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CITY OF SEATTLE
Department of Public Works

•
**STANDARD PLANS
AND
SPECIFICATIONS**
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SIXTH EDITION

1944

CITY OF SEATTLE
DEPARTMENT OF PUBLIC WORKS

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STANDARD PLANS
and
SPECIFICATIONS

SIXTH EDITION
PREPARED BY THE CITY ENGINEER

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EXAMINED AND APPROVED BY
THE BOARD OF PUBLIC WORKS
SEPTEMBER, 14, 1944

G. W. ROBERGE, *Secretary.*

W. C. MORSE, *Chairman.*

CITY OF SEATTLE
DEPARTMENT OF PUBLIC WORKS

**STANDARD PLANS
AND
SPECIFICATIONS**

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CITY OF SEATTLE
DEPARTMENT OF PUBLIC WORKS

STANDARD PLANS AND SPECIFICATIONS

SECTION 1

GENERAL STIPULATIONS APPLICABLE TO ALL CONTRACTS

1-1 PLANS AND SPECIFICATIONS PART OF CONTRACT

These Standard Plans and Specifications, together with the laws of the State of Washington and the Charter and ordinances of the City of Seattle, so far as applicable, together with the special specifications, detailed improvement plans, proposal, and contract form prepared for each individual project and such additional detailed plans as may be required during the progress of the work, shall constitute the contract for the improvement and shall be considered as a whole.

The contract shall be held to cover any and all work, labor, implements and materials, including the use of compressed air, for whatsoever purpose used, and all other special methods of construction that could reasonably be required properly and satisfactorily to complete the work indicated. The special specifications and detailed improvement plans accompanying the proposal are intended to modify and shall take precedence over the standard specifications and standard plans. The work shown on the detailed improvement plans and not mentioned in the special specifications or vice versa shall be accomplished the same as if shown by both, and in case of conflict the decision of the City Engineer shall determine which shall govern. Whenever a reference is made to any section of these standard plans and specifications it shall be deemed to include the entire section, with all sub-heads under said section. Reference to one or more sections shall not limit the application of the standard plans and specifications to the sections referred to.

1-2 DIMENSIONS

All dimensions shall be taken from the figures on the plans and not by scaling the drawings.

1-3 MEANING OF TERMS

Whenever the term "City Engineer" is used herein, it shall be, and it is, understood to designate the City Engineer of the City of Seattle, and his duly appointed assistants or inspectors limited by the particular duties entrusted to them. Whenever the words "City" and "Board of Public Works" are used herein, they shall be, and are, understood to designate the corporation of the City of Seattle, of which the Board of Public Works is the duly authorized agent. Whenever the word "Contractor" is used herein, it shall be, and is, understood to designate the party or parties contracting to do any of the work described herein and to furnish materials therefor, or the duly authorized representatives of such party or parties.

Whenever the terms "Removed" or "Disposed of" are used herein as applied to waste or condemned material, such terms shall be, and are, understood to mean the complete destruction of such materials, by fire, or their removal from within the limits of the improvement district.

1-4 REFERENCES

Whenever in these specifications a reference is made to a standard specification, method of testing, or procedure, set up by a recognized agency, such as the American Society for Testing Materials or West Coast Lumbermen's Association, such reference shall pertain to the latest revision thereof.

1-5 ABBREVIATIONS

Whenever the following abbreviations are used on the plans, specifications, proposals and contracts, they shall be construed to mean the words and terms as listed below:

A.....Acre
A. C.....Alley Crossing
Adj.....Adjust
Adj. W. M.....Adjust Watermains
Arm. Conc. Cb.....Armored Concrete Curb
Asp. Pav.....Asphalt Pavement
Asp. Conc. Pave.....Asphaltic Concrete Pavement
A. S. T. M.....American Society for Testing Materials

Section 1

GENERAL STIPULATIONS

Ave.....	Avenue
B. D.....	Box Drain
Bk.....	Book
Blvd.....	Boulevard
Br. Ch.....	Brick Valve Chamber
Br. Gutters.....	Brick Gutters
Br. In.....	Break In
Br. Pav.....	Brick Pavement
Br. Sew.....	Brick Sewer
C. B.....	Catch Basin
C. B. (etc.) #.....	C. B. (Etc.) moved to position shown
C. C. P.....	Centrifugally Cast Pipe
Cb. Inlet.....	Curb Inlet
C. I. P.....	Cast Iron Pipe
C. I. V. B.....	Cast Iron Valve Box
C. L.....	Center Line
Conc.....	Concrete
Conc. Cb.....	Concrete Curb
Conc. Pav.....	Concrete Pavement
Conc. Ret. Wall.....	Concrete Retaining Wall
Conc. Sew.....	Concrete Sewer
Cond.....	Conduit
Conn.....	Connect
Cor. C. W.....	Corrugated Concrete Sidewalks
Cr.....	Cross
C. R.....	Curb Radius
C. S. S.....	Concrete Side Stop
C. to C.....	Center to Center
C. W.....	Concrete Sidewalks
C. X. W.....	Concrete Cross Walks
D. B.....	Drift Bolt
Dr.....	Drive or Driveway
E.....	East
Elev.....	Elevation
Ell. C. B.....	Elliptical Catch Basin
Em.....	Embankment
Ex.....	Existing
Exc.....	Excavation
F. A. H.H.....	Fire Alarm Handhole
F. A. L. P.....	Fire Alarm Lamp Post

CITY OF SEATTLE

Section 1

Ft.....	Foot or Feet
F. T.....	Flush Tank
G. I. P.....	Galvanized Iron Pipe
G. Stl. P.....	Galvanized Steel Pipe
G. V.....	Gate Valve
H. E. S.....	High Early Strength
H. H.....	Handhole
Hyd.....	Hydrant
Hyd. Ext.....	Hydrant Extension
I. C.....	Integral Curb
In.....	Inch
Inl.....	Inlet
L.....	Length
Lbs.....	Pounds
L. C. Cable.....	Lead Covered Cable
Loc.....	Location
L. P.....	Lamp Post
M.....	Margin
M. C.....	Monument Case
M. H.....	Manhole
N.....	North
No.....	Number
O. D.....	Open Drain
Pav.....	Pavement
P. B. T.....	Post Base Transformer
P. C.....	Point of Curvature
P. J. M.....	Premoulded Expansion Joint Material
Pl.....	Place
Plk.....	Planking
Pos.....	Position
Pri.....	Primary
Prop.....	Proposed
P. S.....	Pipe Sewer
P. T.....	Point of Tangency
Pvt. Dr.....	Private Driveway
R.....	Radius
R. C. Wire.....	Rubber Covered Wire
Reb.....	Rebuild
Reconn.....	Reconnect
Rem.....	Remove

Repl.....	Replace
S.....	South
S. B.....	Sand Box
S. C. P.....	Sand Cast Pipe
Sec.....	Secondary
Sew.....	Sewer
S. P. & S.....	Standard Plans and Specifications of the City of Seattle
Sp.....	Special
S. S.....	Side Sewer
Std.....	Standard
Stl.....	Steel
Sub. Dr.....	Sub Drain
Temp. W. W.....	Temporary Wood Walks
Temp. Inlet.....	Temporary Inlet
Temp. Plk.....	Temporary Planking
Temp. X. Walks.....	Temporary Cross Walks
Trans.....	Transformers
V. C.....	Vertical Curve
V. Ch.....	Valve Chamber
W.....	West
W. B.....	Warning Beacon
W. M.....	Watermain
W. M. H.....	Wood Manhole
W. M. H. Ext.....	Wood Manhole Extension
Wood B. H.....	Wood Bulkhead
Wood C. & G.....	Wood Curb and Gutter
Wood B. S.....	Wood Box Sewer
W. P.....	Working Point
W. S. P.....	Wood Stave Pipe
W. V. B.....	Wood Valve Box
X. Walks.....	Cross Walks
Yd.....	Yard

1-6 ERRORS AND OMISSIONS

The Board of Public Works will not take cognizance of claims of errors or omissions made by bidders on public work, when such claims are made after the opening of the bids, but that in all cases any relief afforded the bidder must be secured by court action.

**1-7 BIDDERS TO MAKE EXAMINATION—UNFORE-
SEEN CONDITIONS**

Bidders are required to read and examine carefully the plans and specifications, contract, and other forms governing the work embraced in this improvement. The plans show the location and extent of the area to be improved and the profiles and other drawings show conditions as they are believed to exist, but it is not intended or inferred that the conditions shown constitute a representation by the City that such conditions are actually existent. The contractor assumes the risk of unforeseen conditions and agrees to complete the work under whatever circumstances that may develop.

The bidders shall examine the location and surroundings of the proposed improvement and judge for themselves the nature of the work to be accomplished, the proper method of doing the work, and all conditions affecting performance. The contractor agrees that he has satisfied himself by his own investigation and research regarding all conditions and that his conclusion to enter into the proposed contract is based upon such investigation, and that he will make no claim against the City because any of the estimates, tests, or representations of any kind affecting the work made by any officer or agent of the city may prove to be in any respect erroneous.

1-8 QUANTITIES FURNISHED TO BIDDERS

Quantities listed on the quantity sheet are for the purpose of comparing bids only and may be increased or diminished. Payment shall be made *only* for the actual quantities included in the finished work and at prices stated in the bid, provided, however, that no payment shall be made for unauthorized work or material not shown on the plans or specified.

1-9 FEES AND ROYALTIES

All fees, royalties and costs arising from patents, trade marks and copyrights in any way involved in or connected with the work or with these specifications, shall be included in the price stated in the bid, and the contractor shall appear and defend and indemnify and save harmless the City from any and all claims for infringement or for such fees and royalties by reason of the use of any such patented invention, design, device, material or process; and shall indemnify said City from any cost, expense and damages which it may be obliged to pay by reason of any such infringe-

ment, or use, whether such demands or claims be filed during the life of the contract or after its completion.

1-10 CONTRACT—WHEN TO TAKE EFFECT

The contract for this improvement shall not take effect or be in force until the approval of the contractor's bond by the Mayor and the City Comptroller, and until same shall be filed with the City Comptroller as required by law.

1-11 ASSIGNMENT OF CONTRACT

No assignment of the moneys to become due under any such contract shall be made without the written approval of the contractor's bondsmen and the consent of the Board of Public Works being first obtained and endorsed thereon. Such assignment, however, shall not release the contractor or his sureties from any obligations or liabilities arising under or because of said contract.

1-12 SUBLETTING OF CONTRACT

Any person or persons, or any firm or corporation, entering into a sub-contract or other agreement with the contractor to furnish labor or material for or upon any improvement constructed under these specifications, shall be deemed an employee of the contractor; and any such person or persons, or the employees of any such firm or corporation, when employed directly upon such improvement, shall be subject to all the provisions respecting workmen, orders, rates and payment of wages, hours of labor, and all other provisions regarding employees herein specified.

The contractor alone, subject to the provisions of his surety bond, shall be held responsible for the full and faithful performance of the contract.

1-13 ORDERS TO BEGIN WORK

The contractor shall begin the work at such points as the City Engineer may direct, and shall comply with his directions as to the order of time in which the different parts of the work shall be done.

1-14 USE OF STREETS

The contractor shall secure a permit from the City Engineering Department to occupy with machinery, tools or materials any street area outside the boundaries of this improvement district.

1-15 ACCOMMODATIONS FOR EMPLOYEES

The contractor shall erect and maintain at all times while men are employed upon the work a building where workmen may take

their lunches, change clothes, etc., and he shall provide such sanitary facilities and first aid equipment as are or may be required by the laws of the State of Washington and ordinances of the City of Seattle.

1-16 WORKMEN

All workmen employed shall be competent and skilled in the performance of the special work to which they may be assigned. Whenever the contractor is not present on the work, orders may be given to the superintendent or overseer who may have immediate charge thereof. If any person employed on the work shall refuse or neglect to obey the directions of the City Engineer, or in the opinion of the City Engineer shall be incompetent, unfaithful, disorderly or otherwise unsatisfactory, he shall, upon the order of the City Engineer, be at once discharged and not again employed upon any part of the work. Any person so discharged shall, however, have the right of appeal to the Board of Public Works, whose decisions shall be final and conclusive.

1-17 LABOR PREFERENCE

Preference in the employment of labor shall be in accordance with the laws of the State of Washington, Charter and ordinances of the City of Seattle.

1-18 RATES OF WAGES

The contractor shall pay or cause to be paid to his employees on the work herein specified not less than the scale of wages fixed for the City of Seattle by the United States Department of Labor, so long as said department continues to establish such rates. Otherwise, he shall not pay less than such rates as shall have been established by City ordinances, and in any event not less than the minimum prescribed by the City Charter.

1-19 PAYMENT OF WAGES

The contractor agrees to perform said contract according to the terms, conditions and stipulations, and to pay as they become due all just claims for all work and labor performed on or about said work, and all skill or labor and material purchased for or furnished in the execution of the contract, and further agrees to comply with all the provisions of state law and with all the requirements of the charter and ordinances of the City and the amendments thereto; and the City of Seattle may withhold from payments due to the contractor under this contract such sums as

will fully cover such claims, and such retained sums shall not be paid to the contractor until a sufficient release from such claimant, endorsed by the surety of said contractor, shall be presented to and approved by the Board of Public Works to guarantee that the provisions of this section have been fully complied with.

The City Comptroller shall not pay to the contractor any portion of the amount due on this contract, unless at the time of payment of all claims, filed with the City Comptroller for material purchased or labor performed thereon, shall have been fully paid. If at any time during the progress of this improvement it shall appear to the City Comptroller that the contractor has neglected, refused or failed to pay in cash for any labor performed thereon, and that time checks or other evidences of indebtedness have been issued by such contractor, then the City Comptroller, upon presentation to him of such time checks or other evidences of indebtedness, shall issue to such labor claimants a warrant or warrants therefore upon the improvement contingent fund. The City Comptroller shall charge the amount of all warrants so issued against the account of the contractor for this improvement, and shall deduct the amounts thereof, together with a penalty of ten per cent. (10%) thereon, from the next or succeeding payments to be made to said contractor. Any sum or sums so paid may be deducted from the eighty-five per cent. (85%) to be paid to such contractor, as provided in this contract, or from any other sum or sums due said contractor.

1-20 CONTRACTOR RESPONSIBLE FOR WORK DONE

The contractor shall furnish for the prices bid, all skill, labor, materials and equipment required for the complete performance of the contract, and shall fully complete the work in accordance with the plans and specifications. He shall be responsible for the entire contract and shall maintain the same for a period of thirty (30) days after the final acceptance of the improvement by the Board of Public Works and shall replace and make good all damaged work that may be evidenced. But the acceptance of the work, and the release of the same, shall not prevent the City from making claim against the contractor for any uncompleted or defective work if the same is discovered within two years from the date of such release. The fact that an inspector was present during the progress of any construction shall not relieve the contractor from

responsibility for defects discovered after the completion of the work.

1-21 CHANGES IN PLANS AND QUANTITIES

The City Engineer, with approval of the Board of Public Works, reserves the right, by proper order in writing, to make changes in the plans for this improvement, to make variations in the quantity of the work to be done, and to eliminate any of the items of work at any time, either before the commencement or during the progress of the work, without thereby altering or invalidating any of the prices herein named. In case such action should diminish the amount of work, no claim shall be allowed for damages on the ground of loss of anticipated profits. Provided, that if such action should be taken after the commencement of any particular piece of work, and should thereby result in extra cost to the contractor, the City Engineer, with the approval of the Board of Public Works, shall make a fair and equitable estimate of the amount to be allowed therefor, which shall be accepted as final by both parties to such contract.

1-22 CLAIMS FOR EXTRAS AND FORCE ACCOUNT WORK

If, for any reason, extra work should be ordered by the City Engineer, with the approval of the Board of Public Works, and a price for such work has not been agreed upon, it shall be paid for as follows:

—22.01 For all labor and foreman in direct charge of the specific operation, the contractor shall receive an amount equal to the current wages paid such labor and foreman, for the time actually engaged in such work, plus an amount equal to 15% thereof.

—22.02 For all materials used, the contractor shall receive the actual cost thereof, exclusive of sales tax, to which amount shall be added 15% thereof.

—22.03 For any machine power tools or equipment which the engineer may deem necessary or desirable to use, the contractor will be allowed a reasonable rental price, to be agreed upon in writing before such work is begun, for each and every hour that said tools or equipment are in use on such work and to which sum no percentage shall be added. Said rental price shall be full compensation also for fuel, lubricants, repairs, transportation and all other expenses incidental to the use of said tools and equipment,

except labor for operation thereof.

—22.04 The contractor shall be allowed compensation for payments made to the State Department of Labor and Industries which are occasioned by extra work. These payments shall include Industrial Insurance premiums and 50% of the Medical Aid payments. Compensation for such premium shall be in the amount of the actual payments made by the contractor to which no percentage will be added.

—22.05 The compensation as herein provided shall be payment in full for all work done on a "cost plus" basis and shall cover all expenses of every nature, kind and description, including overhead expenses, payments required under the Social Security Act, State Unemployment Compensation Act, Occupational Tax and any other Federal or State revenue acts, together with all premiums on Public liability and property damage insurance policies, use of small tools and equipment for which no rental is allowed, and profit, provided, a separate payment, covering sales tax, will be made, in accordance with the State Revenue Act of 1935 and later amendments thereto, on all force account work involving the construction of a facility which does *not* fall within the meaning of the clause "Publicly owned street, place, road, highway, bridge or trestle which is used or is to be used primarily for foot or vehicular traffic, . . ." as defined in "Rules relating to The Revenue Act" issued by the Excise Division of the Tax Commission of the State of Washington revised May 1, 1943.

The amount and cost of any such extra or force account work shall be computed by the City Engineer and the amount certified to by him shall be final and conclusive and binding upon the contractor. No claims for extras under this contract will be allowed unless a memorandum of such work signed by the contractor and approved by the City Engineer be furnished the latter as soon as possible, and in any event not later than the 20th of the month following.

1-23 INSPECTION AND TESTING OF MATERIALS

All material shall be subject to inspection by the City Engineer. He shall select samples of such material and subject the same to such tests as may be necessary to determine whether their qualities conform to the requirements herein specified, and he shall accept or reject the materials in accordance with the results of such tests. Such tests shall be repeated as frequently as may be necessary to

insure the rejection of all materials which fail to comply with the provisions of the plans and specifications. All materials rejected by the City Engineer shall be removed from the work and adjacent surroundings by the contractor at his own expense within forty-eight (48) hours after he has been notified of their rejection. If this condition is not strictly complied with, the City Engineer reserves the right to have such rejected materials removed by other parties and the cost of such removal shall be deducted from any moneys which may be or become due and payable to the contractor.

In order to facilitate the inspection of materials, or the preparation, manufacture or fabrication of materials, the City Engineer or his authorized representative shall at all times have free access to any shop, plant, or other place where such materials are being prepared and/or manufactured.

The contractor shall furnish the City Engineer, without charge, such samples of materials proposed to be used as may be necessary to make sufficient tests to determine the character of said materials.

1-24 LAYING OUT OF WORK

When required, the City Engineer shall lay out the work and furnish all necessary grades and locations in connection therewith, upon forty-eight (48) hours written notice from the contractor. The contractor shall furnish and keep on the work at all times a spirit-level and straight-edge of such form and size as may be directed by the City Engineer. The contractor shall carefully preserve all reference points and stakes, and in case of wilful and careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes caused by their loss or disturbance.

1-25 USE OF WATER, LIGHT AND POWER

The contractor shall take out and pay for all permits required by the City. He shall not draw water from any hydrants until the required permit has been secured. All water, electric light, or power used by the contractor on this improvement shall be paid for at the current rates and the cost of the same shall be included in the prices bid for the various items in this improvement.

The contractor shall be allowed to operate hydrants only by the use of a hydrant wrench or key made to fit the hydrant valve

stems, and any damage resulting to city hydrants while in use by the contractor shall be repaired by the Water Department, and the cost of such repairs shall be paid by the contractor.

Hydrants shall be inspected by the Water Department prior to the beginning of work upon any contract. No charge will be made for this inspection. Upon completion of the work, hydrants will again be inspected by the Water Department and the cost of such latter inspection, together with the cost of repairing any damages to hydrants, shall be paid by the contractor.

Whenever fills or backfills in trenches are water settled, the water used shall be taken from the mains or hydrants of the City Water Department. The contractor shall furnish all hose and other implements necessary for water settling.

The yardage of earth upon which the charge for water shall be made shall be the total volume of earth in the fill or trench where water settling is used, and no deduction of any kind shall be made for any effect which ground water or rain water may have upon the settlement of the fill or backfill.

The rates for use of water other than measured by meters shall be known as "Flat Rates" and shall be as follows:

Earthwork, for settling each 100 cubic yards of earth.....	\$1.40
Pre-mix C. W., per 100 square yards.....	0.10
Concrete Sidewalks, per 100 square yards.....	0.50
Pavement, 6" or less, per 100 square yards.....	0.50
Pavement, 6 1/4" or over, per 100 square yards.....	0.75
Curing Pavement, Standard Cement, per square yard.....	0.02
Curing Pavement, Early Strength Cement, per square yard....	0.01

Water used for all other purposes not herein enumerated shall be furnished and charged for either at meter rates or a special rate to be fixed by the Superintendent of Water.

1-26 INTERFERENCE WITH EXISTING UTILITIES

Whenever an existing public utility interferes with the actual construction of any improvement and the moving of the same has not been specially included in the contract, such public utility shall be moved by the department, district, or other agency, charged with the operation of the same.

Whenever an existing privately owned utility, occupying space in the street by permit or franchise, interferes with the actual construction of any improvement, such utility shall be moved by the person, company, or corporation owning the same.

Provided, however, that except when otherwise especially specified, no utility, either publicly or privately owned, shall be moved to accommodate the contractor's equipment or methods of operation when such utility does not interfere with the improvement under construction unless the cost of such work be borne by the contractor.

1-27 PROTECTION OF WORK AND PROPERTY

The contractor shall at his own expense shore up, protect, and make good as may be necessary all buildings, walls, fences, or other property injured or likely to be injured during the progress of the work, and shall be held responsible for all damage to neighboring property, streets, or improvements resulting from his neglect to exercise proper protection in the prosecution of the work.

Whenever it may be necessary for the contractor to trench through any lawn area the sod shall be carefully cut and rolled and replaced after ditches have been water settled or otherwise properly compacted. All such work shall be done in a manner calculated to leave the lawn area clean of earth and debris and in a condition as near as possible to that which existed before work began.

The contractor shall not remove, even temporarily, any trees or shrubs which exist in parking strip areas or easements across private property without first having notified the property owners, or in the case of public parks the authorities maintaining the same.

Payment for the above work shall be included in the unit prices bid for the item or items which required doing the work in such manner.

1-28 PRESERVATION OF MONUMENTS

The contractor shall not disturb any survey monuments or hubs found on the line of the improvements until ordered to do so by the City Engineer. A penalty of twenty-five dollars (\$25.00) shall be imposed for every monument or hub disturbed without such orders, twenty-five dollars being the estimated cost of re-establishing such location.

1-29 DAMAGE TO EXISTING IMPROVEMENTS

All damage done to existing improvements during the progress of the work, through fault or negligence of the contractor, shall be repaired by the contractor under the direction of the City Engineer. Materials for such repair shall conform to the requirements

of these specifications. If upon being ordered, the contractor fails to furnish the necessary labor and materials for such repairs, the City Engineer may cause said necessary labor and materials to be furnished by other parties, and the cost thereof shall be deducted from any moneys which may be or become due and payable to the contractor by reason of work performed or materials furnished for any part of this improvement. No payment to the contractor shall be made for this work.

1-30 CONSTRUCTING UTILITIES UNDER PAVEMENT —RESTORING PAVEMENT

Whenever it is necessary to break through existing pavement for the purpose of constructing a sewer, side sewer, outlet to catch basin, watermain, or any similar utility, the contractor shall remove the pavement to a width six (6) inches greater on each side than the width of the trench. The contractor shall use such methods, either by drilling or chipping, as will assure breaking of the pavement along straight lines. The face of the remaining pavement shall be approximately vertical.

Backfilling of open cuts in pavement and the restoring of the pavement shall be done by the City Engineering Department, and the cost thereof borne by the contractor as specified in Section 1-40.

If the contractor elects to tunnel under the pavement, it shall be adequately supported by timbering and shall be approved by the City Engineer. Backfilling of tunnels shall be done by the City Engineering Department, and the cost thereof shall be borne by the contractor as specified in Section 1-40.

No separate payment shall be allowed for the additional cost entailed in constructing such facilities under pavement, nor for the restoring of the pavement. Payment for the cost thereof shall be considered as included in the unit price bid for the item or utility which necessitated construction in such manner. Asphalt surfacing shall be paid for as provided in Section 1-40.

1-31 PROTECTION TO UTILITIES

The contractor shall support and protect by timbers or otherwise, all pipes, conduits, poles, wires or other apparatus which may be in any way affected by the work, and do everything necessary to support, sustain and protect the same, under, over, along or across said work. In case any of said pipes, conduits, poles, wires or apparatus should be damaged they shall be repaired by

the authorities having control of the same, and the expense of such repairs shall be charged to the contractor.

The contractor shall further be responsible for any damage done to any street or other public property, or to any private property by reason of the breaking of any water pipe, sewer, gas pipe, electric conduit, or other utility by or through the negligence of the contractor.

The contractor shall inform himself as to the existence and location of any underground utilities the existence and location of which are of record in the various city departments and protect the same against damage.

Provided, however, that whenever the contractor elects to construct a main sewer by means of a trenching machine or power shovel, on a street in which a standard watermain exists, all water services crossing the sewer line shall be removed for the passage of such machine and replaced after the excavation has been completed. This work will be done by the Water Department and the cost thereof shall be borne by the improvement and paid for as outlined in Section 1-39. This provision shall apply to water services only and shall not include watermains.

1-32 PROVISION FOR SEWER, WATER AND GAS CONNECTIONS

The City of Seattle reserves the right to construct and reconstruct any sewer or sewers and appurtenances, to lay and adjust any watermains and appurtenances, set poles, or install or adjust any other public utility, and to grant permits to lay gas mains, steam pipes and conduits and other utilities, and to make private connections with sewer, water, gas or steam pipes, at any time during the progress of the work. The contractor shall not interfere with or place any impediment in the way of any person or persons who may be engaged in doing such work. The Board of Public Works reserves the right to suspend the work on any part of this improvement at any time during the construction of the same, for the purpose above stated. In any such case the contractor shall not be entitled to any damages, either for the digging up of the street, or for the delay, but he shall be paid for any additional material or for labor furnished by him either at contract rates or such reasonable sum as may be agreed upon.

of these specifications. If upon being ordered, the contractor fails to furnish the necessary labor and materials for such repairs, the City Engineer may cause said necessary labor and materials to be furnished by other parties, and the cost thereof shall be deducted from any moneys which may be or become due and payable to the contractor by reason of work performed or materials furnished for any part of this improvement. No payment to the contractor shall be made for this work.

1-30 CONSTRUCTING UTILITIES UNDER PAVEMENT —RESTORING PAVEMENT

Whenever it is necessary to break through existing pavement for the purpose of constructing a sewer, side sewer, outlet to catch basin, watermain, or any similar utility, the contractor shall remove the pavement to a width six (6) inches greater on each side than the width of the trench. The contractor shall use such methods, either by drilling or chipping, as will assure breaking of the pavement along straight lines. The face of the remaining pavement shall be approximately vertical.

Backfilling of open cuts in pavement and the restoring of the pavement shall be done by the City Engineering Department, and the cost thereof borne by the contractor as specified in Section 1-40.

If the contractor elects to tunnel under the pavement, it shall be adequately supported by timbering and shall be approved by the City Engineer. Backfilling of tunnels shall be done by the City Engineering Department, and the cost thereof shall be borne by the contractor as specified in Section 1-40.

No separate payment shall be allowed for the additional cost entailed in constructing such facilities under pavement, nor for the restoring of the pavement. Payment for the cost thereof shall be considered as included in the unit price bid for the item or utility which necessitated construction in such manner. Asphalt surfacing shall be paid for as provided in Section 1-40.

1-31 PROTECTION TO UTILITIES

The contractor shall support and protect by timbers or otherwise, all pipes, conduits, poles, wires or other apparatus which may be in any way affected by the work, and do everything necessary to support, sustain and protect the same, under, over, along or across said work. In case any of said pipes, conduits, poles, wires or apparatus should be damaged they shall be repaired by

the authorities having control of the same, and the expense of such repairs shall be charged to the contractor.

The contractor shall further be responsible for any damage done to any street or other public property, or to any private property by reason of the breaking of any water pipe, sewer, gas pipe, electric conduit, or other utility by or through the negligence of the contractor.

The contractor shall inform himself as to the existence and location of any underground utilities the existence and location of which are of record in the various city departments and protect the same against damage.

Provided, however, that whenever the contractor elects to construct a main sewer by means of a trenching machine or power shovel, on a street in which a standard watermain exists, all water services crossing the sewer line shall be removed for the passage of such machine and replaced after the excavation has been completed. This work will be done by the Water Department and the cost thereof shall be borne by the improvement and paid for as outlined in Section 1-39. This provision shall apply to water services only and shall not include watermains.

1-32 PROVISION FOR SEWER, WATER AND GAS CONNECTIONS

The City of Seattle reserves the right to construct and reconstruct any sewer or sewers and appurtenances, to lay and adjust any watermains and appurtenances, set poles, or install or adjust any other public utility, and to grant permits to lay gas mains, steam pipes and conduits and other utilities, and to make private connections with sewer, water, gas or steam pipes, at any time during the progress of the work. The contractor shall not interfere with or place any impediment in the way of any person or persons who may be engaged in doing such work. The Board of Public Works reserves the right to suspend the work on any part of this improvement at any time during the construction of the same, for the purpose above stated. In any such case the contractor shall not be entitled to any damages, either for the digging up of the street, or for the delay, but he shall be paid for any additional material or for labor furnished by him either at contract rates or such reasonable sum as may be agreed upon.

1-33 PROVISION FOR WATER COURSES

The contractor shall provide for the flow of all water courses, sewers or drains, intercepted during the progress of the work, and shall replace the same in as good condition as he found them or shall make such final provisions for them as the City Engineer may direct.

The contractor shall not obstruct the gutter of any street, but shall use all proper measures to provide for the free passage of surface water.

The contractor shall make provision to take care of all surplus water, mud, silt, slickings, or other run-off pumped from excavations or resulting from sluicing or other operations, and shall be responsible for any damage, of whatever nature, resulting from his failure so to provide.

No direct payment shall be allowed for the above work. Payment for the cost thereof shall be included in the prices bid for the various items which comprise the improvement.

1-34 MAINTAINING TRAFFIC

The contractor shall not obstruct travel unnecessarily and shall cause as little inconvenience as possible to occupants of abutting property and to the general public. He shall erect and maintain suitable timber bulkheads to confine earth from trenches or other excavations, in order to encroach upon sidewalks or paved roadways as little as possible. He shall construct and maintain adequate and safe crossings over excavations and across streets under improvement to accommodate vehicular and pedestrian traffic.

Vehicular crossings shall be constructed of plank, timbers and blocking of adequate size to safely accommodate vehicular traffic. Decking shall be not less than four (4) inches thick and shall be securely fastened together with heavy wire and staples.

Pedestrian crossings shall consist of plank three (3) inches thick, twelve (12) inches wide and of length required, together with necessary blocking. The walk shall be not less than three (3) feet in width and shall be provided with a railing, if required by the City Engineer.

The material used in the above crossings shall remain the property of the contractor and if still in good condition may be re-used.

Payment shall be made at the price bid per M Ft. B.M. for "Temporary Planked Timber Crossings" and for "Temporary

Footways," which price shall be in full for all labor and material necessary to furnish, erect, maintain and remove said crossings as directed by the City Engineer, provided no payment shall be allowed for maintaining traffic, as above specified, unless bid items therefor are included in the proposal for the improvement. When no bid is taken for such work it shall be construed that payment for the cost thereof shall be included in the prices bid for the various items which comprise the improvement.

1-35 CONTRACTOR TO MAINTAIN GUARDS

The contractor shall erect and maintain good and sufficient guards, barricades, signals, and standard "Street Closed" and "Detour" signs at all unsafe places on the work, and shall indemnify and save harmless the City of Seattle from all suits and actions of every name and description brought against the City for, or on account of, any injuries or damages received or sustained by any party or parties by reason of the failure to erect or maintain such guards, barricades or signals, or by reason of any negligence of said contractor or his agents or employees, in carrying on said work, or on account of any act or omission of said contractor in the performance of said work; and so much of the money which shall be due the contractor under and by virtue of the contract for this improvement as shall be considered necessary by BPW, may be retained by the City, until all suits or claims for damages as aforesaid shall have been settled, and evidence to that effect is furnished to the satisfaction of said Board of Public Works. Such amount shall be in addition to the percentage reserved as otherwise herein provided.

Wherever the Standard Specifications require that an improvement be closed to traffic for a definite length of time or for a period as directed by the City Engineer, the contractor shall completely barricade each street, alley, driveway, or other unprotected place leading to the improvement with barriers as shown on page 29.

No direct payment shall be allowed for the above work. Payment for the cost thereof shall be included in the prices bid for the various items which comprise the improvement.

1-36 INJUNCTIONS

If the contractor, or the City of Seattle, shall be unable to complete any portion or portions of this improvement by reason of

court proceedings, enjoining the construction or completion of any portion or portions thereof, and if it shall be deemed impracticable by the City Engineer to construct or complete any other portion or portions thereof, then, and in any such case, the contractor shall waive any and all claim or claims for damages by reason of such inability to construct such portion or portions of said improvement, and the City Engineer reserves the right to report such improvement completed and file his final estimate thereon as though such improvement had been fully completed, and such contractor shall accept in full settlement and as a cancellation of his contract, a sum of money for labor performed, and for materials furnished, in strict accordance with his bid for such contract, on the basis of the work actually performed or materials and labor actually furnished in said work to the date of stopping thereof. Should the court proceedings allow the work to be resumed prior to the issuance of the notice of completion on said work by the City Engineer, then the contractor, on being so ordered by the City Engineer, shall proceed with the work immediately, carrying out the contract in full, according to all original intents, or modifications of the court, as the case may be, at the prices specified in the contract, and no extra payment shall be allowed said contractor for change in price of material or labor or for any other reason whatever.

1-37 INTERFERENCE WITH OTHER CONTRACTS

The Board of Public Works reserves the right to suspend the work on any portion of this contract whenever it interferes with the work on any other contract.

The City Engineer shall determine which contractor shall have the right of way.

1-38 EXTENSION OF TIME

The contractor shall not be entitled to any claim for damages by reason of any hindrance or delay from any cause whatever, in the progress of the work or any portion thereof; but such detention may entitle said contractor to a reasonable extension of time for completing this contract; provided the City Engineer and the Board of Public Works shall have immediate notice in writing of the cause of such detention, and shall consider such cause sufficient.

1-39 BILLS OF CITY DEPARTMENTS AGAINST LOCAL IMPROVEMENT DISTRICTS—HOW PAID

The contractor shall pay in cash all bills rendered against the local improvement district by any city department, when properly approved by the City Engineer, and shall accept warrants or bonds equal to the amount of such bills. These bills shall be paid without any additional percentage being allowed. As far as practicable the amount of such bills shall be estimated and shown on the proposal blank for the improvement.

1-40 BILLS OF CITY DEPARTMENTS AGAINST CONTRACTOR

Bills due the city for which the contractor is liable, also all fees or excise taxes due the City by reason of the contract, shall be promptly paid by the contractor, and if not so paid shall be deducted from any money due or to become due the contractor.

1-41 INDUSTRIAL INSURANCE AND MEDICAL AID

The contractor shall pay into the City Treasury, or to the Industrial Insurance Commission of the State of Washington, in cash, the amounts required to be paid to the State of Washington by Section 7676, Remington Compiled Statutes 1927 Suppl., or any amendment thereto (Workmen's Compensation Act) on account of this contract before payment is made to him by the City on any estimate, and final payment shall not be made until the contractor shall have complied with the provisions of this section.

1-42 ESTIMATES AND PAYMENTS WHEN FINANCED BY L. I. D. BONDS

There shall be reserved from the moneys earned by the contractor on estimates during the progress of the improvement, or work, a sum equal to fifteen per cent (15%) of such estimates as a trust fund for the protection and payment of any person or persons, mechanics, subcontractors or material men who shall perform any labor upon such contract or the doing of said work, and all persons who shall supply such person or persons or subcontractors with provisions and supplies for the carrying on of such work. Said fund shall be retained for a period of thirty (30) days following the final acceptance of said improvement or work as completed, and every person performing labor or furnishing supplies towards the completion of said improvement or work shall have a lien upon such fund so reserved; provided, such notice of the lien of such claimant shall be given in the manner and within the time

provided by the laws of the State of Washington; provided, however, that where in any improvement or work the contract price shall exceed Two Hundred Thousand Dollars (\$200,000.00), but ten per cent (10%) shall be reserved on estimates in excess of said sum, or where the aggregate of previous estimates equals or exceeds said amount. No improvement shall be deemed completed until the Board of Public Works shall have filed with the City Clerk a statement signed by a majority of the members of said Board, declaring the same to have been completed.

During the time allowed for the completion of the contract the City Engineer shall on the first day of each month issue an estimate of the amount of work completed by the contractor during the preceding month; provided, that after the expiration of the time allowed for such completion no estimate other than the final estimate shall be issued. The final estimate shall include a statement of the amount of money due the contractor, a statement of the amount of money expended for abstracts, advertising, accounting and collection, and engineering expenses incurred prior to the expiration of the time allowed for the completion of the contract. Engineering expenses incurred after the time allowed for the completion of the contract shall be borne by the contractor as a liquidation of the damages suffered by the City by reason of his failure to complete the work within the specified time.

After the issuance of the estimate by the City Engineer, the City Comptroller shall on or about the 25th day of the month deliver to the contractor money or warrants in an amount equal to such estimate less the percentage to be retained therefrom as herein provided. After the expiration of thirty (30) days following the final acceptance of said improvement or work and the expiration of the time for the filing of lien claims as provided by law, said reserve, or all amounts thereof in excess of a sufficient sum to meet and discharge the claims of material men and laborers who have filed their claims as provided by law, together with a sum sufficient to defray the cost of such action, and to pay attorneys' fees, shall be paid to said contractor; provided, however, that no payment shall be made to the contractor in any event of any part of said reserve until the City Engineer shall certify to the City Comptroller that the thirty days since the completion of the work have elapsed and that no uncompleted or defective work has been discovered for which the City makes claim, and in case

the City Engineer shall report any claim of the City by reason of uncompleted or defective work, the cost of perfecting such uncompleted or defective work shall be retained until the same shall have been perfected or arranged to the satisfaction of the Board of Public Works; provided, further, that no payment shall be made for any portion of said reserve nor shall the warrants therefor begin to bear interest until the contractor shall have deposited with the City Treasurer a sufficient amount of money in cash to cover the cost of engineering, advertising, accounting and collection, together with any other proper charges against the contractor, including any bill due the City or any of its departments, as shown by the final estimate.

Such warrants shall be drawn against the local improvement district fund and shall bear interest at the rate of five per cent (5%) per annum from the date of issuance until redeemed; provided, that warrants shall not bear interest after one hundred twenty (120) days from the time fixed in the proposal and contract for the completion of the contract.

If the work is completed within the time fixed by the Board of Public Works, or any extension thereof, and there is no money available for payment of contractors' warrants at the expiration of the one hundred twenty (120) day period above mentioned, the contractor may be paid by separate non-interest bearing warrants, a sum equivalent to interest at five per cent (5%) per annum on outstanding warrants from the date when interest on such warrants ceased to the date when funds are available for the redemption thereof.

If an extension of time is granted for the completion of the contract and the work is not completed when the extension period has expired, the contractor may be paid by separate non-interest bearing warrants, a sum equivalent to interest at five per cent (5%) per annum on outstanding warrants from the day when interest ceased, as above mentioned, to a date one hundred twenty (120) days from the date on which the extension period expires.

The City Comptroller shall immediately upon receipt of the final estimate for a local improvement file in the office of the City Clerk a certificate setting forth the total amount of said final estimate, together with accrued interest on warrants issued or to be issued to the contractor.

All warrants issued shall be redeemed in cash, in order of issuance within one hundred twenty (120) days after the completion and acceptance of the contract, so far as payment into the local improvement district fund will permit. Warrants not so redeemed in cash shall, except as otherwise herein provided, be redeemed in order of their issuance in local improvement district bonds, the lowest numbered warrants being redeemed with the lowest numbered bonds, if the mode of payment is "Payment by Bonds," or, if the mode of payment be "Immediate Payment," by the issuance of local improvement district fund warrants with interest at five per cent (5%) per annum from the date of issuance until redeemed.

The contractor shall pay all taxes on the contract required by law and the above specifications relating to estimates and payments are hereby modified to the extent that they are affected by the provisions of Chapter 180, Laws of Washington for 1935, and any amendment thereto, or any other statute or ordinance not specifically mentioned herein.

1-43 ESTIMATES AND PAYMENTS WHEN FINANCED BY DIRECT APPROPRIATION

There shall be reserved from the moneys earned by the contractor on estimates during the progress of the improvement, or work, a sum equal to fifteen per cent (15%) of such estimates, as a trust fund for the protection and payment of any person or persons, mechanics, subcontractors or material men who shall perform any labor upon such contract or the doing of said work, and all persons who shall supply such person or persons or subcontractors with provisions and supplies for the carrying on of such work. Said fund shall be retained for a period of thirty (30) days following the final acceptance of said improvement or work as completed, and every person performing labor or furnishing supplies towards the completion of said improvement or work, shall have a lien upon such fund so reserved; provided, such notice of the lien of such claimant shall be given in the manner and within the time provided by the laws of the State of Washington; provided, however, that where in any improvement or work, the contract price shall exceed Two Hundred Thousand Dollars (\$200,000.00), but ten per cent (10%) shall be reserved on estimates in excess of said sum, or where the aggregate of previous estimates equals or exceeds said amount. No improvement shall be deemed completed

until the Board of Public Works shall have filed with the City Clerk a statement signed by a majority of the members of said Board, declaring the same to have been completed.

During the time allowed for the completion of the contract, the City Engineer shall, on the first day of each month, issue an estimate of the amount of work completed by the contractor during the preceding month; provided, that after the expiration of the time allowed for such completion, no estimate other than the final estimate shall be issued. The final estimate shall include a statement of the amount of money due the contractor, a statement of the amount of money expended for advertising, and a statement of the amount of engineering expenses incurred prior to the expiration of the time allowed for the completion of the contract. Engineering expenses incurred after the time allowed for the completion of the contract shall be borne by the contractor as a liquidation of the damages suffered by the City by reason of his failure to complete the work within the specified time.

After the issuance of the estimate by the City Engineer, the City Comptroller shall, on or about the 25th day of the month, deliver to the contractor money or warrants, in an amount equal to such estimate less the percentage to be retained therefrom as herein provided. After the expiration of thirty (30) days following the final acceptance of said improvement or work and the expiration of the time for the filing of lien claims as provided by law, said reserve, or all amounts thereof in excess of a sufficient sum to meet and discharge the claims of material men and laborers who have filed their claims as provided by law, together with a sum sufficient to defray the cost of such action, and to pay attorneys' fees, shall be paid to said contractor.

The contractor shall pay all taxes on the contract required by law, and the above specifications relating to estimates and payments are hereby modified to the extent that they are affected by the provisions of Chapter 180, Laws of Washington for 1935, and any amendment thereto, or any other statute or ordinance not specifically mentioned herein.

1-44 DECISION OF QUESTIONS

To prevent all disputes and litigation it is understood that all questions arising as to the proper performance and amount of work to be paid for under this contract, shall be subject to the

decision of the City Engineer. In case of non-compliance with the contract in any manner, the City Engineer may suspend such work at any time. In case of default or failure properly to perform such work, the City Engineer shall have the power to adjust all differences as to damages or prices which the contractor should pay to the City according to the just and reasonable interpretation of this contract. In all such matters the decision of the City Engineer shall be final and conclusive between the parties hereto, subject to the approval of the Board of Public Works.

1-45 FORFEITURE OF CONTRACT

If at any time the City Engineer is of the opinion that the work is unnecessarily delayed and will not be finished within the prescribed time, he shall notify the contractor and the Board of Public Works to that effect in writing. If said contractor shall not within five (5) days thereafter take such measures as will, in the judgment of the said City Engineer, insure the satisfactory prosecution and completion of the work, the Board of Public Works may then notify the said contractor to discontinue all work under the contract for this improvement; and the contractor shall immediately respect such notice and stop work and cease to have any right to the possession of the grounds. The Board of Public Works may thereupon employ such force as it may deem advisable to complete the work, and the cost of all labor and materials necessary for such completion shall be paid by the City of Seattle out of moneys then due, or which would have become due the contractor under and by virtue of the contract for the improvement. In case such expense is less than the sum which would have been payable under such contract, if the same had been fulfilled by the contractor, then said contractor shall be paid the difference; and in case such expense is greater, the contractor shall be liable for and shall pay the amount of such excess to the City.

If the contractor shall abandon or breach said contract or shall fail or refuse to comply with any of the provisions of the same, or shall neglect or refuse to comply with the instructions of the City Engineer relative thereto, the Board of Public Works shall have the right to declare said contract breached and forfeited by the contractor, and to complete or relet the work or any part thereof. Such annulment shall not affect the rights of the City to recover damages which may arise by reason of such failure, neglect or refusal.

In case the City shall proceed with the work following such breach or forfeiture the City shall be entitled to recover all expenses incurred and a sum sufficient to pay the additional cost of the work, and any other or further damages sustained by the City.

1-46 PERSONS TO WHOM CONTRACTS ARE FORBIDDEN

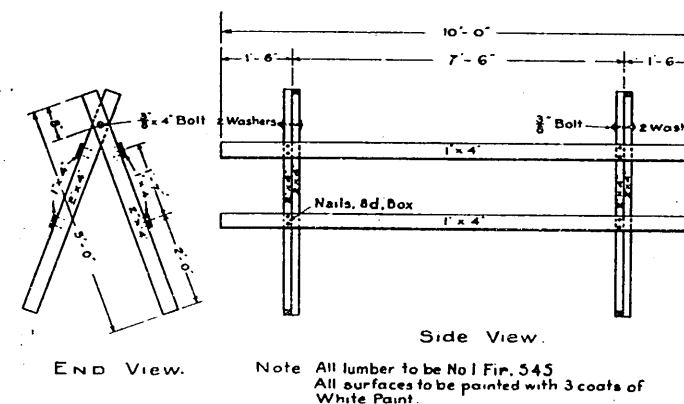
The Board of Public Works is prohibited by the City Charter from entering into any contract for the doing of any work or labor, or the furnishing of any skill or material, with any person who, within two years prior thereto, shall have made default in the payment of any just claim for any work or labor performed or for any skill or material furnished pursuant to any such contract with such party; or with any person who, within two years prior thereto shall have assigned, abandoned, surrendered or failed to complete any such contract, except as authorized by the City Charter, or who shall have failed to comply with any of the provisions of the City Charter relating to public works.

1-47 FINAL CLEANUP

Upon completion of any work and before final payment is made, the contractor shall remove from the site of the work and adjoining property and dispose of all surplus and discarded materials, rubbish, temporary structures, construction equipment and debris which may have accumulated during the prosecution of the work.

No separate payment shall be allowed for the above work. Payment for the cost thereof shall be included in the prices bid for the various items which comprise the improvement.

STREET BARRICADE



SECTION 2

QUALITY OF MATERIALS

2-1 ALLOYS

—1.01 ALUMINUM ALLOY

Aluminum alloy for Street Lighting Standards shall be composed of 95 per cent pure aluminum and 5 per cent pure silicon.

—1.02 BRONZE ALLOY

Bronze alloy shall be composed of 88 per cent copper, 7 per cent tin, 3 per cent zinc, and 2 per cent lead.

2-2 ASPHALTS

Asphalts for paving or for waterproofing, or for any other purpose herein required, shall be in accordance with the specifications for "Asphalts, Paving and Liquid," as prepared by The Asphalt Institute, Pacific Coast Division.

2-3 BRICKS

Bricks having special shapes and dimensions shall be furnished when required, according to details shown on the special plans for the improvement.

Bricks shall be made by the stiff mud, wire cut process and shall not be repressed, or when Class "C" bricks are specified they may be concrete bricks.

Bricks shall be divided according to quality into three classes, "A", "B" and "C", and the quality of bricks specified under any class shall conform to the requirements for that class as herein-after stated:

—3.01 CLASS "A"

Bricks in this class shall not vary more than seven per cent (7%) from the dimensions called for. They shall be true to shape, thoroughly annealed, and free from checks and fire cracks. When broken, the fractured surfaces shall show uniform vitrification, and shall not be granular or show laminations. The maximum permissible absorption, after seventy-two (72) hours immersion in water shall be three per cent (3%). The test shall be made upon thoroughly dried cold broken specimens.

Bricks that contain lime or other soluble matter in amounts that, after three (3) days immersion in water and three (3) days in air will cause the surface to become pitted shall be rejected.

Two inch (2") cubes cut from sample bricks shall not fail under a compression stress of forty-eight thousand (48,000) pounds.

The specific gravity shall not be less than two and twenty-five hundredths (2.25).

This class of bricks shall be used for pavements, sewer inverts and where otherwise specified.

—3.02 CLASS "B"

Class "B" bricks shall conform generally to the requirements for Class "A" bricks, except that the maximum permissible absorption after twenty-four (24) hours immersion in water shall be six per cent (6%).

This class of bricks shall be used for sewer arches and where otherwise specified.

—3.03 CLASS "C"

Bricks in this class may be class "A" or "B" bricks which, because of lack of vitrification or irregularity in shape, have been rejected as unfit for paving or brick sewer purposes, or they may be common hard burned building brick or concrete brick. Class "C" brick shall have a compressive strength of not less than twenty-five hundred (2500) pounds per square inch. They shall show less than ten per cent (10%) absorption after twenty-four (24) hours immersion in water. They shall be evenly burned and not unduly warped. They shall be free from large lumps or pebbles exceeding three-eighths inch ($\frac{3}{8}$ ") in diameter.

This class of bricks shall be used for manholes, catch basins, flush tanks, and where otherwise specified.

—3.04 CONCRETE BRICKS

Concrete bricks shall be manufactured from concrete which when tested by standard methods at 28 days will show a compressive strength of not less than 2500 pounds per square inch.

—3.05 CONCRETE RADIAL BLOCKS

Precast Concrete Radial Blocks for constructing manholes, catch basins, valve chambers, etc., shall have a minimum modulus of rupture of 500 pounds per square inch and a minimum compressed strength of 3,000 pounds per square inch. Tests shall be in accordance with A. S. T. M. Serial Designation C-55 and C-67, except that in the flexure test the span shall be nine (9) inches. Three blocks shall be tested for every five thousand blocks or

less delivered. The average strength of the three blocks tested shall meet the above requirements.

Blocks shall be of such size and shape that the circular walls of the catch basin or manhole constructed therewith will not be less than six (6) inches thick.

Blocks shall be cured either by keeping them wet for ten days or steam curing for two days.

Blocks shall not be laid until tested samples show a compressive strength of three thousand (3000) pounds per square inch.

No concrete blocks shall be accepted unless they have been manufactured under the inspection of the City Engineer.

Blocks which are cracked or have the corners broken off or which are damaged in any way from rough handling shall be rejected if in the opinion of the City Engineer such defect impairs their strength or usefulness for the purpose at hand.

2-4 BRIDGE HARDWARE

Machine bolts, drift bolts and dowels may be either wrought iron or medium steel. Washers may be cast Ogee or iron or steel washers or malleable iron or forged steel washers.

Machine bolts shall have square heads and nuts unless otherwise specified. Nails shall be round wire of standard form. Spikes shall be wire spikes or boat spikes, as specified on the plans. Bolts, dowels and washers shall be black or galvanized as specified on the plans.

2-5 CAST IRON CASTINGS

All iron castings, with the exception of watermain castings, shall conform to the requirements of the A. S. T. M. Standard Specifications for Gray Iron Castings, Serial Designation A-48.

Castings shall be boldly filleted at angles and the arrises shall be sharp and perfect.

Iron castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Cast iron frames and covers for manholes, flush tanks, monument cases, valve chambers or other roadway appurtenances, shall be machined so as to have perfect contact around the entire circumference.

All castings shall be coated as specified in Section 2-26 under Cast Iron Pipe Watermains.

2-6 CEMENT

Cement shall be a true Portland cement, dry and free from lumps and of a brand known to possess the proper qualities. It shall be delivered on the work in original packages with the factory name thereon. All cement shall be delivered in advance in such quantity as to afford the engineer opportunity to make tests and the contractor shall notify the City Engineer immediately of such delivery, if purchased in small lots, and if purchased in car-load lots the contractor shall notify the City Engineer of its arrival, where it is to be used, the car number and location and where it is to be stored. The amount in each car shall be plainly marked.

No cement will be accepted until it has cooled to normal temperature. Different brands of cement or concrete made from different brands of cement, shall not be mixed. Concrete used in the various parts of any structure shall be made from one brand of cement or from cements producing concrete of the same color.

No cement which has been conveyed more than 200 miles by water shall be used on any work unless such cement shall have been so transported in containers lined with tightly sealed waterproof paper, and delivered upon the work in such containers with the seals unbroken.

—6.01 VOLUME OF SACK

A sack of cement shall contain ninety-four (94) pounds net. A barrel shall contain four (4) sacks and shall be considered as measuring four (4) cubic feet. Variations greater than two per cent (2%) less than the specified weights, determined by taking the average weight of ten (10) sacks selected at random from the shipment shall be sufficient cause for rejection.

—6.02 TESTS

All tests shall be made in conformity with the A. S. T. M. Specifications, Serial Designation C150, for Type I cement, and no cement shall be used which fails to conform to said specifications.

—6.03 HIGH EARLY STRENGTH CEMENT

—6.03 A General Requirements

High early strength cement shall conform to the requirements of the A. S. T. M. Standard Specifications and Tests for Portland Cement, Serial Designation C150, Type III. It shall be a cement of the best quality, dry and free from lumps and all foreign material.

It shall be a cement which usage has proved to possess the proper qualifications and uniformity for the work intended.

—6.03 B *Additional Requirements*

In addition to the above requirements for High Early Strength Cement, the average compressive strength of not less than four 6"x12" cylinders, made in accordance with the A. S. T. M. Standard Method of Making Compression Tests of Concrete, Serial Designation C 39, and proportioned as described below, shall be equal to or higher than the following:

Age at Test	Compressive Strength Lbs. per Square Inch
72 hours.....	4,200
7 days.....	4,700
28 days.....	5,500

Each cylinder shall be made from a batch of concrete containing the following weights of materials:

High Early Strength Cement.....	5.00 Lbs.
Washed Sand from Steilacoom, Washington.....	10.00 Lbs.
Washed Gravel from Steilacoom, Washington.....	16.00 Lbs.
Clean Water, in quantity to give a slump of 1½ inches plus or minus ½ inch.	

The aggregates used in the above test shall conform to the requirements for Sand, Section 2-29, and Gravel, Section 2-15, of these Specifications and they shall be graded as follows:

(1) Sand

Passing No. 3 Tyler Sieve.....	100%
Passing No. 4 Tyler Sieve.....	94%
Passing No. 8 Tyler Sieve.....	78%
Passing No. 14 Tyler Sieve.....	59%
Passing No. 28 Tyler Sieve.....	35%
Passing No. 48 Tyler Sieve.....	8%
Passing No. 100 Tyler Sieve.....	1%

A variation of 2 in the percentage passing any sieve will be permitted but the sum of the percentage passing all sieves shall not be more than 380 nor less than 370.

(2) Gravel

Passing 2" Square Opening.....	100%
Passing 1½" Square Opening.....	96%
Passing 1" Square Opening.....	63%

Passing ¾" Square Opening.....	38%
Passing ⅜" Square Opening.....	15%
Passing ¼" Square Opening.....	0

—6.03 C *Acceptance of Cement*

Upon request of the manufacturer, the Engineer will sample and test High Early Strength Cement at the time of manufacture, provided facilities are available for storage, under seal at the factory. If such cement is found satisfactory, shipments will be accepted upon tests for fineness, setting time and soundness, made upon samples taken after loading.

2-7 **COAL TAR CREOSOTE OIL**

This oil, unless otherwise specified, shall be used for treating all creosoted piling and lumber.

The creosote shall be a distillate of coal-tar or coke-oven tar. It shall not contain more than 3% of water.

It shall not contain more than .5% of matter insoluble in benzol.

The specific gravity of the creosote at 38° C. compared with water 15.5° C. shall be not less than 1.03.

The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C, not more than 5%.

Up to 235° C, not more than 25%.

The residue above 355° C, if it exceeds 5% shall have a float-test of not more than 50 seconds at 70° C.

The creosote shall yield not more than 2% of coke residue.

The residue above 355° C, shall not exceed 30% by weight.

The treating cylinders of the creosoting company shall be provided with the following instruments:

1. Recording thermometers
2. Recording pressure gauges
3. Recording vacuum gauges, or combination recording pressure and vacuum gauges
4. Indicating mercurial thermometers as a check against the recording thermometers.

Fraction distilling between 210° C. and 235° C. shall be solid or contain solids when cooled to 25° C.

All of the fractions up to 315° C. shall contain at least one per cent (1%) of tar acids.

The specific gravity of the fraction between 235° C. and 315° C.

shall not be lower than 1.025 and specific gravity of the fraction between 315° C. and 355° C. shall not be lower than 1.085 at 38° C. compared with water at 15.5° C.

All tests shall be made in accordance with the standards of the American Wood-Preservers' Association. One week before the first treatment begins the Creosoting Company shall furnish the City Engineer with a quart sample of the oil which it proposes to use under these specifications. In the event that a different oil is thereafter used, a new sample of the same shall be furnished as specified above.

The Creosoting Company shall at any time it is requested to do so, furnish additional samples of the creosote oil for analysis. These samples will be taken from the treating cylinder, measuring tank, operating or storage tank at the option of the City Engineer.

2-8 CONCRETE

Whenever "Concrete" is mentioned in these specifications, such term shall be construed to mean "Portland Cement Concrete."

—8.01 CLASSIFICATION

Concrete mixes shall be classified according to the nominal number of sacks contained therein per cubic yard; i. e., Class "4," 4 sacks per cubic yard; Class "5," 5 sacks per cubic yard; Class "5.5," 5.5 sacks per cubic yard; etc. This designation, however, shall not be construed as a guarantee by the City of Seattle that the concrete mixes as designed shall always yield a full cubic yard of concrete.

Concrete for any purpose shall be of the class specified or indicated on the plans. Where not so specified or indicated, concrete shall be Class "5."

Each class of concrete shall conform to the requirements hereinafter set forth.

The weights of aggregates for the various classes of concrete are based upon an average moisture content of five per cent (5%) in the sand and one per cent (1%) in the gravel and a specific gravity of 2.69. The City Engineer reserves the right to make corrections in said specified weights wherever tests show the moisture content to be abnormal or the specific gravity to vary appreciably from that above stated. Such correction shall be made upon recommendation of the City Engineer's Testing Laboratory and not otherwise. The City Engineer further reserves the right to

change the proportions of the various sizes of aggregates, provided, however, that the ratio of the weight of cement to the total weight of aggregate shall remain as specified, subject to corrections as above provided.

—8.01 A *Class "4" Concrete.* Class "4" concrete shall be produced by mixing cement, sand and gravel in the following proportions:

Cement (1 sack)	94 Lbs.
Damp Sand	373 Lbs.
Damp Gravel	540 Lbs.

—8.01 B *Class "5" Concrete.* Class "5" concrete shall be produced by mixing cement, sand and gravel in the following proportions:

Cement (1 sack)	94 Lbs.
Damp Sand	290 Lbs.
Damp Gravel	420 Lbs.

—8.01 C *Class "5.5" Concrete.* Class "5.5" concrete shall be produced by mixing cement, sand and gravel in the following proportions:

Cement (1 sack)	94 Lbs.
Damp Sand	261 Lbs.
Damp Gravel	377 Lbs.

—8.01 D *Class "6" Concrete.* Class "6" concrete shall be produced by mixing cement, sand and gravel in the following proportions:

Cement (1 sack)	94 Lbs.
Damp Sand	238 Lbs.
Damp Gravel	343 Lbs.

—8.01 E *Class "7" Concrete.* Class "7" concrete shall be produced by mixing cement, sand and gravel in the following proportions:

Cement (1 sack)	94 Lbs.
Damp Sand	198 Lbs.
Damp Gravel	285 Lbs.

—8.02 AGGREGATES

The specified weights of aggregates in the above concrete mixtures shall pertain to either structural grade or coarse grade aggregates, depending upon the purpose for which the concrete is

to be used. Unless otherwise specified, Class "4" and "5" concrete shall be produced using paving grade sand and a combination of approximately one-half structural grade gravel and one-half coarse grade gravel.

Unless otherwise specified, Class "5.5," "6" and "7" concrete shall be produced, using all structural grade aggregates.

—8.03 MIXING TIME

Unless otherwise specified, Class "4," "5" and "5.5" concrete shall be mixed one (1) minute and Class "6" and "7" shall be mixed two (2) minutes.

—8.04 MANUFACTURE

A *Proportioning Materials:*

All aggregates shall be measured by weight, using a weighing device which will weigh the sand and two sizes of gravel accurately, indicating the weight of each ingredient upon a dial not less than 14 inches in diameter.

Aggregates may be weighed either at the place of mixing or at a central proportioning plant, and transported to the mixer in trucks, or cars, so divided that the aggregates for each batch are kept entirely separated from the aggregates for other batches.

Upon small and unimportant work and in locations where it is impracticable to weigh aggregates, the contractor may, by special permission of the City Engineer, use volume measurements. When volume measurements are used, one cubic foot of sand shall be taken as equivalent to 100 pounds of sand, and one cubic foot of gravel shall be taken as equivalent to 105 pounds of gravel.

Cement shall either be weighed on separate scales or emptied directly from the sacks into the hopper or skip from which the mixer is charged.

When using sack measurement of cement, batches shall always be of such size that a whole number of sacks is required, and the number of sacks necessary for one batch shall be brought to the mixer upon a hand truck, car or wheelbarrow from which they shall be lifted and dumped into the skip or hopper; and all sacks for one batch shall be emptied before the load for the next batch is brought up.

Whenever requested by the City Engineer, the contractor shall furnish a man to count the empty sacks in the presence of the City Engineer or his representative, and after being counted the empty

sacks shall be removed from the immediate vicinity of the mixer.

Water shall be measured by means of a measuring tank which may be accurately set to deliver a definite amount of water per batch or by means of an accurate water meter. The amount of water to be used shall in all cases be as specified for the work upon which the concrete is to be used, or as directed by the City Engineer. All water used for mixing concrete shall be obtained from the city water system.

B *Mixing:*

All concrete shall be mixed in a machine of the batch type. The quantity mixed in one batch shall not exceed the manufacturer's rated capacity of the mixer.

The mixer shall produce a concrete of a homogeneous nature and any mixer which discharges the concrete in such a manner as to separate the gravel from the mortar shall not be used.

The mixing shall continue for not less than the time specified for concrete of the various classes and such mixing time shall commence after all materials are in the drum. The drum shall rotate at a peripheral speed of approximately 250 feet per minute, or at the speed recommended by the mixer manufacturer. The drum shall be completely emptied before a new charge is put in.

Every concrete mixing machine shall be equipped with a timing device which shall ring a bell at the end of the mixing period. The mechanism of such timing device shall be so constructed as to be automatically put into operation as soon as all materials are in the drum, and to lock the mixer so as to prevent discharge until the bell has sounded. The bell shall be of such size that its ringing can be plainly heard while the mixer is in operation. This timing device shall be tested each day before beginning work, and shall be regulated only in the presence of the City Engineer or his representative.

All scales, water gauges or other measuring devices shall be so located that the entire proportioning and mixing operation may be readily observed by one inspector.

The contractor shall keep the interior of the drum of the mixer free from incrustations of concrete. Whenever the pickup and throw-over blades in the drum have been worn down three-quarters of an inch, they shall be replaced by new blades.

When a boom and bucket attachment is used the bucket shall

be kept in good order so that mortar will not leak out when the doors are closed.

Except when authorized by the City Engineer or in case of emergency, no concreting shall be done when the temperature is below 40° Fahrenheit. When such an emergency arises, special precautions shall be taken by the contractor to remove the frost from all ingredients, and after the concrete has been placed it shall be protected until thoroughly hardened, in a manner satisfactory to the City Engineer.

The intent of these specifications is to permit concrete for any class of work to be mixed either on the immediate site of its final deposition, or at a central mixing plant and delivered to the work in an approved manner. The City Engineer, however, reserves the right to reject any and all concrete which arrives upon the work in a separated or partially set condition or in any condition which makes it inferior to concrete mixed on the work, regardless of the fact that an inspector was present when the concrete was mixed.

—8.05 FINISH FOR STRUCTURAL CONCRETE

Immediately after removing the forms all structural concrete shall be given the class of surface finish indicated on the plans or specified in the special specifications, the various classes of finish conforming to the following requirements:

A Class "A" Finish:

The surface shall, after all irregularities have been corrected, as specified for Class "D" finish, be thoroughly wetted and brushed with a grout composed of one part fine sand and one part cement, excess mortar being immediately removed by means of a fabric pad or carpet float. It shall then be kept damp for 24 hours, after which it shall be rubbed with a coarse carborundum stone, water being applied during the process. The surface shall then be brushed with grout of the same proportions in the same manner and kept damp for a second period of 24 hours, after which it shall be rubbed with a fine carborundum stone. The resulting surface shall be smooth, dense and uniform, showing neither form marks nor brush marks.

B Class "B" Finish:

The surface shall, after all irregularities have been corrected as specified for Class "D" finish, be thoroughly wetted, brushed with a neat cement grout, and immediately rubbed with a coarse

carborundum stone. The paste thus formed shall be shaped with a clean brush and allowed to set for 24 hours. It shall then be rubbed down with a pad of carborundum paper or similar abrasive and thoroughly washed.

C Class "C" Finish:

The surface shall, after all irregularities have been corrected, as specified for Class "D" finish, be thoroughly wetted and brushed with a grout composed of one part fine sand and one part cement. It shall then be kept wet for 48 hours.

D Class "D" Finish:

All irregularities, such as gravel pockets, bolt holes, etc., shall be neatly pointed with mortar of the same proportions as used in the concrete, and the surface film of all such patches shall be rubbed off after initial setting has taken place. Every concrete surface shall be given a Class "D" basic finish.

—8.06 MODIFIED REQUIREMENTS

Specified methods for obtaining the above classes of finish may be modified or eliminated if in the opinion of the City Engineer the surface produced by proper form work, careful and diligent mixing and placing of the concrete produces a finish which is comparable to the finish produced by the above specified methods.

2-9 CONDUIT

All metal conduit for electric wires or cables shall be galvanized or Sherardized wrought iron conduit bearing the underwriters' inspection stamp.

2-10 DUMMY JOINT MATERIALS

Dummy Joint material shall be "Carey's Elastite," or equal.

2-11 EXPANSION JOINT MATERIALS

—11.01 For Concrete Sidewalks

Expansion joint material for concrete sidewalks shall be "Carey's Elastite," or equal.

—11.02 Premoulded Expansion Joint Material

Pre-moulded expansion material for general use shall be composed of approved fibre and asphalt and of cellular nature, complying with the following requirements:

A The joint material shall contain at least thirty-five per cent (35%) of durable asphaltic compound by weight of the finished product.

B The joint material shall return to not less than seventy per

cent (70%) of its original thickness within one (1) hour after being compressed, as follows:

A sample of the filler four (4) inches by five (5) inches shall be compressed at the rate of 0.1 inch per minute to one-half of its original thickness, the compression being repeated five (5) times at intervals of from one (1) to two (2) hours.

C When compressed as under "B" above, the material shall not lose more of the preservative compound than five per cent (5%) of the original weight of the sample.

D The total pressure necessary for compression under B above shall not exceed 1,000 pounds per square inch.

E The material shall have an extension of not more than one-quarter inch when a sample of the finished strip four (4) inches by five (5) inches is confined by a suitable mould on the two long sides and one end, and is compressed to one-half of its original thickness.

F The material shall not show a deviation from the horizontal of more than one inch when subjected to the distortion test of the American Association of Highway Officials.

2-12 FELT (WATER-PROOFING)

Felt for water-proofing shall consist of cotton and wool fibres containing between twenty-five (25) and thirty (30) per cent of animal wool. The fibres shall be saturated and coated with an asphaltic medium. The finished product shall weigh not less than fourteen (14) pounds per one hundred (100) square feet. The asphalt used for this work shall conform to the standard specifications for Paving Grade Asphalt.

2-13 GALVANIZED MATERIAL

—13.01 GENERAL

All material which is described in these specifications, or indicated on the drawings as being "galvanized," shall be zinc-coated by the "Hot Dip" process, and shall conform to the following specifications:

All material or articles to be galvanized shall be free from injurious defects or other coating or markings which would interfere with the application of zinc coating. The material shall have been treated so as not to be injuriously embrittled by the galvanizing operation. All welded areas shall be free from slag, welding flux, or other contamination, having been cleaned by sand blasting

or other satisfactory means.

Galvanizing shall be done after all cutting of threads, shopwork or bending has been done and the pieces are ready to be placed in the structure. Threads, however, may be cut deeply before galvanizing and recut after coating to insure proper fitting of bolts and nuts, provided such recutting does not expose the base metal.

—13.02 ZINC FOR COATING

A Zinc (Spelter)

The zinc used for the coating shall be prime spelter of a quality capable of forming a satisfactory coating and conforming to the requirements of the A.S.T.M. Serial Designation B6.

B Molten Zinc Bath

The zinc bath shall conform to the chemical composition specified in the following table:

Lead (max.) Percent	Iron (max.) Percent	Sum of Aluminum and Tin (max.) Percent	Cadmium (max.) Percent	Zinc Percent
1.60 ¹	0.08 ¹	0.002	0.75 ¹	Remainder

¹When the cadmium content is in excess of 0.41 percent, the total lead, iron and cadmium content shall not exceed 1.25 percent.

C Metal Flux (brightener)

If the zinc bath is metal fluxed, the amount of "brightener" agent added shall be such that the "tin-plus-aluminum" content shall not exceed that allowed in the above table.

D Chemical Analysis of Zinc Bath

Samples for chemical analysis shall be taken from the zinc bath, at the location where articles are to be immersed by means of a suitable dipping ladle, adequately preheated to avoid solidification of zinc due to any chilling effect; immersing the ladle below the surface of the zinc bath by at least 6 inches, and manipulating sufficiently to obtain a sample representing the zinc at that depth. Immediately prior to withdrawing the ladle sample the surface of the zinc bath shall be cleared free from accumulated surface impurities by means of skimmers or other suitable devices. The sample of molten zinc shall be allowed to solidify in the sampling ladle and removed therefrom when completely solidified. At least 4 ounces of drillings shall be taken from sound metal below the surface of the solidified sample thus obtained and submitted to the City Engineering Department laboratory for analysis. Sampling

of the zinc bath shall be performed at any time, and as often as, in the opinion of the inspector, such samples are necessary to insure that the zinc in the bath conforms to the requirements of paragraph 2-13.02B.

—13.03 WEIGHT OF COATING

Unless otherwise directed by the City Engineer, the molten zinc bath shall be maintained at a constant temperature between 840° and 860° F, and articles or material to be galvanized shall be immersed therein and allowed to remain until the article or material reaches the temperature of the bath.

Both the submerion in the bath and withdrawal therefrom shall be of such duration as will produce a uniform coating of not less than 2 ounces of zinc spelter to each square foot of area to be galvanized.

The workmanship shall be first class in every respect. After immersion in the molten zinc, the work shall not be subjected to any process of scraping or wiping which may result in a non-uniform coating or a thickness of coating less than that required. The wiping of articles such as angles, pipe and wire to remove foreign substances, such as oxides, will be permitted.

—13.04 TEST FOR WEIGHT OF COATING

When determining the weight of coating an appropriate number of representative specimens, in no case less than three, or representative sections thereof, shall be used.

When the material is inspected during manufacture, the weight of the zinc coating for pieces the areas of which can be readily calculated may be determined by weighing the representative specimens after pickling and drying, and again after the coating is applied.

When the material is inspected after the zinc coating is applied, the weight of the coating for pieces the areas of which can be readily calculated shall be determined by stripping the entire piece, or suitable representative section thereof, in accordance with the hydrochloric acid-antimony chloride method as described in the Standard Methods of Test for Weight of Coating on Zinc-coated (Galvanized) Iron or Steel Articles (A.S.T.M. Designation: A 90) of the American Society for Testing Materials.

—13.05 ADHERENCE OF COATING

The zinc coating shall adhere tenaciously to the surface of the

base metal. When the coating is cut or pried into, such as with a stout knife applied with considerable pressure in a manner tending to remove a portion of the coating, it shall only be possible to remove small particles of the coating by paring or whittling, and it shall not be possible to peel any portion of the coating so as to expose the iron or steel.

—13.06 DEFECTS

The zinc-coated articles shall be free from uncoated spots. The coating shall be free from blisters, flux, black spots, dross, and projections which will interfere with the proper use of the article, or other defects not consistent with good galvanizing practice.

—13.07 INSPECTION

The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the application of the zinc coating to the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the zinc coating is being furnished in accordance with these specifications. All inspection and tests shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

—13.08 REJECTION

If any set of test specimens fails to conform to the requirements of these specifications, two additional sets shall be tested, both of which shall conform to the requirements in every respect, or the lot of the material represented by the specimens may be rejected.

2-14 GATE VALVES

All Gate Valves shall conform to the specifications of the American Water Works Association effective May 1, 1939, except as otherwise noted. They shall be iron bodied, bronze mounted, parallel faced, double disc valves with bronze wedging device between the discs.

Valves 12 inches and less shall stand erect unless otherwise shown.

Valves 16 inches and larger shall be on their edge and shall be provided with bevel gears and by-pass. They shall also be equipped with a bronze track, rollers and scrapers to carry the discs.

- 16" and 20" Valves shall have 3" by-pass
 24" and 30" Valves shall have 4" by-pass
 36" and 42" Valves shall have 6" by-pass
 48" Valves shall have 8" by-pass

By-pass valves shall be provided with a nut for a wrench and arrow indicating the direction of opening. All main valves shall open counterclockwise and main valve stems shall be provided with nuts.

In order to determine whether the thicknesses of valve bodies and bonnets conform to the thicknesses given in Table I of the A. W. W. A., the contractor shall, at the request of the City Engineer, drill a one-half ($\frac{1}{2}$) inch hole, as directed, in the valve body or bonnet. He shall tap the hole and insert a brass plug, and the labor and material cost thereof shall be at the contractor's expense.

The City of Seattle will accept valves of the following manufacturers, providing such valves conform to these specifications: Rensselaer, Chapman, Ludlow, Iowa, and Crane in all sizes, and Smith in sizes 12 inches and less.

2-15 GRAVEL

Gravel shall be free from loam, clay, vegetable matter, bark, roots, sticks and other foreign substances. It shall consist of uniformly hard durable particles graded as follows:

—15.01 STRUCTURAL GRADE

- 100% shall pass a 2-inch screen
 Not less than 95% shall pass a $1\frac{1}{2}$ -inch screen
 Not less than 48% nor more than 80% shall pass a 1-inch screen
 Not less than 30% nor more than 60% shall pass a $\frac{3}{4}$ -inch screen
 Not less than 12% nor more than 34% shall pass a $\frac{1}{2}$ -inch screen
 Not more than 8% shall pass a $\frac{1}{4}$ -inch screen

—15.02 COARSE GRADE

- Not less than 95% shall pass a 3-inch screen
 Not less than 81% shall pass a $2\frac{1}{2}$ -inch screen
 Not less than 45% nor more than 85% shall pass a 2-inch screen
 Not more than 15% shall pass a $1\frac{1}{2}$ -inch screen

Not more than fifty per cent (50%) of either grade of gravel heretofore specified shall consist of crushed rock.

The screens specified above shall be screens having a square effective opening as indicated by the size given.

2-16 HYDRANTS

All hydrants shall have bronze mountings, and be so arranged that all working parts can be removed without digging around or disturbing the barrel.

Bronze hose nipples or hose and steamer ports shall be screwed into the body of the hydrant and locked in place.

Hydrants shall have a waste orifice for draining, so located and designed that when all hose and steamer ports are closed and the main valve is slightly opened, water will be forced through the waste orifice under pressure. The waste orifice shall have a threaded connection for attaching a drain pipe, not less than three-fourths of an inch ($\frac{3}{4}$ ") inside diameter.

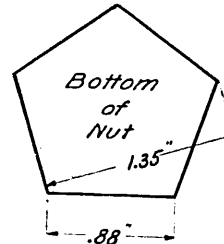
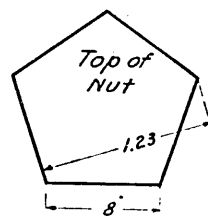
Each hydrant connection shall be provided with an auxiliary gate valve placed vertically near the hydrant. This gate valve shall conform to the foregoing specifications. All hydrants and auxiliary gate valves shall have flanged ends. All flanges which are designed to be tight under water pressure shall be machine finished to a true surface. Hydrants having such flanges made by casting against a plate will be rejected.

All hydrants shall open by turning to the left and shall stand a pressure of 300 pounds per square inch when the hydrant valve is closed, and of 300 pounds per square inch when the valve is open.

The dimensions and details of hydrants shall be as follows:

	Hydrant 6 Inch Connection	Hydrant 8 Inch Connection
Hydrant connection, C.I. pipe, ins. diam...	6 inches	8 inches
Standpipe, minimum ins. diameter.....	6 $\frac{7}{8}$ inches	8 inches
Length of hydrant from bottom of hydrant connection to sidewalk ring:		
For pipe lines 6 and 8 inches diameter....	3 $\frac{1}{2}$ feet	3 $\frac{1}{2}$ feet
10 inches diameter.....	4 feet	4 feet
12 inches diameter.....	4 $\frac{1}{2}$ feet	4 $\frac{1}{2}$ feet
16 and 20 inches diameter.....	4 feet	4 feet
24 and 30 inches diameter.....	4 $\frac{1}{2}$ feet	4 $\frac{1}{2}$ feet
Valve opening—minimum diameter.....	5 inches	6 $\frac{1}{4}$ inches
Size of Auxiliary Gate Valve.....	6 inches	8 inches
Hose Nozzle, number and size.....	2-2 $\frac{1}{2}$ inches	3-2 $\frac{1}{2}$ inches
Thread (Nat. Board Fire Under- writers)	7 $\frac{1}{2}$ per inch	7 $\frac{1}{2}$ per inch
Outside diameter finished.....	3 $\frac{1}{8}$ inches	3 $\frac{1}{8}$ inches

	Hydrant 6 Inch Connection	Hydrant 8 Inch Connection
Thread (Nat. Board Fire Under- writers)	7½ per inch	7½ per inch
Outside diameter finished.....	3⅞ inches	3⅞ inches
Diameter at root of thread.....	2.8715 inches	2.8715 inches
Pattern of thread.....	60° V-thread	60° V-thread
Total length of hose thread.....	1 inch	1 inch
Steamer Nozzles, number and size.....	1-4 inch	1-4 inch
Thread, outside diameter finished.....	4⅞ inches	4⅞ inches
Diameter at root of thread.....	4.6263 inches	4.6263 inches
Threads (Seattle Std.).....	6 per inch	6 per inch
Pattern of thread.....	60° V-thread	60° V-thread
Total length of hose thread.....	1⅞ inches	1⅞ inches
Operating Nuts, same for both size hydrants.		
Dimension in section as shown.		
Minimum height of nuts :		
Pentagon	1⅞ inch	1⅞ inch
Diameter of Shackle Rods.....	¾ inch	1 inch



If the contractor proposes to use a make or type of some make not previously approved, a sample, and, if required, detail plans of such hydrants shall be submitted to the Board of Public Works for approval. Such approval, however, shall not release the contractor from any obligations prescribed by these specifications for any defects in construction of mechanism or materials.

2-17 LAMP BLACK

Lamp black for use in concrete shall contain not less than ninety-nine per cent (99%) pure carbon.

2-18 LEAD

All pig lead shall show upon analysis not less than 99.75% pure metallic lead. The pig lead shall be soft, free from objectionable impurities and in every way satisfactory to the City Engineer.

2-19 LEAD COVERED CABLE

19.01 PRIMARY LEAD COVERED CABLE

All primary lead covered cable shall be manufactured for a normal operating voltage of either 5000 or 3000 volts as specified on the improvement plan. The cable shall be round and either duplex or triplex, as specified. All conductors larger than No. 6 A. W. G. shall be stranded concentric lay conductors. No. 6 A. W. G. and smaller sizes shall be solid unless otherwise specified.

Insulation on primary cable shall be impregnated paper of a thickness as follows :

For 5000-volt cable—4/32 inch around each conductor with a 4/32 inch belt of the same material. The lead sheath shall be ⅞ inch thick.

For 3000-volt cable—⅜ inch around each conductor with a ⅜ inch belt of the same material. The lead shall be ⅜ inch thick.

—19.02 SECONDARY LEAD COVERED CABLE

All secondary lead covered cable shall be manufactured for a normal operating voltage of 600. The cable shall be round triplex, unless otherwise specified. All conductors of secondary cable shall conform to requirements of conductors of primary cable. Each conductor shall be insulated with rubber. The thickness of the insulation, quality of materials, etc., shall be as specified in the National Electric Code of the National Board of Fire Underwriters. The lead sheath shall be 4/64 inch thick for conductors of size No. 8 A. W. G. and ⅜ inch thick for conductors of sizes No. 6 and No. 4. Other sizes shall be governed by the specifications of the Association of Edison Illuminating Companies for "Impregnated Paper Insulated, Lead Covered Underground Cable," as submitted in their latest report.

All secondary lead covered triplex cable from transformers to secondary fuse boxes shall have impregnated paper or varnished cambric insulation of a thickness of ⅜ inch around each conductor, and a ⅜ inch belt of the same material. Single conductors shall be insulated with ⅜ inch of the same material. The lead sheath shall be ⅜ inch thick.

In all respects not mentioned in these specifications, the paper insulation shall conform to the specifications of the Association of Edison Illuminating Companies for "Impregnated Paper In-

sulated, Lead Covered Underground Cable," as submitted in their latest report.

All varnished cambric insulation shall conform to the "Standard Specifications for Varnished Cambric Insulated Cables for the Transmission and Distribution of Electrical Energy, as Prepared by The Insulated Power Cable Engineers Association."

All cable shall be tested for five (5) minutes between conductors, and for five (5) minutes between each conductor and lead sheath. The testing voltage shall be twice the voltage specified for the cable plus one thousand (1000) volts.

2-20 LUMBER

All timber and plank in permanent structures shall be Douglas fir and conform to the "Standard Grading and Dressing Rules" for Douglas fir adopted by the West Coast Lumbermen's Association.

—20.01 GRADING REQUIREMENTS

Unless otherwise noted on the plans, lumber for Stringers, Truss members, Floor Beams and Caps shall be graded to withstand an extreme fiber stress of 1600 pounds per square inch in bending. Posts shall be graded to withstand a compression stress, with the grain of 1200 pounds per square inch.

All other lumber for general use shall be of a grade equal or better than "No. 1 Boards and Sheathing."

—20.02 ADDITIONAL REQUIREMENTS

A Heart Requirements

Timber to be used without creosoted pressure treatment shall show not less than the following amount of heartwood:

For Stringers, Floor Beams, and Truss Members—85% of heart on any face.

For Caps, Sills and Posts—75% of heart on any face.

B Seasoning

Lumber to be painted shall be thoroughly air dried and shall be stored in such a manner as to remain in a thoroughly dry condition until being placed in the work.

—20.03 INSPECTION

The contractor shall apply to the mill from which timber is purchased for inspection of the timber by the Pacific Lumber Inspection Bureau or the West Coast Lumbermen's Association,

and shall furnish the City Engineer with a certificate as to the grade of the timber. This certificate of inspection, however, shall not constitute an acceptance of the material and the City Engineer reserves the right to reject all timber that does not comply with the specifications.

2-21 LUMBER CREOSOTED

—21.01 MATERIALS

Timber and lumber shall conform to the requirements of Section 2-20 and shall be inspected prior to treatment.

The preservatives used shall conform to the requirements of Section 2-7.

—21.02 SEASONING

A Air Seasoning

Materials to be treated preferably shall be air seasoned until the moisture remaining in the wood will not prevent the injection and proper distribution of the specified amount of preservative. For air seasoning, the materials shall be stored as follows:

Lumber shall be segregated according to size and each layer in the pile shall be separated by at least one-inch strips with an air space of one inch or more between each two pieces of lumber in any layer; for caps, stringers, posts or large timbers, at least two-inch strips shall be used to separate the layers. Alleys at least three (3) feet wide shall be left between rows of stacks and the material shall be at least twelve (12) inches off the ground on concrete or treated timber sills. The space under and between the rows of stacks shall be kept free at all times of rotting wood, weeds or rubbish. The yard shall be so drained that no water can stand under the stacks or in their immediate vicinity.

B Oil Seasoning for Douglas Fir

When permitted by the City Engineer, Douglas Fir may be seasoned by boiling in oil under a vacuum until the moisture remaining in the wood will not prevent the injection and proper distribution of the specified amount of preservative.

The material shall be boiled in creosote under a vacuum at temperatures not less than 180° F. and not more than 200° F.

A minimum vacuum of twenty (20) inches shall be maintained during boiling. The seasoning period shall be maintained until condensation passing off from the timber is at the rate of approximately 1/10 of a pound per cubic foot of timber per hour.

—21.03 PREPARATION FOR TREATMENT

Each cylinder charge shall consist of pieces approximately equal in size and moisture and sapwood content, into which approximately equal quantities of preservative fluid can be injected. Pieces shall be so separated as to insure contact of steam and preservatives with all surfaces.

—21.04 PLANT EQUIPMENT

Treating plants shall be equipped with thermometers and gauges necessary to indicate and record accurately the conditions at all stages of treatment, and all equipment shall be maintained in a satisfactory condition. The apparatus and chemicals necessary for making the analysis and tests required shall also be provided by the operators, and kept in condition for use at all times.

—21.05 TREATMENT

The method of treatment shall be left to the discretion of the Creosoting Company, provided that at no time during the treatment shall the material be subjected to a temperature greater than 220° F.

—21.06 PENETRATION

The range of pressure, temperature and time duration shall be controlled so as to result in a maximum penetration by the quantity of preservative injected, which shall permeate all the sapwood and as much of the heartwood as practicable.

In Douglas Fir, the minimum penetration for the specified amount of creosote oil shall be as follows:

Treatment per Cubic Foot (Full Cell)

Sizes	8 lbs.	10 lbs.	12 lbs.	14 lbs.	16 lbs.
2 x 4.....	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{5}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "
2 x 6.....	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{5}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "
2 x 8.....	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{5}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "
2 x 12.....	$\frac{1}{4}$ "	$\frac{5}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{2}$ "
3 x 6.....	$\frac{1}{4}$ "	$\frac{5}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{2}$ "
3 x 12.....	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{2}$ "	$\frac{9}{8}$ "
4 x 6.....	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{2}$ "	$\frac{9}{8}$ "
4 x 12.....	$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{2}$ "	$\frac{9}{8}$ "	$\frac{5}{8}$ "
6 x 6.....	$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{2}$ "	$\frac{9}{8}$ "	$\frac{5}{8}$ "
6 x 8.....	$\frac{7}{8}$ "	$\frac{1}{2}$ "	$\frac{9}{8}$ "	$\frac{5}{8}$ "	$\frac{11}{8}$ "
8 x 8.....	$\frac{7}{8}$ "	$\frac{1}{2}$ "	$\frac{9}{8}$ "	$\frac{5}{8}$ "	$\frac{11}{8}$ "

Sizes	8 lbs.	10 lbs.	12 lbs.	14 lbs.	16 lbs.
8 x 10.....	$\frac{1}{2}$ "	$\frac{1}{8}$ "	$\frac{5}{8}$ "	$\frac{11}{8}$ "	$\frac{3}{4}$ "
8 x 12.....	$\frac{1}{2}$ "	$\frac{1}{8}$ "	$\frac{5}{8}$ "	$\frac{11}{8}$ "	$\frac{3}{4}$ "
8 x 16.....	$\frac{1}{8}$ "	$\frac{5}{8}$ "	$\frac{11}{8}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "
10 x 12.....	$\frac{1}{8}$ "	$\frac{5}{8}$ "	$\frac{11}{8}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "
12 x 12 and larger.....	$\frac{5}{8}$ "	$\frac{11}{8}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "

8 lb. Empty Cell Treatment = 12 lb. Full Cell Treatment.

10 lb. Empty Cell Treatment = 14 lb. Full Cell Treatment.

The penetration of the preservative shall be based on black or dark oil and in no case will light discoloration of the wood due to treatment be taken into consideration in measuring the depth of penetration.

Tests for penetration shall be made by taking borings with an increment borer or a $\frac{5}{8}$ " auger; all holes so bored shall be plugged by the contractor with tight-fitting creosoted plugs.

As many penetration tests of lumber shall be made as is considered necessary by the inspector.

—21.07 AMOUNT OF PRESERVATIVE

The amount of preservative to be used shall be shown on the plans or specified and this amount shall be retained in the timber unless the oil has been injected to refusal. When not otherwise specified, the amount of preservative retained shall be as follows:

For use in coastal water: Full-cell process, not less than twelve (12) lbs. per cubic foot of lumber.

For general construction, except in coastal water: Empty-cell process, not less than eight (8) lbs. per cubic foot of lumber for timber over five (5) inches in thickness and ten (10) lbs. per cubic foot of lumber for timber less than five (5) inches in thickness.

—21.08 CONDITION AFTER TREATMENT

After the lumber has been removed from the treating cylinder and allowed to cool in the air for not less than six (6) hours, it shall be free from all heat checks, water bursts and other defects due to improper treatment which would impair its usefulness or durability for the purpose intended.

—21.09 PIPE STAVES

Pipe staves, of material air or kiln dried before milling, shall, unless otherwise specified, be treated by the empty cell process with eight (8) lbs. of creosote retained per cubic foot of net section. Method of treatment to be such as to eliminate distortion

and to produce clean staves with no excess of creosote. Minimum penetration of creosote shall be one-quarter ($\frac{1}{4}$) inch.

2-22 NAILS AND SPIKES

All nails and spikes used on the structure under these specifications shall be made from steel wire of the common, plain grade. They shall conform to the following physical properties:

SIZE	NAILS			SPIKES		
	Length in Inches	Diameter in Inches	Approx. Number per lb.	Length in Inches	Diameter in Approx.	Approx. Number per lb.
4d.....	1½	.099	316	....	....	....
5d.....	1¾	.099	271	....	....	....
6d.....	2	.113	181	....	....	....
7d.....	2¼	.113	161	....	....	....
8d.....	2½	.131	106	....	....	....
9d.....	2¾	.131	96	....	....	....
10d.....	3	.148	69	....	....	....
12d.....	3¼	.148	63	....	....	....
16d.....	3½	.162	49	....	....	....
20d.....	4	.192	31	....	....	....
30d.....	4½	.207	24	....	....	....
40d.....	5	.225	18	....	....	....
50d.....	5½	.244	14	....	....	....
60d.....	6	.263	11	....	....	....
.....	.....	.....	.....	7	$\frac{5}{8}$	7
.....	.....	.....	.....	8	$\frac{3}{8}$	6
.....	.....	.....	.....	9	$\frac{3}{8}$	5
.....	.....	.....	.....	10	$\frac{3}{8}$	4
.....	.....	.....	.....	12	$\frac{3}{8}$	3

Except where otherwise specified, it is the intention of these specifications that wherever nails or spikes are called for in any structure, they shall be of such length as will most nearly conform to the following rule: The nails or spikes shall penetrate the second piece of timber to a depth which is one and one-eighth ($1\frac{1}{8}$) times the thickness of the first piece, provided that the nail or spike shall fail to pass entirely through the second timber by not less than one-quarter ($\frac{1}{4}$) inch.

All nails shall be driven home in a manner satisfactory to the City Engineer.

2-23 OAKUM

Oakum shall be of fine, long, uniform fibre, and equal in quality to that commercially known as U. S. Navy Oakum.

Also see "Rope Gaskets," Section 2-27.

2-24 PAINT

—24.01 GENERAL REQUIREMENTS

A Sampling Raw Materials

All paints shall be manufactured under inspection of the City Engineer. They shall be made up from lots of raw materials which have been sampled and approved by the City Engineer. The term "raw material" is understood to apply to each separate ingredient of the paint mentioned in the formulas below, except that pigments ground to a paste in pure raw linseed oil shall be considered as "raw materials."

B Acceptance of Raw Materials

The contractor shall furnish and deliver to the City Engineer's laboratory samples of all paint materials at least ten (10) days before mixing paint. The City Engineer will test the various lots proposed for use. After all raw materials have been approved for use, the City Engineer will inspect the manufacture of the paint.

C Process of Manufacture

The following process of manufacture shall, in general, be followed for each paint. Pigments shall be thoroughly ground in sufficient raw linseed oil to produce a stiff paste. The grinding shall be done in a machine of a type approved by the City Engineer. Weighed quantities of the pastes and measured amounts of vehicles shall then be thoroughly mixed in a paint mixing machine. Pastes which at the time of mixing into paint have hardened to any appreciable extent or which show a tendency to separate from the oil shall be rejected.

D Hand Mixing

When approved by the City Engineer, small quantities of paint may be mixed from pastes by hand. When mixed by hand the following approximate procedure shall be used. The paste shall first be placed in a receptacle and small amounts of oil stirred in successively until about one-half the required amount of oil is thoroughly worked in; then if tinting pigment is to be used, it shall separately be brought to the same relative consistency and added, then the drier, and finally the remaining linseed oil shall be added.

E Addition of Turpentine

Paints when supplied by a manufacturer shall be made up, under inspection, to the complete formula with the exception of turpentine. The turpentine shall be added just prior to use in the quantities required by the character of the work, but in no case shall the amount exceed the maximum stated in the paint formula.

F Weight Variation

All paint mixtures after being thoroughly mixed but previous to the addition of thinner shall weigh within two and one-half (2½) per cent of the respective weights shown for the various formulas.

G Quantity of Drier

Owing to a difference in strength of driers, the manufacturer is permitted to vary the quantity of the drier in any formula to produce a paint with only enough drier to set the paint sufficiently.

—24.02 RAW MATERIALS

Except as otherwise specified, raw materials for paint shall conform to the requirements of the Standard and Tentative Standard Specifications of the American Society for Testing Materials under the Serial Designations shown below but with the exceptions noted.

A Red Lead pigment and paste, Serial Designation D83, except that the minimum percentage of true red lead (Pb_3O_4) shall be ninety-seven (97). In all other respects the pigment and paste shall conform to the specifications for the ninety-five (95) per cent grade.

B Basic Carbonate White Lead pigment and paste, Serial Designation D81.

C Flaked Metallic Lead Paste shall consist of pig lead (ASTM Designation B 29, Grade III) in the form of fine flakes combined with mineral spirits (ASTM Designation D 235) and a fatty acid to form a paste suitable for use as an ingredient in paint. It shall contain no fillers or adulterants. The paste shall conform to the following requirements:

Non-volatile matter at 105° to 110° C., per cent	90 to 92
Easily extracted fatty and oily matter, per cent	2 Maximum
Total impurities, other than fatty and	

oily matter, per cent.....	1 Maximum
Coarse particles	
retained on a No. 100 sieve, per cent....	2 Maximum
retained on a No. 200 sieve, per cent....	11 Maximum
retained on a No. 325 sieve, per cent....	20 Maximum

The paste when added to paint of the following formula in the proportion of 2 pounds of paste to 1 gallon of paint shall cause a marked reduction in the gloss of the dried paint, a substantial improvement in spreading properties, and shall eliminate "crawling" of a succeeding coat of Formula B-1 paint applied 24 hours later.

Dry red lead.....	100 pounds
Raw linseed oil.....	3 gallons
Liquid drier	1.5 pints

D Lampblack pigment and paste, Serial Designation D 209.

E Prussian Blue pigment and paste, Serial Designation D 261.

F Ochre pigment and paste, Serial Designation D 85.

G Aluminum Paste for paint, Serial Designation D 474 Type A. The paste shall be equal in luster to "Albron" brand Standard Varnish Aluminum Bronze Powder manufactured by Aluminum Company of America.

H Lemon Chrome Yellow pigment and paste, Serial Designation D 211.

I Chrome Oxide Green, Serial Designation D 263.

J Zinc Oxide pigment and paste, Serial Designation D 79.

K Lithopone pigment and paste, Serial Designation D 208. The behavior on exposure to light, the mixing properties with raw linseed oil, the final consistency with this vehicle, and the brightness and tinting strength (or hiding power) shall be not less than that of "Albalith" brand lithopone as manufactured by the New Jersey Zinc Company.

L Boiled Linseed Oil, Serial Designation D 260.

M Kettle Bodied Linseed Oil shall be prepared by heat-treating pure linseed oil. The treated oil shall be soluble in all proportions in turpentine and mineral spirits. It shall conform to the following requirements:

Iodine Number (Wijs).....	Not less than 115
Specific Gravity, 15.5/15.5° C.....	Not less than 0.937

Acid Number Not more than 4.0
 Viscosity 35 to 75 seconds

N *Raw Linseed Oil*, Serial Designation D 234. The minimum iodine number shall be not less than 177.

O *Turpentine*, Serial Designation D 13. The material shall be either gum spirits of turpentine or steam distilled wood turpentine.

P *Mineral Spirits*, Serial Designation D 235.

Q *Liquid Drier* shall conform to the United States Government Federal Specification for Liquid Paint Drier for general use, containing lead, TTD 651.

R *Spar Varnish* shall be that known to the trade as "long oil spar varnish," and shall meet the requirements of Federal Specifications, TT-V-121.

S *Mixing Varnish* for Aluminum Paint shall be Federal Specification TT-V-81A, Type II, Class B.

—24.03 PAINT FORMULAS

All paint shall be made by the processes and from the materials specified above. The paint shall be made in accordance with one of the following formulas as called for on the plans or as directed by the City Engineer. These formulas are stated in terms of dry pigment. The amount of oil as stated includes both that to be used in grinding pigments to a paste and that to be used in reducing the pastes to a paint.

A *Formula No. A-1, Red Lead Shop Coat for Steel*

Red Lead (dry pigment).....	100 pounds	74.3%
Flaked Metallic Lead Paste.....	10 pounds	7.4
Raw Linseed Oil.....	3 gallons	17.3
Liquid Drier.....	1.5 pints	1.0

100%

Weight per gallon.....	27.8 pounds
Approximate yield	4.68 gallons

Turpentine, to be added as required on the work, not to exceed 0.6 pint per gallon of above paint.

B *Formula No. B-1, Brown First Field Coat for Steel*

Red Lead (dry pigment).....	100 pounds	71.2%
Lampblack (dry pigment).....	1.0 pounds	.7

Flaked Metallic Lead Paste.....	10 pounds	7.1
Raw Linseed Oil.....	3.6 gallons	19.8
Liquid Drier.....	1.0 quart	1.2

100%

Weight per gallon.....	25.3 pounds
Approximate yield.....	5.56 gallons

Turpentine, to be added as required on work, not to exceed 0.75 pint per gallon of above paint.

C *Formula No. C-1, Black Second Field Coat for Steel*

Red Lead (dry pigment).....	50 pounds	34.8%
Lampblack (dry pigment).....	8.4 pounds	5.8
Prussian Blue (dry pigment).....	4.3 pounds	3.0
Raw Linseed Oil.....	10 gallons	54.0
Liquid Drier.....	2.0 quarts	2.4

100%

Weight per gallon.....	11.9 pounds
Approximate yield.....	12.1 gallons

Turpentine, to be added as required on the work, not to exceed 0.5 pint per gallon of above paint.

D *Formula No. C-2, Gray Second Field Coat for Steel*

White Lead (dry pigment).....	100 pounds	68.17%
Lampblack (dry pigment).....	3.0 ounces	0.13
French Ochre (dry pigment).....	5.0 ounces	0.21
Raw Linseed Oil.....	5.75 gallons	30.30
Liquid Drier.....	1.0 pint	1.19

100%

Weight per gallon.....	19.0 pounds
Approximate yield.....	7.7 gallons

Turpentine, to be added as required on the work, not to exceed 0.5 pint per gallon of above paint.

E *Formula No. C-5, Green Second Field Coat for Steel*

Basic Carbonate White Lead (dry pigment)...	80 pounds	49.3%
Zinc Oxide (dry pigment).....	20 pounds	12.3

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Chrome Oxide Green (dry pigment) not to exceed.....	12 pounds	7.4
Chrome Yellow Medium (dry pigment) not to exceed.....	2 pounds	1.2
Raw Linseed Oil, not to exceed.....	6 gallons	28.7
Liquid Drier.....	1 pint	1.1

	100%
Weight per gallon, not less than.....	19.0 pounds
Drying time (for testing purposes only).....	24 hours
Approximate yield.....	8.5 gallons
Turpentine, to be added as required on the work, not to exceed 0.5 pint per gallon of above paint.	

F Formula No. D-1, Aluminum Paint

Aluminum Paste.....	2 pounds
Spar Varnish.....	1.0 gallons
Aluminum Paint shall be mixed on the work and only enough for one day's use shall be mixed at a time.	

G Paint for wood shall consist of pure white carbonate of lead mixed with pure raw linseed oil, and not to exceed ten per cent (10%) by weight of turpentine drier.

2-25 PILING

—25.01 CONCRETE PILING

Concrete Piling shall be manufactured as specified under Reinforced Concrete Structures, Section 11.

—25.02 UNTREATED TIMBER PILING

A Quality of Timber

Piles shall be cut from sound, live, slow-growth Douglas Fir trees. They shall be cut above the ground swell and shall have a uniform taper from the place of butt measurement to the tip. They shall be solid and free from defects, such as injurious shakes, twist of grain exceeding one-half of the circumference in any twenty (20) feet of length, unsound or loose knots, numerous knots, sound knots in clusters, numerous holes, splits longer than the diameter of the butt, and from any other defects which might impair their strength or durability.

Piles shall have an average of at least six annular rings per inch measured radially over a distance of three (3) inches on

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the butt, beginning at a point $3\frac{1}{2}$ inches from the center of the heart.

B Straightness

Piles shall be free from pronounced short bends, reversed bends and crooks.

Short bends shall not exceed the following:

The distance from the center of the pile to a line joining the centers of the pile above and below the bend shall not exceed four per cent (4%) of the length, nor two and one-half ($2\frac{1}{2}$) inches.

The offset caused by a crook in a pile shall not exceed one-quarter of the diameter of the pile at the middle of the bend.

A straight line joining the centers of the butt and tip shall be wholly within the body of the pile.

C Limitation on Size of Sound Knots

Sound knots in certain sections of piles shall be limited as follows:

In piles fifty (50) feet and less in length and in the sections between midlengths and the butts of piles more than fifty feet in length, sound knots shall be not greater in diameter than one-third of the least diameter of the pile at the section where they occur except that no knot shall exceed four (4) inches in diameter.

In section between midlengths and the tip of piles more than fifty feet in length, sound knots shall be not greater in diameter than one-half of the least diameter of the section where they occur, except that no knot shall exceed five (5) inches in diameter.

Diameter of knots shall be measured at right angles to the length of the pile.

D Table of Dimensions

Length of Pile	Butt Measured 8 ft. from End		Tip	
	Min.	Max.	Min.	Max.
40 ft. and less.....	13 in.	20 in.	9 in.	13 in.
41 ft. to 50 ft.....	13	20	8	13
51 ft. to 80 ft.....	14	20	8	13
81 ft. to 90 ft.....	15	20	7	13

The diameter of piles shall be determined by dividing the circumference by 3.14 or by taking the average of the maximum and

minimum diameters at the place of measurement. All dimensions shall be measured under the bark.

E *Trimming and Peeling*

All knots shall be trimmed flush with the body of the pile.

Unless otherwise specified, all piles shall be barked and peeled as soon as practicable after piles are cut. In peeling the piles, not less than eighty per cent (80%) of the inner skin shall be removed. No piece of inner skin left on a pile shall be more than three-quarter ($\frac{3}{4}$) inch wide or eight (8) inches long, and there shall not be less than one (1) inch of clean wood surface between strips.

—25.03 CREOSOTED TIMBER PILING

A *Quality of Timber*

Piling to be creosoted shall comply in all respects to the foregoing specifications for Timber Piling and in addition shall be entirely free from splits and shall have a minimum sapwood thickness at the butt of not less than one (1) inch. In peeling the piles, care shall be taken not to remove the sapwood but to leave it smooth and clean.

Green or freshly cut piling shall not be treated with seasoned or partially seasoned piling.

B *Creosote Oil*

The oil shall conform to the Standard Specifications for coal tar creosote oil in Section 2-7.

C *Treatment*

The method of treatment shall be left to the discretion of the Creosoting Company, provided that at no time during the treatment shall the piling be subjected to a temperature greater than two hundred twenty degrees Fahrenheit (220° F.).

D *Amount of Creosote*

The amount of preservative to be used shall be as specified on the plans or in the special specifications. When not so specified, the following amounts shall be used:

For use in coastal water: Full-cell process, not less than 12 lbs. per cubic foot of piles.

For use in fresh water or other locations where marine borers are not present: Empty-cell process, not less than 8 lbs. per cubic foot of piles.

E *Penetration*

Unless otherwise specified, the minimum penetration determined as specified for timber in Section 2-21.06 shall be as follows:

Full-cell Process: After retention of 12 lbs. per cubic foot—minimum $\frac{3}{4}$ inch of creosoted wood.

Empty-cell Process: After retention of 8 lbs. per cubic foot—minimum $\frac{3}{4}$ inch of creosoted wood.

F *After Treatment*

The piling shall be free from excessive heat checks or other defects which would impair its usefulness or durability for the purposes intended. Piles, when bored at any point in the length of the pile, shall have a minimum penetration of three-quarters ($\frac{3}{4}$) inch of black oil and the wood beyond the oil penetration shall show no moisture and retain its natural elasticity and strength. All holes so bored shall be plugged with creosoted plugs furnished by the Creosoting Company.

Piling shall not be inspected in booms or singly in the water and no stock pile shall be accepted unless otherwise specified.

The contractor shall notify the City Engineer when material for City work is to be treated and shall arrange with the Creosoting Company for the facilities for the inspection thereof.

2-26 PIPE

—26.01 CAST IRON PIPE

A *Description of Pipe*

Cast Iron Pipe may be Pit Cast in accordance with A. S. T. M. Serial Designation A44 and as herein specified, or it may be centrifugally cast in accordance with Federal Specification WW-P-421 for Types I and II, and as herein specified.

All pipe shall be made with bell and spigot ends, and shall conform accurately to the dimensions prescribed in the following tables for the various types of pipe.

All pipe shall be completely lined and coated, as hereinafter specified.

B *Material and Workmanship*

All pipes shall be made of cast iron of good quality, and of such character and so adapted in chemical composition to the thickness of the pipe to be cast, that the iron in the pipe shall be strong, tough, resilient, of even grain, and soft enough for satisfactory

drilling and cutting and it shall comply with the physical requirements herein specified.

The iron shall not contain more than 0.9% phosphorus nor more than 0.1% sulphur.

Cast Iron for Sand Cast Pipe when tested by the Talbot Strip Method, shall have secant modulus of elasticity not to exceed 10,000,000 pounds per square inch with a corresponding modulus of rupture not less than 30,000 pounds.

Cast Iron for Centrifugally Cast Pipe Type I when tested similarly shall have a secant modulus of elasticity not to exceed 12,000,000 pounds per square inch with a corresponding modulus of rupture not less than 40,000 pounds per square inch.

Cast Iron for Centrifugally Cast Pipe Type II when tested similarly shall have a secant modulus of elasticity not to exceed 10,000,000 pounds per square inch with a corresponding modulus of rupture not less than 40,000 pounds per square inch. Where the modulus of elasticity exceeds 10,000,000 pounds per square inch, the modulus of rupture shall exceed 40,000 pounds by at least the same percentage.

Formulae and methods of sampling and testing shall be in accordance with A. S. T. M. Serial Designation A44 for Pit Cast Pipe and in accordance with Federal Specification WW-P-421 for Centrifugally Cast Pipe.

Pipe shall be straight and shall be true circles in section with their inner and outer surfaces concentric.

Each pipe shall be smooth, free from cold shuts, blisters, and sand holes and defects of every nature which unfit it for the use intended. No plugging, filling, "burning in" or welding will be allowed.

C Foundry Records

(1) *Casting*: A record of the melting and pouring temperature of the iron shall be furnished the City Engineer, when requested.

(2) *Chemical Analysis*: Chemical analysis shall be made by the manufacturer from each heat to determine graphitic and combined carbon, total carbon, manganese, phosphorus, sulphur and silicon. Duplicate copies of test reports shall be furnished the City Engineer when requested.

D Cement Lining

Unless otherwise specified, all Cast Iron Pipe shall be lined with Portland Cement mortar. The interior surfaces of the pipe,

with the exception of the bell, shall be cement lined and the cement lining shall have a uniform and approximate thickness as shown in the table below.

The lining shall be centrifugally applied in such a manner as to produce a hard, dense lining, thoroughly compacted and bonded to the metal surface. Pipe will not be accepted in which the cement lining is blistered, scaled, flaked or which shows any other evidence of a poor bond between the cement lining and the barrel of the pipe.

A bituminous seal coat shall be brushed or sprayed on the cement lining when it is still wet. In all other respects, cement lining shall conform to Federal Specification WW-P-421.

The tabulated weights of the various sizes, types and classes of cast iron pipe, as herein set forth, shall be the nominal weight of the cast iron pipe exclusive of the cement mortar lining. In field checking the weights of pipe as delivered, the City Engineer will determine the gross weight of the cement lined pipe and will then deduct therefrom the following weights of the cement lining for the various sizes of pipe. The net weight of the cast iron content thereof, as thus determined, shall not be below the nominal weight, except as herein provided under "Tolerance in Weights."

DIMENSIONS AND WEIGHTS OF THIN CEMENT MORTAR LINING FOR CAST IRON PIPE

Diam. of Pipe	Approx. Thickness of Cement Lining	Weight of Lining per 12' Length	Weight of Lining per 18' Length
4" •	$\frac{3}{32}$ "	15 #	22 #
6"	$\frac{3}{32}$ "	22	33
8"	$\frac{3}{32}$ "	29	43
10"	$\frac{3}{32}$ "	36	54
12"	$\frac{3}{32}$ "	43	65
16"	$\frac{1}{8}$ "	80	120
20"	$\frac{1}{8}$ "	99	149
24"	$\frac{1}{8}$ "	120	180
30"	$\frac{5}{32}$ "	182	
36"	$\frac{5}{32}$ "	218	
42"	$\frac{5}{32}$ "	254	
48"	$\frac{5}{32}$ "	290	

E Coating

Every pipe and casting shall be coated on the outside with coal-tar pitch varnish. The varnish shall be made from coal tar. To this

material sufficient oil shall be added to make a smooth coating, tough and tenacious when cold, and not brittle or with any tendency to scale off.

Each casting shall be heated to a temperature of 300° F. immediately before it is dipped, and shall possess not less than this temperature at the time it is put in the vat. The ovens in which the pipes are heated shall be so arranged that all portions of the pipe shall be heated to an even temperature. Each casting shall remain in the bath at least five minutes.

The varnish shall be heated to a temperature of 300° F. (or less if the City Engineer shall so order) and shall be maintained at this temperature during the time the casting is immersed.

Fresh pitch and oil shall be added when necessary to keep the mixture at the proper consistency and the vat shall be emptied of its contents and refilled with fresh pitch when deemed necessary by the City Engineer. After being coated the pipe shall be carefully drained of the surplus varnish. Any pipe or casting that is to be recoated shall first be thoroughly scraped and cleansed.

In place of dipping, the coating may be applied with a brush. This alternative, however, applies only to castings other than pipe.

After delivery at the trench and before laying, the pipe and all castings shall be carefully inspected for injury to the coating. At all places where the coating has been removed or abraded, the iron shall be first carefully cleaned and then recoated with a field coating that is equal in quality to P. and B. paint.

F Marking Pipe

Each pipe shall have distinctly cast or stamped on the face of the bell, or on the outside surface of the pipe, as the manufacturer may elect, the manufacturer's mark and the year in which the pipe was cast. When specified, each pipe may also have cast or stamped upon it a symbol such as numbers (serial numbers excepted) or letters not exceeding four, or some private mark. Letters and figures cast on the pipe, either raised or recessed, shall have minimum dimensions as follows:

Pipe Diameter	Height of Letters	Recess or Relief
4" to 10", incl.....	3/4"	3/8"
12" to 20", incl.....	1 1/4"	3/8"
24" and larger.....	1 3/4"	1/8"

Stamped letters and figures shall not be less than 1/2" in height and cut 1/8" into the pipe. If serial numbers are required, they may

be painted or stamped on the pipe. The weight shall be conspicuously painted on the inside of the bell.

G Weighing

Each length of pipe or casting shall be weighed after the application of tar pitch coating but before the application of cement lining.

H Allowable Variations in Diameter of Pipes and Sockets

Special care shall be taken to have the sockets of the required size. The sockets and spigots shall be tested by circular gauges and no pipe which is defective in joint room, from any cause, will be accepted. The diameters of the sockets and the outside diameters of the spigot ends of the pipes shall not vary from the standard dimensions by more than .06 of an inch for pipes of 16 inches or less in diameter; .08 of an inch for 18-inch, 20-inch and 24-inch pipes; .10 of an inch for 30-inch, 36-inch and 42-inch pipes; .12 of an inch for 48-inch, and .15 of an inch for 54-inch and 60-inch pipes.

I Allowable Variations in Thickness

The tolerances, or maximum permissible variation from specified thickness of pipe and in dimensions of bells, shall be as listed below:

PIT CAST PIPE		CENTRIFUGALLY CAST PIPE	
Nominal Diam.—In.	Tolerances in Thickness, Plus or Minus, In.	Nominal Diam.—In.	Tolerances in Thickness, Plus or Minus, In.
3 to 8, incl.....	0.07	4	0.04
10 to 24, incl.....	0.08	6 .....	.045
30 to 60, incl.....	0.10	8 .....	.05
		10 .....	.055
		12 .....	.06
		14, 16, 18, 20, 24.....	.08

NOTE—In pipe barrel thickness, tolerances 0.02 inches greater than those listed above shall be permissible over areas not exceeding 8 inches in length in any direction.

J Allowable Variation in Weights

The weight of no single pipe shall be less than the nominal tabulated weights by more than five (5) per cent for pipe sixteen (16) inches or less in diameter and four (4) per cent for pipe more than sixteen (16) inches in diameter.

The total weight of any order shall be not more than two (2) per cent under nominal weight.

K Length of Pipe

All Pit Cast Pipe shall have nominal laying lengths of twelve (12) feet. Centrifugally Cast Pipe shall have nominal laying lengths of 12, 16, 16½, 18 and 20 feet.

L Defective Spigots May Be Cut

Defective spigot ends on pipe twelve (12) inches or more diameter may be cut off in a lathe and a half-round welded wrought-iron band shrunk into a groove cut in the end of the pipe. Not more than twelve (12) per cent of the total number of accepted pipes of each size shall be cut and banded. No pipe shall be banded which is less than eleven (11) feet in length, exclusive of the sockets.

M Standard Fittings and Special Castings

Standard fittings and special castings for Pit Cast Pipe shall be made in accordance with the standard specifications of the American Waterworks Association adopted May 12, 1908, for Class "C" and "D" fittings; provided, if the contractor chooses to furnish pipe in sizes over 24 inches, made from high tensile strength cast iron, as hereinafter provided, the dimensions of such fittings shall be in accordance with detail plans submitted by the contractor and approved by the City Engineer.

Standard fittings and special castings for use with centrifugally cast pipe shall also conform to the standard specifications of the American Waterworks Association for like castings to be used with pit cast pipe. They shall be made from Class "D" patterns and shall have bells which conform to the dimensions given in the following table:

DIMENSIONS OF BELLS OF SPECIAL CASTINGS

Nominal Inside Diameter of Pipe—Inches	Outside Diameter of Pipe—Inches	Inside Diameter of Bells—Inches	Depth of Bells—Inches
4	4.80	5.70	4.00
6	6.90	7.80	4.00
8	9.05	10.00	4.00
10	11.10	12.10	4.00
12	13.20	14.20	4.00
14	15.65	16.65	4.00
16	17.80	18.80	4.00

Nominal Inside Diameter of Pipe—Inches	Outside Diameter of Pipe—Inches	Inside Diameter of Bells—Inches	Depth of Bells—Inches
18	19.92	20.92	4.00
20	22.06	23.06	4.00
24	26.32	27.32	4.00

Iron for standard fittings and special castings shall conform to the requirements of the specifications of the American Society for Testing Materials for Grey Iron Castings, Serial Designation A 48-35 T, or later revision thereof.

Class No. 20 Castings, minimum tensile strength 20,000 pounds per square inch, shall be used with Class 150 pipe.

Class No. 25 Castings, minimum tensile strength 25,000 pounds per square inch, shall be used with Class 200 pipe.

Class No. 30 Castings, minimum tensile strength 30,000 pounds per square inch, shall be used with Class 250 pipe.

All castings shall have cast upon them in raised letters the class of pipe with which they are used. Thus, castings for use with Class 150 pipe shall be marked "Cl. 150," etc.

The diameters of the sockets and the external diameters of the spigot ends shall not vary from the standard dimensions by more than .12 of an inch for 18-inch, 20-inch and 24-inch; .20 of an inch for 30-inch, 36-inch and 42-inch, and .24 of an inch for 48-inch, 54-inch and 60-inch.

When plugs are used, lugs shall be cast on the fittings and the plugs shall be secured by bolts as shown on the standard plan. All plugs except those used in hydrant tees shall be tapped and provided with a four-inch screw plug, the latter to be coated with steam-fitter's cement before being inserted.

N Flanged Fittings

The drilling and size of bolts for all flanged fittings unless otherwise noted on the drawings shall conform to the standard drilling given in the tables of August, 1894, and supplemented in 1901 by the American Society of Mechanical Engineers and the Master Steam and Hot Water Fitters' Association.

(1) *Gaskets*: All gaskets on flanged cast iron pipe (except when otherwise specified and for hydrant connections as mentioned under hydrants) shall be corrugated copper ring gaskets of No. 27 U. S. Gauge.

(2) Table of Flange Drillings:

NOTE: These dimensions are good for all pressures up to and

including 200 pounds per square inch. Diameters of bolt holes shall be one-eighth ($\frac{1}{8}$) inch larger than diameter of bolts. Bolts shall have hexagon nuts and square heads. All flanges shall be plain face and machined.

Diameter of Pipe Inside Inches	Diameter of Flange in Inches	Thickness of Flange in Inches	Diameter of Bolt Circle in Inches	No. of Bolts	Diameter of Bolts in Inches	Length of Bolts in Inches
4	9	$\frac{1}{8}$	$7\frac{1}{2}$	8	$\frac{5}{8}$	$2\frac{3}{4}$
5	10	$\frac{1}{8}$	$8\frac{1}{2}$	8	$\frac{3}{4}$	3
6	11	1	$9\frac{1}{2}$	8	$\frac{3}{4}$	3
8	$13\frac{1}{2}$	$1\frac{1}{8}$	$11\frac{3}{4}$	8	$\frac{3}{4}$	$3\frac{1}{4}$
10	16	$1\frac{1}{8}$	$14\frac{1}{4}$	12	$\frac{7}{8}$	$3\frac{1}{2}$
12	19	$1\frac{1}{4}$	17	12	1	$3\frac{3}{4}$
16	$23\frac{1}{2}$	$1\frac{1}{8}$	$21\frac{1}{4}$	16	1	$4\frac{1}{4}$
20	$27\frac{1}{2}$	$1\frac{1}{8}$	25	20	$1\frac{1}{8}$	5
24	32	$1\frac{7}{8}$	$29\frac{1}{2}$	20	$1\frac{1}{4}$	$5\frac{1}{2}$
30	$38\frac{3}{4}$	$2\frac{1}{8}$	36	28	$1\frac{1}{4}$	$6\frac{1}{4}$
32	$41\frac{3}{4}$	$2\frac{1}{4}$	$38\frac{1}{2}$	28	$1\frac{1}{2}$	$6\frac{1}{2}$
36	46	$2\frac{3}{8}$	$43\frac{3}{4}$	32	$1\frac{1}{2}$	$6\frac{1}{2}$
42	53	$2\frac{5}{8}$	$49\frac{1}{2}$	36	$1\frac{1}{2}$	$7\frac{1}{2}$

O Handling

Care shall be taken in handling the pipes not to injure the coating, and no pipes or other material shall be placed in the pipes during transportation, or at any time after they have been coated.

TABLE NO. 1—PIT CAST PIPE

Nominal Diameter Inches	Class and Working Pressure	Equivalent Head in Feet	Thickness of Pipe in Inches	Inside Diameter in Inches	Outside Diameter in Inches	Diameter of Socket		Depth of Socket		Weight of Pipe per 12 Foot Laying Length	Average Weight per Lineal Foot Including Bell	Weight of Barrel in Pounds per Foot
						Pipe	Standard Specification Castings	Pipe	Std. Spec. Castings			
4	150	346	0.4	4.0	4.80	5.60	5.70	3.50	4.00	230	19.2	17.3
4	200	462	0.4	4.0	4.80	5.60	5.70	3.50	4.00	230	19.2	17.3
4	250	576	0.4	4.0	4.80	5.60	5.70	3.50	4.00	230	19.2	17.3
6	150	346	0.43	6.04	6.90	7.70	7.80	3.50	4.00	360	30.0	27.3
6	200	462	0.43	6.04	6.90	7.70	7.80	3.50	4.00	360	30.0	27.3
6	250	576	0.43	6.04	6.90	7.70	7.80	3.50	4.00	360	30.0	27.3
8	150	346	0.46	8.13	9.05	9.85	10.00	4.00	4.00	515	42.9	38.7
8	200	462	0.46	8.13	9.05	9.85	10.00	4.00	4.00	515	42.9	38.7
8	250	576	0.50	8.05	9.05	9.85	10.00	4.00	4.00	550	45.8	41.9
12	150	346	0.58	12.04	13.20	14.00	14.20	4.00	4.00	935	77.9	71.8
12	200	462	0.63	11.94	13.20	14.00	14.20	4.00	4.00	1005	83.8	77.6
12	250	576	0.68	12.14	13.50	14.30	14.20	4.00	4.00	1105	92.1	85.5
16	150	346	0.68	16.44	17.80	18.80	18.80	4.00	4.00	1500	125.0	114.1
16	200	462	0.79	16.22	17.80	18.80	18.80	4.00	4.00	1710	142.5	131.7
16	250	576	0.85	16.10	17.80	18.80	18.80	4.00	4.00	1825	152.1	141.2
20	150	346	0.83	20.40	22.06	23.06	23.06	4.00	4.00	2265	188.8	172.7
20	200	462	0.90	20.26	22.06	23.06	23.06	4.00	4.00	2430	202.5	186.7
20	250	576	0.97	20.12	22.06	23.06	23.06	4.00	4.00	2600	216.7	200.5
24	150	346	0.93	24.46	26.32	27.32	27.32	4.00	4.00	3030	252.5	231.5
24	200	462	1.00	24.32	26.32	27.32	27.32	4.00	4.00	3230	269.2	248.2
24	250	576	1.08	24.16	26.32	27.32	27.32	4.00	4.00	3460	288.3	267.2
30	150	346	1.10	30.20	32.40	33.40	33.40	4.50	4.50	4405	367.1	337.5
30	200	462	1.19	30.36	32.74	33.74	33.74	4.50	4.50	4835	402.9	368.0
30	250	576	1.39	29.96	32.74	33.74	33.74	4.50	4.50	5545	462.1	427.1
36	150	346	1.22	36.26	38.70	39.70	39.70	4.50	4.50	5896	491.3	448.2
36	200	462	1.43	36.30	39.16	40.16	40.16	4.50	4.50	6940	578.3	528.9
36	250	576	1.54	36.08	39.16	40.16	40.16	4.50	4.50	7405	617.1	567.9
42	150	346	1.35	42.40	45.10	46.10	46.10	5.00	5.00	7655	637.9	578.9
42	200	462	1.58	42.42	45.58	46.58	46.58	5.00	5.00	8990	749.2	681.4
42	250	576	1.71	42.16	45.58	46.58	46.58	5.00	5.00	9635	802.9	735.3
48	150	346	1.48	48.44	51.40	52.40	52.40	5.00	5.00	9596	799.6	724.2
48	200	462	1.73	48.52	51.98	52.98	52.98	5.00	5.00	11280	940.0	852.1
48	250	576	2.02	47.95	51.98	52.98	52.98	5.00	5.00	12925	1077.1	989.2
54	150	346	1.63	54.54	57.80	58.80	58.80	5.50	5.50	11965	997.1	897.4
54	200	462	1.90	54.60	58.40	59.40	59.40	5.50	5.50	14025	1168.8	1052.2
54	250	576	2.21	53.98	58.40	59.40	59.40	5.50	5.50	16005	1333.8	1217.2
60	150	346	1.89	60.42	64.20	65.20	65.20	5.50	5.50	15250	1270.9	1154.3
60	200	462	2.20	60.42	64.82	65.82	65.82	5.50	5.50	17860	1488.3	1350.3
60	250	576	2.38	60.06	64.82	65.82	65.82	5.50	5.50	19135	1594.6	1456.6

NOTE:—Weight of pipe rounded off to nearest 5 pounds.

TABLE NO. 2—CENTRIFUGALLY CAST PIPE

Nominal Diameter— Inches	Class and Working Pressure	Equivalent Head in Feet	Thickness of Pipe in Inches	Inside Diameter in Inches	Outside Diameter in Inches	Diameter of Socket			Weight per Laying Length in Pounds						Average Weight per Linear Foot Including Bell			Calculated Weight of Barrel in Pounds per Linear Foot	
						Pipe	Standard Specification	Type I Pipe	Type II Pipe		Type I Pipe	Type II Pipe		Type I Pipe			Type II Pipe		
									Feet	Feet		Feet	Feet	Feet	Feet	Feet	Feet		Feet
4	150	346	0.34	4.12	4.80	5.60	5.70	3.30	3.50	4.00	195	285	255	265	16.4	15.9	16.1	16.0	14.9
*4	200	462	0.36	4.08	4.80	5.60	5.70	3.30	3.50	4.00	210	305	290	300	17.5	16.9	18.1	18.0	15.7
4	250	576	0.38	4.04	4.80	5.60	5.70	3.30	3.50	4.00	220	325	290	300	18.4	17.9	18.1	18.0	16.5
6	150	346	0.37	6.16	6.90	7.70	7.80	3.88	3.50	4.00	315	460	410	425	26.3	25.5	25.7	25.6	23.7
*6	200	462	0.40	6.10	6.90	7.70	7.80	3.88	3.50	4.00	335	490	440	455	27.9	27.2	28.7	28.6	25.5
6	250	576	0.43	6.04	6.90	7.70	7.80	3.88	3.50	4.00	350	515	460	475	29.3	28.5	28.7	28.6	27.3
8	150	346	0.42	8.21	9.05	9.98	10.00	4.38	4.00	4.00	475	690	615	635	39.4	38.3	38.6	38.5	35.6
8	200	462	0.46	8.13	9.05	9.85	10.00	4.38	4.00	4.00	510	745	665	685	42.4	41.3	41.6	41.4	38.8
8	250	576	0.50	8.05	9.05	9.85	10.00	4.38	4.00	4.00	545	800	715	735	45.5	44.3	44.6	44.5	42.0
12	150	346	0.50	12.20	13.20	14.00	14.20	4.38	4.00	4.00	810	1180	1055	1090	67.4	65.6	66.1	65.9	62.3
12	200	462	0.57	12.06	13.20	14.00	14.20	4.38	4.00	4.00	905	1325	1185	1240	75.4	73.7	74.1	75.2	70.7
12	250	576	0.62	11.96	13.20	14.00	14.20	4.38	4.00	4.00	990	1450	1300	1335	82.5	80.7	81.1	81.0	76.6
16	150	346	0.60	16.60	17.80	18.80	18.80	4.50	4.00	4.00	1320	1935	1730	1780	110.2	107.4	108.1	107.9	101.4
16	200	462	0.68	16.44	17.80	18.80	18.80	4.50	4.00	4.00	1490	2175	1945	2015	124.1	120.7	121.6	122.1	114.3
16	250	576	0.75	16.30	17.80	18.80	18.80	4.50	4.00	4.00	1635	2390	2135	2200	136.1	132.7	133.6	133.3	125.5
20	150	346	0.68	20.70	22.06	23.06	23.06	4.50	4.00	4.00	1860	2720	2430	2505	155.0	151.0	152.0	151.7	142.7
20	200	462	0.78	20.50	22.06	23.06	23.06	4.50	4.00	4.00	2125	3105	2775	2860	177.1	172.4	173.6	173.4	162.9
20	250	576	0.88	20.30	22.06	23.06	23.06	4.50	4.00	4.00	2365	3465	3095	3190	192.4	192.4	193.6	193.2	183.0
24	150	346	0.76	24.80	26.32	27.32	27.32	4.50	4.00	4.00	2480	3630	3245	3340	206.8	202.1	202.9	202.5	190.7
24	200	462	0.88	24.56	26.32	27.32	27.32	4.50	4.00	4.00	2855	4170	3730	3845	237.8	231.6	233.1	233.0	219.8
24	250	576	1.00	24.32	26.32	27.32	27.32	4.50	4.00	4.00	3200	4690	4195	4320	266.8	262.1	262.1	261.7	248.3

* Dimensions and weights apply only to Type I Pipe.

NOTE:—Weights of pipe are rounded off to nearest 5 pounds. Average weight per linear foot is based on weight of pipe computed to nearest pound.

26.02 CENTRIFUGAL CONCRETE PIPE

Centrifugal Concrete Pipe shall be manufactured by a centrifugal process which will produce a dense homogeneous pipe.

A Dimensions

Centrifugal concrete pipe shall have a minimum wall thickness as follows:

Internal Diameter	Wall Thickness
33"	27/8"
36"	3 1/8"
39"	3 1/2"
42"	3 3/4"
45"	3 7/8"
48"	4 1/8"
51"	4 1/4"
54"	4 1/2"
57"	4 3/4"
60"	5"
72"	5 1/2"

B Forms

Forms shall be of iron or steel. They shall be true to shape with accurately fitting joints. They shall be so mounted as to revolve in true circles.

C Concrete

The concrete shall have a cement content of not less than that specified for Class "7" concrete. The rate of spinning shall be such as will insure a uniform distribution of the coarse and fine aggregates throughout the wall of the pipe.

Water and laitance expelled from the concrete shall be removed and the interior of the pipe shall be trowelled and finished to a true straight line.

Pipes shall be steam cured for eight hours before removing the forms. They shall then be kept continuously wet for six days. No pipe shall be hauled or laid until at least fourteen days old.

D Reinforcement

Steel for Reinforcing bars or mesh shall conform to the provisions of Section 2-32. Circumferential reinforcement shall be placed in the center of the wall in pipe designed for pressure, and elliptically in pipe for sewer use, provided if the manufacturer wishes to use two rings of reinforcement, he shall submit detailed

plans thereof to the City Engineer for approval. In the case of steel placed elliptically, the major and minor axes shall be marked on the pipe. Reinforcement shall be sufficient to take all tensile stresses developed in the walls of the pipe under full working load without exceeding 16,000 lbs. per square inch.

E Joints

Any type of mitered or collared joint approved by the Board of Public Works may be used.

F Tests

Centrifugal concrete pipe shall comply with the specifications of and be subjected to the tests described in Specifications P-7C-25T of the American Concrete Institute. Pressure pipe shall in addition be subjected to a hydrostatic test of one and one-half times the designed working head before being placed in the line. After laying and jointing, the entire line shall be subjected to a similar hydrostatic test.

G Contractor to Submit Detailed Plans

Before any centrifugal concrete pipe will be accepted upon any contract where such pipe is specified, the contractor shall submit to the City Engineer for approval, detailed plans showing the amount and position of the reinforcement and the method of jointing.

—26.03 SEWER PIPE

Sewer pipe may be either vitrified clay or concrete; provided, that only one kind of pipe shall be used throughout the improvement.

A Vitrified Clay Pipe

Vitrified clay sewer pipe shall conform to the A. S. T. M. standard specification C-13, except as follows:

Pipes shall be of the best quality and salt-glazed. They shall be sound and well burned throughout their thickness, impervious to moisture, with a clear ring, smooth and well glazed on the interior and exterior surfaces, free from cracks, flaws, blisters, firechecks or other imperfections. Any pipe or special which varies between any two diameters more than three per cent (3%) or which betrays in any manner a want of thorough vitrification, or the use of improper or insufficient materials or methods in the manufacture shall be rejected. Unless otherwise specified all sewer pipe shall be double strength.

(1) *Dimensions*: All pipes shall be of the bell and spigot type with dimensions as indicated in the following table:

TABLE OF DIMENSIONS FOR VITRIFIED CLAY PIPE

Size Internal Diameter	Thickness of Shell Double Strength	Triple Strength	Depth of Socket	Thickness of Socket Double Strength	Triple Strength	Minimum Annular Space
6"	5/8"		2 1/4"			1/2"
8"	1 1/8"		2 1/2"	The thickness of		1/2"
10"	7/8"		2 1/2"	the socket measured		1/2"
12"	1 3/8"	1 3/8"	2 3/4"	1/2" from its outer		1/2"
15"	1 1/4"	1 1/8"	2 3/4"	end shall be not		1/2"
18"	1 1/2"	1 3/4"	3"	less than 3/4 of the		1/2"
21"	1 3/4"	2 1/8"	3 1/4"	specified thickness		5/8"
24"	2"	2 1/8"	3 3/8"	of the barrel of the		5/8"
30"	2 1/2"	2 3/4"	3 1/2"	pipe.		3/4"
36"	2 5/8"	3"	4"			3/4"

The "annular space" is the space between the inside of the socket and the outside of the spigot of the pipe placed therein. The minimum annular space as shown in Column 5 above is measured one-fourth (1/4) inch from the mouth of the socket. The space at the bottom of the socket shall be not less than one-fourth (1/4) inch for each size of pipe.

B Concrete Pipe

Concrete sewer pipe shall conform to the A. S. T. M. Standard Specifications C-14, except as herein otherwise provided.

Concrete for concrete sewer pipe shall have a cement content of not less than is specified for Class "7" concrete.

The interior surface of all concrete pipe shall be equal to the best results obtainable for the method of manufacture used. The City Engineer will be the sole judge as to the fulfillment of this requirement. The finished product shall be sound, hard and dense, free from porosity, cracks or distortion. All dry packed pipe shall show a distinct water web over the entire area of the outside of the pipe. No attempt to plaster or grout any defect shall be permitted.

(1) *Dimensions*: All pipes shall be of the bell and spigot type with dimensions as indicated in the following table;

- TABLE OF DIMENSIONS FOR CONCRETE
SEWER PIPE

1 Size Internal Diameter	2 Thickness of Shell	3 Depth of Socket	4 Thickness of Socket	5 Minimum Annular Space
6"	$\frac{7}{8}$ "	2"	The thickness of	$\frac{1}{2}$ "
8"	1"	$2\frac{1}{4}$ "	the socket,	$\frac{1}{2}$ "
10"	$1\frac{1}{4}$ "	$2\frac{1}{2}$ "	measured one-half	$\frac{1}{2}$ "
12"	$1\frac{3}{8}$ "	$2\frac{1}{2}$ "	inch from its outer	$\frac{1}{2}$ "
15"	$1\frac{1}{2}$ "	$2\frac{1}{2}$ "	end shall be not	$\frac{1}{2}$ "
18"	$1\frac{3}{4}$ "	$2\frac{3}{4}$ "	less than $\frac{3}{4}$ of	$\frac{1}{2}$ "
21"	2"	$2\frac{3}{4}$ "	the specified thick-	$\frac{5}{8}$ "
24"	$2\frac{3}{8}$ "	3"	ness of the barrel	$\frac{5}{8}$ "
30"	3"	3"	of the pipe.	$\frac{5}{8}$ "

The "annular space" is the space between the inside of the socket and the outside of the spigot placed therein. The minimum annular space as shown in Column 5 above is measured one-quarter ($\frac{1}{4}$) inch from the mouth of the socket. The space at the bottom of the socket shall be not less than one-quarter ($\frac{1}{4}$) inch for each size of pipe.

Concrete sewer pipe eight (8) inches in diameter and larger shall be furnished in units not less than thirty-six (36) inches long.

When the special specifications for the improvement require a hydrostatic test, the socket design on all pipe eighteen (18) inches in diameter and larger shall be modified as follows:

The shoulder of the bell or socket against which the spigot rests shall be beveled to permit caulking and pointing the joint from the inside. The bevel of the shoulder shall be sufficient to allow a space of three-eighths ($\frac{3}{8}$) inch between the inside edge of the shoulder and the spigot end of the pipe inserted therein.

(2) *Tests for Concrete Sewer Pipe*

The City Engineer shall be permitted to select at random for test purposes the required number of pipe for each test specified. Stock pipe submitted for test shall be previously culled for seconds as no retest will be permitted.

All sewer pipe manufacturing plants shall be fully equipped to make all the specified tests and shall conduct the same under the supervision of the City Engineer. The cost of such tests, including the cost of the pipe tested, shall be borne by the contractor for

the improvement and no allowance whatever shall be made for such costs.

Failure of twenty (20) per cent of the specimens selected to meet the requirements of any of the tests imposed shall result in the rejection of all the pipe in the shipment or delivery or consignment corresponding to the sizes thus failing to comply; provided, that concrete pipe that fails to meet the crushing test may be retested at a later date. The City Engineer shall be permitted to place a satisfactory mark of identification on all pipe approved.

(a) *Absorption Test*: Specimens for absorption tests shall be prepared and tested in accordance with the A. S. T. M. C-14.

(b) *Fill Test*: The following "Fill Test" may be used as a short cut, preliminary to, or in lieu of, the percolation tests as prescribed by the A. S. T. M.

The pipe selected for test shall be placed, spigot end down, on a soft rubber pad and filled with water. The pipe shall be kept full of water for a period of two (2) minutes. At the end of this time, the outer surface of the pipe shall show no moist spots due to water passing through the walls of the pipe.

The City Engineer shall test as many pipes as he deems necessary, but in no case shall less than five (5) pipe of each size be tested.

Pipe submitted for acceptance and which fails to pass the fill test, may be subjected to the pressure test in accordance with the A. S. T. M. Acceptance or rejection shall be based on the result of such test.

Pipe passing the "Fill Test" shall be approved for percolation unless, in the opinion of the City Engineer, the Standard percolation test is required.

(c) *External Crushing Test*: The crushing tests shall be according to the A. S. T. M. three-point bearing method. When tested in this manner, the various sizes shall withstand the following loads:

Internal Diameter	Lbs. per Lin. Ft. (Double Strength)	Lbs. per Lin. Ft. (Triple Strength)
6"	1500	2000
8"	1500	2000
10"	1600	2400
12"	1750	3000
15"	2000	3500
18"	2250	3800
21"	2400	4000
24"	2650	5000
30"	3000	5500
36"	3500	6000

Two (2) per cent of each size pipe ordered shall be selected for test. In orders less than fifty (50), one pipe of each size shall be tested.

—26.04 WROUGHT PIPE, GALVANIZED

A Iron Pipe

Galvanized Wrought Iron Pipe shall conform to the requirements of the specifications of the American Society for Testing Materials for Welded Wrought Iron Pipe, Serial Designation A72 and later revisions thereof. It shall be thoroughly galvanized.

B Steel Pipe

Galvanized Steel Pipe shall conform to the requirements of the specifications of the American Society for Testing Materials for Welded and Seamless Steel Pipe, Serial Designation A53 and later revisions thereof. It shall be thoroughly galvanized.

C Manufacturer's Mark

The manufacturer's name, trade mark, or other identification shall be permanently marked on each length of Galvanized Wrought Iron Pipe and Galvanized Steel Pipe.

2-27 ROPE GASKETS (WATERMAIN YARNING)

Rope Gaskets for Watermain "Yarning" shall be untreated, clean, square braided rope yarn designed especially for packing Cast Iron Pipe joints. Or they may be such other manufactured rope packing made of paper or other material which is clean,

sterile and dry and free from oil, grease, or tar and is approved by the City Engineer.

2-28 RUBBER COVERED WIRE

—28.01 STANDARD

Rubber covered wire except when used in underground conduits shall conform in all respects to the requirements of the "National Electric Code Standard Specifications."

—28.02 FOR UNDERGROUND USE

All rubber covered wire for use in underground conduits shall be single conductor copper wire covered with thirty (30) per cent "Para" rubber and double braid insulation, or covered with thirty (30) per cent "Para" rubber and tape and braid insulation. Sizes shall be B. & S. gauge.

—28.03 TESTS

All rubber covered wire shall be suitable for continuous operation at 600 volts alternating E M F. No. 4 and No. 6 R. C. Wire shall be required to resist a puncture test of 2,000 volts effective alternating E M F, and wires smaller than No. 6 shall be required to resist a puncture test of 1,500 volts, such test applied for five (5) minutes between conductors and ground. Wire No. 6 or larger shall be stranded. Wire smaller than No. 6 may be solid.

2-29 SAND

Sand shall be free from loam, clay, vegetable matter or other foreign substances. It shall consist of uniformly hard durable particles, and shall be graded as follows:

—29.01 STRUCTURAL GRADE

100% shall pass a No. 4 sieve.

Not less than 93% shall pass a No. 6 sieve.

Not less than 85% nor more than 95% shall pass a No. 8 sieve.

Not less than 63% nor more than 80% shall pass a No. 14 sieve.

Not less than 40% nor more than 60% shall pass a No. 28 sieve.

Not less than 12% nor more than 30% shall pass a No. 48 sieve.

Not more than 14% shall pass a No. 65 sieve.

Not more than 8% shall pass a No. 100 sieve.

Not more than 2% shall pass a No. 200 sieve.

—29.02 PAVING GRADE

100% shall pass a No. 3 sieve.

Not less than 87% shall pass a No. 4 sieve.

Not less than 74% nor more than 98% shall pass a No. 6 sieve.
 Not less than 63% nor more than 88% shall pass a No. 8 sieve.
 Not less than 40% nor more than 62% shall pass a No. 14 sieve.
 Not less than 20% nor more than 40% shall pass a No. 28 sieve.
 Not less than 10% nor more than 21% shall pass a No. 48 sieve.
 Not more than 8% shall pass a No. 100 sieve.
 Not more than 2% shall pass a No. 200 sieve.

—29.03 FOR MORTAR

For mortar one hundred per cent (100%) shall pass a No. 6 sieve and not more than ten per cent (10%) shall pass a No. 48 sieve.

—29.04 FOR PLASTER AND GROUT

For plaster and grout one hundred per cent (100%) shall pass a No. 8 sieve and not less than fifty per cent (50%) nor more than eighty per cent (80%) shall pass a No. 28 sieve.

—29.05 STANDARD SIEVES

Wherever sieves are mentioned in these specifications they shall have a square effective opening in inches as follows:

Sieve No.	Effective Square Opening—in Inches
3	0.263
4	0.185
6	0.131
8	0.093
14	0.046
28	0.0232
48	0.0116
65	0.0082
100	0.0058
200	0.0029

2-30 STEEL CASTINGS

Steel castings shall conform to the requirements of the A. S. T. M. Standard Specifications for Steel Castings; Class B, Medium Grade, Serial Designation A 27, supplemented by the following paragraphs:

All steel casting shall be thoroughly annealed unless otherwise provided.

Steel castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Blow holes appearing upon finished castings shall be so located that a straight line laid in any direction will not cut a total length of cavity greater than one inch in any one foot, nor shall any single blow hole exceed one inch in any dimension or have an area greater than one-half square inch. Minor defects which do not impair the strength, may with the approval of the City Engineer, be welded by an approved process. The defects shall be removed to solid metal by clipping, drilling or other satisfactory methods and, after welding, shall be annealed, if required by the City Engineer. Castings which have been welded without the City Engineer's permission shall be rejected.

Large castings, if required by the City Engineer, shall be suspended and hammered all over. No cracks, flaws, or other defects shall appear after such treatment.

No sharp unfilleted angles or corners will be allowed.

2-31 STEEL FORGINGS

Steel forgings shall conform to the requirements of the A. S. T. M. Standard Specifications for Carbon Steel Forgings for Locomotives, Serial Designation A-19.

All forgings shall be thoroughly annealed prior to being machined to form finished parts.

2-32 STEEL REINFORCING BARS

Steel concrete reinforcing bars shall be billet steel bars, conforming to the Specifications of the American Society for Testing Materials, Serial Designation A-15, except for the place of making tests. The City Engineer reserves the right to designate the place for making tests.

These specifications cover two classes of billet-steel concrete reinforcing bars; namely, plain and deformed. Unless otherwise noted on the plans, both plain and deformed bars shall be intermediate grade.

The price bid for reinforcing steel shall include the cost of all specimen bars used for testing purposes.

2-33 STRUCTURAL STEEL

Structural Steel (including rivet steel) shall conform to the requirements of the A. S. T. M. Standard Specifications for Structural Steel for Bridges, Serial Designation A-7 supplemented by the following paragraphs:

Test specimens of structural, rivet or eyebar steel shall show a fracture having a silky or fine granular structure throughout with a bluish gray or dove color; and shall be entirely free from granular black and brilliant specks.

Finished rolled material shall be free from cracks, flaws, injurious seams, laps, blisters, ragged and imperfect edges, and other defects. It shall have a smooth, uniform finish, and shall be straightened in the mill before shipment.

Material shall be free from loose mill scale, rust pits, or other defects affecting its strength and durability.

2-34 WATER

Water for use on any improvement shall be obtained from the City's water system, unless permission is given to obtain water from other sources. The contractor shall supply water in sufficient quantities to comply with the requirements of these specifications.

SECTION 3

SPECIFICATIONS FOR GRADING, CURBING AND APPURTENANCES

3-1 CLEARING AND GRUBBING

The district to be cleared and grubbed shall include: First, the area covered by the improvement under contract, including all slope areas and the area of all approaches to be made to the improvement. Second, all areas except private property where waste material is to be deposited. All roots, stumps, trees, logs, brush, old sidewalks, planking, sills, crosswalks, curbs, gutters, box drains, bulkheads and other lumber, with the exception of sod, all material subject to shrinkage or decay and all other debris encountered on any portions of the work shall be piled and burned or otherwise disposed of as the City Engineer may direct; provided, that no debris of any kind whatsoever shall be deposited in any water surrounding the City, or in any street or alley, or upon any private property, except by written consent of the owner of such private property. Lumber containing spikes or nails shall not be burned in the street. All boulders encountered during the progress of the work shall be removed and disposed of to the satisfaction of the City Engineer.

All wood crosswalks, curbs, gutters and other lumber which has a salvage value shall be removed in such manner as to sustain as little damage as possible and shall be carefully piled and guarded until used. All salvaged lumber not used in connection with the improvement under contract and which in the judgment of the City Engineer may be deemed of use to the Maintenance Division shall be set aside by the contractor in suitable piles for removal by said Maintenance Division.

In removing any bulkheads or retaining walls, special care shall be taken to adequately support any existing sidewalks or other structures. Where necessary to adjust any existing improvement, such as wood or concrete sidewalks, planking or paving, to the new improvement, such work shall be taken up and replaced, as directed by the City Engineer. In such cases, however, the cost of taking up such existing improvement shall be included in the prices bid for relaying or replacing the same.

The work of clearing and grubbing shall be commenced only at such place or places, and shall be extended only over such area or areas at one time, as the City Engineer may designate.

On grading contracts, the district to be cleared and grubbed shall include also the area covered by all slopes, whether in excavation or embankment, extending beyond the margins of the streets. All stumps that stand on the line of the street or on the line of the slope of any excavation or embankment, shall be entirely removed; the removal of a portion of such stumps will not suffice. All fences adjoining any excavation or embankment, which may be liable to fall or to be buried, shall be carefully removed and placed upon the adjoining property. After the excavation or embankment has been completed, these fences shall be rebuilt by the contractor upon the property lines.

Payment for clearing and grubbing shall be made at the prices bid per acre or lump sum, as shown on the proposal sheet.

3-2 STRIPPING

Where directed by the City Engineer all areas to be filled shall, after being cleared as specified under clearing, be stripped of all turf, sod and grass.

Payment for stripping shall be made at the price bid per acre.

3-3 EARTHWORK

Under this head is included all excavation and embankment required to bring the street to a finished grade, making approaches to abutting streets and alleys, and all other excavation or embankment connected with or incident to the completion of the work. The surfacing of all slopes and parks is included in Earthwork.

—3.01 SLOPE STAKES

The City Engineer shall set slope stakes at the edge of the slopes in both cuts and fills. The amount of cut or fill marked on the stake shall be measured from the horizontal red line appearing on the stake and not from the surface of the ground. Before any clearing, grubbing or grading is begun on any improvement which has been slope-staked, the contractor shall set a substantial, wooden reference hub five (5) feet back from the slope stake, at right angles to the street, and in such a manner that the top of the hub is at a designated elevation above or below the horizontal red line appearing on the slope stake.

Failure to comply with this requirement will authorize the City Engineer to set the reference hubs and the cost of such work done by the City Engineer shall be deducted from any money due the contractor for this improvement.

—3.02 EXCAVATION

All material shall be removed from the excavations by some method to be approved by the City Engineer, and shall be deposited in the embankments. In case any material shall slide into the excavations during the progress of the work, it shall be removed at the contract price. No extra payment shall be allowed therefor. All side slopes shall be made at the inclination shown on the plans or as may be directed by the City Engineer. Except where otherwise directed, they shall be dressed to straight lines and plane surfaces. Material from excavations in excess of the amount required to complete the embankments within the local improvement district under contract, shall be deposited in adjoining streets and alleys or upon other public property, as may be directed by the City Engineer. Any remaining waste material shall be deposited upon such private property as may be assessed for the cost of the improvement under contract, the owners of which have filed with the City Engineer an application for such waste material. All applications made prior to the opening of bids will be attached to the specifications for the improvement. In addition to the applications made prior to the opening of bids, the contractor shall comply with all requests made subsequently, provided the earth has not been already removed from the excavation. The contractor shall not remove any material from the district, until he has ascertained that no more material is required by the property owners within the local improvement district. Where earth is placed on private property by direction of the City Engineer the contractor will not be required to haul the same a greater distance than six hundred (600) feet.

The contractor shall not deposit earth on private property without the written consent of the owner thereof. Should he do so, he shall remove such earth immediately, upon the order of the City Engineer, without reimbursement therefor.

All solid or loose rock or boulders encountered in the progress of the work shall be removed and disposed of by the contractor to the satisfaction of the City Engineer.

All material remaining after the requirements set forth herein have been met, shall be disposed of by the contractor.

—3.03 EMBANKMENT

The contractor shall furnish all material required for embankments. All borrow pits shall be cleared and grubbed in such manner as to prevent any objectionable material specified under "Clearing and Grubbing," from being deposited in the embankment. No payment shall be made for the clearing and grubbing of borrow pits, or for any loose or solid rock found therein. The clearing and grubbing shall be kept at least two hundred (200) feet in advance of the embankment, and no embankment shall be commenced until the clearing and grubbing has been inspected and approved by the City Engineer. All embankments shall be made of such width and with such side slopes as may be shown on the plans or as may, in the judgment of the City Engineer, be required to maintain solid and permanent sidewalks and roadways. *The contractor must use his own judgment as to the amount of shrinkage or settlement of the underlying ground to be provided for.* Where required by the City Engineer, the slopes of all embankments shall be dressed as specified above for excavations.

—3.04 REMOVING UNSUITABLE MATERIAL

Whenever, in the judgment of the City Engineer, the original ground is too soft or is otherwise unsuitable to remain in the street, the contractor shall excavate the same to such a depth as may be directed, and dispose of such material outside of the limits of any public streets or alleys. All material so removed shall be classified and paid for as "Earthwork."

If "Earthwork" is being paid for on the basis of embankment, both excavation and refill shall be allowed at the price bid per cubic yard for "Earthwork." If "Earthwork" is being paid for on the basis of excavation and the earth required is available from waste material within this improvement district, and within a distance not exceeding thirteen hundred (1300) feet no allowance shall be made for refill. If suitable material cannot be obtained from the streets in this improvement district, within thirteen hundred (1300) feet, payment for refill shall be made at a price per cubic yard agreed upon by the contractor and the City Engineer.

—3.05 MEASUREMENT AND PAYMENT

All excavations and embankments required shall be carefully

and accurately cross-sectioned, and the cubical contents computed by the method of averaging end areas.

Payment for "Earthwork" shall be made at the price bid per cubic yard, and shall include the cost of excavating and removing all material from excavations and depositing the same in embankments, whether on the street or on private property. It shall include also the removal of all loose rock or boulders less than one-half ($\frac{1}{2}$) cubic yard in volume, encountered during the work, all water settling, rolling and tamping of embankments or subgrades, and all other labor and material necessary for the complete work. Where the excavation exceeds the embankment, payment shall be made for excavation only. Where the embankment exceeds the excavation, payment shall be made for embankment only, and allowance shall not be made for shrinkage of the materials used for filling or for settlement of the underlying ground. Solid rock or boulders over one-half ($\frac{1}{2}$) cubic yard in volume shall be paid for as "Rock Excavation." Solid rock shall include all rock in ledge formation that cannot be removed except by drilling and blasting and all boulders containing more than one-half ($\frac{1}{2}$) cubic yard.

In no case will formations known as cemented gravel or hardpan be paid for as "Rock Excavation" nor any other formation which can be removed as readily as cemented gravel or hardpan.

"Rock Excavation" shall be measured and paid for to the neat lines of the section called for by the plans and specifications or to the section as actually excavated where the finished lines have been determined by the engineer.

In trenches, ditches and excavation for structures the volume to be paid for shall include only the neat section necessary for such trench, ditch or structure. In tunnels, rock shall be paid for, for the necessary section of the tunnel only.

3-4 SURFACING ROADWAYS AND PARKING STRIPS

All earth roadways shall be dressed to a smooth and uniform surface, crowning uniformly between gutters to a crown height equal to mean curb elevation. All rocks or stones greater than two (2) inches in longest diameter shall be removed from the surface of the street. All fill in parking strips shall be made of the best soil available from excavation within the district, and all parking strips shall be carefully raked to a smooth and even surface.

Payment for such surfacing shall be included in the price bid for "Earthwork."

3-5 EXTRA EXCAVATION

Extra Excavation shall include all excavation beyond that specified or shown on the standard or special plans, which may be necessary to secure a proper foundation for structures, for special trenching or extra depth of trenches; provided, however, that additional excavation in connection with grading or subgrading, which is caused by the changing of the street grade, or the removal of unsuitable material, as specified under Section 3-3.04, shall be paid for as earthwork or subgrade and not as extra excavation.

Payment for "Extra Excavation" shall be made at the price bid per cubic yard.

3-6 CONCRETE CURB

Concrete Curb shall be constructed according to the plan.

After the concrete has been deposited, it shall be well spaded on both face and back to full depth of curb with a perforated spade, to secure a smooth and uniform finish. The top of the curb shall be troweled smooth and finished with a stipple brush.

Two (2) inch weep holes through the curb shall be provided for all existing drains. Where no drains exist, similar weep holes shall be placed through the curb where street is in cut, approximately sixty (60) feet apart.

The contractor shall provide galvanized sheet metal forms for these holes and fit them into the curb forms in a workmanlike manner so as to insure a neat appearance at the face of the curb.

Three-eighths ($\frac{3}{8}$) inch transverse expansion joints shall be placed in the curb at intervals of thirty (30) feet.

Form lumber shall be of three (3) inch stock thickness, provided form lumber for curb returns of a radius of twenty (20) feet or greater shall be of one (1) inch lumber. Returns of a radius less than twenty (20) feet shall be constructed of one-half ($\frac{1}{2}$) inch lumber or plywood.

After the forms have been removed, any defects shall be corrected. Any faults or interstices shall be filled with cement mortar and smoothed so that the top and face of the curb are free from defects. The contractor shall protect the curb from all damage due to traffic and the weather. In hot, dry weather the curb shall

be kept moist by sprinkling as often as directed by the City Engineer.

Payment for Concrete Curb shall be made at the price bid per linear foot for "Concrete Curb" in place and shall include payment for the expansion joints and the two (2) inch weep holes and all other labor and material necessary. Measurement shall be made along the face of the curb.

3-7 CONCRETE CURB AND GUTTER

Concrete curb and gutter shall be constructed of Class "5" concrete.

The subgrade shall be thoroughly tamped and shall be wet before placing concrete, as specified for concrete pavement. The gutter surface shall be floated and brushed in a longitudinal direction with a soft brush. The curb shall be finished and provided with weep holes as specified for concrete curb. Concrete alley crossings and private driveways shall be constructed with concrete curb and gutter, as specified with concrete pavement, except that the joint along the curb may be omitted and the gutter portion of private crossings shall be seven (7) inches thick. The entire crossing, including the gutter, shall be paid for as Private Driveway.

One-half inch expansion joints shall be placed through the concrete curb and gutter at each side of alley crossings, driveways and street margins, and at intervals of approximately ninety (90) feet.

Dummy joints one-eighth ($\frac{1}{8}$) inch thick shall be placed at intervals of not to exceed fifteen (15) feet, as hereinafter specified for concrete pavement.

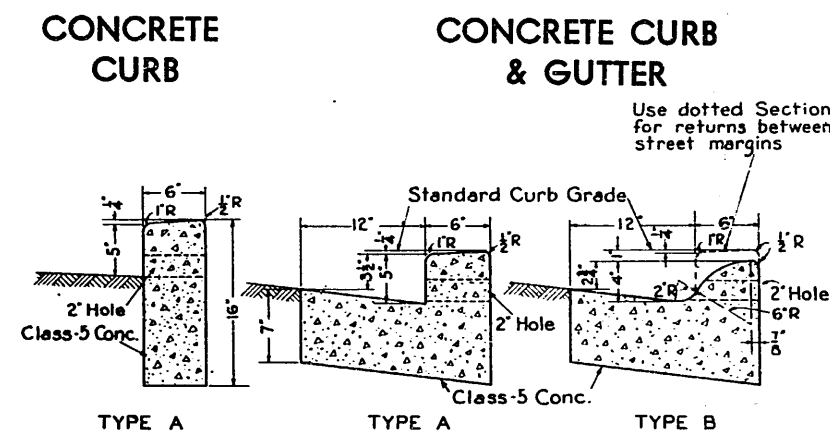
A three-eighths ($\frac{3}{8}$) inch through joint shall also be placed between each alley crossing or private driveway and the existing concrete walk.

At street intersections, Type "B" Concrete Curb shall be raised from four (4) inches to five (5) inches in height, as shown on the plan. The higher section shall extend around the return from street margin to street margin projected, the transition being made in the six (6) feet immediately inside the projected street margin.

Concrete curb and gutter shall be cured by covering with earth and keeping the same wet for five (5) days.

Payment shall be made at the price bid per linear foot for

"Concrete Curb and Gutter. Type 'A' or 'B,'" and shall include payment for the expansion joints and the two (2) inch weep holes, earthwork and subgrading, and all other labor and material necessary. Measurement shall be made along the face of the curb, except in the case of Type "B" curb where measurement will be made on a line parallel to and six (6) inches from the back of the curb.



3-8 WOOD CURB AND GUTTER

Lumber for curbs, gutters and lips shall be laid in sixteen (16), twenty-four (24) or thirty-two (32) foot lengths, and shall rest on sound blocks of the dimensions shown, placed not more than eight (8) feet center to center, under every joint, and solidly bedded in the ground. The lumber for curb, gutter and lip shall be dressed on four sides. The gutters shall be nailed to each block with two 60-penny nails, and the curbs and lips to the gutters with 60-penny nails, every two feet, driven horizontally. Curbs, gutters and lips shall be laid breaking joints. Angle blocks shall be nailed with two 16-penny nails at each end. All breaks in grades shall be carefully rounded by vertical curves.

On horizontal curves having a radius of sixty (60) feet or less, all pieces of curb, gutter and lip shall be sawed to fit the curve. On those having a radius of more than sixty (60) feet but less than one hundred fifty (150) feet, the gutter boards shall be sawed to fit the curve and the curb and lip pieces shall be made of straight lumber, sawed partly through on the back side in such

a manner and at such intervals as may be directed by the City Engineer, and fitted to the curve. On curves of one hundred fifty (150) feet or more radius, all pieces shall be made of straight lumber, provided that on curves of less than two hundred (200) feet, the pieces shall be partly cut as specified above, and bent to conform to the prescribed curve.

Payment for "Wood Curbs and Gutters" shall be made at the price bid per M. ft. B. M. in place.

3-9 ADJUSTING WOOD CURBS AND GUTTERS

Where directed, curbs and gutters existing before the award of this contract shall be adjusted to grade by blocking up, or by taking up and relaying them. Such old lumber as may be suitable shall be used over again.

Payment for "Adjusting Wood Curbs and Gutters" shall be made at the price bid per M. ft. B. M. in place and all new lumber that is needed shall be paid for at the price bid per M. ft. B. M. for "Wood Curbs and Gutters."

3-10 SHEAR BOARDS (For plan, see page 100)

Shear boards shall be well fitted, securely spiked to the gutter lip, and well bedded in the ground.

Payment for "Shear Boards" shall be made at the price bid per M. ft. B. M. in place.

3-11 SAND BOXES (For plan, see page 103)

Sand boxes shall be built according to the details shown. The outlet shall consist of a one-quarter ($\frac{1}{4}$) bend sewer pipe of the same inside diameter as is required for the connection to the main sewer. It shall be neatly fitted into the box with the spigot end inside. A proper connection between the hubs outside the box shall be made by means of a short section of pipe. Unless otherwise specified, the connection to the main sewer shall be made with eight (8) inch sewer pipe.

Payment for "Sand Boxes" shall be made at the price bid as listed on the proposal sheet. This payment shall include all labor and material for the box, inlets, excavation and connection to the main sewer, provided said connection is not over forty (40) feet in length. One dollar (\$1.00) per foot shall be allowed for all pipe used beyond the 40-foot connection.

3-12 SEWER PIPE DRAINS (For plan, see page 99)

Sewer pipes for drains shall be of the same quality as specified

under "Sewers." The pipe shall be laid to a straight line and grade and solidly bedded in the ground. They shall be provided with such inlets as may be ordered.

Payment for "Sewer Pipe Drains" shall be made at the price bid per linear foot in place for the size and type specified, and shall include inlets and excavation and backfilling of the trench with gravel.

3-13 BOX DRAINS (For plan, see pages 101, 102)

The planking for the sides and bottom of box drains shall be dressed on one side and two edges. The three-cornered strips nailed to the bottom of the box shall be dressed on all sides.

A box drain screen shall be constructed at the upper end of all box drains in fills. The ends of all rods shall be flattened out to one-fourth ($\frac{1}{4}$) inch in thickness, and punched to take a 10-penny nail. Payment for box drain screens shall be included in the price bid for box drain lumber.

The construction of temporary inlets shall include all labor and material necessary to connect the gutter with the box drain and also to provide and set a grating. Payment for temporary inlets shall be included in the price bid for "Box Drains."

Payment for "Box Drains" shall be made at the price bid per M. Ft. B. M., which shall include all excavation and backfilling.

3-14 ROCK POCKETS

Rock pockets shall be constructed where shown on the plans. The rock used shall conform to the specifications for coarse gravel.

Payment shall be made at the price bid per cubic yard for "Gravel in Rock Pockets" and per linear foot for "Sewer Pipe Drain Connection" of the size required. Such prices shall be in full for furnishing all labor and material including all excavating, backfilling and disposal of surplus material.

3-15 CONCRETE POST FENCE (For plan, see page 99)

Where shown on the plan or where directed by the City Engineer, the contractor shall construct a concrete post fence. The posts shall be precast of concrete of the class shown, with smooth, dense surface. Rails shall conform to the specifications for structural timbers. Rails and posts shall be given three (3) coats of white paint of the quality specified in Section 2-24.

Payment for "Concrete Post Fence" shall be made at the price

bid per linear foot, which shall be in full for all labor and material necessary to construct the fence according to the Standard Plans.

3-16 BEAM GUARD RAIL (For plan, see page 106)

—16.01 GENERAL

Beam Guard Rails complying with the requirements of these specifications shall be constructed where indicated on the plans or where directed by the City Engineer.

—16.02 BEAM OR RAIL ELEMENT

Beam Guard Rails shall consist of a single steel plate, not less than 12 gauge, mounted horizontally on concrete posts.

The steel plates shall be stiffened by means of two or more longitudinal corrugations not less than three (3) inches deep. The overall width of the beam after being corrugated, shall not be less than twelve (12) inches.

Steel for the rail element shall conform to A.S.T.M., Serial Designation A-27.

The posts shall be spaced 12 feet 6 inches (12'6") on centers measured along the centerline of the rail. The rail element shall be spliced at each point by lapping in the direction of traffic or by butt joints. The holes in the plate shall be slotted to facilitate erection and to permit expansion and contraction. Where the rail is on a curve the plates at the splice shall make contact throughout the area of splice; the rail shall be shaped before erection if necessary. The rail element, including splices, shall have an ultimate tensile strength of at least 70,000 pounds.

The edges of the rail shall be rolled or rounded so that they present no sharp edges. The projecting heads of all connection and splice bolts shall be rounded and shallow so that no appreciable projection will obstruct a vehicle sliding along the rail.

The ends of each length of guard rail shall be finished off with a section of rail bent or turned so that the end shall be in line with the back face of the end post. The end pieces shall be the same material as the rail and shall be spliced with it as other joints.

—16.03 CONCRETE POSTS

The posts shall be precast of concrete of the class shown and shall have smooth dense surfaces. They shall be reinforced as indicated on the plans.

—16.04 ERECTION OF RAIL

All metal work shall be fabricated in the shop. No punching, cutting or welding shall be done in the field, except that holes for special details in exceptional cases may be drilled in the field, when approved by the City Engineer. The rail shall be erected so that the bolts at expansion joints shall be located at the centers of the slotted holes.

All bolts, except where otherwise required at expansion joints, shall be drawn tight. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another longitudinally. Bolts shall be sufficiently long to extend at least one-quarter inch beyond the nuts. Except where required for adjustments, bolts shall not extend more than one-half inch beyond the nuts.

—16.05 FASTENINGS

Rail plates shall be fastened to the posts with galvanized bolts, washers, and nuts of the size and kind shown on the plans.

—16.06 PAINTING

Concrete posts shall be given one coat of concrete primer and two coats of white paint.

The Steel Rail Element shall be painted at the factory with one coat of approved primer. After erection it shall be given one coat of red lead and two coats white paint of the quality specified in Section 2-24.

—16.07 MEASUREMENT AND PAYMENT

Beam Guard Rail shall be measured along the face of the completed rail from end to end.

Payment shall be made at the price bid per linear foot for "Beam Guard Rail," which price shall be in full for the completed guard rail in place, including concrete posts, painting and any other labor, material or equipment necessary in connection therewith.

3-17 REFLECTOR SIGNALS

Whenever a Reflector Signal on Concrete Post, as per detail plan, File No. 805-9, is to be placed as an individual unit, bids will be taken on "Reflector Signal and Concrete Post." Payments shall be made at the price bid per each and shall be in full for Reflector Signal and Concrete Post in place.

Whenever a Reflector Signal and Concrete Post become part of a Concrete Post Fence or a Beam Guard Rail, bids shall be taken for "Reflector Signals" only. Payment shall be made at the price bid for each, and shall not include the Concrete Post. The specially formed Concrete Post on which the Reflector is mounted shall then be measured as a part of the Concrete Post Fence or Beam Guard Rail and shall be paid for at the price bid per linear foot for such fence or rail. Specially formed posts shall be provided as are needed to accommodate said "Reflector Signals."

3-18 TWIN DANGER LIGHT (For plan, see pages 104, 105)

Twin Danger Lights shall be constructed where shown on the plans. They shall conform in all respects to the detail plans. The contractor shall install all conduit and wiring to and including the condulets and fuses upon the existing service pole, as shown on the plans. He shall furnish sufficient one-half ($\frac{1}{2}$) inch conduit to reach from the conduit to the top of the pole, together with a one-half ($\frac{1}{2}$) inch T & B entrance cap. Installation of the conduit beyond the conduit and connection to the feed wires shall be done by the City Light Department and the cost thereof shall be paid for as specified in Section 1-39.

Payment for "Twin Danger Light" shall be made at the price bid therefor, which price shall be in full for the concrete post, Twin Danger Light and all equipment and wiring in place, except the three-quarter ($\frac{3}{4}$) inch conduit extending from the coupling at the concrete post to the conduit on the service post, and all of the No. 14 rubber covered wire, which items shall be paid for at the price bid per linear foot in place.

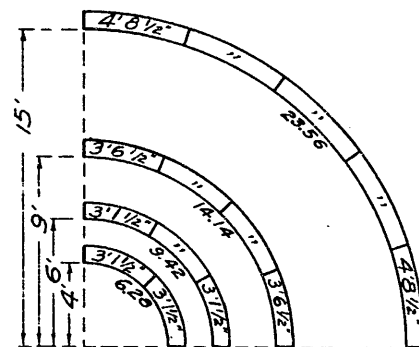
3-19 WOOD FENCES (For plan, see page 99)

Lumber for wood fences shall be dressed on four sides. The posts shall be cedar. They shall be set in excavated holes and the backfill thoroughly tamped around them. When in place, the fence shall be painted with three coats of white paint of the quality specified in Section 2-24.

Payment for wood fence shall be made at the price bid per linear foot, which shall be in full for all labor and material for the complete fence in place, including painting.

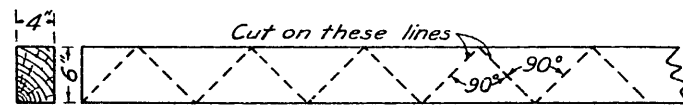
3-20 PIPE CULVERT

Culverts shall be constructed of vitrified clay sewer pipe, reinforced concrete pipe or concrete pipe as specified. It shall be

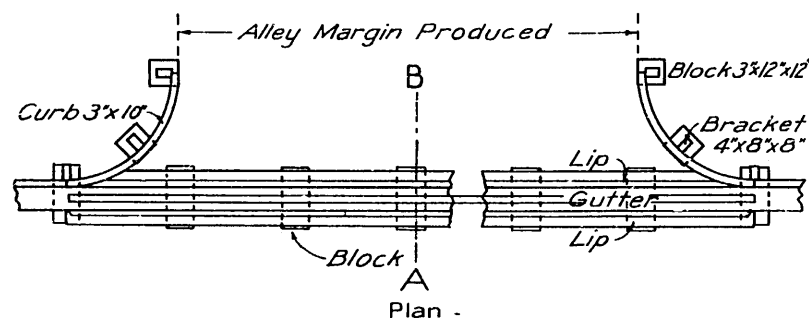


NOTE: For radii longer than 15' and shorter than 50' Gutter Boards shall be cut approximately in six foot (6') lengths. For radii longer than 50' they shall be cut in approximately eight foot (8') lengths.

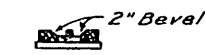
METHOD OF CUTTING GUTTER BOARDS



METHOD OF CUTTING BRACKETS



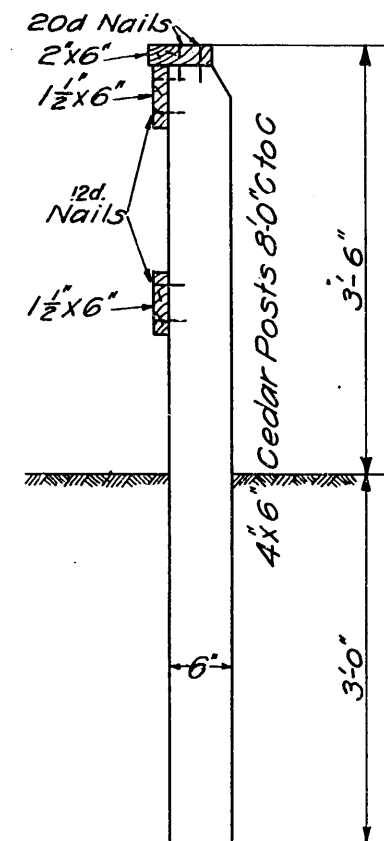
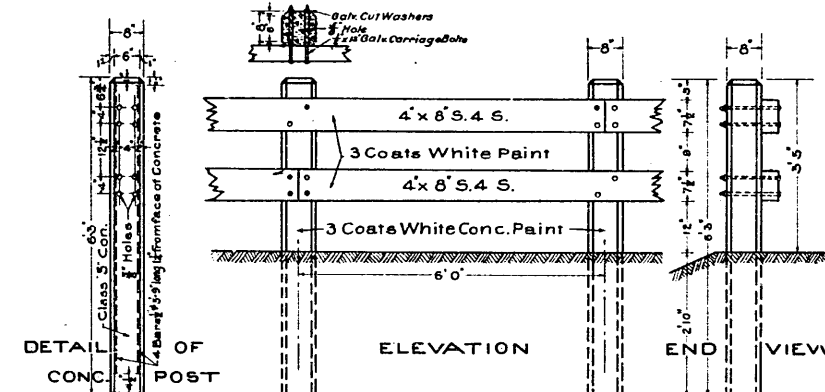
Gutter.....3'x10"
Lips.....6'x6"
Block 3'x12'x26"-4' C.to C
Center Strip 3'x3"



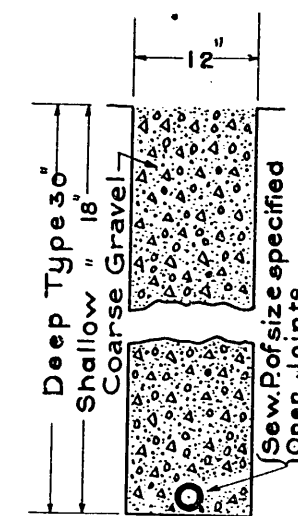
Section A-B

ALLEY GUTTER AND RETURNS

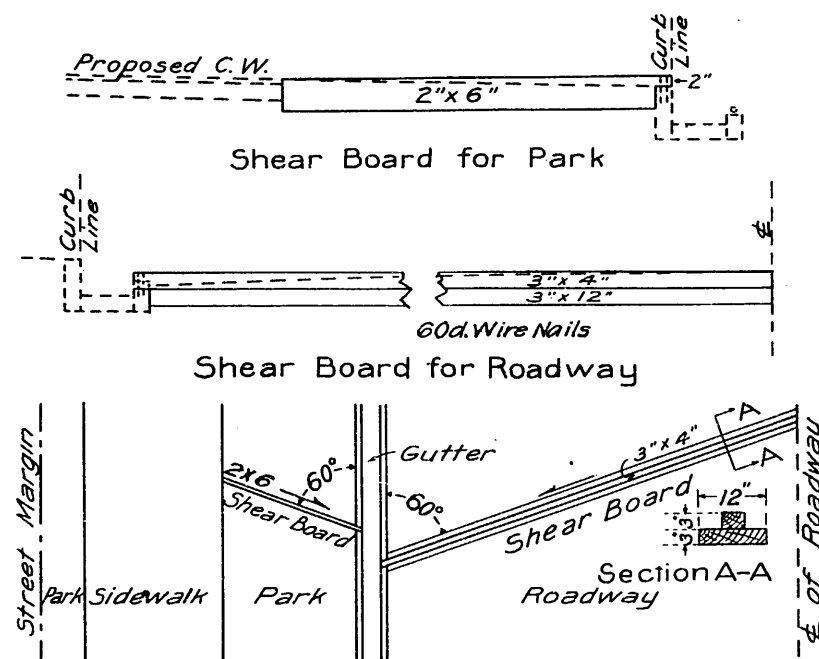
CONCRETE POST FENCE



WOOD FENCE



SEW. P. DRAINS



SHEAR BOARDS

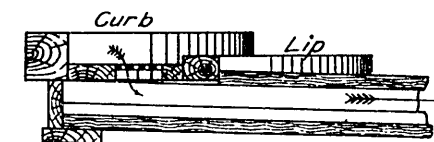
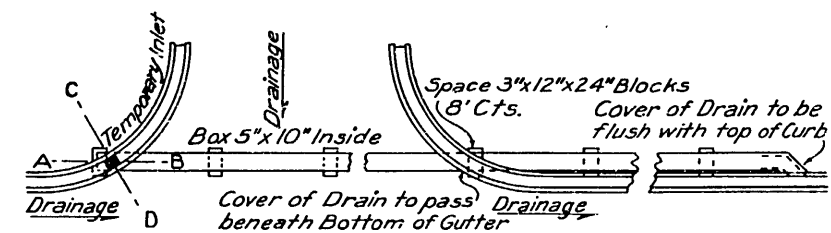
Size Inside	Cover	Sides	Bottom	Blocks	Ft. B.M. per lin. ft.
5" x 10"	3" x 16"	3" x 8"	3" x 10"	3" x 12" x 24"	11.58
7" x 10"	3" x 16"	3" x 10"	3" x 10"	3" x 12" x 24"	12.58
9" x 10"	3" x 16"	3" x 12"	3" x 10"	3" x 12" x 24"	13.58
9" x 12"	3" x 18"	3" x 12"	3" x 12"	3" x 12" x 24"	14.58
11" x 12"	3" x 18"	3" x 14"	3" x 12"	3" x 12" x 24"	15.58

60d. Wire Nails
Battens 2"x2" Sawed diagonally Blocks spaced 8' C. to C.

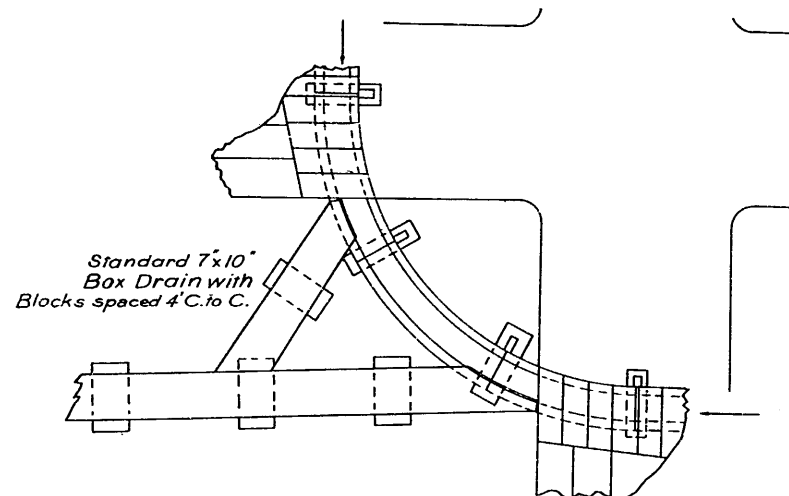
BOX DRAIN SECTION & BILL OF MATERIAL

Blocks & Side Cleats spaced 4' C. to C. Battens 2"x2" sawed diagonally	24"x36"	32"x36"
274' B.M. per lin. ft.	565' B.M. per lin. ft.	634' B.M. per lin. ft.

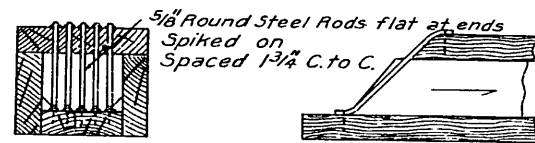
BOX DRAIN SECTIONS & BILL OF MATERIAL



Section A-B
SPECIAL BOX DRAIN



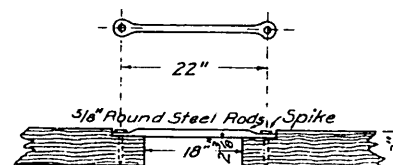
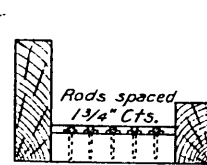
BOX DRAIN AT STREET INTERSECTION



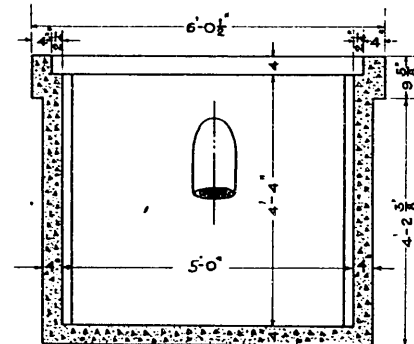
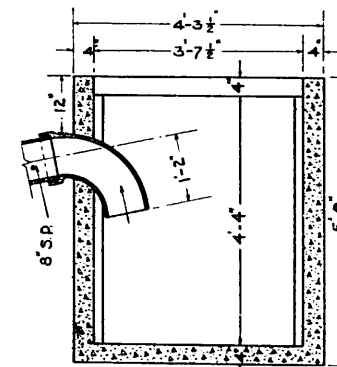
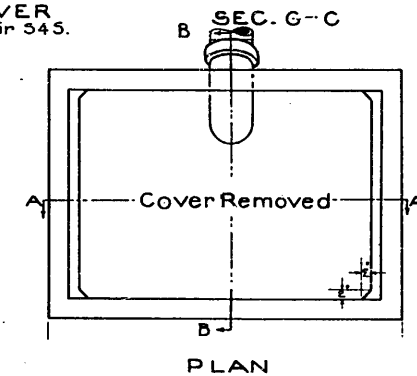
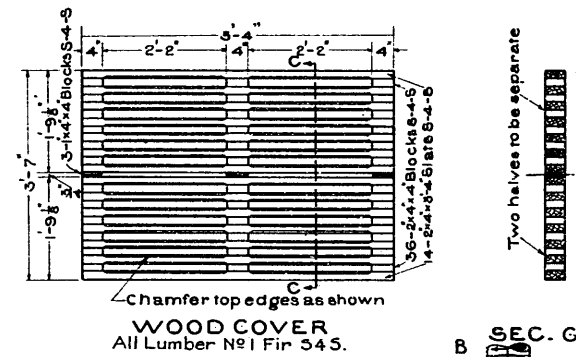
BOX DRAIN SCREEN



Gutter.....3"x10"
Lips.....6"x6"
Center Strip.....3"x3"
Block 3"x12"x30" every 8 feet
10.19 Ft. B.M. per lin. ft.

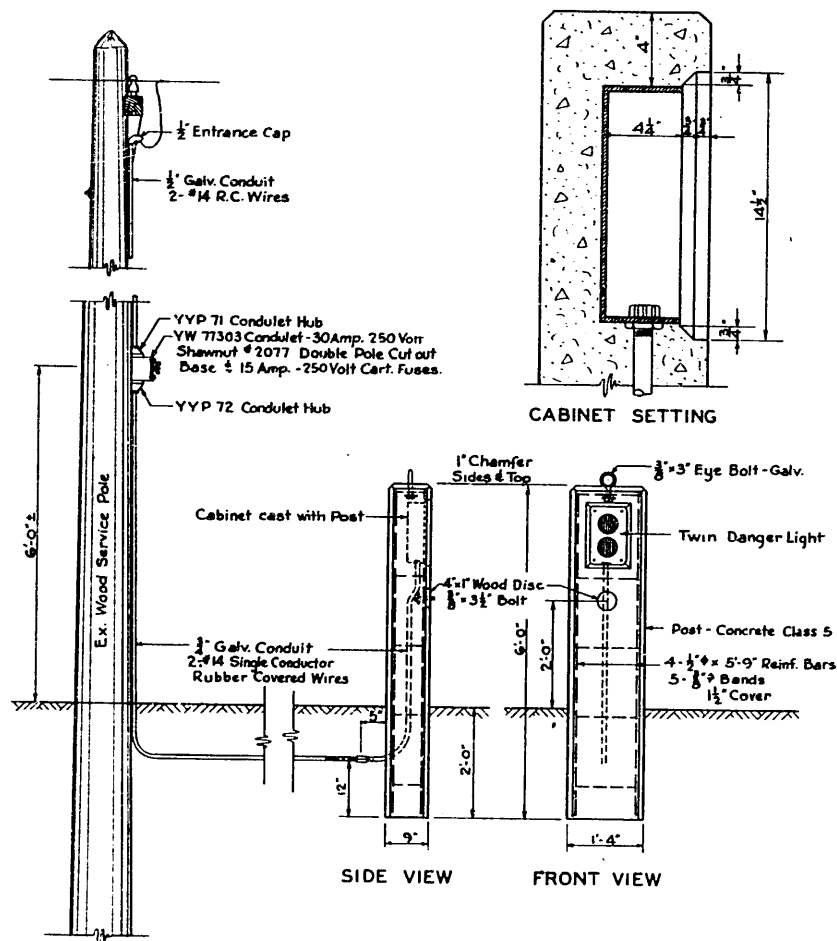


TEMPORARY INLET



CONCRETE SAND BOX

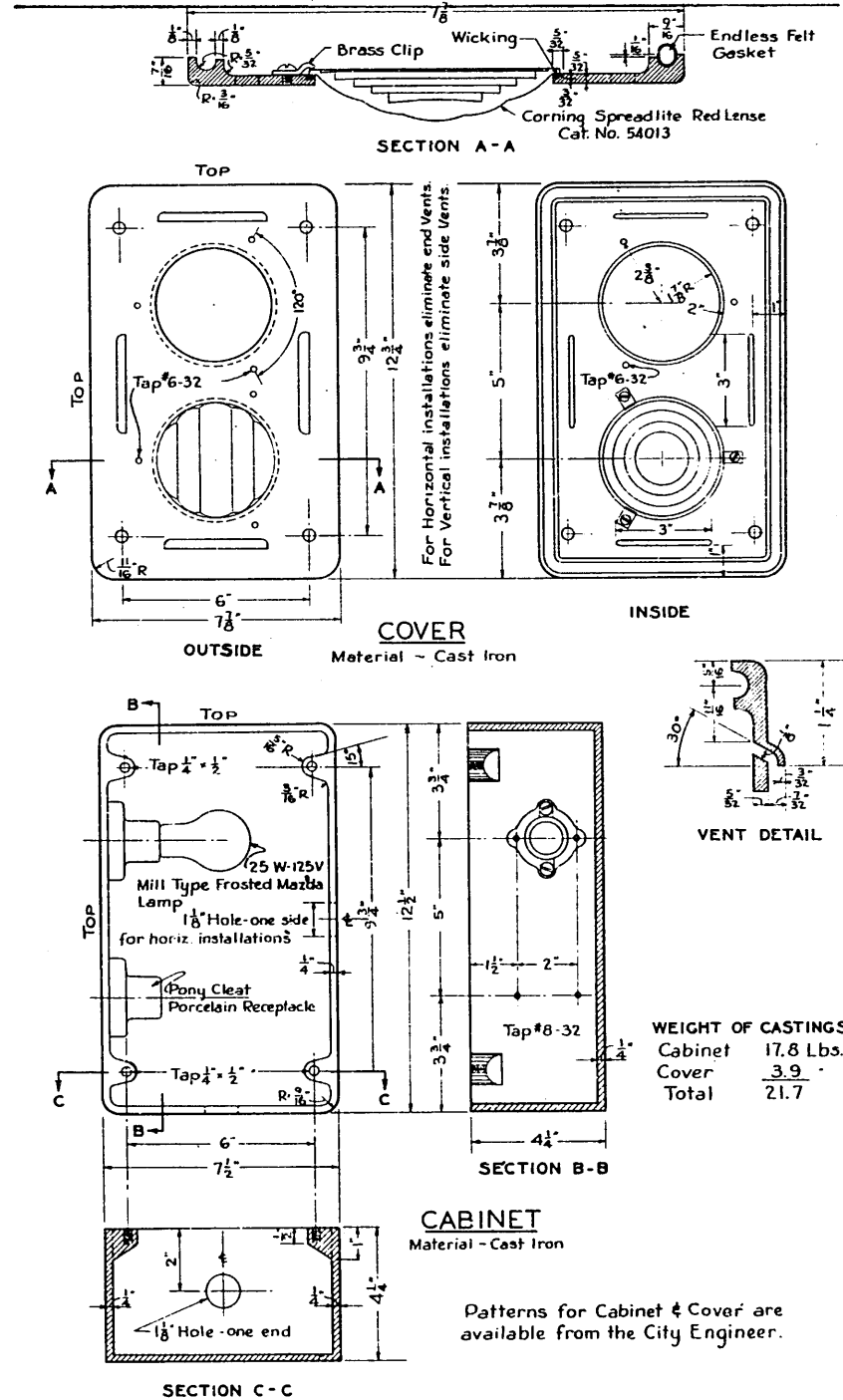
Section 3 GRADING, CURBING AND APPURTENANCES



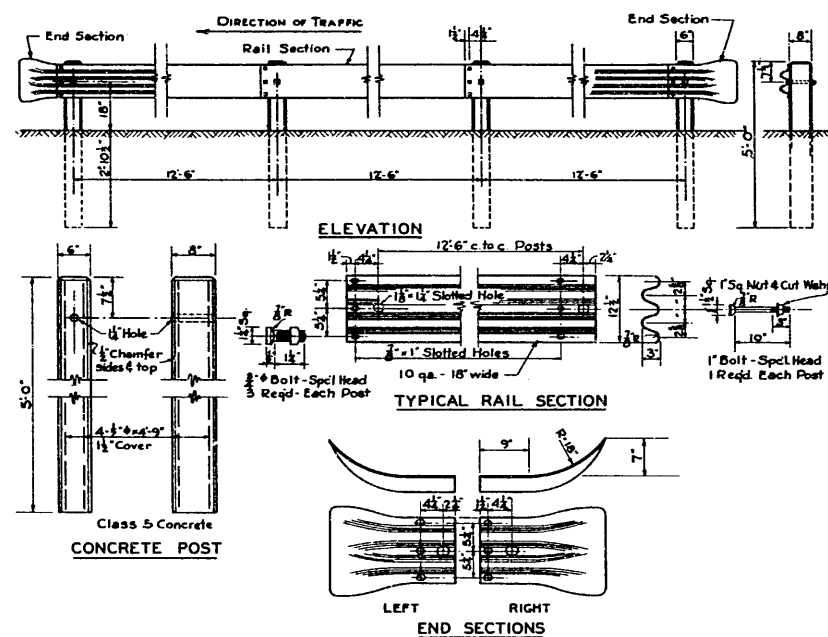
TWIN DANGER LIGHT POST & CONNECTION

CITY OF SEATTLE

Section 3



TWIN DANGER LIGHT



BEAM GUARD RAIL

SECTION 4 SPECIFICATIONS FOR SIDEWALKS AND APPURTENANCES

4-1 CLEARING AND GRUBBING

Clearing and Grubbing shall include the removal, where necessary, of all brush, old sidewalks, planking, sills, crosswalks, and all other old lumber or undesirable materials that may be found on the location of the walks, between the curb and property lines. All such material shall be burned or held for further use, as directed by the City Engineer.

Payment for "Clearing and Grubbing" shall be made at the lump sum price bid.

4-2 EARTHWORK

—2.01 EXCAVATIONS

Excavations for concrete sidewalks on streets to be graded shall be made in accordance with the specifications for "Earthwork," Section 3-3.

—2.02 EMBANKMENTS

All fills under sidewalks shall be made of suitable material spread in layers not exceeding one (1) foot in thickness. Each layer shall be thoroughly flushed with water and tamped or rolled until a hard, unyielding surface is obtained.

—2.03 MEASUREMENT—PAYMENT

Measurement and payment for "Earthwork" shall be made in accordance with said Section 3-3. Quantities of earthwork shall be computed to the surface of the sidewalk and no additions or deductions shall be made for the volume of the sidewalk. Payment for the quantities of earthwork involved in the subgrade and the preparation of the subgrade shall be included in the price bid for "Concrete Sidewalks," provided, if no bid is taken for "Earthwork" the contractor shall judge for himself the total amount of additional earthwork necessary and shall include the cost thereof also in the price bid per square yard for "Concrete Sidewalk."

4-3 ONE COURSE CONCRETE SIDEWALKS

Concrete sidewalks shall consist of a single course of concrete three and one-half (3½) inches thick and of the width shown on the improvement plan.

—3.01 SUBGRADE

The subgrade shall be excavated to a depth of three and one-half ($3\frac{1}{2}$) inches below the finished grade and thoroughly settled and compressed by wetting and tamping. To obtain a proper subgrade, a rigid template indicating a full three and one-half ($3\frac{1}{2}$) inch depth and shod with iron shall be dragged over the subgrade. No template provided with adjustable attachments of any kind shall be used on the work.

—3.02 FORMS

Forms for sidewalks shall consist of surfaced lumber two (2) inches by four (4) inches stock size, placed accurately to line and grade and held rigidly in place by stakes set not more than six (6) feet apart which shall be driven down flush with the top of the forms. The inside stakes shall not be removed until sufficient concrete has been placed against the forms to hold them in position. In addition, the forms shall be blocked with two (2) inch by six (6) inch by eight (8) inch blocks spaced approximately six (6) feet apart, having a firm bearing on solid ground. Forms for curved portions of the sidewalk shall be constructed to provide for proper tamping and finishing and must meet the approval of the City Engineer.

—3.03 CONCRETE

Concrete for sidewalks shall be Class "5," using structural grade aggregates, and shall be mixed without an excess of water. Mixing time shall be one (1) minute. Not less than one (1) barrel of cement shall be used for every 74.5 square feet of sidewalk.

—3.04 PLACING CONCRETE

Twelve (12) hours before placing concrete, the forms and subgrade, including two feet on each side of the subgrade, shall be thoroughly wetted with water. Just before placing the concrete, the forms and subgrade shall again be wetted down to the satisfaction of the City Engineer.

Concrete shall be placed as soon as possible after mixing and spread upon the prepared subgrade in a layer of such depth that after compacting it shall be not less than three and one-half ($3\frac{1}{2}$) inches thick. After the spreading of the concrete, it shall be thoroughly tamped with an approved steel shod rod constructed of a three (3) inch by eight (8) inch stock size timber provided with proper handles. Following the tamping as above specified, it shall

be rolled with a light roller as prescribed for concrete pavement, and spaded along the edges of the forms with a perforated spade. After striking off and rolling, the concrete shall again be thoroughly rodded with a second rod of the same size as previously specified. Care shall be taken to have a surplus of mortar ahead of the rod at all times.

—3.05 EXTRA CONCRETE UNDER SIDEWALK

(For plan, see page 118)

At all intersections where concrete sidewalks adjoin concrete or granite curb, extra concrete shall be placed under the sidewalk as herein detailed.

—3.05 FINISHED CONCRETE

Following the final rodding, the surface shall be floated by hand with a wood float. As soon as the surface has set sufficiently it shall be troweled smooth with a steel trowel, following which the surface shall be brushed as directed by the City Engineer. The surface shall then be divided into blocks thirty-six (36) inches square in the case of six (6) foot walks, thirty (30) inches square in the case of five (5) foot walks, and twenty-four (24) inches square in the case of four (4) foot walks, by V-shaped grooves one-quarter ($\frac{1}{4}$) of an inch in depth, made with a suitable jointing tool. The marking shall be done in a workmanlike manner. The transverse grooves shall be at right angles to the walk. All edges shall be edged to a radius of one-quarter ($\frac{1}{4}$) inch.

—3.07 EXPANSION JOINTS

At all street margins produced, around all poles, and at such points approximately thirty (30) feet apart as the City Engineer may direct, there shall be constructed at the time the concrete is placed, an expansion joint consisting of a strip of expansion joint material three-eighths ($\frac{3}{8}$) inch in thickness, three and one-half ($3\frac{1}{2}$) inches in depth, and in length equal to the full width of the walk.

There shall also be a three eighths ($\frac{3}{8}$) inch expansion joint placed between the back of the curb and the sidewalk in locations where the new sidewalk covers the entire area between curb and an existing building, retaining wall or other structure.

Expansion joint material shall be Carey's Elastite or equal.

—3.08 CURING CONCRETE

The surface of the walk shall be sprayed with water as soon as the concrete is sufficiently hardened to prevent pitting and

shall be kept wet by hosing on the day it is laid and on the following day. In case of rain the walk shall be completely protected until the concrete has set. During the rainy season or at such other times when rain is threatening, the City Engineer shall not permit the contractor to proceed with the construction of concrete sidewalks unless he has sufficient canvas or other approved covering on hand to protect the surface of the walk in the event of rain.

—3.09 CLEANUP

After the concrete sidewalks have been completed and when directed by the City Engineer, the contractor shall remove the forms, stakes and blocking. The area adjoining the sidewalk that was excavated to permit construction of forms shall be filled with a selected material and the slopes and parking strips shall be surfaced and smoothed to conform to the lines shown on the plan or to the standard graded section. On streets that have been previously graded, resurfacing of slopes and parking strips shall conform to the requirements of Section 4-9.

—3.10 MEASUREMENT AND PAYMENT

Measurement of concrete sidewalks shall be made on the slope and no deductions shall be made for castings or poles around which the sidewalk is laid.

Payment for "Concrete Sidewalks" shall be made at the price bid per square yard, which price shall be in full for all labor, material and equipment necessary for the completed sidewalk, including in all cases the necessary earthwork for subgrading and preparation of the subgrade and unless a bid is taken for "Earthwork" it shall also include all other earthwork incidental to the construction of the sidewalk.

"Extra Concrete Under Sidewalk" shall be paid for at the price bid per cubic yard, which price shall also include payment for the necessary additional excavation.

4-4 TEMPORARY WOOD WALKS AND CROSS WALKS (For plan, see page 115)

Where directed by the City Engineer, temporary wood walks shall be constructed of 2" x 12" rough plank, laid lengthwise, and firmly nailed with 30-penny nails to 3"x8" blocks laid crosswise every eight (8) feet and properly bedded in the ground. On grades over ten per cent (10%), or where directed by the City Engineer,

battens 1/2"x2" shall be nailed to the planks eighteen (18) inches apart with four 8-penny nails to each batten.

Where called for on the plans or where directed by the City Engineer, temporary wood cross walks shall be constructed of the type specified and according to detail plans. Lumber for aprons shall be dressed on one (1) side and laid with the rough side up.

Payment for "Temporary Wood Walks and Cross Walks" shall be made at the price bid per M. Ft. B. M. in place and shall include all necessary excavation, nails and other material.

4-5 CROSSWALKS (For plan, see page 15)

Covering planks of cross walks shall be uniformly four (4) inches thick and twelve (12) inches wide, and shall be nailed to the stringers with two 7-inch nails in each plank at each stringer. The stringers shall be shaped accurately to the dimensions shown on the plans, and shall be solidly bedded in the ground. The ends of planks shall be adzed off to remove uneven joints. Aprons shall be made from planks three (3) inches thick by eight (8) inches wide, dressed on one (1) side, and laid with the rough side up.

Payment for "Wood Cross Walks" shall be made at the price bid per M. Ft. B. M. in place and shall include all excavation necessary properly to construct the cross walk.

4-6 SIDEWALK DRAINS (For plan, see page 120)

Where directed, three (3) inch sewer pipe shall be laid under the concrete sidewalks, extending across the parking strip to the drainage ditch or through holes in the concrete curb or wood curb, if existing. Cutting of the curb will not be allowed. The pipe shall be laid close to the concrete and shall be solidly bedded in the ground. All joints shall be made in a workmanlike manner with cement and sand mortar. The connection to the gutter, the extension of the pipe through the curb, and the construction of a coarse gravel pocket shall be done in accordance with the Standard Plan.

Payment for "Sidewalk Drains" shall be made at the price bid per linear foot in place, and shall include excavation, gravel pocket and boring or extending through curb.

4-7 CONCRETE ALLEY CROSSINGS (For plan, see pages 121, 214)

Concrete Alley Crossings shall be constructed where shown on the plan or where directed by the City Engineer.

The materials, proportions, mixing and treatment of the subgrade shall conform in all respects to the Standard Specifications for concrete pavement, except that thorough tamping of the subgrade may be substituted for the rolling.

The surface of the concrete alley crossing shall be struck off with a heavy steel shod strike board and floated with a wood float. The surface shall then be brushed transversely, as directed.

The crossing shall then be cured, as specified for Concrete Sidewalk. When constructed in conjunction with pavement, alley crossings shall be cured as specified for concrete pavement.

Payment for "Concrete Alley Crossings" shall be made at the price bid per square yard, which shall include excavation, placing, wetting and maintaining the earth covering and for removing the same.

4-8 PRIVATE DRIVEWAYS (For plan, see pages 121, 215)

Private Driveways constructed through concrete walks as part of the walk construction shall be constructed as shown on the Standard Plan. They shall be one course, as specified for concrete walks. The surface between expansion joints shall be brushed with a soft brush and edged, but not jointed into squares. Curing shall be done as specified for "Concrete Walks."

See also Section 8-16.

Payment for "Private Driveways" shall be made at the price bid per square yard and shall include the necessary excavation and subgrading.

4-9 RESURFACING SLOPES AND PARKING STRIPS

Where sidewalks are constructed on streets that have previously been graded, the contractor shall resurface the slopes and parking strips as required in the Standard Specifications for "Grading." All slopes between the sidewalk and property on one side and between the sidewalk and the curb on the other side, shall be carefully redressed to a smooth even surface. Prospective bidders are cautioned to acquaint themselves with the amount of resurfacing to be done in each case.

Payment for "Resurfacing Slopes and Parking Strips" shall be included in the price bid per square yard for "Concrete Walks."

4-10 REPLACING CONCRETE SIDEWALKS

The plans and specifications for new concrete walks shall apply in all respects, except that marking shall match the adjacent walk.

Payment for "Replacing Concrete Sidewalks" shall be made at the price bid per square yard in place and shall include the removal and disposal of the old concrete walks.

4-11 CONCRETE STAIRWAYS (For plan, see page 119)

Concrete Stairways shall be constructed of Class "6" Concrete.

In order to secure drainage, the treads of all steps shall have a slope of three-sixteenths ($3/16$) of an inch.

On each side of the steps and along the sides of the landings, where so indicated on the plans, or where directed by the City Engineer, there shall be constructed a coping of the dimensions and designs shown on the detail plan. The coping shall be built in the same manner as specified for concrete steps.

Concrete stairways shall be reinforced as shown on the plans. One-half ($1/2$) inch transverse reinforcing bars shall be placed in each step and shall be hooked or bent around those in the coping.

All forms shall be constructed of dressed lumber. Form lumber shall be of sufficient thickness and braced in such a manner that step risers and coping shall be true to line and grade.

Measurement for stairs shall be taken across the step from inside to inside of coping. Measurement of coping shall be on the slope.

Payment for "Concrete Stairways" shall be made at the price bid per linear foot and shall include the furnishing and placing of the steel reinforcing rods and forms.

Payment for "Concrete Coping" shall be made at the price bid per linear foot.

Concrete landings shall be classed as concrete sidewalks, and shall be paid for at the price bid for concrete sidewalks and shall include steel.

4-12 CONCRETE GUTTERS FOR STAIRWAYS (For plan, see page 119)

For gutters attached to concrete stairways, the materials shall be as specified herein for "Concrete Stairways." The steel rods in the stairway shall extend into the gutter, as shown on the standard plans for concrete stairways.

Payment for "Concrete Gutters" shall be made at the price bid per linear foot. Measurement shall be on the slope.

4-13 GALVANIZED IRON RAILING (For plan, see page 119)

The upright posts shall be securely set in the concrete so that

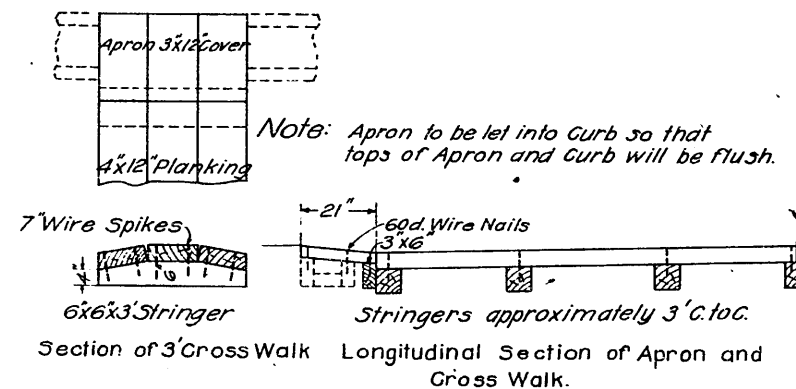
the entire railing shall be thoroughly rigid and firm. The fittings shall be made of the best quality malleable iron. The pipe and fittings shall be galvanized as specified under "Quality of Materials." When in place, the railing shall be painted with two coats of Aluminum Paint, the quality of which is specified in Section 2-24.

Payment for "Galvanized Iron Railing" shall be made at the price bid per linear foot of completed railing, and shall include the painting. Measurement shall be on the slope.

4-14 WOOD STAIRWAYS (For plan, see page 117)

The blocks shall be well bedded in the ground at the proper elevation so as to bring the finished structure to grade. The stringers shall be toe-nailed to the sills with four 30-penny nails at each bearing. The treads shall be dressed on one (1) side and two (2) edges and nailed with three 20-penny nails to each stringer. The risers shall be dressed on four (4) sides, and when in position shall be painted with two coats of white paint, the quality of which is specified in Section 2-24.

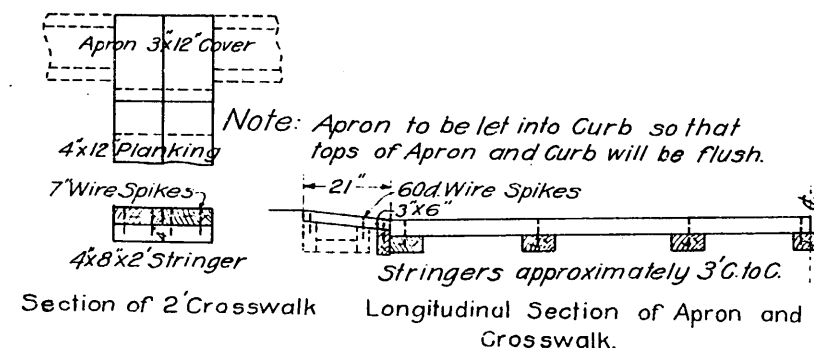
Payment for "Wood Stairway" shall be made at the price bid per M. Ft. B. M. in place, and railing, including posts, shall be paid for at the price bid per linear foot, which shall include painting.



Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B.M. 3' wide	284	332	386	410	464	488	554	602	644	692	753

Crosswalk Bill of Material
including Aprons.

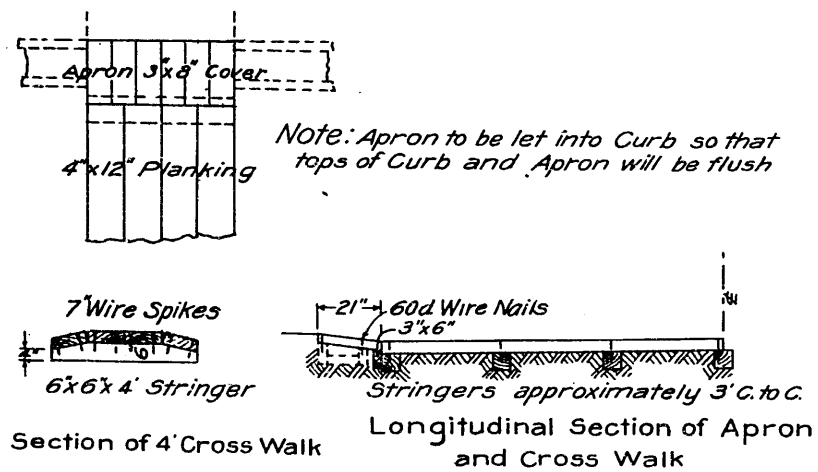
3 FT. WOOD CROSSWALK AND APRON (Temporary)



Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B.M. 2' wide	184	216	251	267	302	318	360	392	419	451	494

Crosswalk Bill of Material
including Aprons.

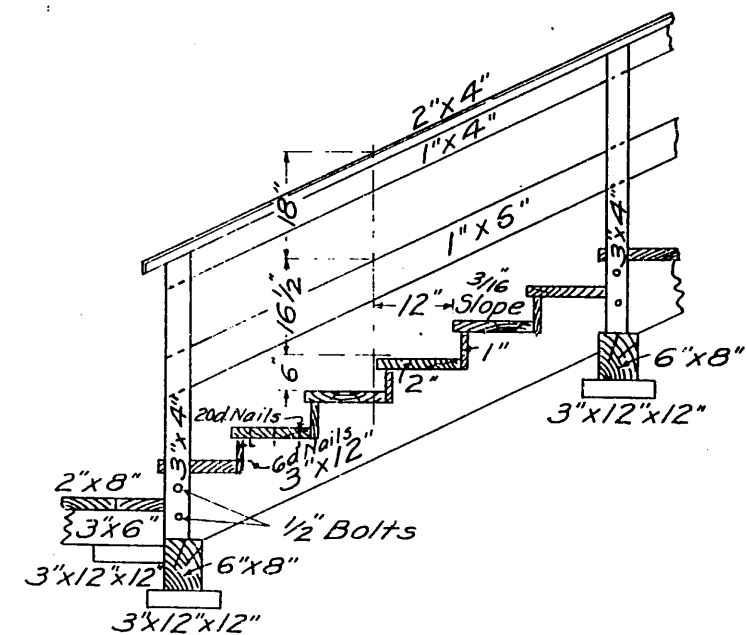
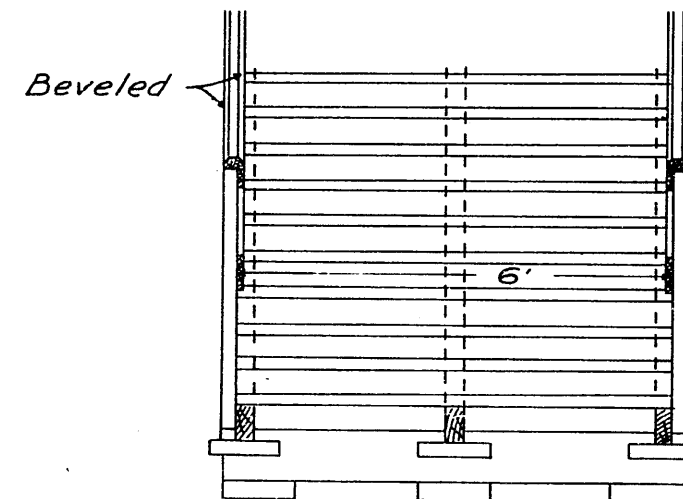
2 FT. WOOD CROSSWALK AND APRON (Temporary)



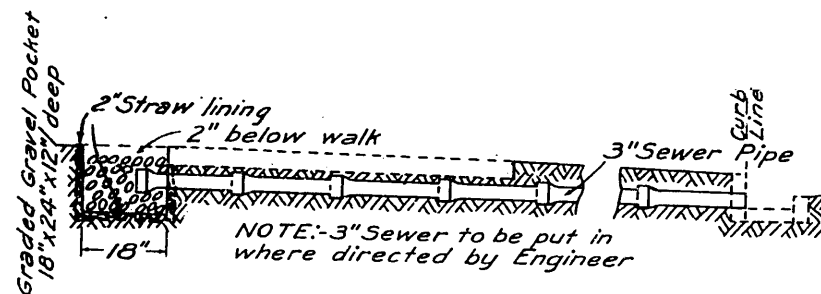
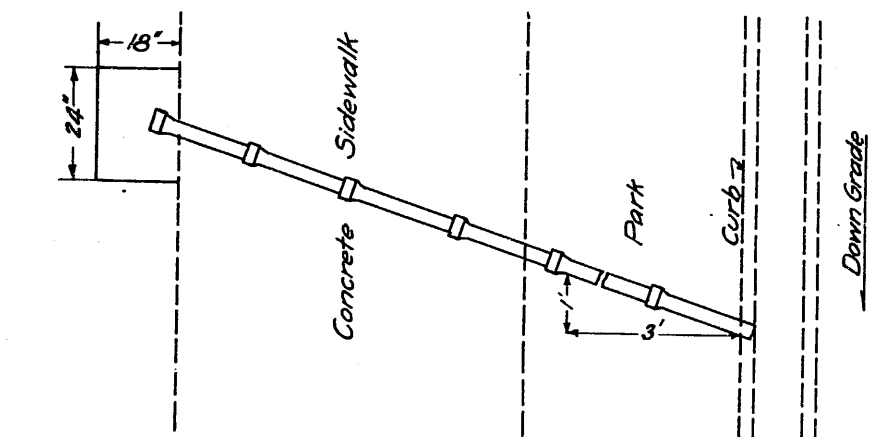
Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B. M. 4' Wide	414	478	550	582	654	686	774	838	894	958	1046

Crosswalks Bill of Material
Including Aprons

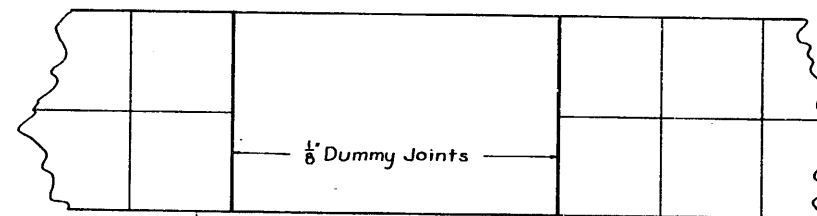
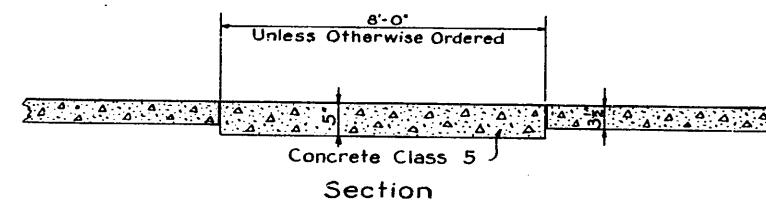
4 FT. WOOD CROSSWALK AND APRON



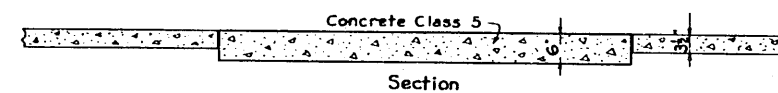
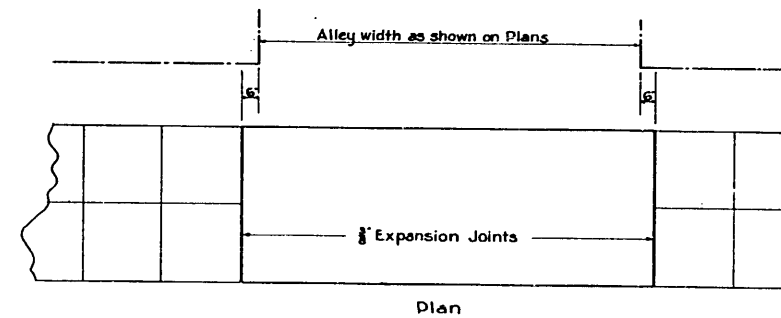
WOOD STAIRWAY



SIDEWALK DRAIN



PRIVATE DRIVEWAY CROSSING



CONCRETE ALLEY CROSSING

SECTION 5**SPECIFICATIONS FOR
CONCRETE RETAINING WALLS****5-1 THE FOUNDATION**

The foundation for any retaining wall shall be excavated to the depth shown on the plans, or to such additional depth as the City Engineer may require. If required, an efficient pumping plant shall be installed to keep the excavation pits free from water. Where permanent drainage of the foundation or of any other part of the wall is desired, a sewer pipe drain shall be laid and connected to the sewer, or given some other suitable point of discharge chosen by the City Engineer.

Extra Excavation shall be performed and paid for as specified in Section 3-5.

5-2 CONCRETE

Unless otherwise shown on the plan, concrete for gravity type retaining walls shall be Class "4" and for reinforced walls shall be Class "6."

5-3 PLACING CONCRETE

Wherever possible, retaining walls shall be of monolithic construction. To accomplish this end, the contractor shall arrange his plans for executing the work to the satisfaction of the City Engineer. Where monolithic construction is impractical, however, and the wall is over two (2) feet thick, the contractor shall construct keys in the concrete at the end of each day's work. These keys shall be six (6) inches deep, one-third (1/3) the width of the wall at that point, and shall run the full length of all work in progress. In all walls, the forms, moldings, etc., along the finished sides shall be kept clean of all dry mortar or concrete which would mar the appearance of the finished wall.

5-4 REINFORCING STEEL

Reinforcing steel for concrete retaining walls shall conform to the requirements specified in Section 2-32. It shall be placed on the exact position shown on the plans and shall be held securely in place while the concrete is being placed. Care shall be taken to see that the bars are well lined up and rigidly fastened together. The requirement concerning minimum space between steel and

concrete surface shall be strictly enforced. Steel which is badly rusted or dirty shall not be accepted. Bars shall be wired tightly together at every point of contact, and no concrete shall be poured until the City Engineer has inspected the arrangement and position of the steel.

5-5 VERTICAL JOINTS

Joints shall be made in all walls as indicated on the plans or where directed by the City Engineer. Where joints are required, precast expansion joint material as specified under "Quality of Materials," Section 2-11, one-half (1/2) inch thick shall be used. The walls shall be poured one section at a time. The joint material shall be accurately cut to fit the bulkhead between sections, and nailed to the bulkhead with 6d nails. These nails shall be driven into the lumber only enough to hold the material in place, the heads being embedded in the concrete. The bulkheads between sections shall be removed not sooner than twelve (12) hours after the concrete has been poured, and the nail points clinched into the joint material.

At the surface of the wall, unless otherwise shown, the joint shall end in a "V" shaped groove, two (2) inches wide and one (1) inch deep.

5-6 FINISHING

Unless otherwise specified, all exposed concrete surfaces shall be given a finish equivalent to Class C.

5-7 WATERPROOFING

When called for on the improvement plan or special specifications, the back of concrete retaining walls shall be waterproofed as follows:

The surface of the concrete shall be clean and dry before waterproofing is begun. If possible all work on waterproofing shall be done during dry weather, but if it is necessary to proceed with the work during wet weather, the contractor shall protect the masonry from the rain by means of tarpaulins or other suitable cover.

In order to provide a temporary support for the water-proofing fabric, and to prevent any tendency of the water to gain an entrance between the waterproofing and the concrete, a water-drip and nail girt shall be provided at the top of the wall as shown in the figure. The water drip shall be constructed by means of a

2"x4" beveled to the required shape, well soaped to prevent sticking, and firmly nailed to the top of the studding. In removing this strip extra precaution shall be taken to prevent breaking the projecting water-drip.

WATER-DRIP AND NAIL GIRT



The surface of the concrete shall be painted first with a thin coat of hot asphalt, well rubbed into the pores of the concrete. When this first coat has cooled, a second heavy coat of hot asphalt shall be applied, and on this coat, while still hot, two plies of felt shall be laid with each strip lapping half way over the preceding strip, said half width of preceding strip also to have a heavy coat of hot asphalt, so as to prevent any two unpainted surfaces of felt from coming in contact. The entire surface shall again be coated with hot asphalt, and on this, while hot, two additional plies of waterproofing felt shall be laid in the manner specified for the first operation. Finally, the entire surface shall be coated uniformly with hot asphalt, so that none of the felt appears exposed.

In applying the materials to the wall, every practical means shall be used to expedite the operation so as to prevent much cooling until the felt has been well rubbed down into the asphalt. Furthermore, the contractor shall see to it that no spots or areas are left unpainted by anyone of the several coats of asphalt, and, within the range of possibility, no separation of layers, either from the wall or from each other, is to be permitted.

At the ends of the walls, and at any other places where the edges of the felt must be left exposed, the contractor shall use Flax ("Irish") Felt to seal those edges from the water. This felt shall be cut in strips, three from the roll, and shall be laid in hot asphalt and two plies thick. These strips shall be laid one-half on the concrete and one-half on the felt edge which they are to protect.

5-8 SEWER PIPE

When the waterproofing has been completed as specified above, sewer pipe shall be laid along the heel at the foot of the wall and in any other location that the City Engineer may designate. Sewer pipe shall also be laid from this drain to the sewer or as directed.

5-9 BACKFILLING

The backfilling for retaining walls shall be completed within ten (10) days after the waterproofing has been put on. It shall consist of two materials: first, a layer of gravel four inches (4") thick over the drain and against the waterproofing; and second, an earth fill. The gravel shall be placed with shovels in a manner which does not injure the waterproofing and which prevents the earth fill from clogging the voids in the gravel. The earth fill shall be placed in layers not exceeding one (1) foot in thickness. Each layer shall be thoroughly rammed with a rammer not more than ten (10) inches in diameter and weighing not less than forty (40) pounds, or with an approved mechanical tamper. Unsuitable earth or vegetable matter shall not be placed behind retaining walls. Except by express permission of the City Engineer, filling with loose earth and puddling shall not be done.

In all other respects, concrete retaining walls shall be constructed as hereinafter specified for concrete structures.

5-10 PAYMENT

Payment for concrete retaining walls shall be made at the unit price for the following items:

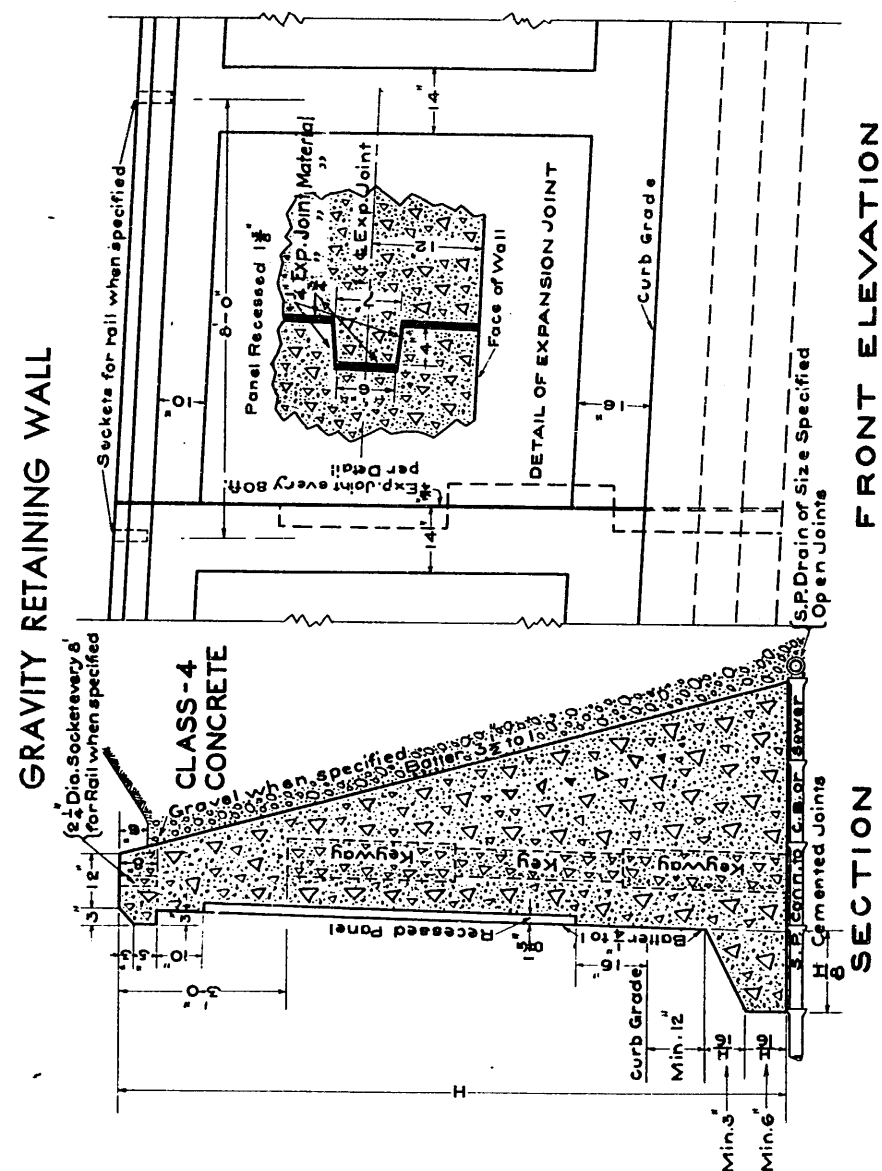
—10.01 "Concrete Retaining Wall," per cubic yard, which price shall be in full for excavation, including foundation excavation, necessary drainage during construction, form work, concrete in place, finishing, backfilling, and any other material and labor not otherwise specifically paid for.

—10.02 "Sewer Pipe Drain," per linear foot, in accordance with Section 3-12.

—10.03 "Waterproofing," per square yard, which price shall be in full for all labor and materials to waterproof as above specified.

—10.04 "Gravel in back of wall," per cubic yard, which price shall be in full for furnishing and placing the gravel as above specified.

—10.05 "Reinforcing Steel," per pound, in accordance with Section 10-3.04.



SECTION 6

SPECIFICATIONS FOR SEWERS AND APPURTENANCES

6-1 ALIGNMENT AND GRADE

On ungraded streets, profiles refer to the center line ground elevations. On graded streets, the profiles refer to mean curb grades. The bidder must estimate for himself the distance of the existing ground above mean curb.

The alignment and grade of the sewer shall be indicated upon cross sills or timbers, four (4) inches by eight (8) inches by ten (10) feet long, except where sewers are eighteen (18) inches in diameter or less, in which case sills or timbers may be four (4) inches by eight (8) inches by eight (8) feet in length. These timbers shall be bedded at intervals of from twenty-five (25) to thirty (30) feet at right angles to the line of the sewer. They shall be furnished and placed by the contractor. The line will be given, and the cut to the invert of the sewer shall be marked on these timbers. A marker board shall be nailed to each timber by the contractor, so that a line drawn from the top of one marker to the top of the next one indicates the true line and true grade, the invert being a known depth below and parallel to said line. The contractor shall provide a suitable plumb bob and rod to project this line accurately to the bottom of the trench. The rod used for measuring depths shall have an iron shoe projecting accurately at right angles to the rod a distance of about five (5) inches.

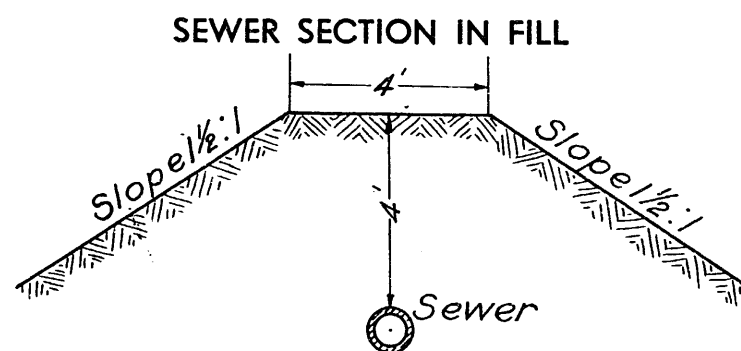
When the contractor wishes to excavate the sewer trench by means of a trenching machine or steam shovel, the line and grade will be given from hubs set on a line parallel to and at a uniform distance from the line of the sewer. After the trench has been excavated the contractor shall transfer the reference points from the hubs to the level boards and proceed as specified above.

6-2 TRENCHING FOR PIPE SEWER

All cuts in pavements for trench openings shall be made at least six (6) inches wider on each side than the width of the trench at the top.

The completed trench shall be kept not less than thirty (30) feet ahead of the pipe layers. The trenches shall be at least six (6)

inches wider on each side, or a total width of twelve (12) inches more than the exterior diameter of the pipe. If rock is excavated it shall be removed to a depth of six (6) inches below the bottom of the bell and the trench refilled with sand or gravel and well tamped. Such refill shall be paid for at the price bid for "Gravel in Trench."



The contractor shall furnish all necessary machinery for the work and shall pump, bail or otherwise remove any water which accumulates in the trenches. He shall perform all work necessary to keep the trenches clear of water while the foundations and the masonry are being constructed or the pipe laid.

Wherever, in the judgment of the City Engineer, the work would be expedited by the use of straw, the contractor shall furnish it, in such quantities and use it in such manner as the City Engineer may direct.

When necessary the sides of the trench shall be braced and rendered secure by using either open or closed sheathing.

All sewer pipe twentyfour inches (24") or more in diameter shall be laid in open trench.

Whenever it is necessary to lay sewer pipe above the existing ground a fill of the dimensions shown shall be made. This fill shall be water settled or placed in layers of one (1) foot or less and each layer rolled or tamped up to a point one and one-half (1½) feet above the top of the pipe. Level boards then shall be placed, the trench excavated, and the pipe laid. The balance of the fill may be placed loose.

Payment for trenching and filling as above specified shall be included in the price bid per linear foot for sewer.

6-3 LUMBER LEFT IN TRENCH

No timber bracing, lagging, sheathing or other lumber shall be left in any trench without the permission of the City Engineer, and in the event such permission is granted, no payment shall be allowed for such lumber.

6-4 EXTRA EXCAVATION

Extra excavation, when required, shall be made and paid for according to the specifications for "Extra Excavation" in Section 3-5.

6-5 TUNNELING FOR SEWERS

Where pipe which is less than twenty-four (24) inches in diameter is used and the trench is twelve (12) feet or more in depth, tunneling may be resorted to. Open trenches between tunnels shall be not less than eight (8) feet in length; and tunnels shall be not more than twelve (12) feet long. Tunnels shall be not less than four (4) feet high, and two (2) feet wide, nor shall any tunnel be less than one (1) foot wider than the external diameter of the sewer pipe.

Tunnels longer than twelve (12) feet will be permitted where the sewer is under pavement or other obstructions. Such tunnels shall be back filled by means of mechanical tampers.

Payment for tunneling shall be included in the price bid per linear foot for Sewer.

6-6 BACKFILLING

—6.01 BACKFILLING TRENCHES

Backfilling of trenches shall not be permitted until the cement in the pipe joints or in brick or concrete masonry has become thoroughly hardened. Backfilling shall follow as close after the pipe laying as the setting of the cement will permit, and except by special permission of the City Engineer the contractor shall not have more than two hundred (200) feet of the trench open, in which the sewer has been completed.

The material used for backfilling around and to a point one (1) foot above the top of the sewer, shall be clean earth or sand free from all gravel or stones which will not pass through a one (1) inch ring.

The space between the pipe and the bottom and sides of the trench shall be filled by hand and thoroughly compacted. The filling shall be carried up evenly on both sides to the level of the top

of the pipe. The pipe shall then be covered to at least one (1) foot above its top. The material shall be placed in such a manner as to avoid injuring or disturbing the completed sewer.

The remaining portion of the backfill shall be water settled by casting or sluicing the earth into the trench which has been partially filled with water. Where water cannot be obtained, the backfill shall be tamped into place with mechanical tampers.

Walking on or over the pipe sewer shall not be allowed until at least one (1) foot of earth has been placed upon it.

—6.02 BACKFILLING TUNNELS

In backfilling tunnels between open trenches, the earth shall be broken away at the end of the trench over the pipe for a distance of four (4) feet into the tunnel, and shall be sloped therefrom at an angle of forty-five degrees (45°) with the horizontal up to the end wall of the trench. The tunnels shall then be backfilled as specified for trenches.

6-7 RESTORING ROADWAY

The contractor shall fill all trenches and other excavations as above specified and remove all surplus earth. If the roadway is paved, the surface shall be restored in accordance with Section 1-30; otherwise he shall shape the roadway to conform to the original cross section, after which the City Engineering Department will do such graveling as may be necessary, and the cost of such graveling will be paid for as provided in Section 1-40.

6-8 PIPE SEWERS

—8.01 QUALITY OF THE PIPE

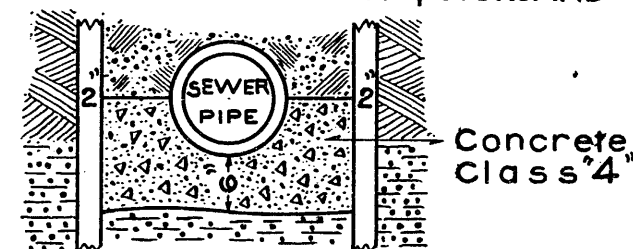
Sewer pipe shall conform to the Standard Specifications for Sewer Pipe as given in Section 2-26.03 under "Quality of Materials."

—8.02 PIPE LAYING

Before being laid the pipes and specials shall be carefully inspected for defects, and those not meeting the foregoing specifications shall be rejected. The pipes shall be so laid in the trench that after the sewer is completed the interior surface thereof, conforms accurately to the grades and alignment given by the City Engineer. All adjustment to line and grade shall be done by scraping away or filling in the earth under the body of the pipe, and not by blocking or wedging up. Great care shall be exercised that the pipe has a full, solid bearing along its entire length.

Where quicksand is encountered and when so ordered by the City Engineer, the pipes shall be bedded in concrete, as shown. Concrete so used shall be paid for at the rate bid per cubic yard for "Concrete Blocking." Such payment shall be in full for furnishing and placing in position all material required.

SEWER SUPPORT IN QUICKSAND



Wyes shall be placed at the positions shown upon the plan, or as directed by the City Engineer, and an earthenware or concrete stopper cemented in place shall be used to close the open end. The inclination given each wye, unless otherwise directed by the City Engineer, shall be about thirty degrees (30°) above a horizontal line.

The interior of the pipes shall be carefully cleaned of dirt, cement and superfluous material of every description. Each joint shall be carefully scraped as the work progresses, or, when directed by the City Engineer, a disk swab large enough to fill the pipe and attached to a rod or cord, shall be kept in pipes eighteen (18) inches or less inside diameter, and drawn forward as the work proceeds, care being taken not to loosen the joints.

As soon as each joint of pipe has been properly placed and jointed, the spaces between the pipe and sides of the trench shall be carefully filled with sand or fine earth which shall be well rammed under and around the pipe. Sufficient filling and tamping shall be done to hold the pipe firmly in position. The joint shall be checked for line and grade before the next succeeding joint is placed.

On any portion of the work where sewers are being constructed, the contractor shall furnish and keep a ladder in the trench at each point where pipe is being laid to enable the inspector to inspect readily the pipe-laying work.

—8.03 JOINTING SEWER PIPE

All sewer pipe shall be jointed with cement mortar mixed in the proportion of one part cement to one and one-half parts plaster sand. The mortar shall be mixed with the least amount of water necessary to cause the mortar to barely retain its shape when squeezed into a ball with the hands.

At each joint the interior of the bell shall be carefully wiped clean and the lower one-third ($\frac{1}{3}$) shall be well covered with cement mortar before the insertion of the spigot end. Special care shall be taken to avoid shoving mortar ahead of the spigot end of the pipe. The spigot shall seat firmly against the shoulder of the socket.

In completing the joint the pipes shall first be accurately centered and the annular space at the sides and top of the pipe partly filled with mortar. Then beginning at the bottom of the joint the mortar shall be thoroughly tamped (not spaded) into place with a metal caulking tool having a minimum tamping surface one-quarter ($\frac{1}{4}$) inch thick and of sufficient width to facilitate the forcing of mortar to the full depth of the joint. The pipe layer shall have caulking tools available with larger tamping surfaces to be used as directed by the City Engineer. The process of filling with mortar and tamping into place shall continue until the annular space is completely filled. The mortar shall then be extended beyond the outside edge of the bell to make a forty-five degree (45°) angle fillet between the outside rim of the bell and the barrel of the pipe. The mortar forming said fillet shall be applied in three (3) successive layers and each layer shall be thoroughly trowelled into the preceding layer. When directed by the City Engineer, a mortar of slightly wetter consistency may be used for making the fillet.

When a hydrostatic test is required, concrete pipe eighteen (18) inches and larger shall also be caulked and pointed on the inside flush with the barrel of the pipe.

Sufficient room shall be provided under and along the side of the joint to properly perform the above jointing operations.

The joints shall be kept free from running water for at least twelve (12) hours after completion. If at any time the City Engineer deems it necessary he may require the joint to be caulked with oakum soaked in neat cement mortar.

Joints shall be protected from the drying effects of sun and wind. If immediate backfilling is not feasible, then the contractor shall cover the joints with wet burlap or shall otherwise protect them in a manner satisfactory to the City Engineer.

—8.04 MEASUREMENT AND PAYMENT

Payment for pipe sewers shall be made at the price bid per linear foot for each size of sewer in place, and shall be in full for all trenching and timbering, all wyes and specials shown on the plan, the removal of existing sewers, all connections to existing sewers, the adjustments of inverts to existing manholes, and all labor and material necessary to furnish and place the pipe, backfill the trench, restore the street surface and all other work necessary to give a finished result, in accordance with the foregoing specifications. Payment for "Rock Excavation" shall be made as specified in Section 3-3.05.

Measurement shall be along the slope, and shall include the exact length of sewer laid. Whenever split pipe is used through manholes or wherever dead ends project beyond manholes, such pipe shall be included in the measurement.

6-9 REINFORCED CONCRETE SEWERS

Monolithic reinforced concrete sewers shall be constructed in conformity with the special plan and in accordance with applicable sections of the specifications for Reinforced Concrete Structures.

6-10 EXTRA WYES

Whenever the number of wyes authorized and ordered by the City Engineer for any size of pipe exceeds the number of wyes shown on the plan for that size of pipe the following amounts shall be allowed for each extra wye so used, and no reduction shall be made from the length of pipe as measured.

6" on 8"	\$.60
6" on 10" .....	.80
6" on 12"	1.05
6" on 15"	1.75
6" on 18"	2.50
6" on 21"	3.00
6" on 24"	3.75
6" on 30"	6.80

6-11 SIDE SEWERS

Side sewers shall be constructed where shown, or where directed by the City Engineer upon application of the abutting

property owners, in accordance with the Standard Plans and Specifications for "Sewers," with the top of side sewer connections at the curb line one (1) foot above the main sewer. All ends of the side sewers shall be marked by a No. 12 galvanized iron wire fastened to the end of the pipe and extending vertically to within six (6) inches of the surface. A brass tag $1\frac{1}{2}'' \times 3''$ stamped "SEWER" in letters $\frac{1}{4}''$ high shall be attached to the surface end of wire. When concrete curb is constructed on an improvement calling for side sewers, the top of the curb shall be stamped with the letter "S" $2\frac{1}{2}''$ inches high, and the brass tag may be omitted.

The entire length of the side sewer except four (4) feet adjoining the main sewer shall be in open trench. Provided, however, that side sewers exceeding fourteen (14) feet in depth may be constructed by tunneling. Tunnels shall not exceed twelve (12) feet in length and shall be backfilled as provided for tunnels for main sewers. Backfilling in the trench or tunnel shall not be commenced until the work has been approved by the City Engineer. Backfilling shall be done as specified for "Sewers."

Whenever a new wye or other opening is to be inserted in an existing sewer, either for a side sewer, or other connection, it shall be done by the City Engineer's Department and paid for by department bills, as outlined in Section 1-39. The contractor shall make the excavation, furnish the wye, and do all other work except inserting the wye or other opening in the main sewer.

Payment for "Side Sewers" shall be made at the price bid per linear foot and shall include the payment for side sewer markers, or marking the concrete curbs. Side sewers shall be measured on the slope.

6-12 STANDING CONNECTIONS

Standing connections shall be constructed as shown on the standard plan. They shall be of the size specified.

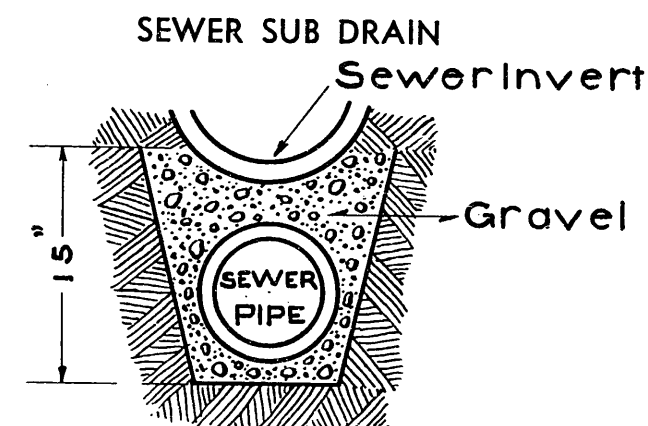
Payment shall be made at the price bid each for "Standing Connections," which price shall be in full for the complete installation and shall include the special cast iron casting necessary to make the connection between the clay and cast iron pipe. Connections above and beyond the double wye shall be paid for at the price bid per linear foot for "Side Sewers."

6-13 EXTENSION OF SIDE SEWERS

Property owners shall be permitted to extend side sewers in accordance with Ordinance No. 49831 and connect fixtures thereto as soon as the work in the street has progressed sufficiently. Such permission shall not relieve the contractor from maintaining the street sewers until final release has been issued.

6-14 SEWER SUB-DRAIN

In wet ground a subdrain shall be constructed when so directed by the City Engineer, of sewer pipe of the size indicated, laid with open joints and surrounded with gravel. At proper intervals, the subdrain may be connected to the sewer if suitable provision is made to prevent sand and other material from running out and undermining the adjacent masonry. After the completion of the



sewer the connections between the subdrain and the sewer shall be filled with concrete or brick work, surfaced and finished, in the same manner as the sewer.

Payment shall be made at the price bid per linear foot for "Sewer Pipe Subdrain," and shall include all excavation, pipe, gravel and other material. Measurement shall be made on the slope.

6-15 MANHOLES (For plan, see pages 140, 141, 142)

Manholes may be constructed of Class "C" brick, concrete or concrete blocks at the contractor's option.

The excavation for all manholes shall be sufficient to leave six (6) inches in the clear between their outer surfaces and the earth or timber used to support it.

—15.01 BRICK MANHOLES

Brick shall be wetted just before being used and laid with shove joints, and special care shall be taken to see that all joints are well filled. The mortar shall be composed of one (1) part Portland cement and two (2) parts sand. The covers of manholes shall be brought accurately to the grade given. Where the accurate adjustment to grade requires a thickness less than a whole brick, the contractor may use brick chips or small pieces of broken sewer pipe embedded in mortar. The cover ring shall be embedded in a final course of heavy mortar. The channels in manholes shall conform accurately to the sewer grade. They may be made of split sewer pipe or brick on edge embedded in the concrete base or they may be constructed integrally with the concrete base. Brick channels shall be lined with cement mortar one-quarter ($\frac{1}{4}$) inch thick.

—15.02 CONCRETE MANHOLES

Poured concrete manholes shall be constructed of Class "5" concrete. The materials used shall be of the same quality and mixed in the same manner as specified under Section 2-8. The concrete shall be mechanically vibrated and spaded sufficiently to produce dense concrete, free from air bubbles. It shall have a smooth surface next to the inner form and shall be laid continuously in order to form a monolithic mass. All forms shall be water-tight. Filling in around the work shall not be allowed until the concrete has thoroughly set.

—15.03 PAYMENT

Payment for manholes, whether built of brick, concrete, or concrete blocks, shall be made at the price bid each for "Manholes" and shall include the excavation, backfilling, castings, the construction of inverts, and all other labor and material necessary for their completion in accordance with the foregoing specifications.

6-16 DROP MANHOLES (For plans, see pages 141, 142)

The specifications hereinbefore written for Standard Manholes shall apply as well to Drop Manholes, with addition of the particular details, shown on the plan. Special care shall be exercised in water settling the backfill around the manhole and in connecting the vertical pipe to the sewer above.

Payment for "Drop Manholes" shall be made at the price bid each and shall include excavation, masonry, backfill, iron steps,

castings, cast iron pipe and specials, and all other labor and material necessary to complete the work according to specifications.

6-17 FLUSH TANKS (For plan, see page 143)

Flush tanks may be constructed of brick, concrete, or concrete blocks, at the contractor's option.

The specifications for Manholes shall apply to flush tanks in regard to masonry and general requirements for castings.

Flush tanks shall be connected to the nearest watermain using a $\frac{1}{2}$ " copper pipe. The connection shall be installed by the contractor with the exception of the connection to the existing main. Such connection shall be made by the Water Department and the contractor shall deposit with said department the sum of twelve dollars (\$12.00) in payment therefor.

Flush tanks shall be plastered on the inside with a coat of cement mortar one-quarter ($\frac{1}{4}$) inch in thickness, mixed with one (1) part cement to one (1) part sand.

Payment for "Flush Tanks" shall be made at the price bid each and shall include the price paid the City Water Department for the tap and the connection to the watermain, excavation, backfilling, castings and all other labor and material necessary to complete the work according to plans and specifications.

6-18 CATCH BASINS (For plans, see pages 145 to 154 inclusive and page 216)

Catch Basins shall be constructed of brick, concrete, or concrete blocks. The specifications on manholes shall apply to catch basins in regard to masonry and the general requirements for castings. All catch basins shall be made to hold water by plastering on the inside with a coating of cement mortar one-quarter ($\frac{1}{4}$) inch in thickness, mixed one part Portland cement to one part sand.

The connection made from the catch basin to the sewer shall be located to meet the requirements of plans adopted by the Board of Public Works and on file in the City Engineer's office. After catch basin connections are made, the contractor shall "rod" all inlet and outlet pipes. All connections that cannot be successfully rodded shall be removed and new connections made.

Catch basins shall be provided with cast iron frames, covers, inlet gratings and outlet traps, as shown on the standard plans. Two styles of catch basin traps are available: Type "A" for connections with deep sewers, and Type "B" for connections with shallow sewers. The contractor shall furnish whichever style is

specified. Type "A" trap shall be used unless otherwise ordered.

The number of inlets to be furnished with each catch basin and the type of cover or frame and cover to be furnished shall be as shown on the improvement plan and as indicated in the proposal by the wording of the bid item; i. e., "Catch Basin, One Inlet," "Catch Basin, Two Inlets," "Catch Basin, Inlet Top," "Catch Basin, Large Inlet Top," "Elliptical Catch Basin," "Small Catch Basin," or any combination thereof. In each instance, payment shall be made at the price bid each for the complete installation, including the number and type of castings required, small pieces of curb, gutter and lip necessary to piece out the work around the castings, reinforcing steel, if required, and all other labor and material necessary to complete the work in accordance with the specifications and standard plans.

6-19 ADJUSTING MANHOLE, ETC., COVERS— REBUILDING MANHOLE, ETC., TOPS

Where shown on the plan or as directed by the City Engineer, the existing manholes, catch basins, gate chambers or flush tanks shall be rebuilt to the new grade, either by tearing down or building up, or both. The contractor may use such of the old material as is suitable and shall furnish all new material as required. The finished work shall conform to all the requirements of the Standard Specifications and Plans of the City of Seattle. Where the change is less than one (1) foot, the work shall be classified and paid for at the rate bid each, for "Adjusting M. H. etc. Covers." Where the change is one foot or more in height, but does not involve the entire reconstruction of the manhole, catch basin, gate chamber, or flush tank, then the work shall be classified and paid for at the price bid per linear foot for "Rebuilding M. H. etc. Tops." Measurements shall be taken from top to bottom of new brick work. Where the entire reconstruction of the manhole, catch basin, gate chamber or flush tank is made, the work shall be classified and paid for at the price bid each for "Rebuilding Manholes, Catch Basins, Gate Chambers or Flush Tanks." The payment made on any of the above items shall be in full for all labor and material in the complete work. When no bid is taken upon rebuilding tops, this item shall be paid for at the rate of \$5.00 per Lin. Ft.

6-20 MOVING CATCH BASINS

The existing catch basins shall be moved to the position shown.

The contractor shall furnish all material and make the necessary standard connections and do all necessary excavating.

Payment for "Moving Catch Basins" shall be made at the price bid for each and shall include all excavation and backfilling.

6-21 INLETS (For plan, see pages 151, 154)

Inlets shall be set in a neat and workmanlike manner and conforming to the existing curb and gutter, unless otherwise directed by the City Engineer. They shall be well bedded in concrete, as shown in detail on the plans. When set in pavement, the highest point shall be set flush with the surface of the pavement.

The connection from the inlet to the catch basin, whether the inlet is new or existing, shall be made in a straight line with no bends whatever and shall successfully admit of "rodding" with jointed or hinged poles used for the purpose. The concrete around the inlets shall be Class "5."

Where inlets are built in connection with catch basins, payment for same shall be included in the price bid for each catch basin. When constructed separately, payment shall be made at the price bid for each, and in either case the pipe and connection from the inlet to the catch basin shall be included.

6-22 MOVING OR ADJUSTING INLETS

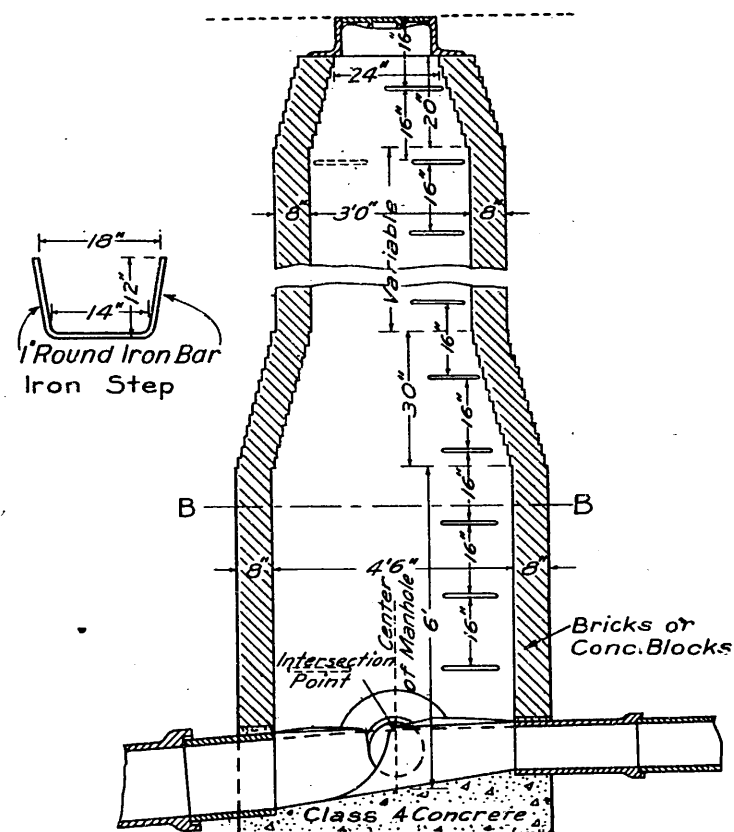
Existing inlets shall be adjusted to the new grade or shall be moved to a new position, where shown on the plan or as directed by the City Engineer. The contractor shall furnish all new material required and reset such inlets in the manner specified for new work.

Payment for "Moving or Adjusting Inlets" shall be made at the price bid for each.

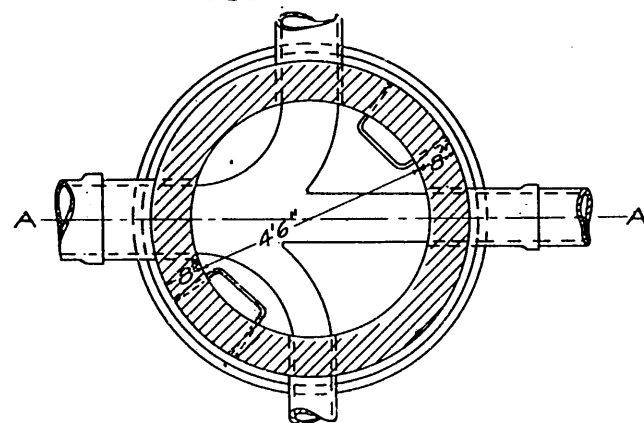
6-23 CURB INLETS (For plan, see page 152)

Curb inlets shall be set where shown on the plans or as directed by the City Engineer. They shall be carefully set to a neat fit with the curb and gutter or pavement as the case may be, and firmly bedded in concrete. Care shall be taken to see that the drainage is clear and free. The connection to the catch basins shall be without bends and shall successfully admit of "rodding." The concrete shall be Class "5."

Payment for "Curb Inlets" shall be made at the price bid for each, and shall include all labor and material necessary to complete the work according to specifications.

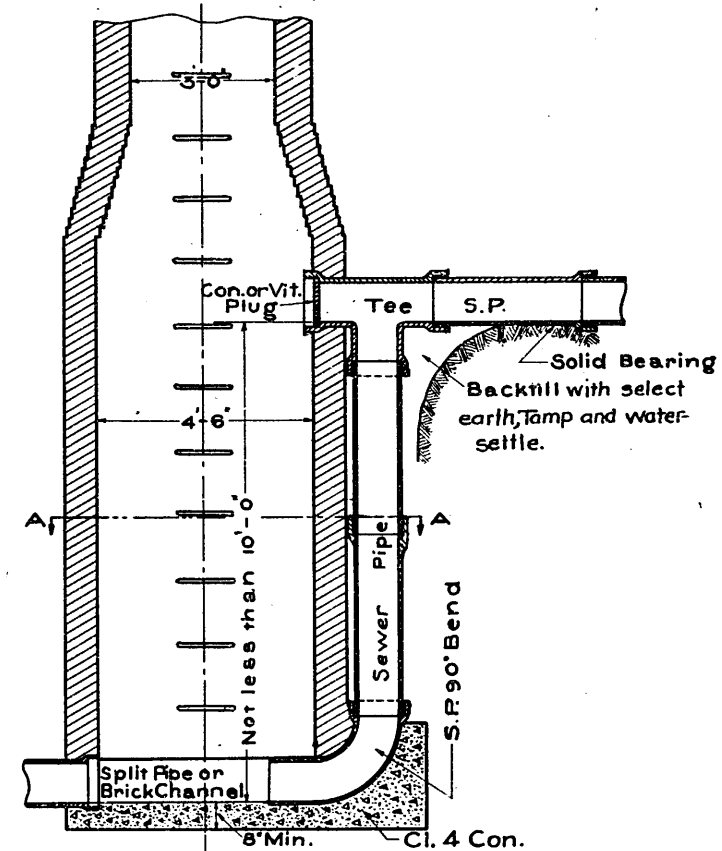


Section A-A

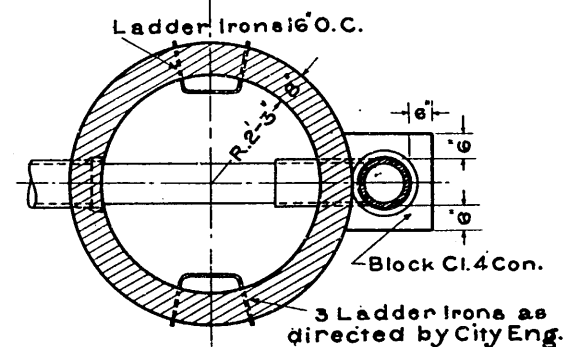


Section B-B
MANHOLE

Std M.H. top and Cover

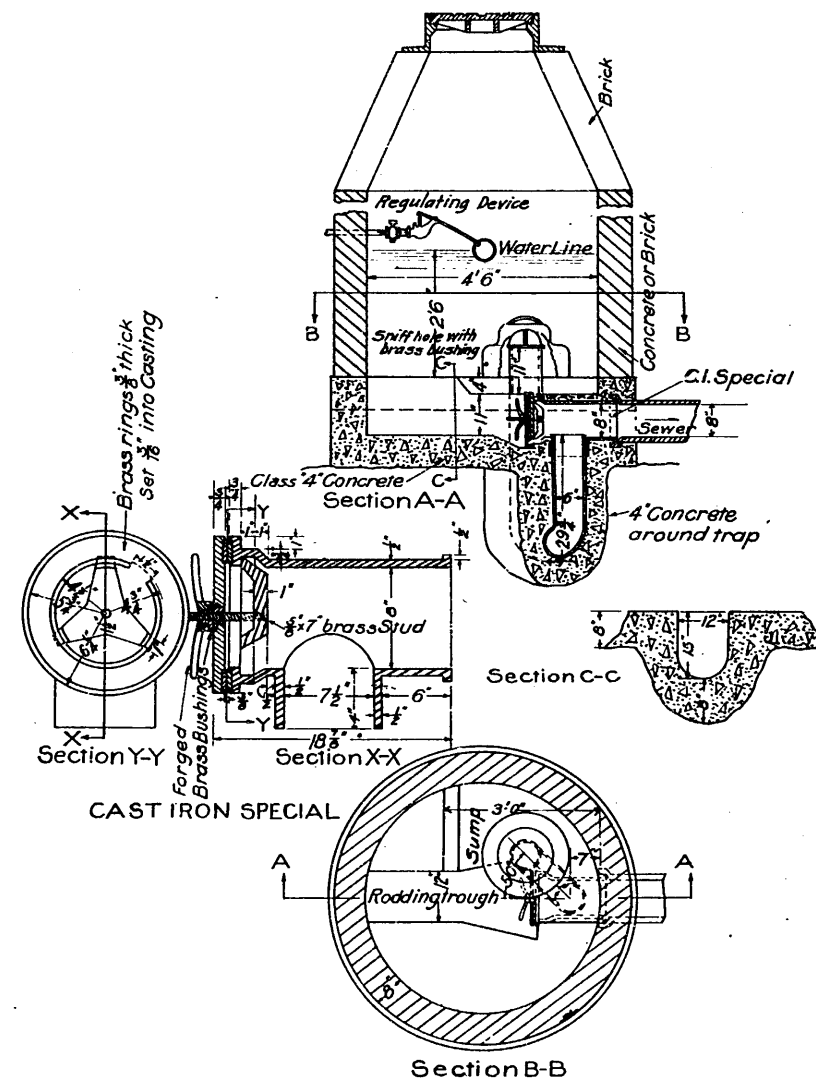
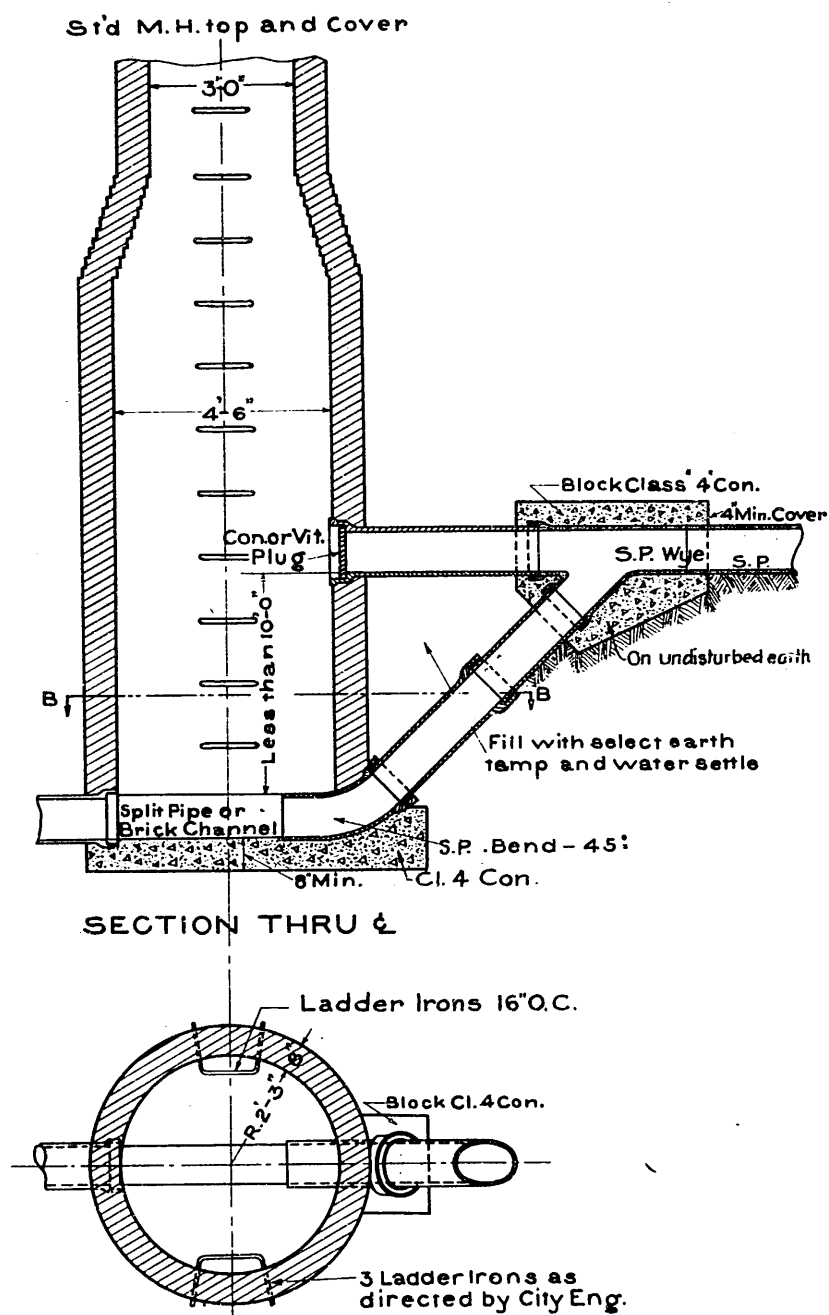


SECTION THRU

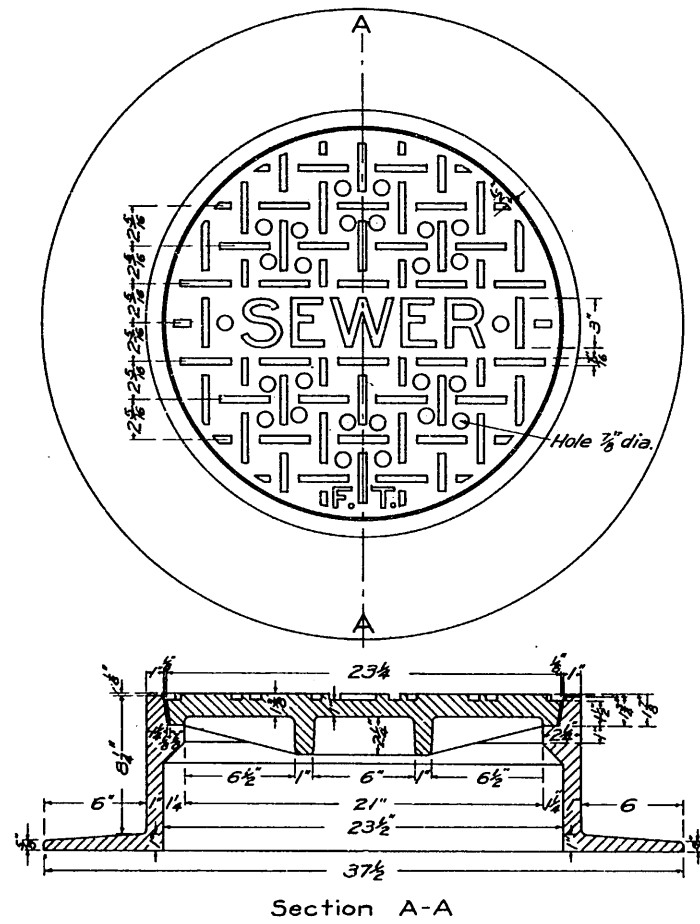


SECTION A-A
DROP MANHOLE

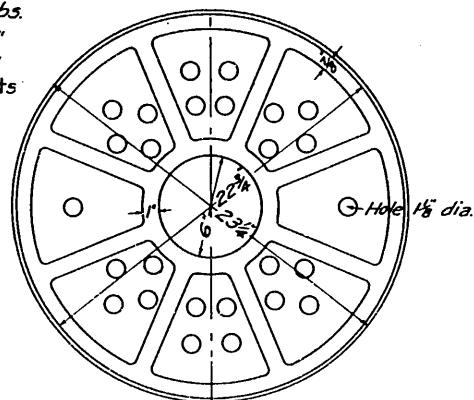
To be used where drop is 10 ft. or more



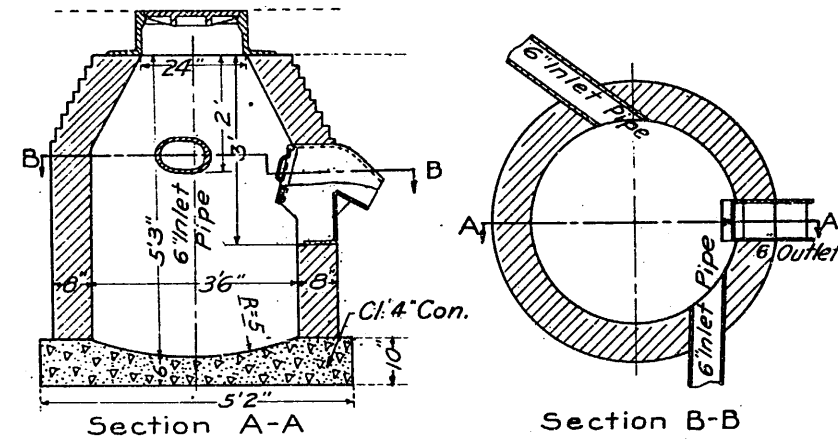
FLUSH TANK-SIPHON TYPE



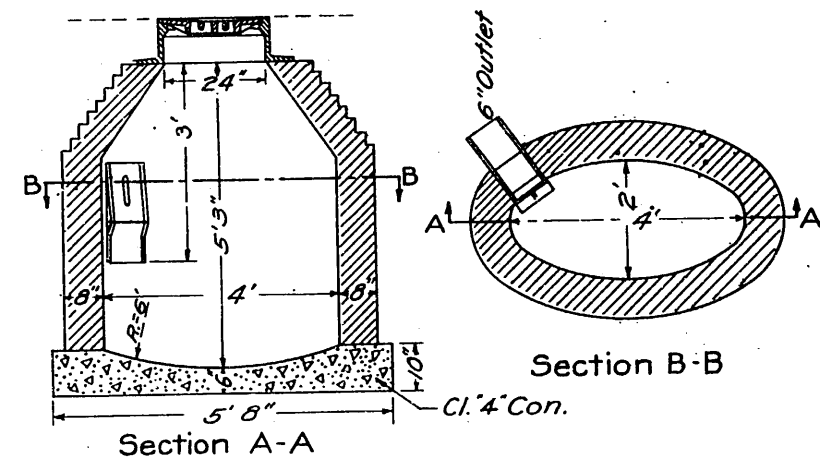
Ring 345 lbs.
Cover 153 "
Total 498 "
Approximate Weights



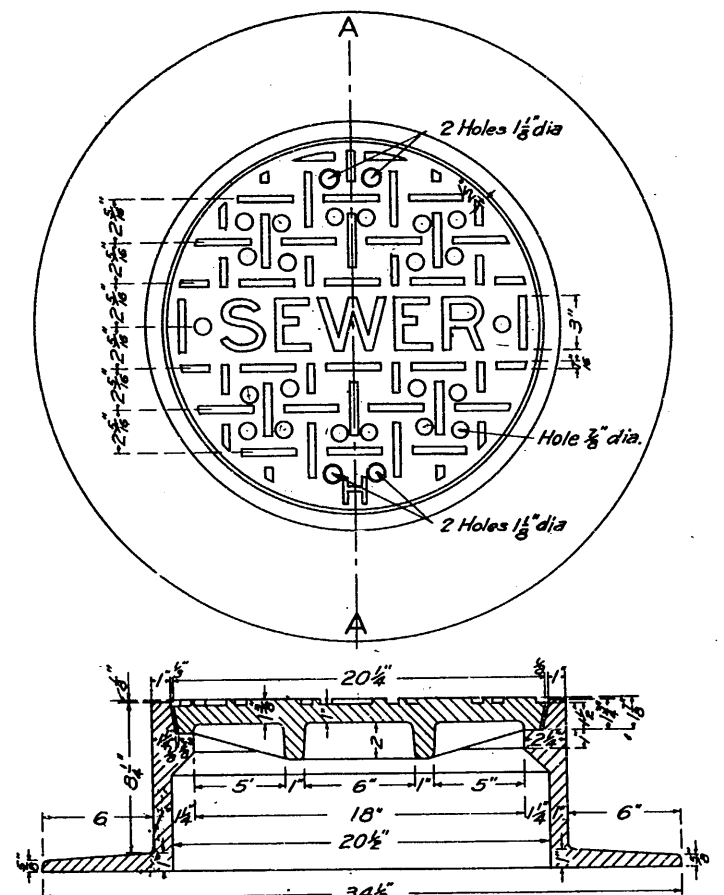
Bottom View of Cover
COVER FOR FLUSH TANK



CATCH BASIN

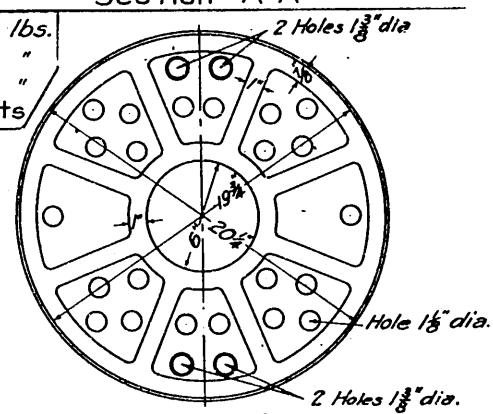


ELLIPTICAL CATCH BASIN



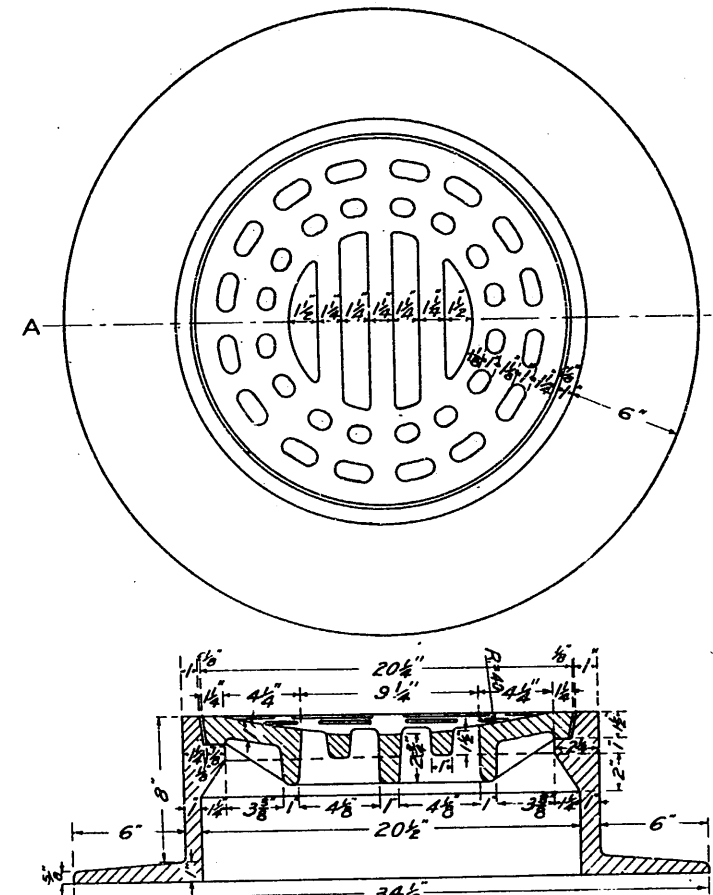
Section A-A

Ring	321 lbs.
Cover	116 "
Total	437 "
Approximate Weights	

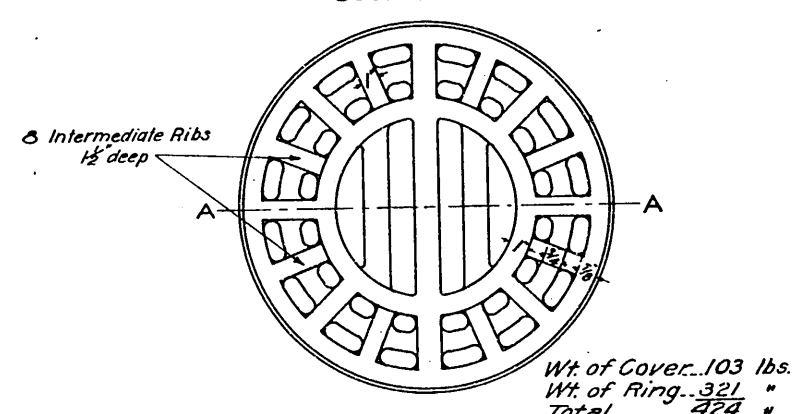


Bottom View of Cover

COVER FOR CATCH BASIN & MANHOLE



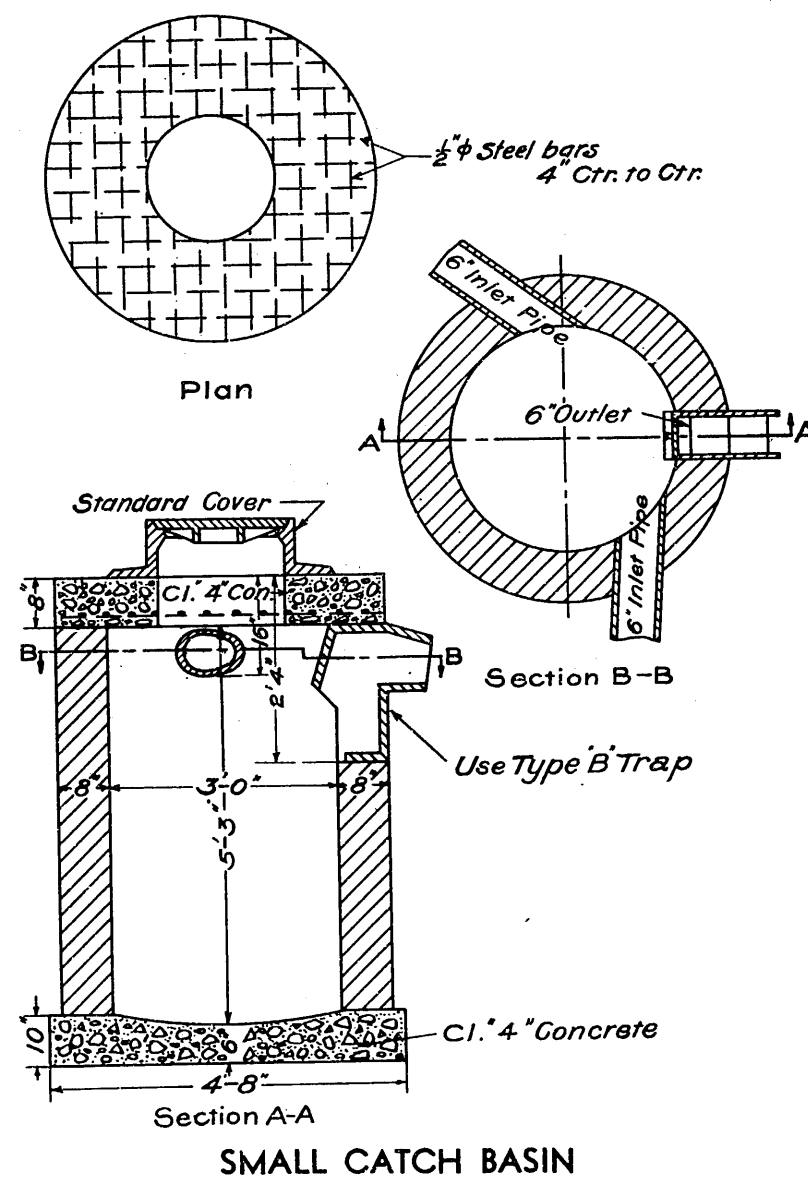
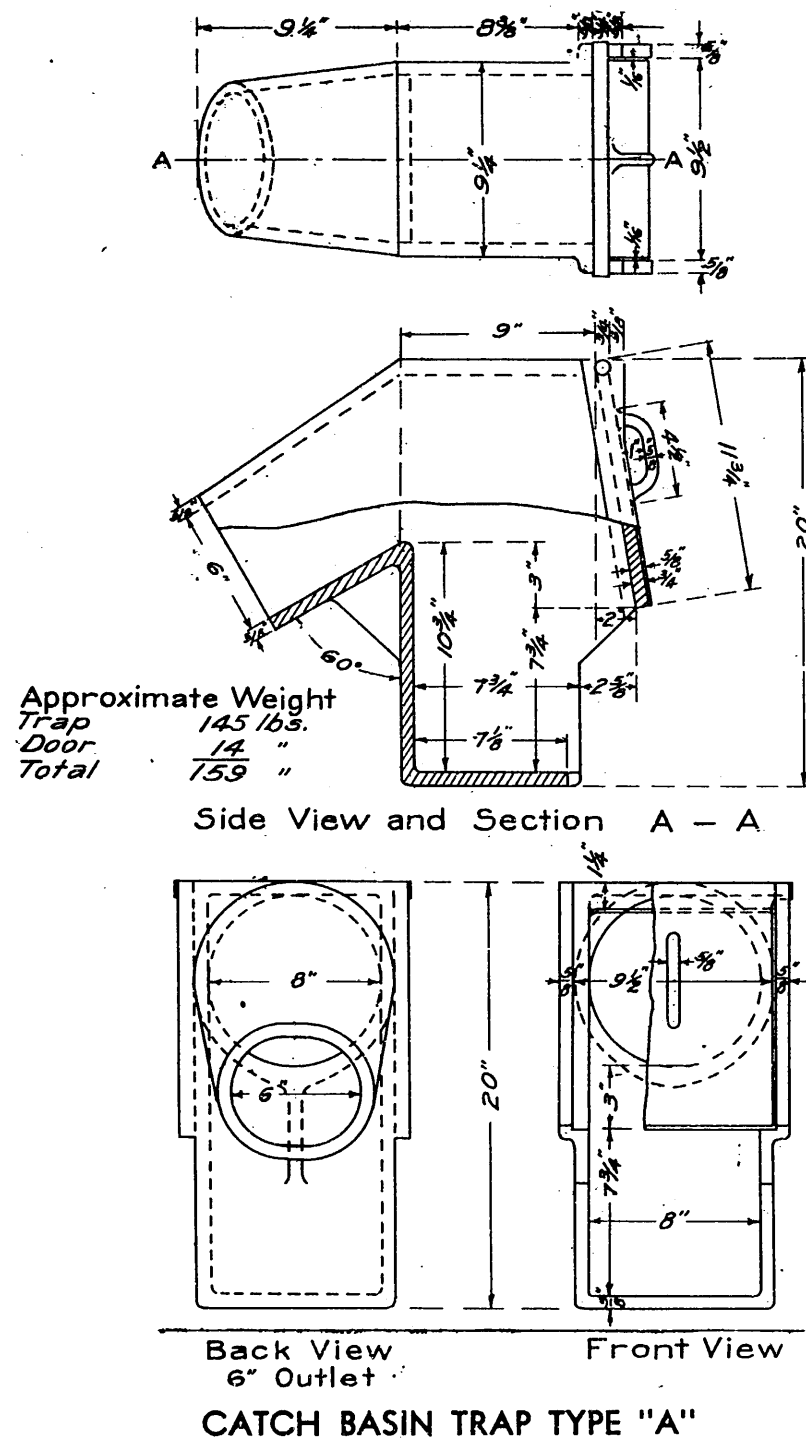
Section A-A

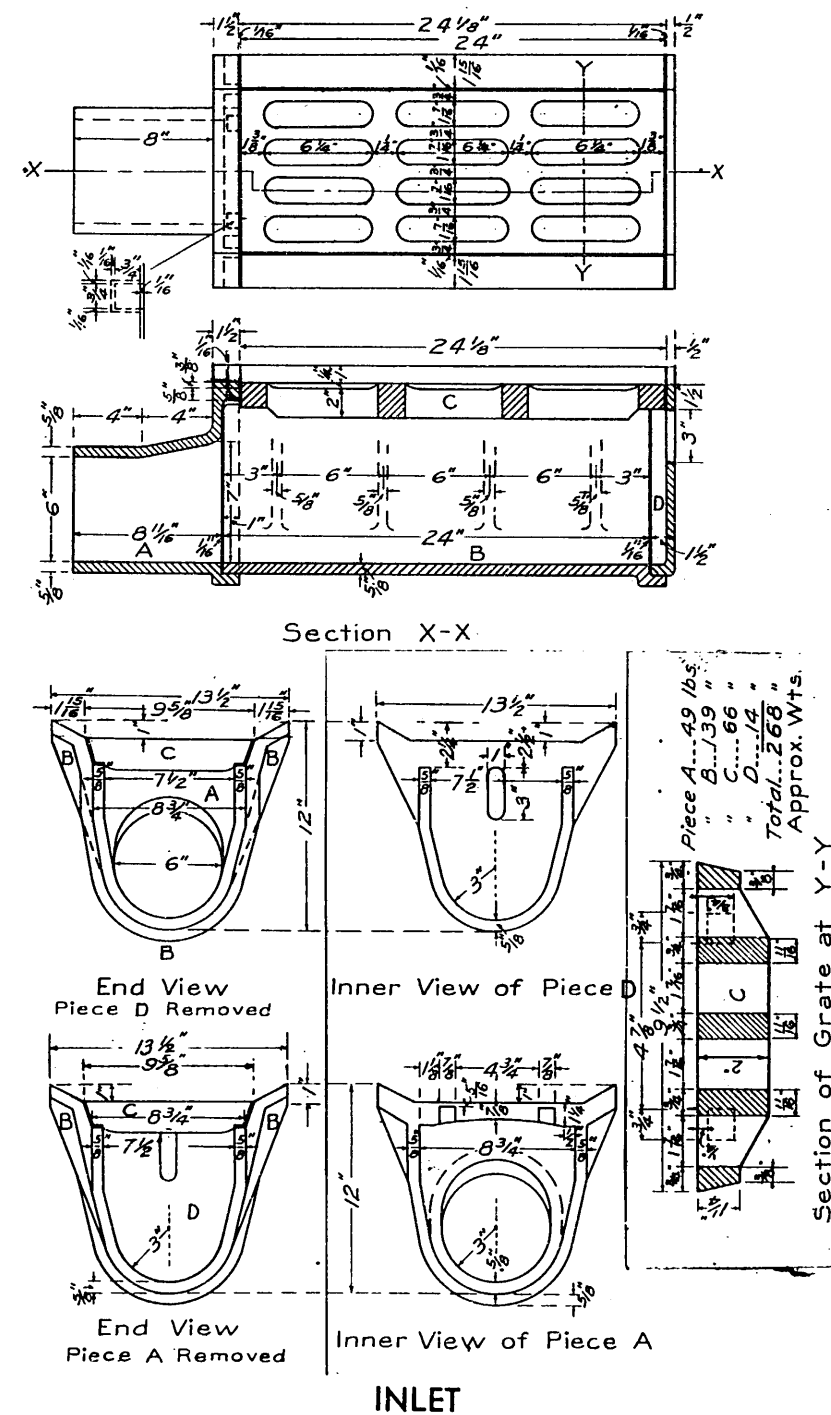
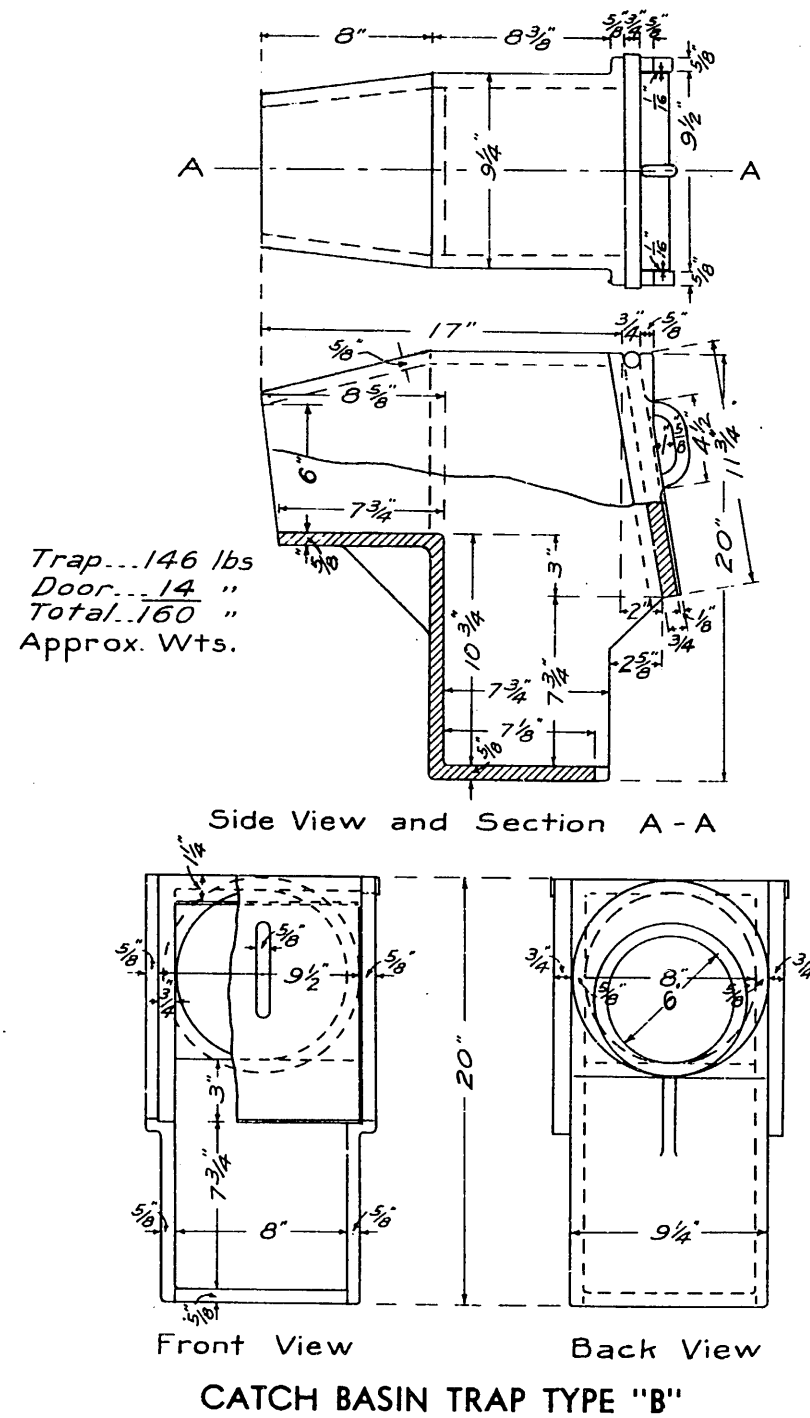


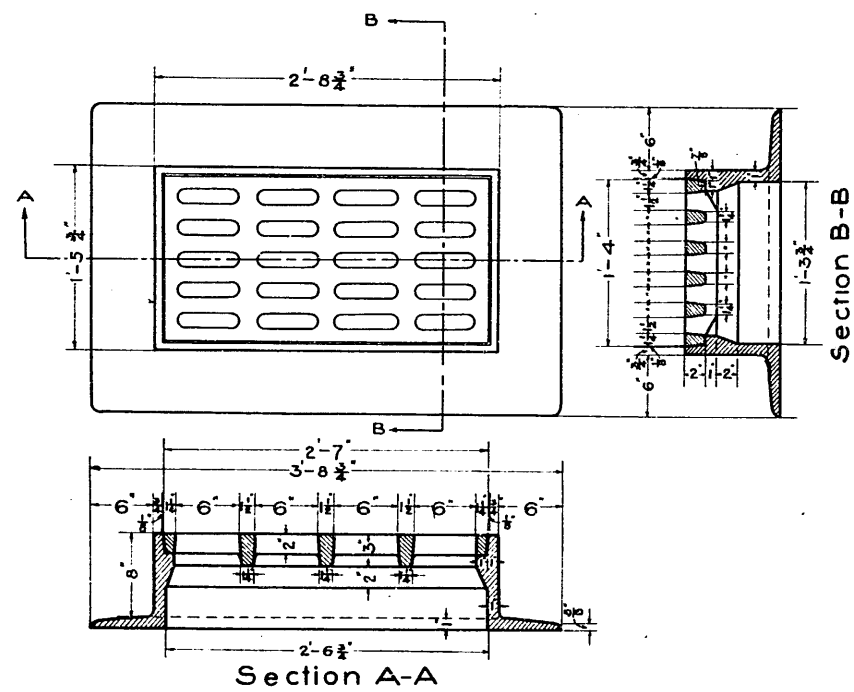
Bottom View of Cover

CATCH BASIN COVER—INLET TOP

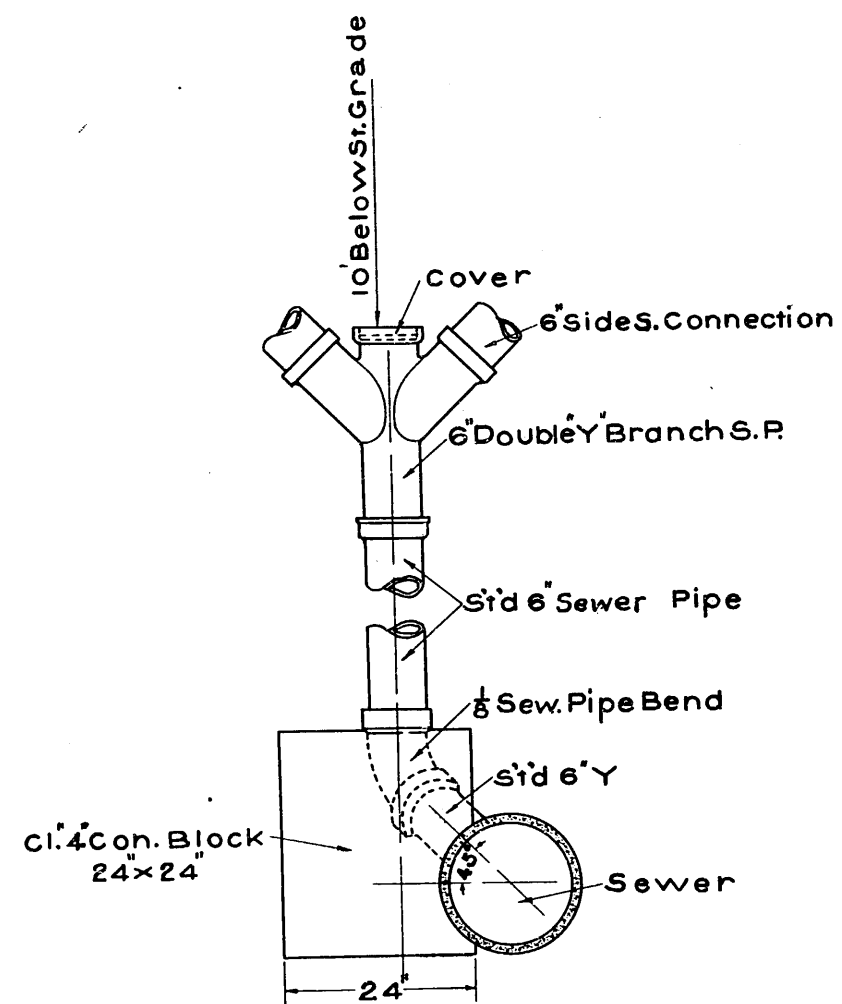
Wt. of Cover	103 lbs.
Wt. of Ring	321 "
Total	424 "







LARGE INLET TOP
FOR CATCH BASIN
Cast Iron



STANDING CONNECTION

SECTION 7**SPECIFICATIONS FOR
WATERMAINS AND APPURTENANCES****7-1 ALIGNMENT, GRADE AND COVER**

Alignment and grade will be given from hubs driven into the ground parallel to the line of pipe. In graded streets grades may be taken, when directed, from the existing curbs. The top of the pipe shall be at the following depths below the mean curb elevations, measured to the barrel of the pipe. These depths shall apply to all pipe laid regardless of the depth of any existing pipe being replaced.

For four (4) inch, six (6) inch and eight (8) inch pipe, thirty-five (35) inches; for ten (10) inch pipe, forty (40) inches; for twelve (12) inch pipe, forty-three (43) inches; and for all larger sizes up to thirty (30) inch pipe, inclusive, thirty-six (36) inches. Where one side of the street is higher than the other, due allowance must be made to secure proper cover. In ungraded streets a profile will be furnished and the pipe shall be laid in conformity with the grades shown on the profile. No allowance will be made for extra excavation beyond the price bid per linear foot of pipe in place. The pipe shall conform accurately to the alignment and grades given. Gate valves, hydrants, standard fittings and special castings shall be set as shown on the plan as directed by the City Engineer.

7-2 TRENCHING

Trenches for the pipe shall be opened in accordance with the lines and grades given, and in such order as may be directed. They shall be of sufficient width to give convenient access for caulking the joints and packing the earth under and about the pipe. Wherever water occurs in the bottom of the trench it shall be sufficiently drawn off to obtain a firm bed for the pipe, and to admit of proper caulking. The contractor shall bear all expense arising from the draining of the trenches.

Wherever the pipe is to be laid above the existing ground surface, a fill shall be made of proper material and of such dimensions as to be not less than eighteen (18) inches in depth over the top of the pipe, and four (4) feet in width on top of the fill,

with proper side slopes. Earth for such fills may be borrowed from the street area adjacent to the watermain, provided, however, that no existing roadway shall be disturbed or left in a dangerous condition by such borrowing. Before laying the pipe the fills shall be properly compacted by tamping or otherwise, as may be directed by the City Engineer. The cost of such filling shall be included in the price bid per linear foot for the pipe complete. Any culverts or box drains which may be necessary through fills shall be constructed in accordance with the details shown on the plans, or as directed by the City Engineer.

Culverts or box drains shall be paid for at the prices bid per linear foot for "Pipe Culverts" and per M. Ft. B. M. for "Box Drain" as called for on the proposal.

All stumps and parts of stumps that are within four (4) feet of the pipe line shall be entirely removed and burned or otherwise disposed of. Boulders or rocks shall be either entirely removed or cut out to the width of the trench and to a depth twelve (12) inches below watermain grade. Where rock is removed, the trench shall be backfilled to grade with sand and gravel or other material satisfactory to the City Engineer and thoroughly compacted. The cost of such removal of stumps and boulders, and the disposal of the same, and the cost of such backfilling as may be necessary, shall be included in the price bid per linear foot of watermain laid, provided, however, that "Rock Excavation" will be measured and paid for as provided in Section 3-3.05.

Whenever it is necessary to break through existing pavements for the purpose of constructing a watermain, the work shall be accomplished in accordance with the provisions of Section 1-30.

7-3 EXTRA EXCAVATION

For specifications regarding Extra Excavation, see Section 3-5 under "Grading, Curbing and Appurtenances."

7-4 CAST IRON PIPE WATERMAIN**—4.01 QUALITY OF PIPE**

Cast Iron Pipe for Watermains shall be as specified under "Quality of Materials," Section 2-26.

**—4.02 CONDITION OF CASTINGS WHEN
DELIVERED**

All the pipe and other castings shall be delivered in all respects sound and conformable to these specifications. The inspection at the place of manufacture shall not relieve the contractor of any

of his obligations in this respect, and any defective pipe or other castings which may have passed at the works or elsewhere shall be at all times liable to rejection when discovered. Care shall be taken in handling the pipe not to injure the coating, and no pipe or other material of any kind shall be placed in the pipe during transportation or at any time after they have received the coating.

After delivery at the trench and before laying, the pipe and all castings shall be carefully inspected for injury to the coating. At all places where the coating has been removed or abraded, the iron shall be first carefully cleaned and then recoated with a field coating that is equal in quality to "P. and B." paint.

—4.03 LAYING PIPE

After the trenches are complete to the required depth and the bell holes dug, the pipe shall be laid therein. Where pipe is laid on a grade the laying shall be started at the bottom and shall proceed upward with the bell ends of the pipes laid up grade. Spigot ends of pipes shall be entered full depth into the bells and where gate valves are placed in the line the pipes and fittings shall be jacked tightly together, to prevent any movement of the valves when closed and under pressure, the jacks being maintained in place until the lead joints have been run. The pipe shall be so adjusted as to give uniform space all around, and pipes which do not have sufficient joint space shall be removed and replaced with others of proper dimensions.

The pipe and all other castings as they are laid, shall be carefully swept out and cleaned of any earth or rubbish which may have found place inside during or before the operation of laying. Open ends of pipe and fittings which are laid in the trench shall be temporarily plugged before leaving the work for the night.

—4.04 LAYING PIPE ON CURVES

When bell and spigot cast iron pipe is to be laid on curves the minimum radius to be used for the respective diameter of pipe shall not be less than shown in the table below.

Diameter of Pipe in Inches	Laying Length in Feet				
	12	16	16 ½	18	20
4.....	170	230	235	260	285
6.....	195	260	270	295	330
8.....	210	285	295	320	355

Diameter of Pipe in Inches	Laying Length in Feet				
	12	16	16 ½	18	20
12.....	230	305	315	345	380
16.....	260	350	360	390	435
20.....	320	430	440	480	535
24.....	390	520	535	585	650
30.....	480	640	660	720	800
36.....	570	760	785	855	950
42.....	660	880	910	990	1100
48.....	750	1000	1030	1125	1250

—4.05 DISINFECTING NEW WATERMAINS

In accordance with the regulations of the State Department of Health, all new watermains shall be disinfected as follows:

All pipes and fittings shall be swept or brushed free from mechanical dirt prior to installation. As each length of pipe is laid, sufficient dry calcium hypochlorite having an available chlorine content of about 65% shall be placed in the pipe to give a dosage of about 50 parts per million available chlorine calculated on the volume of the water which the pipe will contain.

The following table shows the amount of high-test calcium hypochlorite which shall be used in each twenty foot length of pipe to give 50 p.p.m. available chlorine:

Pipe Size (Inside Diameter in Inches)	Pipe Size (Inside Diameter in Inches)
2 1/30 ounce	20 3 ½ ounces
4 1/8 ounce	24 5 ounces
6 1/3 ounce	30 7 ¾ ounces
8 5/8 ounce	36 11 1/8 ounces
10 7/8 ounce	42 15 ¼ ounces
12 1 ¼ ounces	48 20 ounces
16 2 ¼ ounces	

When the watermain is completed, water shall be allowed to flow into the main until it appears at the hydrant at the far end. The hydrant shall then be closed and the line allowed to stand under normal pressure not less than three (3) hours. Upon completion of the disinfecting period, the main shall be flushed through fire hydrants until tests show not more than 0.2 parts per million

available chlorine. The test for available chlorine will be made by the City Engineer.

—4.06 JOINTING

The annular space between the spigot and bell of the pipe shall be packed with clean rope gaskets, complying with Section 2-27. Rope gaskets shall be thicker in diameter than the annular space to be filled and shall be forced and rammed into place with a "yarning tool." At least two rings of rope gasket shall be used on all sizes of pipe. The ends of the rings shall be butt jointed with one joint on either side of the pipe and the other at the top, thus assuring that joints will not be adjacent to each other. Additional gaskets shall be placed until the space remaining is of the depth specified in the accompanying table for "Depth of Lead Joints." Such space shall then be filled with lead.

Before running the lead, the joints shall be carefully wiped out to make them clean and dry. The joint shall be run full at one pouring, and the melting pot shall be kept within fifty (50) feet of the joint about to be poured. The joint shall then be caulked by competent mechanics; the caulking shall be faithfully executed and in such manner as to secure a tight joint without over-straining the iron of the hub. The lead, after being caulked, shall be flush with the face of the socket. The bell hole shall be perfectly free from water while the joint is being prepared.

The depth of lead joints, and the approximate amount of lead per joint, for various sizes of pipe shall conform to the dimensions and weights shown in the following table:

DEPTH OF LEAD JOINTS

Pipe Size (Inside Diameter in Inches)	Depth of Lead Joints in Inches	Approximate Weight of Lead in Lbs. per Joint
4.....	2.25	9
6.....	2.25	12
8.....	2.25	15
12.....	2.25	22
16.....	2.75	42
20.....	2.75	51
24.....	2.75	61
30.....	2.75	75
36.....	3.00	89
42.....	3.00	103
48.....	3.00	117

Whenever it is discovered that a lead joint is less in depth than required by these specifications, the contractor shall at his own expense, drill, cut out, or otherwise remove the lead from any or all joints desired, until the City Engineer is satisfied that all shallow joints have been discovered. All joints deficient in lead depth shall then be cleared of lead and yarning, re-yarned to the depth required by these specifications, leaded and caulked as required; all at the contractor's expense.

—4.07 BACKFILLING

For refilling the trenches, the earth filled into the bottom of the trench, under, around and to the top of the pipe, and other castings, shall be free from stones. It shall be carefully packed and well rammed with the proper tools. Special care shall be taken in ramming not to injure the coating of the pipe.

The remaining portion of the backfill shall be water settled by casting or sluicing the earth into the trench which has been partially filled with water. Where trenches are less than eighteen (18) inches in depth, measured from the top of the pipe, to the surface of the ground, a fill shall be made to provide not less than eighteen (18) inches of cover over the top of the pipe, and the cost of such fill shall be included in the price bid per linear foot for the pipe in place.

Backfilling of trenches cut through existing pavement and the restoring of the pavement shall be accomplished in accordance with Section 1-30. Unpaved roadways shall be restored as specified in Section 6-7.

—4.08 FIELD TESTS

All pipe shall be subjected to a hydrostatic test after being laid.

As soon as any section between gate valves is laid, or when directed by the City Engineer, the same shall be subjected to such test. The pressure shall be brought up to three hundred (300) pounds per square inch for four (4) inch, six (6) inch and eight (8) inch pipes; two hundred seventy-five (275) pounds per square inch for ten (10) inch pipe; two hundred fifty (250) pounds per square inch for twelve (12) inch pipe; two hundred twenty-five (225) pounds per square inch for sixteen (16) inch pipe; and two hundred (200) pounds per square inch for all larger sizes. The test pressure shall be maintained for not less than fifteen minutes; on stopping the pump the pressure shall not drop abruptly. Any pipe which exhibits any defects shall be

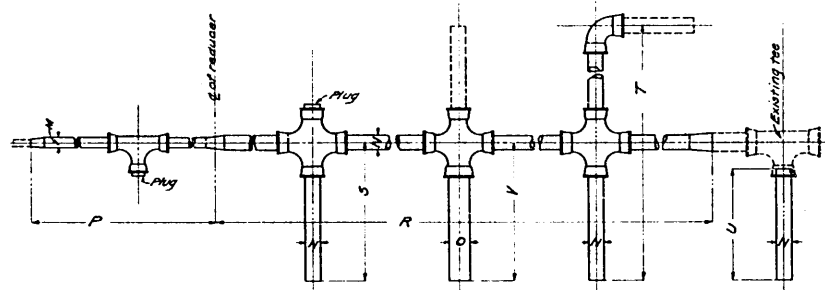
taken out and replaced by a sound pipe. All pumps, gauges, plugs and other appliances used in making this test shall be furnished by the contractor, but the City reserves the right to test and approve all gauges used. If, after any portion of the trench is re-filled and before the final release of contract any defects appear, the contractor shall, at his own expense, correct such defects.

When joints have been made with lead substitutes, the pipe shall be kept at normal pressure for 24 hours before applying test pressure.

—4.09 MEASUREMENTS

Measurements of watermains shall be taken along the top of the pipe in a vertical plane passing through the axis and shall include all gate valves and standard specials, but shall omit all special castings.

The method of making measurements for payment is more clearly shown in the following diagram in which full lines represent new pipe and dotted lines represent existing pipe.



Payment will be made for
P—linear feet of pipe of diameter "M"
R, S, & V—linear feet of pipe of diameter "N"
V—linear feet of pipe of diameter "O"

—4.10 PAYMENT

Payment for cast iron pipe shall be made at the price bid per linear foot for "Sand Cast Pipe," or "Centrifugally Cast Pipe," and shall be in full for furnishing and laying the pipe, and all standard fittings shown on the plans, and this shall also include payment for all trenching, laying, disinfecting, jointing, backfilling, restoring the street surface, relaying of pavement or plank-ing, and all other material and labor necessary for the complete work. In case any standard fittings shown on the plans are omitted in the final work a corresponding reduction will be made from the

estimate. Any excavation above that shown on the profiles or specified above, under "Alignment, Grades, and Cover," which may be ordered by the City Engineer, shall be paid for at the rate bid per cubic yard for "Extra Excavation."

7-5 CONNECTIONS TO EXISTING MAINS

All connections to watermains in use shall be made by the City Water Department. All crosses or other specials required to be inserted in any main already in use shall be furnished by the contractor and set by the City Water Department. The contractor shall furnish the special as shown on the plans, and all other material required. He shall make all necessary excavations and backfilling. The labor of cutting and inserting the special shall be performed by the City Water Department. The contractor shall give at least twenty-four (24) hours' notice to the City Engineer when the service of the Water Department is required.

Department bills for any such services or labor performed by the City Water Department shall be paid by the contractor according to the provisions of Section 1-39 of General Stipulations.

7-6 SERVICE CONNECTIONS

As soon as section of pipe satisfactorily stands the required test, the Water Department will make any service connections or changes of connection required. The contractor shall leave the section of trench open until such connections have been made, except at street or other crossings and where backfilling is especially directed by the City Engineer.

For the purpose of supplying consumers with water during the progress of the improvement, it is understood and agreed that the City of Seattle shall have the right, at such time or times, and at such place or places, as the Superintendent of the Water Department may elect, to attach corporation cocks to the main or mains to be constructed hereunder, and that the attaching of any such corporation cock or cocks shall not be construed as an acceptance by the City of Seattle of any part of the work to be performed under this contract.

7-7 REMOVAL OF OLD PIPE

The contractor shall give proper care and protection during construction to any water pipes or mains in use. As soon as service connections have been taken care of by the Water Department, all the old pipe which may be located within the trench for the new

pipe shall be carefully taken up and removed. All excavating, removing of old pipe and backfilling shall be performed by the contractor. The pipe shall become the property of the improvement district, and shall be removed from the job by the Water Department.

In removing existing cast iron pipe, the lead joints shall be melted out with an oxyacetylene flame or by some other method which does not overheat or crack the pipe. Burning out with wood fire or similar means shall not be done.

Payment shall be made at the price bid per linear foot for "Removing Existing Pipe," provided where no item is included in the proposal for payment of such cost and where the pipe to be removed is all shown on the improvement plan, full compensation for removing such pipe shall be considered as included in the prices bid for the various other items comprising the improvement.

7-8 GALVANIZED PIPE

—8.01 IRON PIPE

Galvanized Wrought Iron Pipe shall conform to the specifications, Section 2-26.04A.

—8.02 STEEL PIPE

Galvanized Steel Pipe shall conform to the specifications, Section 2-26.04B.

—8.03 INSTALLATION

When possible, connection shall be made to the main line at a tapped plug. Otherwise, connections shall be made to the main pipe line by means of a standard water pipe clamp with threaded outlet. All threads of screw connections shall be unbroken and cut full depth. Before connections are made all male threads shall be well covered with steamfitters' cement. The pipe shall be laid with a cover of not less than two and one-half (2½) feet. All galvanized pipe when laid shall be subjected to hydrostatic pressure equal to 300 pounds per square inch.

—8.04 PAYMENT

Payment shall be made at the price bid per linear foot for "Galvanized Iron Pipe" and "Galvanized Steel Pipe," and shall include all trenching and filling, necessary bushings, clamps, fittings and all labor necessary to place the pipe in position ready for use.

7-9 GATE VALVES

Gate valves shall be placed in the watermain at locations indicated on the plans or as directed by the City Engineer. They shall be of the quality specified in Section 2-14.

After gate valves are delivered on the ground, but before they are placed in the line, they shall be cleaned and all rust removed and then thoroughly painted with "P & B" Paint or its equal.

Payment for "Gate Valves" shall be made at the price bid for each and shall include the cost of the valves, together with all material and labor necessary for setting in place.

7-10 DISTRICT GATE VALVES

At any point in the system where two services of different pressures come together a district valve shall be placed to connect or disconnect said services by opening or closing the valve.

District valves shall be provided with a shackle consisting of a chain and a steel socket fitting over the operating nut. The chain shall have links so shaped that a lock may be inserted between any two. This shackle when locked in place shall prevent the opening and closing of the gate with a gate key.

In all other respects, "District Gate Valves" shall be furnished and installed as specified for "Gate Valves."

7-11 VALVE CHAMBERS (For plan, see pages 172 to 176 inclusive)

Where shown on the plans, or where directed by the City Engineer, gate valves shall be enclosed in valve chambers provided with a cast iron frame and cover, as shown on the standard detail plans.

Where directed by the City Engineer, valve chambers shall be connected to the sewer, or other suitable outlet, by a four (4) inch sewer pipe drain, the labor and material for which shall conform in all respects to the standard specifications for pipe sewers.

Where Valve Chambers are connected to the sewer, a four (4) inch clay or concrete "P" trap shall be placed in the line just outside of the chamber, and the gravel pocket shall be omitted.

Valve Chambers may be constructed of brick, concrete or concrete blocks at the contractor's option. The specifications for man-holes shall apply to valve chambers in regard to masonry and the general requirements for castings.

Valve Chambers constructed of concrete and large valve cham-

bers with reinforced concrete top shall be constructed with two rings or courses of brick between the top of the concrete and the bottom of the cast iron ring to facilitate adjustment to future pavement grades.

The concrete to be used in the reinforced concrete top of large chambers shall be Class "6."

Valve Chambers with reinforced concrete covers will be designated as large valve chambers and payment shall be made at the price bid for "Valve Chambers, Large." Other valve chambers will be designated as valve chambers, and payment shall be made at the price bid for "Valve Chambers."

Payment for either type shall also include payment for one joint of four (4) inch sewer pipe and the rock pocket.

Payment for the four (4) inch Valve Chamber Drain, and the connection of the same to the sewer, will be made at the price bid per linear foot for "4-inch Valve Chamber Drain." Measurement thereof shall include the four (4) inch "P" trap but not the one joint of pipe furnished with the chamber, as above specified.

7-12 WOOD VALVE BOXES (For plan, see page 177)

Where shown on the plans, or where directed by the City Engineer, gate valves, including district gate valves, shall be protected by a wooden box, constructed of three (3) inch lumber and made to conform to the standard drawings, unless otherwise shown on the plans.

Payment for "Wood Valve Boxes" shall be made at the price bid per M. Ft. B. M. in place.

7-13 HYDRANTS

Hydrants of proper size shall be installed at locations shown on the improvement plans and in accordance with the details set forth herein for the various conditions encountered.

Hydrants shall conform to the specifications for hydrants in Section 2-16.

Hydrants shall be connected to the main with a section of six (6) inch or eight (8) inch cast iron pipe which shall conform both in material and laying to the requirements of these specifications for "Cast Iron Pipe." Each hydrant connection shall be provided with an auxiliary gate valve set vertically and placed as indicated in the detail, and provided with a cast iron valve box. Auxiliary gate valves shall conform to the specifications for gate valves, Section 2-14.

The hydrant base shall be set in a bed of broken stone or coarse gravel unless the waste orifice is connected with a sewer or satisfactory drain. When hydrants cannot be connected to drains at the time of setting, the threaded waste orifice shall be so placed on the hydrant barrel that future connection can be made without disturbing the hydrant. Screw nipples and other fittings needed to accomplish this end shall be furnished without extra charge.

All gaskets required in connecting hydrants to the main shall be cloth insertion ring gaskets one-sixteenth (1/16) inch thick. The cast iron tee for hydrant connection shall have lugs cast on the outlet for the insertion of rods to tie the hydrant to the main.

A cast iron hub and flange connection made in accordance with the standard drawings shall be bolted on to each hydrant gate valve.

Hydrants shall be shackled to the main pipe by two iron rods attached at one end to the lugs cast on the outlet tee in the main pipe and at the other end to lugs cast on the hub and flange connection mentioned above.

The auxiliary gate valve, the portion of the hydrant below the surface of the ground, and the shackle rods and fittings shall be thoroughly painted with two coats of "P and B" paint or some other similar paint approved by the City Engineer. The portion of the hydrant above ground shall be painted with two coats of dark green paint after the hydrants have been set and tested.

Payment for "Hydrant, 6" Connection" or "Hydrant, 8" Connection," shall be made at the price bid for each and shall include payment for the auxiliary gate valve, cast iron valve box, hub and flange casting, all bolts, nuts and gaskets, and any other labor or material necessary to furnish and install the hydrant as above specified, except that the six (6) inch or eight (8) inch cast iron pipe connecting the hydrant with the main shall be paid for as hereinafter specified, and except that the shackle rods, together with all nuts, washers, turnbuckles, or other necessary fittings, shall be paid for at the price bid per pound for "Shackle Rods."

7-14 SHACKLE RODS FOR HYDRANTS AND PLUGS

All hydrants shall be shackled to the main by means of steel rods of the size, shape and arrangement shown in detail on the standard plans for various conditions.

All cast iron plugs shown on the plan and installed as part of a

new main shall be shackled to lugs cast on the fitting, as detailed on the standard plans.

All cast iron plugs installed on existing fittings, not provided with lugs, shall be shackled by means of short steel bars engaged in a steel collar clamped behind the bell of the fitting.

Shackle rods shall be thoroughly painted with two coats of "P & B" paint or equal. One coat shall be applied after the shackles are installed.

Payment for the cost of such shackles, together with all nuts, turnbuckles, collars, washers or other necessary fittings, and including painting, shall be made at the price bid per pound for "Shackle Rods," provided no payment shall be made for shackling plugs on new watermains when such plug is required by the plan as submitted. Payment for the cost thereof shall be considered as included in the price bid for the watermain.

7-15 CAST IRON VALVE BOXES (For plan, see page 181)

Cast iron Valve Boxes shall be provided where shown on the plans, as for auxiliary gate valves on hydrants or where directed by the City Engineer.

Payment for "Cast Iron Valve Boxes" shall be made at the price bid for each in place, except as hereinbefore provided for Hydrants.

7-16 HYDRANT CONNECTIONS

(For plan, see pages 178, 179, 180)

"Hydrant Connections" shall be paid for at the rate bid therefor per linear foot, and such payment shall be in full for furnishing, laying, jointing, and all other material and labor necessary for the completed result. "Hydrant Connections" shall be measured from socket of tee on main line to socket of hub and flange casting at hydrant.

7-17 RESETTING EXISTING HYDRANTS

Where shown on the plans or when directed by the City Engineer, existing hydrants shall be reset. In resetting hydrants the location of the hydrant tee is not changed; the hydrant, however, may be adjusted to conform to a new street grade or to a change in width of roadway. The work shall conform in all respects, including painting, to the specifications for setting hydrants as mentioned elsewhere in these specifications. Where existing hydrants are blocked to the main line the same method shall be used in resetting unless it is found necessary in the judgment of the

City Engineer to shackle them, in which case some approved form of shackling to the main line with steel rods shall be used.

Payment for "Resetting Hydrants" shall include payment for all labor and material necessary to place and connect the hydrant in its new position, but shall not include payment for new shackle rods or new pipe for hydrant connections. Such items shall be paid for at the rate bid for "Shackle Rods" per pound and "Hydrant Connections" per linear foot.

7-18 MOVING EXISTING HYDRANTS

Where shown on the plans or when directed by the City Engineer existing hydrants shall be moved. In moving hydrants the location of the hydrant tee in the line is changed. The work shall conform in all respects, including painting, to the specifications for setting hydrants as mentioned elsewhere herein. Where existing hydrants are blocked to the main line, the same method shall be used in moving unless it is found necessary in the judgment of the City Engineer to shackle them, in which case some approved form of shackling to the main line with steel rods shall be used.

Payment shall be made for "Moving Hydrants" at the price bid for each, and shall include payment for all labor and material necessary to place and connect the hydrant in its new position but shall not include payment for new shackle rods or new pipe for hydrant connections, which shall be paid for at the rate bid for "Shackle Rods" per pound in place and for "Hydrant Connections" per linear foot.

7-19 RECONNECTING EXISTING HYDRANTS

Where shown on the plans or when directed by the City Engineer, existing hydrants shall be reconnected. In reconnecting hydrants the position of the hydrant shall remain unchanged, but the existing hydrant connection shall be connected to the hydrant tee in the new line.

Payment shall be made for "Reconnecting Hydrants" at the price bid for each, and shall include payment for adjustment of hydrant connections, furnishing and cutting extra length of hydrant connections, lengthening existing shackle rods and all other labor and material necessary to connect the hydrant to the new line, but shall not include payment for new shackle rods, which shall be paid for at the rate bid for "Shackle Rods," per pound in place.

7-20 HYDRANT DRAINS

When ordered by the City Engineer, waste orifices of hydrants new or existing shall be connected to the nearest sewer or other outlet, by three-quarter ($\frac{3}{4}$) inch galvanized wrought steel pipe, which shall conform in all respects to the requirements for "Galvanized Wrought Steel Pipe," as specified in Section 2-26.04B. The pipe shall be connected at the hydrant with a three-quarter ($\frac{3}{4}$) inch union.

When connecting hydrant drains to existing sewer or other sewer pipe outlet, such connection shall be made by drilling a small hole in the top of the sewer pipe, just large enough to admit the threaded end of a three-quarter ($\frac{3}{4}$) inch street ell. The street ell shall be screwed onto the end of the $\frac{3}{4}$ -inch hydrant drain pipe and securely blocked in place and cemented with a generous quantity of cement mortar. Care shall be exercised in backfilling not to disturb the connection.

Payment for "Hydrant Drains" shall be made at the price bid per linear foot and shall be in full for furnishing and laying the pipe, including all trenching, backfilling, fittings and all labor necessary to place in position.

7-21 HYDRANT EXTENSIONS

All two flanged extensions, such as vertical extensions in the barrel of hydrants, or horizontal extensions between the hydrant and auxiliary gate valve, shall conform in quality of material, coating, marking, and all other respects to special castings as specified elsewhere in these specifications. In all cases the contractor shall see that the drilling in flanges of extensions will fit the drilling in the flanges of hydrant barrels or gate valves, as the case may be, and in no case shall the City be held responsible for any error in these drillings. The length of the vertical extensions shall be determined after the hydrant is in place.

Payment for vertical or horizontal hydrant extensions shall be made at the price bid for "Hydrant Extensions" per pound in place. The weight so paid for shall include the weight of castings together with the weight of additional length of hydrant rods, bolts, nuts, washers and gaskets.

The price paid per pound shall cover the cost of all machine work and all labor required to lengthen the rods and there shall not be any additional compensation either per pound additional or

otherwise for such work. Lengthening of hydrants to specified length with vertical hydrant extensions shall not be allowed except by permission from the City Engineer and in such cases no extra payment will be allowed for vertical extensions, but they shall be included in the price bid for "Hydrants."

7-22 SPECIAL CASTINGS

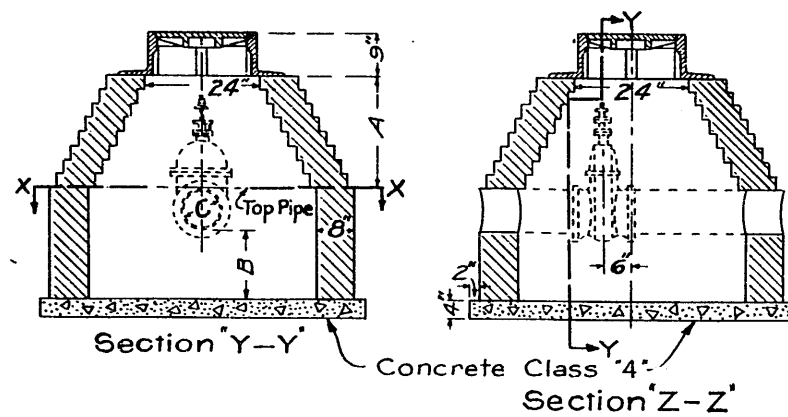
The term "Special Castings" shall be used to include any cast iron special fittings required for this improvement or any standard fittings which are necessary and ordered by the City Engineer but which are not included in the special plans and specifications.

Payment for "Special Castings" shall be made at the price bid per pound in place. In case of flanged special castings the weight so paid for shall include the weight of castings, together with the weight of all necessary gaskets, bolts, nuts and washers.

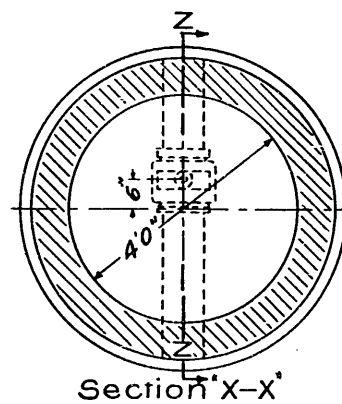
The price paid per pound shall cover the cost of all machine work required and there shall be no additional compensation either per pound additional or otherwise for such work.

7-23 BLOCKING

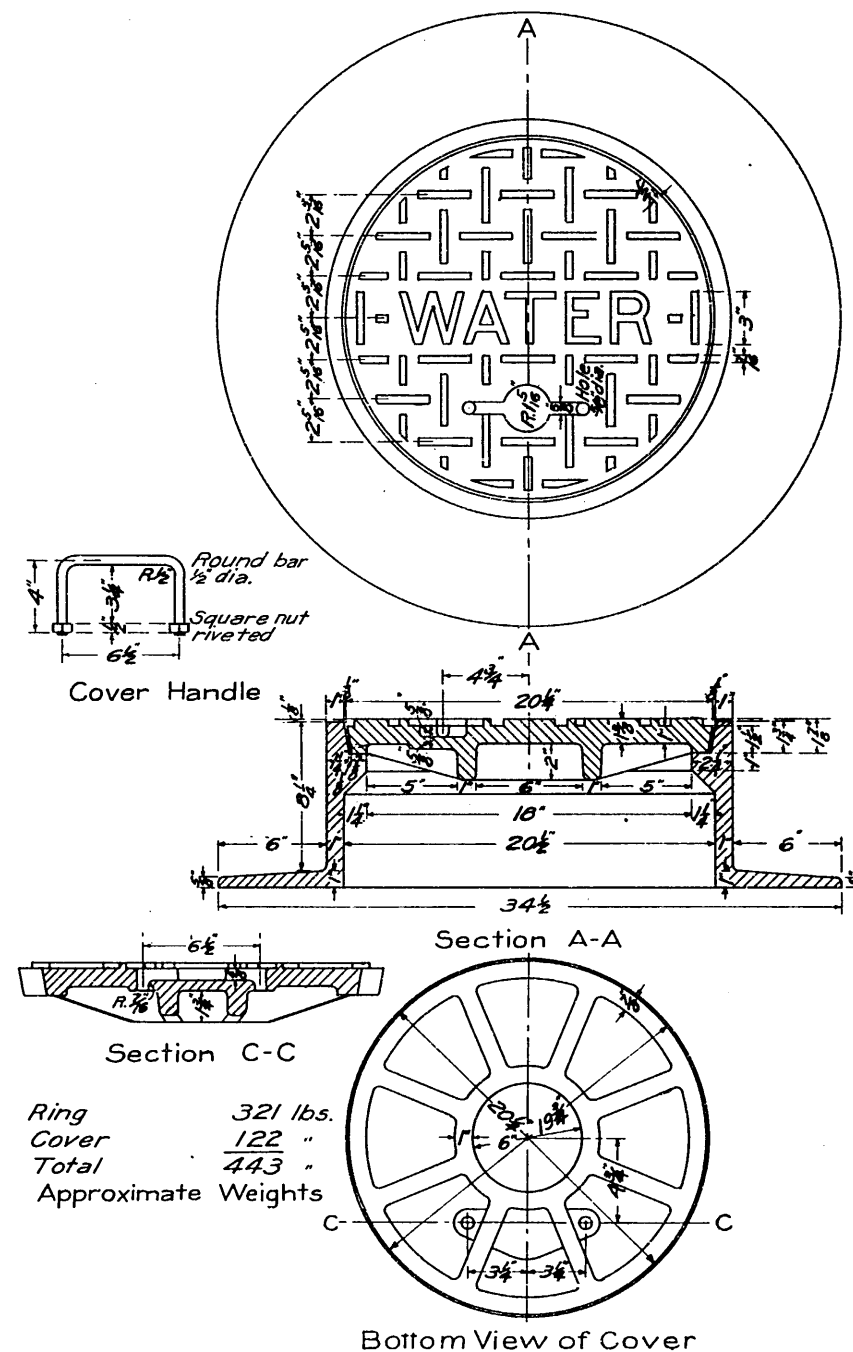
Plugs at the end of lines left for future extension, horizontal or vertical bends, and other places as ordered by the City Engineer, shall be blocked with concrete or creosoted wood, as directed. Blocking shall extend to a solid bearing against undisturbed ground. Payment shall be made at the price bid for "Concrete Blocking," per cubic yard, or "Creosoted Wood Blocking," per M. Ft. B. M.



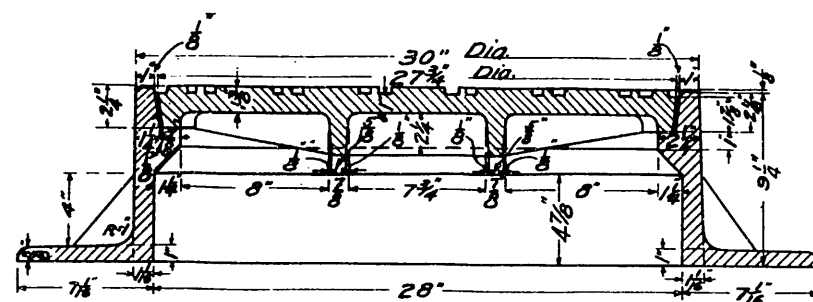
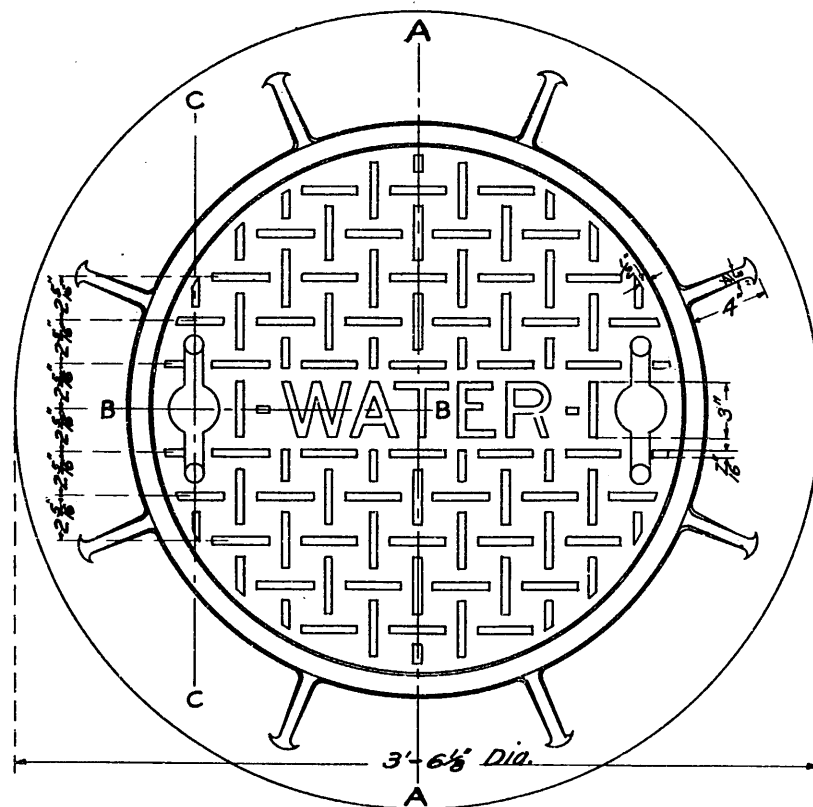
When C=8" A=23 3/4" not less
 " C=10" A=28 1/2" " "
 " C=12" A=31" " "
 " C=8" B=10" " "
 " C=10" B=12" " "
 " C=12" B=12" " "



VALVE CHAMBER

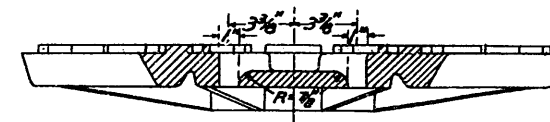


Ring 321 lbs.
 Cover 122 "
 Total 443 "
 Approximate Weights

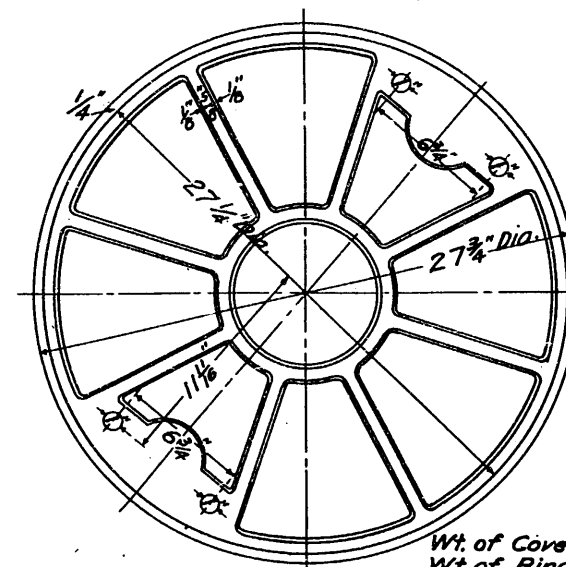


Section A-A

VALVE CHAMBER

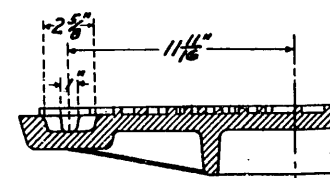


Section C-C

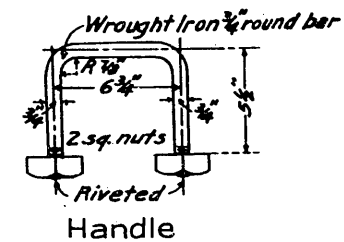


Bottom View

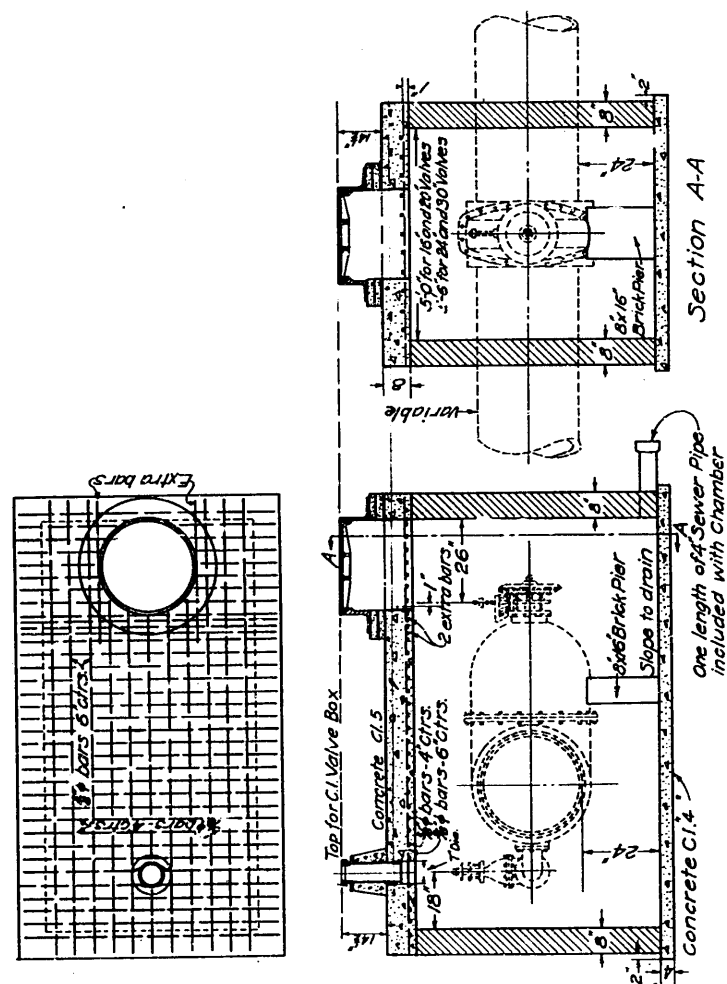
Wt. of Cover...21.7 lbs
Wt. of Ring...440 "
Total...657 "



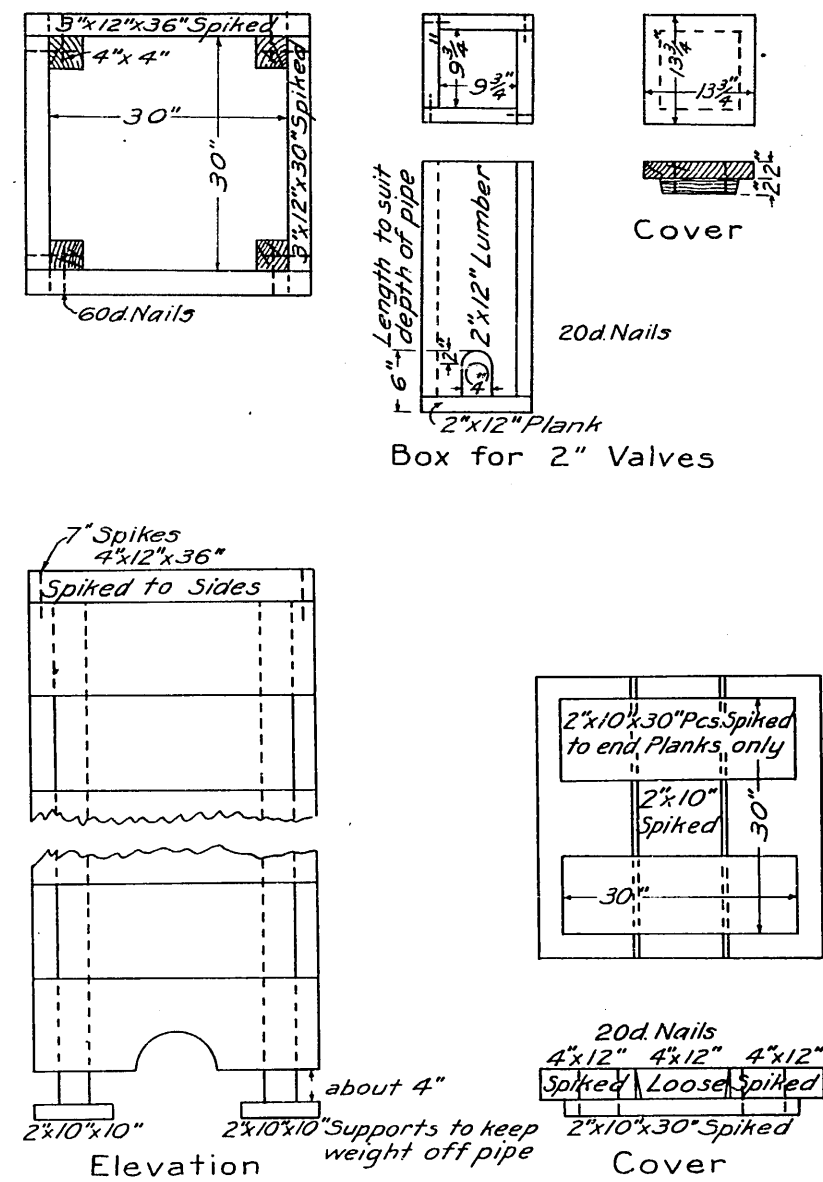
Section B-B



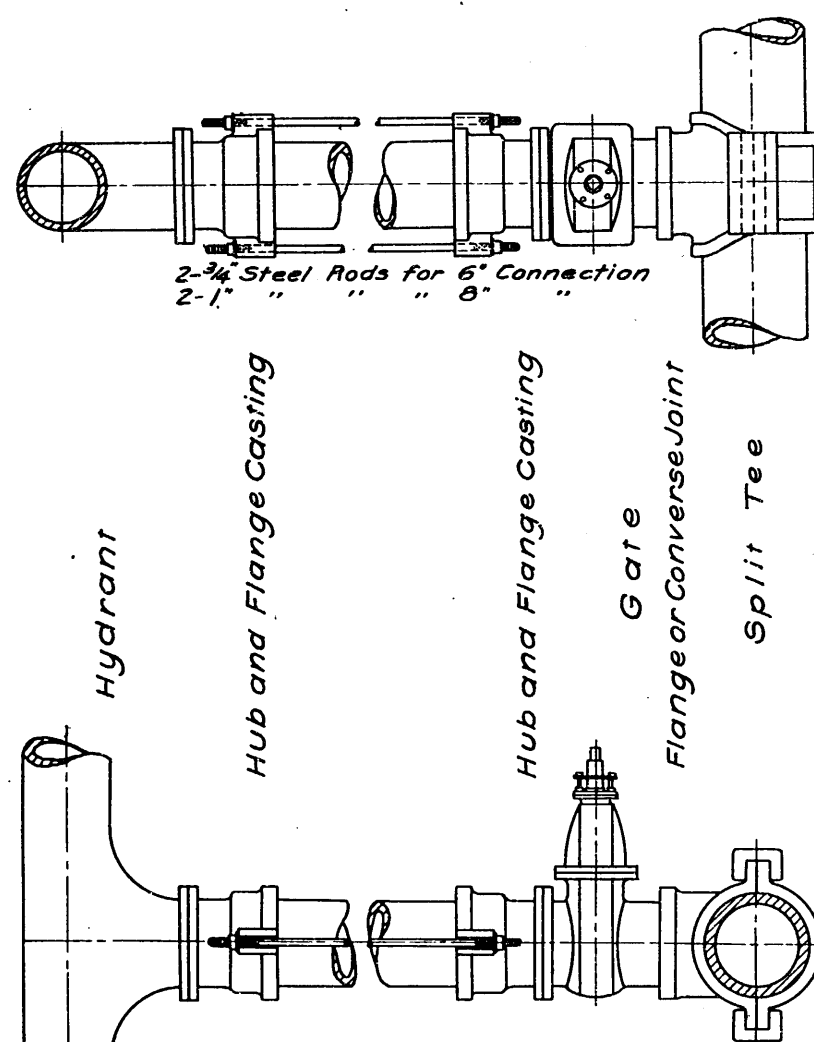
COVER (LARGE)



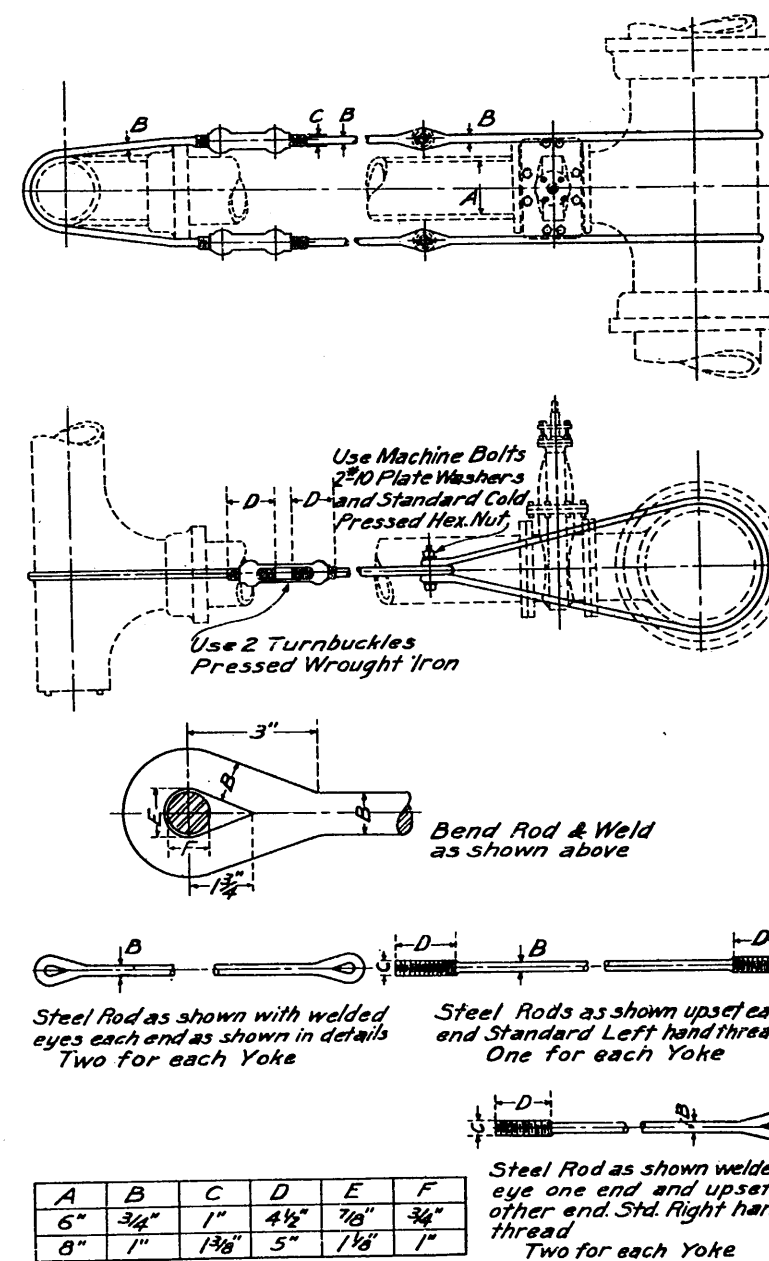
LARGE VALVE CHAMBER



WOOD VALVE BOX

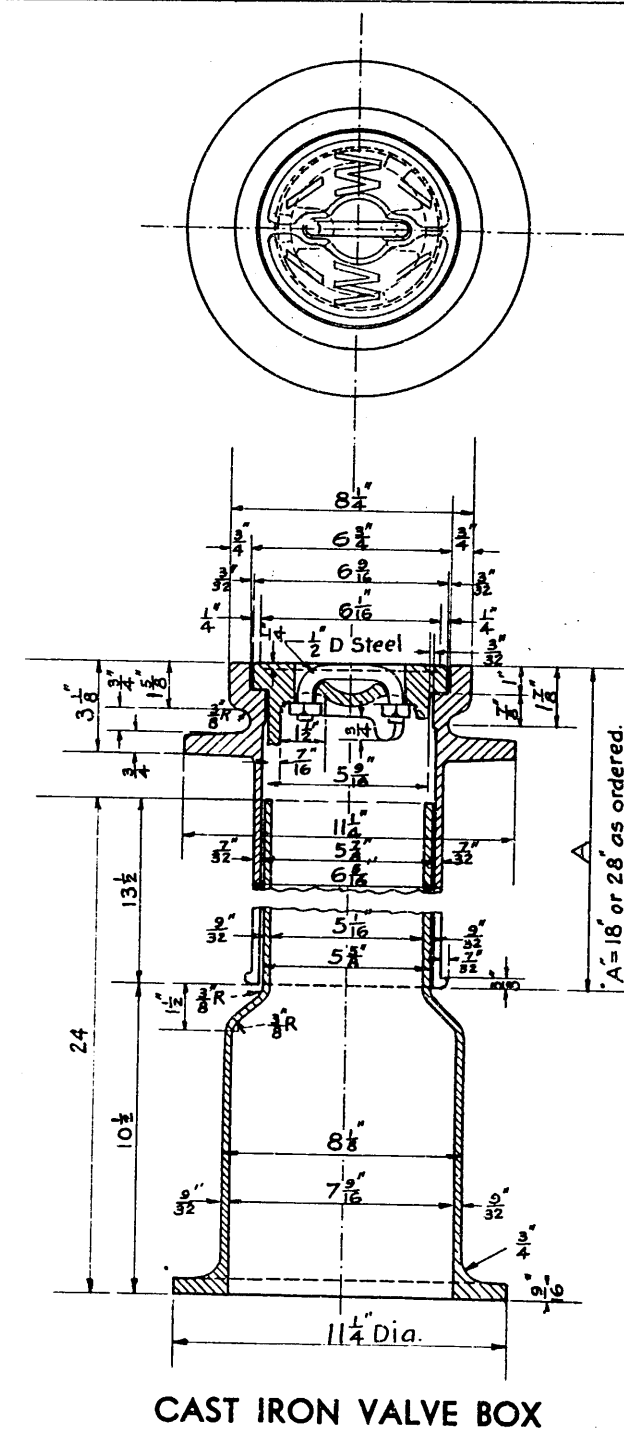
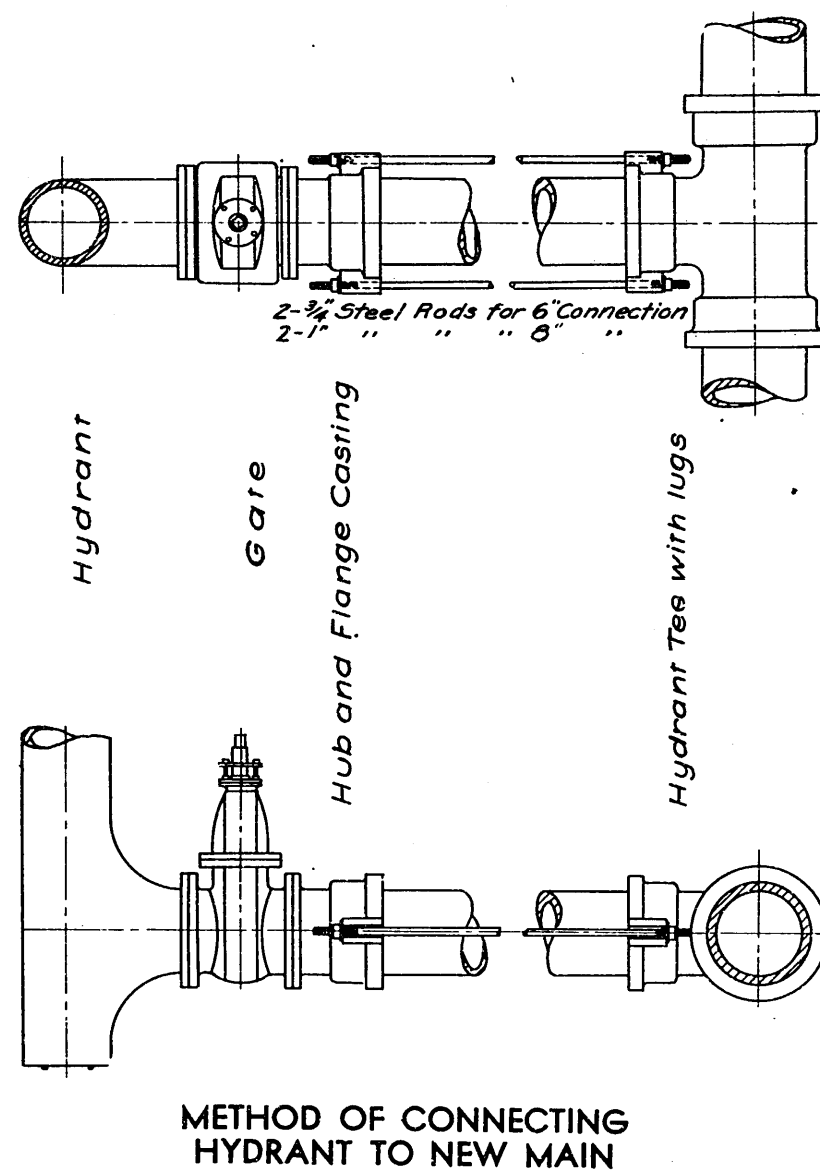


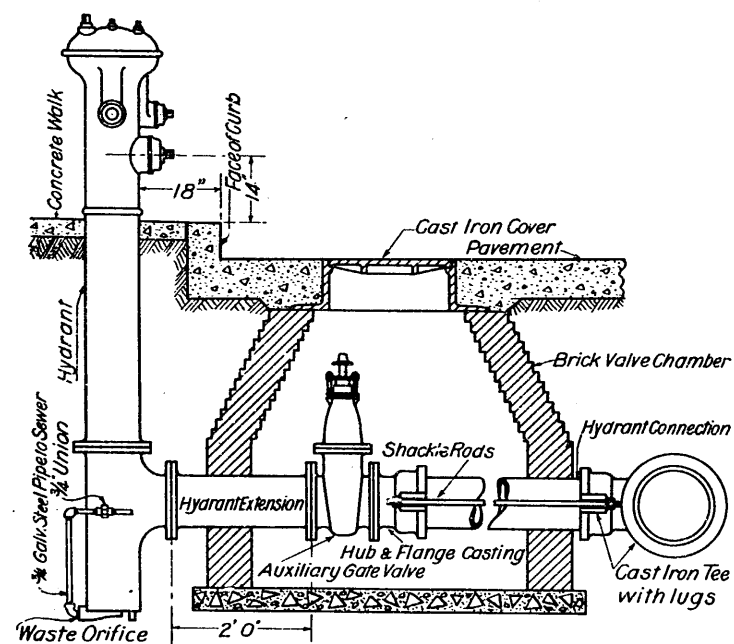
METHOD OF CONNECTING HYDRANT TO EXISTING MAIN USING SPLIT TEE



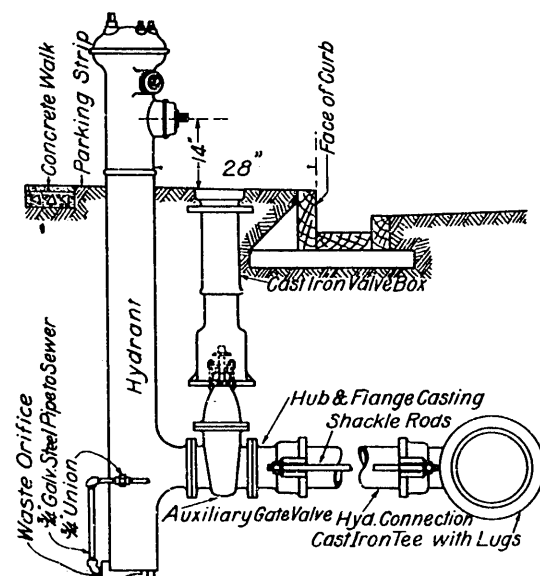
A	B	C	D	E	F
6"	3/4"	1"	4 1/2"	7/8"	3/4"
8"	1"	1 3/8"	5"	1 1/8"	1"

METHOD OF CONNECTING HYDRANT TO EXISTING MAIN WITH FLANGED OUTLET TEE

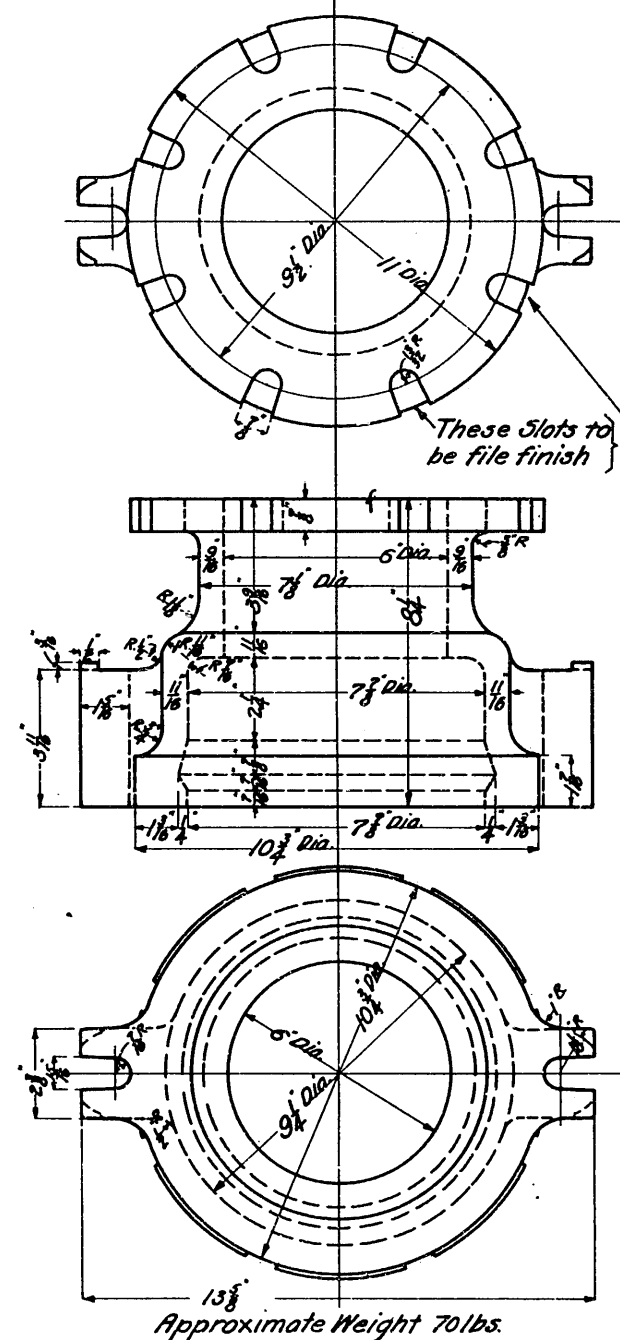




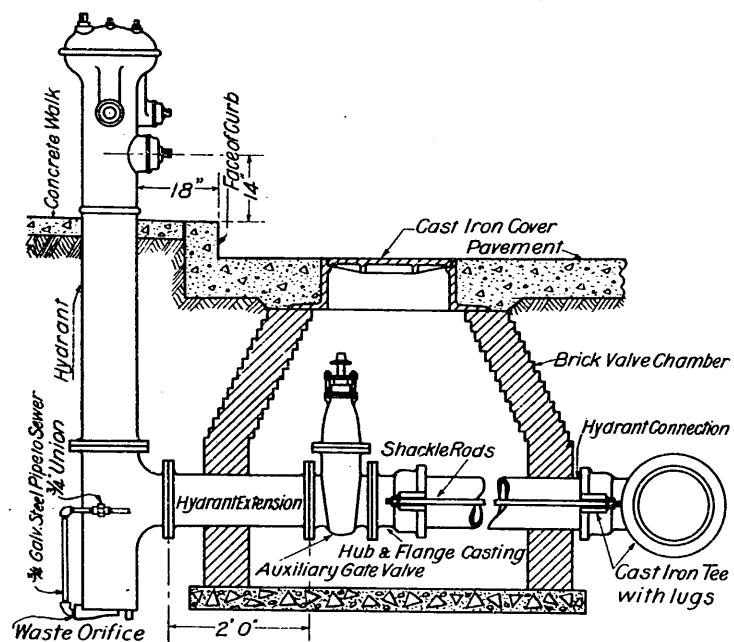
METHOD OF SETTING HYDRANTS
BUSINESS DISTRICT



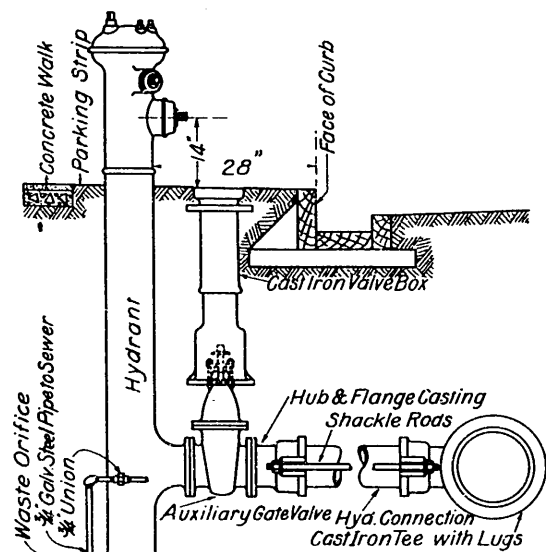
METHOD OF SETTING HYDRANTS
RESIDENCE DISTRICT



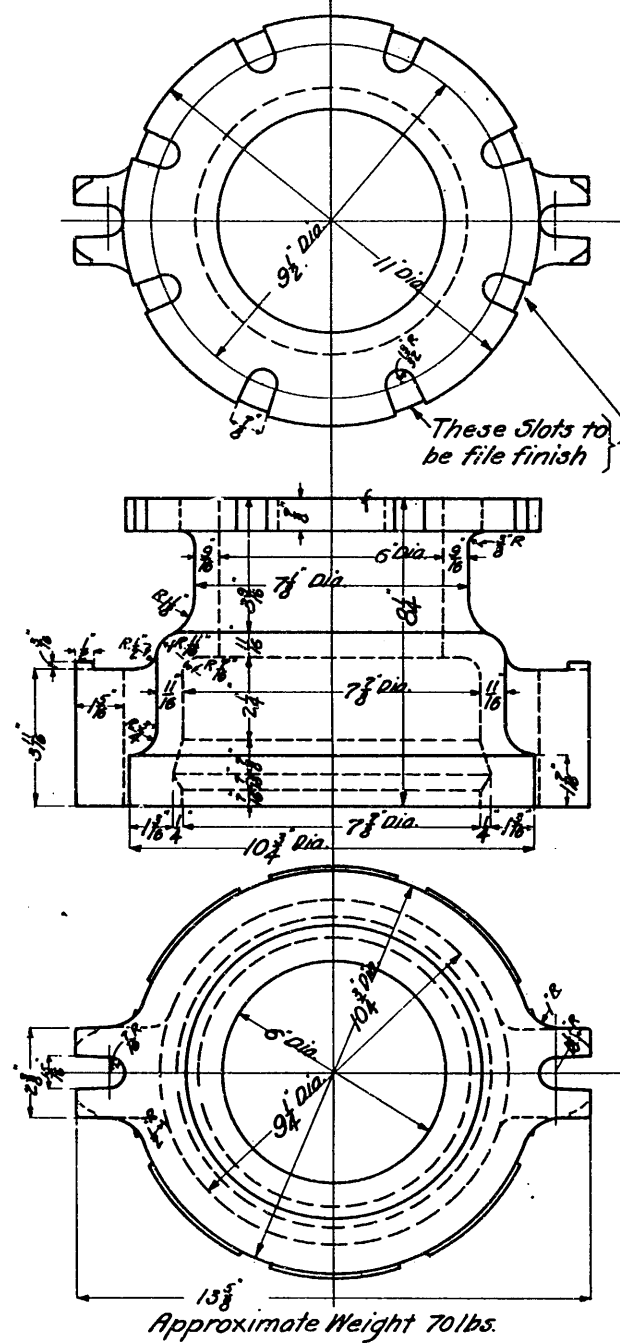
6" HUB AND FLANGE CASTING



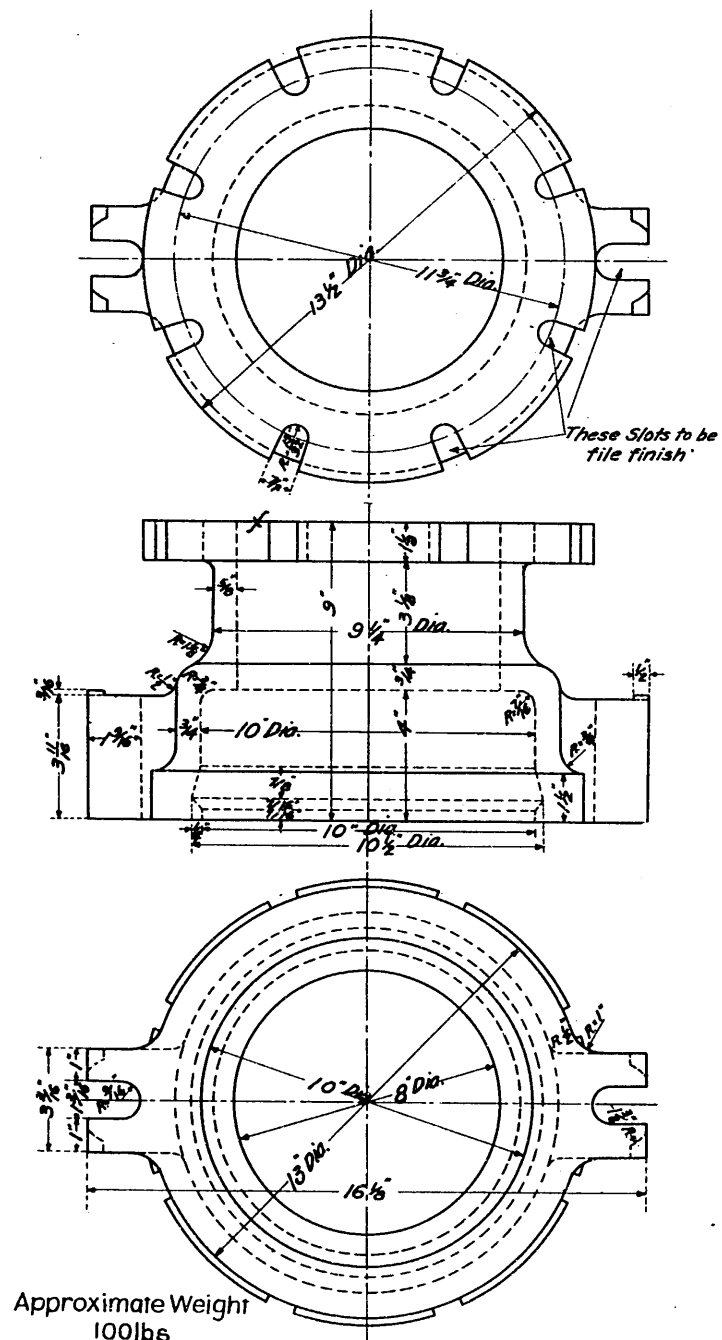
METHOD OF SETTING HYDRANTS BUSINESS DISTRICT



METHOD OF SETTING HYDRANTS RESIDENCE DISTRICT



6" HUB AND FLANGE CASTING



Approximate Weight
100lbs

8" HUB AND FLANGE CASTING

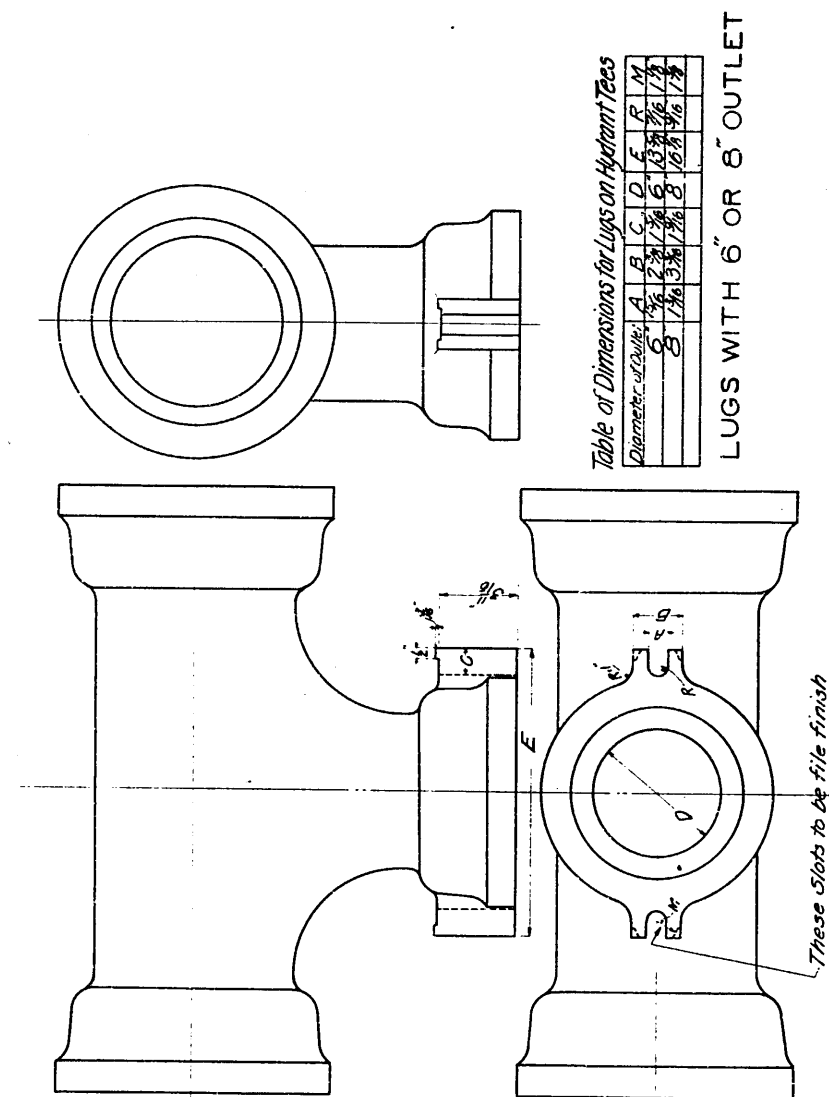
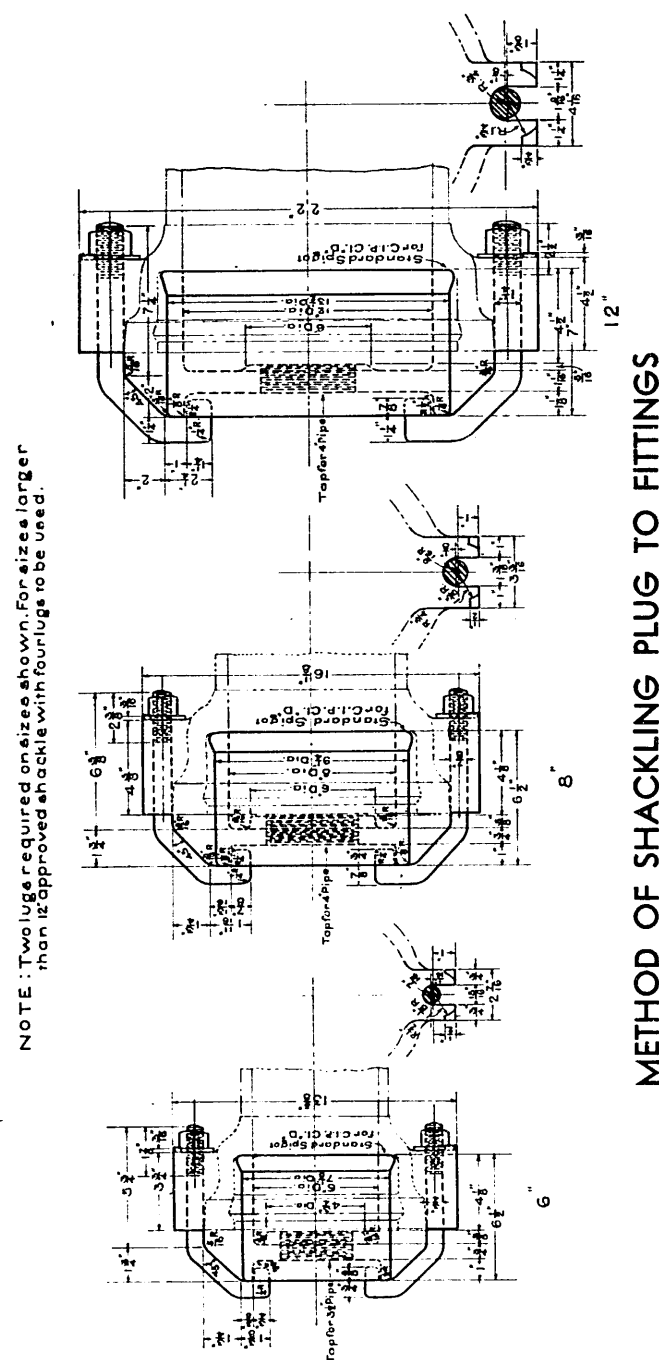


Table of Dimensions for Lugs on Hydrant Tees

Diameter of Lugs	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
6"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
8"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"

LUGS WITH 6" OR 8" OUTLET

HYDRANT TEE



SECTION 8

SPECIFICATIONS FOR PAVEMENTS AND APPURTENANCES

8-1 CLEARING AND GRUBBING

Clearing shall be done as specified under "Grading," and all stumps, crosswalks, old curbs and gutters, planking, trees, existing pavement, walks or any other obstruction shall be removed. Whenever any pavement adjoins or abuts against any wood or concrete header, stop, or side stop, the same shall be removed and the cost of such removal shall be included in the price bid for clearing.

8-2 SUBGRADING FOR PAVEMENT

After the surface of the street has been cleared and grubbed as specified above, all lumber, drains, dead pipes or similar material not suitable for the foundation found more than one (1) foot below the subgrade of the street, shall be removed by the contractor by trenching or otherwise, as directed by the City Engineer, and shall be paid for as "Extra Excavation" under the terms of Section 3-5. Such material found within one (1) foot of the subgrade shall be removed by the contractor as part of the clearing.

The City Engineer shall be the sole judge as to what shall constitute unsuitable or improper materials to remain in the subfoundation, and in order to ascertain the presence of unsuitable materials he shall cause holes or trenches to be dug, of such dimensions and lengths and in such directions and to such depths as he deems necessary. If sinking spots develop, the City Engineer shall require the same to be excavated to sufficient depth to investigate and determine the cause of such sinking and the necessary remedy thereof. Such remedy as he may require shall be used. Such excavation, unless otherwise ordered, shall be refilled with suitable earth or material, the refill to be made in layers and thoroughly tamped or water settled. The amount of earth so removed shall be paid for at the rate bid for subgrading, and if the material required is available from waste material within this improvement district, no allowance shall be made for refill. If suitable material cannot be obtained from the streets in this improvement district, payment for refill shall be made at a

price per cubic yard agreed upon by the contractor and the City Engineer.

No other payments whatsoever shall be made on the above work.

Unless otherwise specified, all embankments exceeding one (1) foot in height shall be sluiced into place in such a manner that all earth shall have been moved into its place of final deposit by water.

When so specified, embankments shall be built up by rolling, which operation shall consist of spreading the earth in layers not exceeding six (6) inches in thickness, by means of a sheep's foot roller, with spreading scraper attachment, and rolling each layer with a ten-ton road roller. Both the sheep's foot roller and the road roller shall pass over each layer not less than four times. Where necessary, each layer shall be sprinkled with water to secure the proper amount of moisture. Rolling of embankment slopes shall be started by excavating a horizontal bench, wide enough to accommodate the rolling equipment, at the toe of the slope and building up from this point in substantially horizontal layers.

All waste material removed during subgrading operations shall be disposed of as specified for Grading, Section 3-3, except that when earth is placed upon private property by application, and the quantity required is less than one hundred (100) cubic yards, the owner of such property shall provide a means of crossing walks or other improvements. The contractor shall furnish all material for embankment not found within the district covered by this contract. Embankment slopes shall be dressed to a uniform line and shall have such inclinations as are shown on the plans, or as the City Engineer may direct.

—2.01 FORMS

The side forms shall be of steel or of surfaced lumber not less than 4-inch stock width and of a depth equal to or greater than the thickness of the pavement, provided, that where the thickness of the pavement requires form lumber to exceed eight (8) inches in depth, lumber 3-inch stock width and of a depth equal to the full depth of the pavement may be used.

Forms shall rest on blocks two (2) inches thick, having a minimum bearing on solid ground of 6"x8" and spaced not to exceed four (4) feet center to center, unless otherwise permitted

by the City Engineer. Blocks two (2) inches thick and having a minimum bearing of 6"x16" shall be placed to form a common support for the ends of adjacent forms. Plocking shall not project within the inside face of the forms. Wedges shall be used where necessary between the top of the blocks and the under side of the forms.

When the pavement is to be compacted or finished by machine methods, the forms shall rest on concrete blocking, poured in place, and properly compacted, and the unsupported span between blocking shall not exceed three (3) feet. When wood forms are used, a scab three (3) inches thick, two (2) feet long, and of a depth equal to the depth of the form shall be nailed to the outside of the forms spanning each junction, using 5 40-penny common nails in each end of each side form. Concrete blocking shall be poured in place at least twenty-four hours in advance of paving operations.

Forms shall be held in true alignment by stakes driven into the ground along the inside and outside edge of the forms at intervals of not to exceed five (5) feet. The forms shall be nailed firmly to the side stakes. The inside stakes shall be removed after concrete has been deposited against the side forms and not before.

Forms shall be held rigidly to true line and grade and the upper edges shall conform to the grades set by the City Engineer. If the methods of support detailed above are not sufficient to accomplish this result, additional means shall be used as directed by the City Engineer.

The forms shall not be removed until the following day, provided the concrete is sufficiently set to withstand their removal without danger of chipping or spalling. All forms shall be removed at the end of the curing period. When forms are removed before the expiration of the curing period, the edges of the pavement shall be protected with moist earth or other approved curing method.

—2.02 SCARIFYING AND ROLLING SUBGRADE

Rolling shall be done after the forms have been placed and while the fine grading is being done and immediately thereafter. Just before rolling, the subgrade shall be thoroughly scarified to a uniform depth of two and one-half (2½) inches below the final elevation of the subgrade surface. Subgrade shall be thoroughly

wetted the day before rolling. Contractor may, at his option, use a five (5) ton, three-wheeled gas roller, having a minimum pressure of two hundred forty (240) pounds to the inch of tread on the back wheels, or he may use a steam roller having the same or greater pressure per inch of tread. Rolling shall be continued until the subgrade has been brought to the correct elevation, which shall be determined by dragging the subgrade with a template resting on the side forms. Any low spots indicated by dragging with the template shall be filled and rolled until brought to correct elevation. Any soft or muddy spots due to rains, or the water settling of ditches or other excavations, which develop during rolling, or at any time before placing pavement, shall be shoveled out, refilled with suitable material, and rolled as specified, at the contractor's expense. Rolling shall be done as close to the side or curb forms as practicable.

Intersections shall be fine graded after all material has been hauled through them, and rolled as specified above. Where necessary the Engineer will set temporary subgrade stakes to serve as a guide during fine grading of intersections just prior to rolling.

Any portion of the surface of the subgrade which may be inaccessible to the roller shall be thoroughly tamped with a rammer ten (10) inches in diameter, weighing not less than forty (40) pounds.

After the rolling has been completed as herein specified, the contractor shall, in the presence of the City Engineer or his representative, check the subgrade by means of a template resting on the side forms. During the hauling of material, should ruts develop, they shall be filled with suitable material and re-rolled.

In order to comply with these specifications, the contractor shall have upon the work, and shall continually use, at all times while fine subgrading is being done, or while material is being hauled in, a roller conforming to these specifications.

All excavation for side sewers, catch basins, or any other excavation whatsoever which exceeds two (2) feet in depth below the subgrade shall be completed, backfilled, water settled and rolled at least five (5) days before placing pavement.

All minor excavations such as are necessary for the adjustment of castings and which do not exceed two (2) feet in depth

below the subgrade shall be completed, backfilled, and hand-tamped not less than twenty-four (24) hours before placing concrete. All castings except monument cases shall be set or adjusted to grade at least twenty-four (24) hours before placing concrete.

Care shall be taken while subgrading is being done that earth does not get into manholes, and all manholes shall be cleaned within twenty-four (24) hours after the adjacent earth in the subgrade has been removed.

About twelve (12) hours before the concrete is placed, unless otherwise directed by the City Engineer, the subgrade shall be thoroughly saturated, and again wetted just before placing the concrete.

Immediately preceding the placing of concrete pavement or concrete base the subgrade shall be dragged with a heavy iron shod template, operated by means of a power attachment on the mixer, and so constructed that the ends of the same ride on the side forms, the template remaining normal to the roadway during operation, and the cutting edge being made of a three by three (3x3) inch angle iron with a vertical leg flush with the forward face of the template. Special attention is called to the fact that no earth shall be placed on the subgrade after it has been rolled. In the event that the contractor considers the subgrade low, the drag shall be carried back, sand shoveled in, and the subgrade re-dragged. This sand shall be furnished by contractor at his own cost and expense. In no case, because of low or sandy subgrade, or for any reason whatsoever, will he be allowed to vary the ratio of cement to aggregate, or to raise the subgrade template. During the subgrading of any street, the contractor shall locate and reference with stakes or painted marks on the concrete walks all drains leading to the curb. When the curb is constructed all such drains shall be connected to two (2) inch galvanized sheet metal weep holes through the curb. The drain connection to the weep holes will be paid for at the price bid for "Sidewalk Drain."

—2.03 PAYMENT

Payment for subgrading for pavement shall be made at the price bid per cubic yard for "Subgrading," and shall include payment for spreading, tamping, rolling and sluicing.

—2.04 APPROACHES

Wherever this improvement joins an existing unpaved street, the contractor shall make such approach excavations as are nec-

essary or as are ordered by the City Engineer, and such excavations will be paid for at the price bid for "Subgrading."

8-3 CONCRETE PAVEMENT

—3.01 CONCRETE

Unless otherwise specified or shown on the plan, Concrete Pavement shall be constructed of Class "5" concrete.

—3.02 PLACING CONCRETE

The concrete shall be placed upon the subgrade prepared as specified under "Subgrading," by means of a bottom-dumping bucket, dump truck, or other device approved by the City Engineer.

In the event that premix concrete is used to construct the pavement, a heavy iron shod template similar to that used behind a concrete mixer shall be provided. The concrete shall be deposited on the far side of the template, which shall be dragged ahead as the concrete is placed to remove any irregularities in the subgrade.

Prior to the placing of concrete pavement around manholes, catch basins, gate chambers, etc., a temporary cover fitting below the rim of the ring casting shall be provided to prevent concrete from falling or flowing into the same.

Concrete shall be spread evenly with shovels and spaded along the forms with a perforated spade, after which it shall be struck off and thoroughly tamped with a steel shod tamping rod three (3) inches wide. Such rod shall be cut to the exact crown of the roadway, fitted with handles at each end, and of such a depth or trussed in such a manner as to be rigid.

After thoroughly tamping the concrete, as specified above, it shall be rolled with a light studded roller ten (10) inches in diameter and five (5) feet long, weighing approximately seventy-five (75) pounds. The roller shall be worked across the pavement as directed by the City Engineer. The rolling shall be continued until mortar has been worked to the entire surface of the panel. When operating studded roller, care shall be taken to prevent dishing of concrete surface at pause of stroke.

After striking off with the steel shod tamping rod and rolling, a shaping rod of similar construction to the tamping rod, two and one-half (2½) inches thick, shall be worked forward and across the width of the roadway with a sawing motion, keeping a small amount of mortar ahead of it at all times.

Such mortar shall extend substantially along the entire length of the rod.

Unless otherwise directed by the City Engineer, this operation shall lag behind the heavy tamping rod at least twenty (20) feet.

The pavement shall then be floated transversely with a rigid panel float not less than sixteen (16) feet long. Such float shall be constructed from a 2"x6" steel shod plank stiffened with a 2"x8" plank fastened perpendicular to the back of the float plank, running lengthwise along the center, and fitted with plow handles. If necessary, this float shall be trussed in a manner that will keep its face in a true plane.

The panel float shall be applied to the surface of the concrete with its length parallel to the center line of the street and shall be operated transversely with a combined longitudinal and transverse motion, planing off the high places and filling in the depressions. The operation shall be repeated until the steel face of the float makes contact with the pavement surface throughout its entire length. The float shall then be advanced not more than one-half its length and the operation continued.

Unless otherwise directed by the City Engineer, this operation shall lag behind the shaping rod a distance of at least twenty (20) feet.

Transverse dummy joints shall be placed in the surface of the pavement, immediately following the floating operations.

Longitudinal dummy joints shall not be placed until a clear run of forty-five (45) feet can be placed in a continuous line.

After the concrete has set sufficiently the joints shall be adjusted to the surface of the pavement and edged with an edger having a three-eighths (¾) inch radius.

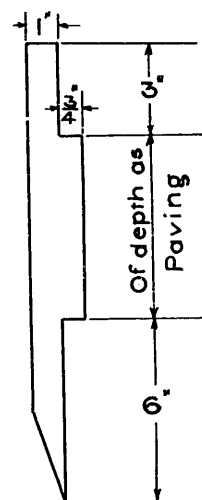
After the dummy joints have been placed and edged, and when directed by the City Engineer, the longitudinal float shall again be applied as above specified.

The finished surface of the pavement, except on vertical curves and intersections, shall not vary more than three-sixteenths (⅜) inch from the lower edge of a ten (10) foot straight edge when laid on the surface of the roadway parallel to the center line. The City Engineer shall make such determination before the initial set of the concrete has taken place. The contractor shall refinish, at his

own expense, any such portions which fail to meet the requirements specified.

For intersections, vertical curves, and other warped surfaces, where it is impracticable to use the tamping and shaping rods, the contractor shall furnish intersection grade stakes, as shown. Such stakes may be made of wood or iron and shall be driven down

INTERSECTION GRADE STAKE



until the bottom of the projecting block rests upon the Engineer's subgrade stake, and kept in place until the concrete has been placed and floated to the next stake. Floats of two by twelve (2x12) inch plank, two (2) feet long, and fitted with handles, shall be used in lieu of the tamping and shaping rods in all intersections.

Through joints and sides of the longitudinal centerline joint shall be edged with an edger having a three-eighths ($\frac{3}{8}$) inch radius. Such joints shall be re-edged as a final operation after the concrete has become stiff enough to hold the full radius specified and leave a clean, polished margin.

All vertical curves and all intersections, insofar as it is practicable and where directed by the City Engineer, shall be floated and finished as above specified, substituting a flexible one by six (1x6) inch board for the stiffened one.

The various stages of finishing shall be performed at such intervals that the finishing operation as a whole shall be delayed as much as possible and yet obtain a tightly sealed surface.

The final brushing shall be done at such time and manner as designated by the City Engineer.

The contractor shall furnish sufficient skilled men to operate the above specified tools in an efficient manner and at a speed sufficient to keep pace with the mixer, or he shall limit the mixer output to the amount which can be properly finished by the men furnished. Four men shall at all times be used to operate the tamping and shaping rods.

—3.03 MACHINE FINISHING

In lieu of hand finishing, as above specified, the contractor may use a mechanical finishing machine, provided that the results obtained are equal in all respects to the results obtained by hand finishing, and provided further the contractor shall equip himself with all of the tools specified herein for hand finishing and have them available on the work.

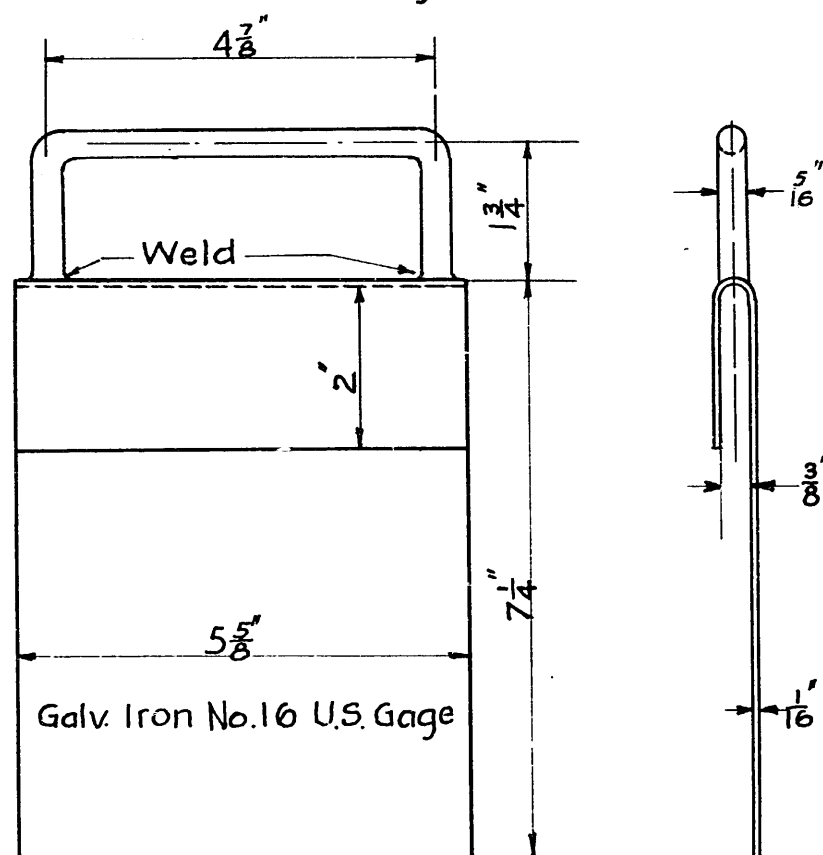
—3.04 EXPANSION JOINTS

A Through Expansion Joints

A three-eighths ($\frac{3}{8}$) inch through transverse expansion joint shall be placed against existing pavements, and shall be the nominal depth of the existing pavement. Three-quarter ($\frac{3}{4}$) inch through transverse expansion joints shall be placed at all street margins except where the new pavements adjoin existing pavement. Such joints shall be three (3) inches greater in depth than the nominal thickness of the pavement. Three-quarter ($\frac{3}{4}$) inch through joints shall also be placed in the center of blocks exceeding four hundred (400) feet in length.

The premoulded expansion joint filler material shall be of the thickness specified. It shall be held firmly by approved holders and set into the subgrade so that the top of the filler is submerged three-quarters ($\frac{3}{4}$) of an inch below the surface of the finished pavement. All through joints not placed in one piece shall be securely stapled together by means of clinched staples. The joint filler shall be temporarily capped with $\frac{3}{4}$ "x $\frac{3}{4}$ "-wood strips having a minimum length of six (6) feet. These strips shall be securely fastened to the filler by nailing or tying, and shall be re-

EXPANSION JOINT HOLDER For Integral Curb

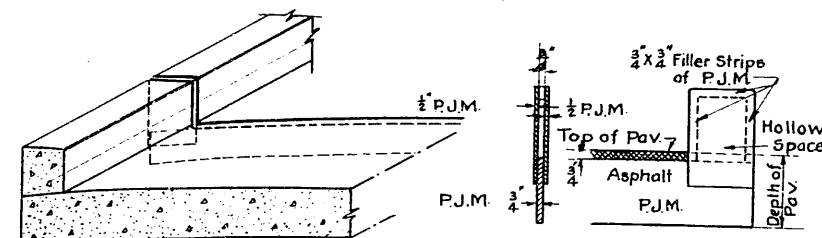


moved when the tamping and floating operations are finished. The resulting void prior to curing, shall be filled with a homogeneous mixture composed of eighty (80) per cent Paving Grade Asphalt and a twenty (20) per cent Portland Cement, proportioned by weight.

Where curbs are constructed integrally with the pavement, the "Through Expansion Joint" shall be extended through the curb by means of built up sections of Expansion Joint material, fabricated as shown in the following sketch.

Extreme care shall be used to hold the joint exactly normal to the pavement surface while pouring concrete. After the removal of the forms, the joint material shall be exposed for the full height of the curb face.

CURB JOINT



Whenever a street or alley pavement adjoins or abuts against an existing approach, masonry wall, or building a through expansion joint one-quarter ($\frac{1}{4}$) inch thick shall be placed between the pavement and such structure.

Whenever a pavement adjoins an existing pavement or an existing concrete curb and gutter, a one-quarter ($\frac{1}{4}$) inch dummy joint as hereinafter specified shall be placed between the new pavement and such existing structure.

At the end of each day's run a wooden header conforming to the width and proper crown of the roadway and four (4) inches thick shall be used as a guide to obtain the proper crown to the pavement, and left in place until paving is resumed.

Construction joints shall be constructed with thickened edges, as herein detailed for "Through Expansion Joints."

B Dummy Joints

A longitudinal dummy joint shall be placed on the center line of all paved roadways, or sections of roadways, placed in one operation, which are eighteen (18) feet or more in width. Transverse dummy joints shall be placed to divide the distance between through joints into approximately fifteen (15) foot panels. Dummy Joints in intersections or other irregular areas shall be placed as directed by the City Engineer. The areas of the panels thus formed shall not exceed two hundred (200) square feet, with greatest dimension not to exceed fifteen (15) feet.

Material for dummy joints shall be Carey's "Elastite," or equal. Longitudinal joints shall be one-quarter ($\frac{1}{4}$) inch thick and approximately one-third ($\frac{1}{3}$) the depth of the concrete pavement in which they are to be used. Transverse dummy joints shall be of the same depth but only one-eighth ($\frac{1}{8}$) inch thick.

Dummy joint material shall be sufficiently submerged below the surface of the pavement to allow finishing operations to be car-

ried on over the joint as if it were not there. Just prior to final finishing operations the dummy joint material shall be raised to the finished surface of the pavement and floated smooth with the surface and edged to a three-eighth ($\frac{3}{8}$) inch radius.

Dummy joints shall be extended through the upper portion of integral curb by placing alongside the one-eighth ($\frac{1}{8}$) inch strip a piece of one-quarter ($\frac{1}{4}$) inch Carey's "Elastite," or equal, expansion joint material, cut to the proper section. This material shall be held in place in the forms by means of a sheet metal holder, as herein detailed.

Extreme care shall be used to hold the joint exactly normal to the pavement surface and after the removal of the forms the joint material shall be exposed for the full height of the curb face.

C Payment

No separate payment will be made for "Through Expansion Joints" or "Dummy Joints." Payment for the cost thereof shall be included in the price bid for "Concrete Pavement." Extra depth of pavement will be paid for as "Extra Concrete Under Pavement."

—3.05 CURING

When directed by the City Engineer, the contractor shall use a nozzle which will throw a fog-like spray of water to keep the pavement moist.

The pavement edges and backs of curbs shall be banked to the top with earth the day following construction, and care shall be exercised during the curing period to prevent water from collecting along the back of the curbs or outside edge of the pavement. When the pavement adjoins or is near any building, as in the case of alley pavements, the contractor shall protect such buildings from damage by means of canvas, waterproof paper or other suitable material.

A Curing With Water

At the contractor's option, one of the following methods of curing shall be installed the day following the construction of the pavement:

(1) *Sprinklers*: A system of continuous sprinklers shall be installed which shall be designed to keep the entire paved surface constantly wet. Sprinkling heads shall be "Babcock" or equal and shall be operated day and night, without interruption, for the entire curing period. An automatic or intermittent sprinkling device may be used if of a type approved by the City Engineer.

(2) *Ponding*: The contractor shall construct a system of earth dams across and along the edges of the pavement in such a manner as to permit flooding the entire pavement. Such system shall be flooded and maintained for the full curing period.

(3) *Irrigation System*: The contractor shall construct channels of straw or other suitable material, held in place with earth, in such a manner that a continuous flow of water shall keep the pavement constantly wet. Such a system shall be maintained for the full curing period.

B. Curing Membrane

When permitted by the special specifications, or when directed, the concrete pavement shall be cured by means of an impervious membrane applied under pressure with a spray gun, in such manner as to cover the entire area of the concrete with a uniform film. This shall be applied to the fresh concrete as soon as the surface is finished.

The sealing compound shall be transparent blend of oils and waxes, held in suspension or solution in a volatile solvent. Not more than seventy-five (75) per cent by weight shall be volatile, and not more than two hundred (200) square feet shall be covered per gallon. When first applied the covering shall be colored, and the color shall fade out in about three days, leaving the concrete its natural color. The sealing compound shall adhere to the concrete to form an impervious membrane, and shall set to touch in two to four hours, under normal conditions. It shall not be applied at temperatures below forty-five degrees (45°) F.

Concrete areas cured by the membrane method shall be barricaded against all vehicular or pedestrian traffic for the full curing period. Failure to keep traffic from the area shall be cause for requiring other means of curing.

C Length of Curing Period

Concrete pavement constructed with standard cement shall be cured for a period of five (5) consecutive days following the day it is laid.

Concrete pavement constructed with early strength cement shall be cured for a period of three (3) consecutive days following the day it is laid.

D Opening to Traffic

After the pavement has been properly cured as above speci-

fied, and as soon as the concrete has attained a minimum compressive strength of 2,500 pounds per square inch as determined by the City Engineer from test cylinders, the contractor shall remove all earth dams or curing devices and debris, and shall open the roadway to traffic. However, such opening to traffic shall in no way relieve the contractor of his responsibility to maintain same against all defects or damage of whatever nature until its acceptance by the Board of Public Works.

—3.06 WASHING PAVEMENT

Before the work is reported complete, the pavement shall be washed clean with a fire hose, or street flushing machine, and all manholes, catch basins, flush tanks, valve chambers, etc., thoroughly cleaned.

—3.07 MEASUREMENT OF PAVEMENTS

Paved areas, excepting intersections, shall be measured on the slope and no deduction shall be made for expansion joints, castings or poles around which the pavement is laid. Intersections shall be measured on a horizontal plane.

—3.08 PAYMENT

Payment for "Concrete Pavement" shall be made at the price bid therefor per square yard and shall be in full for all labor, materials and equipment necessary to furnish and place the concrete pavement complete, including expansion and dummy joints, curing and washing. Pavement appurtenances shall be paid for as hereinafter provided.

8-4 RESURFACING

The following specifications apply particularly to resurfacing improvements involving a change in grade to allow for additional thickness of surfacing, or involving removal of surface pavement to allow repaving, without changing grade, or a combination of both.

—4.01 MAINTAINING TRAFFIC

In addition to the requirements of Sections 1-34 and 1-35 and unless otherwise permitted by the City Engineer, the contractor shall accomplish the improvement of one-half of each street for the full length of the project and shall wait until said portion is opened to traffic before commencing work on the other half.

Ingress and egress to all driveways leading to places of business shall be maintained at all times.

When necessary, the City Engineer shall furnish signs prohibiting the parking of cars at the curb. Such signs shall be transported, placed and maintained by the contractor and returned to the City Engineer upon completion of the work. The contractor will be billed for signs not returned and for signs damaged.

—4.02 CLEARING

Separate bids shall be taken for the major items of clearing and payment therefor shall be definitely provided. Payment for the cost of any other clearing shall be included in the price bid for the item the construction of which involves clearing.

—4.03 REMOVING EXISTING SURFACING

Within the areas shown on the plan or where directed by the City Engineer, the contractor shall remove and dispose of the existing brick, asphalt, or stone surfacing down to the existing base. Care shall be exercised in removing the surfacing not to injure the concrete base or adjoining pavement.

The removal of the brick, asphalt or stone surfacing shall also include the removal and disposal of all sand cushion, cement mortar, plank patches or any other material down to the existing concrete base.

Payment shall be made at the price bid per square yard for "Removing Existing Surfacing," which shall be payment in full for all labor and equipment necessary to accomplish the work herein specified.

Measurement of areas from which surfacing is removed shall be made on the slope and no deduction shall be made for areas occupied by castings.

—4.04 REMOVING EXISTING PAVEMENT

Within the areas shown on the plan or where directed by the City Engineer, the contractor shall remove and dispose of the entire existing pavement, including the concrete base in the case of asphalt, brick or stone pavement.

Payment shall be made at the price bid per square yard for "Removing Existing Pavement," which shall be payment in full for all labor and equipment necessary to accomplish the work herein specified.

Measurement of areas from which pavement is removed shall be made on the slope and no deductions shall be made for areas occupied by castings.

—4.05 PLACING CONCRETE BASE AROUND ITEMS MOVED, ADJUSTED, RESET OR REBUILT

Whenever a change in alignment or grade on a street to be resurfaced requires the moving or adjusting of any street casting, such as Monument Case, Inlet or Manhole, etc., Cover, or when any other item or structure is to be moved, adjusted, reset or rebuilt, and involves the breaking out of existing pavement and/or existing concrete base, such as may be required when streets are resurfaced, the price bid for the item moved, adjusted, reset or rebuilt shall also include compensation for the cost of replacing concrete base flush with the adjacent base or pavement ready for surfacing. Such concrete base shall be constructed in accordance with these specifications and shall be placed at least twenty-four (24) hours ahead of surfacing operations.

—4.06 CONCRETE PAVEMENT, VARIABLE THICKNESS, ON EXISTING BASE

Where shown on the plans or where directed by the City Engineer, concrete pavement, variable thickness, shall be constructed on the existing base.

Unless otherwise specified or shown on the plan. Concrete Pavement shall be constructed of Class "5" concrete.

Before concrete is deposited on existing base, all debris shall be removed and the surface of the base shall be thoroughly cleaned by washing and sweeping as directed by the City Engineer.

A Forms—False Ribbon

Forms or False Ribbons for concrete placed on existing base shall conform to the general requirements of Section 8-2, except as to method of staking or holding the forms rigidly in place. The forms shall be held in place by any means the contractor may devise, subject to the approval of the City Engineer. If false ribbons are placed in the area to be paved, they shall be so constructed as to allow easy removal after final shaping of the concrete but before finishing operations are completed, and the resulting void shall be filled by hand, and tamped to the proper grade. Concrete blocks or bricks may be used to block the forms in place and may be left in place upon removal of the forms. When the new pavement abuts an existing pavement which is to be resurfaced or retopped, proper method of setting forms shall be used to assure a true alignment and vertical face along the edge of the pavement.

B Concrete and Placing Concrete

Class of concrete and method of placing shall be as hereinbefore specified for "Concrete Pavement," Section 8-3.

C Expansion Joints

(1) *Through Expansion Joints*: Unless otherwise specified on the plans, no Through Expansion Joints will be required in concrete pavement constructed on existing base.

(2) *Dummy Joints*: Dummy Joints shall be furnished and placed as herein specified for Concrete Pavement, except that the interval between transverse joints shall be twelve (12) feet unless otherwise specified or shown on the plan.

D Payment

Due to the irregularities in the thickness of the concrete pavement to be constructed on the existing concrete base, full payment for such pavement will be made in two (2) separate items, as follows.

(1) *Constructing Concrete Pavement*: Payment will be made at the price bid per square yard for "Constructing Concrete Pavement, Variable Thickness, on Existing Base," which price shall be in full for all labor and material, except concrete, necessary to construct the completed concrete pavement, including forms, preparation and cleaning of the existing base, spreading, rodding, expansion joints, surface finishing, and curing. Measurement will be made in accordance with the Standard Plans and Specifications.

(2) *Furnishing Concrete for Pavement*: Payment will be made at the price bid per cubic yard for "Furnishing Concrete, for Variable Thickness Pavement," which price shall be in full for the concrete delivered on the job.

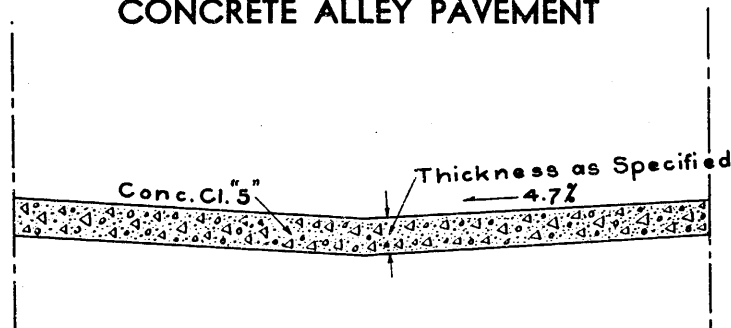
Measurement of the concrete for variable thickness pavement will be made on the basis of the amount of cement used. For the purpose of measurement, the nominal number of sacks of cement, for the class of concrete specified shall be equivalent to one (1) cubic yard of concrete. The City Engineer will measure the amount of cement used at the time the concrete is mixed.

8-5 ALLEY PAVEMENTS (For plan, see page 204)

The construction of Alley Pavements shall be done insofar as practicable as specified for Pavements of like character, except that one rod may be used for tamping and shaping the concrete,

and the concrete roller may be omitted. The rolling of the subgrade shall be done before the forms have been placed. In order to make such rolling effective, the contractor shall, before subgrading the alley, reference all slope stakes upon offset stakes or existing buildings or walls and from these references he shall fine grade the alley just prior to rolling. The rolling shall leave the surface true to elevation as specified for "Pavements." In alleys the subgrade drag may be operated by hand.

CONCRETE ALLEY PAVEMENT



8-6 GRADING PARKING STRIPS

All fill in parking strips shall be of the best available soil selected from the improvement. Before filling, all concrete, gravel, wood and other debris shall be removed.

All parking strips shall be graded on a true plane from the new curb to the existing concrete sidewalk, or where no walk exists, to the property line whenever so ordered by the City Engineer. Parking strips shall be finally cleaned and raked and roadways cleaned up not later than ten (10) days after street is open to traffic.

Payment shall be made for "Grading Parking Strips" at the price bid per linear foot and measurement shall be taken as the length of curb between street margins and no deduction shall be made for alley crossings or private driveways. No payment, however, shall be made for grading parking strips where new concrete sidewalks are constructed as part of this improvement.

8-7 REINFORCING STEEL IN PLACE

Reinforcing Steel shall be one-half ($\frac{1}{2}$) inch round deformed billet steel bars, according to Section 2-32. Steel shall be used to

reinforce pavement around castings, over outlet pipes of inlets, and where needed in pavement, as directed by the City Engineer.

Payment is to include cutting and bending of steel where necessary to length and shape, as directed by the City Engineer, and to be in full for steel in place.

The above specifications do *not* cover steel used in reinforced concrete pavement. Where a bid is called for on "Reinforced Concrete Pavement," such bid shall include the steel in the amount and position as specified by the City Engineer.

8-8 EXTRA CONCRETE UNDER PAVEMENT

Extra concrete under pavement placed according to the detail plan shall be used under the edges of all panels adjoining any longitudinal construction joint between sections of roadways constructed in two or more operations, adjacent to existing pavement or concrete curb and gutter at through joints and cold joints, and where ordered by the City Engineer.

Payment for "Extra Concrete Under Pavement" shall be made at the price bid per cubic yard and shall include the necessary excavation.

8-9 CONCRETE BASE FOR PAVEMENTS

Concrete base for pavement shall be constructed of Class "4" Concrete and shall be of the thickness called for on the plan.

It shall be placed and finished in all respects as specified for alley pavements except that edging will not be required and expansion joints shall be placed as required by the special specifications.

All concrete base for pavements, when not immediately surfaced, shall be cured as specified for concrete pavements.

Measurement and payment for "Concrete Base" of the thickness specified shall be made as herein specified for Concrete Pavement.

8-10 CONCRETE BASE, VARIABLE THICKNESS

Concrete base of variable thickness shall be placed on top of existing base or elsewhere where shown on the plan. Such base shall be constructed as specified for concrete base of uniform thickness.

Measurement shall be as herein specified for "Concrete Pavement, Variable Thickness," except that 4 sacks or 376 pounds of cement shall be equivalent to 1 cubic yard of concrete.

Payment shall be made at the price bid per cubic yard for "Concrete Base, Variable Thickness," which price shall be in full for all labor and material necessary to furnish and place the concrete base, including payment for forms if required, cleaning of existing base, expansion joints, surface finishing and curing.

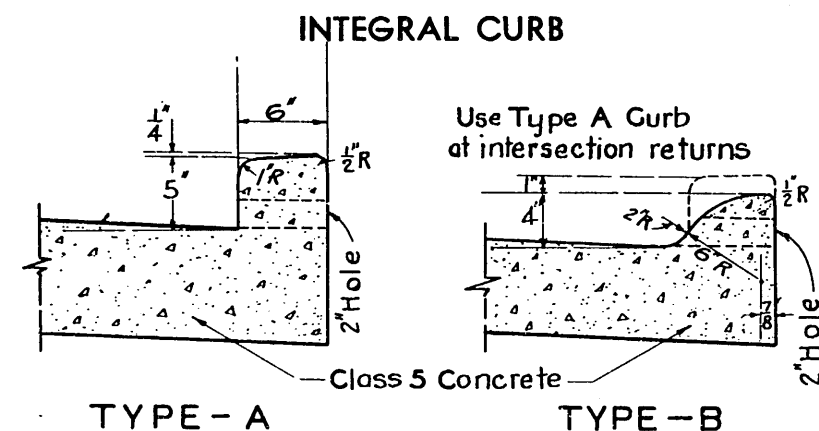
8-11 CONCRETE WEARING SURFACE FOR TRETTLES

Concrete wearing surface for trestles shall be constructed, finished and cured in all respects as specified for concrete pavement. Payment for such wearing surface shall be made at the price bid per square yard for "Concrete Pavement," or "Reinforced Concrete Pavement."

8-12 INTEGRAL CURB

Unless otherwise shown on the plan, all curb shall be constructed integral with concrete pavement. The pavement side forms shall be placed at the back of the curb and at an elevation determined by the intersection of the back lines of the curb and the pavement surface projected.

Immediately following the final floating, the curb forms shall be placed true to line and grade and at once filled with the same grade of concrete as used in the pavement.



The forms shall be of three (3) inch lumber.

The back forms shall be securely toe-nailed to the lower pavement form and in the case of Type "A" Integral Curb, the face form shall be spaced with six (6) inch spreaders and held by means of an iron hook every four (4) feet, or such interval as will insure a straight curb without bulges.

Forms may be reused, provided they have been cleaned of all concrete and are free from splits, warp and other defects likely to impair their usefulness. Forms rejected for the face of the curb may be used for the back if approved by the City Engineer.

Form lumber for curb returns of a radius twenty (20) feet or greater shall be constructed of one (1) inch lumber. Returns of a radius less than twenty feet shall be constructed of one-half (1/2) inch lumber or plywood.

Care shall be taken to spade the curb concrete into that previously placed and against both sides of the curb form.

Two (2) inch weep holes through the curb shall be provided for all existing drains. Where no drains exist, similar weep holes shall be placed through the curb where street is in cut, approximately sixty (60) feet apart.

The contractor shall provide galvanized sheet metal forms for these holes and fit them into the curb forms in a workmanlike manner so as to insure a neat appearance at the face of the curb.

The top of integral curb shall be troweled smooth and finished with a stipple brush.

At street intersections, Type "B" Concrete Curb shall be raised from four (4) inches to five (5) inches in height, as shown on the plan. The higher section shall extend around the return from street margin to street margin projected, the transition being made in the six (6) feet immediately inside the projected street margin.

All through expansion joints in the pavement and all dummy joints shall extend entirely through the curb, as specified under Section 8-3.04B.

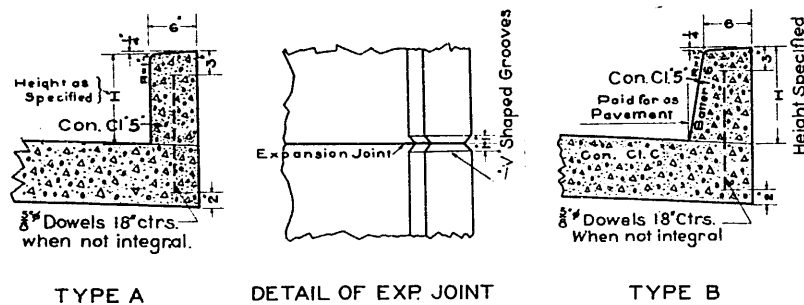
Measurement shall be made along the face of the curb, provided that when the curb is of Type B, measurement shall be made to lines parallel to and six (6) inches from the back line of the curb. Payment shall be made at the price bid per linear foot for "Integral Curb, Type A" or "Type B," and shall be in full for all labor and material necessary to construct the curb according to these specifications.

8-13 HIGH CURB

High curb shall be constructed according to the plan and shall be of the type and face height specified.

It shall be constructed in all respects as to placing of concrete, spading, finishing and placing of expansion joints and weep

HIGH CURB



TYPE A

DETAIL OF EXP. JOINT

TYPE B

holes as specified for integral curb. It shall be constructed either integral with the pavement or after the pavement has been constructed. When the latter method is employed, the contractor shall furnish and set dowels as shown on the plan. When constructed integral with the pavement, forms for curb having a face height exceeding twelve (12) inches shall be set, blocked up, and bolted at four (4) foot intervals prior to placing concrete. When the face height is twelve (12) inches or less the forms may be placed as specified for integral curb. Through and dummy expansion joints shall be placed exactly normal to the pavement and a one (1) inch by one (1) inch triangular fillet nailed to the forms on either side of the joint. After stripping, the expansion joint material shall be cut to the bottom of the groove thus formed.

Payment for "High Curb" shall be made at the price bid per linear foot in place for the type and height specified. Measurement shall be along the face of the curb, except in the case of Type "B" High Curb, where measurement will be made on a line parallel to and six (6) inches from the back of the curb.

8-14 REFLECTING CURB

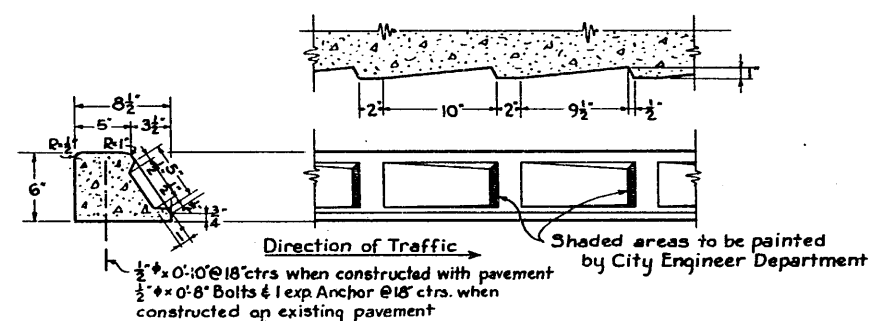
Reflecting Curb shall be constructed according to the standard plan. When reflecting curb is constructed in connection with new concrete pavement, the steel dowels shall be placed therein while the concrete is still soft. Care shall be taken to adequately weight or fasten down the face form so that a clean corner detail is attained.

Expansion joints and dummy joints shall be as herein specified for Integral Curb.

Payment shall be made at the price bid per linear foot for "Reflecting Curb," which price shall be in full for the super-

imposed curb, including furnishing and placing the steel dowels. If the concrete the curb rests on is not existing, it shall be measured and paid for as "Concrete Pavement."

REFLECTING CURB TYPE I



8-15 ALLEY CROSSING (For plan, see pages 121, 214)

Alley Crossings shall be constructed where shown on plan or where directed by the City Engineer.

The material, proportions, mixing, curing, and treatment of the subgrade shall conform in all respects to the Standard Specifications for pavement, except that thorough tamping of the subgrade may be substituted for the rolling.

The surface of concrete alley crossings shall be struck off with a heavy steel shod strike board and floated with a wood float. The surface shall then be brushed in a transverse direction.

Payment for Alley Crossings shall be made at the price bid per square yard for "Concrete Alley Crossings" and shall be in full for constructing the crossing to conform in all respects with the specifications for Concrete Pavement, including the subgrading.

8-16 PRIVATE DRIVEWAYS (For plan, see pages 121, 215)

Private driveways shall be constructed according to the plan. At the contractor's option, they may be constructed after the pavement is completed, as indicated on the detail plan—Method No. 2. They shall be constructed where shown, or where directed by the City Engineer, upon application of the abutting property owners. Such applications shall be honored when the same are received before the adjoining pavement has been constructed.

The materials, proportions, mixing, curing, and treatment of the subgrade, shall conform in all respects to the Standard Speci-

fications for concrete pavement, except that thorough tamping of the subgrade may be substituted for the rolling.

A metal or wood form shaped to the proper reverse curve shall be placed along the curb line to obtain a proper face on the warped portion of the driveway.

The warped portion of the driveway shall be troweled by hand and the entire surface of the crossing brushed in a transverse direction.

Measurement for curb shall stop at point "A." All paved surfaces between points "A" and from face of curb produced to end of driveway including warped surface, shall be paid for as "Private Driveway," at bid price per square yard, which price shall include subgrading.

8-17 ALLEY CATCH BASIN (For plan, see page 216)

Alley catch basins shall be constructed where shown on the plans, or where directed by the City Engineer. They shall be constructed according to the Standard Plan.

Payment shall be made at the price bid for each, for "Alley Catch Basins," and shall include all labor and material necessary to construct the catch basin according to these specifications.

8-18 REPLACING CONCRETE SIDEWALKS

Where directed by the City Engineer, the existing concrete sidewalks shall be replaced or extended. All such work shall be done according to Standard Specifications for "Replacing Concrete Walks" as written in Section 4.

8-19 MONUMENT CASES (For plan, see page 213)

Cast Iron Monument Cases conforming to the detail plan shall be placed where shown on the plan or where directed by the City Engineer. The top of the casting shall be set to the exact grade and contour of the street in which it is placed.

Payment shall be made at the price bid for "Monument Cases," which shall include payment for the concrete in which the casting is set.

8-20 ADJUSTING CAST IRON VALVE BOXES

Payment for adjusting cast iron valve boxes shall be included in the price bid for pavement, provided, on resurfacing improvements a bid will be taken for "Adjusting Cast Iron Valve Boxes" in accordance with Section 8-4.05.

8-21 ADJUSTING MANHOLE, ETC., COVERS

Manholes, catch basin, or similar frame and cover castings shall be adjusted to the proper grade in the manner specified for setting covers in new work. Care shall be taken that they are set to the grade and contour of the street in which they are placed and that the pavement is brought up flush with the covers.

The contractor shall provide and have available at all times during the progress of the work, a light weight portable template cut to the exact crown of the pavement and so constructed that the ends of the same ride on the side forms for the pavement. Such template shall be used for determining adjustment and setting of castings.

Payment shall be made at the price bid each for "Adjusting Manhole, etc., Covers," or as specified in Section 6-19. Such payment shall also include the cost of furnishing the above specified light weight template.

8-22 MOVING OR ADJUSTING INLETS

Existing inlets shall be adjusted where necessary to the proper elevation or shall be moved to the new position indicated. The contractor shall furnish all new material required and reset such inlets in the same manner as specified for new work.

Payment shall be made for "Moving or Adjusting Inlets," at the price bid for each.

8-23 GRAVEL SUBBASE

Gravel subbase shall be used in such locations and of such thickness as may be shown on the plan or as directed by the City Engineer. After excavating for subbase and before any backfilling is placed, the resulting subgrade shall be brought to a true surface and thoroughly rolled.

The backfilling to normal subgrade shall then be made and may consist of an approved pit run sand and gravel mixture, or washed sand and gravel conforming to the Standard Specifications.

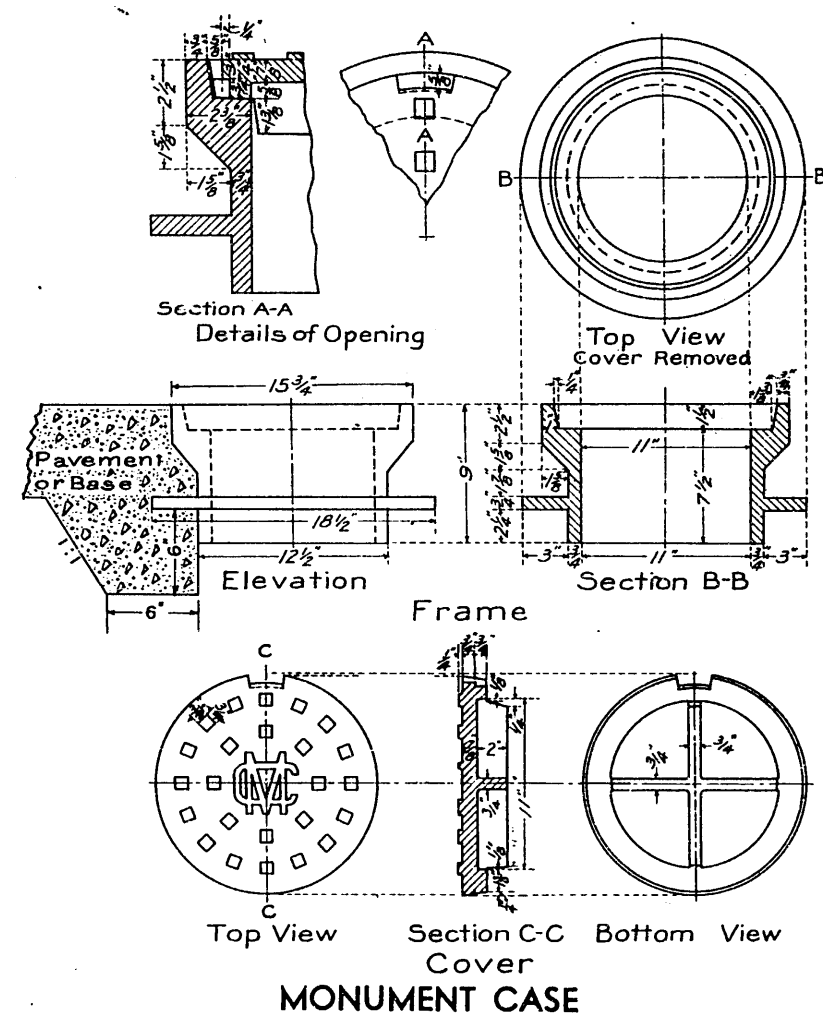
The backfilling shall be rolled in the same manner as specified for the normal subgrade.

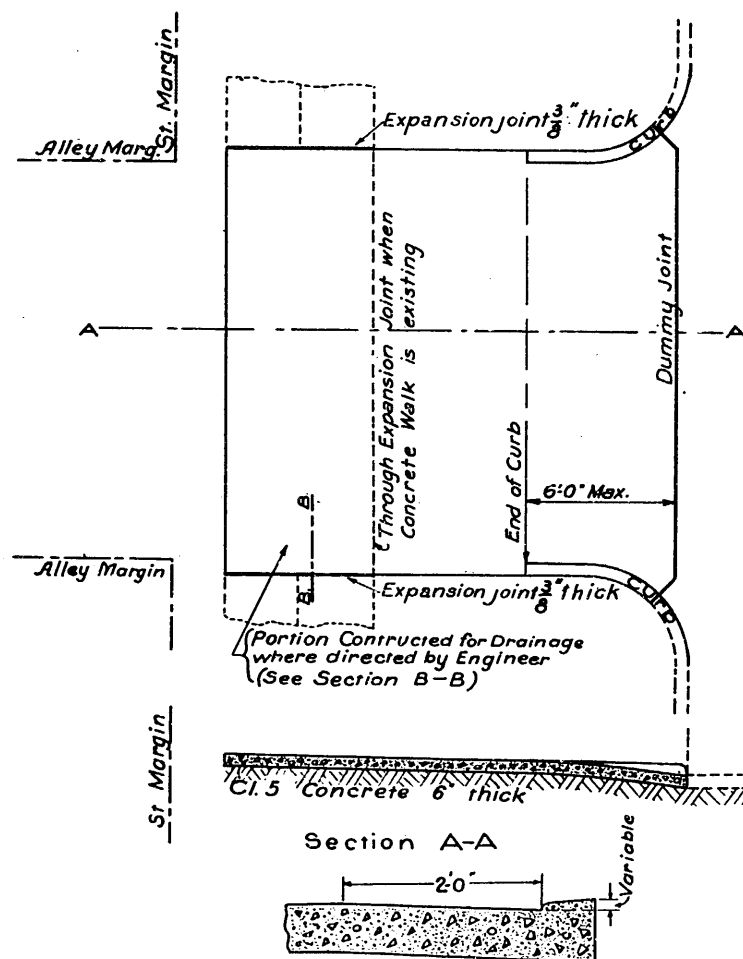
Payment for gravel subbase will be made at the price bid per cubic yard for the same in place. Payment for the extra depth of subgrade will be made at the price bid per cubic yard for subgrading.

8-24 TRAFFIC LINES

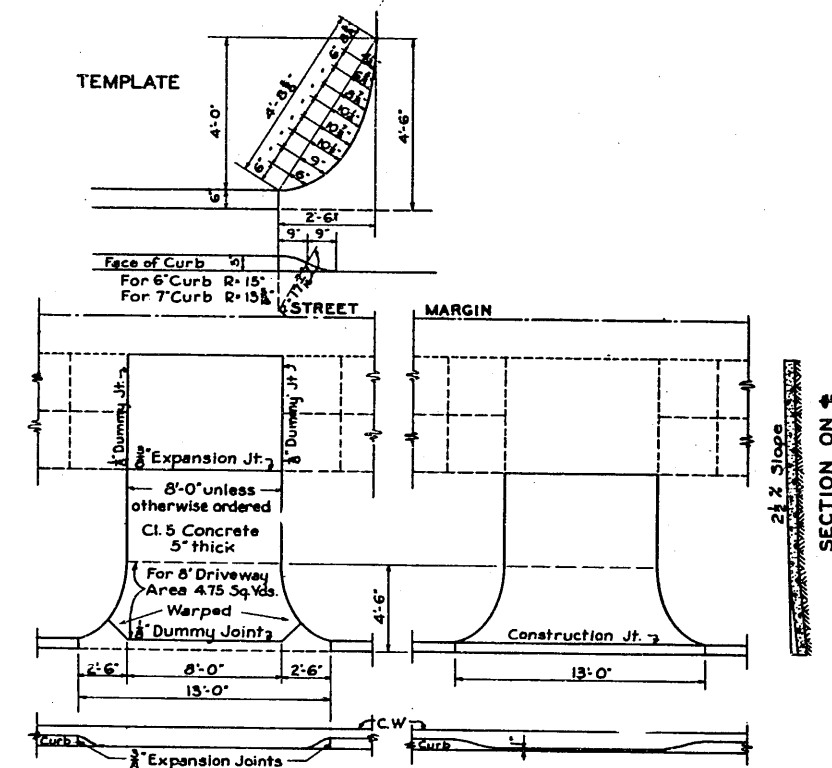
White traffic lines shall be laid in the pavement where shown on the plan or where directed by the City Engineer. They shall be constructed in the following manner: a 2"x6" board, rough on the bottom to provide more bonding surface, shall be floated flush with the pavement. The pavement shall then be edged adjacent to the board. Within one hour after floating the board shall be removed, and the space filled with a mixture composed of one part white Portland cement and one and one-half parts white marble or white granite chips mixed with white sand. The mixture shall be well troweled into place and edged.

Payment shall be made at the price bid per linear foot for "Traffic Lines" in place, which shall be in full for all labor and material in the completed work.

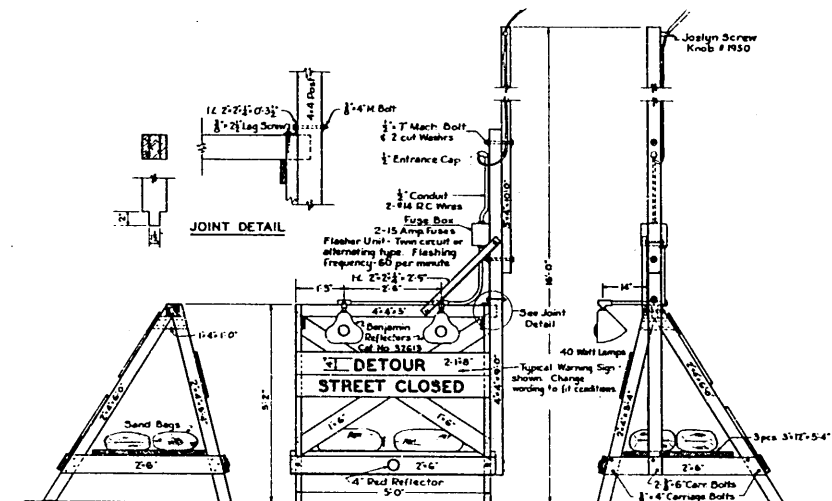




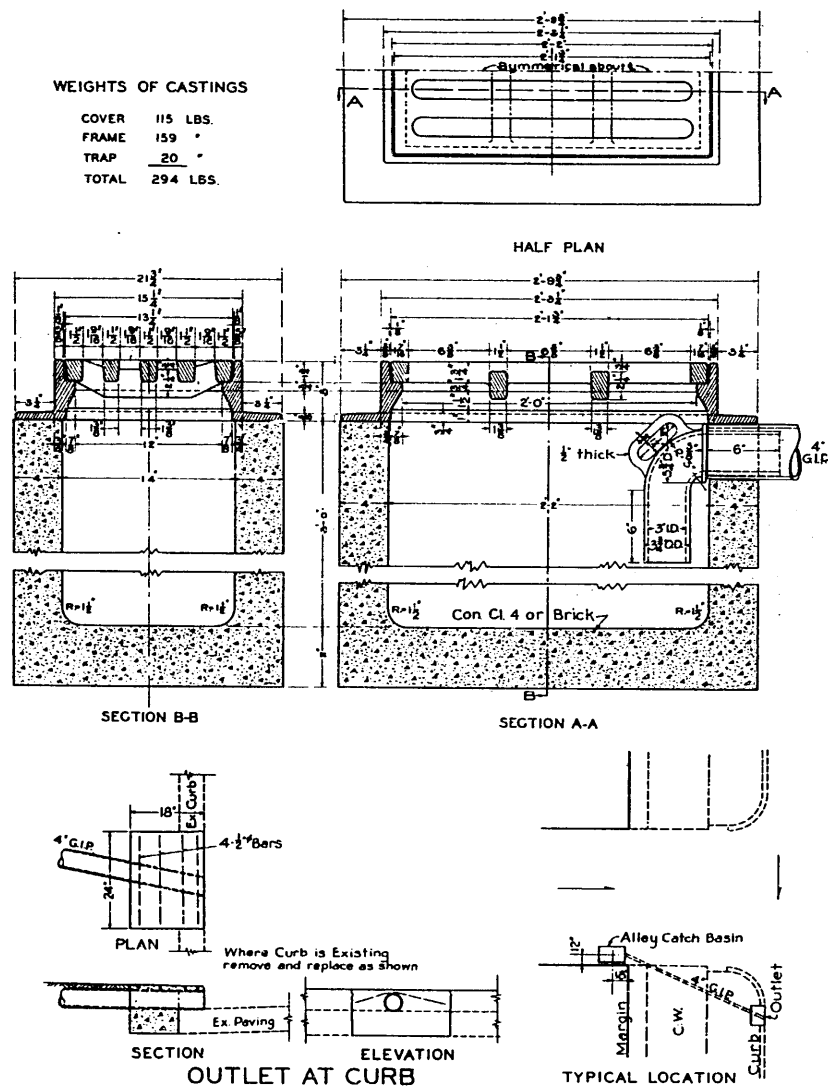
Section B-B
When Required for Drainage
CONCRETE ALLEY CROSSING
For Paved Streets



METHOD - 1
DRIVEWAY INTEGRAL WITH PAVEMENT
METHOD - 2
OPTIONAL METHOD - 2 OPERATIONS
PRIVATE DRIVEWAY

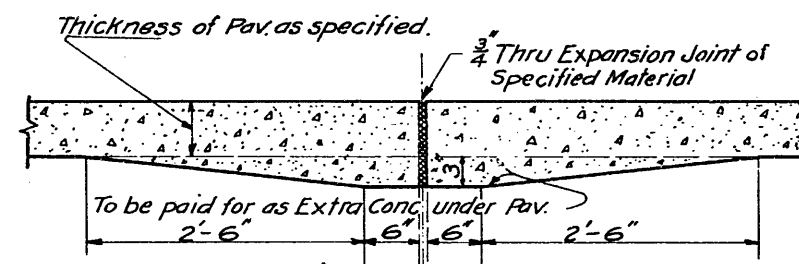


ILLUMINATED BARRICADE

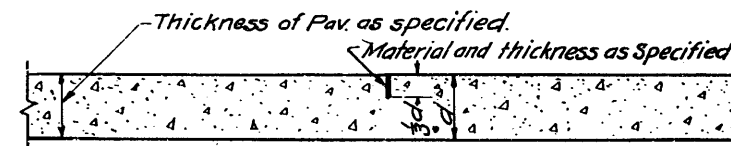


ALLEY CATCH BASIN

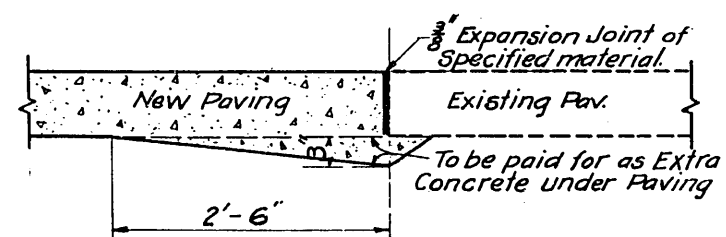
PAVEMENT SECTIONS AT EXPANSION JOINTS



THROUGH EXPANSION JOINT



DUMMY JOINT



BETWEEN NEW AND OLD PAVING

SECTION 9

SPECIFICATIONS FOR TIMBER STRUCTURES

9-1 MATERIAL

All lumber, timber, hardware and other materials shall conform to the requirements set forth under "Quality of Materials."

9-2 STORAGE OF MATERIAL

Lumber and timber on the site of the work shall be stored in piles.

Untreated material shall be open stacked at least twelve (12) inches above the ground surface and piled to shed water and prevent warping. When required by the City Engineer it shall be protected from the weather by suitable covering.

The ground underneath and in the vicinity of all material piles shall be cleared of weeds and rubbish.

9-3 WORKMANSHIP

Workmanship shall be first class throughout. None but competent bridge carpenters shall be employed and all framing shall be true and exact. Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood. Deep hammer marks in wood surfaces shall be considered evidence of poor workmanship and sufficient cause for the removal of the workman causing them. The workmanship on all metal parts shall conform to the requirements as specified for Steel Structures.

9-4 TREATED TIMBER

Treated timber shall be carefully handled without sudden dropping, breaking of the outer fibers, bruising or penetrating the surface with tools. It shall be handled with rope slings and no cant dogs, peaveys, hooks or pike poles shall be used.

All cutting, framing and boring of treated timbers shall be done before treatment insofar as is practicable. In waters infested with marine borers, cutting and boring below high water shall be avoided.

All cuts in treated piles or timbers and all abrasions after having been carefully trimmed, shall be coated with two coats of creosote oil and covered with hot roofing pitch.

Before driving bolts, hot creosote oil shall be poured into all bolt holes in such a manner that the entire surface of the hole shall be thoroughly coated with creosote oil. Any unfilled holes, after being treated with creosote oil, shall be plugged with creosoted plugs.

Pile heads after being cut to receive the caps, shall be given three coats of hot creosote oil.

9-5 UNTREATED TIMBER

In structures of untreated timber the heads of all piling, ends, tops and all contact surfaces of posts, caps, stringers and bracing shall be thoroughly coated with one brush coat of hot creosote oil. Particular attention is called to the necessity for the avoidance of stains from creosoting on surfaces which are to be painted. Hot creosote shall be poured into all vertical bolt holes exposed to the weather before driving the bolt.

In addition to the above treatment, all depressions or openings around bolt holes, joints or caps which may retain moisture and cause decay shall be carefully sealed by means of hot asphalt of an approved quality.

9-6 HOLES FOR RODS, BOLTS, ETC.

Holes for drift bolts and boat spikes shall be bored with a bit $\frac{1}{8}$ inch less in diameter than the bolt to be used. Holes for machine bolts and dowels shall be bored with a bit of the same diameter as the bolt or dowel and holes for truss rods shall be bored with a bit of a diameter $\frac{1}{8}$ inch greater than that of the rod.

9-7 BOLTS AND WASHERS

Washers of the size and type specified shall be used under all bolt heads and nuts which would otherwise come in contact with wood.

All bolts shall be effectively checked by burring the threads after the nuts have been finally tightened. Vertical bolts shall have the nuts on the lower end.

9-8 COUNTERSINKING

Countersinking shall be done wherever smooth faces are required.

9-9 FRAMING

All lumber and timber shall be accurately cut and framed to a close fit in such a manner that the joints will have a close

fit over the entire contact surfaces. Mortises shall be true to size for their full depth and tenons shall make a snug fit therein. No shimming will be permitted in making joints, nor will open joints be accepted.

9-10 PILE BENTS

Piles for trestles shall conform to the requirements of Section 2-25. Driving piles shall conform to the requirements of Section 10-2.

The location of all piles shall be "spotted" by pegs set to true line and position. The piles shall be driven as accurately as possible in the correct location and to the vertical or batter lines indicated on the plans. In case a pile is driven out of line, it shall be straightened without injury before it is cut off or braced. Piles damaged in driving or straightening, or piles driven below grade, shall be removed and replaced at the contractor's expense. No shimming on top of piles will be permitted.

The piles of any one bent shall be carefully selected as to size, to avoid undue bending or distortion of the sway bracing.

Cut-offs shall be accurately made to insure perfect bearing between the cap and piles of a bent.

9-11 CONCRETE PEDESTALS

Concrete pedestals for the support of framed bents shall be carefully finished so that the sills will take even bearing on them. Dowels of not less than three-fourths ($\frac{3}{4}$) inch diameter and projecting at least six (6) inches above the tops of the pedestals, shall be set in them when they are cast for anchoring the sills.

9-12 SILLS

Sills shall have true and even bearing on piles or pedestals. They shall be drift bolted to piles with bolts of not less than three-fourths ($\frac{3}{4}$) inch diameter and extending into the piles at least six (6) inches. All earth shall be removed from contact with the sills so that there will be free circulation of air around them.

9-13 POSTS

Posts shall be fastened to sills with dowels of not less than three-fourths ($\frac{3}{4}$) inch diameter extending at least six (6) inches into the posts.

9-14 CAPS

Timber caps shall be placed to secure an even and uniform

bearing over the tops of the supporting posts or piles and to secure an even alignment of their ends. All caps shall be secured by drift bolts not less than three-fourths ($\frac{3}{4}$) inch in diameter extending at least nine (9) inches into the posts or piles. The drift bolt shall be approximately in the center of the pile or post.

9-15 BRACING

All pile bents over ten (10) feet high shall be braced transversely at each bent and longitudinally in alternate pairs. Single story bracing shall not exceed twenty (20) feet. The ends of bracing shall be bolted through the pile, post or cap with a bolt not less than five-eighths ($\frac{5}{8}$) inch in diameter. Intermediate intersections shall be bolted or boat spiked, as indicated on the plans. Sway bracing shall extend far enough to lap both upper and lower caps or sills and shall be bolted to the caps or sills at each end.

9-16 STRINGERS

All stringers carrying laminated decking and any stringer varying in depth by more than one-eighth ($\frac{1}{8}$) inch shall be sized to an even depth at bearing points.

Outside stringers shall be butt jointed and spliced, but interior stringers shall be lapped to take bearing over the full width of the cap or floor beam at each end. Joints shall be broken and stringers either toe nailed or drifted, as specified on the plans. Stringers must be of sufficient length to cover two bents, except on sharp horizontal and vertical curves. The ends of lapped stringers shall be separated at least one-half ($\frac{1}{2}$) inch for the circulation of air by means of suitable spacing blocks and shall be securely nailed.

Cross bridging between stringers shall be neatly and accurately framed and securely toe nailed with at least two nails in each end.

9-17 DECKING

The planks shall be sized on one side, laid with the heart side down, and spiked to each stringer. There shall be two (2) spikes at each end of every plank and one (1) spike at each intervening stringer, staggered. One spike in each end stringer and the spike in alternate intermediate stringers shall be inclined, when driven, in the opposite direction to all the others.

9-18 WHEEL GUARD AND RAILINGS

Wheel guards and railing shall be accurately framed in accordance with the plans and erected true to line and grade. Wheel guards shall be laid in sections not less than sixteen (16) feet long. All materials for wheel guards and railings shall be surfaced four sides (s4s).

9-19 TRUSSES

Trusses, when completed, shall show no irregularities of line. Chords shall be straight and true from end to end in horizontal projection and in vertical projection shall show a smooth curve through panel points conforming to the correct camber. All bearing surfaces shall fit accurately. Uneven or rough cuts at the points of bearing shall be cause for rejection of the piece containing the defects. Unless otherwise directed by the City Engineer, all trusses shall be completed, swung free of their falsework and adjusted for line and camber before the handrailing is placed.

9-20 PAINTING

All rails and rail posts shall receive two coats of white paint of the quality specified under Section 2-24. Metal parts, except hardware, shall be given one coat of shop paint, and after erection, two coats of field paint of the quality specified under Section 2-24.

9-21 MEASUREMENT AND PAYMENT

Payment for "Piling" shall be made at the price bid per linear foot of pile in place. Piles shall be measured downward from the "cut-off." Braces shall be measured over all, no reduction being made for diagonal cuts.

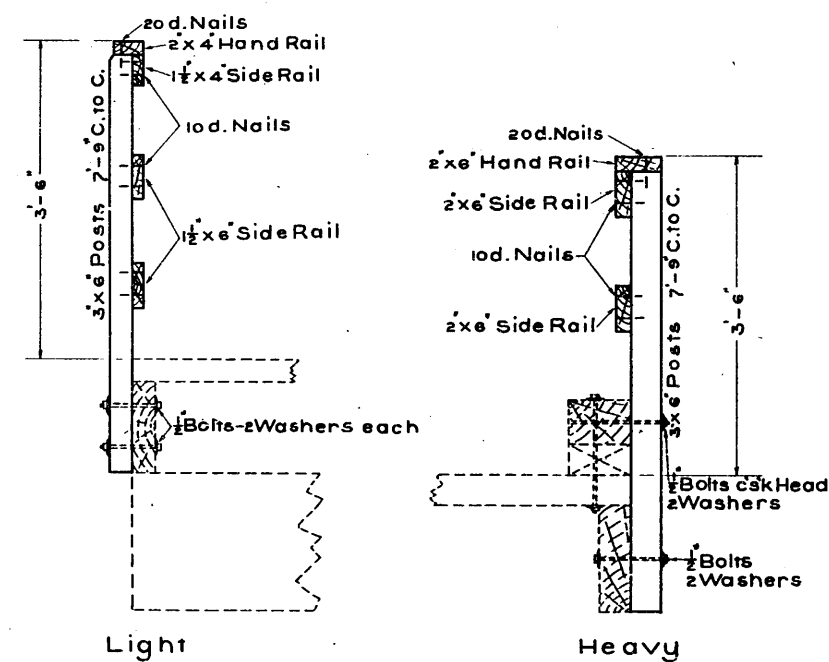
Lumber and plank shall be paid for at the price bid per thousand feet board measure (M'BM) for the actual material remaining in the finished structure, which payment shall include the cost of all hardware.

Metal parts, other than hardware, shall be paid for at the price bid per pound in place, the weight being computed in the same manner as specified for Steel Structures.

The contract prices for the pay items of work involved shall be full compensation for the construction of timber structures, which prices shall include the furnishing of materials, preserva-

tive treatment, equipment, tools and labor necessary for the erection of the work in a satisfactory manner.

Payment for wood railing shall be made at the price bid per linear foot in place for "Light Wood Railing" or "Heavy Wood Railing," and this price shall include payment for all material, cutting, fitting, etc., painting and protection.

WOOD RAILING

SECTION 10

SPECIFICATIONS FOR REINFORCED CONCRETE STRUCTURES

10-1 WORK INCLUDED

Reinforced concrete structures shall conform to the lines, grades and dimensions shown on the plans. All materials shall conform to the requirements set forth under "Quality of Materials." Construction details, unless otherwise provided for in the plans and special specifications, shall conform to the requirements herein-after set forth.

Payment will be made for the various items involved, at the prices bid, and such payment shall be in full for the complete structure, including all incidental items shown on the plans or specified in the special specifications, and upon which no bid has been taken.

10-2 FOUNDATIONS

—2.01 EXCAVATION

Excavations for all footings, piers, or other structure foundations, shall be made to the lines and grades shown on the plans. Should the character of the foundation material encountered, in the opinion of the City Engineer, necessitate a change in foundation dimensions, the City Engineer reserves the right to change the lateral dimensions of foundation pits without limit and to increase the depth of such pits as much as four (4) feet, or up to twenty per cent (20%) of the original depth of the same, whichever is larger, without alteration of the unit prices for such items. Any redriving of cribbing, re-bracing or any increase in depth exceeding the above stated 4 feet or 20% shall be paid for as extra work.

A Cofferdams

Cofferdams for foundations below the water line shall be made of tongue and groove material or Wakefield, or steel sheet piling, or other similar tight sheeting, or cribbing driven to sufficient depth below the bottom of the excavation to permit pumping the excavation dry if possible. Where it is impracticable to dewater the foundation pit before placing concrete, lagging shall be driven at least one (1) foot below the bottom of the foundation and the

lagging shall be sufficiently tight to permit dewatering of the pit after the tremie seal has been constructed.

Cofferdams shall be braced in such a manner as to maintain their shape and shall be large enough to permit the construction of the forms to the proper lines. No braces or other timbers shall be placed in such a manner as to extend into the concrete. Sufficient clearance between foundation forms and cofferdams shall be allowed to permit of pumping outside of the forms, provided, however, that foundation seals placed by the tremie method shall be poured directly against the cofferdam sides.

After the concrete work has been completed, all cofferdams, lagging, bracing, etc., shall be removed to a point at least one foot (1') below the natural ground line, or to a point at least two feet (2') below extreme low tide; provided, however, that in any navigable channel such cofferdam material shall be entirely removed above the top of the foundation seal.

B Backfilling

All excavations for footings, piers, or other structure foundations shall be backfilled to the original level of the ground, and the surplus material shall be removed from the site of the structure and disposed of by the contractor; provided, however, that the City Engineer may require the surplus material to be evenly spread over the area immediately adjacent to the structure. All backfilling shall be tamped into place in six (6) inch layers. Water settling may be used in lieu of tamping where the foundation rests upon piling or where otherwise permitted by the City Engineer.

The cost of backfilling and disposing of surplus material as herein provided shall be included in the price bid for "Foundation Excavation."

C Measurement and Payment

Excavations for foundations of any nature shall be paid for at the price bid per cubic yard for "Foundation Excavation," and shall include the removal of all materials encountered of whatever nature, including logs, stumps, boulders, etc.

To determine the amount of material to be paid for as "Foundation Excavation," measurement shall be made of a pit having a bottom area equal to the largest area of the footing and with vertical sides; provided, however, that when any dimensions of such bottom area is less than two and one-half feet (2½') such dimension shall be taken as two and one-half feet (2½').

No allowance shall be made for slope, slides, or swell due to pile driving, or for volume occupied by cofferdams, or for any excess excavation above that herein specified.

—2.02 PILING

A Timber Piling

Timber piling shall conform in all respects to the requirements of Section 2-25, under "Quality of Materials."

B Concrete Piling

Concrete piles shall be precast piles of the dimensions shown on the plans and of such length as shown on the plans or as ordered by the City Engineer.

They shall be cast in a horizontal position of Class "7" concrete. Reinforcement shall be rigidly wired at all intersections, forming one unit, and shall be accurately spaced in the forms. All corners of square piles shall be chamfered. Each pile form shall be completely and immediately filled before pouring the next pile, to insure the absence of horizontal or diagonal cleavage planes. Concrete shall be thoroughly spaded and vibrated with mechanical vibrators of the type that is inserted directly in the concrete.

Concrete piles shall be kept continuously wet for a period of ten (10) days after casting. They shall not be driven until at least twenty-one (21) days old.

C Methods of Driving

All piling shall be accurately spaced and driven vertically or to the batter shown on the plans. A deviation of more than one-quarter ($\frac{1}{4}$) inch per foot from specified lines shall not be allowed. No piling shall be driven until the foundation pits in which they are to be driven have been completely excavated.

Unless otherwise specified, piling may be driven either by a drop hammer or a steam hammer. For timber piles, drop hammers shall weigh not less than three thousand (3,000) pounds, and the drop shall be limited to fifteen (15) feet. For concrete piles, drop hammers shall weigh not less than the weight of the pile being driven, and the drop shall be limited to eight feet (8').

For timber piles, steam hammers shall deliver a blow of approximately fifteen thousand (15,000) foot pounds. For concrete piles, steam hammers shall deliver a blow of at least thirty-five hundred (3500) foot pounds per cubic yard of concrete in the pile

but in no case less than ten thousand (10,000) foot pounds per blow.

Jetting, either before driving or during driving of the piles, may be required, when in the judgment of the City Engineer such jetting is necessary. The jet shall not reach the final position of the point of the pile and the pile shall be set by additional driving when the jet has stopped.

Timber piles shall be fresh headed just before driving and protected from splitting during driving by metal rings. And in addition, creosoted piling shall be notched for the full perimeter of the pile approximately twelve (12) inches below the head, to control further the splitting of the treated portion of the pile. Concrete piles shall be protected during driving by a wood, fiber, or other cushion.

Driving shall be stopped while all piles are far enough above cut-off to insure the removal of all broomed or split material. No timber piling shall be driven to cut-off.

For deep foundations and underwater work, a follower may be used, provided the same be made of seasoned timber, held in place upon the pile head by means of a steel sleeve at least sixteen (16) inches long, into the center of which has been welded a steel diaphragm at least one (1) inch thick, and protected on the top by a metal cap.

Foundation piles shall be driven to refusal if possible, and in no case, unless otherwise specified, shall the safe bearing value of a timber pile be less than twenty (20) tons, computed by the following formulae:

$$\text{For Drop Hammer} \dots P = \frac{2wh}{s+1}$$

$$\text{For Single Acting Steam Hammer} \dots P = \frac{2wh}{s+0.1}$$

$$\text{For Double Acting Steam Hammer} \dots P = \frac{2h(w+ap)}{s+0.1}$$

Where P = bearing value of pile in pounds

w = weight of hammer or moving part in pounds

h = fall or stroke in feet

a = area of piston in square inches

p = steam pressure in pounds per square inch
s = penetration of last blow in inches

Concrete piles shall show a safe bearing value of at least twenty-five (25) tons as determined by loading test in which the safe allowable load shall be taken as one-half of the load which, after forty-eight (48) hours application, causes a permanent settlement of not more than one-quarter inch ($\frac{1}{4}$ ").

D Test Piles

The contractor shall drive such piles as the City Engineer may direct and load the same in such a manner that the load rests vertically upon the pile and is free to move in a vertical direction. The load shall be applied in such increments as the City Engineer may direct and suitable periods allowed to elapse between the times of applying increments.

After the test has been completed the contractor shall remove the load and all platforms, boxes, etc.

For each pile so tested the contractor shall be paid his bid price per linear foot for piling in place plus his bid price for "Loading Test Piles." Should no bid be taken on the latter item, the same shall be paid for as provided for extra work.

E Measurement and Payment

All foundation piling shall be paid for at the price bid per linear foot for piling in place, and measurement shall be made only of the piling actually left in the completed foundation, except that where concrete piles of certain lengths have been specified or ordered by the City Engineer and cannot be driven to this length, the contractor shall be paid his bid price per linear foot for the lengths of piles so ordered. All concrete piling not driven to cut-off shall be cut off at the contractor's expense. Concrete piling driven below cut-off shall be built up and the contractor shall be paid therefor at his bid price per linear foot for concrete piling in place.

The contractor shall be held responsible for determining and ordering the proper length of timber piling.

—2.03 CONCRETE

Concrete shall be of the class specified and shall conform to the requirements set forth in Section 2-8 under "Quality of Materials."

A Forms

Forms shall be accurately set to line and grade and adequately

braced. Wire ties will be allowed in foundation forms below the ground line where the foundation thickness is twelve (12) inches or less. Form work below the ground line over twelve (12) inches thick and all form work above the ground shall be secured in place by rods or bolts in such a manner that after stripping such bolts may be either entirely removed or may be removed for a distance of at least one (1) inch below the concrete surface.

Forms for foundations shall conform in quality and workmanship to the specifications for "Forms" for superstructures Section 10-3.

B Placing Concrete

Concrete shall be placed by means of a bottom dumping bucket or cart. It shall be brought up in approximately horizontal layers. Mass piers exceeding ten (10) feet in depth and all reinforced walls or other light sections shall be poured through vertical sectional spouts, the end of the spout being not more than six (6) feet above the concrete at any time. Foundation concrete shall be delivered, placed and otherwise treated as specified for superstructure concrete, Section 10-3.

Wherever possible, foundation excavations shall be pumped dry and kept in this condition during the placing of concrete. Where a foundation seal is provided for on the plans or where, in the judgment of the City Engineer, it is impracticable to dewater the foundation pit, concrete shall be placed by means of a tremie.

The tremie shall consist of a pipe having a diameter of not less than eight (8) inches, equipped with a hopper at the top and suspended by some means giving accurate and immediate control over the raising and lowering of the same. It shall be equipped with a satisfactory device for expelling the water and first filling the tremie.

The tremie pipe shall be kept full to the top at all times, the flow being regulated by raising or lowering the pipe, keeping the lower end continuously buried in the concrete.

Concrete placed by the tremie method shall be placed in still water; only sufficient pumping will be allowed to remove the water raised in the cofferdam by the placing of the concrete. Cofferdam shall be vented at the ground line or low water line to allow the escape of water thus raised without further pumping.

Whenever the area of the foundation requires the concrete to

flow more than eight (8) feet from the tremie, additional tremies shall be used.

Concrete poured by the tremie method shall be brought up as evenly as possible and shall be poured continuously until the entire seal is placed. Care shall be taken to cause a minimum disturbance of the fresh concrete. All laitance shall be removed before resuming construction upon any foundation seal.

Foundations sealed by the tremie method and subject to hydrostatic uplift shall not be pumped until the concrete seal has set at least three (3) days.

After the removal of forms all foundation concrete above the ground line, unless otherwise specified, shall be given a Class "C" finish.

Payment for foundation concrete shall be made as specified for superstructure concrete Section 10-3.

C Anchor Bolts

All anchor bolts in piers, abutments or other foundations shall be accurately set with a template in pipes at least one (1) inch larger than the bolt, using a washer or steel plate at least four (4) times the diameter of the bolt as an anchorage. The pipes shall be filled with cement grout at the time the bearing plates or other castings are grouted in position.

10-3 SUPERSTRUCTURES

—3.01 ORDER OF CONSTRUCTION

The component parts of any reinforced concrete structure shall be built in the order shown on the pouring diagram or as directed by the City Engineer. No construction joints other than those provided for will be permitted except as an emergency measure.

When such emergency construction joint is unavoidable, it shall be at right angles to the direction of the main reinforcement at the point of minimum shear. The contractor will be required to construct such keyways or use such extra reinforcing stubs as the City Engineer may direct. Where an emergency joint is subject to hydrostatic pressure, a sheet copper seal shall be placed in the joint in such a manner as to prevent leakage.

Old concrete at all construction joints other than expansion joints shall be thoroughly cleaned before placing new concrete.

—3.02 FALSEWORK

Detailed plans for falsework or centering proposed to be used

shall be furnished the City Engineer whenever requested, but the approval of such plans or the acquiescence of the City Engineer in the work constructed according thereto, shall not relieve the contractor of the responsibility for satisfactory results.

All falsework shall rest upon a solid footing and the contractor will be required to excavate to such depth as, in the opinion of the City Engineer, is necessary to secure such footing. Where adequate footing cannot, in the opinion of the City Engineer, be secured, all falsework shall be carried on piling.

Falsework shall be erected with as few sub caps as practicable and the workmanship shall be such as to give full bearing at all points of contact between piles, posts, caps and stringers.

No falsework shall be carried upon any bridge, trestle or other structure subject to vibration from passing rail or vehicular traffic.

After completion of the structure, all falsework shall be removed to a point at least one (1) foot below the natural ground line, or two (2) feet below tide; provided, however, that in any navigable channel such falsework shall be entirely removed.

—3.03 FORMS

Forms shall conform to the shape and dimensions shown on the plans and shall be accurately set to line and grade. Unless otherwise specified, all sheeting in contact with concrete surfaces shall be matched or tongue and groove lumber, sized to uniform thickness and free from wane, warp, splits, loose knots, or other defects which will prevent obtaining a smooth, tight form. Forms for exposed exterior surfaces shall be lined with plywood conforming to the grading rules for "Concrete Form Plywood," as specified by the Douglas Fir Plywood Association. All plywood lining shall be used in as wide pieces as possible. Areas less than four (4) feet in width shall be lined with a single width of plywood. Joints in lining and backing shall not occur at the same place and the abutting edges of adjacent sheets shall be nailed to the same board.

Joints in the lining shall be filled with cold water putty, patching plaster, plastic wood, or other plastic filler satisfactory to the City Engineer. Lining material may be re-used if it is in satisfactory condition, well cleaned, re-oiled and approved by the City Engineer.

Posts, stringers, studding, and other supporting members shall be of such size and spaced at such intervals as to prevent sagging, bulging, or any deviation from the prescribed lines.

All forms shall be securely tied with bolts or rods in such a manner that after stripping, such bolts or rods may be either entirely removed or may be removed for a distance at least one (1) inch below the concrete surface. Such bolts or rods shall be threaded and provided with nuts to prevent slipping and to provide adjustments. No wire ties or clamping devices shall be permitted.

Columns shall be clamped either with adjustable iron clamps or bolted wooden collars.

To determine the size and spacing of form members, ties and clamps, green concrete shall be assumed to weigh one hundred fifty (150) pounds per cubic foot.

Tie bolts shall be located from three (3) inches to six (6) inches below horizontal construction joints so that the forms can be retightened against the hardened concrete.

Form systems for cantilevered copings, curtain beams or other members presenting long, unbroken lines shall be carried on wedges to facilitate bringing the forms to grade just before pouring. Where supports cannot be secured at sufficiently short intervals, such members shall be given the proper camber to absorb deflection. Curb face forms, the bottom of which determines the gutter line of the roadway, shall on flat grades, be carried in a manner which will permit grade adjustment during pouring.

Forms for columns, wall faces, outside faces of curtain beams, railings, and all similar work shall be thoroughly oiled before placing concrete, using a light colored form oil which will not discolor the concrete.

Forms for concrete copings, handrails and other ornamental members shall either be made of metal or press board or so constructed that each unbroken surface is made of one piece of lumber.

Sheeting for walls, ramps, etc., except where the surface is later to be backfilled, shall be placed horizontally regardless of the grade of the top or bottom of the wall.

All sharp, exposed corners shall be chamfered by means of a triangular strip in the form corners.

Forms for columns, walls, beams, slabs, etc., shall have large cleanout openings at their lowest points, which shall not be closed until just before pouring concrete, and all forms shall be thoroughly cleaned and soaked with water immediately before filling.

Forms may be removed from the various portions of any superstructure at periods after pouring as follows:

Columns and walls not yet supporting loads, three (3) days.

Vertical sides of beams, girders and similar members, five (5) days.

Supporting timbers under any beam, slab, girder or other member subject to bending stress, twenty-one (21) days.

Posts supporting structures carrying sidewalks or other cantilever sections shall be released in advance of the supports under the main structure.

Form lumber not injured in removal may be re-used, provided that surfaces to be in contact with the concrete shall be thoroughly cleaned.

The foregoing specifications for forms, as regards design, tightness, filleted corners, bracing, alignment removal, re-use and in all other particulars, shall apply to metal forms. The metal shall be of such thickness that the forms shall remain true to shape. All bolts, rivets, etc., shall be counter-sunk. Clamps, pins and other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injuring the concrete. Special care shall be exercised to keep metal forms free from rust, heavy grease or other foreign matter.

—3.04 REINFORCING STEEL

Reinforcing steel shall conform in quality to the requirements set forth in Section 2-32 under "Quality of Materials." It shall be free from loose scale, excessive rust, or coatings of any character which will reduce the bond between steel and concrete.

A Placing Reinforcement

Reinforcement lists upon or accompanying the plans may be used by the contractor only at his risk. In all cases the location, size, shape and number of bars shall be as shown on the plans which shall take precedence over the tabulated list.

Bars shall be bent cold and shall conform accurately to the shape and dimensions shown on the bending diagram. Bent up

bars unless otherwise specified shall be bent up at an angle of forty-five degrees (45°) and in no case shall the radius of any bend be less than four times the diameter of the bars.

Reinforcement shall be positioned as indicated on the plans or as hereinafter specified, and shall be rigidly blocked and wired in place, using metal supports or concrete blocks and securely tied at each intersection with annealed iron wire of at least twelve gauge.

Splicing bars at points not indicated on the plans will not be permitted except as an emergency measure and with the consent of the City Engineer. Such splices shall be at the points of minimum tensile stress and the lap shall be not less than forty (40) diameters of the bar.

Unless otherwise specified the minimum clear space between reinforcing bars and the cover shall be as follows:

Minimum distance between adjacent bars in a layer.....	2½"
Minimum distance between adjacent layers.....	2"
Cover on main bars (except slabs).....	2"
Cover on bottom slab bars.....	1"
Cover on top slab bars (not used as roadway surface)....	1"
Cover on top slab bars (roadway surface over 10" slab) ..	1½"
Cover on top slab bars (roadway surface less than 10" slab) 1"	
Cover on main bars in piers and mass footings.....	3"

B Payment for Reinforcing Steel

Reinforcing steel shall be paid for at the price bid per pound, computed weight, in place in the completed structure. Measurement will be of the steel in place and no allowance will be made for laps or stubs not shown on the plans. To facilitate computation of weights, the contractor shall furnish the City Engineer with two copies of his shop lists.

For the purpose of computing weights, the following table shall be used:

Size.....	⅜"	½"	⅝"	¾"	⅞"	1"	1⅛"	1¼"
Wts. lbs.								
Round.....	.376	.668	1.043	1.502	2.044	2.67		
Square.....						3.40	4.303	5.313

—3.05 CONCRETE

Concrete used in the various parts of the structure shall be of

the class specified and shall conform in all respects to the requirements of Section 2-8 under "Quality of Materials." It shall be mixed with the minimum amount of water which can be used and still give sufficient workability to place properly in the various parts of the structure. Before depositing any concrete, all debris shall be removed from forms and spaces to be filled, forms shall be thoroughly oiled and reinforcing steel secured in position and approved by the City Engineer.

Columns, walls and similar high structures of relatively small cross section shall be filled from the top through vertical sectional spouts, the bottom of the spout being kept not more than three (3) feet above the concrete and so arranged that the concrete falls vertically into place without coming into contact with reinforcing steel or other obstructions. Where it is not possible to convey concrete by means of metal spouts, openings shall be provided in the forms for placing the concrete. In such case, the concrete shall not be allowed to drop more than six (6) feet. Openings in the forms shall be so arranged that they can be readily closed when the concrete reaches the level of the opening.

Beams, slabs, floors and similar open sections shall be filled by means of carts or bottom-dumping buckets. The concrete shall be placed continuously from one side or end of the section to the other, using precaution to put the full load upon any given area of form as rapidly as possible. The rate of delivery of concrete to the work shall be such as to insure continuity of placement. No partially completed surface shall be allowed to stand more than forty-five (45) minutes before continuing the placing of concrete thereon. To insure compliance with this provision, the City Engineer reserves the right to pass upon the sufficiency of the mixing plant and delivery system before the placing of any section of the work.

Concrete shall be handled from the mixer to the place of final deposition as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients.

Concrete delivered from a central mixing plant shall be deposited at the job in a hopper of sufficient capacity to receive a full load. It shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. It shall be de-

posited in approximately uniform, horizontal layers, the thickness of which shall generally not exceed ten (10) to twelve (12) inches. The piling up of the concrete in the forms in such a manner as to permit the escape of the mortar from the coarse aggregate shall not be permitted. In any given layer, the separate batches shall follow each other so closely that each one shall be placed and compacted before the preceding one has taken initial set, in order that the green concrete shall not be injured and that there shall be no line of separation between the batches. A succeeding layer placed before the underlying layer has become set shall be compacted in a manner that will entirely break up and obliterate the tendency to produce a construction joint between layers.

No spouting of concrete into place shall be permitted, except as hereinbefore provided.

Construction joints shall be permitted only as shown on the plans and in such other locations specifically designated and approved by the City Engineer. The contractor shall be required to give special attention to the forming of construction joints between beams and slabs and at other points where shear stresses occur. Surfaces to which concrete is to be bonded shall be roughened while in a plastic state.

As soon as the concrete has set and before it has hardened the surface shall be wetted and brushed with a stiff wire brush or broom until all laitance and surface glaze has been removed. Before fresh concrete is added, the construction joints and surface shall be thoroughly wetted and a thin layer of grout shall be applied and well rubbed in. The preparation of sand and cement for grout shall be the same as specified for concrete.

Where construction joints occur on a clear exposed surface they shall be made in the following manner:

To insure a level straight bond on the exposed surface, a strip of one-inch sheathing shall be tacked to the forms at the outside surface. The concrete shall be carried about one-half ($\frac{1}{2}$) inch above the under-side of the strip. About one hour after the concrete is placed, the strip shall be removed.

—3.06 COMPACTING

All concrete shall be thoroughly spaded, especially along the forms, with a thin metal perforated spade or fork, to prevent the formation of gravel pockets and to permit the escape of entrapped

air. Special care shall be taken to avoid gravel pockets around or adjacent to reinforcing steel. In addition to spading, the contractor shall also provide suitable internal vibrating tampers of the type designed to be placed directly in the concrete. The type of vibrator and method of use shall be subject to the approval of the City Engineer. Vibration shall be such that the concrete becomes uniformly plastic. Vibrators shall be inserted to a depth sufficient to vibrate the bottom of each layer effectively, but shall not be allowed to penetrate partially hardened concrete which will not become plastic under the vibratory action, nor shall the vibrator be applied directly to steel which extends into partially hardened concrete. The intervals between points of insertion and the duration of the vibrating at each point shall be as directed by the City Engineer. Vibration shall not continue in any one spot to the extent that pools of grout are formed. In vibrating and finishing top surfaces which are exposed to weathering or wear, extreme care shall be exercised to avoid drawing water or laitance to the surface. In relatively high lifts the top layer shall be comparatively shallow and the concrete mix shall be as stiff as can be effectively vibrated into place and properly finished. The size and number of vibrators necessary will be determined by the City Engineer. Pouring of concrete shall not commence until mechanical efficiency of vibrators is proved in the presence of the City Engineer's representative. If electric vibrators are used the contractor shall furnish electric wiring of ample capacity to efficiently supply the number of vibrators required.

—3.07 FINISH

Roadway surfaces shall be finished as specified for concrete pavement, except that the first tamping rod and roller may be omitted. Reinforced concrete sidewalks shall be finished as specified for one-course concrete walks, except that the tamping rod and roller may be omitted. Unless otherwise specified, other parts of any reinforced concrete structure shall be given a finish equal to the following class of finish:

Concrete hand rails—Class "A."

Copings, columns, exposed surface of beams, walls, piers, etc.

—Class "B."

All other concrete—Class "D."

The use of plywood lining in the concrete forms as herein-

before specified, water-tight forms, proper spading and vibrating along the forms, and proper control of the water content of the concrete, will in general produce a satisfactory finished surface provided it is free from gravel pockets, air bubbles, fins, or other blemishes.

The contractor shall use such care in the construction of the form work and in the depositing and compacting of the concrete that all exposed surfaces shall be free from gravel pockets, air bubbles, or other blemishes and shall be uniform in texture and appearance. The degree of care exercised in these operations shall determine to a great extent the amount of additional surface treatment necessary to produce the desired result. The City Engineer shall be the sole judge as to fulfillment of finish requirements.

—3.08 CURING

Roadway surfaces, sidewalks, floors, curbs and similar parts of the structure shall be cured as specified for concrete pavement.

Walls, railings and similar units shall be covered with burlap curtains and kept continuously wet for three (3) days.

—3.09 MEASUREMENT AND PAYMENT

Concrete in any superstructure or part thereof shall be paid for at the price bid per cubic yard in place for the class of concrete specified, and measurement shall be taken as the computed volume of the structure as shown on the plans.

SECTION 11 SPECIFICATIONS FOR STEEL STRUCTURES

11-1 MATERIALS

Except where otherwise provided, all members and rivets shall be of structural steel.

Forgings shall be carbon steel and shall be thoroughly annealed before machine finishing.

Castings shall be of cast steel or cast iron, as specified.

—1.01 STORAGE OF MATERIALS

All materials stored at the fabricating plant prior to the fabrication of the material shall be properly protected from rust and an accumulation of dirt, oil or other foreign matter. Material which shows any sign of pitting due to rust will not be accepted.

All fabricated material stored prior to shipment shall be subject to the same requirements of storage as the unfabricated material.

—1.02 STRAIGHTENING MATERIAL

All deformed structural material shall be properly straightened by methods which are non-injurious prior to being laid off, punched or otherwise worked in the shop. Sharp kinks and bends shall be cause for rejection.

—1.03 WORKMANSHIP AND FINISH

The workmanship and finish shall be first class and equal to the best practice in modern bridge shops. Welding, shearing and chipping shall be neatly and accurately done and all portions of the work exposed to view shall be neatly finished.

11-2 MILL AND SHOP INSPECTION

—2.01 NOTICE OF ROLLING AND FABRICATION:

The contractor shall give ample notice to the City Engineer of the beginning of work at the mill and shop, so that inspection may be provided. No material shall be rolled or fabricated before the City Engineer has been notified where the orders have been placed.

—2.02 FACILITIES FOR INSPECTION

The contractor shall furnish all facilities for the inspection of material and workmanship in the mill and shop and inspectors shall be allowed free access to the necessary parts of the premises.

—2.03 REJECTIONS

The acceptance of any material or finished members by the inspector shall not be a bar to their subsequent rejection, if found defective. Rejected materials and workmanship shall be replaced promptly or be made good by the contractor.

—2.04 MEASURING CAMBER

A camber diagram shall be furnished the City Engineer showing the camber at each panel point for each truss, taken from actual measurements while the truss is assembled.

—2.05 MILL ORDERS AND SHIPPING STATEMENTS

The contractor shall furnish the City Engineer with as many copies of mill orders and shipping statements as the City Engineer may direct. The weights of the individual members shall be shown.

—2.06 WEIGHING

All structural steel shall be weighed in the presence of and certified to by the inspector. The contractor shall supply satisfactory scales and shall perform all the work involved in handling and weighing the various members. Car weights will not be accepted. Rivets, pins and other small parts shall be shipped in boxes and kegs and a list and description of the contained material and its weights shall be marked on the outside of the container.

The weight of all tools and erection material shall be kept separate.

—2.07 LOADING AND UNLOADING

The loading, transportation, unloading and piling of the structural material shall be so conducted that the metal will be kept clean and free from injury from rough handling.

11-3 SHOP WORK

—3.01 SHOP PLANS

The contractor will be required to furnish the City Engineer with all shop detail plans required for fabrication of the steel. The original drawings may be made either on paper or cloth but the details must be drawn in ink so that the prints will be clear and legible. Only complete sets of drawings, which have been checked, will be accepted for approval. Casting details, however, may be submitted for approval previous to the other details. Shop plans shall follow the design plans and the required strength shall be developed as shown in the plans and specifications. When sub-

mitting shop plans for approval, two sets of shop plans shall be furnished the City Engineer, who will retain one set and return the other either approved or with corrections marked thereon. After the plans have been approved, four sets of shop plans shall be furnished the City Engineer. All shop plans shall be submitted for approval at least fifteen days before fabrication is started and no material shall be fabricated until the plans have been finally approved by the City Engineer.

The City Engineer's approval of any shop plan is understood to be an acceptance of the character and sufficiency of the details and not a check on any dimensions.

—3.02 CHANGES AND SUBSTITUTIONS

No changes shall be made in any drawing after it has been approved except by the consent or direction of the City Engineer in writing.

Substitutions of sections having different dimensions than those shown on the plans shall be made only when approved in writing by the City Engineer. Should the substitution of heavier members be allowed upon the contractor's request, no extra weight will be allowed over the original design section.

—3.03 RIVET HOLES

When reaming is not required, holes in material three-fourths ($\frac{3}{4}$) inch or less in thickness may be punched full size. Holes in material more than three-fourths ($\frac{3}{4}$) inch in thickness shall be sub-punched and reamed, or drilled from the solid.

—3.04 PUNCHED HOLES

Full size punched holes shall be one-sixteenth inch ($\frac{1}{16}$ ") larger than the nominal diameter of the rivet. The diameter of the die shall not exceed the diameter of the punch by more than three thirty-second inch ($\frac{3}{32}$ "). Holes must be clean cut, without torn or ragged edges. If any holes must be enlarged to admit the rivets, they shall be reamed.

—3.05 ACCURACY OF PUNCHED HOLES

The punching of holes shall be so accurately done that, after assembling the component parts of a member, cylindrical pins one-eighth ($\frac{1}{8}$) inch smaller than the nominal diameter of the punched hole may be passed through at least seventy-five of any group of one hundred (100) contiguous holes in the same surface or in like proportion for any group of holes. If this requirement is not ful-

filled, the badly punched pieces shall be rejected. If any holes will not pass a pin three-sixteenth ($\frac{3}{16}$) inch smaller than the nominal diameter of the punched holes, this shall be cause for rejection.

—3.06 DRILLED HOLES

Drilled holes shall be one-sixteenth ($\frac{1}{16}$) inch larger than the nominal diameter of the rivet. Burrs on the outside surfaces shall be removed with a tool producing a one-sixteenth ($\frac{1}{16}$) inch fillet around the edge of the hole.

—3.07 SUB-PUNCHED AND REAMED HOLES

Sub-punched and reamed holes for rivets having diameters greater than three-fourths ($\frac{3}{4}$) inch shall be punched three-sixteenths ($\frac{3}{16}$) inch smaller than the nominal diameter of the rivet, and for rivets having diameters three-fourths ($\frac{3}{4}$) inch or less the holes shall be punched one-sixteenth ($\frac{1}{16}$) inch less than the nominal diameter of the rivet. The punch and die shall have the same relative sizes as specified for full size punched holes. After punching, the holes shall be reamed to a diameter one-sixteenth ($\frac{1}{16}$) inch larger than the nominal diameter of the rivet. Burrs resulting from reaming shall be removed with a tool producing a one-sixteenth ($\frac{1}{16}$) inch fillet around the edge of the hole.

Reaming of rivet holes shall be done with twist drills or with short taper reamers. Reamers preferably shall not be directed by hand. No oil or grease shall be used as a lubricant.

—3.08 ACCURACY OF REAMED AND DRILLED HOLES

Reamed or drilled holes shall be cylindrical and perpendicular to the member and their accuracy shall be the same as specified for punched holes except that, after reaming or drilling, eighty-five (85) of any group of one hundred (100) contiguous holes in the same surface, or in like proportion for any group of holes, shall not show an offset greater than one thirty-second ($\frac{1}{32}$) inch between adjacent thicknesses of metal.

—3.09 DRIFTING OF HOLES

The drifting done during assembling shall be only such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal.

—3.10 REAMING

All stringer and floor beam connections, all main members and

their connections and such other rivet holes as are indicated on the plans shall have sub-punched and reamed rivet holes or shall be drilled from the solid. This requirement shall not apply to rivet holes in top and bottom chord lateral members, lateral hangers, truss and girder sway bracing and to the lateral plates, connection angles, etc., connecting these members to the main members of the structure. Reaming shall be done after the pieces forming a built member are assembled and firmly bolted together. No interchange of reamed parts will be permitted.

Holes for field connections in main truss members shall be reamed with the entire truss assembled. All stringers and floor beam connections shall be reamed to a steel template not less than one inch thick.

—3.11 SHOP ASSEMBLING

All surfaces of metal to be in contact when assembled shall be carefully painted one coat of the paint specified for the shop coat. The paint shall be applied on surfaces free from dirt, loose mill scale or other foreign matter and the parts shall be assembled while the paint is plastic.

The component parts of the built member shall be assembled, drift pinned to prevent lateral movement, and firmly bolted to draw the parts into close contact before reaming, drilling or riveting is begun. At least twenty-five (25) per cent of the holes should be bolted up and the City Engineer may require fifty (50) per cent. Assembled parts shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation.

The member shall be free from twists, bends or other deformations.

Preparatory to shop riveting where the rivet holes are punched full size, they shall be cleared for the admission of the rivets by reaming.

End connection angles, stiffeners, angles, etc., shall be carefully adjusted to correct locations and rigidly bolted, clamped or otherwise firmly held in place until riveted.

—3.12 MATCH-MARKING

Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections, shall be match-marked, and diagram showing such marks shall be furnished to the City Engineer.

—3.13 RIVETS

The diameter of rivets indicated upon the plans shall be understood to mean their diameter before heating.

Heads of driven rivets shall be of approved shape, concentric with the shanks, true to size, full neatly formed, free from fins and in full contact with the surface of the member.

—3.14 FIELD RIVETS

Field rivets, for each size and length, shall be supplied in excess of the actual number to be driven to provide for losses due to misuse, improper driving or other contingencies. Rivets shall be free from furnace scale on their shanks and from fins on the under side of the machine formed heads.

—3.15 BOLTS AND BOLTED CONNECTIONS

Bolted connections shall not be used unless specifically authorized. Where bolted connections are permitted the bolts furnished shall be unfinished bolts (ordinary machine bolts), or turned bolts as specified or directed by the City Engineer.

—3.16 UNFINISHED BOLTS

Unfinished bolts shall be standard bolts with hexagonal heads and nuts. The use of "button head" bolts will not be permitted. Bolts transmitting shear shall be threaded to such a length that not more than one thread will be within the grip of the metal. The bolts shall be of lengths which will extend entirely through their nuts but not more than one-fourth ($\frac{1}{4}$) inch beyond them. The diameter of the bolt holes shall be one-sixteenth ($\frac{1}{16}$) inch greater than the diameter of the bolts used.

—3.17 TURNED BOLTS

Holes for turned bolts shall be carefully reamed or drilled and the bolts turned to a driving fit by being given a finishing cut. The threads shall be entirely outside of the holes and the heads and nuts shall be hexagonal. Approved nut-locks shall be used on all bolts unless permission to the contrary is secured from the City Engineer. When nut-locks are not used, round washers having a thickness of one-eighth ($\frac{1}{8}$) inch shall be placed under the nuts.

—3.18 RIVETING

Rivets shall be heated uniformly to a light cherry red color and shall be driven while hot. The heating of the points of rivets more than the remainder will not be permitted. When ready they shall be free from slag, scale and other adhering matter and when

driven they shall completely fill the hole. Burned, burred or otherwise defective rivets, or rivets which throw off sparks when taken from the furnace or forge shall not be driven.

Loose, burned, badly formed or otherwise defective rivets shall be cut out. Caulking and recupping of rivet heads will not be allowed. In cutting out defective rivets care shall be taken not to injure the adjacent metal and if necessary, the rivet shanks shall be removed by drilling.

Countersinking shall be neatly done and countersunk rivets shall completely fill the holes.

Shop rivets shall be driven by direct-acting riveters where practicable. The riveting machine shall retain the pressure for a short time after the upsetting is complete.

Pneumatic hammers shall be used for field riveting except when the use of other hand tools for riveting is permitted by the City Engineer.

—3.19 EDGE PLANING

Sheared edges of material more than five-eighths ($\frac{5}{8}$) inch in thickness shall, when required by the City Engineer, be planed to a depth of not less than one-eighth ($\frac{1}{8}$) inch. Re-entrant cuts shall be filleted before cutting.

—3.20 PLANING OF BEARING SURFACE

Ends of columns taking bearing upon base and cap plates shall be milled to true surfaces and correct bevels after the main section of these members and the end connection angles have been fully riveted.

Caps and base plates of columns and the sole plates of girders and trusses shall have full contact when assembled. The plates, if warped or deformed, shall be hot-straightened, planed or otherwise treated to secure an accurate, uniform contact. After being riveted in place the excess metal of countersunk rivet heads shall be chipped smooth and flush with the surrounding metal and the surfaces which are to come in contact with other metal surfaces shall be planed or milled, if necessary to secure proper contact. Correspondingly, the surfaces of base and sole plates which are to come in contact with masonry shall be rough finished, if not free from warps or other deformations.

Surfaces of cast pedestals and shoes which are to come in contact with metal surfaces shall be planed and those which are to take bearing upon the masonry shall be rough finished.

In planing the surfaces of expansion bearings the cut of the tool shall be in the direction of expansion.

Surfaces of bronze bearing plates intended for sliding contact shall be carefully milled and polish finished.

—3.21 ABUTTING JOINTS

Abutting ends of compression members shall, after the members have been riveted, be accurately faced to secure an even bearing when assembled in the structure.

Ends of tension members at splices shall be rough finished to secure close and neat but not necessarily contact fitting joints.

—3.22 END CONNECTION ANGLES

End connecting angles of floor beams and stringers shall be flush with each other and accurately set as to position and length of member. In general, end connection angles shall not be finished unless required by the City Engineer. However, faulty assembling and riveting may be cause for requiring them to be milled, in which case their thickness shall be reduced not to exceed one-sixteenth ($\frac{1}{16}$) inch, nor shall their rivet bearing value be reduced below design requirements.

—3.23 BUILT MEMBERS

The several pieces forming one built member shall be straight and close fitting. Such members shall be true to detailed dimensions and free from twists, bends, open joints or other defects resulting from faulty fabrication and workmanship.

—3.24 LACING BARS

The ends of lacing bars shall be neatly rounded unless otherwise indicated.

—3.25 WEB PLATES

Web plates of girders having no cover plates may be detailed with the top edge of the web flush with the backs of the flange angles. Any portion of the plate projecting beyond the angles shall be chipped flush with the backs of the angles. Web plates of girders having cover plates may be one-half ($\frac{1}{2}$) inch less in width than the distance back to back of flange angles.

When web plates are spliced, not more than three-eighths ($\frac{3}{8}$) inch clearance between ends of plates will be allowed.

—3.26 WEB STIFFENERS

End stiffener angles of girders and stiffener angles intended as supports for concentrated loads shall be milled or ground to

secure a uniform, even bearing against the flange angles. Intermediate stiffener angles shall fit sufficiently tightly to exclude water after being painted.

—3.27 WEB SPLICES AND FILLERS

Web splice plates and fillers under stiffeners shall fit within one-eighth ($\frac{1}{8}$) inch at each end.

—3.28 EYE-BARS

Eye-bars shall be straight and true to size and shall be free from twists, folds in the neck and head, or any other defect affecting their service strength. Heads shall be made by upsetting, rolling or forging. Welds in the body portions or in the head of bars will not be permitted. The form of the heads may be determined by the dies in use at the works where the eye-bars are to be made, if satisfactory to the City Engineer. The thickness of head and neck shall not overrun more than one-sixteenth ($\frac{1}{16}$) inch.

—3.29 BORING

Before boring, each eye-bar shall be properly annealed and carefully straightened. Pinholes shall be located on the center line of the bar and in the centers of the heads. The holes in the ends of the bars shall be bored simultaneously and be so accurately located that when the bars of the same truss panels are placed in a pile the pins may be completely inserted in the pinholes without driving. All eye-bars intended for the same locations in the trusses shall be interchangeable.

—3.30 ANNEALING

All eye-bars shall be annealed by heating uniformly to the proper temperature followed by slow and uniform cooling in the furnace. The temperature of the bars shall be under full control at all stages.

Forged pins, and other steel parts requiring their full strength, which have been partially heated shall be subsequently annealed. Slight bends in pieces of secondary importance may be made without heating the metal. Crimped web stiffeners need not be annealed.

—3.31 PINS AND ROLLERS

Pins and rollers shall be accurately turned to detailed dimensions and shall be smooth, straight and free from flaws. The final surface shall be produced by a finishing cut.

—3.32 FORGED PINS

Pins having a diameter greater than six (6) inches shall be forged and annealed.

—3.33 BORED PINS

Pins larger than eight (8) inches in diameter shall have a hole not less than two (2) inches in diameter bored longitudinally through their centers. Pins showing defective interior conditions shall be rejected.

—3.34 BORING PIN HOLES

Pin holes shall be bored true to detailed dimensions, smooth and straight, at right angles with the axis of the member and parallel with each other unless otherwise required. A finishing cut shall always be made.

The length outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from detailed dimensions more than one-thirty-second ($\frac{1}{32}$) inch. Boring of holes in built up members shall be done after the riveting is completed.

—3.35 PIN CLEARANCES

The difference in diameter between the pin and the pin hole shall be not more than one-thirty-second ($\frac{1}{32}$) inch. All pins shall be fitted to their respective pin holes in the assembled member and numbered.

—3.36 WELDS

Welding of steel shall not be permitted except to remedy minor defects and then only with the approval of the City Engineer.

—3.37 SCREW THREADS

Screw Threads shall make close fits in the nuts and shall be U. S. Standard, except that for diameters greater than one and one-half ($1\frac{1}{2}$) inches, they shall be made with six (6) threads to the inch.

—3.38 PILOT AND DRIVING NUTS

Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

11.4 ERECTION

—4.01 FIELD INSPECTION

All work of erection shall be subject to the inspection of the City Engineer who shall be given all facilities required for a thorough inspection of workmanship.

Material and workmanship not previously inspected will be inspected after its delivery to the site of the work.

—4.02 STORAGE

All material shall be stored in such manner as to prevent deterioration by rust or loss of minor parts. No material shall be piled so as to rest upon the ground or in water, but must be placed on suitable skids or platforms.

—4.03 FALSEWORK

All falsework shall conform to the specifications for falsework as specified under "Reinforced Concrete Structures."

—4.04 HANDLING MEMBERS

The field assembling of the component parts of a structure shall involve the use of methods and appliances not likely to produce injury by twisting, bending or otherwise deforming the metal. No member slightly bent or twisted shall be put in place until its defects are corrected and members seriously damaged in handling shall be rejected.

—4.05 ALIGNMENT

Before beginning the field riveting the structure shall be adjusted to correct grade and alignment and the elevations of panel points (ends of floor beams) properly regulated. For truss spans a slight excess camber will be permitted while the bottom chords are being riveted, but the correct camber and relative elevations of panel points shall be secured before riveting the top chord joints, top lateral system and sway bracing.

—4.06 STRAIGHTENING BENT MATERIAL

The straightening of bent edges of plates, angles and other shapes shall be done by methods not likely to produce fracture or other injury. The metal shall not be heated unless permitted by the City Engineer, in which case the heating shall not be to a higher temperature than that producing a dark cherry red color. After heating the metal shall be cooled as slowly as possible.

Following the completion of the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of incipient or other fractures.

—4.07 ASSEMBLING AND RIVETING

All field connections and splices shall be securely drift pinned and bolted before riveting. Important connections in trusses, girders, floor system, etc., shall have at least fifty (50) per cent of

the holes filled. An ample number of drift pins shall be used to prevent slipping at joints and splices. Structures erected by the cantilever method shall be field bolted to seventy-five (75) per cent full strength unless otherwise permitted by the City Engineer.

The results obtained in the field assembling and riveting of the members of a structure shall conform to the requirements for shop assembling and riveting. Field driven rivets shall be inspected and accepted before being painted.

Field riveting shall be done before the false work is removed, unless special permission to the contrary is given by the City Engineer.

No riveting shall be done at compression joints until the blocking has been adjusted so that there will be full and even bearing over the entire joint.

Railings shall not be riveted until the falsework has been released and the deck placed. Sidewalk railings on concrete walks shall be bolted instead of riveted.

—4.08 ADJUSTMENT OF PIN NUTS

All nuts on pins shall be thoroughly tightened and the pins so located in the holes that the members shall take full and even bearing upon them. All pins shall have sufficient thread to allow "burring" after the nuts are tightened.

—4.09 SETTING ANCHOR BOLTS

Anchor bolts shall be set in accordance with the requirements specified under Foundations, Section 10-2.03 C.

—4.10 SETTING ROCKER BEARINGS

Rocker bearings at the expansion end of spans shall be adjusted to the proper position for the prevailing temperature at the time of erection.

11-5 PAINTING

Unless otherwise provided by the special specifications, all steel structures shall be given one shop and two field coats of paint as specified under "Quality of Materials," and as follows:

—5.01 SHOP PAINTING

All structural steel shall be thoroughly cleaned of all mill scale, dirt, rust, chips, oil, grease or other deleterious material which will in any way affect the bond between the paint and the steel. The cleaning shall be done by thorough scraping and wire brushing. Grease and oil shall be removed by a cloth wet with benzine.

No painting shall be started until the inspector has examined the surfaces to be painted and accepted the same as suitable for painting. All surfaces shall be thoroughly dry and free from moisture.

Shop painting shall be done immediately after fabrication.

Surfaces in contact riveted in the shop shall not be painted.

Surfaces inaccessible after assembling, but not in contact, shall be given a shop coat of paint before assembling.

The steel shall not be handled until thoroughly dry.

—5.02 FIELD PAINTING

When the erection work is complete, including all riveting, straightening of bent metal, etc., all adhering rust, scale, dirt, grease or other foreign matter shall be removed as specified under shop painting.

As soon as the field cleaning is done to the satisfaction of the City Engineer, the heads of field rivets, bolts and any surfaces from which the shop coat has become worn or has otherwise become defective, and all shipping and erection marks, shall be thoroughly covered with one coat of the same paint as used in the shop and permitted to become thoroughly dry before the first field coat is applied.

The field coats shall then be applied, the second coat being thoroughly dry before the final coat is applied. At least five (5) days shall be allowed between successive coats.

—5.03 APPLICATION OF PAINT

All paint shall be of the mixtures specified and shall be applied in a thorough and workmanlike manner.

In general, brush application is required on all outside or easily accessible surfaces. However, if experienced operators are employed, permission may be given by the City Engineer to use spray guns, subject to his direction.

All brush coats shall be applied by means of round or oval brushes, except in places where it is impossible to use them. Particular care must be exercised to brush out thoroughly the paint film and to obtain in all cases a heavy, even coat on all surfaces. In no case will dipping be allowed as a means of applying the shop coat. All shop marks shall be painted on surfaces which have been previously given a coat of shop paint.

Great care must be exercised in thoroughly covering all inside surfaces of members and places of difficult accessibility, as shoes, panel points, etc.

On surfaces which are inaccessible for paint brushes, the paint shall be applied with sheep skin daubers specially constructed for the purpose.

Paint shall not be applied when the atmospheric temperature is below 40 degrees or above 100 degrees Fahrenheit, nor in wet, damp or foggy weather.

All work, including manufacture and mixing of paints, shall be subject to the direction and rejection of the City Engineer.

All metal coated with impure or unauthorized paint shall be thoroughly cleaned and repainted to the satisfaction of the City Engineer at the expense of the contractor.

If it is necessary in cool weather to thin paint in order that it shall spread more freely, this shall be done only by heating in hot water.

—5.04 MACHINE FINISHED SURFACES

With the exception of abutting chord and column splices, column and truss shoe bases, machine finished surfaces shall be coated, as soon as practicable after being accepted, with a hot mixture of white lead and tallow before removal from the shop. Surfaces of iron or steel castings milled for the purpose of removing scales, scabs, fins, blisters or other surface deformations shall generally be given a coat of shop paint.

The composition used for coating machine finished surfaces shall be mixed in the following proportions:

- 4 pounds pure tallow
- 2 pounds white lead
- 1 quart pure linseed oil

11-6 MEASUREMENT AND PAYMENT

—6.01 BASIS OF PAYMENT

The contract price for structural steel shall include all material, labor, supplies and equipment used in the manufacture, fabrication, transportation, erection and painting of all structural steel necessary for the proper completion of the work.

Payment will be made at the price bid per pound in place, unless otherwise provided in the special provisions. For the purpose of payment, such minor items as bearing plates, pedestals, anchor bolts, etc., shall unless otherwise provided, be considered as structural steel, even though made of other materials.

—6.02 WEIGHT PAID FOR

Payment for Structural Steel shall be based on the weight of metal in the fabricated structure, including field rivets shipped, providing such rivets do not exceed by ten (10) per cent the weight of the rivets required. The weight of erection bolts, pilot and driving nuts, field paint and all boxes, crates or other containers used for packing, together with sills, struts and rods used for supporting members during transportation, shall be excluded.

Weights paid for shall be shop-scale weights providing such weights are within the allowable variation of the computed weights as hereinafter specified.

—6.03 VARIATION IN WEIGHT

The allowable variation of the total scale weight of any structure above the weight as computed from the approved shop plans, shall not exceed two (2) per cent. Payment shall not be made for any greater excess in weight but an additional allowance of five-tenths (0.5) of one per cent of the total computed weight may be made for shop paint.

If there is a deficiency in scale weight of any member of more than two (2) per cent of the computed weight, it may be cause for rejections.

—6.04 COMPUTED WEIGHT

The weight of steel shall be assumed at four hundred ninety (490) pounds per cubic foot. The weight of cast iron shall be assumed at four hundred fifty (450) pounds per cubic foot.

The weight of rolled shapes and of plates up to and including thirty-six (36) inches in width, shall be computed on the basis of the nominal weights and dimensions as shown on the approved shop drawings, deducting for copes, cuts, etc.

The weights of plates wider than thirty-six (36) inches shall be computed on the basis of their dimensions, as shown on the approved shop drawings, deducting for cuts, etc. To this shall be added one-half of the allowable percentage of overrun in weight given in the Standard Specifications for Structural Steel for Bridges, Serial Designation A-7, of the American Society for Testing Materials.

The weight of heads of shop driven rivets shall be included in the computed weight, assuming the weights to be as follows:

<i>Diameter of Rivet</i>	<i>Weight for 100 Heads</i> <i>Lbs.</i>
1/2"	4.5
5/8"	8.6
3/4"	14.3
7/8"	21.3
1"	31.0

The weight of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of ten (10) per cent for fillets and overrun.

CONTRACT (Sample Form)

THIS CONTRACT, Made this.....day of
....., A. D. 19....., by and between the
City of Seattle, a Municipal Corporation of the State of Wash-
ington, party of the first part, and.....
....., part.....of the second part:

WITNESSETH:

Section 1. That the said part.....of the second part agree.....
to improve
in said City of Seattle as ordered by Ordinance No.....
in all respects in accordance with the plans now on file in the office
of the City Engineer of said City and in accordance with the
standard plans and specifications of the City of Seattle, duly ap-
proved by the Board of Public Works thereof on the 14th day of
September, 1944, and filed in the office of the City Comptroller
and ex-officio City Clerk, being File No. 182,800 in said office,
insofar as the provisions of said standard plans and specifica-
tions are applicable to said work, which said standard plans and
specifications are, by express reference thereto, hereby made a
part of this contract; and also in accordance with the special speci-
fications and instructions hereto attached, and the Laws of the
State of Washington, and Charter and Ordinances of the City of
Seattle, as amended and now in force, all of which, so far as
applicable, are hereby made a part of this contract.

Section 2. The said part.....of the second part agree.....
to begin the work embraced in the contract for this improvement
immediately after written notice shall have been given to said
part.....of the second part by the City Engineer, and to carry
said work on regularly and uninterruptedly thereafter (unless the
City Engineer or the Board of Public Works shall otherwise, in
writing, specially direct), with such force as to secure its comple-
tion within
days (Sundays and holidays included) after such notice to begin
work: the time of beginning, rate of progress and time of com-
pletion being essential conditions of this contract.

Section 3. That the said party of the first part agrees to pay to
said part.....of the second part for the actual quantities in the

CONTRACT

completed work according to the schedule of unit prices set forth in the proposal hereto attached and made a part of this contract.

Section 4. Subject to the provisions of Chapter 246, Laws of Washington for 1943, the said party of the second part hereby covenants, stipulates and agrees:

That he will pay or cause to be paid to the employees on or in connection with this work or under this contract not less than the current hourly rate of wages specified for the class of labor performed.

That he will not enter directly or indirectly into any agreement with any person or persons for labor or employment at any less wage.

That he will not make or permit any assignment or transfer of this contract, or of any of the work to be performed hereunder, nor sublet said work or any part thereof in any manner or by any scheme, device or subterfuge which will permit or secure the performance of labor upon or in connection with this work or under this contract, at a rate of wage less than herein specified.

That every scheme or device by which employes employed upon or in connection with this work or under this contract shall sublet or subcontract the same, or take any transfer or assignment of this contract or of any work herein provided for, as a co-partnership or other association, whereby in lieu of receiving the minimum rate of wages hereinabove specified they shall receive a less sum in cash and become sharers in the profits or losses under this contract in compensation for their labor, shall be deemed a subterfuge, device or scheme to evade the provisions of this contract, and shall be null and void and shall render this contract subject to forfeiture.

That the above covenants are made for the benefit of the individual employes of the contractor, and that any employe performing work or labor under this contract shall have a cause of action against the contractor for the difference between the wages herein specified and the amount actually paid to such employe.

That he will keep complete and accurate pay rolls, upon which shall appear the following information with respect to each person employed upon or in connection with this work or under this contract:

1. Name and residence address;
2. Classification of work as defined by specifications;

CITY OF SEATTLE

3. Number of hours employed each day;
4. Total number of hours employed each pay roll period;
5. Rate of wages;
6. Total amount earned;
7. Deductions authorized or required by law;
8. Net amount paid;
9. Whether a citizen of the United States;
10. Whether a head of a family;

said pay roll to be at all times accessible and open to inspection by the Board of Public Works, and a copy thereof duly signed by the contractor or his authorized agent and verified before a Notary Public, to be filed with the Secretary of said Board not later than seventy-two (72) hours after the expiration of each pay roll period.

That all employes will be paid in full not less often than once each week and in lawful money of the United States, in the full amount accrued to each employe at the time of closing of the pay roll, which shall not be more than three (3) days prior to the date of payment.

That preference in employment upon the work contemplated herein or done hereunder shall at all times be given to citizens of the United States who are heads of families and residents of The City of Seattle, and who shall have been such residents for at least one year last past: Provided that citizens of the United States who are not heads of families and residents of The City of Seattle for at least one year last past may be employed in the event that citizens and residents who are heads of families and are competent and willing to perform the work required for or upon this improvement or under this contract, cannot be obtained; that the exclusion of aliens from the work will exclude any and all alien members of the undersigned contracting firm or co-partnership; and that no alien will be employed thereon or in connection therewith without a valid and subsisting permit from the Board of Public Works therefor.

That to facilitate the enforcement of the above covenants the contractor agrees to prepare and file with the Board of Public Works a complete list containing the names and resident addresses of all of his employes and keep the same up to date at all times.

That in event of violation of any of these covenants or any pro-

CONTRACT

vision thereof payment due from The City of Seattle on any work done under this contract may be withheld until full compliance therewith; that the work may be stopped, or, at the discretion of said Board of Public Works, with the consent of the City Council, this contract may be cancelled and forfeited.

IN WITNESS WHEREOF, Said party of the first part has caused these presents to be signed by the Chairman of the Board of Public Works and to be attested by the Secretary of said Board; and said part.....of the second part.....hereunto set.....hand.....the day and year first above written.

THE CITY OF SEATTLE,

By.....

Chairman of Board of Public Works.

.....
Secretary Board of Public Works.

..... (Seal)

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