

PART 7

EXCAVATION, BACKFILL AND EMBANKMENT

SECTION 700

EXCAVATION - GENERAL REQUIREMENTS

700.01 GENERAL. - The Contractor shall do all excavating, backfilling, and restoring of pavement necessary or required to properly construct and install the required work and equipment, including the required removal of existing sewers, City-owned or abandoned structures, foundations, pipes and other improvements and equipment. He shall conduct all excavating operations in accordance with the requirements of the applicable Sections of this Part 7. Payment therefor shall be as specified in such Sections subject to the provisions of Section 220.

The requirement that the Contractor obtain a street opening permit is waived for Department of Public Works contracts.

Trenches and other excavations shall be made safe and passable by the use of barricades, bridges, and other improved means.

Traffic routing shall be done in accordance with Section 110.

In accordance with Section 373 of the San Francisco Public Works Code there shall be no limitation on the use of labor-saving devices except at the locations specified in Sections 104.04 and 701.06.

Trenches and other excavations shall be sufficiently wide to allow for the proper construction, installation and inspection of the work, but shall not exceed such necessary width.

Tunneling or jacking shall not be used unless specified or approved in writing by the Engineer.

Where the existing finished pavement surface is concrete, including concrete parking strip, concrete gutter, and concrete sidewalk, all cuts therein between pavements to be removed and those to remain in place shall be made in accordance with the applicable requirements of Section 701.03.

700.02 SAFETY REQUIREMENTS. - All excavating and other earthwork shall be done in conformance with the rules and regulations pertaining to safety established by the California Department of Industrial Relations, Division of Occupational Safety and Health (CAL-OSHA).

The rules and regulations establish minimum standards and prescribe measures to be taken for securing safety in places of employment. The measures shall include the adoption of a Code of Safe Practices for the work, the inauguration and maintenance of an accident prevention program which shall include the inspections, corrective measures, safety meetings, instructions, precautions, illumination, and protective and traffic control measures prescribed by the hereinafter specified rules and regulations.

The Contractor shall do whatever additional work he considers necessary to assure the safety of all persons employed on the work, and of the general public.

Trenches and other excavations shall be guarded against hazard by means of shoring, lagging and bracing in conformance with the applicable Safety Orders issued by CAL-OSHA and the therein prescribed procedures for the installation thereof.

During construction, the Contractor shall construct and maintain satisfactory, substantial, and appropriate barricades and steel plates at all excavations, at locations where materials are stored, and at other hazards. All such enclosures shall have warning lights adequate for public safety.

High rise warning flag units, to provide advance warning for traffic approaching excavations, will be required in all cases where motorists' visibility of the work is limited or obscured. Where required, the Contractor shall provide and maintain safe and adequate passage for vehicular and pedestrian traffic over and adjacent to trenches and other excavations by the use of barricades, bridges and other approved means. Additional traffic safety requirements are included in Section 110.

The Contractor's attention is drawn to the restrictions specified in Section 110.02 on his operations during the Christmas holiday season.

Estimated dates of starting and finishing the various excavations shall show a reasonable and orderly work sequence precluding excessive time for completion of the work at any excavation, and shall be compatible with material and equipment delivery dates.

Excavating shall not be done significantly ahead of the time required for expeditious prosecution of the subsequent work.

The Contractor's operations at excavations, and the work necessitating excavation, shall be prosecuted as continuously as practicable, in order that his operations will be in compliance with the requirements of Sections 107.04, 110.02 and 110.05.

The Contractor shall take adequate measures, commensurate with the danger involved, to prevent unauthorized entry by children or others upon the area of excavation operations. The measures shall include the provision of proper and adequate guard railing, solid or chain link fence, and the placement of a difficult to remove weighted cover on each deep shaft excavation.

If the Contractor encounters material in trench or other excavation which he has reason to believe may be hazardous waste, as defined by Section 25117 of the Health and Safety Code of the State of California, he shall immediately so notify the Engineer in writing. If authorized by the Engineer, excavation in the immediate area of the suspected hazardous material shall be suspended until the Engineer authorizes it to be resumed. If such suspension delays the current controlling operation, the Contractor will be granted an extension of time as provided in Section 107.10. The City reserves the right to use other forces for exploratory work to identify and determine the extent of the hazardous material and for removing such material from the site.

700.03 EXCAVATIONS TO HAVE VERTICAL SIDES. - Unless specific provisions in the contract provide otherwise, all trenches and other excavations shall have vertical sides, and shall be no wider at the top than at the bottom, except as required to accommodate successive lifts of lagging. In all cases trenches and other excavations shall be constructed in accordance with CAL-OSHA rules and regulations.

700.04 SHEET PILING, LAGGING, BRACING AND COFFERDAMS.

General. - The Contractor shall furnish, install and maintain such sheet piling, bulkheading, cribbing, timbering, lagging, underpinning, shoring, bracing, cofferdams, and other temporary construction as necessary to safely support the sides of excavations and any adjacent structures, and to prevent any movement of adjacent ground, pavement or improvements, or danger to life or property, and such construction shall be carried to adequate depths and heights and made as tight as necessary for the proper performance of work.

The manner of bracing excavations shall be in accordance with the rules, orders and regulations of CAL-OSHA.

The use of vibratory hammers and other vibratory equipment will be subject to the approval of the Engineer. However, such approval does not relieve the Contractor of the responsibility for any damages or injuries resulting from the use thereof.

The use of high frequency vibrating equipment, or sonic equipment, for the driving or withdrawal of sheet piling, is prohibited.

Unless otherwise specifically approved for each particular location by the Engineer, struts, braces and other temporary construction shall be so constructed as not to pass through volumes to be occupied by concrete structures leaving openings in the concrete which must be subsequently filled.

In excavations where sand or other non-cohesive material is encountered, placing of the necessary lagging or sheet piling shall commence before a depth of 5 feet is attained, and thereafter such lagging shall be driven or lowered progressively with the excavating in a manner such that the sides of the excavation will be completely covered and adequately supported.

Should any sheet piling, lagging, or bracing which has been installed be in any way insufficient for its purpose, the Contractor shall at once provide additional and adequate materials. The provision of any additional supports ordered by the Engineer shall in no way relieve the Contractor of his responsibility for the sufficiency of his precautions.

Excavation safety plans shall be submitted and permits obtained, in accordance with the requirements of Section 106.09. The approval of such plans by the Engineer shall in no way relieve the Contractor of any responsibility or liability, including that for structural adequacy, under the contract, and he shall take all precautions he considers proper for the protection of the public and the work.

Any voids that exist between the outside surface of the lagging and the adjacent side of the excavation shall be immediately backfilled in accordance with Section 703.

Lagging shall not be used as a surface against which concrete is placed unless permitted in the Special Provisions. Adequate space shall be provided within the limits of the excavation, sheet piling, lagging, or bracing, as the case may be, to allow for proper construction of the structure to the alignment and cross sections shown on the plans. If lagging is used for the outside form, the concrete shall be separated from the lagging by a waterproof membrane, or by other means approved by the Engineer, and any excess width of trench caused by misalignment of the lagging shall be offset by increasing the structure wall thickness. No deviation in the interior alignment or dimensions will be permitted.

Unless otherwise specified or approved, sheet piling, lagging, and bracing shall be removed during backfilling. Vacancies left by such removal shall be immediately backfilled with acceptable material compacted into place.

Sheet piling and lagging which during withdrawal fails or breaks, or in the opinion of the Engineer is otherwise incapable of being withdrawn, shall be cut off at least 3 feet below pavement subgrade and the upper part removed.

Payment. - When a bid item exists for trench support or excavation support, such work satisfactorily completed shall be paid for in accordance with the Contractor's bid price. When no bid item exists for trench support or excavation support work, such work shall be constructed as Incidental Work.

700.05 - EXCAVATION ADJACENT TO EXISTING STRUCTURES - HAZARDOUS EXCAVATION. - The Contractor shall engage the services of a registered engineer to determine the methods and construction sequence to be employed, and the precautions to be taken, to prevent earth slippage or damage to, or displacement of, any improvement or facility, and to design the required temporary supports and construction when it is necessary to excavate:

1. adjacent to and below the foundations of existing structures to remain;
2. slopes steeper than 1 horizontal: 2 vertical;
3. where unstable or unsound soil or a potential slide requires that sheet piling or otherwise temporary construction be used to support earth or slopes and safeguard the work, adjacent property or street pavements; or
4. in the area of any existing facility or improvement within or over the required excavation, and specified to be supported, worked around, and protected by the Contractor, other than pipes, mains and ducts the support for which is specified in Section 104.

The Contractor shall submit for review, in accordance with the requirements of Section 106.08, 6 copies of the description or detailed drawings of the proposed methods, construction sequence, and precautionary measures.

The description or drawings shall be signed by a Civil Engineer specializing in soils and foundations, or a Structural Engineer, as applicable, properly licensed by the State of California. Submittal to the City will constitute evidence only that there has been review by a qualified person of the temporary support design, and will in no way relieve the Contractor of any responsibility or liability under the contract. The Contractor shall take all precautions he considers proper for the protection of the public and the work.

The sequence and scheduling of all construction activities shall be included in the Progress Schedule.

700.06 PROTECTION OF FILL MATERIAL. - The Contractor shall protect fill material during stockpiling by plastic sheeting or other acceptable means, to prevent the entry of water during rains. If the

material becomes permeated with water and the required compaction cannot be obtained by the Contractor after drying the material, he shall remove such material from the site and replace it with acceptable material, in accordance with Section 706.02, at no cost to the City.

700.07 STORAGE OF EXCAVATED MATERIALS. - The Contractor shall store excavated materials at the site only at locations and in a manner that will ensure compliance with the requirements of the specifications. The Standard Specification requirements with respect to public safety, site maintenance, and material protection are in Sections 108.13, 108.17 and 700.06, respectively.

The Contractor's attention is particular drawn to the requirements of Section 110.02 with respect to vehicular and pedestrian movements and access to properties, and access by emergency vehicles and to fire hydrants.

700.08 EXCAVATIONS TO BE KEPT DRY - DEWATERING AND DISPOSAL OF WATER.

General. - The Contractor shall conduct his operations with respect to the handling and disposal of water and sewage in accordance with the requirements of Sections 108.06, 301, 321 and 712.

He shall protect the work from water damage, keep excavations dry and, by proper diversion and pumping, remove therefrom and dispose of all water and sewage that enter upon the work. He shall provide, maintain and operate all pumping equipment required for such purpose during the time concrete or other work is being placed and thereafter as required for the protection of the work. The aforesaid requirements shall be observed as necessary or required prior to the completion of drainage facilities specified or ordered to be constructed under the contract.

Dewatering and the rate and manner of lowering the water table shall be such as to minimize any settlement that might be caused thereby.

Pumping operations for excavations shall be continuous and satisfactory from the time drawdown is first accomplished until all the concrete has been placed. The Contractor shall not allow his pumping operations to be interrupted; shall take adequate precautions to such end; and shall assume full responsibility for any damage that occurs due to fluctuating water table in the area influenced by the dewatering.

Pumping from the interior of the excavation shall be done in such a manner that there will be no movement of water through any fresh concrete, and for a period of 24 hours after a pour shall be done from a suitable sump separated from the concrete work by a watertight wall or by other effective means.

The Contractor shall at all times, by the institution of proper precautions, prevent hydrostatic uplift and flotation of the work.

Drains - When specified, shown on the plans, or required by field conditions, the Contractor shall construct permanent or temporary drains and appurtenances adequate to keep excavations and subgrades sufficiently dry to permit proper conduct of his operations. Unless otherwise specified, pipe to carry such drainage shall be perforated bell and spigot vitrified clay pipe, not less than 6 inches in diameter, and shall be placed with the perforations facing down. The drains shall be

placed in filter material in accordance with Section 711, extending at least 6 inches laterally from each side of the pipe and 12 inches vertically above the top of the pipe, with an approved waterproof membrane thereover and acceptable backfill over the membrane.

The Contractor shall not allow water originating on or due to his work, or which he is obliged to handle and dispose of, to discharge upon the work or into the trenches of another contractor.

700.09 REMOVAL OF SUBSURFACE OBSTACLES - DIFFERING SUBSURFACE CONDITIONS.

General. - Subsurface obstacles are defined as foreign, man-made, or man-deposited materials and objects required to be removed in order to construct the contracted for facilities, and are included in one or more of the following categories:

- 1) building and other debris, and rubble, used as fill material;
- 2) boulders obviously not native material;
- 3) abandoned sewers and sewer structures not shown on the plans or specified to be removed;
- 4) iron and steel, including rails and auto bodies;
- 5) wood, steel or concrete, including
 - a) structures;
 - b) walls, foundations and slabs;
 - c) abandoned utility facilities, not shown on the plans or specified to be removed;
- 6) pavement materials;
- 7) cable care yokes;
- 8) piles, separate from attached material, (not subject to the hereinafter specified initial one cubic yard exclusion);

Subsurface obstacles, regardless of size, shape or type of material, encountered within the limits of the excavation necessary for the work, shall be removed by the Contractor to the extent required and the resulting void backfilled.

Subsurface obstacles shall be removed to not less than 3 feet below subgrade for street pavement, curb and sidewalk.

Within areas where the required subgrade is that for a structure, pipe, or like facility, or where excavation is to graded ground upon which no construction is called for under the contract, removal of subsurface obstacles shall be to not less than one foot below such subgrade or ground surface.

Where the surface serves as subgrade for footings or foundations, the voids left by the removal of subsurface obstacles shall be backfilled with Class 4-2000-1½ concrete.

The City assumes responsibility for the correctness of the information shown on the Log of Test Borings plans only at the location of each test boring.

The City assumes no responsibility for the soils investigations or reports, or for any interpretation, deduction or conclusion given therein, or any soil or rock profiles, estimated quantities of rock excavation, etc. which the City or its consultants may have made.

Bidders must make their own deductions and conclusions as to the nature and difficulty of excavation of all natural materials.

Conditions for Payment. - The removal of subsurface obstacles and the subsequent backfill of the resulting voids shall be done as Incidental Work except under the following conditions:

- 1) the subsurface obstacles is not shown on the plans, other than the Log of Test Borings;
- 2) the subsurface obstacle is not mentioned in the Special Provisions;
- 3) the subsurface obstacle, except for piles, exceeds one cubic yard in volume; and
- 4) the removal of the subsurface obstacle involves additional cost.

In the event the above conditions are met, the removal of subsurface obstacles shall be done as Extra Work. Payment for the removal of subsurface obstacles will be made even if the Log of Test Borings in the plans, or the soils report, indicates the probability of encountering subsurface obstacles.

Obstacles connected to, or enmeshed with, each other such that work additional to the excavation thereof is required to separate them will be considered a single obstacle.

Each initial cubic yard, except as specified for piles, shall be removed as Incidental Work. The negotiated Extra Work payment for the excavation or removal of, and, if required, backfill for, each subsurface obstacle shall be for 100% of all allowable costs therefor, over and above the cost of normal excavation at the location of the subsurface obstacle.

The City will use the soils investigation as a general indication of the types of materials expected to exist in the excavation. Normal excavation cost will be based on the Contractor's observed performance in each such type of material. This cost will be used as a base for payment as Extra Work of the herein allowable additional cost of excavating each qualifying subsurface obstacle volume.

Where excavation is designated to be paid for under a Bid Item, no reduction in the pay quantity thereof will be made on account of the presence of any subsurface obstacle.

The Contractor shall give written notice of each claim for subsurface obstacle Extra Work.

700.10 EXCAVATION OF UNSOUND SUBGRADE MATERIAL. - The Contractor, where and as shown on the plans, and where and to the extent directed, shall excavate, as common excavation, all existing topsoil, loam, wet clay, and any other materials determined by the Engineer to be unsound and inferior, encountered at any required subgrade. In place of the unsound materials he shall construct satisfactorily compacted backfill in accordance with Section 707. Payment therefor shall be in accordance with the provisions of Section 714.03. This provision shall apply to subgrade for embankment as well as to subgrade for any other construction.

If the proposal does not contain a Bid Item for common excavation or excavation, the excavation and disposal of unsound subgrade materials shall be done only where directed by the Engineer.

Such excavation to a depth of 12 inches below the existing or required subgrade, whichever is lower, will, together with the disposal of the material so excavated and the required backfilling, be paid for as Extra Work as set forth in Section 112.01 of the Standard Specifications, to the extent that the excavation of unsound material exceeds 5% of the total area of the work requiring any excavation, grading or filling. The initial 5% shall be done as Incidental Work.

All excavation of unsound subgrade materials below such 12 inch depth, together with the disposal of the materials so excavated and the required backfilling, will be paid for as "Extra Work."

Construction of required backfill shall be done in accordance with the requirements of Sections 703 or 709 as the case may be, and except as hereinafter specified shall be done as Incidental Work.

700.11 DISPOSAL OF EXCAVATED MATERIALS. - All excavated materials not in accordance with or in excess of requirements for the construction of backfill, fill and embankment, and, except as otherwise specified, all trees and other vegetation complete with their entire root structures, and all humus-containing topsoil, shall be removed from the site by the Contractor as his property, as Incidental Work.

Such material shall also include excavated pavement, concrete and masonry, including foundations, slabs, and cable car conduit and yokes, all rails except those specified to be salvaged, all ties, track fittings and appurtenances, and all rubbish and other construction debris.

The Contractor shall not allow any portion of any excavated material or refuse to be disposed of upon paved streets, into catchbasins, or otherwise into the City Sewer System. No materials shall be placed on private or public property without proper authority.

Quantities of surplus material shown on the plans or specified in the Special Provisions, are approximate only. The Contractor shall satisfy himself that there is sufficient material available for the completion of all embankment before disposing of any indicated surplus material. Any shortage of material, caused by premature disposal of material by the Contractor, shall be replaced by him at no additional cost to the City.

Disposal of excavated and other materials shall be in accordance with the requirements of Section 108.10.

SECTION 701

PAVEMENT EXCAVATION

701.01 GENERAL. - The Contractor shall excavate, remove, and conduct his operations in all respects in accordance with the requirements of Section 700; shall excavate, remove and dispose of, existing concrete curb, sidewalk, pavement and base, stone curb, asphalt concrete base and wearing surface, including the latter at conform points, cement treated rock base, and plain and reinforced concrete and masonry, walls, foundations, coping, sections of manholes, catchbasins and other structures, all where, as, and from within the limits shown or indicated on the plans for pavement excavation, and elsewhere where directed; shall construct compacted embankment in the areas from which, as necessary to obtain the required subgrade, the

hereinafter specified materials have been removed; and shall do all other necessary or required Incidental Work.

Payment under a pavement excavation Bid Item will be made based on calculations of the actual volumes of pavement removed within the limits shown on the plans.

In the absence of cross sections, information on the plans or specific limits set forth in the Special Provisions defining lateral limits of excavation, pay quantities shall include only those volumes lying between existing street property lines.

Excavating that shall not be done under a Bid Item for pavement excavating is that:

1. of earth, untreated rock and macadam bases, asphalt paths, basalt block gutters, and cable car conduit and yoke structure;
2. within the limits defined for a Bid Item for excavation in a specified width of existing street railway track area;
3. outside of or beyond, including overbreak, the limits shown on the plans or specified to be done under a Bid Item for pavement excavating.

Materials excavated beyond the shown or specified limits, and overbreak, shall be satisfactorily replaced by the Contractor, at no cost to the City.

Pavement excavation not within the limits shown or specified therefor, including that, as specified in Section 220, necessitated by other work under the contract shall be done as Incidental Work.

Existing concrete, masonry, and pavement necessary to be removed to obtain the required subgrade shall be excavated to 3 feet below such subgrade and the resulting voids created below subgrade shall be backfilled. In areas where no improvement is to be constructed, such concrete, masonry and pavement shall be excavated to a depth of one foot, measured normal to the slope, beneath the face of the slope.

Abandoned pits, vaults, and basements under pavement or sidewalk areas, to the extent that the walls and slabs thereof are to remain in place, after having been broken or penetrated as required to allow normal water filtration and drainage, shall be backfilled with sand compacted to maximum density.

701.02 REMOVAL OF ASPHALT TOPPED PAVEMENT. Where existing pavement surface is asphalt concrete, cuts therein, as for trenches, etc., shall be made vertical and to neat regular lines.

701.03 REMOVAL OF CONCRETE PAVEMENT, SIDEWALK AND PARKING STRIP - CONCRETE SAW CUTTING REQUIRED. - Where the existing finished pavement surface is concrete, including concrete parking strip, concrete gutter and concrete sidewalk, cuts therein between pavements to be removed and those to remain in place shall be made by an approved pavement cutting saw before any pavement is jackhammered or broken, and in sidewalk and traffic island pavement shall be to neat flag lines. Similarly, concrete saw cuts shall be made for the full length of the juncture of the portion of existing concrete structure or footing to remain with that to be removed.

Saw cuts shall be 2 inches deep, neat, regular and vertical. The Contractor shall exercise extreme care not to damage the cut edges of the surface. Damaged edges shall be recut to acceptable alignment and vertical surface.

Where the edge of excavation closest to the curb in concrete parking strip or pavement is less than four feet from the curb, the pavement in the area of the cut shall be removed to the curb; if the parking strip in this case is monolithic with curb, removal shall be to within 6 inches of the curb.

When an edge of excavation is less than 4 feet from a construction joint in parking strip or pavement, that portion thereof between the construction joint and the excavation shall be removed.

Cuts to the curb in concrete pavement not monolithic with adjacent curb shall be saw cut to as close to the curb as possible, and extended neatly and regularly thereto by means other than saw cutting.

Saw cuts to the curb in monolithic curb and parking strip shall be terminated as close to the curb as possible, and in the case of trench, with a saw cut parallel thereto, and the work completed by tunneling. If the cut is not for trench, extension thereof shall be as hereinbefore specified for pavement not monolithic with curb.

701.04 REMOVAL OF PAVEMENT AND RAILS WITHIN STREET RAILWAY TRACK AREA. - Pavement excavation in a specified width of existing street railway track area shall include:

1. the excavation, by means of hand tools and hand operated pneumatic tools, of pavement materials and header blocks to the full depth of the rails in preparation for the removal and salvage, under a separate Bid Item, of street railway rails without damage thereto; and after such removal and salvage,
2. the excavation of all rails and railway track materials not to be salvaged, and all pavement materials, ballast, ties and other materials, including concrete rail stringers, if any

all from within the limits of the specified width of track area shown on the plans, and lying within the depth specified or shown on the plans or cross sections, from, and measured normal to the surface of the existing pavement.

701.05 REMOVAL OF CABLE CAR CONDUIT AND YOKE STRUCTURE. - The Contractor shall excavate, remove from the site, dispose of, and construct compacted backfill in place of, all abandoned cable car conduit and yoke structures and elements and appurtenances thereof within the limits of the work, where and as shown on the plans, or where directed by the Engineer.

701.06 CITY MAY LIMIT USE OF PAVEMENT BREAKER. - In accordance with the requirement of Section 373 of the Public Works Code there shall be no limitation on the use of labor-saving devices except at the locations, if any, specified in Section 104.04 or in the Special Provisions, provided, however, that when, during construction operations, an additional location is revealed where, in the judgement of the Engineer, such limitation is necessary to avoid public nuisance or

protect public health, safety or facilities, then the limitation shall apply to such additional location and the expense caused to the Contractor by the limitation on his operations in such additional location shall be estimated and paid for as Extra Work in accordance with the requirements of Section 112.

701.07 PAYMENT.

General. - Pavement excavation satisfactorily done, as specified, will be paid for at the price bid per cubic yard measured in place as the aggregate net volume of pavement materials excavated from within the limits shown, specified, or directed, but not including specified exclusions.

The removal of asphalt concrete wearing surface in conform areas, if the Proposal contains a Bid Item therefor, will be paid for at the price bid per cubic yard, or if a specific Bid Item therefor does not exist, the volume of wearing surface removed from conform area will be included for payment as pavement excavation.

Pavement excavation, if there is no Bid Item therefor, will be included for payment as common excavation or excavation.

If the Proposal does not contain a Bid Item for any such work, it shall be done as Incidental Work as set forth under Section 108.

In Specified Width of Track Area. - Pavement excavation within a specified width of track area and depth will be paid for at the price bid per linear foot of such track area satisfactorily excavated, measured horizontally along the centerline of the tracks.

Removal of Cable Car Conduit and Yoke Structure. - Removal of cable car conduit and structure will be paid for at the price bid per linear foot of conduit and structure, satisfactorily excavated, measured horizontally along the longitudinal centerline thereof.

If the Proposal does not contain a Bid Item for such work, it shall be removed as a "Subsurface Obstacle" as set forth under Section 108.05.

SECTION 702

TRENCH EXCAVATION

702.01 GENERAL. - The Contractor shall conduct his operations in all respects in accordance with the requirements of Section 700 and shall do all trenching and excavating, as to the depths necessary, or required, for the proper construction of the work and installation of equipment.

Tunneling or jacking shall not be used unless specified, or approved in writing by the Engineer, except that the Contractor may tunnel under concrete curb and combined concrete curb and gutter. If it required, or if the Contractor elects to remove a portion of the curb or of combined curb and gutter, he shall remove an entire section between construction joints.

702.02 MINIMUM AND MAXIMUM LENGTH OF TRENCH. - The Contractor shall prepare trench subgrade for sewers and pipes not less than 30 linear feet in advance of such sewer and other pipe construction.

The Contractor shall not have more than 500 linear feet of trench, other than side sewer or culvert trench, open at any one time, subject however, to possible further limitations because of traffic routing restrictions. Such maximum footage of open trench shall include backfilled but unpaved trench, partially or completely excavated trench, and area from which pavement has been removed for anticipated trench excavation.

702.03 PAYMENT. - Trench excavation, including saw cutting of concrete pavement and disposal of materials, shall be paid for in accordance with the Schedule of Bid Prices. If no bid item exists for trench excavation, it shall be done as Incidental Work and payment therefor shall be included in the price or prices bid.

SECTION 703

TRENCH BACKFILL

703.01 GENERAL. - The Contractor shall do all backfilling and restoring of pavement necessary, or required, to satisfactorily complete the work, and he shall backfill all excavations to the elevations of the required subgrade or adjacent ground, as the case may be.

Backfilling shall not commence until after sewers, culverts, drains, sewerage and drainage structures, pipe, conduit, and other equipment and appurtenances placed in trench or similar excavations have been properly constructed, or installed as applicable, inspected, and if required, tested.

Backfill shall be placed in a manner not to disturb, damage, nor subject such facilities to unbalanced loads or forces. Restoring of pavement shall be done in accordance with Section 109.

703.02 CONCRETE STRENGTH BEFORE BACKFILLING. - Backfilling over and against sewerage and drainage facilities shall not commence until concrete has attained a compressive strength of at least 2,500 pounds per square inch based on field cured cylinders, nor until all mortar joints are set sufficiently to prevent damage.

703.03 SAND BED FOR PIPE SEWERS AND CULVERTS. - All pipe sewers, and all cast or ductile iron pipe culverts, shall be constructed on a prepared or natural sand bed the width of which shall be at least the full width of the pipe, and not less than 4 inches thick below the line of the bells of the pipe after installation; however, a sand bed will not be required for pipe sewers on concrete foundations, in encasements, or on crushed rock bedding.

703.04 SUBGRADE SURFACES FOR PILE-SUPPORTED CONCRETE. - Subgrade surfaces on which pile-supported concrete is placed shall be adequately prepared to assure proper support for the placed concrete

until such concrete has sufficient strength to span and be supported solely by the piles.

703.05 CRUSHED ROCK LAYER IN TRENCH. - Crushed rock shall be furnished and placed where necessary to maintain an appropriately dry trench in accordance with Section 712.

703.06 REQUIRED SAND BACKFILL. - Backfill around all sewers, culverts, sewerage and drainage structures, and all cast or ductile iron pipe, from the bottom of the trench to a height 6 inches above the top of such facilities for the full width of the trench shall be sand only.

Backfill around manholes and catchbasins shall be sand to a level 6 inches above the supporting structure or adjacent sewer or culvert.

703.07 BACKFILL ABOVE REQUIRED SAND. - Backfill material above the required sand shall be in accordance with the provisions of Section 706.02.

703.08 BACKFILL LAYERS. - Each layer of backfill shall be compacted both during placement and following the withdrawal of sheet piling and lagging to the top of the layer being compacted. Withdrawal of sheet piles or other trench support systems shall be done such that voids are not created from loose material under the adjacent pavement entering the trench. After the placing of backfill has been started, the Contractor shall proceed as soon as practicable with densification. All sand backfill to be densified by water shall be jetted, unless flooding is specified or otherwise authorized by the Engineer. Flooding of sand will be prohibited where sewers or structures might be damaged, or adjacent materials softened, by the applied water. The Contractor shall make his own determination that flooding or jetting will not result in damage. Any resulting damage shall be repaired at the Contractor's expense. Sand backfill jetted, flooded, or compacted by other approved means, shall be done in horizontal layers not more than five feet thick.

Jetting of backfill shall be done in accordance with the following requirements:

1. The jet pipe shall consist of a minimum one inch diameter pipe to which a minimum 1-1/2 inch diameter hose is attached at the upper end. The jet shall be of sufficient length to project to within one foot of the bottom of the lift being densified.
2. The Contractor shall jet to within one foot of the bottom of the lift and apply water in a manner, quantity and at a rate sufficient to thoroughly saturate the thickness of the lift being densified. The jet pipe shall not be moved until the backfill has collapsed and the water has been forced to the surface.
3. Voids left by the removal of sheeting, piles and similar sheeting supports shall be immediately backfilled with clean sand which shall be jetted into place to ensure dense and complete filling of the voids.

All backfill other than sand shall be placed in horizontal layers not more than 8 inches thick before compaction, and each layer shall be

satisfactorily compacted by mechanical means. Flooding or jetting, in this case, will not be allowed.

In all cases, each layer of backfill material shall be satisfactorily compacted before placing the next layer thereon. Compaction shall be in accordance with the applicable requirements of Section 707.

703.09 PAYMENT. - Trench backfilling shall be done as Incidental Work and payment therefor shall be included in the price or prices bid.

SECTION 704

CLEARING, GRUBBING AND SITE PREPARATION

704.01 GENERAL. - The Contractor shall clear and remove from the site of the work all trees, stumps, roots, brush, grass, rubbish, debris, fences, street improvements, structures, and obstructions of any kind, natural or artificial which, if left in place, would interfere with the construction of the work.

All cleared areas shall be grubbed. Grubbing shall consist of the complete removal of stumps, tap and lateral roots $1\frac{1}{2}$ inches or more in diameter, buried logs, and similar objectionable material, if encountered, to a depth of 3 feet below required subgrade, final ground line, or existing ground surface in an area to receive embankment, as the case may be.

The Contractor shall backfill with acceptable material, as specified in Section 706.02, to the elevation of the ground line as it existed prior to the start of the contract or to new subgrade, as the case may be, the voids being created by the hereinafter specified removals. Such backfilling shall be done as Incidental Work and shall be compacted to 95% relative compaction.

The Contractor shall not disturb the existing trees designated to remain. The City reserves the right to remove any trees or plants prior to the clearing and grubbing. Existing improvements, facilities, trees, and shrubbery that are not required to be removed shall be protected from destruction or damage by the Contractor's operations.

If required, sod and loam which is removed shall be properly preserved and stored for use.

All existing abandoned concrete or masonry building walls, footings, copings, stairs, slabs and pavement shall be removed to a depth of 3 feet below required subgrade or final ground line, as applicable. The Contractor shall break up or penetrate, as required, existing slabs and walls which are to remain in place in order to allow normal water filtration and drainage.

The Contractor shall give reasonable notice to occupants of buildings or property adjacent to the work to permit such occupants to salvage or relocate plants, trees, fences, sprinkler systems, or other improvements which they have placed within the limits of the work and which might be destroyed or damaged by the Contractor's operations. Portions of fence, water lines, etc., remaining after site is cleared shall be properly terminated.

Materials, specified on the plans or in the Special Provisions to be salvaged, shall be carefully removed and delivered by the Contractor to

the City yard designated on the plans, where a receipt will be issued in duplicate. The Contractor shall furnish one copy of this receipt to the Engineer.

The disposal of all cleared, grubbed and razed materials shall be in accordance with the requirements for excavated materials set forth in Section 108.10.

704.02 PAYMENT. - Clearing, grubbing, site preparation and related backfilling shall be done as Incidental Work. However, if there is a contract Bid Item for "Pavement Excavation," pavement excavation within the street area, i.e., within the existing street property lines, will be paid for at the price bid therefor in accordance with the provisions of Section 701.

If embankment is to be placed in cleared and grubbed areas, the quantity to be paid for will be measured from the original ground line and not the cleared ground line.

SECTION 705

COMMON EXCAVATION

705.01 GENERAL. - The Contractor shall conduct his operations in all respects in accordance with the requirements of Section 700 and shall excavate to bring the existing subgrade or ground surface, as the case may be, to the required subgrades and elevations, where shown on the plans or where directed. The work shall include:

- 1) excavating waterbound macadam, untreated rock base, asphalt paths and basalt block gutters;
- 2) stripping and grading existing slopes;
- 3) removing and disposing of obstructions;
- 4) excavating all concrete and masonry walls, slabs, structures, and pavement materials not specified to be removed under Bid Items, all rubble and debris within the volume specified to be excavated as common excavation, and all material contained by structures and parts thereof which are to be removed as other than common excavation;
- 5) breaking up or penetrating, as required, to allow normal water filtration and drainage, exposed or encountered existing slabs and walls which are to remain in place, and;
- 6) the constructing of drainage ditches necessary or required for the protection of the work.

If the proposal does not include a separate Bid Item for pavement excavation, no differentiation will be made between pavement material and other material excavated, and pavement excavation shall be included

under whatever Bid Item, such as excavation, common excavation or embankment, is included in the Proposal.

In the absence of cross sections, information on the plans, or specific limits set forth in the Special Provisions defining lateral limits of excavation and embankment, pay quantities shall include only those volumes lying between street property lines.

Excavating shall not unnecessarily disturb the material below subgrade. Materials excavated beyond the shown or specified limits, and overbreak, shall be backfilled at no cost to the City.

All excavating such as trench and footing excavation, below the required subgrade or final graded ground line, shall be done as Incidental Work.

Not included in this work will be that shown or specified to be done under other Bid Items or as Incidental Work, such as the excavating and removal of grass, shrubs, trees, stumps, roots and other vegetation and fencing. No reduction, however, will be made in the pay quantity of a Bid Item for common excavation or excavation on account of excavating specified to be done under another Bid Item, such as that of those portions of concrete and masonry foundation, walls, slabs, stairs and appurtenances, and cable car conduit and yoke structures, that intrudes into, or occurs within, the volumes specified to be excavated as common excavation or excavation.

Excavation for the purpose of obtaining borrow material shall be done as Incidental Work and payment therefor shall be included in the price or prices bid.

If the proposal contains a Bid Item for earthwork, it will contain a Bid Item for either excavation or embankment, whichever is estimated to exceed in quantity, and other earthwork shall be done as Incidental Work.

If the proposal does not contain a Bid Item or Items for other work required to be done in connection with excavating, all such work shall be done as Incidental Work and payment therefor included in the price or prices bid. Such work includes, but is not limited to, the following:

- 1) Placing and compacting approved material to construct required embankment, or to fill or backfill holes, pits, depressions, and excavations resulting from the removal of subsurface obstacles, structures and other facilities, all to the elevations required to obtain the pavement subgrade or ground surface shown on the plans or cross sections. Such work done with site excavated materials shall include all loading and hauling thereof; if specified or required to be done with imported fill or designated borrow material, or crushed rock, the furnishing of the required material at the proper site location, if the Proposal contains a Bid Item therefor, will be included for payment thereunder.

- 2) All required benching, scarifying, watering or drying of materials to the required moisture content, shaping and finishing constructed subgrade as specified in Section 200, constructing and maintaining the slopes and ditches and stockpiling and replacing topsoil.

If required in order to comply with the traffic routing or other provisions of the specifications or because of the danger of

overburdening an existing or potential slide area, materials shall not be stored on the site, nor, in the latter case, on the slopes above or below the site.

The Contractor, at his sole expense, shall remove materials that, on account of the nature or performance of the work, slide into, or slip from, a constructed slope or subgrade, and shall refinish and maintain during the contract period, such slopes and subgrades to the lines and grades shown on the plans and cross sections.

Tops of slopes shall be rounded as shown on the plans. Material removed in rounding excavated slopes will be measured for payment as specified for the material removed. No payment other than the contract unit price governing the applicable earthwork will be made by reason of field modification of slopes.

The Contractor, in accordance with the requirements of Section 108.17, shall wet down any area whenever necessary to prevent dust nuisance.

The Contractor shall not remove from the work, nor waste, any site excavated material that is in accordance with the specified requirements for backfill, and embankment, except that quantity thereof, if any, that may be in excess of the total quantity required to complete all backfilling and embankment as specified in Section 700.11.

705.02 PAYMENT. - Common excavation or excavation, satisfactorily done as specified, will be paid for at the price per cubic yard measured in place within the limits shown, specified, or directed, and computed from cross sections between the existing ground surface, or the lower limit of pavement excavation if the Proposal contains a Bid Item therefor, and the final graded ground surface or constructed subgrade, as applicable, but not including trench, structure, or other excavating below or outside of that required for subgrade for street work.

If the Proposal does not contain a Bid Item for such work, it shall be done as Incidental Work set forth under Section 108.

SECTION 706

EMBANKMENT

706.01 GENERAL. - The Contractor shall prepare the subgrade for, and construct, compacted embankment and fill from earth, concrete pavement, other site excavated concrete materials, borrow materials from designated on-site areas, and from imported fill material if required, all as necessary to complete the work.

The work shall include all common excavation, the furnishing of imported fill materials except as the provisions of a Bid Item for such furnishing otherwise state; all loading, hauling, stockpiling, depositing, watering, aerating, vibrating, tamping and rolling of the embankment and fill material. The work shall further consist of constructing embankment to bring all surfaces, including those of areas where pavements or unsound subgrade materials have been excavated, to the lines, grades and cross sections required for final graded ground surfaces and subgrades, all where and as shown on the plans and cross sections, including all Incidental Work.

Required topsoil or loam placed on areas of embankment will be paid for as embankment if the Proposal does not contain a Bid Item for loam.

All required benching, scarifying, watering or drying of materials to the required moisture content, shaping and finishing constructed subgrade as specified in Section 200, and constructing and maintaining the required slopes and ditches, shall be done as Incidental Work.

Backfilling of voids, below subgrade, left by the removal of subsurface obstacles, or by the specified removal of facilities, will not be paid for as embankment.

Materials excavated beyond or below the specified limits shall be satisfactorily replaced by the Contractor at no cost to the City.

The construction of embankment and fill not within the limits shown on the plans or cross sections, or specified to be paid for under a Bid Item, shall be done as Incidental Work.

If the Proposal contains a Bid Item for earthwork, it will contain a Bid Item for either excavation or embankment, whichever is estimated to exceed in quantity, and the other class of earthwork shall be done as Incidental Work.

706.02 ACCEPTABLE MATERIALS. - Acceptable embankment, fill and backfill materials, are materials which meet the compaction requirements of Section 707 and are free of debris, wood, other organic or deleterious matter, and from materials that would prevent or adversely affect permanent compaction and stability. The compaction and acceptability of the material will be determined by the City's Materials Testing Laboratory, based on the results of the tests specified in Section 707.01.

Lumps, ballast, rocks and broken concrete measuring 3 inches or less in greatest dimension may be incorporated into backfill and embankment, and if satisfactorily distributed in earth or other fine materials, pieces not greater than 6 inches in greatest dimension may be so incorporated, provided that such latter pieces be not placed within 3 feet of finished grade or subgrade. Rocks, concrete, or hard lumps of earth larger than allowed shall be broken up before compacting.

Rocks, broken concrete or other solid materials, larger than 4 inches in greatest dimension, shall not be placed in embankment areas where piles are to be placed or driven.

706.03 PROCEDURES. - Existing material to remain will be subject to approval and shall be compacted as specified in Section 707.03.

Except in contained volumes, the compacted material upon which embankment is to be constructed shall be scarified to a depth of 6 inches, and in no case shall backfill, fill, or embankment be constructed upon topsoil or other unsound material.

Excavated untreated rock base shall be used prior to the use of any other material for constructing compacted fill and embankment.

Embankment and fill material shall be spread with a bulldozer or other equipment upon which the blade precedes the wheels or tracks. If such material is deposited against an existing slope, the depositing shall be in accordance with the requirements of Section 706.05.

The materials for, and placement of, backfill, fill and embankment above and against structures, sewers and the like shall be as specified in the applicable portions of Sections 703 and 709. The Contractor's attention is directed to the possibility of excessive lateral pressure on,

and resultant damage to, retaining walls; he shall, therefore, exercise care in properly placing backfill, fill and embankment behind such walls.

At the time of compaction, materials to be incorporated in backfill, fill, and embankment, shall have the proper uniform moisture content required to obtain the specified relative compaction. The Contractor shall water, or do whatever spreading, mixing and stockpiling is necessary to dry such materials, as the case may be, in order to obtain such proper moisture content.

Fill material that is segregated such that the maximum density of samples thereof varies by more than 5 pounds per cubic foot shall be thoroughly mixed by mechanical means before placement, or shall be compacted in alternate layers of each material, or shall be removed from the site and replaced with acceptable material, in accordance with Section 706.02, at no cost to the City.

Material deposited within two feet of final graded ground surface and of side slopes, the latter measured at right angles to the face of the slope, shall contain clay or other acceptable binder material in a proportion adequate to minimize erosion by wind and rain.

If there are insufficient excavated earth materials for completion of all required backfilling and embankment, the balance of fill material needed to bring the grades to the elevations shown on the plans shall be obtained, at no charge to the Contractor, from a specified on-site "borrow area." If there is no such borrow area, the Contractor shall, as approved by the Engineer, furnish at the site, where and in the quantities required to correct the deficiency, "Imported Fill Material" in accordance with the requirements therefor of Section 714.

Slopes shall be maintained to the grade and cross sections shown on the plans until the acceptance of the contract.

706.04 EMBANKMENT AND FILL LAYERS. - All embankment and fill, other than sand, shall be placed in horizontal layers not more than 8 inches thick before compaction, and each layer shall be satisfactorily compacted as and to the degree specified in Section 707.02 by means of suitable mechanical equipment. Flooding or jetting, in this case, will not be allowed.

Section 707.02 specifies methods of compaction where the material is sand or too sandy to be satisfactorily compacted by the usual tamping and rolling. In the case of compaction of such material by vibratory rollers the maximum thickness of layer may be increased to 3 feet.

In all cases, each layer material shall be satisfactorily compacted before placing the next layer thereon.

706.05 PLACING MATERIAL AGAINST SLOPES. - Slopes and slide areas upon which embankment or fill is to be placed shall have all loose material removed therefrom, and shall be benched in level terraces separated by vertical or nearly vertical slopes. Such stepped benches shall each be cut 4 feet horizontally into the slope, and may be cut progressively with the construction of embankment. Final cutting of each bench shall be with hand tools to undisturbed, compact, and stable materials. The material so removed may be incorporated in the Embankment, provided such material is in accordance with the requirements of Section 706.02.

706.06 PAYMENT. - Embankment will be paid for at the price bid per cubic yard of compacted embankment satisfactorily constructed, in place, within the limits shown or specified, or where directed, computed from cross sections between the ground surface existing at the start of the contract and the final graded ground surface, or prepared subgrade for the subbase, base, curb, sidewalk, or other construction for which the embankment is required, but not including backfilling specified to be done as Incidental Work.

If the Proposal does not contain a Bid Item for embankment, it shall be done as Incidental Work as set forth under Section 108.

Embankment to bring cleared ground back to the elevations of original ground shall be furnished and placed as Incidental Work.

SECTION 707

COMPACTION

707.01 GENERAL. - The Contractor shall do the work necessary to obtain the required compaction of subgrade, embankment, fill, and backfill materials. Compaction shall be obtained in accordance with the restrictions imposed by the applicable provisions of Sections 703, 706 and 709.

Tests of relative compaction, including determination of optimum moisture content and maximum density of backfill, fill, and embankment materials, will be made in accordance with Method "C" of ASTM "Standard Methods of Test for Moisture-Density Relations of Soils, Using 10-lb. Rammer and 18-in. Drop," Designation D 1557, ASTM "Standard Method of Test for Density of Soil in Place by the Sand Cone Method," Designation D 1556, and Methods "A" and/or "B" of ASTM "Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)," Designation D 2922. As stated therein, the term "relative compaction," used hereinafter regarding compaction of backfill or embankment, means the percentage ratio of the field-compacted dry density to the maximum dry density obtainable by compaction at optimum moisture content.

Density and compaction tests of in place compacted backfill, fill, or embankment, as the case may be, and of the materials used, required by the Engineer as the work progresses, will be conducted and evaluated by the City at no cost to the Contractor.

707.02 BACKFILL, FILL, AND EMBANKMENT AREAS. - The Contractor shall obtain a relative compaction of not less than 95% throughout each layer of all backfill, fill, and embankment constructed within 3 feet of pavement subgrade, or adjacent ground, as the case may be. Below the top 3 feet of backfill, fill, and embankment constructed, the relative compaction shall not be less than 90%.

Compaction of material too sandy to be satisfactorily compacted by the usual rolling and tamping shall be effected by watering to the point that the required compaction is obtained by rolling and tamping, or by the use of vibrating rollers or compactors.

707.03 CLEARED OR EXCAVATED AREAS. - The Contractor shall obtain a relative compaction of not less than 95% for the 6-inch layer of undisturbed material underlying all areas cleared, or from which existing pavement or excavated material has been removed, and which serve as subgrade for backfill, embankment, pavement subbase or base, curb, or pavement, as the case may be. Such compaction shall extend for a lateral distance of not less than 3 feet beyond the neat lines of such areas except where confined to a lesser lateral distance by lagging, or by existing construction to remain.

707.04 BACKFILL IN AREAS OF EXCESSIVE EXCAVATION AND AREAS OF REMOVED UNSOUND MATERIAL. Except as required by Section 708.01, 95% relative compaction shall be obtained in backfilling excavation in excess of that shown on the plans, including overbreak and that from which unsound subgrade materials have been removed.

707.05 FILTER MATERIAL. - When combined aggregate filter material in accordance with the requirements of Section 711 is placed as a layer in backfill, fill or embankment, such material, and the first 12-inch layer of backfill or embankment directly above it, shall be compacted by use of a vibratory compactor.

707.06 EQUIPMENT. - Unless otherwise specified, all compacting equipment shall be power equipment, and shall be capable of obtaining the specified compaction.

If, however, compaction is not sufficiently uniform, or tests show it to be inadequate, the Engineer may require placement in thinner layers or the use of other or additional equipment. Selection of such equipment shall be by the Contractor, and it shall be solely his responsibility to obtain the specified compactions throughout the required volume.

The use of heavy compacting equipment in areas immediately behind retaining walls will not be permitted, and in general only hand-portable power tampers or vibratory compactors will be approved for such compaction.

If small or hand-portable equipment is used, as for compacting narrow berm, confined areas, or behind retaining walls, the thickness of layers and other conditions shall be adjusted as required to obtain the specified compaction.

707.07 PAYMENT. - Compaction shall be done as Incidental Work and payment therefor shall be included in the price or prices bid.

SECTION 708

STRUCTURAL EXCAVATION

708.01 GENERAL. - The Contractor shall do all excavating necessary to obtain the subgrade required for the foundations, footings, slabs or other structural components of the contract work, including constructing related drainage facilities and doing other Incidental Work, all where and as shown on the plans and in accordance with the requirements set forth herein.

Excavation for the footing or foundation of any structure shall extend to undisturbed material. The last three inches of material excavated for footings and foundations shall be loosened and removed with hand tools to leave an undisturbed bed.

Where the slope of the bottom of the required excavation for footings or foundations is greater than 10 horizontal: 1 vertical, the Contractor, at no additional cost to the City, shall excavate "step footings" having a 4'- 0" minimum length of step and 2'- 6" maximum depth.

Excavations below the subgrade for footings and foundations shall be backfilled to the required subgrade by the Contractor at his own expense. Such backfilling shall be with Class 4-2000-1½ concrete.

708.02 PREPARATION OF SUBGRADE. - Subgrade shall be prepared to provide a satisfactory, uniform and compacted bearing surface for the construction.

Subgrade surfaces on which pile-supported concrete is placed shall be adequately prepared to assure proper support for the placed concrete until such concrete has sufficient strength to span and be supported solely by the piles.

708.03 PAYMENT. - Structural excavation shall be done as Incidental Work and payment therefor shall be included in the price or prices bid.

SECTION 709

STRUCTURAL BACKFILL

709.01 GENERAL. - The Contractor shall furnish, place and compact backfill from site excavated or other earth and concrete materials, all as required to bring all surfaces to the lines, grades and cross sections shown on the plans and cross sections, or that of the adjacent existing ground surface, as the case may be, including loading, hauling, stockpiling, depositing, watering and compaction, and all other Incidental Work, all in accordance with the requirements set forth herein.

709.02 STRUCTURAL BACKFILL MATERIALS. - Structural backfill shall consist of approved material, free from debris, wood, and other organic, unsound or deleterious matter, and from all other materials that will prevent or adversely affect thorough and permanent compaction and stability.

Materials, including those excavated at the site, yielding a maximum dry density of less than 112 pounds per cubic foot, when tested in the laboratory in accordance with the compaction test described in Section 707 shall not be used as structural backfill or fill.

The material used for structural backfill behind or around structures and appurtenant facilities shall have a sand equivalent value of not less than 30. The percentage composition by weight shall conform to the following grading:

<u>Sieve Size</u>	<u>Percentage Passing</u>
3-inch	100
No. 4	35-100

Lumps, rocks and concrete pieces measuring 3 inches or less in greatest dimension may be incorporated into backfill; and, if contained in backfill more than 4 feet deep, and satisfactorily distributed in earth or other fine materials, pieces not greater than 6 inches in greatest dimension may be so incorporated, provided that such latter pieces be not placed within 3 feet of finished grade or subgrade, nor in areas where piles are to be driven or drilled.

Rocks, concrete, or hard lumps of earth larger than allowed shall be broken up before compacting.

709.03 PROCEDURES. - All sand backfill, except that behind abutments and except pervious material and backfill behind retaining walls, shall be flooded or jetted, or compacted by other approved means, in horizontal layers not more than 3 feet thick. Flooding shall be such that, after 5 minutes, water will show on the surface.

Backfilling for facilities in street areas such as sewers, sewer structures, and the like, shall be as specified in Sections 703 and 707.

Flooding or jetting of sand will be prohibited where facilities or structures might be damaged, or adjacent materials softened, by the applied water.

All backfill, other than sand, shall be placed in horizontal layers not more than 8 inches thick before compaction, and each layer shall be satisfactorily compacted as and to the degree specified in Section 707.02, by means of suitable mechanical equipment. Flooding or jetting, in this case, will not be allowed.

Pervious material, sand, and filter material in accordance with Section 711, behind retaining walls and abutments shall not be flooded or jetted but shall be deposited in 8-inch layers and compacted with mechanical vibrators.

Compaction of sand and of pervious backfill shall be to the degree specified in Section 707.02.

In all cases, each layer of material shall be satisfactorily compacted before placing the next layer thereon.

Backfilling above or against any facilities to be constructed under the contract shall not commence until after such facilities have been properly constructed and inspected. Further, backfilling above or against poured-in-place reinforced concrete structures shall not commence until the concrete has attained a compressive strength of at least 2,500 pounds per square inch based on field cured cylinders. Backfill shall be placed in a manner not to disturb or damage such facilities of structures, nor subject them to unbalanced loads or forces.

Furthermore, structural members shall not be subjected to any live loads until the concrete has attained its 28 day compressive strength.

Backfill in front of a retaining wall shall be placed and compacted prior to backfilling behind such wall.

Backfilling behind the retaining walls shall not commence until a minimum of fourteen days have elapsed after construction of the wall.

At the time of compaction, materials to be incorporated in backfill, except sand, shall have the proper uniform moisture content required to

obtain the specified relative compaction. The Contractor shall water, or do whatever spreading, mixing and stockpiling is necessary to dry such materials, as the case may be, in order to obtain such proper moisture content.

The Contractor's attention is directed to the possibility of excessive lateral pressure on, and resultant damage to, retaining walls; he shall, therefore, exercise care in properly placing the backfill behind such walls. The use of heavy compacting equipment in areas immediately behind retaining walls will not be allowed, and all such compaction shall be done with portable equipment.

709.04 PAYMENT. - Structural backfilling shall be done as Incidental Work and payment therefor shall be included in the price or prices bid.

SECTION 710

PERVIOUS BACKFILL MATERIAL

710.01 GENERAL. - Pervious backfill material shall be furnished and placed where specified or shown on the plans and in accordance with the following requirements.

Pervious backfill material shall consist of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations thereof. Pervious backfill material shall conform to the following grading requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
2"	100
No. 50	0-100
No. 100	0-8
No. 200	0-4

That portion of pervious backfill material passing the No. 4 sieve shall have a Sand Equivalent of not less than 60.

Pervious backfill material shall be placed in horizontal layers along with and by the same methods specified for structural backfill. Pervious backfill material at any one location shall be of approximately the same grading, and at locations where the material would otherwise be exposed to erosion shall be covered with at least a one foot layer of earthy material approved by the Engineer.

710.02 PAYMENT. - Pervious backfill material shall be furnished and placed as Incidental Work and payment therefor shall be included in the price or prices bid.

SECTION 711

FILTER MATERIAL

711.01 GENERAL. - The Contractor shall furnish and place filter material, consisting of 3/4-inch combined aggregate in accordance with Section 800.06, where and as shown on the plans or specified, including doing all Incidental Work necessary or required.

Where specified or shown on the plans, the Contractor shall construct subdrainage facilities within or below volumes of backfill, fill or embankment. He shall furnish and place, in accordance with the requirements of Section 700.08, the required perforated drain pipe with the perforations down, filter material bed, layer of approved impervious material, and riprap drain troughs.

711.02 BEHIND RETAINING WALLS. - The Contractor shall furnish and place filter material behind retaining walls, for drains and otherwise, where and as shown on the plans or specified.

711.03 PAYMENT. - Filter material shall be furnished and placed as Incidental Work and payment therefor shall be included in the price or prices bid.

Filter material, if the Proposal includes a Bid Item therefor, satisfactorily furnished and placed, as specified, and where specified or directed, will be paid for at the price bid per ton, and shall be furnished saturated surface dry, the weight thereof subject to the deduction specified in Section 111.02.

SECTION 712

CRUSHED ROCK LAYER

712.01 GENERAL. - The Contractor shall furnish and install an 8-inch minimum thickness crushed rock layer including all necessary or required Incidental Work.

When a Bid Item for crushed rock is included in the Proposal, the Engineer will, under such a Bid Item, order crushed rock where necessary, in his opinion, to maintain an appropriately dry subgrade. Sanitary and storm water flow shall be handled and disposed of in accordance with the requirements of Section 301.

Crushed rock shall be uniformly graded from No. 4 to 3/4-inch sieve size.

The crushed rock layer shall be placed within the longitudinal limits and widths ordered by the Engineer. Such ordered widths will not exceed the outside width of the sewer, structure, or manhole base, as the case may be, plus two feet. Crushed rock placed in excess of the required minimum thickness, or outside the limits ordered by the Engineer, shall be at the Contractor's sole expense, and no direct or additional payment will be made therefor.

712.02 PAYMENT. - Crushed rock layer satisfactorily furnished and installed, in place, as specified, will be paid for at the price bid per square foot, measured horizontally within the limits ordered by the Engineer.

When subdrains are used in conjunction with a crushed rock layer, no reduction in the quantity of crushed rock will be made because of the construction of subdrains and related appurtenances within the layer.

SECTION 713

RIPRAP

713.01 GENERAL. - The Contractor shall furnish and place riprap to the lines, grades and depths shown on the plans, or where specifically ordered by the Engineer.

713.02 ROCK. - Rock for riprap will be hard, durable and not subject to disintegration by the action of air or water. When tested for soundness by the sodium sulphate test in accordance with the requirements of ASTM "Standard Method of Test for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate," Designation C 88, not more than 7 percent of the rocks tested after 5 cycles of immersion and drying shall show any of the following types of deterioration: (1) Disintegration; (2) Splitting; (3) Crumbling; (4) Cracking; (5) Flaking. Sound metamorphic sandstone and basalt will pass this test; shale, weathered sandstone and igneous rock subject to splitting in seams will not pass the test.

Percentage by weight of the various individual rock weights shall be as follows:

<u>Percent of Total Weight</u>	<u>Approximate Limits of Rock Weights</u>
40 percent.....	400 lbs to 200 lbs
35 percent.....	200 lbs to 50 lbs
25 percent.....	50 lbs to 2 lbs

No stone shall be less than 2 inches in diameter.

When required by the Engineer, samples of the rock shall be furnished by the Contractor and tested by the City at no cost to the Contractor.

713.03 PLACING. - Rock shall be well graded and placed to form a practicable minimum of voids. In general, the larger rocks shall be dumped first and the smaller rocks shall be dumped and distributed to fill the voids.

713.04 PAYMENT. - Riprap, satisfactorily furnished and placed as specified, will be paid for at the price bid per ton.

SECTION 714

IMPORTED FILL MATERIAL

714.01 GENERAL. - The Contractor shall furnish imported fill material at the site to supplement site-excavated materials required for embankment, fill, or backfill, including that required for backfilling voids left by the removal or abandonment of subsurface obstacles and by the specified removal of facilities and materials from below the required subgrade. The borrow site for imported fill material may be designated by the City.

The work, as applicable, shall include:

- 1) loading and disposing of by the Contractor as his property, a quantity of site-excavated material suitable for use as embankment or fill, equal in volume to the quantity of imported fill material furnished;
- 2) excavating and disposing of unsuitable material as necessary, in order to excavate from the borrow area, the material required for embankment of fill; and
- 3) all other necessary or required Incidental Work.

Imported fill material is defined as material to be used for embankment or fill, obtained by the Contractor elsewhere than from the site of the work, and shall be in accordance with the requirements of Section 706.

Before importing any fill material the Contractor shall incorporate into embankment and fill all site-excavated materials that meet the requirements for embankment.

Any satisfactory material required for embankment and removed from the site by the Contractor, or wasted as a result of his operations, shall be satisfactorily replaced at the site by him at his sole expense.

Imported fill material shall not be delivered to the work until the source has been approved and the material tested and approved as hereinafter specified.

Removal from a borrow area shall be in a manner to obtain thereon the grades shown on the plans.

714.02 TESTING. - The Contractor shall notify the Engineer, in writing, 30 days in advance of hauling imported fill material to the site of the work, of the location of the area and the exact portion thereof from which he will obtain imported fill material.

The Contractor, as Incidental Work, shall excavate test pits in the aforementioned area at least 4 feet square and extending 4 feet below the unacceptable overburden, to expose representative samples of the material.

The City, at no cost to the Contractor, will conduct and evaluate tests of samples from the test pits in its laboratory to determine the acceptability of such material.

Material which is not as specified will be rejected.

714.03 PAYMENT.

1. If the Proposal does not contain a Bid Item for imported fill material, or if the contract is on a lump sum basis, the furnishing, placing, and compacting of the quantity of imported fill material specified, or indicated on the plans, shall be done as Incidental Work and included in the price or prices bid.
2. If imported fill material is to be furnished, placed and compacted as Incidental Work, as in 1) above, and more is required than contemplated in the plans and Special Provisions, the furnishing, placing, and compacting of such excess will be paid for as Extra Work in accordance with the provisions of Section 112.
3. If the Proposal contains a Bid Item for imported fill material, such material satisfactorily furnished, placed and compacted where directed will be paid for at the price bid per cubic yard. Measurement for payment will be as set forth in the Special Provisions, and will be one of the following:
 - a. The aggregate volume, in place, of material satisfactorily furnished, computed from the cross sections between the ground surface existing at the start of the contract or the lower limit of pavement excavation, and the final graded ground surface or subgrade, as the cases may be.
 - b. The original volume, in place, of satisfactory material excavated from the borrow area and placed where required, computed by the average end area, or borrow pit, method.
 - c. Truck measurement, in accordance with the provisions of Section 111.03.
4. If a Bid Item for imported fill material occurs in a contract containing a Bid Item for embankment, the furnishing only of imported fill material to make up the deficiency of proper site excavated material will be paid for by truck measurement. All work to incorporate and compact imported fill material to the lines and grades of originally contemplated embankment or fill, shall be done as Incidental Work.

END PART 7