shall begin before the pavement starts shrinking and before uncontrolled cracking takes place.

Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete or the removal of the curing media and the cutting of the joints. In no case shall the pavement be left overnight without having the joints sawed.

The standard contraction joint configuration is a 3/8" wide joint sawed to a depth of 1/3 (one-third) the thickness of the slab. Material created by sawing shall be flushed from the pavement before it has had time to dry or set. The spacing shall be as shown on the plans but should not exceed 15 feet. Joint spacing should not exceed 24 times the pavement thickness with maximum spacing of 15 feet (i.e. 6" slab – 6 x 24 = 144, 144" = 12' Maximum joint spacing).

The joint shall be thoroughly cleaned by approved methods prior to the placing of the joint material. This is accomplished by sand-blasting the dry joint in two passes, one for each joint face. This sand, as well as dust and dirt deposited by wind and traffic, must be blown out of the joint and away from the area around it using a high-pressure air blast prior to placing backer rod and joint material.

(c) Pre-molded Strip Joints. Pre-molded strip joints shall be of the proper dimensions as shown on the plans and standard drawings and shall be secured at the proper location so as not to be disturbed by the finishing of the concrete.

(d) Longitudinal and Construction Joints. Longitudinal joints or construction joints shall be placed as shown on the plans or where the contractor's construction procedure may require them to be placed.

1. Center Joints. Longitudinal center joints shall be constructed using the methods specified in Section 1404b "Contraction Joints".

2. Longitudinal Construction Joints. Longitudinal construction joints (joints between construction lanes) shall be keyed joints or shall be constructed with tiebars. Joint configuration shall conform to the dimensions shown on the plans or standard drawings.

3. Transverse Construction Joints. Transverse construction joints of the type shown on the plans or standard drawings shall be placed wherever concrete placement is suspended for more than 30 minutes or for such a time that the concrete has begun to take its initial set. No construction joint shall be placed within ten (10) feet of an expansion, contraction, or other construction joint.

4. Tiebars. Tiebars shall be of deformed steel of the dimensions specified by the plane or standard drawings. Tiebars shall be supported in the proper position and at the specified spacing and be firmly secured so as not to be disturbed by the construction procedure. They shall be free from dirt, oil, paint, grease, loose mill scale, and thick rust which could impair bond of the steel with the concrete.

Section 1405 PLACING, FINISHING, CURING, AND PROTECTION. Concrete shall be furnished in quantities required for immediate use and shall be placed in accordance with the requirements of Section 2000 of these Technical Specifications and as specified herein.

(a) Concrete Placement. Prior to placement of the concrete pavement, all debris and foreign material shall be removed from the inner surfaces of the forms and all forms and subgrade properly moistened. All required reinforcement and other special metal parts shall be properly and firmly set into position to preclude movement during placement of the concrete.

The concrete shall be deposited over the entire width of the prepared subgrade between the forms in such a manner to prevent segregation and to require as little rehandling as possible. The pour shall be made to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. Concrete shall be thoroughly vibrated along the forms or

sides and along expansion and key type longitudinal joints. Attachments on finishing machines to vibrate the concrete adjacent to forms and longitudinal joints will be permitted provided satisfactory results are attained. Care shall be taken that the vibrator does not penetrate the subgrade or dislodge or move the joints. The vibrating shall be sufficient to produce a smooth pavement edge. Over vibrating will not be permitted as it will cause segregation. Insufficient vibrating can cause honeycomb. Honeycomb in the edge may be cause for rejection of the pavement.

The concrete shall be well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been brought to the required grade, alignment, and cross slope. All utility appurtenances shall be boxed out and isolated using expansion joint material. The minimum size of a boxed out section shall be two feet by two feet.

Concrete shall not be allowed to extrude below the forms.

(b) Concrete Finishing. The pavement shall be struck off and consolidated with a mechanical finishing machine or by hand-finishing methods.

When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the exact elevations as shown on the plans. A depth of at least two inches of concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the least possible number of passes of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand-finishing tools shall be kept available for use in case the finishing machine breaks down.

When hand finishing is used, the pavement shall be struck off and consolidated by a vibrating screed to the exact elevation as shown on the plans. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off; it shall not be allowed to idle on the concrete. Internal mechanical vibration shall be used along all formed surfaces.

1. Longitudinal Floating. After the concrete has been struck off and consolidated, it shall be further smoothed by means of a mechanical longitudinal float or float finishers using a longitudinal hand float. If a longitudinal hand flat is used, it shall be operated from foot bridges spanning the pavement and shall be worked with a wiping motion parallel to the center line, and passing from one side of the pavement to the other. Movement ahead along the center line of the pavement shall be in successive advances of not more than ½ of the length of the float. The float shall not be less than 12 feet in length and 6 inches in width, and shall be properly stiffened and provided with handles at each end. This operation may be eliminated if specified tolerances can be attained by some other approved method.

   In cases where the longitudinal floating operation has been eliminated, the pavement shall be scraped with a straight edge 10 feet long, equipped with a handle to permit it to be operated from the edge of the pavement.

   The longitudinal float and straightedge shall be operated so that any excess water and laitance are removed from the surface of the pavement. After the scraping operation, the surface of the pavement shall be within the specified tolerances.

2. Straightedging. While the concrete is still plastic, the slab surface shall be tested for smoothness with a 10-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be placed on the surface parallel to the center line of the pavement and at not more than 5 foot intervals transversely. After each test the straightedge shall be moved forward one-half its

length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed places shall be smoothed with a float not less than 3 feet long and not less than 6 inches wide, and again straightedged. The pavement surface shall have no depression in which water will stand.

3. Edging. Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans or standard details.

4. Final Surface Finish. A burlap drag or a broom finish shall be used as the final finishing method. When a drag is used it shall be at least 3 feet in width and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the surface of the pavement and dragged in the direction in which the pavement is being laid. When broom finishing, a hard bristle broom shall be used. The broom shall be kept clean and used in such a manner as to provide a uniform textured surface. The curb shall have the same final finish as the pavement.

   The final surface of the concrete pavement and curb shall have a uniform gritty texture free from excessive harshness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

(c) Curing. Curing shall conform to the requirements set forth in Section 2000 – Concrete with the exception that water proof paper, or polyethylene sheeting, shall not be acceptable as curing methods for concrete pavement. The use of straw or burlap for curing shall be as approved by the Engineer.

As soon as practical after the concrete is finished it shall be cured with one of the acceptable methods. If a liquid curing membrane is used, it shall be according to the manufacturer's directions.

A nozzle producing a uniform mist pattern will be used on all spray equipment when applying the liquid curing membrane. Rate of application to the pavement shall be (1 gallon/175 ft) with a wet thickness of 6 to 10 mils.

If the forms are removed from finished concrete pavement within a period of 72 hours or if a slip form paving machine has been used, these surfaces shall also be cured.

(d) Protection. The contractor shall, at his own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the City. Concrete pavement which is not acceptable to the Engineer because of damage or defacement, shall be removed and replaced, or repaired to the satisfaction of the Engineer, at the expense of the contractor.

All vehicular traffic shall be prohibited from using the new concrete pavement until it has attained the proper strength. The concrete pavement shall not be opened for light traffic until the concrete is at least 72 hours old and has attained a minimum compressive strength of 3000 pounds per square inch. The pavement shall not be opened to all types of traffic until the concrete is at least 120 hours old and has attained a minimum compressive strength of 3500 pounds per square inch. If high early strength concrete is used, the pavement may be opened to all types of traffic when the concrete has attained a compressive strength of 3500 pounds per square inch.

(e) Temperature Limitation. Concrete work shall proceed in accordance with the requirements established in Section 2000 – Concrete.

Section 1406 BACKFILL. A minimum of 24 hours shall lapse before forms are removed and 5 days shall lapse before pavement shall be backfilled unless otherwise approved by the Engineer.

Backfill shall be accomplished in accordance with Sections 1100 and 1200 entitled "Grading" and "Subgrade Preparation".

The contractor shall be responsible for the repair of any existing street pavement disturbed by the construction to the satisfaction of the Engineer.

Section 1407 JOINT SEALING AND CLEANUP. All joints shall be sealed with an approved joint sealer and backer rod applied in accordance with the manufacturer's directions and City specifications, standards, and Design Criteria. The joints shall be sealed within 7 days of the placement of the concrete and prior to the opening of the pavement to traffic.

The contractor shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of the construction.

Section 1408 CONCRETE CURB. Concrete curb will be constructed as shown on the plans unless otherwise approved by the Engineer. The options available for concrete curb are as listed below and detailed in standards 21-1 and 21-2.

(a) Integral curb. Integral curb shall be constructed immediately following the finishing operation unless otherwise shown on the plans. Special care shall be taken so that the curb construction does not lag the pavement construction and form a "cold joint".

Steel curb forms shall be required to form the backs of all curbs except where impractical because of small radii street returns or other special sections.

In placing curb concrete, sufficient spading shall be done to secure adequate bond with the paving slab and eliminate all voids in the curb.

Curbs shall be formed to the cross section as shown on the drawings with a mule or templates supported on the side forms and with a float not less than 4 feet in length.

The finished surface of the curb and gutter shall be checked by the use of a 10 foot straightedge and corrected if necessary. Where grades are flat and while the concrete is still plastic, the drainage of the gutter should be checked with a four foot level.

(b) Separate Curb and Gutter with Tiebars. Separate curb and gutter may be poured prior to pouring the remaining pavement. Tiebars 5/8 inches in diameter and 24 inches long shall be cast in the curb and gutter at 30-inch centers as shown on the standard details.

(c) Separate Curb and Gutter with Keyway. Separate curb and gutter may be poured prior to pouring the remaining pavement. A keyway of the configuration and dimensions shown on the standard details shall be cast in the curb and gutter section.

Section 1409 SURFACE TOLERANCES. Concrete pavement shall have a surface tolerance in all directions of ¼ inch in 10 feet when checked with a 10-foot straightedge.

Section 1410 THICKNESS TOLERANCES. It is the intent of these specifications that pavement shall be constructed strictly in accordance with the thickness shown on the plans. The thickness of the pavement may be measured by coring, and where any pavement is found deficient in thickness, it may be compensated for at an adjusted unit price or shall be removed and replaced.

In removing pavement, it shall be removed from the outside edge of the curb and gutter (curb and gutter with tiebars or keyway may remain if in good condition) to a longitudinal joint or between longitudinal joints, and on each side of the deficient measurement until no portion of the exposed cross sections are more than 2/10-inch deficient, except that there shall not be less than 5 linear feet of pavement removed. If there remains less than 10 feet of acceptable pavement between the section that has been removed and a transverse contraction, expansion, or construction joint, the contractor shall remove pavement to the joint.

DIVISION 1500 – CONTRACTOR CONSTRUCTION STAKING

DESCRIPTION: Contractor Construction Staking shall consist of establishing or re-establishing the Project centerline; referencing or re-referencing, and re-establishing all necessary control points and established PLSS and property corners; running a level circuit to check or re-establish plan bench marks; set other bench marks as needed; take any original cross sections needed that are not incorporated in the plans; stake right-of-way or re-stake right-of-way where needed if it has been previously staked and perform all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, grading, paving, drainage and all other appurtenances required for the completion of the construction work and acceptance of the Project.

CONSTRUCTION REQUIREMENTS: The Contractor personnel performing the construction staking shall work under the direct supervision of qualified Engineering or surveying personnel who are trained and experienced in construction layout and staking of the type and kind required in the contract and who are acceptable to the Engineer.

All stakes, references, line, grades and batter boards which may be required for the construction operations shall be furnished, set and properly referenced by the Contractor in a manner consistent with standard Engineering practices and in accordance with the Department's standard prescribed procedures and alternate procedures approved by the Engineer. The Contractor shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. Any errors or apparent discrepancies found in previous surveys, plans, specifications or special provisions shall be called to the attention of the Engineer by the Contractor for correction or interpretation prior to proceeding with the work.

Field notes shall be kept in standard, bound field note books in a clear, orderly and neat manner consistent with standard Engineering practices and in accordance with the Department's note book procedures. The Contractor shall provide the note books which shall become the property of the City of Lansing upon the completion of the Project. The field note books shall be subject to inspection by City Project personnel at any time.

The Contractor shall be responsible for the placement and preservation of adequate ties and references to all control points, whether established by him or found on the Project, necessary for the accurate re-establishment of all base lines or center lines shown on the Plans. All land ties (i.e. section corners, fractional section corners, property corners, etc.) that may be lost or destroyed during construction shall be carefully referenced in order that they may be re-established and/or relocated. These references shall be submitted to the Engineer at the completion of the Project. This information shall then be forwarded to the appropriate City authorities.

On road projects, the level circuit to check the plan bench marks shall be run the full length of the Project. At important bridge sites the circuit shall include four (4) bench marks, if possible, two (2) on each end of the structure.

The Engineer will make all necessary final checks, measurements and surveys that involve the determination of final pay quantities. He may check the accuracy and control of the work, as established by the Contractor's construction staking, at any time as the work progresses. These checks made by the Engineer in no way relieve the Contractor of his responsibility for the accuracy of the Engineering layout or the final result of construction accuracy.

The supervision of the Contractor's construction Engineering personnel shall be the responsibility of the Contractor; and, any deficient Engineering layout or construction work which may be the result of inaccuracies in his staking operations or of his failure to report inaccuracies found in work previously done by the Department shall be corrected at the expense of the Contractor and at no additional cost to the Department.

Work involving right of way, property corners, and PLSS monument locations and ties is Professional Land Survey work and must be done by or under the direct supervision of a Professional Land Surveyor with a current Kansas Registration or certificate of authorization.

In order to expedite the commencement of construction operations the staking operation may commence prior to the issuance of the Notice to Proceed. The Contractor shall notify the Engineer prior to commencing the staking.

BASIS OF PAYMENT: This work shall be subsidiary to other items of work unless otherwise provided for in the proposal and contract documents.

When provided for in the contract documents as a bid item: Contractor Construction Staking as specified herein shall be paid for on a Lump Sum Basis which shall include furnishing all necessary personnel, Engineering equipment and supplies, materials, transportation and work incidental to the accurate and satisfactory completion of the work. Partial payment will be made as follows:

(1) When work amounting to 5% of the original contract amount has been completed, 40% of the amount bid for Contractor Construction Staking may be paid. (2) When work amounting to 50% of the original contract amount has been completed, 80% of the amount bid for Contractor Construction Staking may be paid. (3) Upon completion of all the work on the project, one hundred (100) percent of the original contract amount will be paid.

No adjustment will be made in the Lump Sum Bid Price because of overruns in original contract items developed in the process of construction.

The term “Original Contract Amount” used in this Special Provision shall be construed to mean the total dollar value of the original contract, including all bid items shown in the contract.

When computing the percentage of the original contract amount completed, DO NOT include monies earned for mobilization, materials stored, traffic control (when bid as Lump Sum) and Contractor Construction Staking.

DIVISION 1600 - MOBILIZATION

Section 1601 DESCRIPTION. This item shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project, and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site.

Section 1602 BASIS OF PAYMENT.

(a) Partial Payments. Partial payments may be made as follows:

1. When work amounting to 5 percent of the original contract amount has been completed, 25 percent of the contract amount for the item of mobilization or 2.5 percent of the original contract amount, whichever is lesser, will be paid.

2. When work amounting to 10 percent of the original contract amount has been completed, 50 percent of the contract amount for the item of mobilization or 5.0 percent of the original contract amount, whichever is lesser, will be paid.

3. When work amounting to 25 percent of the original contract amount has been completed, 60 percent of the contract amount for the item of mobilization or 7.5 percent of the original contract amount, whichever is lesser, will be paid.

4. When work amounting to 50 percent of the original contract amount has been completed, 100 percent of the contract amount for the item of mobilization or 10 percent of the original contract amount, whichever is lesser, will be paid.

5. Upon acceptance of the contract, payment of any amount in excess of 10 percent of the original contract amount will be paid.

(b) The term “Original Contract Amount” used shall be construed to mean the total dollar value of the original contract, including all bid items shown in the contract.

When computing the percentage of the original contract amount completed, do not include monies earned for Mobilization, materials stored, Traffic Control (when bid as lump sum) and Contractor Construction Staking.

DIVISION 2000 – CONCRETE MATERIALS

Section 2001 SCOPE. This section covers all cast-in-place slip-formed concrete, and concrete for precast structures.

Section 2002 GENERAL. All cast-in-place and slip-formed concrete shall be accurately formed, and properly placed and finished as shown on the drawings and specified herein.

Where governing specifications are referred to, material and construction requirements shall conform to the governing specification as modified herein. "KSS" shall refer to Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, current edition including special provisions.

The contractor shall inform the Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

Section 2003 MATERIALS. All material used in the manufacture of concrete shall conform to the following:

Cement	KSS Section 2001. Refer to part l. Field Blended Cement Concrete" for additional supplementary cementitious material (SCM) requirements. All concrete mix designs shall contain SCM's as required per this part of the KSS Section 2001 and meet the requirements of ASTM C 1567
Water	KSS Section 2401.
Fine Aggregate	KSS Section 1102, Type FA-A, except that artificial or manufactured sand will not be acceptable.
Coarse Aggregate	Coarse aggregate shall meet the requirements set forth in the current ASTM C33 for Class 5S aggregate, and Coarse aggregate shall be entirely granite, quartzite, or trap rock. All coarse aggregate shall come from a large, accessible, uniform geological formation and be easily field identifiable in concrete. Coarse aggregates shall meet the gradation requirements of the current ASTM C33. The acceptable gradation sizes shall be numbered 1 through 7, 56, 57, 67, 357, or 467. Mix designs shall specify the gradation designation. Max absorption shall be 0.5%.
Air-Entraining Agent And other Admixtures	KSS Section 1401 and 1402

Section 2004 PRELIMINARY REVIEW. A report shall be submitted to the Engineer two weeks prior to the placement of concrete and shall include on the proposed use for the concrete, the design strength, concrete mix proportions, maximum water/cement ratio, slump designated at the point of delivery, the percent of air in the concrete for air-entrained concrete and the fine and coarse aggregate gradation.

Concrete mix design submittals shall include:

- Mix designation.
- 28 day compressive strength that meet the requirements of ACI 318 current edition
- Design slump and allowable range after addition of all admixtures.
- Proportions/weights of all mix materials.
- Source of all mix materials.
- Design water to cement ratio minimum 0.25 and maximum 0.44. Mix designs shall be submitted for each combination of materials, differing material proportions, or differing water to cement ratios Design unit weight at the design air content.
- Proportion of admixtures (admixtures for water reduction, set acceleration, or set retardation may be shown as optional provided they are Kansas Department of Transportation approved and the mix design shows the allowable application rates or dosages for each optional admixture.)

- Gradation designation for the coarse aggregate.
- A certification that the coarse aggregate meets the current ASTM C33 5S requirements (including the magnesium sulfate test for soundness.)
- Test results performed by a qualified laboratory for coarse and fine aggregate gradations.
- Test results performed by a qualified laboratory that meet specifications listed in KSS Section 1102, Type FA-A (natural sand).

Failure to get a mix design approved from the Engineer prior to concrete placement is just cause for removal of the concrete at the contractor's expense.

A certification from the cement supplier per KSS 2001.5 is required for acceptance of the finished product. A certification that admixtures are approved by the Kansas Department of Transportation. is required for acceptance of the finished product.

Section 2005 CONCRETE MIX DESIGNATIONS. . Unless otherwise specified in Plans/Contract Documents, or otherwise approved in writing by the Engineer, all concrete shall be Grade 4.0 (AE) .

Section 2006 LIMITING REQUIREMENTS. Each concrete mix shall be designed and concrete shall be controlled within the limits shown in KSS Section 401. except as modified herein.

The practice of withholding a portion of the water at the batch plant to be added at the job site is not permitted without prior approval of the engineer In no case shall the design water/cement ratio be exceeded.

The initial set as determined by ASTM C403 shall be attained 5½ hours, plus or minus one hour, after the water and cement are added to the aggregates. If such use has been approved by the Engineer, the quantity of retarding or accelerating admixture shall be adjusted to compensate for variations in temperature and job conditions.

The use of admixtures other than air-entraining agents shall not be allowed without the approval of the Engineer. When approved for specific purposes the admixture content shall be in accordance with the recommendations of the manufacturer for compliance with these specifications.

The total volumetric air content of concrete after placement shall be six (6.5) percent, plus or minus one (1.5) percent.

As the work progresses, the Engineer reserves the right to change the proportions from time to time if conditions warrant such changes to produce a satisfactory job. Any such changes may be made within the limits of the specifications at no additional compensation to the contractor.

Supplementary cementitious materials (SCM) are required for alkali-silica reaction mitigation (ASR).

Section 2007 BATCHING AND MIXING. KSS Section 401.

Section 2008 PLACEMENT. KSS Section 401.

Section 2009 COLD WEATHER CONCRETING. KSS Section 401.

Section 2010 HOT WEATHER CONCRETING. KSS Section 401

Section 2011 CURING AND PROTECTION.

Curing Materials Shall conform to KSS Section 1405

Concrete shall be cured by protecting it against loss of moisture, rapid temperature changes and mechanical injury for at least four days or a time period designated by the Engineer after placement. Acceptable methods shall be moist curing, white polyethylene sheeting, liquid membrane-forming compounds. After finishing operations have been completed and immediately after the free water has left the surface, the entire surface of the newly-placed concrete shall be covered by the curing medium

applicable to local conditions and acceptable to the Engineer. The contractor shall have the necessary equipment for adequate curing on hand and be ready to install prior to concrete placement.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire surface of the work and lapped a minimum of 18" at joints to prevent drying between adjacent sheets.

White polyethylene sheets shall be large enough to cover the entire surface of the work and shall be lapped not less than eighteen (18) inches. The sheets shall be adequately weighted to prevent displacement or billowing due to wind. Tear holes appearing in the material during the curing period shall be immediately repaired or replaced with material in acceptable condition.

White membrane curing compound shall be applied after finishing operations have been completed and immediately after the free water has left the surface. The surface of the work shall be completely coated and sealed with a uniform layer of the curing compound at a rate of not less than one gallon per 200 square feet. The compound shall not be thinned and shall be kept agitated to prevent settlement of pigment. On surfaces where forms are removed prior to the end of the specified curing period, the entire exposed surface shall be coated at the specified rate of coverage. If rain falls on the newly-coated surface before the film dries sufficiently to resist damage, or if the film is damaged in any other way, the contractor will be required to apply a new coat of the same or equivalent compound to the affected area.

During cold weather concreting when the ambient air temperature is expected to drop below 40°F, a sufficient supply of burlap, straw, hay, or other blanketing material shall be provided along the work to protect the concrete and maintain a minimum temperature of 40°F in the concrete as measured on the surface. An approved moisture barrier such as wet burlap or plastic sheeting shall be placed on the concrete prior to placement of the blanketing material. This type of curing shall be maintained for a period of six days as the initial cure. Contractor shall provide adequate supervision of the curing process to ensure that discoloration does not occur on concrete covered by plastic, burlap or other means.

Sidewalks, curb and gutter, and miscellaneous concrete shall be protected and cured for a period of not less than seventy-two (96) hours or a time period designated by the Engineer after the placing of the concrete by covering with wet burlap, white polyethylene sheeting, or by the application of a membrane curing compound as specified above.

Section 2012 FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimension shown on the drawings. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement.

Forms may be of wood or metal and shall be designed to permit easy removal without injury to the concrete. Forms for all exterior exposed surfaces which will be visible after backfilling shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms shall be coated with an approved light oil to prevent concrete from adhering and shall be thoroughly cleaned and re-oiled before re-use.

Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete. The following table gives the approximately minimum time that forms shall be left in place.

Average Air Temperature Greater Than Structural Member	70°	60°	50°	40°
	Time in Place (24 Hour Days)			
Slab Shoring	10	12	14	21
Beams Soffits and Shoring	10	12	14	21
Beam Side Forms	1	1	2	3
Wall Side Forms	2	2	3	4

Section 2013 FINISHING FORMED SURFACES. Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be in contact with backfill. A power grinder shall be used, if necessary, to remove projections and provide a flush surface. Surfaces to be damp-proofed shall have fins removed and tie holes filled, but no additional finishing will be required, unless otherwise specified in the plans or by the Engineer.

Tie holes in all formed surfaces shall be cleaned, wetted, and filled with a non-shrinking, expansive cement mortar. Tie hole patches shall be left flush, sound, smooth, even and shall match the texture and color of the adjacent concrete.

Unless provided otherwise in the plans all exposed edges shall be beveled by using dressed, triangular molding, having three-fourths (3/4) inch sides.

Section 2014 REPAIRING DEFECTIVE AND DAMAGED CONCRETE. Any concrete found not to be formed as indicated on the plans, or out of alignment or level, having a defective surface, or cracked or damaged, or found not to pass the tests for ari content and for 28 day strength prior to acceptance of the project by the City, shall be considered as not conforming to the intent of these specifications and may be ordered removed and replaced by the contractor at his expense unless the Engineer authorizes patching of the defective or damaged area. Defective surfaces include: Shrinkage cracks, plastic cracks, stress cracks or construction damage, crazing, scaling, discoloration, spalling, over-worked and badly boomed or tooled surfaces. Surface defects such as ridges and bulges may be removed by grinding with the approval of the Engineer.

Honeycombed and other defective concrete that does not affect the structural integrity of the structure shall be chipped out and the vacated area shall be filled. The methods used in this type of repair shall be approved by the Engineer. Material used for patching shall be a non-shrink, non-metallic epoxy-type grout with a minimum 28-day compressive strength of 5000 psi or a similar material approved by the Engineer. Prior to placement of the repair filling, the contact surface of the affected area shall be thoroughly cleaned of all loose and foreign material and shall be coated with an epoxy bonding agent.

Concrete repair work shall conform to Chapter 9 of ACI 546R-04 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured and protected from further damage.

Section 2015 REINFORCEMENTS. The metal reinforcement shall be protected by the thickness of concrete indicated on the construction drawings. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

Location of Reinforcement	Cover in Inches
Surfaces where concrete is deposited directly against the ground.	3
Formed surfaces exposed to the ground, to water, or to weathering.	2
Beams, girder, and columns not exposed to ground, water, or weathering.	1½
All surfaces other than those above.	1

Reinforcing steel shall be accurately placed and positioned on supports, spacers, hangers, or other reinforcing steel as approved by the Engineer and shall be secured in place with wire ties or suitable clips. The minimum clear distance between parallel bars shall not be less than 1½ times the diameter of round bars, except that in no case shall clear spacing between parallel bars be less than 2 inches or less than 1½ times the nominal size of the coarse aggregate.

Splices in reinforcing steel will not be permitted at points of maximum stress. When it becomes necessary to splice reinforcing steel at points other than those shown on the contract drawings the character and location of the splice shall be approved by the Engineer. Welding or tack welding of reinforcement will not be permitted. Reinforcements upon which unauthorized welding has been done shall be removed and replaced as directed by the Engineer. Spliced bars shall be placed in contact and securely tied together.

Metal reinforcement at the time concrete is placed shall be free from rust, scale, or other contaminants that will destroy or reduce the bond.

Woven Wire Fabric shall be supported on “support chairs”. Under no circumstances shall WWF be “walked-in” to place or pulled up with hooks during placement operations.

Reinforcing Steel	Shall conform to KSS Sections 1601 and 1602; All Bars – Grade 60
Reinforcing Steel Splices	Shall conform to KSS Section 1605
Welded Wire Fabric	Shall conform to KSS Section 1603
Helical Reinforcing	Shall conform to KSS Section 1604

Section 2016 CONSTRUCTION JOINTS. Construction joints shall be made at locations indicated on the drawings or specified, and shall be constructed in accordance with the plans and specifications, or as directed by the Engineer. When the contractor desires to make construction joints at other locations, he shall anticipate such changes at least 10 business days ahead of the construction operations to allow the Engineer to investigate such changes and approve additional construction joints.

Section 2017 EXPANSION AND CONTRACTION JOINTS. Expansion and contraction joints shall be at locations indicated on the drawings or as specified.

Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the concrete. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. Sawed joints shall be constructed by sawing through the surface of the concrete with an approved concrete saw. Sawing of the joints shall begin as soon as the concrete has cured sufficiently to prevent excessive raveling. Unless otherwise specified, all joints shall be minimum 1/3 the depth of the placed slab.

Expansion joints shall be formed with pre-formed expansion joint filler Type B, or Redwood in accordance with KSS Subsection 1503.

Section 2018 REINFORCED CONCRETE BOX FORMING SEQUENCE. Wall forms may be placed the day following the placement of the bottom slab, as long as care is taken to protect the slab against rough or abusive handling of forms and or placing equipment. The actual placement of concrete shall not occur prior to the fifth day after placing the bottom slab. Top forms may be placed with wall forms if the walls and top are to be monolithic construction, otherwise top forms are not to be placed until the third day after placing the walls. The actual placement of concrete for the top shall not occur prior to the fifth day after placing the walls (for base to top shoring) or until the walls have reached their design strength for slab forms shored by the walls. Wall forms shall remain in place a minimum of two days after the walls are poured. Supports for the top slab shall be left in place according to the schedule shown in Section 2012 Forms.

The above guidelines for placing forms for reinforced concrete boxes are based on the use of standard forming procedures and with the use of concrete containing no admixtures to achieve high early strength. Variations in forming techniques and/or the use of high early strength concrete shall only be allowed after the contractor obtains the written approval of the Engineer.

DIVISION 2100 – CONCRETE CURB, CURB AND GUTTER, SIDEWALK, AND DRIVEWAY ENTRANCES

Section 2101. SCOPE. This section covers concrete curb, curb and gutter, concrete sidewalk and concrete driveway entrances, including reinforcing steel, forms, joints, finishing, curing, and other appurtenant work.

Section 2102. MATERIALS. All items of material included in this work shall conform to the requirements of Section 2000 Concrete.

Section 2103 GENERAL. All construction covered in this section shall conform to the requirements of Section 2000 Concrete. Curb or curb and gutter construction shall be performed prior to placement of pavement or sidewalk, except when otherwise approved by the Engineer. 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.

Section 2104 GRADING AND SUBGRADE PREPARATION. All excavation required in the grading and subgrading preparation shall be considered as "Unclassified Excavation" as defined in Section 1100 Grading. All grading shall be done in conformance with Sections 1100 Grading and 1200 Subgrade Preparation.

Section 2105 EXPANSION AND CONTRACTION OR CONSTRUCTION JOINTS. Expansion and contraction or construction joints shall be as herein specified on the standard detail sheets or as otherwise specified by the Engineer.

Section 2106 FINISHING. Finishing shall be performed as follows:

(a) Curb and Curb and Gutter. The curb shall be tooled to the required radii as soon as possible after the concrete takes its initial set. After the forms and templates are removed the joints shall be tooled and the curb surface finished with a wood or cork float to remove all imperfections without additional mortar. 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 drawings.

(b) Sidewalk and Driveway Entrances. 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 and contain no imperfections. The edges shall be rounded with a tooling edge. Special care shall be taken to ensure a straight, neat appearance along the edges of the sidewalk or driveway entrance and at the joints.

Section 2107 REINFORCEMENT (Curb and Gutter). Reinforcement for concrete curb and gutter shall be as designated on Standard Details 21-1 and 21-2. The exception to this shall be when the curb and gutter is to be constructed on an asphaltic concrete base with a minimum depth of three (3) inches. In this case, no reinforcement shall be required unless otherwise determined by the Engineer.

Section 2108 REINFORCEMENT (Other). Reinforcement for all other work shall be as shown on the contract drawings or as depicted on details contained in this specification.

DIVISION 3000 - SANITARY SEWER

Section 3001 SCOPE:

This Section governs all work, materials and testing required for installation of gravity and pressure pipelines of the respective types and sizes shown on the Drawings for the particular location and conforming to the requirements of these specifications. All pipelines shall be constructed to proper line and grade as shown on the Drawings and shall result in an unobstructed, smooth and uniform conduit.

Section 3002 GENERAL:

3002.1 Description: Sanitary sewer construction shall consist of furnishing all labor, materials and equipment for the complete installation of sewers and appurtenances in accordance with contract drawings, Drawings, General Conditions and these specifications.

3002.2 Specification Modifications: It is understood that throughout this section these Specifications may be modified by appropriate items in the Contract Special Provisions or notes on the Contract Drawings.

3002.3 Revisions of Standards: When reference is made to a Standard Specification i.e. ASTM, ANSI, AWWA, the Specification referred to shall be understood to mean the latest revision of said specification as amended at the time of the Notice to Bidders, except as noted on the Drawings or in the Contract Documents

3002.4 Submittals: The Contractor shall provide certifications and shop drawings in accordance with 105.02 on all materials provided under these specifications. Failure to do so shall be cause for rejection.

Section 3003 MATERIALS:

3003.1 General: This section governs materials that may be required to complete pipeline construction, exclusive of structures, as shown on the Drawings and/or as provided for in the Contract Documents.

1. Requirements: Furnish pipe of materials, joint types, sizes, and strength classes indicated and specified. Higher strengths may be furnished at the Contractor's option at no additional cost to the Owner.

2. Manufacturer: The manufacturer shall be experienced in the design, manufacture and commercial supplying of the specific material.

3. Inspection and Testing: Inspection and testing shall be performed by the Manufacturer's quality control personnel in conformance with applicable standards. Testing may be witnessed by Owner, Engineer, or approved independent testing laboratory. The Contractor shall provide three (3) copies of certified test reports indicating that material does conform to the specifications.

4. Handling: The Manufacturer and Contractor shall use equipment and methods adequate to protect the pipe, joint elements and prevent shock contact of adjacent units during moving or storage. Damaged sections that cause reasonable doubt as to their structural strength or water-tightness will be rejected.

3003.2 Pipe, Fittings, Joints, Coatings and Linings:

1. General: Furnish pipe and fittings of materials, joint types, sizes, strength classes, coatings and linings as indicated and specified. Magnet tape shall be laid on top of all sanitary sewer pipe installed in the City of Lansing. This would include all interceptors, laterals mains and stub lines. The magnetic tape shall at least three (3) inches wide be marked with the words “sanitary sewer” or “sewer”, with letters at least (one) 1 inch in height, and be of a contrasting color to the tape itself. The tape shall be installed on top of the granular pipe embedment material and brought vertically to the surface from the ends of all stub lines.

2. Ductile-Iron Pipe and Fittings: Pipe and fittings shall conform to ANSI A21.51, except as otherwise specified herein.

   a. General: Furnish maximum pipe lengths normally produced by the manufacturer except for fittings, closures and specials.

   b. Design: All ductile iron pipe shall meet the requirements of ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51 and shall be of the thickness class specified herein or shown on the drawings. The minimum thicknesses allowed are Special Class 50 and 51. If Standard Pressure Classes pipe is provided, the thickness of the pipe shall equal or exceed the wall thickness of a Special Class 50 and 51, except as shown on the drawings.

   c. Joints: Mechanical and push-on joints for pipe and fittings shall conform to the requirements of ANSI/AWWA C151/A21.11. Flanged joints for ductile iron pipe and fittings shall conform to the requirements of ANSI/AWWA C110/A21.10. Gaskets shall be neoprene or other synthetic rubber material. Natural rubber gaskets will not be acceptable. All pipe shown on the Drawings to be restrained joint shall employ one of the following restraining systems:

      (1) Snap-Lok Restrained Joint or Bolt-Lok Restrained Joint as manufactured by Griffin Pipe Products Co. or approved equal.
      (2) Flex-Ring Restrained Joint or Lok-Ring Restrained Joint as manufactured by American Ductile Iron Pipe or approved equal.
      (3) TR Flex Restrained Joint as manufactured by U.S. Pipe & Foundry Company or approved equal.
      (4) Approved Equal Restrained joints incorporating steel gripping wedges in rubber gaskets will not be allowed.

   d. Fittings: Fittings shall be in accordance with ANSI/AWWA C 110/A21.10 and shall have a pressure rating of not less than that specified for the pipe. Fittings used with ductile iron pipe shall be ductile iron or cast iron. Fittings for pipe with mechanical joints shall have mechanical joints. Fittings for pipe with push-on joints shall have either mechanical joints or push-on joints. All fittings shown on the Drawings to have restrained joints shall employ one of the restraining systems specified in Paragraph 3003.2.2.c. Restrained joints incorporating steel gripping wedges in rubber gaskets will not be allowed.

   e. Coatings: Pipe and fittings shall be furnished with exterior bituminous coating conforming to ANSI/AWWA C151/A21.51.

   f. Linings: Pipe and fittings shall have a hydrogen sulfide resistant interior lining conforming to ANSI/AWWA C104/A21.4. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. Bell restraint clamps shall be Ford Meter Box “Series 1350 Uni-Flange Block Buster”, Romac “Series 611”, or approved equal, conforming to ANSI/AWWA C111-A21.

   g. Polyethylene Encasement: Ductile Iron pipe and fittings shall be installed with a polyethylene tube encasement having a thickness of 0.008" (8 mils) and conforming to ASTM D-1248, Type 1, Class C, Grade E-1 material. The polyethylene tube encasement shall be overlapped at the joints a length of at least 18” and taped in place.

3. Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR) and Fittings: Pipe and fittings shall conform to ASTM D 2241, except as otherwise specified herein.

a. General: Furnish maximum pipe lengths normally produced by the manufacturer, except for fittings, closures and specials. Pipe shall be used only for pressure flow systems.

b. Materials: The pipe shall be made of PVC plastic pipe having a minimum cell classification of 12454 B (PVC1120) or 12454 C (PVC1220) as defined in ASTM D 1784. The pipe materials shall have a minimum hydrostatic design stress of 2000 psi as certified by the Plastic Pipe Institute. Additives and fillers including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 20 parts by weight per 100 of PVC resin in the compound. The compounding ingredients may consist of lubricants, stabilizers, non-poly (vinyl chloride) resin modifiers, and pigment essential for processing, property control, and coloring. Certification of resin compounding shall be provided by the pipe manufacturer prior to shipment to the job site.

c. Design: Pressure flow systems, i.e., force mains, shall have a minimum wall thickness conforming to SDR 21 and a minimum pressure rating of 200 psi.

d. Joints: Pressure flow systems shall be joined in accordance with ASTM D 3139 with particular attention given to Section 5.3.

e. Fittings: Fittings for pressure flow systems shall be ductile iron or cast iron mechanical joint fittings and shall conform to 3003.2.2.d.

4. Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (8-inch through 15-inch diameters only, not greater than 15"): Pipe and fittings shall conform to ASTM D 3034, except as otherwise specified herein.

a. General: Furnish maximum pipe lengths normally produced by the manufacturer except for fittings, closures and specials.

b. Materials: The pipe shall be made of PVC plastic having a minimum cell classification of 12454 B or 12454 C or 13364 B as defined in ASTM D 1784. Additives and fillers including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 20 parts by weight per 100 of PVC resin in the compound. The compounding ingredients may consist of lubricants, stabilizers, non-poly (vinyl chloride) resin modifiers, and pigment essential for processing, property control, and coloring. Certification of resin compounding shall be provided by the pipe manufacturer prior to shipment to the job site.

c. Design: Pipe shall have an integral wall bell and spigot joint and a minimum wall thickness conforming to SDR 26.

d. Joints: Joints shall conform to ASTM D 3212. Joints shall be push-on type only with the bell-end grooved to receive a gasket. Elastomeric seal (gasket) shall have a basic polymer of synthetic rubber conforming to ASTM F 477. Natural rubber gaskets will not be accepted.

e. Fittings: Fittings defined as tee or wye connections suitable for assembly to four (4) inch or six (6) inch building service lines shall be bell-end with a minimum wall thickness conforming to SDR 26 and shall be furnished by the pipe manufacturer.

5. Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings (18-inch through 30-inch diameters only, or sewers who's depth is greater than 16'): Pipe and fittings shall conform to ASTM F 679 except as otherwise specified herein.

a. General: Furnish maximum pipe lengths normally produced by the manufacturer except for fittings, closures and specials.

b. Material: The pipe shall be made of PVC plastic having a minimum cell class of 12364C or 12454C, as defined in ASTM D 1784. Additives and fillers including but not limited to stabilizers,

antioxidants, lubricants, colorants, etc., shall not exceed 20 parts by weight per 100 of PVC resin in the compound. The compounding ingredients may consist of lubricants, stabilizers, non poly (vinyl chloride) resin modifiers, and pigment essential for processing, property control, and coloring. Certification of resin compounding shall be provided by the pipe manufacturer prior to shipment to the job site.

c. Design: Pipe shall have an integral wall bell and spigot joint. Pipe shall have a minimum wall thickness conforming to Table No. 1 of ASTM F 679.

Table 1 Pipe Dimensions and Minimum Pipe Stiffness

Nominal Pipe Size	Average Outside Diameter	Tolerance on Average Outside Diameter	Minimum Wall Thickness		Minimum Pipe Stiffness
In.	In.	In.	T-1[A] In.	T-1[B] In.	psi
18	18.07	±0.028	0.536	0.499	46
21	22.047	±0.033	0.632	0.588	46
24	24.803	±0.037	0.711	0.661	46
27	27.953	±0.042	0.801	0.745	46
30	31.496	±0.047	0.903	0.840	46
33	35.433	±0.053	1.016	0.945	46
36	39.370	±0.059	1.129	1.050	46

[A] T-1 is for material with a minimum cell classification of 12454C (400,000 psi minimum modulus)
[B] T-1 is for material with a minimum cell classification of 12454C (500,000 psi minimum modulus)

d. Joints: Joints shall conform to ASTM D 3212. Joints shall be push-on type only with the bell-end grooved to receive a gasket. Elastomeric seal (gasket) shall have a basic polymer of synthetic rubber conforming to ASTM F 477. Natural rubber gaskets will not be accepted.

6. Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (18-inch through 30-inch diameters only): Pipe and fittings shall conform to ASTM F794 except as otherwise specified herein.

a. Reserved.

b. Material: The pipe shall be made of PVC plastic having a minimum cell classification of 12454C or 12364C as defined in ASTM D1784. The pipe materials shall have a Standard Grade Hydrostatic Design Basis established in accordance with ASTM D 2837, and the material shall be listed in the Plastic Pipe Institute Technical Report 4. Additives and fillers including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 20 parts by weight per 100 of PVC resin in the compound. Certification of resin compounding shall be provided by the pipe manufacturer prior to shipment to the job site.

c. Design: Pipe shall have integral wall bell and spigot joint and a minimum pipe stiffness of 46 pounds per square inch (psi) at five percent deflection.

d. Joints: Joints shall conform to ASTM D3212. Joints shall be push-on type only with the bell-end grooved to receive a gasket. Elastomeric seal (gasket) shall have a basic polymer of synthetic rubber conforming to ASTM F477, and be factory installed and chemically bonded to the bell-end of the pipe. Natural rubber gaskets will not be accepted.

e. Fittings: All fittings shall be fabricated from pipe meeting the requirements of ASTM F794.

Fabricated miter joints shall be reinforced or fusion butt welded.

7. Reinforced Concrete Pipe and Fittings: Pipe and fittings shall conform to ASTM C 76 except as otherwise specified herein.

a. General: Furnish maximum lengths normally produced by the manufacturer except for fittings, closures and specials. The "packerhead" method for manufacturing reinforced concrete pipe shall not be used.

b. Design: All pipe shall have a wall thickness "B" or "C". Contractor shall provide documentation supporting the selected strength class of the pipe based on earth loadings and the chosen pipe bedding. Reinforcement shall be circular. Modified or special designs are prohibited unless so specified in the Modifications to Detailed Specifications.

ASTM C 76 Reinforced Concrete Culvert , Storm Drain and Sewer Pipe, Tongue and Groove Joints				
	Wall B		Wall C	
Internal Diameter Inches	Minimum Wall Thickness Inches	Approximate Weight, pounds per foot	Minimum Wall Thickness Inches	Approximate Weight, pounds per foot
12	2.00	93	-	
15	2.25	127	-	
18	2.50	168	-	
21	2.75	214	-	
24	3.00	264	3.75	366
27	3.25	322	4.00	420
30	3.50	384	4.25	476
33	3.75	451	4.50	552
36	4.00	524	4.75	654
42	4.50	686	5.25	811
48	5.00	867	5.75	1,011
54	5.50	1,068	6.25	1,208
60	6.00	1,295	6.75	1,473
66	6.50	1,542	7.25	1,735
72	7.00	1,811	7.75	2,015

These tables are based on concrete weighing 150 pounds per cubic foot and will vary with heavier or lighter weight concrete.

c. Materials:

(1) Fine aggregate and coarse aggregate shall conform to Section 2003.

(2) O-ring gaskets shall be synthetic rubber, circular in cross-section and shall conform to AWWA C 302.

(3) Portland cement shall conform to Section 2003.

d. Joints: Joints shall conform to ASTM C443, except as otherwise specified herein.

(1) Pipe and fittings, 36 inches in diameter and larger, shall be furnished with steel end ring joint, spigot groove and O-ring gasket. Pipe and fittings, less than 36 inches in diameter, shall be furnished with either spigot groove type joint with 0-ring gasket or steel end joint with spigot groove and 0-ring gasket.

(2) A 5-inch wide steel skirt, minimum 16 gauge, shall be welded to the spigot joint ring of the pipe. The protective coating on the steel joint ring shall be repaired after welding.

(3) Interior joint space shall be filled with a preformed bead of bitumastic joint sealer conforming to Federal Specification SS-S-00210A placed prior to jointing. Prime surfaces prior to jointing. Join pipe with sufficient force to squeeze out sealing material around interior joint. Trim off excess to obtain flush surface around interior joint space. Do not apply joint sealer by pointing or grouting after joining.

(4) Exterior joint space shall be filled by one of the following methods:

(a) With preformed closed-loop joint filler composed of flexible, water degradable polyurethane foam into which is dispersed unhydrated Portland cement of not less than 63 percent by total weight. Joint filler shall be installed against the concrete spigot shoulder behind the steel spigot ring gasket groove. Join pipe with sufficient force to compress the joint filler.

(b) With preformed bead of bitumastic joint sealer of material conforming to Federal Specification SS-S-00210A placed prior to jointing. Prime surface prior to jointing.

(5) All surfaces of steel joint rings in finished pipe shall have a shop-applied coat of Tnemec 37-77 Chem-Prime or approved equal.

e. Fittings and Specials: Provide strength equal to design D-loads of adjacent pipe and be fabricated as one of the following types:

(1) Steel cylinder segments not less than U.S. No. 16 gauge lined with three-fourths (3/4) inch concrete or mortar and reinforced concrete exterior.

(2) 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.

Miters shall not exceed 30 degrees at deflection angles between segments. Minimum center line curve radius shall not be less than twice the pipe diameter.

f. Marking: All pipe shall be clearly marked with the class, date of manufacture and the manufacturer's name or trademark.

8. Prestressed Concrete Cylinder Pipe:

a. Governing Standard: Pipe and fittings shall conform to ANSI/AWWA C301-92 except as otherwise specified herein. The supplementary information required in the foreword of the governing standard is as follows:

Working Pressure, External Loading Conditions and Method of	As specified in
Detailed Drawings and Schedules (Sec. 1.6.1 and Sec 4.1)	Required
Permission To Supply From Inventory (Sec. 1.6.1)	Not permitted
Tabulated Layout Schedule (Sec. 1.6.2)	Required
Inspection (Sec. 1.8.1)	Required
Material and Manufacturing Test Reports (Sec. 1.10 and Sec. 2)	Required

Steel Test Specimens (Sec. 1.10.5)	Not required
Affidavit of Compliance (Sec 1.11)	Required
Type of Cement (Sec. 2.1.1)	As specified
Use of Pozzolanic Materials (Sec. 2.1.1)	Not permitted
Aggregate Samples (Sec. 2.4)	Not required
Use of Admixtures (Sec. 2.6)	Not permitted
Manufacturer's Verification of Design (Sec. 3.2.1)	Required
Materials and Methods of Welding (Sec. 4.1)	Not Required
Specials and Fittings (Sec. 4.1)	Not Required

b. Materials: Materials used in the manufacture of pipe, fittings and specials shall conform to AWWA C301-92, unless otherwise specified herein.

Cement	Type I or II - ASTM C150
Joint Ring Gaskets	Synthetic rubber only
Joint Lubricant	Vegetable Based
Joint Grout	1 part portland cement to 2 parts clean masonry sand
Joint Mortar	1 part portland cement to 2 parts clean masonry sand
Joint Diapers	9 inch wide fabric with steel strap in hems

c. Basis of Design: Pipe and fittings shall be designed in accordance with the governing standard ANSI/AWWA C304-92 to withstand application of all external loadings. The external loading shall be based on a soil density of 120 pounds per cubic foot and a Class B bedding type.

If the pipe is designed in accordance with Appendix A of the governing standard, the equivalent three-edge bearing loads shall be computed by dividing the specified field external load by a bedding factor of 1.5.

If the pipe is designed in accordance with Appendix B of the governing standard, the bedding angle for design calculations shall be 120 degrees.

d. Protective Coatings: All exposed surfaces of steel joint rings in finished pipe shall have a shop-applied coat of Tnemec 37-377 Chem-Prime or approved equal. All metal surfaces exposed inside manholes after installation shall be cleaned and given two coats of Tnemec Series 69 Hi-Build Epoxiline or approved equal.

3003.3 Pipe Embedment Materials.

1. Scope: Pipe embedment materials shall be furnished and installed to complete the work shown on the Drawings or as called for in the Contract Documents.

2. Bedding Aggregate: Shall conform to Section 5015.

3003.4 Concrete: Concrete shall to Division 2000.

3003.5 Reinforcing steel: Reinforcing steel when required, shall be placed as shown on the Drawings and shall

conform to Section 2003.

3003.6 Backfill Materials: Shall conform to Division 5000.

3003.7 Encasement Materials:

1. Scope: Pipe encasement materials shall be furnished and installed to complete the work shown on the Drawings or as is called for in the Contract Documents.

2. General: Pipe encasement, when required and/or permitted, is intended to provide maximum support for pipe in locations where standard embedment may be insufficient.

3. Concrete:

a. Concrete used for pipe encasement shall be "Class B" concrete as specified in Division 2000.

b. Reinforcing steel, when required, shall conform to Section 2003.

3003.8 Tunneling, Boring and Jacking Materials: Shall conform to Section 5020.

Section 3004 VACANT

Section 3005 VACANT

Section 3006 INSTALLATION:

3006.1 Scope: This section governs construction methods and procedures for the installation of gravity and pressure pipelines and appurtenances.

3006.2 General: All pipeline installations shall conform to the following requirements:

1. Governmental Requirements: Sanitary sewer line installation shall comply with applicable State and Federal requirements. See Modifications to Detailed Specifications for governing requirements.

2. Trench Dewatering: Contractor shall maintain a dry and stable trench, obtain necessary permits, and provide for the proper method of discharging such water from the work site at all times until pipeline installation is completed to the extent that hydrostatic pressure flotation or other adverse effects will not result in damage to the pipeline.

Proper dewatering techniques are the Contractor's sole responsibility. All work performed by the Contractor which is adversely affected by his failure to adequately dewater trenches will be subject to rejection by the Engineer. The Contractor shall repair and/or replace the affected pipeline without additional compensation.

3. Drainage Course Crossing Encasement: Any pipeline crossing a well-defined drainage course, having less than two and one half (2 1/2) feet of cover over the pipe, shall be encased in concrete. The length of encasement shall be as shown on the Drawings, or if not shown, as specified by the Engineer.

4. Trench Shoring and Bracing: All shoring, bracing or blocking, shall be furnished and installed as necessary to preserve and maintain exposed excavation faces, to protect existing improvements, to protect the proposed pipeline and to provide for safety.

Shoring or other methods for support of trench walls is the responsibility of the Contractor and shall be accomplished by methods which will not adversely affect pipeline alignment, grade and/or structural integrity.

All bracing, sheeting and/or shoring installed below a horizontal plane six (6) inches above top of proposed pipe, shall not be disturbed or removed after pipe and/or pipe embedment has been installed, unless

otherwise specified. The bottom skids of a trench-shield shall not extend lower than six (6) inches above top of proposed pipe.

5. Pipe Embedments: Class A embedment shall be used as shown on the Drawings, for trench widths that exceed the design requirements or as required by the Engineer for unstable soils. Class B embedment may be used for concrete pipe and for rigid pipes including reinforced concrete, prestressed concrete cylinder pipe and ductile iron pipe. Flexible Pipe embedment shall be used for poly-vinyl chloride pipe. Installation shall be in strict conformance with instructions for the appropriate Class being utilized.

6. Bedding Installation:

   a. The trench subgrade shall be prepared to provide a uniform and continuous pipe support between pipe bells and joints.

   b. Place and densify embedment material by shovel slicing, or vibrating, and prepare embedment material so that the pipe will be true to line and grade after installation.

   c. After each pipe has been brought to grade, aligned, and placed in final position, deposit and densify by shovel slicing 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, bedding, and backfilling operations. Place bedding material uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

   d. Place pipe that is to be bedded in Class A concrete embedment in proper position on temporary supports consisting of concrete blocks or bricks. When necessary, anchor or weight the pipe to prevent flotation when the concrete is placed.

   e. Place concrete for Class A concrete embedment or encasement uniformly on each side of the pipe and deposit at approximately its final position. Do not move concrete more than five (5) feet from its point of placement. All Class A concrete embedment shall begin and end at a pipe joint.

   f. If unstable subgrade conditions are encountered and it is determined by the Engineer that the bedding specified will not provide suitable support for the pipe, additional excavation to the limits determined by the Engineer will be required. This additional excavation shall be backfilled with crushed stone material approved by the Engineer.

7. Pipe Embedment Designations and Descriptions: Pipe shall be embeded using the standard embedment classes defined in ASTM C12 - Installing Vitrified Clay Pipe Lines, as modified herein:

   a. Class A Embedment - Concrete Cradle, Arch or Encasement:

      (1) All Class A embedments require "Class B" concrete as specified in Division 2000. After initial set of concrete, one (1) foot of backfill material should be placed over the conduit or concrete. The backfill above this point shall not be placed nor sheeting removed until at least forty-eight (48) hours after placement of the concrete. Time requirements may be adjusted by the Engineer to obtain structural integrity.

      (2) Class A embedments for all pipe shall be installed with reinforcing steel of not less than p = 0.4%, where p is the ratio of the area of steel to the area of concrete, or as otherwise specified. Reinforcing steel shall be uniformly spaced and have a minimum lap of sixteen (16) bar diameters.

   b. Class B Embedment : The pipe shall be bedded in granular material with a minimum thickness beneath the pipe as specified in Section 3005.9.5.

It shall be sliced under the haunches of the pipe to a height one-sixth (1/6) of the outside diameter of the pipe. Backfill above the bedding to a point twelve (12) inches above the top of pipe, shall be carefully placed select earth backfill compacted to eighty-five percent (85%) of maximum density as defined in AASHTO T99 or ASTM D 698. The select material shall be free from debris, organic matter, frozen materials and rocks larger than one (1) inch.

c. Flexible Pipe Embedment (PVC): The pipe shall be bedded in granular material with a minimum thickness beneath the pipe as specified in Section 3005.9.5. The pipe shall also be backfilled with bedding aggregate to a level not less than twelve (12) inches above the top of the pipe. See Standard Detail SD30-1.

8. Tees and Building Service Lines: Tees and building service lines shall be installed as shown on the Drawings or specified herein.

a. Tees and saddles shall be installed at forty-five (45) degrees and not less than thirty (30) degrees with pipe spring-line, for pipe sizes 8 through 16 inch diameter. Tees and saddles shall not be installed in pipe sizes greater than or equal to eighteen (18) inch diameter.

b. Building service lines shall be installed with a straight alignment and at a uniform grade not less than two (2) percent unless otherwise specified and shall be embedded with Flexible Pipe embedment. When a building service line grade exceeds twenty (20) percent, pipeline anchors shall be installed as required under Section 3006.2.11., with the first anchor not more than twelve (12) nor less than seven (7) feet upstream of the tee.

c. The Contractor shall maintain an accurate record for submittal to the Engineer of location, size and direction of each tee or saddle and the elevation, location, size and length of each building service line. Locations shall use the pipeline stationing as shown on the Drawings, or the distance from the first downstream manhole. In the event such records are not kept, or are lost before final acceptance of the work, the required information shall be predetermined by the Contractor at no additional cost to the Owner. A four (4) foot long wooden board and metallic locating tape shall be placed at the end of each stub.

9. Gravity Sewers: All gravity sewers shall be installed to the alignment, elevation, slope, and with pipe embedment as specified and/or shown on the Drawings.

10. Pressure Sewers (Force Main): All pressure sewers constructed of poly-vinyl chloride pressure pipe (or other plastic pipes) shall be installed with bedding per Section 3006.2.7.d. Pressure sewers constructed of ductile-iron pipe (or rigid pipes) will not require any rock embedment. All pressure sewers shall be laid to a continuous slope when not shown on the Drawings. Approved air relief valves shall be installed at all locations shown on the Drawings or where required by the Engineer.

The Contractor shall block and anchor and/or restrain the pipeline to accommodate thrust and testing forces at pipe deflections, bends, tees, and plugs in accordance with the Contract Documents. All damage caused by the Contractor's failure to provide adequate thrust supports shall be corrected by the Contractor at no additional cost to the Owner.

11. Anchors: Pipelines shall be anchored in accordance with the table below:

PIPELINE ANCHORS

Percent of Grade	Max. Spacing (Feet) Center to Center
20-35	36
35-50	24
50	16

The anchor shall be of concrete or other material approved by the Engineer. Concrete anchors shall have a minimum thickness of twelve (12) inches. The anchor shall extend not less than one (1) foot into undisturbed

earth on the sides and bottom and one (1) foot above top of pipe. In incompressible material, the above dimensions may be six (6) inches each side and bottom. The anchor shall support a joint fitting.

12. Pipe Laying: All pipe shall be installed in accordance with the pipe manufacturer's recommendations, except as modified herein.

a. Pipe laying shall not proceed if the trench width as measured at the top of pipe exceeds the maximum allowable trench width. If this occurs the Contractor shall submit to the Engineer for approval a better bedding for the pipe or pipe of sufficient strength to provide safe supporting strength.

b. All pipe and fittings shall be stored and handled with care to prevent damage thereto. Do not use hooks to transport or handle pipe or fittings. Do not drop pipe or fittings.

c. Rejected pipe and fittings shall be marked and removed from the Project Site at no cost to the Owner. All pipe and fittings shall be examined for soundness and specification compliance prior to placement in the trench and rejected pipe or fittings shall not be incorporated into the pipeline. Check the class or pipe strength to be sure proper pipe is installed.

d. Clean joint contact surfaces prior to jointing. Use lubricants, primers, or adhesives as recommended by the pipe or joint manufacturer.

e. Pipe laying normally shall begin at the lowest point. The Contractor will not be allowed to lay any pipe if manholes are not on the project site. The pipe laying upstream of a manhole shall not proceed until the base of the manhole has been placed and leveled.

f. Unless otherwise required, lay all pipe straight between manholes. Excavate bell holes for each pipe joint. When jointed, the pipe shall form a true and smooth pipeline.

g. Pipe connecting to a structure shall be supported with Class A embedment, cradle or encasement, to a point twelve (12) inches outside the structure excavation. If flexible wall connections are used, Class B embedment may be used, in lieu of concrete embedment, provided the height of backfill does not result in loads exceeding the pipe's safe supporting strength.

h. All pipelines shall be plugged at the end of each day's progress. Plugs or other positive methods of sealing shall be utilized at all times to protect any existing system from entrance of stormwater or other foreign matter.

i. When a sanitary sewer line crosses an existing pipeline and the clearance is less than two (2) feet, special embedment may be required.

j. All pipe that is to be laid shall also have magnetic tape laid on top of the rock backfill for ease of identification. This includes service stub lines. The magnetic tape shall also be laid from the end of the service lateral, to the above ground stub line marker.

13. Protection of Water Supplies

a. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.

b. Sewer lines, i.e., house connections, laterals, truck lines, interceptors, force mains, etc., shall not be constructed within a 100 foot radius of a public water supply well. Greater separation may be required where soil and drainage conditions indicate the need for greater protection. Sewer lines

constructed of ductile materials may be constructed within 10 feet of a private water supply well. Sewer lines constructed of non-watertight materials must be at least 50 feet from a private water supply well.

c. A minimum horizontal distance of 10 feet shall be maintained between water and sewer lines. At points where sewers cross water mains, the sewer shall be constructed of ductile iron or pipe encased in concrete for a distance of 10 feet in each direction of the crossing unless the water main is at least 2 feet above the sewer.

d. Water and sewer lines shall not be placed in the same trench or excavation.

14. Connection of Pipes of Dissimilar Materials: The connection of pipes of different materials shall be made using approved transition coupling, and shall provide a permanent and watertight connection which will withstand the hydrostatic test pressure.

3006.3 Detailed Installation Requirements: All pipes shall be installed in accordance with the following standards:

1. ASTM D-2321 - PVC Pipe.

2. ANSI/AWWA C 600 - Ductile Iron Pipe.

3. Reinforced Concrete Pipe - Installed in accordance with American Concrete Pipe Association's "Installation Manual".

4. Prestressed Concrete Cylinder Pipe - Installed in accordance with AWWA Manual M9, *Concrete Pressure Pipe*.

3006.4 Casing and Carrier Conduits: The casing and/or carrier conduits for tunneling, boring, jacking and microtunneling shall be installed as specified in Section 5020.

Section 3007 BACKFILL:

3007.1 Scope: This section governs the furnishing of all labor, equipment, tools and materials to properly backfill trenches and structures.

3007.2 General:

1. All trash and debris shall be removed from the pipeline excavation prior to backfilling.

2. Unless otherwise specified, all sewer trenches and excavation around structures shall be backfilled to the original surface of the ground with earth or earth and rock. When an earth and rock mixture is used, it shall be placed and thoroughly consolidated with sufficient earth to completely fill all voids between the rocks.

3. The backfill material shall be placed in lifts. Each lift shall be compacted to the required density prior to the next lift being placed.

4. Commercial sand backfill shall not be used.

5. In areas marked "garden" or "flower garden", the original topsoil shall be replaced to original elevation and depth. (Minimum depth shall be twelve (12) inches).

6. Backfill material shall be carefully placed to avoid damage to or displacement of the pipe and other exposed utilities or structures.

7. Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper

compaction. Contractor shall remove waste material, trees, organic material, rubbish, or other deleterious substances.

8. No rock greater than one (1) foot, measured along its longest axis, shall be placed within two (2) feet of the top of the pipe in any excavation as backfill. No rocks greater than one (1) foot will be allowed in the backfill above the service line terminations, and tees.

9. Impervious ditch checks shall be placed where shown on the Drawings. Length shall be a minimum of 5 linear feet. The height of the check shall extend eight (8) feet above the top of the pipe but shall stop at two (2) feet below finish grade. Flowable fill material shall consist of a Portland cement grout meeting the requirements of Section 5017. The backfill above the ditch check shall be free of debris, organic materials, and stones greater than 12-inches.

3007.3 Backfill: Requirements are as stated in Section 5017.

Section 3008 VACANT

Section 3009 TESTING:

3009.1 All testing of materials and completed work shall conform to the requirements of Division 7000.

DIVISION 3100 – SANITARY SEWER MANHOLES AND SPECIAL STRUCTURES

Section 3101 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, steps, fittings and appurtenances as required in accordance with the Drawings and Contract Documents.

Section 3102 GENERAL: As used herein special structures refers to manholes on large sewers, special junction structures, metering stations and similar structures constructed on the pipeline.

Manholes and special structures may be constructed of pre-cast concrete sections or cast-in-place concrete.

Contractor shall submit shop drawings in accordance with 105.02 for all pre-cast concrete sewer structures prior to fabrication of the structure. Failure to do so shall be cause for rejection.

Section 3103 MANHOLE MATERIALS:

1. Non-Shrink Grout: Non-shrink grout shall be in the plastic state and show no expansion after set as tested in accordance with ASTM C 827 and shall develop compressive strength not less than three thousand (3, 000) pounds per square inch with a trowelable mix within twenty-four (24) hours per ASTM C 109. The placement time shall be not less than forty-five (45) minutes based on initial set per ASTM C 191.

2. Waterproofing: Waterproofing shall be the following approved coatings:

   a. When a sewage force main terminates into a manhole, the internal surface shall be coated with one of the following methods:

      (1) A total dry film thickness of not less than 14.0 mils of Anchor-Tite Uni-Seal Asphalt Damproofing Liquid Grade (or approved equal).

      (2) A total dry film thickness of not less than 8.0 mils of Tnemec Series 69 Hi-Build Epoxiline II (or approved equal).

   b. Exterior applications shall be coated with one of the following methods:

      (1) A total dry film thickness of not less than 14.0 mils of Anchor-Tite Uni-Seal Asphalt Damproofing Liquid Grade (or approved equal).

      (2) A total dry film thickness of not less than 4.0 mils of Tnemec Series 66 Hi-Build Epoxiline (or approved equal).

3. Pre-cast Concrete: Pre-cast concrete manholes shall conform to ASTM C 478 with the following modifications.

   a. Wall thickness not less than one-twelfth (1/12) of inside diameter or four (4) inches, whichever is greater, shall be used when the manhole depth is less than sixteen (16) feet; one-twelfth (1/12) of inside diameter plus one (1) inch or five (5) inches, whichever is greater, shall be used when manhole depth is sixteen (16) feet or greater.

   b. Cement, Fine Aggregate, Coarse Aggregate and Water used in the manufacture of pre-cast manholes shall be as specified in Division 2000.

   c. Developed bases shall be used unless prior approval is obtained from the Engineer. The diameter

of the base pad shall be eight (8) inches greater than outside diameter of the manhole.

d. Pipe openings shall contain flexible gaskets conforming to the requirements of ASTM C923. Mortar connections will be allowed only if prior approval has been given by the Engineer. Flexible gaskets shall be manufactured by the Press-Seal Gasket Corporation or A-Lok Products Inc. When RCP is used with an A-LOK gasket, the barrel of the RCP shall be lubricated to prevent damage to the gasket during insertion.

e. PSX gaskets are only to be used on cored connections to existing manholes, or manholes that are field modified. The take-up screws for the gasket clamps shall be positioned a minimum of 90° apart. The specific type of gasket approved for each diameter is reference in the table below.

Diameter	PSX	A-LOK
8	YES	YES
10	YES	YES
12	YES	YES
15	YES	YES
18	YES	YES
21	YES	YES
24	YES	YES
27	YES	YES
30	YES	YES
36	YES	YES
42	YES	YES

f. The minimum distance from the invert of the downstream pipe to the top surface of the base shall be three (3) inches.

g. Joints shall be sealed with preformed bitumastic sealants meeting the requirements of Federal Specification SS-S-210A. The minimum bead dimension shall be an inch square. The sealant shall be placed at the elbow of the section's joint. The sealant shall be butt-joined and not lapped. Joints below the cone section may be O-ring gasketed.

h. Riser Rings: Pre-cast riser rings shall be 4 inches or 6 inches in thickness. The use of light-weight concrete with fiber reinforcement is recommended. Reinforcing shall conform to ASTM C 478. Tongue and groove joints shall not be used. The maximum allowable adjustment with the use of riser rings is 12". No more than two riser rings are allowed.

i. Cored Connections: All connections to existing manholes or field modified connections shall be cored. Break-in connections with saw cutting with non-shrink grout is not permitted.

4. Cast-In-Place-Concrete: Concrete shall meet the requirements as provided herein or as specified on the Drawings.

a. Class A Concrete: Class A concrete used for aerial crossing piers, wet well walls, manhole walls, bases, inverts, and flat slabs shall meet the applicable requirements of Division 2000..

b. Class B Concrete: Class B standard concrete used for concrete encasements and embedments, thrust blocks, pipe anchors, and pipe collars shall meet the applicable requirements of Division 2000.

c. Admixtures

(1) Retarders: Retarders shall meet the requirements of ASTM C494, Type D.
(2) Plasticizers: Plasticizers shall meet the requirements of ASTM C494, Type A.
(3) Air-Entraining Agents: Air-Entraining Agents shall meet the requirements of ASTM C 260. The maximum air content shall be in the range of 4 1/2 to 7 1/2 percent by volume.

d. Portland Cement: Portland cement shall meet the requirements of Division 2000.

e. Fine Aggregate: Fine aggregate shall meet the requirements of Division 2000.

f. Coarse Aggregate: Coarse aggregate shall meet the requirements of Division 2000.

g. Water: Water shall be clean and free from deleterious substances. Only potable water will be acceptable without testing.

5. Reinforcement steel: Reinforcement steel shall conform with the following minimum requirements.

a. Design: Reinforcing steel shall conform to one of the following:

(1) Welded Wire Fabric - ASTM A 185.

(2) Reinforcing Bars - ASTM A 615, Grade 40, or Grade 60.

(3) Fabricated Steel Bar and Rod Mats - ASTM A 184, Grade 40, or Grade 60.

b. Fabricating Tolerances: Tolerances for concrete reinforcement shall conform to the following requirements.

(1) Sheared length +/- 1 inch.

(2) Stirrups, ties, and spiral = +/- 2 inches.

(3) All other bends = +/- 1 inch.

6. Iron Castings: All casting shall conform to the requirements of ASTM A 48, Class 30B. All castings shall be manufactured true to pattern and component parts shall fit together in a satisfactory manner. All castings shall be of uniform quality, free from blow holes, shrinkage, parting fins, pouring gates or other defects.

a. Rings and Covers: Rings and covers shall meet the following minimum requirements.

(1) The standard cover shall be G.C.I. SM-2202-JC (Sunflower lid) or Engineer approved equal.

(2) The standard frame shall be G.C.I. SM-2202 or Engineer approved equal].

(3) The standard bolt-down cover and frame shall be G.C.I. SB 2200-JC or Engineer

approved equal.

(4) All covers shall have two (2) concealed pickholes

b. Steps:

(1) Steel core, plastic coated steps: Steel core plastic coated steps shall meet the following minimum requirements.

(a) The plastic coating shall be a copolymer polypropylene meeting ASTM D 4101-82 PP200B33454Z02.

(b) The steel core shall be a minimum of 1/2 inch in diameter and grade 60.

Section 3104 MANHOLE SITE PREPARATION: Manhole site preparation shall be governed by Section 3004.

Section 3105 MANHOLE EXCAVATION:

1. Excavation: Excavation for manholes and special structures shall be governed by this Section and Section 3005. It shall be achieved in a suitable and orderly manner providing a minimum disturbance to the general public.

2. Depth of Excavation: Depth of excavation shall be to that required for proper installation of the manhole or structure. Over-depth excavation may be required by the Engineer if the subgrade is unstable. Over-depth excavation due to unstable subgrade shall be backfilled as required by the Engineer. Over-depth excavation occurring through an oversight by the Contractor shall be backfilled with granular embedment, as specified in Section 5015 or as required by the Engineer at no additional cost to the Owner.

3. Side Clearances: Side clearances outside the manhole and/or structures shall be no greater than to allow for forming, connection of piping, proper application of special coatings, if required, and to permit inspection. When concrete is to be placed directly against excavated faces, excavation shall be sufficiently outside of the manhole or structure to provide not less than three (3) inches of concrete cover over the steel reinforcement.

Section 3106 MANHOLE INSTALLATION: Manhole installation shall be governed by this Section and Section 3006. It shall be performed by the Contractor on a schedule that will provide an orderly progression of the Work.

1. Bases:

a. Pre-cast developed bases shall be reinforced in accordance with ASTM C 478. Developed bases shall be installed on a maximum of 4 inches of crushed rock. Depths exceeding this amount shall be filled with mass concrete.

b. If preferred developed bases cannot not be used, poured concrete bases shall be used. Poured in place bases shall have a minimum thickness of twelve (12) inches. The bottom wall sections shall be embedded in the base section a minimum of four (4) inches. The bottom pre-cast wall section shall not be set upon a previously poured base. Wood shall not be used for supporting or leveling the wall section prior to pouring the base.

c. Upon the approval of the Engineer, pre-cast inverts may be used. The use of pre-cast inverts in manholes with large deflection angles may restrict the Contractors ability to perform deflection testing with a mandrel.

2. Inside Dimensions: The minimum horizontal clear distance in the barrel of the manholes shall comply with the table below:

Manhole Inside Diameter Criteria

Pipe Diameter	Minimum Manhole Inside Diameter
8" - 12"	4 ft.
13" - 23"	5 ft.
24" - 48"	6 ft.
› 48"	8 ft.

Note: Larger diameters may be required by the City for manholes over 20 ft. in depth or for other specific circumstances.

3. Pre-cast:

   a. Delivery: Pre-cast concrete components shall not be delivered to the job until representative concrete control cylinders have attained at least 80 percent of the specified minimum design strength.

   b. Inspection: Pre-cast concrete shall be inspected when delivered. Rejection of defective or cracked pre-cast concrete components shall be in accordance with ASTM C 478.

   c. Wall Thickness: Wall thickness shall conform to the requirements of Section 3103.3.

   d. Waterproofing: All precast sections shall be waterproofed on the exterior with the material specified in Section 3103.2 prior to shipment to the project site.

   e. Construction: Pre-cast sections shall be cleaned of all dirt, grass, and other deleterious matter. Seal wall and cone joints with a minimum of one bead of preformed bitumastic joint sealant. Seal the joint between the top adjustment ring and casting with a double bead of preformed bitumastic joint sealant. Sections shall be placed such that steps are aligned but without rotation or damage to sealant integrity. Lift holes shall be patched with non-shrink grout.

   f. The only type of cone allowed is an eccentric cone, unless otherwise specified and approved by the Engineer. Cone shall be installed to allow manhole access to be in line with manhole steps.

4. Cast-In-Place:

   a. Wall Thickness: Wall thickness shall conform to the dimensions as shown on the Drawings.

   b. Construction: Reinforcement steel shall be placed as shown on the drawing. Tie-holes shall be patched with non-shrink grout. Wall sleeves, where required, shall be installed as shown on the drawings. Water stops shall be installed at the wall and slab connection and shall be of the size, thickness and material as shown on the Drawings.

   c. Waterproofing: Interior protective coatings, where required, shall conform to the material specifications. Application shall conform to the manufacturer's recommendation.

5. Top Slabs: Thickness shall conform to the dimensions and reinforcement steel shall be placed as shown on the Drawings.

6. Pipe Stubs: Stubs shall be installed at the locations, angles, elevations and of the materials as shown on the Drawings. A water-tight removable stopper shall be installed in each pipe stub. Pipe stubs shall be installed so that a pipe joint will be two (2) feet or less from the outside manhole wall.

7. Inverts: Inverts shall be structural concrete and steel-troweled (or formed if inverts are pre-cast inverts) to produce a dense, smooth finish. The invert channel shall be "U" shaped in cross section and extend upward three-fourths of the inside pipe diameter. Smooth transitions shall be formed for pipes of different sizes,

elevation and bends. The invert bench shall be sloped to drain. The inverts shall be formed in such a way to pass through the center of the manhole and allow insertion of the City's camera equipment into the pipe openings.

8. Steps: Steps shall be aligned vertically below the casting and spaced at sixteen (16) inch centers. The top step shall be not more than one (1) foot below the top of the cone. The lowest step shall be not more than two (2) feet above the invert bench. Field drilled step holes are not permitted in pre-cast concrete manholes.

9. Top Elevation: The finish top elevation of manhole castings shall conform to the following unless otherwise shown on the Drawings or directed by the Engineer.

   a. In paved or future paved areas, the top of the casting shall conform to the slope of the pavement and be 1/8 inch below the finished pavement elevation.

   b. In non-pavement areas, the top of the casting shall be not more than six (6) inches above the surrounding ground nor less than the sod's upper root limit. The final elevation shall be at a point where water will not pond over the manhole cover.

10. Manhole Adjustment: All new manholes will be provided with adjustment ring(s) underneath the casting as shown on Drawings. A maximum of two (2) 6-inch or two (2) 4-inch riser rings shall be installed on top of the cone section. The joints shall be sealed with a double bead of preformed bitumastic sealant. If the top of an existing manhole is required to be raised to an elevation which will exceed twelve (12) inches, or lowered more than the adjustment rings will allow, all vertical adjustments shall be made to the barrel of the manhole.

11. Castings: Castings shall be installed with the mud ring inserted inside the manhole opening and resting on a minimum of two rows of preformed bitumastic joint sealant. Bolt down castings shall be held in place as shown on the Drawings.

Section 3107 MANHOLE BACKFILLING: Manhole backfilling shall be governed by Section 3007.

Section 3108 RESTORATION: Restoration shall be governed by Section 3008.

Section 3109 MANHOLE TESTING: All manholes shall be tested in accordance with the requirements of Section 7013.

DIVISION 3200 - DESIGN CRITERIA FOR LIFT STATIONS AND FORCE MAINS

Section 3200 GENERAL.

The following discusses the minimum requirements for the contents of the Engineer's Design Memorandum and Technical Specifications for Lift Stations and Force Mains. The Design Memorandum must be submitted and approved prior to plans and specifications being submitted to the City for approval. All equipment listed within these specifications shall be as listed, unless otherwise specified. Any alternate "or equal" equipment must be approved by the city of Lansing, KS.

The Memorandum and Specifications must be prepared and stamped by a professional engineer, licensed in the State of Kansas, for review and approval by the Lansing Wastewater Utility Department and the Lansing Public Works Department. These criteria are meant as a guide to quality and design of equipment and systems that are acceptable to the City. Any variances from these criteria will require comprehensive supporting calculations and data and will be reviewed upon submittal of the complete Design Memorandum.

Section 3201 INTRODUCTION.

Describe in general the watershed(s) that are included in the service area, the estimated, ultimate growth population or population equivalents served and the type of development. Indicate the projected construction schedule (phasing) for the entire project.

Section 3202 DESIGN FLOWS.

Present the calculations of the Average Daily Flow and Peak Flows based upon the highest flows/acre wastewater contribution. The table below should be used to establish the Peak Flow for a project. Low density residential shall be considered as up to and including 3.5 residences/acre. Above that value will be considered high density residential. Extrapolations to determine the Peak Flow/Acre may be made for the specific size of the development (acres).

Peak Flows for Design

Area	Residential		Commercial / Industrial
	High Density	Low Density	
(acres)	(cfs/acre)	(cfs/acre)	(cfs/acre)
Up to 100	0.022	0.019	0.0175
200	0.021	0.018	0.0165
500	0.017	0.014	0.0125
1000	0.014	0.0118	0.01
1500	0.0135	0.0108	0.009
2000	0.013	0.01	0.008

Peak Flows can be increased by outside circumstances such as other watershed contributions flowing by gravity or being pumped into the design watershed. If this is the case, the system design shall include these external factors.

Section 3203 DESIGN PLAN REQUIREMENTS.

Submit:

1. A general location map to indicate the relative position of the project within the City and its proximity to other watersheds.
2. An overall system map that includes the gravity and pressure systems shall be provided. This system map should be of a scale that allows the reviewer to see the entire system on one sheet.
3. No sheets should be larger than 24" x 36" and should be rolled when presented with the Memorandum.
4. One sheet that should be dedicated solely to the proximity of the site to the 100-year Flood Plain.
5. Lift Station site Drawing that shall include the coordinates of the Lift Station and other major equipment items. A minimum of 1" = 50' scale shall be used. The Site Drawing shall show all equipment in plan view. Items to include are: Existing grade contours, Final grade contours, Lift Station, Detention Systems, Standby Generators, Valve Vaults, Measuring Manholes, Quick-disconnect stations for City to pump system (during emergency situations), Odor Control Systems, Davit-Arm Bases, Fencing, Lighting and Paved Access Roads. The above listed items shall be included in this drawing and will require typical plan and elevation, sections and detailed drawings in order to illustrate their relative function, where applicable. A separate electrical power and control drawing should illustrate the equipment selected and its connection to the mechanical equipment proposed.
6. Plan and Profile drawing(s) shall be included for the Force Main that includes air release valves, minimum depths, valve pits and valves and connections to other gravity or pressure systems.
7. If exhibits for this Design Memorandum are being developed from the Construction Drawings, they shall be simplified by removing layers, such as landscaping, etc., that do not apply to the systems design, in order to clarify the exhibits.

Section 3204 HYDRAULIC DESIGN.

The Hydraulic Design data will include data from the Measuring Manhole through the entire system to the discharge connection of the Force Main. Minimal exhibits and calculations that will require presentation in the Design Memorandum shall include:

1. System Curve(s), indicating operating range with maximum and minimum loads.
2. Certified pump curves.
3. Static and Dynamic Head Calculations.
4. System Losses including all fittings, suction and discharge points from the pump suction to the discharge connection of the Force Main.
5. Hydraulic Grade Line of the Pumps and Force Main.
6. The Design Memorandum shall also include the Maximum Velocity which shall not exceed 8 feet per second, unless otherwise approved, and the Minimum Velocity shall not be less than 2.5 feet per second, unless otherwise approved. Minimum and Maximum pumping pressures shall be determined and presented. Test pressure for Force Mains shall be 150 psi.

Section 3205 PUMP STATION.

Pump stations shall be designed to provide firm pumping capacity to pump a 25-year storm event based on ultimate development. The difference of the design pumping rate and the 50-year storm event shall be detained on site.

The following pumping systems (type and model included in the Design Memorandum) shall be acceptable:

1. Submersible Pump Lift Stations are recommended for permanent applications, and 18 ft. and greater suction head, where pumps are manufactured by Flygt, Fairbanks Morse, or city approved equal.

2. Submittals shall include pump curves with operating points and pump and motor efficiencies. A design target should be to select a pump with a 60% efficiency, or greater. A target for minimum wire to water efficiency is a minimum of 60%.

Section 3206 CHECK VALVES.

All lift station check valves shall be Swing Flex Check Valves as manufactured by Val-Matic, Kennedy, or APCO. Depending upon the situation, the design engineer may be required to furnish a Surge Analysis, as part of the Design Memorandum, for the proposed pumps and check valves specified for review by the Utilities Engineering Manager.

Section 3207 WET WELL AND SUBMERSIBLE PUMP SIZING.

Pump start/stop shall be designed according to the following:

1. Motors, 30 Horsepower, or less – 10 start/stops (or less) per hour.
2. Motors, greater than 30 Horsepower – 6 start/stops (or less) per hour.
3. Minimum wet well diameter of 6 ft, and capable of accommodating 6 hours of storage at peak flow.
4. Each lift station under consideration should be at least a duplex pump arrangement, unless it has been determined that additional pumps will be needed.

Section 3208 CONTROLS.

The pump station control panel shall be part of the system that controls all features of the pump station and associated panel or field-mounted instrumentation. The design engineer shall specify a system: Either a Mission M802 Monitoring System, or the more complex SCADA system that includes an AB Micrologix 1100 PLC Control Panel. Both systems are described below and shall be engineered and integrated by one supplier. The contractor shall have the overall responsibility for the complete system which shall include:

1. Design, supply, delivery, installation, certification, calibration and adjustment, software configuration, testing and startup, City personnel training, warranty and routine future field services, of a complete coordinated system.
2. All services and hardware to ensure proper communications are established with off-site remote locations that are to be monitored and controlled.
3. The design engineer shall furnish, review, and coordinate system technical installation and information submitted by Contractor for software; operating system, database, control strategies and the graphical user interface, specifically: report and log formats, graphics, trends, alarming, and other items.
4. The developer will be responsible for compensation to the city's system integrator to ensure that all integration with the proposed pump station will be seamless to the city's SCADA system at the Wastewater Treatment Facility.

Component specifications requirements are:

1. Functions and features of all equipment of the system meet the requirements of the SCADA system.
2. Control panel enclosure shall be NEMA TYPE 4X for outdoor location.
3. Controls shall operate from a source of 120 volts, 1 phase, 60 Hz. All controls shall be protected from lightning or other transient voltages by a power arrestor.
4. Condensation protection shall be provided. Enclosure shall have a heater which operates continuously to prevent condensation build-up. A freeze protective heater and thermostat shall also be provided.
5. All DC power supplies required for operation shall be provided.
6. Wiring shall meet all NEC, NEMA, and local electrical codes.
7. PLC shall be an Allen-Bradley Micrologix 1100, model #1763-L16AWA. Four additional I/O modules shall be provided, where PLC is specified.
8. An uninterruptible power supply (UPS) shall be furnished to supply continuously a reliable source of power to the PLC's, computer and peripherals. The UPS shall provide no-break sine wave power, lightning and surge

protection, isolation per FIP Standard 94, voltage regulation and be switch-mode power supply rated. The UPS shall utilize sealed, maintenance-free batteries to provide a minimum of 30 minutes of backup power at full load in the event of a failure of the normal AC source.

9. All panels and all field modifications shall be in conformance with UL-508. Contractor shall certify that panels have retained their UL labeling or third party certification.
10. Programming and documentation of the PLC's shall utilize RSLogix 500 software. Software shall run under the latest issue of Microsoft Windows operating system. System control logic shall be performed using control blocks or algorithms. The system supplier shall program the pump station PLC to operate and monitor its local I/O. The system supplier shall program the master PLC and Wonderware software to incorporate the lift station into the existing SCADA system, if required.

Minimum component requirements for the Mission M802 Monitoring System
(including 8 digital and 2 analog) are:

1. M802 Standard package alarms
2. Power Failure "built in"
3. High Water (transducer is analog) (floats are digital) Back-up System
4. Amp Meter (analog)
5. Generator Failure (digital)
6. Communication "built in"
7. Pump Failure (digital) – Can have all combined to one alarm
8. Excess Pump Starts "built in"
9. Flow Monitoring (as applicable) (Flow meter rate "flow of day" analog)
10. Rain Gage (as required) is a pulse counter that is added when purchased
11. Seal Failure (as required) (digital) – "can all be combined in one alarm"
12. Fuel (analog) – "can be digital if only a low lever alarm is wanted"
13. Temperature Monitoring (Motor temperature is digital) (Outside temperature is analog)

The AB Micrologix PLC Control panel shall monitor the following I/O (list could be different for each lift station):

Discrete Inputs

1. Pump No. 1 – Running
2. Pump No. 1 – In Remote
3. Pump No. 1 – Fail
4. Pump No. 2 – Running
5. Pump No. 2 – In Remote
6. Pump No. 2 – Fail
7. Wet well High Level Float Switch Alarm
8. Wet Well Low Level Float Switch Alarm
9. Power Failure
10. High/High Level Alarm (for systems with Containment)
11. Motor Moisture Alarm (submersible only)
12. Generator Running and Generator Failure (set in PLC).

Discrete Outputs

1. Pump Station Enable
2. Remote Generator Test

Analog Inputs (4 to 20 milliamps)

1. Wet Well Level (Magnetrol Air Burst Radar for primary, US Filter pressure transducers as back up)
2. Flow Rate
3. VFD Speed Indication (where VFD is used)
4. Force Main Pressure

Analog Outputs

1. VFD Speed Control (where VFD is used)

When an alarm occurs the following sequence shall be provided:

2. The alarm shall be added to the Event Log.
3. The alarm shall be printed on the Event Log Printer.
4. ScadAlarm Software (latest edition) will dial and send alpha-numeric text messages to city personnel..
5. Alarming requirement to be finalized at a coordination meeting with the City, the City's system integrator, and design engineer.

Section 3209 HEATING, VENTILATING AND AIR CONDITIONING.

Include recommendations for HVAC systems, other than standard equipment (as recommended by the manufacturer) depending upon the complexity of the location and environment.

Section 3210 ELECTRICAL POWER SUPPLY.

The fundamental requirements of the electrical power supply are:

1. 3-phase power supply from the utility
2. Emergency disconnect mounted on telephone pole five feet inside the perimeter of the pump station.
3. Utility power meter located outside fenced area
4. Automatic transfer switch for a 3-phase generator

Section 3211 LIGHTNING PROTECTION SYSTEM.

A protection system shall consist of air terminals, antennas, grounding electrodes and interconnecting conductors. The motor control center shall include a transient voltage surge suppressor. The design of the system shall be prepared by a professional designer certified by the Lightning Protection Institute (LPI).The system shall be installed by a master installer certified by LPI.

Equipment furnished shall meet the following for design, construction and testing: ANSI/NFPA 780-Lightning Protection Code, ANSI/UL 96-Lightning Protection Components, and LPI 175-Lightning Protection Institute Standard Practice. System components shall conform to NFPA 780 Class 1 or 2 and shall be fabricated from the following metals:

Conductors:	Copper
Air Terminals:	Copper and Bronze
Grounding Electrodes:	Copper clad steel
Fasteners:	Copper or bronze
Bimetallic Fasteners:	Bronze and aluminum

All material for the system shall bear the UL inspection label.

Section 3212 EMERGENCY POWER.

Emergency power may be required and will be reviewed on a case by case basis. All installations in the City of Lansing shall require emergency stand-by power units. Approved generator sets are Caterpillar, Kohler, or Onan. Fuel storage shall provide a minimum of 24-hour supply. The generator sets shall be furnished and installed in an enclosed outdoor power unit, or can be trailer mounted (with city approval) for ease of use The system shall meet the following requirements:

1. The unit shall consist of a one-piece, seamless fiberglass-reinforced plastic enclosure for weather protection and sound attenuation. The maximum sound additive level shall be 72 dB(A) at 23 feet distance.
2. The FRP enclosure shall be able to withstand a wind load of 120 MPH and the roof capable of supporting 30 lbs per square foot loading.
3. 150 KW generators and smaller shall require a tip-up style FRP enclosure with gas spring lift assist.
4. Generators larger than 150 KW must be provided with a walk-in, seamless FRP enclosure.
5. Acceptable fuels are natural gas, propane or diesel.
6. Controls shall include a terminal strip with alarm and monitoring contacts for connection to the City's telemetry system.
7. The generator, automatic transfer switch, environmental systems, fuel tank (where applicable) and ancillary equipment shall be skid-mounted, pre-installed, and tested as an integrated system by the manufacturer. Individual component testing is not acceptable. The manufacturer shall be responsible for system equipment and testing.
8. The generator and automatic transfer switch shall be covered by a 5-year, or 1,500 hour warranty.

Section 3213 VARIABLE FREQUENCY DRIVES.

Variable frequency drives (VFD) may be considered in some situations. Because this benefit varies depending on system variables such as pump size, load profile, amount of static head, and friction, it is important to calculate benefits for each application before specifying a VFD. If a VFD is proposed, harmonic distortion needs to be evaluated and an isolation transformer provided, if required.

Section 3214 WET WELL AND DISCHARGE MANHOLE LINING.

At a minimum, the wet well and the discharge manhole at the end of the force main shall be lined with a protective coating. The new concrete in these manholes shall be cured prior to application of the protective coating (minimum of 28 days). The lining shall cover all interior surfaces from the bottom to the top including the adjustment rings just under the cast iron ring and lid.

Approved manufacturers are:

1. Quadex Aluminaliner - Quadex, Inc, North Little Rock, AR. This is a factory-blended, rapid setting, high early strength, fiber reinforced, calcium aluminate enhance with NCG aggregate, non-shrink mortar that can be troweled or spray applied.
2. SuperCoat, LaFarge Calcium Aluminates, Chesapeake, VA. This is a 100% calcium aluminate cement and manufactured calcium aluminate aggregates.
3. Raven Lining systems, Inc, 405 Coating System, Tulsa, OK. This is a 100% solids, solvent-free epoxy grout that can be troweled or sprayed.
4. Protective Liner systems, PLS-650 Perpetu Wall Liner System. This is a two-part, 100% solids, epoxy system reinforced with fiberglass.

Installers of these materials must be trained and certified according to the manufacturer's specifications. Installer certification shall be submitted to the City for review and approval prior to commencement of any work.

Section 3215 FLOW MEASUREMENT.

Flow measurement shall be provided to measure influent flow to the wet well of the lift station from the upstream gravity sewer system. The primary element of the flow measurement device recommended is a Parshall flume to be designed so as to be on the lift station site but not so close to the wet well that downstream flow will submerge the flume and result in erroneous readings. An ultrasonic level device shall be used to measure the upstream and downstream levels through the flume. These readings that are converted to flow shall be integrated into the control system.

Section 3216 EMERGENCY OVERFLOW STORAGE.

The difference of the design pumping rate and the 50-year storm event shall be detained on site as emergency overflow storage.

Section 3217 EMERGENCY BY-PASS PUMPING, AND ACCESS ROAD ALIGNMENT.

Six (6) inch suction and discharge connections (Bauer connections), above ground, are required. This design shall include the proper joint restraints as well as a concrete vault to provide access to the valve. The access road into and out of the site shall accommodate the City truck and trailer that will respond to emergency situations. The access road shall be designed to allow along-side access of the trailer to by-pass piping. The road configuration shall be such that the vehicle can drive through on a loop road or maneuver the road configuration under the following conditions: 30 ft. turning radius. See Section 3223 for access road construction requirements.

Section 3218 ODOR CONTROL.

The Design Memorandum shall include an evaluation of whether an Odor Control System is required. The evaluation shall include calculations that demonstrate how long the collected sewage will remain in the system (primarily the wet well and force main). Phasing of construction and planned development as well as options regarding the pumping levels in the wet well and interchangeable pump impellers can be considered. When an Odor Control System is required, it shall be a chemical feed system located at the lift station site and all materials in the system shall be compatible with the chemicals. This system shall consist of the following elements:

1. A 275-gallon bulk storage chemical tote, based upon an average daily flow to the lift station shall be provided at system start-up.
2. Controls to provide variable feed rates over 24 hours.
3. Feed pump shall be a Grundfos or city approved equal and come equipped with the necessary built-in calibration equipment.
4. All plastic piping and tanks UV-protected.
5. Feed system and tanks mountable to concrete slab.
6. Drain in the support slab that drains back to the wet well.
7. All equipment furnished by one manufacturer, under one warranty and tested as a system at the factory.
8. Performance guarantee: To reduce dissolved sulfide at the lift station wet well to less than 0.1 mg/l; and to reduce the atmospheric hydrogen sulfide to at or below 1 ppm average and at or below 10 ppm peak at the lift station wet well.
9. System Warranty: Free from defects in materials/workmanship for 12 months from acceptance or 18 months from shipment, whichever occurs first; and chemical storage tank for 5 years from start-up date.
10. Entire system to be protected from the weather resulting in no down time due to freezing or extreme heat.

Section 3219 PERSONNEL HOIST SYSTEM.

When maintenance is required on any confined spaces, the City will access the spaces by bringing a davit-arm hoist to the site. The Design Engineer shall include a Floor Mount Sleeve by Unique Concepts Ltd (Model No. 16190, mild steel) to mount within 5 ft. of the wet well, measuring manhole and any other confined spaces in the collection system. The sleeves shall mount to a horizontal concrete or steel structure.

Section 3220 EQUIPMENT HOIST SYSTEM

A Gorbel brand jib crane, or city approved equal, with a capacity of two times the weight of the installed submersible pump will be installed on a concrete pedestal, as recommended by the manufacturer. An electric hoist, manufactured by Coffing, or approved equal, shall be installed with stainless steel lift chain with the capacity to remove pumps safely. The site conditions will dictate the radius and length of the boom to allow for easy removal and installation of pumps.

Section 3221 ACCESS HATCH.

Access to manholes or wet wells shall be through an aluminum hatch designed for pedestrian access rated for a minimum live load of 300 psf with deflection not to exceed 1/150th of the span. Aluminum material shall be used for the bars, angles, extrusions and diamond plate. Stainless steel material shall be used for all hardware. Each hatch shall be supplied with an exposed padlock clip. Nominal opening dimensions shall be a minimum of 24" x 30". Each hatch shall be supplied with a safety grille. Approved equipment are "FLE" access hatch as manufactured by ITT Flygt Corp. or "EC"access hatch as manufactured by Syracuse Castings.

Section 3222 SITE LIGHTING.

Site lighting shall be required to provide lighting controlled by a photo-electric cell. Manual off/on switch shall also be provided. Intensity of lighting shall be designed to provide safe maintenance at night but not be of the intensity and direction to cause conflicts with adjacent property owners. Power for the site lighting will be taken from the pump controller in the event there is a loss of utility power. Additionally, a red strobe light will be mounted to the pole to indicate an alarm at the pump station.

Section 3223 SITE CONDITIONS, ACCESS ROAD CONSTRUCTION, AND SECURITY

As a minimum, the following features will be necessary for ease of use and exclusion of trespassers.

1. Eight-foot chain link fence with three strands of barbed wire.
2. Double access vehicle gates – sixteen feet minimum opening.
3. One four-foot walk gate.
4. Concrete apron sufficient to support a one-ton pickup truck around all pump station structures, piping, generator, and odor control system.
5. Access drive from concrete apron of pump station through the double gates all the way to street, conforming to SD21-7, constructed with KDOT Class A(AE) Concrete, and with a minimum of 12 ft. in width. See Section 3217 for alignment requirements..

Section 3223 FORCE MAIN.

As a minimum, the design of the Force Main shall include plan and profile drawings of the route indicating the minimum cover, connection to the receiving system with details if required, air release valve pit location and details, and any required valves (plug valves required) and details.

The Force Main shall be PVC pipe, ANSI/AWWA C900 or C905 with dimension ratios of 25 and 18 corresponding to working pressures of 100 and 150 psi. PVC to PVC joints shall be ANSI/AWWA C900 or C905, push-on type, with elastomeric synthetic rubber gaskets. PVC to Cast Iron joints shall be ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. All cast iron or ductile iron fittings on PVC pipe shall be properly encased with polyethylene. A conductive tracer shall be buried above the PVC pipe, not more than 18 inches below the ground surface. The detection tape shall be 3 inches wide; aluminum foil core, 0.5 mil thick.

If a Ductile Iron Pipe force main is proposed by the design engineer and accepted by the City Engineer, it shall be Class 50, Polyethylene encased. Ductile iron pipe shall be lined using one of the following options: Polyethylene, ceramic epoxy, or calcium aluminate.

Thrust prevention shall be provided with Restrained Joints and distances in both directions from the fittings indicated. Acceptable Restrained Joints for PVC pipe are Certa-Lok with CertainTeed pipe and the Bulldog Restraint System used by various PVC pipe manufacturers.

Section 3224 AIR AND VACUUM RELEASE VALVES.

Air and vacuum release valve assemblies shall be installed in the locations indicated on the drawings. Each valve assembly shall be installed complete with appurtenant piping and valve as specified and shown.

The air/vacuum valve assemblies shall be fully automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall re-open during draining or if a negative pressure occurs. Valve sizes 3 inches and smaller shall have full size National Pipe Thread inlets and outlets equal to the nominal valve size. The valve body, cover, and baffle shall be constructed of ASTM A126 Class B cast iron for Class 125 and Class 250 valves. The float, guide shafts, and bushings shall be constructed of Type 316 Stainless Steel. Valves shall be as manufactured by Crispin No. SL20A, Valmatic No. VM-301ABW or ARI D020, and shall be installed as shown in Standard Detail for Force Main – Air/Vacuum Valve.

Section 3225 TESTING.

The contractor shall be responsible for coordinating the testing of all systems. Prior to testing, the contractor shall furnish all required operation and maintenance manuals to the City of Lansing. All special testing materials and equipment shall be provided by the contractor. The contractor shall coordinate and schedule all of his testing and startup work with the City. Testing shall be witnessed by the City and the requirements are as follows:

- All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly. The manufacturer's representative performing the test shall furnish a copy to the City of the certified check list that indicates test values measured for proper functioning parts and systems.
- The Manufacturer shall also perform factory-certified tests that shall use the latest test code of the Hydraulic Institute to determine head vs. capacity and kilowatt draw. The results of the factory-certified tests shall be furnished in the operation and maintenance manuals.
- Witnessed field tests shall be performed on the complete system. Each function shall be demonstrated to the satisfaction of the Wastewater Director and Design Engineer.
- Each test shall be witnessed and signed off by the Manufacturer upon satisfactory completion. The Contractor shall provide all required operation and maintenance manuals and notify the City at least one (1) week prior to the commencement date of the field tests.

These tests shall include:

1. Megger stator and power cables.
2. Check seal lubrication.
3. Check for proper rotation.
4. Check power supply voltage.
5. Measure motor operating load and no load current.
6. Check level control operation and sequence.
7. Insure that the check valve is closing properly at shut down of the system.

Section 3226 SUBMITTALS.

Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, the Contractor shall review for conformance with the specifications and then shall furnish to the Design Engineer for his review six (6) copies of submittal documents. Coincident with review and mark-up by the Design Engineer the submittals shall be sent to the City of Lansing for review.

Submittals shall include full details, shop drawings, catalog cuts and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. The Contractor shall submit the following materials:

1. Operational description of each system showing all major components and their interconnections and interrelationships. Where appropriate, provide block diagrams. Label each diagram and specify all external power and communications interfaces.
2. Drawings of equipment to be supplied shall include, as a minimum: Overall dimension details for each item and arrangement of items included in each unit. Wiring diagrams of equipment including field device connection shall be included and specific installation/wiring requirements identified.
3. Operational description shall include the principal functions/capabilities.
4. Provide a detailed Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.

Software Submittals

1. Provide complete user manual for all supplier configured software and firmware. For ancillary software such as operating systems and spreadsheets being supplied under this contract, only a listing of the manual which will be included with the Operations and Maintenance documentation is required.
2. Sample communication and control database programs for project in hardcopy form. As a minimum, hardcopy form shall be fully documented, including code, comments, addressing data and cross-references. Every line or section of code shall be accompanied by a comment describing its function.
3. Provide initial graphic display and report format layouts. List and briefly describe all operator interface functions provided at the PC, including: Alarm annunciation and acknowledgment, status displays, control capabilities, report generation, event logging, charting and trending.

Section 3227 OPERATION AND MAINTENANCE MANUALS.

Adequate operation and maintenance (O & M) information shall be supplied for all equipment requiring maintenance or other attention. As a minimum, O & M manuals shall be supplied for pumps/motors, variable frequency drives, valves, flow measurement devices, generator sets, odor control systems, lightning protection systems, and control systems including instrumentation panels.

1. The contractor shall provide two (2) complete sets of hard-covered, ring bound, loose-leaf and digital O & M manuals. In addition to “as-built” system drawings, the manual shall include operating and maintenance literature for all units and components provided for the whole system. Data furnished shall include internal wiring diagrams.
2. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument.
3. O & M manuals shall include copies of all PLC programs written to accomplish the monitoring and control functions specified. Programs shall be updated after startup is complete, with the programs provided to the City on CD medium (two copies).

The O & M manuals shall be organized as follows:

1. System Equipment/Installation
2. System software
3. Operation
4. Maintenance and Troubleshooting

Topics required are:

1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment, and checking instructions.
3. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
4. Lubrication and maintenance instructions.
5. Guide to troubleshooting.
6. Parts list and predicted life of parts subject to wear.
7. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.
8. Test data and performance curves, where applicable.
9. Warranties and warranty contact information including names, phone numbers and email addresses.

Section 3228 TRAINING.

Training shall be provided for each major component or system that requires maintenance (generally furnish training for all equipment that requires an O & M Manual).

The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide common working knowledge concerning all significant aspects of the system being supplied. The training program shall consist of a minimum of one (1), 8-hour day, including time for demonstration in the field. At least two (2) weeks prior to the requested start of the program, the proposed dates of training shall be submitted to the Wastewater Utility Director and Design Engineer for approval.

It shall be the responsibility of the Contractor to coordinate and organize the suppliers for the training program. The suppliers shall provide all instructional course material, equipment and manuals to conduct the training program. The City shall provide the facilities for the training. All training shall be videotaped by the contractor, and two copies of the training will be submitted to the city in DVD format.

Section 3229 DEFINITION OF ACCEPTANCE.

System acceptance shall be defined as that point in time when the following requirements have been fulfilled:

1. All O & M documentation has been submitted, reviewed and approved.
2. The complete controls system and instrumentation have successfully completed all testing requirements and have successfully been started up.
3. All City personnel training programs have been completed.
4. The Wastewater Director and the Design Engineer both sign a document indicating the controls system has formally been accepted.

Section 3230 SPARE PARTS

The contractor shall provide a list of recommended spare parts and expendable items. The list shall be exclusive of any spare parts furnished under this contract. A total purchase cost of the recommended list shall be provided in addition to the unit cost of each item.

DIVISION 4000 - STORM SEWERS

Section 4001 SCOPE. This section covers the furnishings of all labor, materials, and equipment for the complete installation of storm sewers and appurtenances in accordance with the contract documents. The work shall consist of the construction of storm sewers for the removal of water from collection points, in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the contract drawings or established by the Engineer. Unless otherwise indicated in these specifications, the phrase "Storm Sewer" shall refer to pipe sewers, box culvert sewers, or paved or rock lined channels.

Section 4002 REINFORCED CONCRETE PIPE. All reinforced concrete pipe shall conform to ASTM C76, Class III. This Specification covers reinforced concrete pipe of 15 to 108 inches in diameter and is intended for use in conveyance of storm water and for the construction of culverts.

Installation shall conform to the requirements of Section 5000 Excavation, Trenching, and Backfilling. No pipe culverts shall be placed until the embedment below the proposed reinforced concrete pipe has been approved by the Engineer.

Section 4003 CORRUGATED METAL PIPE. Corrugated metal storm sewer pipe shall be furnished with connecting bands, elbows, and fittings. Corrugated metal storm sewer pipe shall have annular ends. The same type of pipe base metal (steel or aluminum) shall be used throughout any individual run or installation of pipe or for pipe extensions. Materials shall conform to the requirements provided in the 1990 edition of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation.

Corrugated metal culvert pipe gauge requirements shall be as listed on the construction drawings and shall have 2-2/3 inch x ½ inch corrugations, unless otherwise indicated. 3 x 1 corrugations may be required for large diameters. In no case shall any pipe be lighter than 16 gauge.

Corrugated metal storm sewer pipe shall be handled in such a manner that it is not chipped, dented, or bent. If in handling the culvert the base metal is exposed in any way, then it shall be rejected or repaired to the satisfaction of the Engineer.

The excavation, trenching, and backfilling of corrugated metal pipe storm sewers shall be performed in accordance with the requirements of Section 5000 of these specifications. No pipe culverts shall be placed until the embedment below the pipe has been approved by the Engineer.

Section 4004 SMOOTH, INTERIOR, CORRUGATED, POLYETHYLENE PIPE. This specification applies to high density polyethylene corrugated pipe with an integrally-formed smooth interior. This specification is applicable to nominal sizes 12- to 36-inch diameter. Requirements for test methods, dimensions, and markings are those found in AASHTO Designation M-294 and ASTM F667. Pipe and fittings shall be made of polyethylene compounds which meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM D-1248 with the applicable requirements defined in ASTM D-1248. Clean rework material may be used. Larger HDPE pipe diameters will be allowed only with approval of the Engineer after pipe specifications have been submitted and reviewed by the Engineer.

Minimum parallel plate pipe stiffness values at 5 percent deflection shall be as follows:

Diameter	Pipe Stiffness*
12"	45 psi
15"	42 psi
18"	40 psi
24"	34 psi
30"	38 psi
36"	22 psi

* Per ASTM Test Method D-2412

The pipe and fittings shall be free of foreign inclusion and holes, and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely effect joining.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Corrugated fittings may be either molded or fabricated by the manufacturer. Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer. Joints shall be made with split couplings, corrugated to match the pipe corrugations, and shall engage a minimum of 4 corrugations. A neoprene gasket shall be utilized with the coupling to provide a soil-tight joint. Installation shall be in accordance with Section 6000 of these specifications. A manufacturer's certification that the project was manufactured, tested, and supplied in accordance with these specifications shall be furnished.

Section 4005 CATCH BASINS, INLETS, AND JUNCTION BOXES. The methods of excavation and backfilling for catch basins, inlets, and junction boxes shall conform to the requirements of Section 5000 Excavation, Trenching, and Backfilling and Standard Details of these specifications.

Contractor shall submit shop drawings for all pre-cast concrete sewer structures and have them approved in accordance with 105.02 prior to fabrication of the structure. Failure to do so shall be cause for rejection.

Reinforced concrete catch basins and inlets shall conform to the standard concrete inlet drawings and shall be constructed of Class A concrete. Concrete cover over steel reinforcement shall be not less than 1½ inches for covers and 1½ inches for walls and floors. All exposed concrete shall have smooth steel trowel or brushed finish. Interiors of structures shall have the forms removed and surface voids filled.

Foundations for all standard catch basins and inlet shall be Class A concrete.

The floors of all catch basins, inlets, and junction boxes shall have inverts. Inverts shall be constructed of concrete conforming to the requirements of Section 2000 Concrete, with the exception that the concrete may be Class B.

All catch basins, inlets, pipes, and junction boxes shall be thoroughly cleaned of any accumulation of silt, debris or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

All hand holes and other means for installation in top slab of catch basins and inlets shall be filled with non-shrinking grout.

Section 4006 REINFORCED CONCRETE BOX CULVERTS. The work performed herein covers the installation of concrete work in strict accordance with the applicable provisions of Section 2000 Concrete, Section 5000 Excavation, Trenching, and Backfilling, Standard Details, all of these specifications, the 1990 edition of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, and the applicable contract drawings.

Section 4007 PAVED DITCHES AND RIPRAP. Paving concrete for paved ditches shall conform to the applicable provisions of Section 2000 Concrete of these specifications and shall conform to the standard drawings or approved equal.

The concrete shall be placed beginning at the lower end of the portion of the ditch to be lined and progressing toward the upper end. If required on the contract drawings, the concrete shall be reinforced with the type of reinforcement and in the manner indicated. Contraction of construction joints shall be spaced and formed as indicated on the contract drawings.

The surface shall be finished with a wooden float. A light brooming may be required for a more acceptable finish. Immediately after the finishing operations are completed, the concrete shall be protected and cured in conformance with the requirements specified in Section 2000 Concrete.

Riprap shall be placed at the locations and to the dimensions shown on the contract drawings in accordance with the specified requirements.

Riprap shall be graded as necessary to form a dense blanket. The finished surface shall present an even surface conforming to the lines, grades, and sections given. Riprap shall be placed to a minimum depth of eighteen (18) inches.

Riprap shall be placed in such a manner that voids created by larger pieces are filled in by smaller pieces and no voids extend directly through the riprap to the surface below. The riprap shall be placed in rows transversely to the center line of the ditch and

in the manner indicated on the drawings. The riprap shall be placed with ends and sides abutting and the joints between rows breaking with the joints in the preceding row.

Riprap shall consist of durable field or quarry stones Broken up concrete or concrete rubble will not be acceptable for use as riprap. Riprap pieces shall range in weight from five (5) pounds to two hundred (200) pounds. Not less than 75 percent shall be within the range of one hundred (100) pounds to two hundred (200) pounds.

Stone for riprap shall be free from earth, soapstone, shale, shale-like or other easily disintegrated material that will tend to decrease the durability of the material after placement.

When grouted stone riprap is indicated the spaces between stones of grouted riprap shall be filled with grout consisting of one (1) part Portland Cement and three (3) parts of fine aggregate with sufficient water to form a plastic mix. The grout shall be poured and broomed into the spaces until they are completely filled.

TURF REINFORCEMENT MAT. Where exit velocities allow, turf reinforcement mats are preferable to stone riprap. Turf reinforcement mats or similar geo-synthetic products shall be installed per manufacturers' recommendations.

Section 4008 HEADWALLS, WINGWALLS, ENDWALLS, AND END SECTIONS. Construction will be according to details in the approved plans.

Materials will be in accordance with Section 2000 Concrete and Section 4000 Storm Sewers and Standard Details of this specification. The same type of pipe base metal (steel) shall be used throughout any individual run or installation of pipe or for pipe extension, including end sections.

The end sections for pipe culverts shall be installed in accordance with the requirements specified in Section 5000 of these specifications.

All end sections shall require the installation of a concrete toewall for support of end section. See Standard Detail SD40-8.

The area excavated for the pipe and headwalls shall be backfilled with suitable material and the material shall be compacted in accordance with the provisions of Section 5000 of these specifications.

Section 4009 RESTORATION OF SURFACE CONSTRUCTION. The restoration of concrete and asphalt pavement, gravel surfacing, walks, drives, curbs, and other surface construction removed or damaged during the progress of the work covered by this section shall conform to the applicable provisions of Section 6000 Restoration of Surface Construction of these specifications.

Section 4010 UNDERDRAINS. In areas that have known subsurface moisture problems, underdrains will be required. They shall be built as shown in Standard Detail 40-9. Where appropriate, projects that are being designed and bid with City funds may have a line item for 50-100 linear feet of underdrain to provide an established unit price for underdrain should it become necessary during construction.

When included for this purpose, the plans shall note that the underdrain line item is a contingency item that may not be constructed with the project if it is not found to be necessary by the Engineer. Projects not bid with City funds will not be required to have a contingency underdrain line item.

If during construction it does become apparent that there is a need for underdrain in a location that was not previously designed for underdrain, the Engineer may require that the consultant submit a revised plan including underdrains that will provide for subsurface drainage as determined by a geotechnical engineer. The standard detail is a minimum. Upon approval of the Engineer, alternate details for increased capacity may be allowed.

DIVISION 5000 – EXCAVATION, TRENCHING AND BACKFILLING (Pipeline Construction)

Section 5001 SCOPE. This section covers excavation and trenching work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property, backfilling, pipe embedment, surfacing and grading, and other appurtenant work.

Attention is directed to the additional requirements set forth in the General Provision, Contract Plans, or Special Provisions.

Section 5002 GENERAL REQUIREMENTS. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow or ice be placed in backfill, fill, or embankment.

Section 5003 CLASSIFICATION OF EXCAVATED MATERIALS. Excavation is unclassified except when specifically indicated in the proposal and contract. When indicated as such in the proposal and contract, classification of excavated materials will be made as follows:

(a) Rock. Rock excavation will be so classified when sandstone, limestone, blue shale or other similar material is encountered and, in the opinion of the Engineer, requires drilling or blasting to remove the material.

(b) Earth. All material not classified as rock.

Section 5004 CLEARING. The contractor shall do all clearing necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

At the option of the contractor, all trees, underbrush, stumps, roots, and other combustible materials may be stacked and burned on the site at such locations as permitted by the Engineer or removed entirely from the site and disposed of at such locations as determined by the contractor. When authorized by the Fire Department and Public Works Department, the contractor may dispose of such refuse by burning on the site of the project, provided all requirements as determined by the Fire Chief are met. Under no circumstances will the authorization to burn on the site 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 into abutting properties, or buried in embankments or trenches on the site. All materials to be burned shall be piled neatly and, when in suitable condition, shall be burned completely. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. All burning shall be so thorough that the materials are completely reduced to ashes. Great care shall be taken to prevent the spread of fire beyond the permanent site limits. Fire guards of adequate width shall be provided wherever there is surface vegetation around any brush pile. No burning of trimmings or brush shall be done when the direction or velocity of the wind is such that there would be any danger of fire being carried into adjacent areas. All governmental requirements relative to burning, fire prevention, and air pollution shall be complied with. City of Lansing burn permits may be obtained at Lansing City Hall, 800 First Terrace, Lansing, Kansas.

Section 5005 DEWATERING. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations twelve (12) inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.
The contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

Section 5006 SHEETING AND SHORING. Except where banks are cut back of a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, and shored, as necessary, to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing, and shoring shall be designed by a qualified professional Engineer and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances. Engineering data and drawings for shoring shall be submitted to the Engineer for review prior to beginning excavation.

Trench sheeting shall not be pulled before backfilling unless the pipe strength is sufficient, in the opinion of the Engineer, to carry trench loads based on trench width to the back of sheeting; nor shall sheeting be pulled after backfilling. When ordered by the Engineer, sheeting shall be left permanently in the trench. Payment for such sheeting will be made in accordance with the contract provisions for extra work.

When trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

Section 5007 ALIGNMENT AND GRADE. The alignment and grade or elevation of each pipeline shall be maintained as shown on the contract drawings by laser pipe grade equipment. Alternate methods require the Engineer's approval.

Section 5008 MINIMUM COVER (Water Mains). Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill covering the top of the pipe of forty-two (42) inches. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

Section 5009 STABILIZATION. Trench bottoms which become soft, mucky, or otherwise unstable during construction operations shall be stabilized, by and at the expense of the contractor, with one or more layers of crushed rock or other suitable material, where and as necessary to provide a firm and stable base for granular fill pipe foundation material to be placed thereon. Not more than one-half (1/2) inch depth of mud or muck shall be allowed to remain on the stabilized trench bottom when the granular fill pipe foundation material is installed.

Section 5010 TRENCH EXCAVATION. The contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. The contractor shall backfill all open trench by the end of the day's work, except that which is necessary for inspection or immediate continuation of the following day's work.

Where original ground is above plan top of pipe, the area shall be filled and compacted (KDOT Type B, MR-90) prior to any trench excavation.

Except where tunneling or boring is shown on the drawings, is specified, or is permitted by the Engineer, all trench excavations shall be open cut from the surface.

All open trenches shall be provided with adequate protective devices.

Section 5011 LIMITING TRENCH WIDTHS. Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. Ledge rock, boulders, and large stones shall be removed to provide a clearance of six (6) inches below and on each side of all pipe. These distances are minimum clear distances which will be permitted between any part of the pipe and appurtenances being laid on any part, projection, or point of such rock, boulder, or stone.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one (1) foot above the top of the pipe.

Limiting trench widths below an elevation of one (1) foot above the exterior top of the installed pipe shall be not less than fifteen (15) inches nor more than twenty-four (24) inches greater than the nominal outside diameter of the pipe.

Section 5012 UNAUTHORIZED TRENCH WIDTHS. Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in Section 5011 of these specifications either special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the expense of the contractor.

Section 5013 MECHANICAL EXCAVATION. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one (1) foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

If the contractor prefers to undercut the bottom of the trench and bring to grade with CA-5 or an alternate crushed aggregate approved by the Engineer, he may do so, provided the depth of undercut and backfill with crushed rock shall not exceed four (4) inches. Where crushed rock is used, it shall be placed in the trench, spread uniformly, and graded prior to placing the pipe in the trench.

Section 5014 ARTIFICIAL FOUNDATIONS IN TRENCHES. Whenever so ordered by the Engineer, the contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed. All timber, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the Engineer. Compensation for extra excavation and timber, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for extra work. All artificial foundations in trenches shall be completely removed as part of backfilling operations. Such removal shall be considered subsidiary to contract provisions for Artificial Foundations.

Section 5015 PIPE BEDDING. The pipe shall be laid in a flat-bottom trench which has been carefully graded and shaped so that the barrel of the pipe will have bearing for its full length. Blocking of the pipe will not be permitted.

(a) Water Mains. Bedding shall be in accordance with the specifications of the water purveyor serving the area.

(b) Sanitary Sewers. Pipe trenches shall be excavated below pipe subgrade elevations to provide for the installation of granular fill pipe foundation material unless otherwise directed by the Engineer.

Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the following supplementary requirements.

Embedment material shall contain no cinders or other material which may cause pipe corrosion.

1. Class A Arch Encasement. Class A arch encasement shall be used where required by the drawings and where trench conditions require its use as determined by the Engineer.

2. Class B Bedding. Class B bedding shall be used for solid wall thermoplastic (PVC) and ABS composite wall, and all HDPE sewer pipe with the following modification: Granular embedment material shall be CA-5 (see KSS) or Engineer approved equal and shall extend to a point not less than six (6) inches above the top of the pipe.

3. Class C Bedding. Class C bedding shall be used for all reinforced concrete and ductile cast iron pipelines. Granular embedment material shall be CA-5 (see KSS), or Engineer approved equal.

Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material and properly seated, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

Class C embedment shall be compacted to the top of the pipe in all areas where compacted backfill is specified.

Continuity of embedment material shall be interrupted by compacted soil around each manhole to impede passage of water through the embedment. Barrier material may be finely divided suitable job excavated material, free from stones, organic matter and debris, and compacted to 95 percent of maximum density.

(c) Storm Sewers. The pipe shall be laid in CA-5 (see KSS) or approved equal which has been carefully graded and shaped so that the barrel of the pipe will have bearing for its full length. Blocking of the pipe will not be permitted. Granular backfill is then required to the spring line of the pipe.

Where rock is encountered, either dug or shot, the pipe shall be bedded with a minimum of six (6) inches of rock between the pipe and trench bottom. Granular embedment shall be used at locations directed by the Engineer and shall be considered a subsidiary obligation unless specifically provided for as a bid item in the proposal.

Continuity of embedment material shall be interrupted by compacted soil around each inlet, junction box, and manhole to impede passage of water through the embedment.

Section 5016 PIPE INSTALLATION. All work shall be in accordance with the following standards or as specified herein.

Vitrified Clay Pipe; ASTM C12
Flexible Thermoplastic Pipe; ASTM D2321
Ductile Iron Water Mains; AWWA C600
Reinforced Concrete Pipe;

Reinforced concrete pipe joint design shall meet the Engineer's approval. Pipe with collars in lieu of integral bells will not be acceptable.

Core holes and handling holes in concrete pipe shall be repaired by cementing a properly-shaped concrete plug in place with epoxy cement or by other methods acceptable to the Engineer.

Corrugated Steel Pipe;

Corrugated metal storm sewer pipe shall be laid with the separate sections joined firmly together, with the separate sections joined firmly together, with the outside laps of the circumferential joints pointed upstream, and with the longitudinal laps on the side.

Lateral displacement of the pipe shall be prevented during embedment operations. Pipe shall not be laid in water, nor under unsuitable weather or trench conditions.

All joint preparation and jointing operations shall comply with the instructions and recommendations of the pipe manufacturer.

Hooks shall not be permitted to contact joint surfaces. Care shall be exercised in handling all pipe to prevent damage to pipe ends. Damaged pipe or pipe damaged in laying shall be replaced by and at the expense of the contractor.

Section 5017 TRENCH BACKFILL. All trench backfill above pipe embedment shall conform to the following requirements.

Compacted backfill shall be required for the full depth of the trench above the embedment where beneath structures, street, road, or highway right-of-way, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work, except that trenches under existing or planned street pavements and curbs, and within two feet of the back of curbs, shall be backfilled with excavatable flowable fill to existing ground or bottom of pavement as the case may be.

1. EXCAVATABLE FLOWABLE BACKFILL

General. This work shall consist of placing an excavatable flowable mortar fill material in all storm sewer trenches, sanitary sewer trenches, waterline trenches, electric trenches, telephone trenches, conduit trenches, and all other utility trenches, where the excavation occurs under or within two feet of an existing or future street, or improved alley, and pavement or curb will be constructed or replaced over the trench, and at other locations as indicated on the plans. The material shall flow under and around the pipe or conduit, providing uniform support without leaving voids, except when the depth to top of pipe from bottom of pavement is equal to or greater than 6 feet, in which case the flowable fill will be placed on properly placed and compacted granular bedding from a depth of 5 feet below bottom of pavement in accordance with SD50-1A.

Materials. Flowable mortar shall consist of the following materials:

1. Cement, 30-50 lbs/CY, Type I
2. Fly Ash, 200 lbs/CY
3. Water, 370 lbs/CY
4. Fine Aggregate, 3000 lbs/CY, shall be natural sand with 100% passing the ½ inch sieve and 0% - 10% passing the No. 200 sieve. The sand shall stay in suspension in the mortar to the extent required for proper flow.
5. When the material has reached its design strength it shall be excavatable by ordinary excavating equipment, without the need for breakers or blasting.

Placement. Flowable mortar shall be discharged from the mixer by a reasonable means into the trench area to be filled. Filling operations shall proceed simultaneously on both sides of pipe or conduit so that the two fills are kept at approximately the same elevation at all times. An external load shall be applied to the pipe or conduit, sufficient to hold it in place, before filling.

The flowable mortar shall be placed to the top of the trench, or the bottom of existing pavement, with no granular embedment placed around the pipe or conduit, unless otherwise approved in writing by the Engineer, or specified in the contract documents.

Measurement and Payment. Excavatable Flowable Backfill will be subsidiary to other items of the contract, unless otherwise stated in the proposal and contract documents. When provided for in the proposal and contract documents the item will be paid as a Lump Sum, by the Cubic Yard, or by the Lineal Foot, as stated in the contract.

2. EARTH AND AGGREGATE BACKFILL. The top portion of the backfill beneath established sodded areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

At the option of the contractor, compacted backfill may be job-excavated material or graded gravel. Embedment shall be graded gravel KSS type CA-5 and shall be brought to the springline of all storm sewer conduits. Above embedment, job-excavated material may be used for compacted backfill when the job-excavated material is finely divided and free from debris, organic material, cinders, or other corrosive material, and stones larger than three (3") inches in greatest dimension. Large masses of moist, stiff clay shall not be used. Job-excavated material shall be compacted to 95 percent of maximum density at optimum moisture content.

Aggregate for compacted backfill, other than for street crossings, shall be KSS AB-3, or a gradation approved in writing by the Engineer.

The backfill shall be compacted by a suitable vibratory roller, platform vibrator, or method approved by the Engineer, to not less than 95 percent standard density at optimum moisture.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The combination of the thickness of the layer, the method of compaction and the type of compaction equipment used shall be ideal for obtaining the density specified above.

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, organic material, or debris of any kind.

Trench backfill above pipe embedment in locations other than those specified in locations other than those listed in paragraph two of this section, shall be compacted to at least 90 percent of maximum density at optimum moisture content, and shall be referred to hereafter in this section as earth backfill.

Earth backfill material to be placed above embedments shall be free of brush, roots more than two (2) inches in diameter, debris, cinders, or other corrosive material, and junk, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth as approved by the Engineer. Earth backfill material above embedments in these locations may be compacted by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on and which will not result in displacement of installed pipe. Earth backfill shall be compacted to the extent necessary to prevent excessive future settlement.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of backfill above pipe embedment.

No earth backfill material containing rocks, or rock excavation detritus, shall be placed in the upper eighteen (18) inches, nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

Section 5018 STRUCTURE BACKFILL. Backfill around structures shall be compacted to the extent necessary to prevent future settlement by tamping or other means acceptable to the Engineer, and as a minimum, shall be compacted to 95% of standard density at optimum moisture.

Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically-compacted backfill shall be deposited or compacted in water.

Section 5019 DENSITY TESTING. At the option of the Engineer, in-place field density testing to determine compliance with specified compaction requirements may be performed using a nuclear moisture-density measuring device. If, as a result of any field or laboratory testing, the Engineer determines that further compaction is required, the contractor shall revise his compaction procedures to obtain the results specified, and correct any deficient backfill.

Section 5020 TUNNEL AND CASING PIPE INSTALLATION. Pipelines shall be constructed in tunnels of the type designated on the drawings, in conformity with the requirements which follow. Before starting work on any tunnel, complete details of the method of operation and liner to be used shall be submitted to the Engineer for review.

Smooth wall casing pipe shall be welded-steel construction and shall be new material with a minimum yield point of 35,000 psi. Minimum casing wall thickness shall be as indicated in the following table.

	Nominal Wall Thickness (Inches)	
Diameter of Casing (Inches)	Under Railroads	All Other Uses
Less than 14	0.188	0.188
14	0.219	0.188
16	0.219	0.250
18	0.250	0.250
20	0.281	0.250
22	0.312	0.250
24	0.344	0.281
26	0.375	0.281
28	0.406	0.312
30	0.406	0.312
32	0.438	0.312
34	0.469	0.312
36	0.469	0.344
38	0.500	0.344
40	0.500	0.344
42	0.500	0.344
44	0.560	0.375
46	0.560	0.375
48	0.560	0.375
50	0.625	0.406
52	0.625	0.406

The conduit shall be installed by jacking into place. Earth displaced by the conduit shall be removed through the interior of the conduit by hand, by auger, or by other acceptable means. Sections of the casing pipe shall be welded together to form a continuous conduit capable of resisting all stresses, including jacking stresses. The casing pipe conduit in its final position shall be straight and true in alignment and grade, as required by the drawings. There shall be no space between the earth and the outside of the casing. Any voids which do occur shall be filled by pressure grouting.

Pipe chocks to support the carrier pipe inside the casing shall be “Powerseal” chocks or Engineer approved equal and shall be installed and spaced according to the manufacturer’s recommendation.

Casing end seals shall be “Powerseal” synthetic rubber wrap around seal or Engineer approved equal and shall be installed according to the manufacturer’s recommendation.

See Standard Detail SD 50-3 .

Other proposed methods of support and seal should be requested in writing with Engineering drawings of the proposed method, and must be approved in writing by the Engineer.

No interruption of traffic will be permitted at any location where tunnels are required.

Section 5021 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially-filled trenches. All material deposited in roadway ditches or other water courses crossed by the lines of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary, and

appropriate sediment control measures shall be taken to prevent sediment or contaminants of any kind from entering any water course due to runoff or spills.

Section 5022 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. When the grade of the ditch exceeds 1 percent, ditch checks shall be installed. Unless otherwise shown on the drawings or directed by the Engineer, ditch checks shall be concrete. Ditch checks shall extend not less than two (2) feet below the original ditch or water course bottom for the full bottom width and at least eighteen (18) inches into the side slopes and shall be at least twelve (12) inches thick.

Section 5023 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of work.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk ,and debris encountered in excavation work and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly. Drag with bale machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, highway right-of-way, or residential lawn. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the contractor and no separate payment will be made therefore.

Section 5024 SETTLEMENT. The contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within two (2) years of time after final acceptance of the contract under which the work was performed.

A suitable maintenance bond in an amount approved by the Engineer shall be furnished to the City of Lansing by the contractor, guaranteeing the maintenance of the construction under which the contract was performed. Said bond shall remain in effect for the period mentioned above from the date of completion and acceptance of the work by the City.

The contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after notice from the Engineer.

DIVISION 5100 - BLASTING

Section 5101 SCOPE. Possession and use of explosive materials as defined by this Chapter for subsurface blasting shall be in accordance with this article.

Section 5102 DEFINITIONS.

A. "Applicant" shall mean the person applying for the blasting permit and the party responsible for compliance with this article.

B. "Blast site" shall mean the area in which explosive materials are being or have been loaded and which includes all holes loaded or to be loaded for the same blast and a distance of 50 feet (15 240 mm) in all directions.

C. "Blasting agent" shall mean a material or mixture consisting of fuel and oxidizer, intended for blasting provided that the finished product as mixed for use or shipment, cannot be detonated by means of a No. 8 test detonator when unconfined. Blasting agents are labeled and placarded as Class 1.5 material by U.S. Department of Transportation.

D. "Blasting expert" shall mean a professional engineer licensed in the State of Kansas with blasting experience, or a consultant whose primary business involves blasting operations and blasting analysis.

E. "Chief" shall mean the fire chief of Fire District 1.

F. "Division of Fire Prevention" shall mean the fire prevention division of the Leavenworth County Fire District 1.

G. "Explosive" shall mean a chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters and display fireworks, (1.3G (Class B, Special.)).

The term "explosive" includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G (Class C, Common) by the hazardous materials regulations of Department of Transportation 49 CFR.

H. "Explosive materials" shall mean explosives, blasting agents, and detonators.

I. "NFPA" shall mean the National Fire Protection Association current edition.

J. "Owner" shall mean persons having vested or contingent interest in the property in question and their duly authorized agents or attorneys.

K. "Person" shall mean a natural person, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or agent of any of the aforesaid.

L. "Property" for the purposes of this article shall mean real property; land.

M. "Public Works Director" shall mean the Director of the City of Lansing Public Works Department.

N. "Structure" shall mean a combination of materials or piece of work built or composed of parts joined together in some definite manner for occupancy, use or ornamentation. The term "structure" shall include everything that is built or constructed and affixed to the real property. The term "structure" shall not include utility lines, and accessory apparatus.

O. "Utility lines" shall mean an electric, cable, fiber optic line, water line, sanitary sewer line, pipeline or other type of conduit used to transport or transmit electricity, gases, liquids, and telecommunications lines.

Section 5103 PERMITS REQUIRED. A permit application to use or possess explosive materials subject to regulation under this article shall be made to the Lansing Public Works Department. The Director of Public Works or his or her designated representative may approve the issuance of the permit only after inspection and review by Fire District No. 1 (Fire Department) and/or Public Works and the Fire Department has made recommendations pertinent to the issuance of the permit. The Director of Public Works or his or her designated representative shall have seven days after receipt of a completed application to review the application, including all supporting documentation, and recommendations from the Fire Department and to issue or deny a permit. The process to apply for a permit shall be as follows:

A. For blasting operations occurring at a distance greater than 1,500 feet of any structure or utility line:

1. The application for a permit shall be accompanied by a Blasting Plan for the blasting operation. The Blasting Plan shall contain the following information:

a. The name of the contractor conducting the blasting operation, and

b. The names of all responsible on-site personnel with copies of their permits to blast explosives issued by the State of Kansas Fire Marshal.

2. The applicant shall maintain and provide proof of liability insurance coverage for the purpose of payment of damages to persons or property which arise from, or are caused by, the blasting operations. The policy or policies shall provide for the following minimum coverage:

a. Liability insurance to cover injuries or damages to persons or property which might result from blasting operations:

(1) General Aggregate (or a combination of general liability insurance and an umbrella policy insuring the blasting operations): $5,000,000

(2) Each Occurrence: $2,000,000

b. Automobile Liability Insurance Combined Single Limit: $1,000,000

c. Workers Compensation: Statutory Coverage

3. The applicant shall pay an application fee of $500.00.

B. For blasting operations occurring at a distance equal to or less than 1,500 feet and greater than 500 feet of any structure or utility line:

1. The application for a permit shall be accompanied by a Blasting Plan for the blasting operation. The Blasting Plan shall contain the following information:

a. Name of the contractor conducting the blasting operation,

b. all responsible on-site personnel with copies of their permits to blast explosives from the Kansas State Fire Marshal.

c. Scale drawing which accurately allows dimensions and all distances relative to the application to be calculated for the following:

(1) Distances to all structures, to the extent such data is available, within 1500 feet of the blast site;

(2) Distances from structures to the explosive storage magazines.

(3) Drill patterns, delay periods, and decking.

(4) Type and amount of explosive to be used at each location.

d. Evidence of the notice required by this article, sent by United States mail, to owners of property and/or utility lines located within 1500 feet of the blast site. The required evidence shall include a copy of the written notification and a list of names and addresses of those notified. Said written notification shall contain the following information:

(1) Notice of intent to blast;

(2) Name of the blasting contractor;

(3) Estimated duration of blasting operations and the general location of the blast site, with a copy of the map included with the notice;

(4) Name of the insurance agency providing the blasting contractor's liability insurance coverage and the agency's contact information; and

(5) The date, time, and location of the informational meeting with property owners and/or utility company representatives.

e. Proof that the seismology equipment to be used at the blasting site has been calibrated and certified within one year of the proposed blasting.

2. The applicant shall maintain and provide proof of liability insurance coverage for the purpose of payment of damages to persons or property which arise from, or are caused by, the blasting operations. The policy or policies shall provide for the following minimum coverage:

a. Liability insurance to cover injuries or damages to persons or property which might result from blasting operations:

(1) General Aggregate (or a combination of general liability insurance and an umbrella policy insuring the blasting operations): $5,000,000

(2) Each Occurrence: $2,000,000

b. Automobile Liability Insurance Combined Single Limit: $1,000,000

c. Workers Compensation: Statutory Coverage

3. The applicant shall pay an application fee of $500.00.

C. For blasting operations occurring at a distance equal to or less than 500 feet of any structure or utility line:

No blasting shall occur within 100 feet of any structure or utility line unless the owner(s) of the structure(s) and/or utility line(s) consent in writing, and the blasting conforms to the limits recommended by the U.S. Bureau of Mines Table of Scaled Distances.

1. The application for a permit shall be accompanied by a Blasting Plan for the blasting operation. The Blasting Plan shall contain the following information:

a. The name of the contractor conducting the blasting operation,

b. The names of all responsible on-site personnel with copies of the blasters certificates,

c. Scale drawing that accurately allows dimensions and all distances relative to the application to be calculated for the following:

(1) Distances to all structures, to the extent such data is available, within 1500 feet of the blast site.
(2) Distances from structures to the explosive storage magazines.
(3) Designation of proposed pre-blast surveyed structures within 500 feet of the blast site.
(4) Drill patterns, delay periods, and decking.
(5) Type and amount of explosive to be used at each location.

d. Name of the independent firm, approved by the Lansing Public Works Department Community Development Division and reporting directly to the Public Works Director, which shall conduct the seismographic monitoring of blasts occurring within 500 feet of any structure or utility line.

e. Proof that the seismology equipment to be used at the blasting site has been calibrated and certified within one year of the proposed blasting.

f. Evidence of the notification required by this article, sent by U.S. mail, to owners of property and utility lines located within 1500 feet of the blast site. The required evidence shall include a copy of the written notification and a list of names and addresses of those notified. Said written notification shall contain the following information:

(1) Notice of intent to blast;

(2) Name of the blasting contractor;

(3) Estimated duration of blasting operations and the general location of the blast site, with a copy of the map included with the notice;

(4) Name of the insurance agency providing the blasting contractor's liability insurance coverage and the agency's contact information; and

(5) The date, time, and location of the informational meeting with property owners and/or utility company representatives.

g. Evidence of the notification required by this article, sent by certified mail, return receipt requested, not less than 15 days before blasting commences to owners of property and utility lines located within 500 feet of the blast site. The required evidence shall include a copy of the written notification and a list of names and addresses of those notified. Said written notification shall contain the following information and/or statements:

(1) Notice of intent to blast;

(2) Name of blasting contractor;

(3) Estimated duration of blasting operations and the general location of the blast site, with a copy of the map included with the notice;

(4) Name of the insurance agency providing the blasting contractor's liability insurance coverage and the agency's contact information;

(5) The date, time, and location of the informational meeting with owners of property located within 500 feet of the blast site and/or with representatives of utility companies with utility lines located within 500 feet of the blast site;

(6) Name of the company performing the pre-blast surveys;

(7) Contact information for the company performing the pre-blast surveys;

(8) An offer to permit representatives of notified utility companies to be present during blasting operations;

(9) A statement advising the utility company or companies that if it fails within ten (10) days of receipt of the notice to object to the intent to blast, or to request additional time to review the plans, any objections are deemed waived; and

(10) A statement advising the utility company or companies that the utility company is responsible for identifying the need for, and requesting, a pre-blast survey of utility company structures.

h. A copy of a pre-blast survey log which contains a list of properties with structures and/or utility lines eligible for pre-blast surveys, and a list of properties with structures and/or utility lines which received pre-blast surveys.

i. The name, address, and telephone number of the qualified blasting expert who shall review and analyze the blasting plan, including the items listed below, anytime blasting occurs within 500 feet of any structure or utility line. The qualified blasting expert shall be experienced in blasting operations. The blasting expert shall be approved by, and report to, the Director of Public Works, and the Fire Chief. Said blasting expert shall be independent of the blasting contractor and shall be compensated by the applicant. The blasting expert shall provide the Director of Public Works, and the Fire Chief with proof of general liability insurance in an amount consistent with industry standards. The blasting expert shall review and analyze the following:

(1) Pre-blast survey records to confirm the pre-blast surveys were performed in accordance with this article;

(2) The notice of the informational meeting for property and utility line owners, to verify it was sent in accordance with this article;

(3) Proposed location and time of the blast(s);

(4) Credentials of the certified blaster designated to be in charge of the blasting operation;

(5) Type of material to be blasted;

(6) Number of proposed holes to be bored and the spacing thereof;

(7) Proposed diameter of, and proposed depth of, holes;

(8) Type and amount of explosives to be used;

(9) Amount of explosives per delay of 8 milliseconds or greater;

(10) Proposed method of firing and proposed type of circuit to be used;

(11) Verification that no blasting shall occur within one hundred (100) feet of any structure or utility line, unless a written consent from the owner(s) of the structure or utility line is on file with the Director of Public Works, and the Fire Chief, and the planned blasting conforms with the limits recommended by the U.S. Bureau of Mines Table of Scaled Distances (NFPA 495);

(12) Whether or not mats or other precautions will be used;

(13) Type of proposed detonators and delay periods;

(14) Type and height of proposed stemming;

(15) Proposed locations of seismology equipment during blasting operations and verification of the equipment's calibration / certification within one year of the proposed blasts;

(16) Verification of notice to utility companies; and

(17) Subsurface analysis of the site.

j. Upon completion of the review and analysis required by Section 8-603(C)(1)(i), the blasting expert shall provide a written statement to the Director of Public Works, and the Fire Chief certifying that the proposed blasting operation does or does not meet the City Code.

k. The applicant shall offer pre-blast surveys to residents or owners of structures and utility lines located within 500 feet of the blasting site. The pre-blast surveys shall conform to the requirements of this article. The pre-blast surveys shall be completed before the initiation of blasting may occur, unless permission to conduct a pre-blast survey has been denied or contact with the owner or occupant of the structure or utility line could not be made after due diligence on the part of the pre-blast survey company representative to make such contact.

2. The applicant shall maintain and provide proof of liability insurance coverage for the purpose of payment of damages to persons or property which arise from, or are caused by, the blasting operations. The policy or policies shall provide for the following minimum coverage:

a. Liability insurance to cover injuries or damages to persons or property which might result from blasting operations:

(1) General Aggregate (or a combination of general liability insurance and an umbrella policy insuring the blasting operations): $5,000,000

(2) Each Occurrence: $2,000,000

b. Automobile Liability Insurance Combined Single Limit: $1,000,000

c. Workers Compensation: Statutory Coverage

(3) The applicant shall pay an application fee of $500.00.

Section 5104 PRE-BLAST SURVEYS OF STRUCTURES WITHIN 500 FEET OF THE BLAST SITE

A. Pre-blast surveys offered: Pre-blast surveys shall be offered to the owners and/or occupants of structures and utility lines located within 500 feet of the blast site. The pre-blast surveys shall be conducted by a firm regularly engaged in performing pre-blast surveys and which is independent of the blasting contractor. The pre-blast surveyor shall promptly conduct a pre-blast survey of the identified structures unless permission for a survey has been denied by the owner or occupant of the structure, or after due diligence on the part of the surveyor, contact with the owner or occupant of the structure could not be made. The surveyor shall promptly conduct a pre-blast survey of utility company structures if a utility company representative requests one from the surveyor.

B. Written Reports: The surveyor shall examine the interior and/or exterior of the structure, documenting through the use of photography or videotaping equipment, any existing damage and other physical factors that could reasonably be affected by the blasting operation. In the event a claim of damage is made, a written report of the surveyor's pre-blast survey or examination of the structure shall be prepared. All photographs shall be identified by number. The written report shall be signed by an authorized representative of the company or firm that performed the pre-blast surveys.

C. Copies of Pre-blast Surveys: Copies of the pre-blast survey shall be made available to the Public Works Department Community Development Division and the Fire Chief and may be provided to the blasting contractor. Upon request, the applicant shall provide to the owner of the structure making the request, a copy of the pre-blast survey of the requesting party's surveyed structure. No person other than the owner or occupant of the surveyed structure shall receive a copy of the pre-blast survey of the structure, unless otherwise provided by law. The applicant may charge the owner or occupant requesting the copy the actual cost of reproducing the pre-blast survey.

D. Initiation of Blasting Operations: Before the initiation of blasting operations, the pre-blast surveys shall be completed, unless permission to conduct a pre-blast survey has been denied or contact with the owner or occupant of the structure could not be made after due diligence on the part of the surveyor to make such contact. The applicant shall submit to the Public Works Department and the Fire Chief a copy of a pre-blast survey log which contains a list of properties and/or utility lines eligible for pre-blast surveys, and which shows a list of properties and/or utility lines which received pre-blast surveys. Blasting may commence if the pre-blast surveys are completed, or permission to conduct a pre-blast survey has been denied, and the ten (10) day period in which a utility company that has utility lines within 500 feet of the proposed blasting site has to object to the intent to blast or to request additional time to review the plans, has expired.

Section 5105 PERMIT – EXPIRATION AND REISSUING

A. Expiration: Permits shall expire thirty (30) days after the date of issuance.

B. Reissuing Permits: Permits may be reissued if they have expired or have been terminated, subject to such provisions of inspection, reporting, and amendments contained in this ordinance as the Public Works Department and the Fire Chief deems necessary.

If a permit is reissued, the applicant shall notify in writing the owners of property within 1500 feet of the blast site of the new permit period if the time period contained in the original written notification expires. The notice to owners of property within 1500 feet of the blast site shall be by regular U.S. mail. If a permit is reissued, the applicant shall notify in writing the owners of property within 500 feet of the blast site of the new permit period if the time period contained in the original written notification expires. The notice to owners of property within 500 feet of the blast site shall be by certified mail, return receipt requested. The notification to owners of properties within 500 feet of the blast site that the permit is reissued shall also state that the owner of the structure may request a second pre-blast survey if the structure underwent an improvement, construction or remodeling project requiring a building permit after the initial pre-blast survey was completed.

Section 5106 REVOCATION OF PERMITS. The public works director, fire chief, or their designated representative is authorized to revoke a permit issued under the provisions of this article when it is found by inspection or otherwise that:

A. There has been a false statement or representation as to a material fact in the application or construction documents on which the permit or approval was based.

B. The permit is used for a location or establishment other than that for which it was issued.

C. The permit is used for a condition or activity other than that listed in the permit.

D. Conditions and limitations set forth in the permit have been violated.

E. There have been any false statements or misrepresentations as to the material fact in the application for permit or plans submitted or a condition of the permit.

F. The permit is used by a different person or firm than the name for which it was issued.

G. The permittee failed, refused or neglected to comply with orders or notices duly served in accordance with the provisions of this chapter within the time provided therein.

H. The permit was issued in error or in violation of any ordinance, regulation, or the Code of the City of Lansing, Kansas, as amended.

The Chief and or Director, or his or her designee, may delay reissuing a permit that has been revoked pursuant to this article until such time as the chief, director or the designee deems appropriate taking into account the nature and severity of the conduct which caused the permit to be revoked.

Section 5107 BLASTING OPERATIONS

A. Use and Handling

1. Distance from structures. There shall be no blasting within one hundred feet of any structure or utility line unless the owner of the structure(s) and/or utility line(s) consent in writing, and the blasting conforms to the limits recommended by the U.S. Bureau of Mines Table of Scaled Distances.

2. General. Blasting operations shall be conducted only by approved, competent operators familiar with the required safety precautions and the hazards involved. Blasting operations shall be performed in accordance with the instructions of the manufacturer of the explosive materials being used.

3. Blasting in close proximity. When blasting is done in close proximity to a structure, railway or highway, or any other installation, precautions shall be taken to minimize earth vibrations and air blast effects. Blasting mats or other protective means shall be used to prevent fragments from being thrown.

4. Restricted hours. Blasting operations shall only be conducted during daylight hours.

5. Personnel. Persons in charge of blasting shall possess a valid permit to blast explosives issued by the Kansas State Fire Marshal, shall not be under the influence of alcohol or drugs which impair sensory or motor skills, shall be at least 21 years of age, and shall demonstrate knowledge of all safety precautions related to the storage, handling or use of explosives or explosive materials. Persons 18 years of age or older are allowed to use and handle explosive materials under the direct supervision of a person who possesses a valid permit to blast explosives issued by the Kansas State Fire Marshal.

6. Open flames and lights. Smoking, matches, flame-producing devices, open flames, fire arms and firearms cartridges shall not be permitted inside of or within the blast site.

7. Blasting safeguards. Before a blast is fired, the person in charge shall make certain that surplus explosive materials are in a safe place, that persons and equipment are at a safe distance or under sufficient cover, and that a loud warning signal reasonably calculated to be heard by individuals not less than 100 feet of the blast site has been sounded.

8. Electric detonator precautions. Precautions shall be taken to prevent accidental discharge of electric detonators from currents induced by radar and radio transmitters, lightning, adjacent power lines, dust and snow storms, or other sources of extraneous electricity.

9. Non-electric detonator precautions. Precautions shall be taken to prevent accidental initiation of non-electric detonators from stray currents induced by lightning or static electricity.

10. Non-sparking tools. Tools used for the opening and closing of packages of explosive materials, other than metal slitters for opening paper, plastic or fiberboard containers, shall be made of non-sparking materials.

11. Disposal of packaging. Empty containers and paper and fiber packaging materials that previously contained explosive materials shall be disposed of or reused in an appropriate manner.

12. Abandonment. Explosive materials shall not be abandoned.

13. Transportation. Explosive materials shall be transported in accordance with Chapter 7 of the Code of the City of Lansing, Kansas, and amendments thereto.

14. Blast Records. A record of each blast shall be kept and retained by the applicant for at least five (5) years and shall be available for inspection upon request by the Public Works Department Community Development Division or the Fire Chief or owners of property within 500 feet of the blast site or as provided by law. These records shall contain the following minimum data:

    a. Name of blasting contractor:

    b. Pre-blast survey records.

    c. Location and time of blast.

    d. Name of certified blaster in charge.

    e. Type of material blasted.

    f. Number of holes bored and spacing.

    g. Diameter and depth of holes.

    h. Type and amount of explosives.

    i. Amount of explosives per delay of 8 milliseconds or greater.

    j. Method of firing and type of circuit.

    k. Identification, direction, and distance, in feet, from the nearest blast hole to the nearest building or structure outside the permit area.

    l. Whether or not mats or other precautions were used.

    m. Type of detonators and delay periods.

    n. Type and height of stemming.

    o. Seismograph and air blast records of each shot.

15. Post-blast survey of structure. If during the course of the blasting operation, a complaint is made, or a claim of damage is stated, the applicant shall, with the owner's consent, have the surveyor conduct a post-blast inspection of the structure in question. The surveyor, blasting contractor, and/or insurance agency representative shall investigate each complaint or claim thoroughly using

where appropriate the surveyor's written report to compare pre-existing damages with those being claimed.

16. Other regulations. Blasting operations shall be conducted in accordance with federal, state and local regulations.

B. Ground Vibration and Air blasts

1. Maximum peak particle velocity. The maximum peak particle velocity at the nearest structure or utility line shall not exceed one inch per second in any one of three mutually perpendicular directions, unless the property or utility line owner(s) consents in writing.

2. Ground vibration. Regardless of the distance to nearby structures and utility lines, the blasting operations shall be carried out in such a manner that they will not cause fly rock damage or damage from exceeding air blast or ground vibration limits.

3. Seismographic monitoring. Seismographic monitoring of blasts occurring within 500 feet of any structure or utility line shall be provided by a firm independent of the blasting contractor, approved by the Fire Prevention Division, reporting directly to the Fire Marshal and compensated by the applicant. The seismograph monitoring site shall be located between the nearest structure or utility line and the blast site. Seismographic monitoring of blasts occurring at a distance greater than 500 feet of any structure or utility line shall be provided by the blasting contractor or by a firm engaged by the blasting contractor.

4. Calibration / certification of seismology equipment. All seismology equipment used on the job site, by either the applicant or a third party independent firm shall have been calibrated and certified within the year preceding the blasting operations.

5. Air blasts. Air blasts at the location of any structure shall not exceed the maximum limits specified in Table 11.2 of N.F.P.A. 495.

C. Notice of New Storage Site When a new explosive material storage location, including a temporary jobsite, is established, the applicant shall notify 48 hours in advance, not including Saturdays, Sundays the City of Lansing Public Works Department, the Lansing Police Department, and Leavenworth county Fire District 1 of the type, quantity and location of explosive materials at the site.

1. The Fire Chief is authorized to limit the quantity of explosive materials allowed at any location.

2. The Fire Chief is authorized to remove, or cause to be removed or disposed of in an approved manner, at the expense of the applicant, explosives and explosive materials stored, possessed, or used in violation of this article.

3. Storage of explosive materials shall comply with Chapter 7 of the Code of the City of Lansing, Kansas, and amendments thereto.

4. The applicant shall possess a valid permit to store explosives from the Kansas State Fire Marshal's Office for the storage site.

D. Posting Notification The applicant shall cause to be posted in a conspicuous location, accessible to the public, a weather protected copy of the site map, a copy of the permit to use or possess explosive materials issued by the Division of Fire Prevention, and copies of the permits to blast explosives issued by the Kansas State Fire Marshal's office for all on-site personnel responsible for blasting operations.

Section 5108 INSPECTION AND ENFORCEMENT. The Leavenworth County Fire District 1 and the Public Works Department shall enforce this article under the supervision of the Fire Chief and Public Works Director. The Public Works

Department and Fire District No. 1 shall adhere to the provisions concerning inspections, enforcement, and appeals procedures adopted in Chapter 7 and Chapter 1 of the Code of the City of Lansing, Kansas and amendments thereto.

Section 5109 APPENDIX TO ARTICLE 6

Application Checklist for Permit to Conduct Blasting Operations

PROJECT NAME / LOCATION:

_____

_____

<table>
<tr><td></td><td>DESCRIPTION OF DOCUMENT/INFORMATION</td></tr>
<tr><td></td><td>Proof of Liability Insurance:
Liability insurance to cover injuries or damages to persons or property which might result from blasting operations:

$5,000,000: General aggregate or a combination of general liability insurance and an umbrella policy insuring the blasting operations;
$2,000,000: Each Occurrence
$1,000,000: Automobile combined, single limit
Statutory Amount: Workers Compensation Insurance

<table>
<tr><td>Insurance Agency Name:</td><td></td></tr>
<tr><td>Insurance Agency Address:</td><td></td></tr>
<tr><td>Insurance Agency Telephone No.:</td><td></td></tr>
<tr><td>Insurance Expiration Dates:</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Certificates of Insurance on file with Public Works? (Y/N)</td><td></td></tr>
</table>
</td></tr>
<tr><td></td><td>Copies of Permits to Blast Explosives for all persons responsible for blasting operations on site</td></tr>
<tr><td></td><td>Blasting Plan:
<table>
<tr><td>Name of blasting contractor:</td><td></td></tr>
<tr><td>Names of responsible on-site personnel with copies of permits to blast explosives:</td><td></td></tr>
<tr><td>Permit to Store Explosives from Kansas State Fire Marshal’s office</td><td></td></tr>
<tr><td>Scale drawing with:
*Distances to structures within 1500 feet of blast site
*Distances to structures / explosive storage magazines
*Designation of proposed pre-blast survey structures within 500 feet of blast site</td><td></td></tr>
<tr><td>Name of Seismographic Monitoring Firm:</td><td></td></tr>
<tr><td>Proof of certification / calibration of seismology equipment</td><td></td></tr>
<tr><td>Evidence of Notification (including copy of notice) to property and utility line owners located within 1500 of blast site</td><td></td></tr>
<tr><td>Evidence of notification sent certified mail return receipt requested (including copy of notice) to owners of property and utility lines within 500 feet of blast site.</td><td></td></tr>
</table>
</td></tr>
</table>

	Copy of pre-blast survey log:	
	Name, Address, Telephone number of blasting expert	
	Proof of insurance for blasting expert:	
	Blasting Expert's certification concerning applicant's blasting operation:	
	Applicant's Information:	
	Name of Person Applying for Permit:	
	Address of Person Applying for Permit:	
	Telephone Nos. of Person Applying for Permit:	
	Applicant's Signature:	
	Application Fee of $500.00	

DIVISION 6000 – RESTORATION OF SURFACE CONSTRUCTION

Section 6001 SCOPE. This section covers restoration of concrete and asphalt pavement, gravel surfacing, walks, drives, curbs, and other surface construction removed or damaged during construction.

Section 6002 GENERAL. All pavement or other surface construction which is removed or damaged during the progress of the work shall be restored in kinds to its original or better condition by the contractor. All restoration work shall be subject to acceptance by the Engineer and the owner or the agency having jurisdiction thereof. All materials used for restoration work shall be new or of like or better in kind quality than the original improvement.

Section 6003 REFERENCE STANDARD. Materials and construction methods, as referred to herein, shall conform to the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation (1990 Edition), and to applicable sections of these technical specifications.

Section 6004 PAVEMENT REPLACEMENT. The replacement of all street surfacing shall be in accordance with the pavement replacement detail shown on Standard Detail 60-1. The replacement concrete and asphalt pavement shall be composed of a concrete base course at least seven (7) inches thick and an asphaltic concrete overlay at least two (2) inches thick. Materials and workmanship shall conform to the following:

Concrete – High early strength	As specified in Section 2005
Asphalt Aggregate	Type BM-2, Section 1103, "Kansas Highway Specification"
Trench Backfill	Excavatable flowable fill

All drives, parking areas, and other pavement or asphalt surfaces which are removed or damaged shall be replaced to at least their original thickness. Materials used shall be new and shall match the existing surfacing as closely as possible in type, kind and quality, with the exception of drive approaches which shall be constructed of 4000 psi Portland concrete as per Divisions 2000 and 2100.

Section 6005 CONCRETE WALKS. Concrete walks removed in connection with, or damaged as a result of, construction operations shall be replaced with new construction. Such walks shall be constructed of concrete on a thoroughly compacted subgrade, shall have a vertical thickness at least as thick as the existing walks, but not less than four (4) inches thick, shall be constructed with expansion joints spaced not exceeding fifty (50) feet apart, and shall be sloped for drainage at right angles to the longitudinal centerline in the amount of 1.00% minimum and 2.00% maximum. (ADA requires maximum 2% cross-slope).

Concrete materials and workmanship shall conform to the applicable requirements of Division 2000 Concrete of these specifications.

Surface finish and tooling/edging of concrete walks replaced shall conform to, and shall match as closely as possible, that of existing concrete walk surfaces.

Section 6006 CONCRETE CURBS AND GUTTERS. Concrete curbs and gutters which have been removed or damaged by reason of construction operations or any other cause shall be replaced with new concrete construction. New curb and gutter sections shall be as designated on the drawings and detailed on Standard Details 21-1 and 21-2.

Concrete materials and workmanship shall conform to the applicable requirements of Division 2100 Concrete Curb, Curb and Gutters, Sidewalk, and Driveway Entrances of these specifications.

Construction and expansion joints, dimensions, elevations and surface finish of curb and gutter replacements shall conform to, and shall match as closely as possible, that of adjacent existing concrete curbs and gutters.

Replacement curb sections shall be dowelled into existing curb sections in accordance with standard details.

Curb removal for replacement sections shall be neat and clean saw cut or shall be removed to the nearest joint in each direction.

Section 6007 GRAVEL SURFACING. Existing gravel drives, parking and surfacing which is removed or damaged during the progress of the work shall be replaced with an aggregate surfacing at least as thick as that removed, but in no case less than six (6) inches.

New aggregate surfacing shall match existing surfacing as nearly as possible in size, gradation, color, and compaction.

Section 6008 MISCELLANEOUS REPAIR WORK. All existing items and construction, whether or not indicated by the drawings but which are removed or damaged as a result of construction operations under this contract, shall be repaired or replaced unless otherwise required by the drawings.

Repair or replacement shall be with materials of like kind and like or better quality than the original improvement, and shall in each case restore the item to its original or better condition as acceptable to the Engineer and the owner thereof.

DIVISION 6100 – CHAIN LINK FENCING

Section 6101 SCOPE. This specification covers chain link fencing and gates.

Section 6102 FENCE TYPE. Fencing shall conform to the alignment and details shown on the drawings and shall consist of galvanized or aluminum-coated steel fabric, steel posts, top rail, and bottom tension wire. Posts shall be set in concrete.

Section 6103 MATERIALS. All steel or malleable iron parts and accessories shall be hot-dip galvanized or aluminum coated after fabrication.

Fabric	9 gauge, 2-inch mesh; galvanized ASTM A392, Class II or aluminum-coated ASTM A491, Class II.
Posts	Steel H-Section, 0.35 percent carbon; steel pipe, ASTM A120, standard weight (Schedule 40) ; or steel hollow structural tubing, ASTM A500 or A501.
Line Posts	
For 6-foot Fencing	H-Section 4.10 pounds per foot; 2 3/8 inch OD pipe, 3.65 pounds per foot; or 2 inch square, 3.85 pounds per foot.
For 42-inch Fencing	H-Section, 2.70 pounds per foot; or 1 7/8 inch OD pipe, 2.72 pounds per foot.
Terminal Posts End, corner, and pull posts.	
For 6-Foot Fencing	2 7/8 inch OD pipe, 5.79 pounds per foot; or 2 ½ inch square, 5.59 pounds per foot.
For 42-inch Fencing	2 3/8 inch OD pipe, 3.65 pounds per foot; or 2 inch square, 3.85 pounds per foot.
Gate Posts	Gate or leaf 6 foot or less, 2 7/8 inch OD pipe, 5.79 pounds per foot; or 2 ½ inch square, 5.59 pounds per foot; gate or leaf over 6 foot, 4 inch OD pipe, 9.10 pounds per foot; or 3 inch square, 9.10 pounds per foot.
Top Rail	1 5/8 inch OD steel tubing, 1.40 pounds per foot.
Rail Couplings	Sleeve type, 6 inches long.
Post Tops	(when barbed wires pressed steel, malleable iron, with are required at the top of pressed steel extension arm, or the fence) hole for top rail, designed to prevent entry of moisture into tubular posts.
Post Tops	Pressed steel, malleable iron, or cast aluminum; designed to prevent entry of moisture into tubular posts.
Barbed Wire	Galvanized, ASTM A121, Class 2 or aluminum coated ASTM A585, Class II; two 12 ½ gauge steel wires with 4 point barbs.
Stretcher Bars	Steel, 3/16 inch by ¾ inch, or equivalent area.
Fabric Ties	Aluminum bands or wires.
Gate Frames	Steel tubing, 1 7/8 inch OD, 2.09 pounds per foot; or 2 inch square, 2.10 pounds per foot.
Tension Wire	Galvanized or aluminum coated coil spring wire, 7 gauge.
Handrail-Setting Cement	Hallemite “Por-Rok Cement”.

Section 6104 GATES. Gates shall be swing type, hinged to swing 90˚ from closed to open, complete with frames, latches, stops, keepers, hinges, and fabric. Gate leaves shall have intermediate members and diagonal truss rods as required for rigid construction. Joints between frame members shall be made by welding or by means of heavy fittings, and shall be rigid and water tight. Gate fabric shall be same as fence fabric and shall be attached to frame ends by stretcher bars, bolt hooks, or other mechanical means.

Hinges shall be heavy pattern with large bearing surfaces and shall not twist or turn under the action of the gate. Latches shall be plunger bar type, full gate height, and arranged to engage the gate stop, except single gates less than ten (10) feet wide may be provided with a forked latch. Latches shall be arranged for padlocking with the padlock accessible from both sides of the gate. Stops shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger. Keepers shall consist of mechanical devices for securing and supporting the free end of gates when in the full-open position.

Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolts shall be peened so that removal will be difficult.

Section 6105 FENCE CONSTRUCTION. The installed fence shall conform to the alignment and finish grade indicated. All posts shall be plumb and unless otherwise shown or required shall be spaced ten (10) feet apart for 6-foot fencing and six (6) feet apart for 42-inch fencing. Where necessary, the fence grade shall be adjusted to fit the ground contour by slipping the fence fabric links. Ground surface irregularities shall be graded as required to maintain not more than a two (2) inch clearance below the bottom of the fence fabric.

Where posts are set in earth, concrete foundations thirty-six (36) inches deep shall be provided. If bedrock is encountered, post excavation shall be continued to the thirty-six (36) inch depth or eighteen (18) inches into the rock, whichever is less. Concrete foundations shall be circular in horizontal section, not less than ten (10) inches in diameter for line posts, and with a diameter not less than the post OD plus nine (9) inches for terminal and gate posts, except that foundations in bedrock shall be a minimum of six (6) inches larger than the outside dimension of the post. Foundations shall extend above the ground surface and shall be crowned approximately one (1) inch. Concrete for foundations shall conform to the requirements of Division 2000 Concrete, Class B. Each foundation shall be cured for at least seventy-two (72) hours before further work is done on the post.

Top rails and bottom tension wires shall be installed before the fabric. Top rails shall be furnished in at least eighteen (18) foot lengths and shall be securely connected to gate and terminal posts. Tension wires shall be installed approximately six (6) inches above grade and shall be attached to each post and securely anchored at terminal and gate posts. Straight runs between braced posts shall not exceed 1500 feet. A terminal post shall be provided at each change in slope.

Fabric shall be attached to the top rail, bottom rail, and bottom tension wire at twenty-four (24) inch centers and to the line posts at fifteen (15) inch centers. Barbed wire shall be fastened to each extension arm by internal clips or external fabric ties. Each stretcher bar shall be threaded through the fabric and anchored to the post at fifteen (15) inch center by positive mechanical means.

Each gate and terminal post shall be braced by horizontal pipe brace and an adjustable truss extending to an adjacent line post. Corner posts shall be braced in both directions.

Fabrics shall be stretched taut and anchored so that a pull of 150 pounds at the middle of a panel will not lift the bottom of the fabric more than six (6) inches.

DIVISION 6200 – SEEDING AND SODDING

Section 6201 SCOPE. This section covers the furnishings of all labor, equipment, tools and materials, and the performance of all work for seeding or sodding as designated on the contract drawings.

Section 6202 GENERAL. The seeding work shall consist of furnishing and drilling in or sowing seed by an experienced seeding contactor approved by the Engineer, having approved equipment manufactured expressly for the purpose, such as a seed drill with fertilizer attachment, mulch chopper and blower for the application of hay or straw mulch, mulch puncher or straight serrated disc for punching mulch into soil and a cultipacker that may be used for final compaction.

For public improvement projects seeding shall be required at all locations shown on the plans and for all grass covered areas that are disturbed by construction operations, either by grading, parking of equipment, temporary roads, or any other operation that has destroyed the existing grasses of the original site, and that is not designated on the drawings to be replaced with sod.

For all other types of construction, including that work done under a work within right-of-way permit, sod shall be required where areas are disturbed by construction within the right-of-way in established yards or as directed by the Engineer.

Sod work shall be performed by an experienced sod-laying contractor.

Section 6203 MATERIAL. Sod shall be a densely rooted blend of 3 to 4 Turf-type Fescue species recommended for this locale by KSU/County Extension or other varieties appropriate to the area, approved by the Engineer. The sod shall contain a growth of not more than 10 percent of grasses and clovers, shall be free from all prohibited and noxious weeds, and shall be three-fourths (3/4) to one and one-fourth (1-1/4) inch; each strip containing at least one (1) square yard. Sod shall be cut in strips not less than twelve (12) inches wide.

Commercial fertilizer for seeded or sodded areas shall contain 12 percent (by weight) nitrogen, 12 percent (by weight) phosphoric acid, and 12 percent (by weight) potash. It shall be uniform in composition, free flowing, and delivered to the site in standard size bags, showing weight, analysis, and name of manufacturer. It shall be stored until use in a weatherproof storage place in such a manner that it will be kept dry and its effectiveness will not be impaired.

Seeds for cover crops shall be the kind and mixture of seeds specified herein. Seeds shall be free of prohibited weed seeds and noxious weed seeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, or trademark and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified. The tags shall be made available to the Engineer for filing.

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.

Pound of Commercial Seed Required = 10, 000 x Rate of Pure Live Seeds

(lbs/acre)
Purity % x Germination %

Where seeding is required in areas of established yards, shoulders and slopes in street right-of-way, and any other areas where a high-quality seeding is deemed necessary, the seed mixture will be as follows:

Kind of Seed	Minimum Pure Live Seed, %	Rate of Pure Live Seed, Pounds/Acre
A blend of 3 to 4 Turf-type Fescue species recommended for this locale by KSU/County Extension	80	210
Annual Rye Grass	85	40
	Total	250 # /Acre

Where seeding is required in areas off street right-of-way that are not frequently maintained, the seed mixture will be as follows:

Kind of Seed	Minimum Pure Live Seed, %	Rate of Pure Live Seed, Pounds/Acre
Alta Fescue or Kentucky 31 Fescue (Festuca Elatior Var. Arundinces)	75	100
Annual Rye Grass	80	50
	Total	150 # /Acre

Warm Season ("native") grass mixtures may be used for difficult to maintain areas when approved by the Engineer.

Mulch for application to seedbed shall include wheat straw, oat straw, smooth brome grass hay, Sudan grass hay or prairie hay. Prairie hay shall consist chiefly of Bluestem grasses, switch grass, Indian grass and other desirable native perennial grasses. Mulch shall be free of prohibited and noxious weed seeds.

Section 6204 TIME OF SEEDING OR SODDING. Seeding and fertilizing shall be performed between August 15 and October 15 for Fall planting and between February 15 and April 30 for Spring planting, unless otherwise acceptable to the Engineer. Seeding and fertilizing shall not be done during periods of such severe drought, high winds, or excessive moisture, as determined by the Engineer, that satisfactory results are not likely to be obtained.

Sod shall not be placed between June 15 and September 15 or on frozen ground nor during the period form October 15 to March 15, unless authorized by the Engineer.

Any seeding or sodding to be performed during periods other than those previously designated will require a written request to extend the permissible period for performing such work. Said request shall explain the reason for the variance and shall include a guarantee (by the general contractor) of satisfactory results by the end of the first four (4) weeks of the following growing season as previously defined, or the necessary re-seeding or re-sodding work performed at that time. The request shall be initiated by the general contractor and directed to the Engineer for consideration for approval.

Section 6205 APPLICATION OF FERTILIZER. Before tilling of the soil for seeded and sodded areas, the commercial fertilizer of the type specified shall be uniformly distributed over the entire site 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 or with a fertilizer drill. The fertilizer may be applied with the seeding operation only if a seed drill with a fertilizer attachment is used. (The above fertilizer rate is equivalent to seven (7) pounds to five hundred (500) square feet).

Section 6206 PREPARATION OF SOD BED. The sod bed shall have a uniform surface free from washes and depressions and shall conform to the finished grade profile or cross section shown on the plans. The soil, except where fresh topsoil has just been applied and compacted, shall be thoroughly tilled to a depth of two (2) inches. Freshly graded areas, which have set long enough to become dry and crusted over shall be, tilled as specified above, preparatory to placing the sod.

The areas to be sodded shall be prepared immediately prior to the placing of the sod by thorough cultivating, smoothing, removal of clods, surface stone 1-inch diameter or larger, and weeds. Soil shall be in a moist condition prior to placing sod. Areas that have washed or eroded shall be brought to grade and compacted thoroughly by the contractor at his own expense prior to placing the sod or seeding. No grading shall be done when the soil is in a muddy or frozen condition.

Sod placed next to existing grassy areas, curbs, sidewalks or like boundaries shall be cut-in to match like grades.

Section 6207 PLACEMENT OF SOD. Sod shall be transplanted within twenty-four (24) hours from the time it is harvested. All sod in stacks shall be kept moist and protected from exposure to the sun and from freezing.

The fertilized sod beds shall be in a firm but not too compacted condition with relatively fine texture at the time of sodding. Sod shall be moist when it is placed. The use of dry sod will not be permitted. Sod strips shall be laid along contour lines by hand,

commencing at the lowest point of the area and working upward. The transverse joints of sod strips shall be staggered and the sod carefully placed to reduce tight joints. The sod shall be firmed, watered, and re-firmed immediately after it is placed. The "firming" shall be accomplished by application of a roller weighing not less than sixty (60) nor more than ninety (90) pounds per linear foot of roller. On steep slopes, the sod may be firmed by compacting with hand shovels. The firming process shall pack the sod roots firmly into the prepared soil.

Sod placed on slopes steeper than 4:1 shall be staked with six stakes per square yard or roll of sod.

Sod shall be laid so that no voids occur between strips and shall be immediately tamped or rolled. The sod shall then be thoroughly watered. The finished sodded surface shall be true to grade, smooth, even and equally firm at all points. Sod will be accepted after it shows definite growth and establishment, but in no case sooner than the 21 day maintenance period. Areas of three square feet or more that do not show these signs shall be re-sodded by the contractor, and those areas shall be in growing condition before acceptance will be made.

The contractor shall water installed sod within twenty-four hours and shall water all sod twice daily for a minimum of twenty-one days from initial laying, except on those days where a minimum of ¼ inch of rain falls in a twenty-four hour period.

Section 6208 PREPARATION OF THE SEEDBED/SODBED. The area to be seeded shall be thoroughly tilled to a depth of at least three (3) inches by discing, harrowing or other approved methods until the soil is well pulverized. After completion of the tilling operation, the surface shall be cleared of all stones, stumps, or other objects larger than 1-1/2 inches in thickness or diameter, and of roots, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Areas tilled shall them be brought to the desired line and grade and maintained until seeding and mulching is complete to ensure a smooth area with no gullies or depressions.

Any objectionable undulations or irregularities in the surface resulting from tillage or other operations shall be removed before planting operations are begun. Seedbed preparation shall be performed only during periods when satisfactory results are likely to be obtained. When results are not satisfactory because of drought, excessive moisture or other causes, the work shall be stopped until such conditions have been corrected to the satisfaction of the Engineer.

Dispose of any growth, rocks, or other obstructions which might interfere with tilling, seeding, sodding or later maintenance operations. Dispose of clods, rocks and other objects which are six inches or greater in diameter.

Section 6209 PLACEMENT OF SEED. Seeding may be accomplished by means of approved mechanical power-drawn drills followed by packer wheels, or by broadcast-type seeders or hydraulic type seeders in small areas not accessible to machine methods, or as approved by the Engineer. Mechanical power-drawn drills shall have depth bands set to maintain a planting depth of at least one-quarter (1/4) inch but not to exceed one-half (1/2) inch. All seed sown by broadcast-type seeders shall be "raked in" or otherwise covered with soil to a depth of at least one-quarter inch and rolled to obtain a firm seed bed. Water shall be applied when necessary.

Hydraulic seeding equipment shall include a pump capable of being operated at 100 gallons per minute and at 100 pounds per square inch pressure, unless otherwise directed. The equipment shall have an acceptable gauge and a nozzle adaptable to hydraulic seeding requirements. Storage tanks shall have a means of agitation and a means of estimation of the volume used, or remaining in the tank.

Seed shall not be drilled or sown during windy weather or when the ground is frozen or otherwise untillable. When a seed drill is used, it shall be set to space the rows not more than 4 inches apart.

Section 6210 MULCHING. Clean prairie hay mulch shall be applied uniformly to seeded areas at the rate of not less than two (2) tons per acre. Other binding materials such as wheat straw or oat straw may be used with written permission of the Engineer when it may be shown that clean prairie hay is not reasonably available. Baled material shall be broken up and loosened sufficiently before being fed into the blower hopper to avoid the placing of matted or unbroken clumps. The use of wet mulch material is prohibited.

Mulching shall be performed within twenty-four (24) hours after seeding, but not be done during windy or rainy weather or when such weather is imminent. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of steep slopes and shall continue uniformly until each area is covered.

The mulching material shall be disced or punched into the soil so that it is partially covered. Several passes may be required, if a straight disc is used, in order to mix the mulching material with the topsoil sufficiently to ensure protection form erosion by either wind or water. The mulch tilling operation shall be performed parallel to the ground contours.

Section 6211 MAINTENANCE. All seeded areas shall be protected against damage by vehicle and pedestrian traffic by the use of barriers and appropriate warning signs. If at any time before completion and acceptance of the seeding work any portion of the seeded area becomes gullied or otherwise damaged, such damaged areas shall be repaired by filling with soil to original grade, re-seeding and re-mulching. All costs of repair work shall be borne by the contractor.

Contractor shall be responsible for watering; including material and labor all seeded areas for a period of five (5) weeks after the time of seeding, except when thoroughly wetted by rain. Sprinkling of the seeded areas shall be carefully done in such manner as to avoid standing water, surface wash, or scour.

All sodded areas shall be thoroughly watered twice daily for a period of twenty-one days (21) after placing, except when thoroughly wetted by rain of ¼-inch or more in a 24-hour period.

Section 6212 GUARANTEE. The contractor shall guarantee all work and materials for a period of one full growing season (Spring to Fall) after the date of final payment under the contract. During the guarantee period, all turf, which dies, shall be replaced, by and at the expense of the contractor, with like material.

DIVISION 7000 - CONSTRUCTION TESTING, OBSERVATION, INSPECTION

Section 7001 SCOPE. This section shall apply to all required testing services for materials, soils, structures, asphalt and concrete.

Section 7002 GENERAL. All materials testing shall be conducted by a testing laboratory qualified and approved by the City to perform the required sampling, analysis, testing and report writing services. Reports shall be prepared by or under the supervision of and bear the seal and signature of a professional Engineer licensed in the state of Kansas. Improperly completed or certified reports will not be accepted. Construction testing shall be the responsibility of the City of Lansing.

Section 7003 RESPONSIBILITIES OF THE CONTRACTOR OR DEVELOPER. An inspection fee to cover the City's costs associated with construction observation and inspection, and construction testing, shall be assessed to all development projects that include public improvements. The fee shall be 3% of the construction cost for the public improvements. A copy of a detailed, itemized contract for the improvements shall be furnished to the Public Works Director for review. If, upon review, the City determines that the contract appears to conform with prevailing costs for similar construction, the fee will be based on the contract amount. If, upon review, the City determines that the contract appears to deviate significantly from prevailing costs for similar construction, the fee will be based on the City Engineer's estimate of probable construction cost for the project. The contractor shall allow the City and any testing agency employed by the City safe access to the job site as may be required and shall assist as needed to obtain and handle samples at the source of the material and at the site of the work. Adequate facilities shall be provided at the project site for the safe storage and proper curing of specimens requiring such facilities. The performance of tests does not relieve the contractor of the responsibility to furnish the required materials and to perform the required construction in full compliance with the City of Lansing Technical Specifications. The successful passing of a test does not constitute acceptance of the work or materials represented by the test or any portion of the work or materials. Final acceptance of the project shall be granted only through the issuance of a Project Completion Certificate by the City of Lansing and the expiration of the required maintenance period (three (3) years for developer financed projects and two (2) years for City funded projects).

The cost of all retesting required due to failed tests shall be paid for by the contractor at the discretion of the Engineer.

The cost of tests performed for the contractor's convenience or his own supplemental information shall be paid for by the contractor.

Section 7004 RESPONSIBILITIES OF THE TESTING AGENCY. All testing agencies shall meet the requirements of ASTM E329. A representative shall inspect, sample and test the materials and work as required by the Engineer. Any material furnished or work performed by the contractor failing to conform to the specification requirements shall be immediately brought to the attention of the Engineer and the contractor. Preliminary written field reports of all tests and inspection results shall be given to the Engineer and to the contractor immediately after they are performed. A copy of all final reports shall be forwarded to the Engineer as they are made available. Results of all tests taken, including failing tests, shall be reported. The testing agency and its representative are not authorized to revoke, alter, relax, enlarge or release any requirement of the specifications, nor to approve or accept any portion of the work.

Section 7005 ASPHALT TESTING. Sampling and testing of the asphalt mix shall be required on all asphalt paving projects constructed in the City of Lansing. Samples of the actual asphalt mix being used on a paving project shall be acquired by a qualified testing laboratory technician at either the construction site or the batching plant per ASTM Standards D979 and D3665. These samples shall be used to perform an aggregate gradation test (ASTM C136), asphalt extraction test (ASTM D2172), stability and flow test (ASTM D1559) and bulk specific gravity test (ASTM D2726). One complete group of tests shall be conducted on each mix designation required on each paving project. Samples of coarse aggregates to be used in the mix shall be obtained from plant stockpile and tested for shale and for soft and friables just prior to or during production for paving of 150 tons or more.

In-place density tests shall be conducted with a nuclear testing device during the course of the work. Density tests shall be performed by, or under the supervision of the Engineer to verify that the performance specifications in Section 1309 Density and Surface Requirements of this specifications manual have been achieved. The number of tests to be taken and the locations thereof shall be determined by the Engineer based upon his observation of the paving process. A minimum of two (2) tests per lift, per 1500 feet of street improvement shall be taken unless otherwise directed by the Engineer. Tests performed with a nuclear device shall be conducted as per the requirements of ASTM D2950.

Section 7006 CONCRETE TESTING. Sampling and testing shall be required on all concrete work including curb and gutter, sidewalk, slope paving, retaining walls, inlets, manholes or any other structures.

During the progress of the work, compression tests of the concrete used shall be made as directed by the Engineer in accordance with the requirements of ASTM C31, C143, and C172. At least one sample for each mix design used, consisting of three (3) cylinders minimum, shall be taken from each 100 cubic yards of concrete placed or fraction thereof. In the event that the total amount of concrete on a project does not exceed 200 cubic yards, a minimum of three (3) specimens (consisting of three (3) cylinders each) shall be submitted for the project. In the case of a reinforced concrete box, a minimum of one sample shall be taken for each day's placement. The cylinders shall be cast in the field and transported to the laboratory 24 hours after the concrete was placed. Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders taken was placed, the delivery truck or batch number, the air content, and the slump. From each sample consisting of three cylinders, one (1) shall be broken at seven (7) days and one at twenty-eight (28) days noting the compressive strength of each break. The third cylinder shall be held in reserve to be used in the event of questionable breaks or other questions that arise.

Slump tests (ASTM C143) and air tests (ASTM C231) shall be made for each 25 cubic yards of concrete placed or fraction thereof. A minimum of two (2) slump and air tests shall be taken per day. Slump and air tests shall be taken with each cylinder series.

In the event that concrete is placed without sufficient notice (48 hours in advance of placement), such that samples of fresh concrete have not been obtained and tested, a minimum of three (3) cores shall be taken per ASTM C42 and broken as directed by the Engineer. Air content (ASTM D457) and cement content (ASTM C85) shall also be determined. Concrete in the portion of the structure from which the core was taken will be considered adequate if the average strength of the cores is equal to a minimum of 95 percent of the specified strength of (f ' c) and if the strength of any single core is not less than 80 percent of f ' c. All core holes shall be completely filled with a low-slump, high strength concrete at the expense of the contractor. The expense of the coring and testing shall be the responsibility of the contractor.

All reports by testing laboratories shall include the type of structure and information on obtaining, transporting, storing, curing, time between obtaining and casting cylinders (when applicable), supplier, finisher and batch as well as the specific test data.

Section 7007 SOIL TESTING. Sampling and testing shall be required on all subgrade preparation for street construction and all structure backfilling operations and trench backfill operations except when excavatable flowable backfill is required.

During the progress of roadway embankment, in-place density tests shall be taken by a qualified technician approved by the City of Lansing or by a City of Lansing Inspector. Frequency and location of tests shall be sufficient to assure a quality roadway, and shall be at the discretion of the City Inspector.

During the progress of the subgrade preparation, in-place density tests shall be performed by a qualified technician approved by the City of Lansing or by a City of Lansing Inspector. The number of tests to be taken and the location thereof shall be determined by the inspector based upon his observation of the subgrade preparation. A minimum of two (2) tests per lift per 1500 feet of street improvement shall be taken unless otherwise directed by the Engineer. Results of these tests shall indicate whether or not the performance specifications stated in Section 1205 Compaction Requirements of this specification manual have been achieved. If the tests indicate the compaction is not sufficient, the contractor shall increase the compactive effort on all such inadequately compacted areas. Tests performed with a nuclear device shall be conducted as per the requirements of ASTM D2922.

During the progress of the work of backfilling, except where excavatable flowable backfill is required, in-place density tests shall be performed by a qualified technician approved by the City of Lansing or by a City of Lansing Inspector. The number of tests to be taken and the locations thereof shall be determined by the inspector based upon his observation of the backfilling process. A minimum of two (2) tests per 1000 feet of trench per each three feet of trench depth shall be taken unless otherwise directed by the Engineer. Results of these tests shall indicate whether or not the performance specifications stated in Section 5017 (Trench Backfill) of this specification manual have been achieved. If the tests indicate the compaction is not sufficient, the contractor shall increase the compactive effort on all such inadequately compacted areas.

Section 7008 COARSE AND FINE INDIVIDUAL AGGREGATES. Coarse and fine individual aggregates shall be sampled in accordance with ASTM D-75, and gradations shall conform to those listed for the specific gradation designation as set forth in KSS unless otherwise stated in these specifications or the contract documents.

Section 7009 SEWER PIPE MATERIAL TESTING:

A. The Engineer and/or the City may require the Contractor to arrange for one test to be performed to verify the resin compounding on any of the following pipe materials:

1. Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR) and Fittings (ASTM D 2241)

2. Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (ASTM D 3034)

3. Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings (ASTM F679)

4. Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (ASTM F 794)

B. The test shall be performed by an independent testing laboratory approved by the City and shall be performed upon a sample of pipe obtained from the job site. The cost of the test shall be paid for by the City. The test shall be performed in accordance with ASTM D 817 - Ash Determination. The test shall also include an analysis of the sample to determine elemental calcium content by atomic absorption. Both ash and calcium values shall be reported as a percentage of the original sample weight.

Section 7010 SEWER PIPE ALIGNMENT AND GRADE TESTING: Alignment, grade and visible defects shall be checked as follows:

A. Visual Internal Inspection: Contractor shall clean and flush with clear water the pipe of excess mortar, joint sealant and other dirt and debris prior to inspection. The downstream manhole connection shall be plugged by means of a mechanical plug, so that the debris will not enter the existing sewer. All the contents flushed from the newly installed sewer shall be pumped out and captured, and all material removed shall be disposed of. The sewer will be inspected by flashing a light between manholes and/or by physical passage to determine the presence of any misaligned, displaced, or broken pipe and other defects. The gravity lines will be checked for alignment by lamping and visual inspection after all installations are complete, including all backfill, compaction, and cleaning. The pipe between successive manholes shall not be more than one-fourth (1/4) of the pipe diameter out of alignment. If it is found to be excessive, the contractor will, at his expense, reinstall the sewer line in accordance with the specifications.

B. Television Inspection: Sewer lines installed under this project are subject to inspection by closed circuit television at the Owner's request and expense when the Engineer cannot determine the pipe condition by the methods of 7010A.

Section 7011 SEWER PIPE INFILTRATION – EXFILTRATION TESTING: Hydrostatic or air pressure tests shall be conducted on sewers before acceptance by the Owner. For sewers with a diameter less than twenty-four (24) inches, the infiltration-exfiltration shall not exceed fifty (50) gallons per day per inch of nominal diameter per mile of sewer line for any section of the system. For sewers with a diameter twenty-four (24) inches or greater, infiltration-exfiltration shall not exceed three thousand six hundred (3,600) gallons per day per mile of pipe. Reinforced concrete pipe shall be hydrostatically tested.

A. Infiltration: Where sewers are laid within the ground water table, infiltration testing shall be conducted. Where evidence of infiltration is discovered by the Engineer, the Contractor shall install weirs or other suitable flow rate measuring devices adequate to determine to the satisfaction of the Engineer that the specified infiltration limit is not exceeded for that reach of gravity sewer. Where the specified infiltration limit is exceeded, the Contractor shall repair or replace the defective reach of pipeline at no additional cost to the

owner. Following repair of the pipeline, the Contractor shall remeasure infiltration flow rates and make additional repairs until an acceptable infiltration flow rate is achieved.

B. Exfiltration: Exfiltration tests shall be performed by the Contractor using one or a combination of methods as set forth below. The required air pressure and/or exfiltration testing shall be successfully performed on carrier conduits prior to filling the void between the casing and the carrier conduits with sand or the sealing of the ends of the casing conduits.

1. Hydrostatic Tests for Gravity Systems:

(a) Test section shall be filled not less than twelve (12) hours prior to testing. Refill test section prior to performing test.

(b) Perform at depths of water as measured above center line of pipe of not less than 4 feet nor more than 10 feet (consideration shall be given for water table above said centerline). Maintain test as necessary to locate all leaks but not less than two hours.

2. Hydrostatic Tests for Pressure Systems:

(a) Conformance Procedure: Perform hydrostatic pressure and leakage tests. Conform to AWWA C 600 procedures as modified herein. Tests shall apply to all pressure sewers.

(b) Sectionalizing: Test in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs. Contractor shall furnish and install test plugs at no additional cost to the Owner, including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs. Contractor shall be responsible for any damage to public or private property caused by failure of plugs. Limit fill rate of line to available venting capacity.

(c) Pressure Test: Conduct at 1.5 times maximum operating pressure determined by the following formula:

Ppt = (1.5) (.433) (OP-GE), in which

Ppt = test pressure in psi at gauge elevation

OP = operating pressure in feet as indicated for highest elevation of the hydraulic gradient on each section of the line.

GE = elevation in feet at center line of gauge.

Perform pressure tests satisfactorily prior to determining leakage.

(d) Leakage Test: Conduct at maximum operating pressure as determined by the following formula:

Plt = 0.433 (OP-GE), in which

Plt = test pressure in psi at gauge elevation

OP and GE - as defined above

All joints shall be watertight and free from leaks.

3. Air Testing of Gravity Systems:

(a) Each section of gravity pipeline between manholes and/or structures after backfill shall be tested as outlined below.

(b) Contractor may perform air tests for all pipe sizes.

(c) Furnish all facilities required including necessary piping connection, test pumping equipment, pressure gauges, bulkheads, regulator to avoid overpressurization, and all miscellaneous items required.

(d) The pipe plug for introducing 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.

(e) The pressure test gauge shall meet the following minimum specifications:

Size (diameter)	4-1/2 inches
Pressure Range	0-15 psi
Figure Intervals	1 psi increments
Minor Subdivisions	0.05 psi
Pressure Tube	Bourdon Tube or diaphragm.
Accuracy	+/-0.25% of maximum scale reading.
Dial	White coated aluminum with black lettering, 270o arc and mirror edge.
Pipe Connection	Low male 1/2 inch N.P.T.

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 Engineer whenever air tests are performed.

(f) Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting 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 supplying air. After temperature has stabilized, the pressure is allowed 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 pressure remains at 3.5 psig for 30 minutes with no drop, the pipe shall be presumed free of defects. If the pressure begins to slowly drop within the first 30 minutes and If the total 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 Diameter (in)	Minimum Time (min:sec),	Length for Minimum Time (ft),	Time for Longer Length L = Total Length in seconds
4	3:46	597	.380 L
6	5:40	398	.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L
24	22:40	99	13.674 L
27	25:30	88	17.306 L
30	28:20	80	21.366 L
33	31:10	72	25.852 L
36	34:00	66	30.768 L
42	39:48	57	41.883 L
48	45:34	50	54.705 L

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired and backfilled.

In areas where ground water is know 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 is installed. Immediately prior to the performance of the line acceptance test, ground water level 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.

(In lieu of the above paragraph, the Contractor may install a monitoring well to measure the height of the ground water prior to air testing. The monitoring well shall be sized to allow measurement of the ground water from the surface and extend into the granular pipe bedding. The monitoring well shall be removed in a manner acceptable to the Engineer and the City.)

(g) If Poly (Vinyl Chloride) (PVC) gravity sewer pipe is used it shall be air-tested in accordance with the requirements of ASTM F-1417.

Section 7012 SEWER PIPE DEFLECTION TESTING: Flexible pipelines shall be tested for deflection by pulling a mandrel through the entire length thereof.

A. The mandrel (go/no-go) device shall be cylindrical in shape and constructed with nine (9) evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. The dimensions of the mandrel shall be as listed in the accompanying table. The "D" mandrel dimension shall carry a tolerance of 0.01 inch. Allowances for pipe wall thickness tolerances or ovality (from heat, shipping, poor production, etc.) shall not be deducted from the "D" dimension but shall be counted in as a part of the five (5) percent or lesser deflection allowance. Contact length (L) shall be measured between points of contact on the mandrel arm. The length shall not be less than as shown in the accompanying table.

Nominal Diameter (Inches)	Mandrel Length (Inches)	Mandrel Diameter (Inches)
8	8	7.50
10	10	9.37
12	10	11.15
15	12	13.66
18	15	16.69
21	16	19.67
24	18	22.13
27	21	24.94
30	24	28.03

B. The Engineer shall be responsible for approving the mandrel. The Contractor shall provide proving rings to verify this.

C. The mandrel shall be hand-pulled by the Contractor through all flexible sewer lines. Any sections of sewer not passing the mandrel test shall be uncovered and the Contractor, at no additional cost to the Owner, shall reround or replace the sewer to the satisfaction of the Engineer. These repaired sections shall be retested.

D. Testing shall be conducted after final trench backfill.

Section 7013 MANHOLE TESTING:

A. General: All manholes and other structures shall be tested for infiltration/exfiltration by one of the two methods described herein. Infiltration/exfiltration testing shall be performed in the presence of the Engineer and City's inspector. Neither infiltration nor exfiltration shall exceed 1.14 gallons per foot depth per day. Notification by the Contractor to Engineer and the City shall be as set forth in Section 2509.2 of these specifications. All visible leaks shall be repaired by the Contractor prior to testing and during the warranty period.

B. Infiltration/Exfiltration Testing: Testing shall be performed using either of the following two methods for new manholes. For existing manholes, only Method 1 shall be used. All lift holes shall be plugged with an approved non-shrink grout prior to testing. All pipes entering the manhole shall be plugged. For Method 2, the plug shall be braced securely to prevent the plug from being drawn into the manhole.

Method 1: The manhole or other structure shall be backfilled prior to testing. The manhole or structure shall be filled to its full depth with water, though water depth shall not exceed 25 feet. Manholes exceeding 25 feet in total depth shall require additional infiltration/exfiltration testing of the upper portion of the manhole as outlined in Method 1A. At least two hours shall be allowed for absorption to take place prior to the start of measurement. Measurement of leakage shall be by measuring the water required to maintain a constant level in the manhole. Measurement shall take place over a 24-hour period unless otherwise directed by the City for existing manholes where service must be restored. If the manhole fails the initial test, repair shall be by pressure grouting or rebuilding the manhole. The grout shall be urethane gel, hydrophilic polymer, Scotch-Seal 5610 or equivalent with reinforcing agent supplied by the same manufacturer, Scotch Seal 5612 or equivalent. When wet, the gel shall exhibit at least 25 psi tensile strength at 150 percent elongation. The material shall not change more than eight percent in linear dimensions when subjected to cycles of wetting and drying. All materials shall be handled, mixed, and applied in accordance with the manufacturer's recommendations. Holes shall be drilled through the manhole wall to the exterior of the manhole through which the grout shall be injected using suitable probes. Grouting from the ground surface will not be allowed. The grouting pressure shall not damage the manhole, structure, or surrounding ground.. Grout holes shall be drill-cleaned and sealed with non-shrink grout. After the grout has cured in accordance with the manufacturer's recommendations, the manhole shall be retested. Retesting and regrouting shall be performed until the manhole passes the test.

Method 1A: The upper portion of manholes exceeding 25 feet in total depth shall be dye water tested in the presence of the Engineer and the City. The dye water testing shall consist of injecting or flooding a

concentrated dye solution just outside the manhole frame. The dyed water shall continue to be applied for a minimum of ten (10) minutes after saturation, as evidenced by surface ponding. The manhole will be observed for a minimum period of five (5) minutes after dye water application. Manholes observed to be actively leaking, greater than 1.14 gallons per day per vertical foot, will not be accepted. Manholes failing the test shall be repaired by pressure grouting as specified above or reassembly of the manhole and retested by the Contractor.

Method 2: The vacuum test apparatus shall be placed on top of the casting and the seal inflated according to manufacturer's directions as appropriate. A vacuum of 10 inches of mercury shall be drawn and then the vacuum pump shall be shut off. With valves closed, the time shall be measured for the vacuum to drop to 9 inches of mercury. The manhole shall be acceptable if the time for the vacuum to drop from 10 inches to 9 inches is greater than 60 seconds for 4-foot diameter, 75 seconds for 5-foot diameter, 90 seconds for 6-foot diameter manholes, 105 seconds for 7-foot diameter manholes and 120 seconds for 8-foot diameter manholes. If the manhole fails the initial test, necessary repairs shall be made with non-sag thiokol sealant, Fed Spec TT-S-00227, two component polysulfide rubber, Bostik "Chem-Calk 400", Pecora "Synthacalk GC-2", or approved equal. Retesting and resealing shall be performed until the manhole passes the test.

DIVISION 8000 - STREET LIGHTS

Section 8001 SCOPE. This section covers the performance of all work and appurtenances required for the installation of street lights, the type of lighting system, the timing of their installation, and the spacing of the lights in a development.

Section 8002 GENERAL.

1. All developers of new subdivisions within the City of Lansing shall provide street lights along all public streets in accordance with the specifications herein detailed. These lights shall be dedicated to the City following a final inspection and approval for acceptance by the Engineer.

2. The developer shall submit a maintenance bond on all street light projects prior to beginning construction. The amount of the bond shall be for the full amount of the project and shall remain in effect for a period of two years after the date of completion and acceptance by the City.

3. A street lighting plan will be submitted in conjunction with the street and drainage construction plans for the subdivision to be approved as a part of the final approval by the Governing Body before commencing street construction. Such plan clearly indicates the proposed locations for all street light fixtures, and conforms to the design standards detailed in the specification section of this policy. The Engineer shall be responsible for determining the extent and phasing of street light construction.

4. It shall be the responsibility of the developer to coordinate with the local electrical utility provider as to the installation of street lights with regard to the development construction (i.e. utility installations and road construction).

5. All light fixtures installed will utilize High Pressure Sodium luminaires, unless otherwise approved in writing by the Engineer. Pole heights and bulb wattages will vary according to street type, and will be in conformance with the various specifications presented in this policy statement.

6. It shall not be the policy of the City to require a continuous level of lighting along local residential streets. In general, lights will be located at intersections of such streets, at the end of cul-de-sacs, where there are sharp changes of the street alignment, and at selected mid-block points.

7. Spacing of street lights along collector and arterial streets shall generally be at intervals not greater than 200 feet, and conform with the design specifications presented in this report.

Section 8003 DESIGN SPECIFICATIONS. The following design details shall be followed when specifying street lighting equipment and placing street light locations.

1. Residential Streets

    (a) In general, street lights will be located at intersections of residential streets; at or near the end of cul-de-sacs longer than 150 feet; at changes of alignment of 45 degrees or more which are 200 feet or more from an intersection; and mid-block lights, as needed, such that spacing between lights is a minimum of 250 feet and a maximum of 350 feet.

    (b) Luminaires shall be the Cobra Head style cut-off luminaire mounted on minimum 6 foot mast arms (length as specified on plans).

    (c) Lamps shall be High Pressure Sodium (HPS) lamps.

    (d) Poles shall be spun aluminum or galvanized steel with 30' luminaire mounting heights.

2. Collector Streets

    (a) Street lights pertaining to this section shall be located at intersections of residential streets, arterial streets and other collector streets. Mid-block lights, as needed, so that the spacing between lights is a

minimum of 150 feet and a maximum of 250 feet. Street lights on collector streets are generally placed on only one side of the street.

(b) Luminaires shall be the Cobra Head style, cut-off luminaries, mounted on minimum 6 foot mast arms (length as specified on plans).

(c) Lamps shall be 150 watt High Pressure Sodium (HPS).

(d) Poles shall be spun aluminum with 30' luminaire mounting heights, or 40' as permitted by the Engineer.

(e) Frangible Aluminum pole bases are required between the footing and the pole.

3. Arterial Streets

(a) Arterial street lights pertaining to this section shall be located at the intersection of residential streets, collector streets and other arterial streets. Mid-block lights shall be included at approximately 100 foot spacing between lights located on alternate sides of the street. (Two-hundred foot spacing between lights on either side of the street).

(b) Luminaires shall be the Cobra Head cut-off style mounted on minimum 6 foot mast arms (length as specified on plans).

(c) Lamps shall be 250 watt High Pressure Sodium (HPS).

(d) Poles shall be spun aluminum with 30 foot luminaire mounting heights, or 40 foot as permitted by the Engineer.

(e) Frangible aluminum pole basis are required between the footing and the pole.

4. DESIGN STANDARDS DIFFERENT FROM THOSE ABOVE MUST BE APPROVED BY THE ENGINEER.

(a) Within the Main Street Overlay District, period lighting is permissible and encouraged, such as Haadco 8787 style.

Section 8004 ELECTRICAL SYSTEM.

1. GENERAL. The electrical system shall comply with the National Electrical Code, the National Electrical Safety Code, and service standards issued by the utility which will be supplying power to the street lighting system.

2. FEED POINT. The feed point location shall be coordinated with the utility to ensure availability of service.

3. DISTRIBUTION SYSTEM

(a) The distribution system shall be of that type which is required for that subdivision or which is already present.

(b) Distribution cable shall be direct buried except under streets, driveways, sidewalks and other paved areas and behind storm sewer inlets where it shall be in conduit. No overhead cabling for street lights will be allowed.

(c) Except where it crosses streets, distribution cable shall be 2' or more behind the back of curb.

(d) Junction boxes shall be used where splices in the distribution cable are required.

(e) The cable shall be sized so that the voltage drop does not exceed five percent at any point in the system.

(f) Conductors shall be no larger than No. 2 AWG and no smaller than No. 8 AWG.

(g) All street lighting circuits shall be 240 volt.

(h) All poles shall be bonded together to form a continuous system.

Section 8005 PROTECTION OF WORK AND CLEANUP. The Developer/Contractor shall care for all work until final completion and acceptance by the City. All damage done to existing improvements by the Developer/Contractor shall be repaired by the Developer/Contractor. The Developer/Contractor shall remove all surplus material and rubbish from the work as it accumulates and before the Developer/Contractor makes application for the acceptance of the work.

Section 8006 TESTING. All street lighting system elements shall function properly as a complete system for a minimum period of fifteen (15) days before acceptance by the City. The fifteen (15) days test period shall be continuous. Any malfunction observed or recorded shall stop the test period as of the time of the malfunction, and the test period shall not resume until all components are satisfactorily operating.

Section 8007 REPLACING DAMAGED IMPROVEMENTS. Improvements such as sidewalks, curbs, gutters, Portland cement concrete and asphalted concrete pavement, bituminous surfacing base material and any other improvements removed, broken or damaged by the Developer/Contractor shall be replaced or reconstructed with the same kind of materials as found on the work or with materials of equal quality. The new work shall be left in a serviceable condition satisfactory to the Engineer. Whenever a part of a square or slab of existing concrete sidewalk, driveway or pavement, is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed as above specified.

Section 8008 MARKING OF UNDERGROUND ELECTRICAL CONDUITS. A durable ground-level mark in concrete shall be placed at the back of curbs for all electric conduit street crossing, and at changes of conductor direction between light poles and junction boxes, clearly identifying that underground electrical exists.

DIVISION 9000 - SEDIMENT AND EROSION CONTROL

Section 9001 SCOPE. Work included in this section:

A. Contractor shall be required to install and maintain all sediment erosion control measures as shown in the project drawings and as noted in these specifications, and as ordered by the Engineer, to provide effective and continuous erosion control protection throughout the construction and post construction period.

B. A Stormwater Pollution Prevention Plan (SWPPP) shall be submitted to the Lansing Department of Public Works for all land disturbances in excess of ½ acre or more, and for smaller sites if deemed appropriate by the Lansing Public Works Director, and approved prior to disturbance. The plan shall specifically designate the party responsible for installation, maintenance, repair, and inspection of erosion/sedimentation control measures. Inspection frequency shall be at least weekly plus immediately following each precipitation event of ½" or more. Maintenance and repairs shall be accomplished within 24 hours of notification of need, either by scheduled inspection or notification from the Lansing Public Works Department.

Prior to land disturbance, a National Pollution Discharge Elimination System "Notice of Intent" shall be submitted and approved by the Kansas Department of Health and Environment (KDHE) for any land disturbance of the minimum size or larger as set forth in KDHE regulations at the time of application.

Section 9002 QUALITY ASSURANCE:

A. Qualifications of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

B. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The latest revision of the following standards shall apply to work hereunder.

American Society for Testing and Materials (ASTM)

1. D 1777 - Method for Measuring Thickness of Textile Materials
2. D 1987 - Test Method for Biological Clogging of Geotextile or Soil/Geotextile Filters
3. D 3786 - Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
4. D 4354 - Practice for Sampling of Geosynthetics for Testing
5. D 4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
6. D 4439 - Terminology for Geotextiles
7. D 4533 - Test Method for Trapezoid Tearing Strength of Geotextiles

8. D 4595 - Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method

9. D 4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles

10. D 4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

11. D 4873 - Guide for Identification, Storage, and Handling of Geotextiles

12. Protecting Water Quality: A field guide to erosion, sediment, and stormwater best management practices for development sites in Missouri and Kansas

13. Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors: Jerald S. Fifield, Ph.D., CPESC; Forester Press, Santa Barbara, CA

Section 9003 JOB CONDITIONS:

A. Contractor shall construct and install erosion control using Best Management Practices (BMPs). Erosion Control shall be constructed and installed per manufacturers' recommendations.

Section 9004 SUBMITTALS:

A. Submit shop drawings of:

1. Silt Fence

B. Receipts of temporary seed delivered to the project site.

Section 9005 PRODUCTS:

A. SILT FENCE:

1. Amoco Propex 2006 or American Excelsior silt stop or approved equal.

B. STRAW BALES:

1. Bales of straw used as a means of controlling sedimentation.

C. TEMPORARY SEEDING:

1. Annual Rye.

D. PERMANENT SEEDING:

1. Turf Type Tall Fescue Blend (2-3 varieties such as Chesapeake, Trident, Aurora or Houndog) - 80%

2. Certified Perennial Rye (Derby or approved equal) - 20%

Section 9006 PERFORMANCE: Erosion Control - The Contractor shall be responsible for control of surface erosion during construction and until final acceptance of the project. The Contractor shall install and maintain the erosion control measures as shown in the plans, these specifications, and the Storm Water Pollution Prevention Plan. Additional erosion control measures may be required to control erosion. Contractor is responsible to use whatever methods are required to control erosion. The contractor is responsible for providing berms, silt fences, straw bales, or other means to prevent erosion from reaching the public rights-of-way, existing drainage ways, and adjoining property. In event the prevention measures are not effective, the contractor shall remove any debris and restore areas to original or better condition. Temporary seeding, to include seedbed preparation, fertilization, seeding with seed herein specified, and mulching may be required by the Engineer.

Sediment Basin Maintenance - This Contractor is responsible for continuous maintenance of any sediment basins shown on erosion control plans for the duration of the contract. Periodic sediment removal will be necessary to keep outlet pipes functioning properly. Immediately prior to acceptance of this work the Contractor shall perform a final cleaning of all basins. Sediment from basins shall be dried and placed in on-site embankments or a directed by the Engineer.

Section 9007 SILT FENCE:

A. Construction Requirements - Silt fences shall be installed to reduce erosion on cut areas.

B. Maintenance - Sediment deposits shall be removed after each storm event. They must be removed when deposits reach approximately three-fourths the height of the barrier. Sediment removal will include removal and disposal in a location where it will not erode into construction areas or water courses.

Section 9008 STRAW BALES:

A. Construction Requirements - Straw bales shall be placed in roadside ditches to reduce erosion and trap sediment. Straw bales shall be maintained until permanent vegetation is established.

B. Maintenance Requirements - The maintenance requirements are the same as those for silt fence.

Section 9009 Mulching:

A. All seeded areas shall be mulched at the rate of two tons per acre with clean prairie hay, or other binding materials with written approval of the Engineer. Mulch must be applied within 24 hours of seeding and shall be immediately anchored with a mulch anchoring device approved by the Engineer.

B. All seeded areas optioned by the Contractor to be hydro-mulched shall be mulched at the following rates:

1. Slopes less than 4:1 = 2000 pounds per acre.

2. Slopes greater than 4:1 = 2500 pounds per acre.

GENERAL PROVISIONS

DIVISION 100 OF THE STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION OF THE KANSAS DEPARTMENT OF TRANSPORTATION, EDITION OF 1990 (STANDARD SPECIFICATIONS), shall be the General Provisions and General Clauses and Covenants for all City of Lansing, Kansas, public improvement projects, except the Sections and Articles which shall be deleted from, revised, or added to DIVISION 100 of the STANDARD SPECIFICATIONS as hereinafter shown. Bidders are responsible for obtaining their own copy of the STANDARD SPECIFICATIONS.

DIVISION 100

GENERAL CLAUSES AND COVENANTS

Section 101

DEFINITION AND TERMS

101.05 BID BOND - ADD - The bid bond shall be a Certified Check, Cashier's Check or Bid Bond in the amount of five percent (5%) of the total bid.

101.11 CONTRACT - DELETE definition and ADD - The written agreement between the City Council of Lansing, Kansas, and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment.

The Contract shall include the Proposal, Plans, Specifications, Supplemental Specifications, Special Provisions, Contract, and Performance and Maintenance Bond, and also any change orders and agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument.

101.12 CONTRACT BOND - DELETE definition and ADD - The Performance and Maintenance Bond executed by the Contractor and his Surety, guaranteeing execution of the Contract and all Supplemental Agreements pertaining thereto and the payment of all legal debts pertaining to the construction of the Project, and guaranteeing correction of project defects that occur within two years after completion of the project.

101.22 DEPARTMENT - DELETE definition and ADD - City of Lansing, Kansas, represented by its City Council.

101.24 ENGINEER - DELETE definition and ADD - City of Lansing, Kansas, or the Director of Public Works of the City of Lansing, Kansas, acting directly or through his authorized representatives on behalf of the City of Lansing, Kansas.

101.28 FIELD ENGINEER - DELETE definition and ADD - The Director of Public Works of the City of Lansing, Kansas, acting directly or through his authorized representatives on behalf of the City of Lansing, Kansas.

101.285 DESIGN ENGINEER – ADD - The engineer responsible for preparation of project plans as indicated by signature and seal on the face of the plans.

101.36 LABORATORY - DELETE definition and ADD - The testing laboratory designated by the Engineer.

101.37 LEGAL HOLIDAYS – DELETE definition and ADD – Legal Holidays include New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day, and any other day proclaimed by the Mayor of the City of Lansing.

101.58 SECRETARY - DELETE definition and ADD - CITY - City of Lansing, Kansas, represented by its City Council.

101.62 STANDARD SPECIFICATIONS – DELETE definition and ADD – Technical Specifications for Public

Improvement Projects, City of Lansing and all specifications referenced therein.

101.65 STATE - DELETE definition and ADD - COUNTY - City of Lansing, Kansas represented by its City Council.

Section 102

BIDDING REQUIREMENTS AND CONDITIONS

102.02 PREQUALIFICATION OF BIDDERS - ADD – new section (d) ALTERNATE PREQUALIFICATION. When it is determined by the Engineer that due to the nature of the work, the preceding prequalification protocol is excessive or unnecessary, prequalification may be satisfied by the following alternate method:

Bidders may be required to submit evidence that they have a practical experience and knowledge in the particular work bid upon, and that they have the financial resources to complete the proposed work.

In determining the Bidder's qualifications, the following factors will be considered: A job of similar scope and magnitude completed by the Bidder within the last three years and whether the Bidder (a) maintains a permanent place of business, (b) has adequate plant and equipment to do the work properly and expeditiously, (c) has the financial resources to meet all obligations incident to the work, and (d) has appropriate technical experience.

The contractor(s) shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to ensure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractor(s) shall comply with all applicable local, state and federal guidelines, practices and regulations.

Each Bidder may be required to show that he has handled former work so that no just claims are pending against such work. No bid will be accepted from a Bidder who is engaged in any work which would impair his ability to perform or finance this work.

Under this alternate, the Engineer's decision regarding qualification of bidders for any specific project shall be final and binding for that project.

102.12 PROPOSAL GUARANTY OR BID BOND - DELETE item and ADD - No Proposal will be accepted unless accompanied by a certified check, cashier's check or a bid bond in the amount specified in the Notice to Contractors and made payable to the City Council, Lansing, Kansas. The full amount of the proposed guaranty shall be forfeited to the City in liquidation of damages sustained in the event the bidder (or bidders) fails to execute a satisfactory Contract and file Contract Bonds within ten (10) days after the notice of the award of Contract.

The Guarantees of the two (2) lowest responsible bidders shall remain in full force until such time as the execution of a Contract has been completed by the successful bidder and satisfactory Contract Bond has been furnished. The Guarantees will be returned after the above has been accomplished.

102.13 DELIVERY OF PROPOSAL - DELETE item and ADD - Each Proposal must be submitted on forms obtainable at the Office of the Director of Public Works, 800 First Terrace, Lansing, Kansas, and must be submitted in sealed envelopes, addressed to the Office of the City Clerk, City Hall, Lansing, Kansas, upon which is clearly written or printed "Proposal for City of Lansing Project No. [*insert project number here*]", and the name and address of the bidder. When a Proposal is sent by mail, the above mentioned envelope shall be enclosed in another envelope addressed to the City Clerk, City Hall, Lansing, Kansas. All Proposals shall be filed prior to the time and at the place specified in the Notice to Contractors. Proposals received after the stated time for filing will be returned to the bidders unopened.

102.14 WITHDRAWAL OF PROPOSAL - DELETE item and ADD - A Proposal may be withdrawn after it has been delivered to the Office of the City Clerk, City Hall, Lansing, Kansas, by a letter or by written request of the bidder or his authorized representative in person, provided the request is in the hands of the City Clerk before the stipulated time for

the opening of the Proposals.

A withdrawn Proposal may be corrected or altered in person by the bidder or his authorized representative and resubmitted before the stipulated time for opening of the Proposals.

Proposals cannot be altered or corrected by wire or letter.

Section 103

AWARD AND EXECUTION OF CONTRACT

103.05 REQUIREMENTS OF CONTRACT BOND - DELETE item and ADD - The successful bidder before entering into a Contract and within ten (10) days after notice of the award of the Contract, shall execute a Performance and Maintenance Bond in the form prescribed by the City and in the penal sum of the amount of the Contract, with a Surety to be approved by the City. The Performance and Maintenance Bond shall be conditioned upon the faithful performance of the Contract and the payment of all indebtedness incurred for all labor, materials and supplies furnished therefore. The Bonds must be kept in full force for a period ending two years from the date of completion and acceptance of the project by the City. In the event the Surety or Bonding Company fails or becomes financially insolvent, then the Contractor shall, within five (5) days of such failure or insolvency, file new and sufficient bonds in the amount designated by the City.

103.06 EXECUTION OF CONTRACT - DELETE the first sentence beginning with "The successful bidder....." and ending with ".... by the secretary." and ADD - The successful bidder shall furnish satisfactory Bonds and sign the Contract at the Office of the Public Works Department, City Hall, Lansing, Kansas, within ten (10) days after notice of the award of Contract.

103.07 FAILURE TO EXECUTE CONTRACT - DELETE item and ADD - The failure of the successful bidder to execute a Contract and file Contract Bonds within ten (10) days from the date of the notice of the award shall be just cause for the annulment of the award and for the forfeiture of the proposal guaranty to the City, not as a penalty but in liquidation damages sustained through delay. The Contract may be re-awarded to the next lowest responsible bidder, or Proposals may again be received at some later date.

Section 105

CONTROL OF WORK

105.02 PLANS AND WORKING DRAWINGS - ADD – (a) Shop Drawings and Engineering Data.

The Contractor shall have one (1) signed copy of the plans (approved by the City of Lansing) and one(1) copy of the appropriate Design and Construction Standards and Specifications at the job site at all times.

Engineering data covering all equipment and fabricated materials which will become a permanent part of the work shall be first submitted to the Design engineer for review and verification, then to the Public Works Department for review. This data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and supports required; performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

All submittals, regardless of origin, shall be stamped with the approvals of the Design engineer and the contractor, and identified with the City project number, contractor's name, and references to applicable specification paragraphs and drawings. Each submittal shall indicate the intended use of the item in the work. When catalog pages are submitted, applicable items shall be clearly identified. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

The Design engineer's and the contractor's stamps of approval are a representation to the Public Works Department that the contractor accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work.

Each submittal shall include a statement prepared by the originator of the drawings and data certifying compliance with the City Technical Specifications except for deviations which are specifically identified.

All deviations from the City Technical Specifications shall be identified on each submittal and shall be tabulated in the contractor's letter of transmittal. Such submittals shall, as pertinent to the deviations, indicate essential details of all changes proposed by the contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams. Deviations and exceptions may only be incorporated in the work following written approval by the Engineer.

The contractor shall accept full responsibility for the completeness of each submission, and, in the case of resubmission, shall verify that all exceptions previously noted by the Public Works Department have been taken into account. In the event that more than one resubmission is required because of failure of the contractor to account for exceptions previously noted, the contractor may be required to reimburse the Public Works Department for the costs for review of the additional resubmissions.

Any need for more than one resubmission, or any other delay in obtaining the Public Works Department's review of submittals, will not entitle the contractor to extension of the contract time unless delay of the work is directly caused by a change in the work authorized by a Change Order or by failure of the Public Works Department to return any submittal within twenty-one (21) days after its receipt in the Director of Public Works' office.

The City of Lansing's plan review is only for general conformance with City of Lansing Technical Specifications and the City Code. The City's review does not indicate a thorough review of all dimensions, quantities, and details of the materials, equipment, device, or item shown. The City of Lansing's review of submittals shall not relieve the contractor from responsibility for errors, omissions, or deviations, nor responsibility for compliance with the City Technical Specifications. The City of Lansing, through approval of construction documents, assumes no responsibility other than as stated above for the completeness and/or accuracy of said construction documents.

Three (3) copies of each drawing and necessary data shall be submitted to the Department of Public Works. The Department of Public Works will not accept submittals from anyone but the contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades. Re-submittals shall bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the re-submittal.

When the drawings and data are returned marked NOT ACCEPTABLE or RETURNED FOR CORRECTION, the corrections shall be made as noted thereon and as instructed by the Public Works Department and three (3) corrected copies resubmitted.

When corrected copies are resubmitted, the contractor shall, in writing, direct specific attention to all revisions and shall list separately any revisions made other than those called for by the Department of Public Works on previous submissions.

When the drawings and data are returned marked EXCEPTIONS NOTED, NO EXCEPTIONS NOTED, or RECORD COPY, no additional copies need be furnished. Distribution of acceptable submissions shall be as follows: Two (2) copies to the City, and one (1) copy to the contractor.

The contract prices shall include the cost of furnishing all shop drawings and Engineering data.

105.09 CONSTRUCTION STAKES, LINES, AND GRADES - DELETE item and ADD - Unless otherwise noted in the contract, the Contractor shall provide qualified personnel for establishing or re-establishing the Project centerline; referencing or re-referencing all necessary control points; running a level circuit to check or re-establish plan bench

marks; set other bench marks as needed; take any original cross sections needed that are not incorporated in the plans; stake right-of-way or re-stake right-of-way where needed if it has been previously staked and perform all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, grading, paving, drainage and all other appurtenances required for the completion of the construction work and acceptance of the Project in accordance with the Plans or other governing criteria. Unless otherwise noted, Construction staking as noted above is the sole responsibility of the contractor. See Section 1500.

Section 106

CONTROL OF MATERIALS

106.03 SAMPLING, TESTING, AND CITED SPECIFICATIONS - To the third paragraph ADD - Molds for concrete test cylinders shall be furnished by the Contractor and the cost of the molds shall be borne by the Contractor.

Section 107

LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.05 FEDERAL AID PROVISIONS - DELETE item and ADD - At stated intervals and not to exceed one (1) calendar month, the Engineer will make an approximate estimate in writing of the amount of work performed during the preceding period and the value thereof at the unit prices contracted. From the amounts so ascertained, there shall be deducted ten (10) percent to be retained until after the completion of the entire work to the satisfaction of the Engineer, and the balance will be certified to the City Administrator for payment except that no amount less than Five Hundred Dollars ($500.00) will be so certified unless the total amount of the Contract remaining unpaid is less than Five Hundred Dollars ($500.00).

108
PROSECUTION AND PROGRESS

108.02 NOTICE TO PROCEED – DELETE the first paragraph and REPLACE with - “No construction of any public improvement project shall be undertaken until the following criteria and requirements have been fully met:

1) Contract plans and specifications have been submitted to and approved by the Engineer.
2) The appropriate performance and maintenance bond has been submitted to and approved by the Director of Public Works.
3) The contractor has provided a minimum of 5 working days advance notification of his requested date to start work.
4) A written Notice to Proceed has been issued by the Director of Public Works.

Compliance with the 4 conditions listed above shall constitute a permit for construction activities. Work discovered underway not complying with these requirements shall be ordered to cease and shall not be allowed to commence until the requirements have been met, any work not visible or accessible for inspection exposed for inspection, and any work not complying with these Technical Specifications removed, all at the Contractor’s expense.”

108.07 WORKING DAY DETERMINATION AND EXTENSION OF CONTRACT TIME - ADD - “Unless otherwise permitted in writing in advance by the Engineer, work shall only be permitted after 7:00 a.m. and prior to 7:00 p.m. in residential neighborhoods, except that it shall only be permitted after sunrise and before sunset when length of day is more restrictive than the stated hours.” Contractor shall not be allowed to work Sundays, holidays or Saturdays unless approved by the City Engineer.

108.07 (a) (3) - REPLACE - “…Kansas civil service holidays and other holidays proclaimed by the Governor of the State of Kansas…” – WITH – “…legal holidays…”

DIVISION 10,000 - PAVEMENT MARKINGS

Section 10001 SCOPE. Work included in this section:

A. Furnish and apply white and yellow thermoplastic reflectorized pavement marking materials. Two types of materials are required, as follows:

1. Hot applied type is preferred for all markings and shall be applied to the pavement surface in a molten state by mechanical means with surface application of glass spheres, and which upon cooling to normal pavement temperature, produces an adherent reflectorized strip of specified thickness and width and is capable of resisting deformation.

2. Cold applied type may be used with written approval of the Engineer and shall consist of a homogeneous, extruded, prefabricated material of specified thickness and width, which shall contain reflective glass spheres uniformly distributed throughout the cross-section, and shall be applied to the pavement surface by means of a precoated adhesive and pressure.

B. Application will be in reasonable close conformity with existing dimensions and lines and with the approval of the Engineer.

Section 10002 QUALITY ASSURANCE AND APPROVALS:

A. The Contractor shall be responsible for the compliance of all materials with the requirements of these specifications.

B. The Contractor shall furnish a manufacturer's certification, in triplicate, attesting that all materials supplied conform to the requirements of these Specifications. The certification shall include, or have attached, specific results of laboratory tests for the specified physical and chemical properties as determined from samples representative of the lot or lots of thermoplastic compound, glass spheres and reflectorized plastic marker material supplied. These submittals shall be the basis of acceptance of these materials.

Section 10003 MATERIALS, HOT APPLIED TYPE:

A. General:

1. The material shall not exude fumes which are toxic or injurious to persons or property, when it is heated to the temperature range specified by the manufacturer for application. It shall remain stable when held for 4 hours at this temperature. or when subject to 4 reheatings after cooling to ambient temperature.

2. The temperature-viscosity characteristics of the plastic material shall remain constant throughout repeated reheatings, and shall show like characteristics from batch to batch. There shall be no obvious change in color of the material as a result of repeated reheatings nor from batch to batch.

3. When applied at the specified temperature and thickness, the material shall set to bear traffic in not more than 2 minutes when the air temperature is 50 degrees F. and not more than 15 minutes when the air temperatures of 90 degrees F.

4. The thermoplastic material shall readily extrude from the equipment to produce a cross-section of line 1/16" to 3/16" thick which shall be continuous and uniform in shape, and have clear and sharp dimensions.

5. Painted on pavement markings shall not be applied on new pavement surfaces until the new pavement has been allowed to “off-gas” for a period of at least 24 hours.

B. Thermoplastic Material:

1. The thermoplastic pavement marking material shall contain the following:

	% by Weight White	% by Weight Yellow
Binder	20-28	20-28
Titanium Dioxide	10-15	- - - - -
Basic Lead Chromate	- - - - -	4-10
Glass Spheres	20-50	20-50
Calcium Carbonate or Equivalent Filler	35-55	45-65

2. The material shall be thoroughly mixed and in a free flowing granular form. The material shall readily melt in a uniform mixture. The material shall be free from all skins, dirt, and foreign objects. It shall be of such composition that it will not bleed, stain or discolor when applied to bituminous pavement.

C. Glass Spheres Used in the Formulation:

1. The glass spheres used in the formulation shall be lustrous, free from film scratch and pits, and shall also meet the other requirements of this paragraph.

2. Roundness: The roundness of the spheres shall be minimum of 75% when tested in accordance with ASTM D-1155.

3. Gradation: The gradation when tested in accordance with the method provided in ASTM D-1214 (by use of U.S. Standard Sieves) shall be:

Size of Sieve	% Passing (by Weight)
18	80-100
50	20-50
80	0-10

4. Refractive Index: When tested by a liquid immersion method at 25°C, the refractive index of the spheres shall be a minimum of 1.50.

D. Glass Spheres Used as Top Dressing:

1. General: The spheres shall be manufactured from glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering.

2. The particles shall be spherical in shape, containing not more than thirty percent (30%) or irregularly shaped particles. They shall be essentially free of sharp angular particles, and particles showing milkiness or surface scoring or scratching.

3. Gradation: The spheres shall meet the following gradation requirements:

Opening - U.S. Standard Sieve	Percent Passing
#20 Sieve	-100
#30 Sieve	80 - 100
#50 Sieve	18 - 35
#80 Sieve	0 - 10
#100 Sieve	0 - 2

4. The spheres, when tested by the liquid immersion method at 25°C, shall show an index of refraction within the range of 1.50 to 1.60.

5. Moisture-Proof Requirements: The spheres shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps.

6. The spheres shall flow freely from dispensing equipment at any time when surface and atmospheric conditions are satisfactory for application.

E. Additional Material Requirements:

1. Color: The color of the thermoplastic line as installed shall be white or yellow, free from dirt or tint.

2. Reflectance: The daylight luminous reflectance of the white material shall be not less than 75% when tested according to ASTM E-97. The yellow shall have a minimum brightness of 45% relative to magnesium oxide, and shall be within the green and red tolerance of the "Standard Color Chips for Highway Signs (January, 1939)" obtainable from the United States Bureau of Public Roads, or its successor, FHWA, Washington, D.C. (TT-P-115a).

3. Color Fastness: The retention of the initial color shall be determined as follows: Specimens shall be prepared and tested from the samples submitted in accordance with ASTM D-795. The ultraviolet source shall be as specified from the test procedure or optionally may be a General Electric 275 watt sun lamp bulb, Type RS, with built-in reflector. After 100 hours of exposure specimens shall show no perceptible color change when compared visually with an unexposed specimen.

4. Softening Point: The softening point shall be not less than 90°C, when tested according to ASTM E-28.

5. Specific Gravity: The specific gravity shall be not less than 1.8 nor more than 2.1 (referred to water at 25°C) when determined by a water displacement method at 25°C.

6. Indentation Resistance: Hardness shall be measured by a Shore Durometer, Type A2, as described in ASTM D-1706-59T, except that the durometer and panel shall be at 25°C, and a 2 kilogram load applied. After 15 seconds, the reading shall be not less than 55.

7. Abrasion Resistance: The material shall not show a maximum loss of 0.7 grams when subjected to 200 revolutions on a Taber Abraser at 25°C, using H-22 calibrated wheels, weighted to 500 grams. The wearing surface shall be kept wet with distilled water throughout the test. The panel for this test shall be prepared by forming a representative lot of material at a thickness of 0.125" on a 4" square monel panel (thickness 0.050+0.0001 inch) on which a suitable primer has been previously applied.

8. Low Temperature Impact Resistance: The materials shall not fracture when subjected to an impact of 64 inch pounds at -20°C. The panel from the previous test is placed into a chamber maintained at -20°C for at least 3 hours. The panel is then placed in an instrument also maintained at -20°C consisting of an 10.5 pound freely falling weight controlled to drop vertically for 6" onto the surface of the panel which it strikes with hemispherical indentor having a radius of 0.28 inches.

F. Packaging and Delivery:

1. The material shall be delivered to the designated points in 50-pound, multiwall paper bags with polyethylene liners. The containers shall be marked with the following information:

   a. The name of the manufacturer.
   b. The place of manufacturer.
   c. The color of material.
   d. The date of manufacturer (month and year).

2. The material shall maintain a free-flowing condition in dry storage for a period of one year, providing the temperature does not exceed 40°C.

Section 10004 MATERIALS, COLD APPLIED TYPE:

A. General:

1. Materials will be considered only from manufacturers of reflectorized plastic pavement markers and legends, who can submit evidence of successful product use over the past 5 years, under climatic conditions similar to that of the work location.

2. Each word and symbol marking shall be supplied with a diagram with each section numbered to correspond with the completed layout.

3. The plastic marker shall mold itself to pavement contours, breaks and faults, merely by traffic action at normal pavement temperatures. The plastic marker shall have resealing characteristics such that it will fuse with itself and with previously applied markings of the same composition under normal conditions of use.

B. Composition Requirements:

1. The reflectorized plastic marker material, hereafter referred to as plastic, shall consist of:

(Comparison by Weight)

	Maximum	Minimum
Plastic and Plasticizers	46%	40%
Pigments	42%	38%
Graded Glass Spheres	18%	14%

2. Pigments shall include titanium dioxide for white markers, and C.P. medium chrome yellow for yellow markers. The titanium dioxide shall be at least 20% of the total pigment in white markers. The yellow markers shall have a minimum of 18% pigment as chrome yellow. The graded glass spheres shall be colorless, clean and transparent, free from milkiness. The spheres, when tested by the liquid immersion method at 25°C shall show

an index of refraction within the range of 1.50 to 1.60. A minimum of 85% of the glass spheres shall be retained on a 140 mesh U.S. Standard Screen, when tested in accordance with ASTM D-1214-54, "Method of Test for Sieve Analysis of Glass Spheres."

3. As supplied, the plastic without precoated adhesive shall be not less than 0.06" in thickness. The edges shall be clear cut and true.

4. Plastic shall be supplied complete with a precoated adhesive and an easily removable backing shall protect the adhesive in storage and facilitate rapid application.

5. The plastic and its adhesive shall be sufficiently free of tack so that it can be easily handled without the protective backing, and be repositioned on the surface to which it is to be applied, before permanently fixing it in this position with a downward pressure.

C. Physical Requirements:

1. Bend Test: The plastic shall be of such a structure that at a temperature of 80°F a piece 3"x 6" (with backing) placed upon a 1" dia. mandrel, may be bent over the mandrel until the end faces are parallel and 1" apart. There shall be no fracture lines apparent in the uppermost surface by visual inspection.

2. Reseal Test: The plastic shall reseal to itself when tested as specified. Cut 1"x 3" pieces of plastic. Overlap these pieces face-to-face for an area of 1 sq. in. on a flat steel plate, with the backing material remaining in place. Center a 1,000 gram weight over the 1 sq.in. overlap area, and place in an oven at 1900 + 10°F for 2 hours. After cooling to room temperature, the pieces shall not be separable without tearing.

3. Adhesive Backing Release Material Removal: The release material shall be completely removed when tested as specified. Cut a 1/2" x 6" specimen. Remove the release material for 1" of the length and attach the non-adhesive side to a vertical surface with a suitable clamp at the point where the release material was removed. Attach a clamp which has a supported 1 lb. weight attached to it, to the end of the partly removed release material. Release the weight. Examine the specimen for any remaining release material.

4. Strength: The plastic shall require between 10 and 25 pounds to break. The elongation shall be no greater than 50%. The specimens for this test shall be Type 1 prepared in accordance to the methods described in ASTM D-638-61T. One-inch squares of carborundum, extra coarse emery cloth or its equivalent, may be applied at each end of the test specimens to prevent the plastic adhesive from adhering to the test equipment. The break resistance shall be based on an average of at least 3 samples, and the rate of pull of the test shall be 0.25 inch per minute. This test shall be conducted at a temperature of between 70°F and 80°F.

5. Plastic Pull Test: A test specimen cut to dimension of 1"x 6" shall support a dead load weight of 6 lbs. for not less than 30 minutes. This test shall be conducted at a temperature of between 70°F and 80°F.

6. Glass Sphere Retention: The plastic shall have glass sphere retention qualities. A 2"x 6" specimen of plastic shall be cut at a right angle to the beveled edge and bent parallel to the beveled edge of a 1/2" mandrel. While the specimen is bent, a strip of 1/2" wide masking tape (such as Utilitape, manufactured by Permacel) shall be applied firmly along the length of the area of maximum bend and then removed. Should any glass spheres remain on the masking tape when the strip is removed, the sample shall be rejected.

7. Skid Resistance: The surface friction of properties of the plastic shall not be less than 35 B.P.N., when tested according to ASTM E-303-66T.

8. Abrasion Resistance: The plastic marker shall have a maximum loss in weight of 0.25 grams in 500 revolutions when abraded according to Federal Test Method Standard No. 141a (Method 6192), using H-18 calibrade wheels with 1,000 gram load on each wheel.

9. Lateral Shock Load Test: A 3"x 6" plastic panel shall be applied to a 3"x 6" piece of carborundum extra coarse emery cloth, or its equivalent, so that 3"x 3" overlap occurs. The application shall be such that a pressure of 50 p.s.i. is placed on the panel for 30 seconds. The overlap ends shall each be clamped with one end in a fixed position; a sudden load of 50 lbs. shall be applied vertically to the other end. Upon immediate load release and examination, there shall be no noticeable slipping or fracture of the adhesive coating. This test shall be conducted at a temperature of between 70°F and 80°F.

10. Adhesive Shear Strength: Specimens shall be tested according to the method described in ASTM D-638-61T as modified to test the adhesive shear strength. The samples shall be prepared as follows: Plastic samples cut as described in paragraph 207-3.3(i), shall have applied to the adhesive face a 1"x 3" piece of carborundum, extra coarse emery cloth, or its equivalent, so that there is 1 sq. in. overlap at one end of the plastic specimens. A pressure of 50 p.s.i. shall be applied over this area for a period of 30 seconds. Load shall be applied by gripping each end of the test piece in a quitable tensile test machine such as a dillion or Scott Tester. The average of the load required to break the adhesive bond shall not be less than 10 lbs. The speed of testing shall be 0.25" per minute. The test shall be conducted at a temperature of between 70°F and 80°F.

Section 10005 MEASURING AND PREMARKING: The Contractor shall do all measuring and premarking required for application of the pavement markings. All premarking shall be approved by the Engineer and City prior to application of thermoplastic reflectorized pavement marking materials.

Section 10006 APPLICATION REQUIREMENTS, HOT APPLIED TYPE:

A. Melting Equipment:

1. A specially designed unit mounted on an appropriate truck chassis is required for melting the material. This equipment shall include the features stipulated in this paragraph.

2. The melter shall be of sufficient capacity to satisfy the minimum installation requirements of the material as specified hereafter.

3. The melter shall be thermostatically controlled so as to provide temperature control and prevent overheating.

4. Suitable temperature gauges to indicate material temperature shall be provided.

5. The melter shall have an agitator to provide continuous mixing while heating.

6. The melter shall have a means of rapidly and efficiently discharging the liquid material into appropriate application equipment.

7. The melter shall be equipped and conducted in such a manner as to satisfy the requirements of the National Board of Fire Underwriters.

B. Application Equipment:

1. Equipment shall be used to place the material on the pavement as a finished line, and shall include the features stipulated in this subparagraph.

2. The applicator shall provide a means of maintaining the material at its proper application temperature (not lower than 340°F nor higher than 400°F) .

3. The applicator shall maintain uniformity of specified width and thickness of not less than 1/16" nor more than 3/16", of generally uniform cross-section.

4. The applicator shall provide a means of cleanly cutting off the ends of each length of line.

5. The applicator shall be capable of providing lines of variable widths from 4" to 12" by use of easily interchangeable parts.

6. The applicator shall be provided with a sphere dispenser capable of uniformly dispensing reflective glass spheres at controlled rates of flow. The sphere dispenser shall be automatically operated in such a manner that it will only dispense spheres while the material is being applied.

7. Applicating equipment shall consist of a portable applicator capable of being propelled by the operator, typically used for traffic line installations such as crosswalk lines, stop bars, short lane lines, and short center lines. The applicator shall be easily maneuverable and so constructed as to permit the installation of curved lines.

8. The applicator shall be equipped and constructed in accordance with the requirements of the National Board of Fire Underwriters.

C. Sealing Equipment: Any conventional mobile paint spray equipment may be utilized as sealing equipment before a material application on concrete.

D. Weather Conditions: Pavement marking shall be applied only in seasonal weather under conditions which will assure a permanent bond to the pavement. The air temperature and pavement temperature shall be above 40°F.

E. Preparation of Pavement Surface: All dust, debris and other foreign matter shall be removed from the pavement surface immediately prior to installation of the material, or immediately prior to the application of sealer where required. The pavement shall be dry and free of oil, dirt, grease or other foreign contaminants at the time of installation.

F. Application of Sealer: A suitable sealer shall be applied to concrete pavement surface before application of thermoplastic material. Application rate of the sealer shall be approximately 50 square feet per gallon.

G. Application of Thermoplastic Reflectorized Material: The thermoplastic reflectorized pavement marking material shall be applied to the pavement at material temperatures no lower than 340°F, nor higher than 400°F.

H. Application of Glass Spheres: Immediately after the installation, drop-on glass shall be applied while the material is still sufficiently molten such that the spheres will be held mechanically imbedded in the surface of the material, in order to provide immediate night reflectivity. The spheres shall be applied at a rate of one pound per 20 square feet of material.

I. Protection from Traffic: The Contractor shall be responsible for keeping traffic off freshly applied markings until they have set sufficiently to bear traffic.

Section 10007 APPLICATION REQUIREMENTS, COLD APPLIED TYPE:

A. Cold applied thermoplastic materials shall be applied to clean, dry pavement surfaces, free of dirt and foreign matter, by removing the release paper and placing the plastic on the surface with continuous pressure for a period of about 30 seconds. then permitting traffic to pass over it. The pavement temperatures shall be 60°F or over, unless special instructions are supplied by the manufacturer for application at temperatures below 60°F.

B. The manufacturer shall supply detailed information concerning any special application procedures. Any necessary activators for the adhesive or various special coatings for different pavement surfaces shall be supplied.