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CITY OF SEATTLE

DEPARTMENT OF PUBLIC WORKS

STANDARD PLANS

AND

SPECIFICATIONS

CITY OF SEATTLE

DEPARTMENT OF PUBLIC WORKS

STANDARD PLANS

AND

SPECIFICATIONS

Third Edition

PREPARED BY THE CITY ENGINEER

APPROVED BY THE BOARD OF PUBLIC WORKS

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GENERAL STIPULATIONS APPLICABLE TO ALL CONTRACTS

1. PLANS AND SPECIFICATIONS PART OF CONTRACT

The special specifications, detailed plans, proposal and contract for this improvement, with these standard plans and specifications and such additional detail plans as may be prepared during the progress of the work, together with the Laws of the State of Washington and the Charter and Ordinances of the City of Seattle, so far as applicable, shall constitute the contract for this improvement and shall be considered as a whole.

The special specifications and detailed plans accompanying the proposal are intended to modify, and shall take precedence over the standard specifications and standard plans.

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.

2. DIMENSIONS

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

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.

4. 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:

Adj.	Adjust
Adj. W. M.	Adjust Watermains
Arm. Con. Cb.	Armored Concrete Curb
Asp. Pav.	Asphalt Pavement
Asp. Con. Pav.	Asphaltic Concrete Pavement

B. D.	Box Drain
Br. Ch.	Brick Valve Chamber
Br. Pav.	Brick Pavement
Br. Gutters	Brick Gutters
Br. In	Break In
Br. Sew.	Brick Sewer
C. W.	Concrete Sidewalks
C. to C.	Center to Center
	Center Line
Cor. C. W.	Corrugated Concrete Sidewalks
Con.	Concrete
Con. Dr.	Concrete Drain
Con. Cb.	Concrete Curb
Con. Pav.	Concrete Pavement
Con. Ret. Wall	Concrete Retaining Wall
Con. Sew.	Concrete Sewer
C. S. S.	Concrete Side Stop
Cb. Inlet	Curb Inlet
Conn.	Connect
C. B.	Catch Basin
C. I. P.	Cast Iron Pipe
Cr.	Cross
C. R.	Curb Radius
D. B.	Drift Bolt
E.	East
Ell. C. B.	Elliptical Catch Basin
Elev.	Elevation
Exc.	Excavation
Em.	Embankment
Ex.	Existing
F. T.	Flush Tank
G. V.	Gate Valve
Gal. I. P.	Galvanized Iron Pipe
Gr. Cb.	Granite Curb
Gr. Pav.	Granite Pavement
Gr. S.	Granite Stop
Heavy C. I. V. B.	Heavy Cast Iron Valve Box
Hyd.	Hydrant
Hyd Ext.	Hydrant Extension
I. C.	Integral Curb
L.	Length
Light C. I. V. B.	Light Cast Iron Valve Box
Loc.	Location
M. C.	Monument Case
M. H.	Manhole
N.	North
O. D.	Open Drain
Pav.	Pavement
P. S.	Pipe Sewer
Plk.	Planking
Pos.	Position
Reconn.	Reconnect
Reb.	Rebuild
Repl.	Replace

S.	South
S. S. Pav.	Sandstone Pavement
S. S.	Side Sewer
Sew.	Sewer
Sub. Dr	Sub Drain
S. B.	Sand Box
Std.	Standard
Temp. W. W.	Temporary Wood Walks
Temp. X. Walks	Temporary Cross Walks
Temp. Plk.	Temporary Planking
Temp. Inlet	Temporary Inlet
W.	West
Wood B. H.	Wood Bulkhead
Wood C. & G.	Wood Curb & Gutter
Wood B. S.	Wood Box Sewer
W. M. H.	Wood Manhole
W. M. H. Ext.	Wood Manhole Extension
W. M.	Watermain
W. P.	Wood Pipe
W. S.	Wood Stop
W. S. S.	Wood Side Stop
Wl. W.	Wood Sidewalks
W. V. B.	Wood Valve Box
X Walks	Cross Walks

5. BIDDERS TO EXAMINE LOCATION OF WORK

Bidders must examine the location of the proposed improvement and judge for themselves the nature of the work to be done.

6. 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.

7. FEES AND ROYALTIES

All fees or royalties for any patented invention, article or arrangement in any manner connected with the work, or with these specifications, shall be included in the price stated in the proposal, and the contractor shall protect and hold the City harmless against any and all demands or claims for such fees or royalties, whether such demands or claims are filed during the life of this contract or after its completion.

8. 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.

9. ASSIGNMENT OF CONTRACT

No assignment of any contract shall be made without the written 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.

10. SUBLETTING OF CONTRACT

Subletting of any portion of the work requiring the employment of labor is hereby expressly forbidden; provided however, that this prohibition does not apply to the furnishing of material therefor. All labor on the work shall be employed directly by the contractor.

11. 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.

12. WORKMEN

All workmen employed shall be skilled in the performance of the special work to which they may be assigned.

13. RATES OF WAGES

The contractor shall pay his employees on the work herein specified, not less than the current rate of wages paid by the City of Seattle for work of like nature. In any event, the minimum rate of wage shall not be less than two dollars and seventy-five cents ($2.75) per day. He shall give preference to citizens of the United States who are heads of families.

14. PAYMENT OF WAGES

The contractor shall pay the wages of all persons employed on or about said work, and for all other service. He shall pay for all materials purchased therefor, and the City of Seattle may withhold any and all payments under this contract until 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 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 therefor upon the local 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 seventy per cent. (70%) to be paid to such contractor, as provided in this contract, or from any other sum or sums due said contractor.

15. HOURS OF LABOR

Except in cases of extraordinary emergency, all work shall be performed in work days of eight (8) hours each. No extraordinary emergency shall be construed to exist in any case where other labor can be found to take the place of labor which has already been employed for eight (8) hours during any calendar day. In case the work is not done according to the provisions of this section, the Board of Public Works may cause the contract to be cancelled.

16. CONTRACTOR RESPONSIBLE FOR WORK DONE

The contractor shall furnish for the prices bid, all skill, labor and materials 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 until its completion and acceptance, and shall be liable for any defects which may appear. The fact that an inspector was present during the progress of any construction, does not relieve the contractor from responsibility for defects discovered after the completion of the work.

17. CHANGES IN PLANS AND QUANTITIES

The City Engineer, under the direction of the Board of Public Works and upon its approval, 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 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.

18. CLAIMS FOR EXTRAS

If for any reason extra work should be ordered by the City Engineer or the Board of Public Works and a price for such extra work cannot be agreed upon, it shall be paid for at the actual cost of field supervision, labor and material required, with the addition of twelve per cent (12%) to cover profit, use of tools and payments to the State of Washington as required by the Workmen's Compensation Act. No claim for any extras under this contract shall be allowed by the City Engineer or the Board of Public Works unless the same shall have been submitted prior to the final acceptance of the work and the issuance of the final estimate, or unless the same shall have been ordered in writing as herein provided.

19. ORDERS TO BE STRICTLY OBEYED

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 in anything relating to the work, or shall appear to be incompetent or disorderly, he shall, upon the order of the City Engineer, be at once discharged and not again employed upon any part of the work.

20. 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 twenty-four (24) 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.

21. 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 dig all holes and furnish lumber for stakes necessary to give grades, and he 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.

22. 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 hydrant 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.

Whenever fills or the back fills in trenches are water settled, the water used shall be taken from the mains or hydrants of the City Water Department. The City Water Department, unless a meter is used, will charge the Contractor for water used in settling earth at the rate of one dollar forty cents ($1.40) for every one hundred cubic yards of earth water settled. The Contractor will be required to furnish all hose and other implements necessary for water settling. The City Inspector in charge of the work will be authorized to open and close the hydrants, provided that any

damages resulting to the city hydrants while in use for the purpose of water settling will be repaired by the City Water Department and the cost of said repairs will be deducted from the Contractor's final estimate.

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 will be made for any effect which ground water or rain water may have upon the settlement of the fill or backfill.

23. PROTECTION TO 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 precaution in the prosecution of the work.

24. PRESERVATION OF MONUMENTS

The contractor shall not disturb any 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 each monument or hub disturbed without such orders.

25. 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 repairs must 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.

26. PROTECTION TO PUBLIC UTILITIES

The contractor shall support and protect by timbers or otherwise, all water or sewer pipes, conduits, poles, wires or other apparatus owned by the City of Seattle, which may be in any way affected by the work, and do everything necessary to support, sustain and protect the same, over, along or across said work. In case any of said water or sewer pipes, wires, poles 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 inform himself as to the existence and location of any underground public utilities and protect the same against damage.

27. 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.

28. 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.

29. MAINTAINING TRAFFIC

The contractor shall not obstruct travel unnecessarily, and shall cause as little inconvenience as possible to the occupants of abutting property and to the general public.

30. CONTRACTOR TO MAINTAIN GUARDS

The contractor shall erect and maintain good and sufficient guards, barricades and signals 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 the Board of Public Works, 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 any improvement to be closed to traffic for a definite length of time or for a period as directed by the City Engineer, the contractor shall erect and maintain at each street, alley, driveway, or other unprotected place leading to the improvement, a barrier of such a type as is approved by the City Engineer, and which cannot be easily removed without tools.

No payment for such barriers shall be allowed other than the price bid for the improvement.

31. 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.

32. 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.

33. EXTENSION OF TIME

The contractor shall not be entitled to any claim for damages by reason of any injunction, or suspension of the work by the Board of Public Works, or 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.

34. BILLS OF CITY DEPARTMENTS—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 will be estimated and shown on the proposal blank for the improvement. Bills due the City or any department thereof, shall be a first lien upon and shall be deducted from any money due or to become due the contractor.

35. INDUSTRIAL INSURANCE

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 Chapter 74 of the Laws of 1911 of the State of Washington (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.

36. ESTIMATES AND PAYMENTS

During the time allowed by the Board of Public Works 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 during the previous month by the contractor, but after the expiration of the time allowed by the Board of Public Works for the completion of said contract. no estimate shall be issued other than the final estimate after the completion and acceptance of the work. Said final estimate issued by the City Engineer shall include, in addition to a statement of the amount of money due the contractor, a statement of the amount of money expended for abstracts, advertising, etc., and shall include engineering expense incurred prior to the expiration of the time allowed by the Board of Public Works for the completion of the contract.

All engineering expense incurred after the time allowed by the Board of Public Works for a completion of the contract, shall be borne by the contractor as a penalty for failure to complete the work within the specified time.

The City Comptroller shall, on or about the 25th day of the month following the issuance of the estimate by the City Engineer, deliver to the contractor money or warrants in an amount equal to seventy per cent (70%) of such estimate, and the balance of said contract price, being thirty per cent (30%) of such estimate, shall be retained for a period of thirty (30) days after the final completion of the improvement and its acceptance by the Board of Public Works. But the acceptance of said work by the Board of Public Works shall not prevent the City from thereafter making claim against the contractor for uncompleted or defective work if the same is discovered within two (2) years from the date of completion and acceptance of the work.

No payment shall be made to the contractor in any event of any part of said thirty per cent (30%) reserve until the City Engineer shall certify to the City Comptroller that the thirty (30) 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. In case notice of any lien against said thirty per cent (30%) is given the City during said thirty (30) days, by or on behalf of any person claiming such lien, or in case the City Engineer shall report any claim of the City by reason of uncompleted or defective work, the amount of all liens so claimed shall be reserved by the City until final determination of such lien claims, and the cost of perfecting such uncompleted or defective work shall be retained until such uncompleted or defective work shall have been perfected or arranged to the satisfaction of the Board of Public Works. No payment shall be made for any portion of said thirty per cent (30%) reserve, nor shall the warrant 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. Subject to the provisions contained in this section, the thirty per cent (30%) reserve above mentioned shall, at the expiration of said thirty (30) days, be paid to the contractor in warrants.

All warrants issued in payment of estimates provided for in this section shall be drawn against the local improvement district fund under which the work is being done, and shall bear interest at the rate of eight per cent (8%) per annum from date of issuance until redeemed; provided, however, that such warrants shall not bear interest beyond a date one hundred twenty (120) days after the time fixed in the proposal and contract for the completion of the contract.

If, by reason of the failure of the contractor to complete the work within the time specified, no funds are available for the redemption of said warrants, on the date on which interest thereon ceases, the contractor shall have no claim for further interest; provided, however, that if prior to the filing of the assessment roll additional time is granted by the Board of Public Works for the completion of the contract, the contractor shall be allowed a sum of money without interest, representing interest at eight per cent (8%) per annum on outstanding warrants from the date when the interest on such warrants ceases to the date when the funds are available for the redemption of such warrants, but such amount shall not exceed a sum equivalent to interest at eight per cent (8%) per annum on outstanding warrants for the period for which such extension of time was granted.

Said warrants shall be redeemed on or before a date one hundred twenty (120) days after the completion and acceptance of the contract, in order of priority, in cash so far as payments into local improvement district fund shall permit. The amount of such warrants not redeemed in cash, shall, if the mode of payment be "Payment by Bonds," be redeemed in order of their priority in local improvement district bonds, or, if the mode of payment be "Immediate Payment," by issuance of a warrant drawn on the local improvement district fund, bearing interest at the rate of eight per cent (8%) per annum from date of issuance until redeemed.

37. DECISION OF QUESTIONS

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 to properly 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.

38. 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 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 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 this 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 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.

39. PERSONS TO WHOM CONTRACTS ARE FORBIDDEN

The Board of Public Works is by the City Charter prohibited 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.

QUALITY OF MATERIALS

40. BRICKS AND BRICK BLOCKS

(a) VERTICAL FIBER BRICKS

Vertical fiber bricks shall conform in shape and dimensions to the standard plans shown on page 15.

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. They shall be so made that after being laid the exposed surface shall be a section perpendicular to the direction in which the brick was forced through the die.

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 hereinafter stated:

(1) 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).

(2) 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%).

(3) 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 building brick. 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 (⅜″) in diameter.

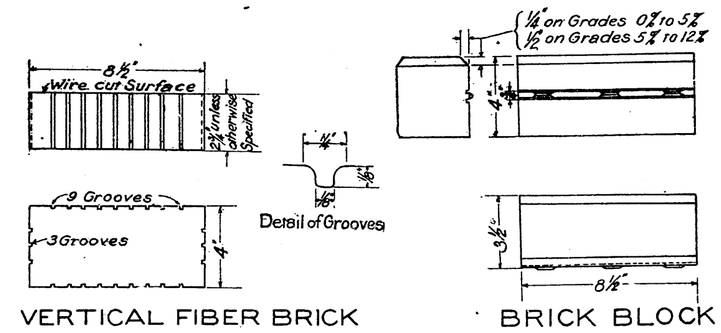
(b) BRICK BLOCKS

Brick blocks shall conform in shape and dimension to the standard plans shown below.

Blocks having special shapes or dimensions shall be furnished when required according to the details shown on the special plans for the improvement.

Blocks shall be made by the stiff mud, wire cut process and shall not be repressed.

Blocks shall be divided according to quality into three classes, "A," "B" and "C," and the quality of blocks for each class shall conform in all respects to the requirements for the same class of bricks as specified under Vertical Fiber Bricks, Section 40 (a).



VERTICAL FIBER BRICK BRICK BLOCK

41. CAST IRON

All iron castings, with the exception of watermain castings used in the pipe line proper (such exceptions are covered by Section 143), shall conform in quality to the Standard Specifications of the American Society for Testing Materials for Gray Iron Castings, Serial Designation A-48-05, which specifications are essentially as follows:

(a) MANUFACTURE

All castings shall be gray iron castings and shall be made by the cupola process. Castings shall be true to pattern, free from cracks, flaws and excessive shrinkage. In other respects they shall conform to whatever points may be covered by special specifications.

(b) CLASS OF CASTINGS

The following standards have been adopted to classify light, medium and heavy castings:

Castings in which any section is less than one-half inch (½″) thick shall be known as light castings.

Castings in which no section is less than two inches (2″) thick shall be known as heavy castings.

Medium castings are those not included in the above classifications.

(c) CHEMICAL PROPERTIES

The sulphur content shall be as follows:

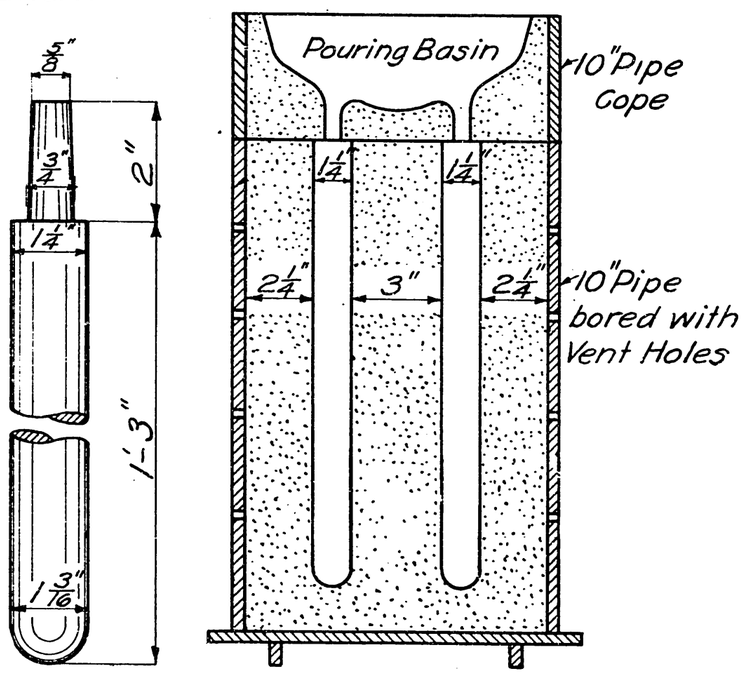
Light	castings—not	over	0.08	per	cent
Medium	"	"	0.10	"	"
Heavy	"	"	0.12	"	"

(d) QUALITY OF IRON

The quality of the iron going into castings under specifications shall be determined by the "Arbitration Bar."

(e) TEST BARS

"Arbitration Bars" shall be one and one-quarter inch (1¼") in diameter and fifteen inches (15") long. The mold for the bars is shown in the figure. The bottom of the bar is one-sixteenth inch ($\frac{1}{16}$") smaller in diameter than the top to allow for draft and for the strain of pouring. The pattern shall not be rapped before withdrawing. The flask shall be rammed up with green molding sand, a little damper than usual, well mixed and put through a No. 8 sieve with a mixture of one to twelve (1:12) bituminous facing. The mold shall be rammed evenly and fairly hard, thoroughly dried and not cast until it is cold. The test bar shall not be removed from the mold until cold enough to be handled.



MOLD FOR ARBITRATION TEST BARS

Two sets of bars shall be cast from each heat, one set from the first and the other from the last iron going into the castings. Where the heat exceeds twenty (20) tons, an additional set of two bars shall be cast for each twenty (20) tons or fraction thereof above this amount. In case of a change of mixture during the heat, one set of two bars shall be cast for every mixture other than the regular one. Each set of two bars is to go into a single mold. The bars shall not be rumbled or otherwise treated, but shall be simply brushed off before testing.

Test specimens shall be withdrawn from the molds only in the presence of the City Engineer or his duly authorized representative. All castings and test specimens shall be match-marked.

(f) TESTS

The minimum breaking strength of the "Arbitration Bar" under transverse load shall not be under:

Light castings	2500	pounds
Medium "	2900	"
Heavy "	3300	"

In no case shall the deflection be under 0.10 inch.

The transverse test shall be made on all bars cast, with supports twelve inches (12") apart, load applied at the middle, and the deflection at rupture noted. One bar of every two of each set made shall fulfill the requirements to permit acceptance of the castings represented.

The rate of application of the load shall be from twenty (20) to forty (40) seconds for a deflection of 0.10 inch. Borings from the broken pieces of the "Arbitration Bar" shall be used for sulphur determinations. One determination for each mold made shall be required. In case of dispute, the standards of the American Foundrymen's Association shall be used for comparison.

(g) INSPECTION

The inspector shall have reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with these specifications. All tests and inspection shall, as far as possible, be made at the place of manufacture prior to shipment.

(h) COATING

All castings shall be coated as specified in Section No. 143 under Cast Iron Pipe Watermains.

(i) PAYMENT

The price bid for items which include castings, shall include the cost of making and furnishing the test bars specified herein.

42. CEMENT

Cement shall be a true Portland cement, dry and free from lumps and of a brand known to possess the proper qualifications. It shall be delivered on the work in original packages with the factory name thereon. It 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 carload 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.

(a) 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 three and one-half (3½) 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.

(b) FINENESS

A No. 200 sieve shall retain not more than fifteen per cent (15%) by weight, provided that no cement shall be rejected when a No. 200 sieve retains eighteen per cent (18%) or less, if the breaking strength of the briquettes does not fall below the normal average breaking strength for the particular brand of cement in question, as shown by the records of the testing laboratory of the City Engineer for the preceding six (6) months, and provided further that the soundness and other qualities of the cement conform to these specifications.

All testing shall be done in conformity with the methods and practice in use in the testing laboratory of the City Engineer.

(c) SET

Initial set to be developed in not less than one (1) hour: hard set in not less than two (2) hours nor more than ten (10) hours.

(d) TESTS

(1) Tensile Strength

Briquettes made of one (1) part cement and three (3) parts standard Ottowa sand by weight, after one (1) day in moist air and six (6) days in clear water, shall show a tensile strength of not less than two hundred (200) pounds per square inch, and after one (1) day in moist air and twenty-seven (27) days immersion in water, not less than three hundred (300) pounds per square inch.

(2) Boiling Test

Pats about three (3) or four (4) inches across by about one-half (½) inch thick in the center and tapering to a thin edge shall be made from cement paste of normal consistency, and placed upon a clean glass plate about four (4) inches square. Then these pats shall be kept in a moist atmosphere for twenty-four (24) hours and then exposed in an atmosphere of steam above boiling water, in a loosely closed vessel for five (5) hours, and at the expiration of that time must remain firm and hard, and show no signs of cracking, distortion or disintegration.

(3) Additional Tests

In addition to the tests hereinbefore specified, all cement shall be subject to such other tests as may be necessary to determine whether or not it possesses the proper qualifications for the particular work for which it is intended. Should there be discovered at any time any objectionable characteristics in any cement being used, or should any cement fail to make good concrete or mortar, its further use shall be prohibited, regardless of the fact that it may have satisfactorily passed the tests hereinbefore specified.

43. COAL TAR CREOSOTE OIL

(a) OIL "A"

Oil "A", unless otherwise specified shall be used for treating all creosoted piling and lumber.

This oil shall be pure coal tar creosote free from admixture with any other material, with a specific gravity of 1.047 to 1.107 at thirty-eight degrees (38°) Centigrade. When distilled by the method adopted by the American Railway Engineering Association, the creosote, calculated on the basis of the dry oil, shall show a distillation as follows:

0° to 170° Centigrade, not more than 0.5%
170° to 210° Centigrade, not more than 3.0%
210° to 235° Centigrade, not less than 5.0% nor more than 15.0%
235° to 270° Centigrade, not less than 11.0% nor more than 22.0%
270° to 315° Centigrade, not less than 20.0% nor more than 30.0%
315° to 360° Centigrade, not less than 20.0%

The residue shall be soft and shall not be over 30% of the original sample, and shall show a penetration of not less than one hundred fifty degrees (150°) Dow at a temperature of seventy-seven degrees (77°) Fahrenheit.

(b) OIL "B"

Oil "B", unless otherwise specified shall be used for treating wood paving blocks.

This oil shall be pure coal tar creosote, free from admixture of any other material, with a specific gravity of 1.092 to 1.142 at thirty-eight degrees (38°) Centigrade. When distilled by the method adopted by the American Railway Engineering Association, the creosote, calculated on the basis of the dry oil, shall show a distillation as follows:

0° to 235° Centigrade, not less than 1% nor more than 5%
235° to 270° Centigrade, not less than 2% nor more than 5%
270° to 315° Centigrade, not less than 7% nor more than 15%
315° to 360° Centigrade, not less than 30%

The residue shall be soft and shall show a penetration of not less than one hundred fifty degrees (150°) Dow at seventy-seven degrees (77°) Fahrenheit.

When a small portion of this residue is placed on white filter paper, and warmed, the spot produced, when viewed by transmitted light, shall not be black, but shall be of amber or reddish brown color. If the spot is black, the oil shall be rejected.

44. CONCRETE

Wherever concrete is mentioned in these specifications the following methods and requirements shall be strictly enforced:

(a) PROPORTIONS OF MATERIALS

The unit of measure shall be the cubic foot. Concrete shall consist of one (1) part Portland Cement, three (3) parts Sand and six (6) parts Gravel, unless otherwise shown or indicated.

Sand and gravel shall be measured in precise measuring hoppers of approved design or in wheelbarrows, the struck measurement of which is such that an even number of barrow loads constitutes the correct quantity of sand for one batch of the proportions specified.

This result may be obtained either by building a wheelbarrow of the proper capacity, or building a sheet metal bulkhead in the standard iron barrow which will reduce its capacity to the specified volume.

The wheelbarrows shall be loaded flush with the top and struck before dumping. Four (4) sacks of cement each weighing ninety-four (94) pounds net shall be considered equivalent to three and one-half (3½) cubic feet, and all proportions of sand and gravel shall be calculated on this basis. The contractor shall keep upon the work at all times, a measuring box 12″x12″x10½″ holding 0.875 Cu. Ft. or the volume of one (1) sack of cement.

(b) WATER

Water used for mixing concrete shall be obtained from the City's water system.

The amount of water required for each batch shall be determined by the City Engineer. The mixer shall be equipped with a tank which is provided with a float indicator or a water gage and an automatic shut-off valve.

This valve shall close automatically when the proper amount of water has reached the tank and the float shall indicate this fact by some means directly above the tank. Just sufficient water shall be used to make concrete of a pasty, quaking consistency, and from which no water runs after floating. A wet, sloppy mixture shall not be used.

(c) MIXING

All concrete shall be mixed in a machine of the batch type. Continuous mixers shall not be used.

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

For laying concrete pavements and concrete pavement base, the concrete shall be delivered from the mixer to the subgrade by means of a boom and bottom dumping bucket. The use of spouts or chutes is prohibited.

The mixing shall continue for not less than one (1) minute after all the materials are in the drum. The drum shall turn at a speed of from fourteen (14) to seventeen (17) revolutions per minute, unless otherwise directed by the City Engineer. 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 when one (1) minute of mixing has elapsed, and its mechanism shall be so constructed that it will be put into operation when the skip is raised to its full height while dumping the charge. The bell shall be of such a size that its ringing can be plainly heard while the mixer is in operation. No concrete shall be discharged by the mixerman until the signal bell has rung. This timing device shall be tested each day before beginning work; it shall be placed in a stout metal box having a glass door which is furnished with a staple and hasp. Only the City Engineer shall regulate this apparatus and he will furnish the lock and key.

The contractor shall keep the interior of the drum of the mixer free from the incrustations of concrete. If a boom or bucket

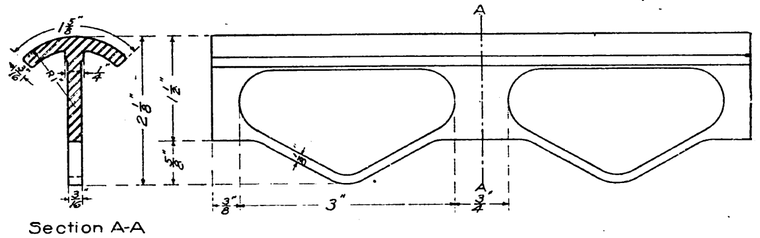
attachment is used, the latter shall be kept in good order so that mortar does not leak out when the doors are closed.

Except in cases recognized by the City Engineer as emergencies, no concreting shall be done when the temperature is below forty (40) degrees 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 is placed, it shall be protected until thoroughly hardened, in a manner satisfactory to the city Engineer.

45. CURB ARMOR

Curb armor of open anchorage type known as Kahn Curb Bar and of dimensions shown, or any pattern approved by the City Engineer, shall be used in concrete curb construction where indicated on the plan. The quality of steel shall conform to the requirements for billet steel concrete reinforcement bars. The metal shall be thoroughly galvanized. Bars showing chipping or spalling of galvanizing shall be rejected.

Armor for curves shall be accurately bent according to plan. When it becomes necessary to cut the armor, it shall be done through the web between openings, thereby leaving no loose anchorage ends. Pieces shorter than three feet (3′) shall not be used.



CURB ARMOR

46. EXPANSION JOINT MATERIALS

The material shall be Carey's Elastite or any make of equal quality. It shall be composed of a layer of asphalt held between two layers of felt. The melting point of the asphalt shall range between two hundred forty degrees (240°) and two hundred sixty degrees (260°) Fahrenheit. Penetration shall range between sixteen degrees (16°) and twenty-four degrees (24°) Dow, at seventy-seven degrees (77°) Fahrenheit. Not less than ninety-five per cent (95%) shall be soluble in Carbon Disulphide.

47. FILLER FOR WOOD BLOCK PAVEMENT

This filler shall show not less than ninety-eight per cent (98%) pure bitumen soluble in Carbon Disulphide. Of the total amount soluble in Carbon Disulphide, ninety-eight and one-half per cent

(98½%) shall be soluble in Carbon Tetrachloride. When tested with a No. 2 needle weighted with two hundred (200) grams operating for one minute at thirty-two degrees Fahrenheit (32°F), it shall have a penetration greater than twenty-five degrees (25°) Dow. When tested with a No. 2 needle weighted with fifty (50) grams operating for five (5) seconds at one hundred fifteen degrees Fahrenheit (115°F), it shall have a penetration not greater than eighty degrees (80°) Dow. When tested with a No. 2 needle weighted with one hundred (100) grams and operating for five (5) seconds at seventy-seven degrees Fahrenheit (77°F), it shall have a penetration between the limits of thirty-five degrees (35°) and fifty degrees (50°) Dow. Its specific gravity at sixty degrees Fahrenheit (60°F) shall be greater than nine hundred seventy-five one-thousandths (.975) and less than unity. It shall have a melting point not lower than two hundred twenty-five degrees Fahrenheit (225°F). The filler shall weigh not less than eight (8) pounds nor more than eight and one-half (8½) pounds per gallon at sixty degrees Fahrenheit (60°F). It shall remain ductile at all climatic temperatures to which it shall be subjected. It shall be waterproof, acid-proof and impervious to street liquids. It shall adhere firmly to wood block and be pliable under all conditions.

48. GRANITE CURBING

Curb stones shall be hard, gray, medium grain granite, uniform in color and texture, free from cracks, seams, scales or flaws, and of a character that will not readily disintegrate. Granite shall have a crushing strength of at least twelve thousand (12,000) pounds per square inch and a specific gravity of at least two and sixty hundredths (2.60), and of the dimensions shown on the plans.

For straight curbing blocks less than four (4) feet in length shall not be used. Stones for the curved corners shall be used in the length shown in section 161. The top surface and the outside face down to the surface of the gutter shall be line work, having four (4) cuts to the inch. The face of the stones for a distance of five (5) inches below the surface of the gutter, and the back of the stones for a distance of four (4) inches below the top of the curb, shall be uniformly pointed to an even surface. The bottom of all curbs shall have a true setting bed, so that the curbs will have a uniform depth throughout. The remaining portions of the stones shall be uniform, true to line and free from depressions. All cut surfaces shall be true and out of wind. The top of all curb stones shall be cut with a slope of one-quarter (¼) of an inch in six (6) inches. The top angle of the street side shall be cut to a curve having a radius of one (1) inch. The ends of all stones shall be square and make joints not exceeding one-quarter (¼) of an inch in thickness.

49. GRANITE OR SANDSTONE BLOCKS

The quality of granite blocks shall be the same as specified under granite curbing, and the sandstone blocks shall be durable, sound and of uniform color. The stones shall be of the same quality as to hardness, color and grain. No out-crop, soft, brittle or laminated stone shall be accepted.

Size of blocks shall be not less than three and one-half (3½) nor more than four (4) inches thick; not less than five (5) nor more than five and one-half (5½) inches deep, and from eight (8) to twelve (12) inches long. The surface of the blocks shall have parallel and rectangular sides and ends and be so prepared that when in place and resting against the adjoining stone, the joints in their widest part shall not exceed one-half (½) inch in thickness. Stones are to be split or broken with top surface hammercut or axed off smooth; sides and ends being dressed, when necessary to secure the one-half (½) inch joint as specified.

50. GRAVEL

Gravel shall be free from loam, clay, vegetable matter, bark, roots, sticks and other foreign substances.

(a) FINE CONCRETE GRAVEL

For thin reinforced construction, and one course concrete walks, gravel shall range uniformly in size from one-fourth (¼) inch to one (1) inch, and no stones shall be larger than one and one-half (1½) inch, measured through their greatest diameter.

(b) COARSE CONCRETE GRAVEL

For all other concrete construction, gravel shall range uniformly from one-fourth (¼) inch to two and one-half (2½) inches, and no stones shall be larger than four (4) inches, measured through their greatest diameter.

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

The screens used for the above are screens having a square effective opening as indicated by the size given.

51. LAMP BLACK

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

52. LEAD

All lead shall be piglead of a quality equal to that commercially known as "Selby Lead." It shall show on analysis not less than ninety-nine and one-half per cent (99½%) of metallic lead.

53. LUMBER

(a) GENERAL REQUIREMENTS

All lumber shall be of Douglas Fir. It shall be cut from sound, live logs and be practically free from sap. All pieces shall be out of wind and free from wind shakes, large pitch seams, splits, large loose or decayed knots, decayed wood, worm holes, wane and other defects impairing its strength or durability.

No rough lumber shall be more than one-eighth (⅛) inch scant of the full dimension specified.

Surfaced lumber, unless otherwise specified, shall be worked according to the official standards as contained in the Standard Classification, Grading and Dressing Rules of the West Coast Lumber Manufacturers' Association, which rules are essentially as follows:

S1S1E or S4S

1x4 to ¾x3½
1x6 to ¾x5½
1½x6 to 1-5/16x5½
2x4 to 1⅝x3⅝
2x6 to 1⅝x5⅝
2x8 to 1⅝x7½
2x10 to 1⅝x9½
2x12 to 1⅝x11½
3x4 to 2½x3½
3x6 to 2½x5½
3x8 to 2½x7½
3x10 to 2½x9½
3x12 to 2½x11½
Stock more than 12 inches wide, sizes to ½ inch off in width 4x4 and larger, ½ inch off each dimension.

(b) CLASS A

This class includes all timbers in any structure (except Howe Trusses) which are subjected to heavy bending moments and shears, such as bridge and trestle stringers, caps and all posts and lagging used in timber bulkheads.

This grade of lumber shall be "Select Common" under "Fir Bridge Stringers" of the Grading Rules referred to and more particularly described as follows: Not less than ninety per cent (90%) heartwood shall appear on each of the four sides of the stick, measured anywhere in the length of the piece. Lumber shall be out of wind, free from shakes, splits, or pitch pockets over three-eighths (⅜) inch wide or five (5) inches long. Knots greater than two (2) inches in diameter shall not be permitted within one-fourth (¼) of the depth of stringers measured from either edge. Knots shall in no case exceed three (3) inches in diameter.

The amount of summer wood in any annular ring shall be not less than one-third (1/3) of the total thickness or width of the ring.

(c) CLASS B

This class is intended to cover all lumber not included in Class A, (but does not cover Howe Truss Material) such as all roadway and sidewalk planking, and stringers which rest on the ground, railings, stairways, curbs and gutters, wood manhole extensions, box drains, sand boxes, and lumber in trenches.

Lumber for this class shall show not less than eighty-five per cent (85%) of heart-wood on each of the four sides of the stick, measured anywhere in the length of the piece. It shall be out of wind, free from shakes, splits, or pitch pockets over one-half (½) inch wide or eight (8) inches long. Knots shall not exceed at any cross-section, one-quarter (¼) the width of the surface of the piece. Knots shall not appear on the corner of any piece. Lumber must not contain knots in groups.

In sidewalk lumber, if the sap appears on the dressed surface, a maximum of fifty per cent (50%) of the width of the piece will be allowed.

On lumber for railings, a maximum of fifty per cent (50%) of sap will be allowed on any side.

Lumber shall be dressed as more particularly specified under the various items in which lumber is used, and all lumber not so specified shall be rough.

(d) CREOSOTED LUMBER

(1) **Before Treatment.** Creosoted lumber shall conform in all respects to the requirements for lumber in Section 53-a. All material shall be framed as far as possible before treatment.

(2) **Treatment.** The method of treatment shall conform to the requirements specified for Piling in Section No. 58. Green or freshly sawed material shall not be treated with seasoned or partially seasoned materials. Dimension lumber shall not be treated in the same charge with planking or timbers, and to insure complete access of the creosote oil to all surfaces, during the seasoning bath, strips shall be placed between each tier as the lumber is placed on the retort trucks.

(3) **After Treatment.** The material shall be free from all heat checks and other defects due to inferior treatment and shall show a penetration of three-fourths (¾) inch at all points in the lumber. All sapwood shall show a complete penetration of black oil.

(4) **Creosote Oil.** The oil used for treatment shall conform to the requirements specified for creosoted piling in Section No. 58.

54. 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	Approximate Number per Pound	Length in Inches	Diameter in Inches	Approximate Number per Pound
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	5/16	7
				8	⅜	6
				9	⅜	5
				10	⅜	4
				12	⅜	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 either one or the other of these rules:

Rule 1. The nails or spikes shall penetrate the second piece of timber to a depth which is one-and one-eighth (1⅛) times the thickness of the first piece.

S1S1E or S4S

1x4 to ¾x3½
1x6 to ¾x5½
1½x6 to 1-5/16x5½
2x4 to 1⅝x3⅝
2x6 to 1⅝x5⅝
2x8 to 1⅝x7½
2x10 to 1⅝x9½
2x12 to 1⅝x11½
3x4 to 2½x3½
3x6 to 2½x5½
3x8 to 2½x7½
3x10 to 2½x9½
3x12 to 2½x11½
Stock more than 12 inches wide, sizes to ½ inch off in width 4x4 and larger, ½ inch off each dimension.

(b) CLASS A

This class includes all timbers in any structure (except Howe Trusses) which are subjected to heavy bending moments and shears, such as bridge and trestle stringers, caps and all posts and lagging used in timber bulkheads.

This grade of lumber shall be "Select Common" under "Fir Bridge Stringers" of the Grading Rules referred to and more particularly described as follows: Not less than ninety per cent (90%) heartwood shall appear on each of the four sides of the stick, measured anywhere in the length of the piece. Lumber shall be out of wind, free from shakes, splits, or pitch pockets over three-eighths (⅜) inch wide or five (5) inches long. Knots greater than two (2) inches in diameter shall not be permitted within one-fourth (¼) of the depth of stringers measured from either edge. Knots shall in no case exceed three (3) inches in diameter.

The amount of summer wood in any annular ring shall be not less than one-third (1/3) of the total thickness or width of the ring.

(c) CLASS B

This class is intended to cover all lumber not included in Class A, (but does not cover Howe Truss Material) such as all roadway and sidewalk planking, and stringers which rest on the ground, railings, stairways, curbs and gutters, wood manhole extensions, box drains, sand boxes, and lumber in trenches.

Lumber for this class shall show not less than eighty-five per cent (85%) of heart-wood on each of the four sides of the stick, measured anywhere in the length of the piece. It shall be out of wind, free from shakes, splits, or pitch pockets over one-half (½) inch wide or eight (8) inches long. Knots shall not exceed at any cross-section, one-quarter (¼) the width of the surface of the piece. Knots shall not appear on the corner of any piece. Lumber must not contain knots in groups.

In sidewalk lumber, if the sap appears on the dressed surface, a maximum of fifty per cent (50%) of the width of the piece will be allowed.

On lumber for railings, a maximum of fifty per cent (50%) of sap will be allowed on any side.

Lumber shall be dressed as more particularly specified under the various items in which lumber is used, and all lumber not so specified shall be rough.

(d) CREOSOTED LUMBER

(1) **Before Treatment.** Creosoted lumber shall conform in all respects to the requirements for lumber in Section 53-a. All material shall be framed as far as possible before treatment.

(2) **Treatment.** The method of treatment shall conform to the requirements specified for Piling in Section No. 58. Green or freshly sawed material shall not be treated with seasoned or partially seasoned materials. Dimension lumber shall not be treated in the same charge with planking or timbers, and to insure complete access of the creosote oil to all surfaces, during the seasoning bath, strips shall be placed between each tier as the lumber is placed on the retort trucks.

(3) **After Treatment.** The material shall be free from all heat checks and other defects due to inferior treatment and shall show a penetration of three-fourths (¾) inch at all points in the lumber. All sapwood shall show a complete penetration of black oil.

(4) **Creosote Oil.** The oil used for treatment shall conform to the requirements specified for creosoted piling in Section No. 58.

54. 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	Approximate Number per Pound	Length in Inches	Diameter in Inches	Approximate Number per Pound
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	5/16	7
				8	⅜	6
				9	⅜	5
				10	⅜	4
				12	⅜	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 either one or the other of these rules:

Rule 1. The nails or spikes shall penetrate the second piece of timber to a depth which is one-and one-eighth (1⅛) times the thickness of the first piece.

Rule 2. The nail or spike shall fail to pass entirely through both pieces of timber by not more than one-quarter (¼) inch.

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

55. OAKUM

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

56. PAINT

(a) PAINT FOR METALS

Paint for metals shall consist of the best grade of pigments mixed with pure raw linseed oil and not to exceed fourteen per cent (14%) by weight of drier. The excessive use of driers, the use of volatile thinners, the use of pigments containing sulphides, nitrites, free water or soluble salts shall not be permitted. Preference shall be given to a paint composed essentially of pure raw linseed oil together with a carbon pigment containing less than fifty per cent (50%) ash or non-carbonaceous matter. The carbon pigment shall be in the form of amorphous graphite lamp black or carbon black or mixtures of these. Powdered coke, charcoal or coal, silica, clay or similar inert filler shall not be used. At least two (2) weeks before any metal is to be painted the contractor shall furnish the City Engineer with samples of the oil and pigment which he proposes to use on this improvement, and the contractor shall not proceed with the painting of any metal until he has been notified that the ingredients are satisfactory.

(b) PAINT FOR WOOD

Paint for wood shall consist of pure white lead, mixed with pure raw linseed oil, and not to exceed ten per cent (10%) by weight of suitable turpentine drier. At least two (2) weeks before any wood is to be painted the contractor shall furnish the City Engineer with samples of the oil and lead which he proposes to use on this improvement, and the contractor shall not proceed with the painting of any wood until he has been notified that the ingredients are satisfactory.

57. PILING

Piles shall be cut from sound, Douglas Fir trees. They shall be close grained, solid and free from defects such as injurious ring shakes, large unsound or loose knots, clusters of knots, worm holes, decay or other defects which may materially impair their strength or durability. Piles shall be cut above the ground swell and have a uniform taper from butt to tip. Piles having short bends shall not be used. A line drawn from the center of the butt to the center of the tip shall lie within the body of the pile. Unless otherwise allowed, piles shall be cut when the sap is down. Piles shall be peeled soon after cutting. All knots shall be trimmed close to the body of the pile.

The minimum diameter at the tip for piles not exceeding thirty (30) feet in length, shall be nine (9) inches; for piles over thirty (30) feet in length, eight (8) inches. The maximum diameter at the tip for piles shall be fourteen (14) inches. The minimum diameter at cut-off for piles shall be fourteen (14) inches. All dimensions shall be measured under the bark.

On any diameter across the butt, the piles shall show not less than ten and one-half (10½) inches of heartwood, and on the same diameter, an average of not less than seven (7) annular rings per inch and thirty-five per cent (35%) summer wood.

58. PILING, CREOSOTED

(a) BEFORE TREATMENT

The piling to be creosoted shall conform in all respects to the requirements specified for "Piling" in Section No. 57, except that when piles are to be creosoted the requirements in reference to the positions of sap when the piling is cut, and to the amount of heartwood do not apply. Also piling with extreme spiral grain having one complete twist in a length of forty (40) feet or less shall not be accepted.

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

(b) TREATMENT

The method of treatment shall be left to the discretion of the Creosoting Company, provided that at no time during the treatment by the steaming process shall the piling be subjected to a temperature greater than three hundred twenty-five degrees Fahrenheit (325°F) and in the boiling process the temperature shall not exceed two hundred forty degrees Fahrenheit (240°F.).

(c) CREOSOTE OIL

The oil shall conform to the Standard Specifications for coal tar creosote oil in Section No. 43a. 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.

(d) 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 one (1) 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 in accordance with the requirements of Section No. 64.

59. SAND

Sand shall be free from loam, clay, vegetable matter or other foreign substances.

(a) FOR CONCRETE

For concrete and for wall surfaces and topping on concrete walks, stairways, curbs, etc., sand shall be graded as follows: One hundred per cent (100%) shall pass a one-fourth (¼) inch screen; not less than twenty per cent (20%) nor more than thirty-five per cent (35%) shall pass a No. 30 screen.

(b) FOR MORTAR AND PAVEMENT CUSHION

For mortar and pavement cushion one hundred per cent (100%) shall pass a No. 6 screen and not more than ten per cent (10%) shall pass a No. 50 screen.

(c) FOR PLASTER AND GROUT

For plaster and grout one hundred per cent (100%) shall pass a No. 10 screen and not less than fifty per cent (50%) nor more than eighty per cent (80%) shall pass a No. 30 screen. Wherever screens are mentioned in these specifications they shall have an effective opening in inches as follows:

Mesh No.	Effective Opening in Inches
¼″	0.2500
4	0.2010
6	0.1310
8	0.0955
10	0.0730
20	0.0335
30	0.0211
40	0.0148
50	0.0110
80	0.0068
100	0.0055
200	0.0028

60. SEWER PIPES

(a) VITRIFIED CLAY

Vitrified Clay sewer 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, fire-checks 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.

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

Internal Diameter	Thickness
6″	⅝″
8″	¾″
10″	⅞″
12″	1″
15″	1¼″
18″	1½″
21″	1¾″
24″	2″
30″	2½″

(2) **Tests:** The City Engineer shall be permitted to select at random for testing purposes, one (1) length of pipe for each two hundred (200) feet of pipe to be laid, but on no contract shall less than five (5) lengths be used. In case the first tests show marked irregularities or peculiarities, a second selection of pipes may be made for further tests.

The pipes selected for testing purposes shall be delivered to the City Engineer's test building at Railroad Avenue West and East Waterway. The cost of such pipes and transportation shall be borne by the contractor for the improvement, and no allowance whatever shall be made for such costs.

Failure of twenty per cent (20%) of the specimens to meet the requirements of any of the tests imposed shall result in rejection of all the pipe in the shipment or delivery corresponding to the sizes thus failing to comply. The City Engineer shall be permitted to place a cull mark upon all pipes so rejected in such a manner as will not render it unsuitable for other than sewer purposes.

(3) **Absorption Test:** The specimens shall be sound pieces with all edges broken, and may be from pipe broken in the crushing or other tests. They shall be from twelve (12) to twenty (20) square inches in area, and shall be as nearly square as they can be readily prepared. These fragments shall be dried at a temperature of two hundred twenty degrees (220°) Fahrenheit for three (3) hours or until the specimen ceases to lose weight, then cooled and when cold immersed in cold water for forty-eight (48) hours. The maximum permissible absorption shall be five per cent (5%) by weight. Tests indicating greater values than this will result in the rejection and cull marking as hereinbefore described.

(4) **Hydrostatic Tests:** The pipes shall show no percolation for a pressure of ten (10) pounds or less per square inch applied continuously for the period shown in the following table, and shall resist fracture at pressures shown in the following table:

Internal Diameter	Fracture at not less than (pounds per sq. in.)	No percolation at 10 lbs. per sq. in. for (minutes)
6″	40	5
8″	35	5
10″	30	5
12″	30	6½
15″	30	7½
18″	30	9
21″	30	10
24″	25	10
30″	25	12
36″	25	12

(5) **External Crushing Test:** The pipe to be tested shall be supported on two (2) wooden strips with vertical sides, each strip having its interior top corner rounded to a depth of approximately one-half inch (½″). They shall be straight and shall be securely fastened to a rigid block with their interior vertical sides one inch (1″) apart. The upper bearing shall be a wooden block, straight and true from end to end and extending the whole length of the pipe exclusive of bell. The test load shall be applied through the

upper bearing block in such a way as to leave the bearing free to move on a vertical plane passing midway between the lower bearings. When tested in this manner the various sizes of pipe shall withstand the following pressures applied to the upper bearing block:

Diameter					
6″	1,000	pounds	per	lin.	ft.
8″	1,000	"	"	"	"
10″	1,100	"	"	"	"
12″	1,200	"	"	"	"
15″	1,375	"	"	"	"
18″	1,540	"	"	"	"
21″	1,800	"	"	"	"
24″	2,150	"	"	"	"
30″	2.580	"	"	"	"
36″	3,100	"	"	"	"

(b) CONCRETE

Concrete pipes shall be composed of one (1) part Portland cement and three (3) parts sand and gravel aggregate. No material other than water, Portland cement, sand and gravel shall be permitted in the manufacture of concrete pipes.

(1) **Cement:** The Portland cement shall conform in all respects to the requirements of the Standard specifications.

(2) **Sand and Gravel:** The sand and gravel aggregate shall in all cases be a washed product, free from earth and other foreign matter and shall be so uniformly graded as to produce a dense mixture with the minimum amount of sand.

(3) **Dimensions:** All pipes shall be of the bell and spigot or self-centering type with a minimum thickness as indicated in the following table:

Internal Diameter	Thickness
6″	5/8″
8″	7/8″
10″	1″
12″	1-3/16″
15″	1½″
18″	1¾″
21″	2″
24″	2⅜″
30″	3″
36″	3½″

(4) **Molding and Curing:** All pipes must be the product of approved factories. The Board of Public Works reserves the right to reject the entire product of any pipe works whenever in its opinion the methods of manufacture are not such as to guarantee uniform results, or where the materials are such as to produce inferior pipe.

The City Engineer shall have access to all parts of the pipe factory, storehouses, yards, etc. at any time. He shall be notified a sufficient time in advance when pipe will be made for any city contract.

The manufacturers shall comply with such orders from the City Engineer as will bring the materials and pipe making process within a reasonable interpretation of these specifications. Failure to comply with such orders will result in the rejection of the product of that plant.

All pipes shall be kept wet continuously for ten (10) days immediately following manufacture. The pipes shall not be laid in the trench until thirty (30) days old, except that where the pipe is properly steam-cured the City Engineer may reduce this period at his discretion, provided the samples selected shall have satisfactorily passed the tests hereinafter provided.

(5) **Marking:** All pipes shall have the factory name or trade mark as well as the date of manufacture plainly impressed thereon.

(6) **Finished Product:** The finished product shall be sound, hard and dense, free from porosity, cracks or distortion, and shall show a distinct water web over the entire area of the outside of of the pipe. Variations in the internal diameter not to exceed three per cent (3%) will be allowed.

No attempt to plaster or grout any defect shall be permitted. The interior surface of the pipe must be smooth.

(7) **Tests:** The selection and delivery of samples and methods of testing concrete pipe shall be the same as hereinbefore provided for vitrified clay pipe.

61. DRAIN TILE

(a) CLAY

Clay drain tile shall be burned from clay or shale, free from pebbles and other foreign substances which impair its strength or durability. The tile shall have a smooth interior and square ends. It shall not vary from a true circle more than ten per cent (10%) of its internal diameter.

(b) CONCRETE

Concrete drain tile shall be composed of one (1) part of Portland cement and three (3) parts of concrete sand. The tile shall be dense and free from rough or porous pockets. It shall be straight of smooth interior and square ends. It shall not vary from a true circle more than five per cent (5%) of its internal diameter.

(c) DIMENSIONS AND TESTS

The following table of dimensions shall apply to either clay or concrete tile:

Internal Diameter	Thickness	Length
3″	½″	16″ or less
4″	5/8″	16″ or less
6″	¾″	16″ or less

Absorption tests shall be made in the same manner as required for absorption test of sewer pipe, except that the maximum permissible absorption of either clay or concrete tile shall be ten per cent (10%) by weight.

62. STEEL CONCRETE REINFORCEMENT BARS

(a) CLASSES OF STEEL

The steel concrete reinforcement bars used by the City of Seattle are of two distinct varieties, namely: Billet-Steel Bars and

Rail-Steel Bars. The Billet-Steel bars are rolled from new billets, whereas the rail-steel bars are the product of re-rolled steel sections. Unless otherwise shown on the plans, Rail-Steel bars may be used, and the sections shall be square and of a deformed type.

These specifications conform to the requirements of the American Society for Testing Materials for Billet-Steel concrete reinforcement Bars, Serial Designation A 15-14, and Rail-Steel concrete reinforcement bars, Serial Designation A 16-14, except for place of making tests, viz: the City Engineer reserves the right to designate the place for making tests.

(b) BILLET STEEL BARS

These specifications cover two classes of billet-steel concrete reinforcement bars, namely: plain and deformed. Both plain and deformed bars are of structural steel grade only.

(1) Manufacture

The steel may be made by the Bessemer or Open-hearth process. The bars shall be rolled from new billets. No re-rolled material shall be accepted.

(2) Chemical Properties and Tests

The steel shall conform to the following requirements as to chemical composition:

Phosphorus—Bessemer not over 0.10 per cent.
" —Open Hearth not over 0.05 per cent.

Ladle Analyses: An analysis to determine the percentages of carbon, manganese, phosphorus and sulphur shall be made by the contractor from a test ingot taken during the pouring of each melt. A copy of the analysis shall be furnished the City Engineer or his representative. The analysis shall conform to the requirements specified under chemical properties and tests.

Check Analyses: Analyses may be made by the City Engineer from finished bars representing each melt of open-hearth steel and each melt or lot of ten tons of Bessemer Steel. The phosphorus content thus determined shall not exceed that specified by more than twenty-five per cent (25%).

(3) Physical Properties and Tests

Tension Tests: The bars shall conform to the following requirements as to tensile properties:

Properties considered	Plain Bars	Deformed Bars
Tensile strength—		
Pounds per sq. in.	55,000 to 70,000	55,000 to 70,000
Yield point—		
Minimum pounds per sq. in.	33,000	33,000
Elongation in 8 inches—		
Minimum per cent	1,400,000 tens. str.	1,250,000 tens. str.

The yield point shall be determined by the drop of the beam of the testing machine.

Modification in Elongation: For all bars over ¾" in thickness or diameter, a deduction of one (1) from the percentage of elongation specified above shall be made for each increase of ⅛" in thickness or diameter above ¾ inch. For all bars under 7/16 inch in thickness or diameter, a deduction of one (1) from the percentage of elongation specified above shall be made for each decrease of 1/16 inch in thickness or diameter below 7/16 inch.

Bend Tests: The test specimen shall bend cold without fracture on the outside of the bend through an angle of 180 degrees around a pin whose diameter is equal to the thickness or diameter of the specimen.

Test Specimens: Tension and bend test specimens for all bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled, except that the specimens for deformed bars may be machined for a length of at least nine (9) inches, if deemed necessary by the contractor to obtain uniform cross-section.

Number of Tests: At least one tension and one bend test shall be made from each melt of open-hearth steel and from each melt or lot of ten tons of Bessemer steel. In case steel differing ⅜ inch or more in thickness or diameter is rolled from one melt, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

If the percentage of elongation of any tension-test specimen is less than that specified and any part of the fracture is outside the middle third of the gage length as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

(4) **Permissible Variation in Weight:** The weight of any lot of bars shall not vary more than five per cent (5%) from the theoretical weight of that lot.

(5) **Finish:** The finished bars shall be free from injurious defects and shall have a workmanlike finish.

(6) Inspection and Rejection

Inspection: The inspector representing the City Engineer shall have free entry at all times while work on the bars under contract is being performed, to all parts of the manufacturer's works which concern the manufacture of the bars ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications.

Rejection: Unless otherwise specified, any rejection based on tests made in accordance with these specifications shall be reported within five (5) working days from the receipt of samples. Bars which show injurious defects subsequent to their acceptance at the manufacturer's works shall be rejected and the manufacturer shall be notified.

Rehearing: Samples tested in accordance with these specifications, which represent rejected bars, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

(c) RAIL-STEEL BARS

These specifications cover three classes of rail-steel concrete reinforcement bars, namely, plain, deformed and hot-twisted.

Rail-Steel Bars. The Billet-Steel bars are rolled from new billets, whereas the rail-steel bars are the product of re-rolled steel sections. Unless otherwise shown on the plans, Rail-Steel bars may be used, and the sections shall be square and of a deformed type.

These specifications conform to the requirements of the American Society for Testing Materials for Billet-Steel concrete reinforcement Bars, Serial Designation A 15-14, and Rail-Steel concrete reinforcement bars, Serial Designation A 16-14, except for place of making tests, viz: the City Engineer reserves the right to designate the place for making tests.

(b) BILLET STEEL BARS

These specifications cover two classes of billet-steel concrete reinforcement bars, namely: plain and deformed. Both plain and deformed bars are of structural steel grade only.

(1) Manufacture

The steel may be made by the Bessemer or Open-hearth process. The bars shall be rolled from new billets. No re-rolled material shall be accepted.

(2) Chemical Properties and Tests

The steel shall conform to the following requirements as to chemical composition:

Phosphorus—Bessemer not over 0.10 per cent.
" —Open Hearth not over 0.05 per cent.

Ladle Analyses: An analysis to determine the percentages of carbon, manganese, phosphorus and sulphur shall be made by the contractor from a test ingot taken during the pouring of each melt. A copy of the analysis shall be furnished the City Engineer or his representative. The analysis shall conform to the requirements specified under chemical properties and tests.

Check Analyses: Analyses may be made by the City Engineer from finished bars representing each melt of open-hearth steel and each melt or lot of ten tons of Bessemer Steel. The phosphorus content thus determined shall not exceed that specified by more than twenty-five per cent (25%).

(3) Physical Properties and Tests

Tension Tests: The bars shall conform to the following requirements as to tensile properties:

Properties considered	Plain Bars	Deformed Bars
Tensile strength—		
Pounds per sq. in.	55,000 to 70,000	55,000 to 70,000
Yield point—		
Minimum pounds per sq. in.	33,000	33,000
Elongation in 8 inches—		
Minimum per cent	1,400,000 tens. str.	1,250,000 tens. str.

The yield point shall be determined by the drop of the beam of the testing machine.

Modification in Elongation: For all bars over ¾" in thickness or diameter, a deduction of one (1) from the percentage of elongation specified above shall be made for each increase of ⅛" in thickness or diameter above ¾ inch. For all bars under 7/16 inch in thickness or diameter, a deduction of one (1) from the percentage of elongation specified above shall be made for each decrease of 1/16 inch in thickness or diameter below 7/16 inch.

Bend Tests: The test specimen shall bend cold without fracture on the outside of the bend through an angle of 180 degrees around a pin whose diameter is equal to the thickness or diameter of the specimen.

Test Specimens: Tension and bend test specimens for all bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled, except that the specimens for deformed bars may be machined for a length of at least nine (9) inches, if deemed necessary by the contractor to obtain uniform cross-section.

Number of Tests: At least one tension and one bend test shall be made from each melt of open-hearth steel and from each melt or lot of ten tons of Bessemer steel. In case steel differing ⅜ inch or more in thickness or diameter is rolled from one melt, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

If the percentage of elongation of any tension-test specimen is less than that specified and any part of the fracture is outside the middle third of the gage length as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

(4) Permissible Variation in Weight:

The weight of any lot of bars shall not vary more than five per cent (5%) from the theoretical weight of that lot.

(5) Finish:

The finished bars shall be free from injurious defects and shall have a workmanlike finish.

(6) Inspection and Rejection

Inspection: The inspector representing the City Engineer shall have free entry at all times while work on the bars under contract is being performed, to all parts of the manufacturer's works which concern the manufacture of the bars ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications.

Rejection: Unless otherwise specified, any rejection based on tests made in accordance with these specifications shall be reported within five (5) working days from the receipt of samples. Bars which show injurious defects subsequent to their acceptance at the manufacturer's works shall be rejected and the manufacturer shall be notified.

Rehearing: Samples tested in accordance with these specifications, which represent rejected bars, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

(c) RAIL-STEEL BARS

These specifications cover three classes of rail-steel concrete reinforcement bars, namely, plain, deformed and hot-twisted.

(1) **Manufacture:**

The bars shall be rolled from Standard section Tee rails.

Hot twisted bars shall have one complete twist in a length not over twelve (12) times the thickness of the bar.

(2) **Physical Properties and Tests**

The bars shall conform to the following minimum requirements as to tensile properties:

Properties considered	Plain Bars	Deformed & Hot Twisted Bars
Tensile Strength—lbs. per sq. in.	80,000	80,000
Yield Point—lbs. per sq. in.	50,000	50,000
Elongation in 8 inches—per cent	1,200,000	1,000,000
	Tens. Str.	Tens. Str.

The yield point shall be determined by the drop of the beam of the testing machine.

Modification in Elongation: For all bars over ¾" in thickness or diameter, a deduction of one (1) from the percentages of elongation specified above shall be made for each increase of ⅛ inch in thickness or diameter above ¾ inch. For all bars under 7/16 inch in thickness or diameter, a deduction of one (1) from the percentages of elongation specified above shall be made for each decrease of 1/16 inch in thickness or diameter below 7/16 inch.

Bend Tests: The test specimen shall bend cold around a pin, without fracture on the outside of the bend, as follows:

Thickness or Diameter of Bars	Plain Bars	Deformed and Hot Twisted Bars
Under ¾ inch	180 deg. d=3t	180 deg. d=4t
¾ inch or over	90 deg. d=3t	90 deg. d=4t

Explanation Note: d=diameter of pin around which specimen is bent.
t=thickness or diameter of the specimen.

Test Specimens: Tension and bend test specimens for all bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled, except that the specimens for deformed bars may be machined for a length of at least nine (9) inches, if deemed necessary by the manufacturer to obtain uniform cross-section.

Tension and bend test specimens for hot-twisted bars shall be taken from the finished bars without further treatment.

Number of Tests: One tension and one bend test shall be made from each lot of ten tons or less of each size of bar rolled from rails varying not more than ten (10) pounds per yard in nominal weight.

If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

If the percentage of elongation of any tension test specimen is less than that specified and any part of the fracture is outside the middle third of the gage length as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

(3) **Permissible Variation in Weight:** The weight of any lot of bars shall not vary more than five (5) per cent from the theoretical weight of that lot.

(4) **Finish:** The finished bars shall be free from injurious defects and shall have a workmanlike finish.

(5) **Inspection and Rejection**

Inspection: The Inspector representing the City Engineer shall have free entry at all times while work on the bars under contract is being performed, to all parts of the manufacturer's works which concern the manufacture of the bars ordered. The manufacturer shall afford the inspector free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications.

Rejection: Bars which show injurious defects subsequent to their acceptance at the manufacturer's works shall be rejected and the manufacturer shall be notified.

(d) PAYMENT

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

Payment shall be made for the length of bars in place, based on the following table of weights:

Corrugated Square Bars

Size in Inches	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼
Weight per ft. in lbs.	.20	.49	.86	1.35	1.94	2.64	3.43	4.34	5.35

63. 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.

64. WOOD BLOCKS—CREOSOTED

Wood blocks shall be cut from sound, Douglas fir timber, free from loose knots, splits, shakes, pitch pockets, or other imperfections which impair their strength or durability. The wood shall contain an average of not less than six (6) annular rings per inch, and no single inch in any block shall contain less than four (4) rings. There shall be not less than forty per cent (40%) of dense summer wood in all material. Sound knots may be permitted provided they appear wholly within one-half (½) of the volume of the block measured in the direction of the fibre. Sapwood may be permitted provided that it is thoroughly impregnated, and that not more than one (1) inch appears on any side of the block. The blocks shall have the following dimensions unless otherwise shown: length about eight (8) inches, width four (4) inches and depth four (4) inches. They shall be perfectly rectangular, cut from lumber uniformly sized in that dimension corresponding to the width of the block, and shall have one side and one end fluted.

The treatment of the blocks shall be conducted in a manner that will insure the absorption of not less than sixteen (16) pounds of oil per cubic foot of material before vacuum is applied, and not less than twelve (12) pounds per cubic foot of material shall remain

in the blocks after the final or complete treatment, and the blocks shall show complete penetration of black oil throughout their entire thickness. At no time during the treatment shall the blocks be subjected to a temperature greater than 240°F.

The oil used shall conform to the Standard Specifications for coal tar creosote oil "B" in Section No. 43 (b).

The blocks shall be delivered on the street and piled in such a manner that the end grain is not exposed.

The City Engineer shall be notified by the Contractor about the treatment of wood blocks in ample time for him to provide for the inspection thereof. He shall be furnished with ample facilities at the treating plant for the accurate determination or measurement of all oil entering and leaving the retort during the entire treatment. He shall have free access to all parts of the treating plant while work on this contract is being performed. He shall be permitted to take samples of the creosote oil or the wood blocks before the treatment begins, at any time during the treatment, or after the treatment is completed, and the Treating Company shall provide all necessary appliances to facilitate making measurements or taking samples.

SPECIFICATIONS

FOR

GRADING, CURBING AND APPURTENANCES

65. 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; 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; 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 whatever shall be deposited in any waters 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 cross-walks, curbs, gutters and other lumber which may be of use for planking streets, shall be removed in such manner as to sustain as little damage as possible, and shall be carefully piled and guarded until used. The contractor shall at his own expense replace with new four (4) inch plank all lumber which cannot be accounted for, except that an allowance of fifteen per cent (15%) of the total original amount of planking, figured on a four (4) inch basis shall be made to cover losses from damage by removal or other causes. All old lumber not used in connection with the improvement under contract, and which in the judgment of the Superintendent of Streets may be deemed of use to the Street Department of the City of Seattle, shall be set aside by the contractor in suitable piles and removed by said department.

In removing any bulkheads or retaining walls, special care shall be taken to sustain 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 relaid 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 price bid per acre or lump sum, as shown on the proposal sheet.

66. 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.

(a) 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 the same elevation as 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.

(b) 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 plans 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 material is required by the property owners within the local improvement district. In all cases where material is wasted, whether on public or private property, the contractor shall not be required to haul material 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.

(c) 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. Payment shall not 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 embankments, 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.

(d) 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 a distance of six hundred (600) feet, no allowance shall be made for refill. If the earth required is available from waste material within one thousand (1000) feet but not within six hundred (600) feet, payment shall be made for the refill at the price bid per cubic yard for "Earthwork." If the earth required

is not abailable within one thousand (1000) feet, or if suitable material cannot be obtained from the streets in this improvement district, payment shall be made at a price per cubic yard agreed upon by the contractor and the City Engineer.

(e) 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 solid or loose rock or boulders encountered during the work, all water settling, rolling and tamping of embankments or sub-grades, and all other labor and material necessary for the completed 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.

67. SURFACING STREETS

All earth roadways shall be dressed to a smooth and uniform surface, crowning uniformly between gutters to the crown height shown on page 45. All rocks or stones greater than two (2) inches in longest diameter shall be removed from the surface of the street. Wherever the material found in cut is unsuitable for a good roadbed, or wherever the City Engineer deems it to be necessary, the contractor shall excavate such material from the roadbed over a width of eighteen (18) feet, and to a depth of eight (8) inches, and refill such excavation with suitable materials. The excavation thus made shall be paid for in the manner specified above for "Removing Unsuitable Materials." All parking strips shall be filled and carefully raked to a smooth and even surface.

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

68. EXTRA EXCAVATION

Extra excavation shall include all excavation which may be necessary to secure a proper foundation for structures, for special trenching or extra depth of trenches. It provides in a general way for the removal, for any purpose whatsoever, of all objectionable or additional materials not covered in the specifications for "Earthwork" that may be ordered removed by the City Engineer; provided, however, that additional excavation in connection with grading improvements, which is caused by the changing of the street grade, shall be paid for as earthwork and not as extra excavation.

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

69. WOOD CURBS AND GUTTERS (For plan, see page 45)

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.

70. WOOD CURBS AND GUTTERS ADJUSTED

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 "Wood Curbs and Gutters Adjusted" 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."

71. SHEAR BOARDS (For plan, see page 47)

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.

72. SAND BOXES (For plan, see pages 47 and 48)

Sand boxes shall be built according to the details shown. The outlet shall consist of a one-quarter (¼) 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. Inlet boxes leading thereto shall be constructed for each box as shown on the plan. Unless otherwise specified, the connection to the main sewer shall be made with eight (8) inch sewer pipe. The planking for sides and bottom shall be sized on one side and two edges.

Payment for "Sand Boxes" shall be made at the price bid respectively for "Sand Box" and "Double Sand Box," as listed on the proposal sheet. This payment to 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.

73. ALLEY SAND BOXES (For plan, see page 48)

The outlet consists of two three (3) inch sewer pipes securely fastened through the sides of the box and leading out under the sidewalk through the curb and discharging into the gutter. The planking for sides and bottom shall be sized on one side and two edges. The curb shall be bored to admit pipes, and the box well nailed together with 60-penny nails.

Payment for "Alley Sand Boxes" shall be made at the price bid for each, and shall include the outlet.

74. SEWER PIPE DRAINS

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. All joints shall be filled with cement mortar, mixed with one part cement to two parts sand. 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, and shall include inlets and excavation and backfilling of the trench to an average depth of three (3) foot cover; any additional depth required shall be paid for as "Extra Excavation."

75. SUB-DRAINS (For plan, see page 51)

The trench shall be excavated to a true line and grade as given by the City Engineer. Two three-inch (3″) pipes shall then be laid on a 2″x8″ plank and covered to a depth of one (1) foot and six (6) inches with coarse concrete gravel. A final layer of coarser gravel, varying up to four (4) inches in longest diameter shall then be placed in the trench until filled to the required height.

Payment for "Sub-drains" shall be made at the price bid per linear foot for the type specified, which shall include excavation, gravel, plank, etc.

76. BOX DRAINS (For plan, see page 49)

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 inch (¼″) 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.

77. ROCK POCKETS

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

Payment for "Rock Pockets" shall be made at the price bid per cubic yard for rock and per linear foot for drainage connections, and shall include all excavation and backfilling.

78. REINFORCED CONCRETE POSTS AND CHAINS (For plan, see page 51)

The concrete for posts shall be composed of one (1) part of Portland Cement, two (2) parts of sand and four (4) parts of gravel, and shall be brush finished with a coat of neat cement grout. The contractor shall notify the City Engineer when the posts are to be poured, and no posts shall be accepted on the ground, which have not been made under the inspection of the City Engineer.

The posts shall be allowed to season twenty (20) days after molding before they are placed in position. They shall be set in the excavation, and the backfill thoroughly tamped around them.

Galvanized iron chains, conforming approximately to the dimensions shown on the plans, shall be suspended between posts with a sag of four (4) inches between supports.

Payment for "Reinforced Concrete Posts shall be made at the price bid for each in place, and payment for chains and fastenings shall be made at the price bid per pound in place.

79. WOOD FENCE (For plan, see page 51)

The lumber for fence shall be dressed on four (4) sides. The posts shall be cedar. They shall be set in excavation, and the backfill thoroughly tamped around them. When in place the fence shall be painted with two (2) coats of white paint, the quality of which is specified in Section No. 56.

Payment for "Wood Fence" shall be made at the price bid per linear foot in place, which shall include the painting.

80. PIPE CULVERT (For plan, see page 51)

Culverts shall be constructed of No. 2 vitrified clay sewer pipe, where shown on the plan or where directed by the City Engineer. The pipe shall be bedded in the original firm ground to a depth of at least two diameters of the pipe. The pipe shall be laid in accordance with the standard specifications for Pipe Sewer in Section No. 113.

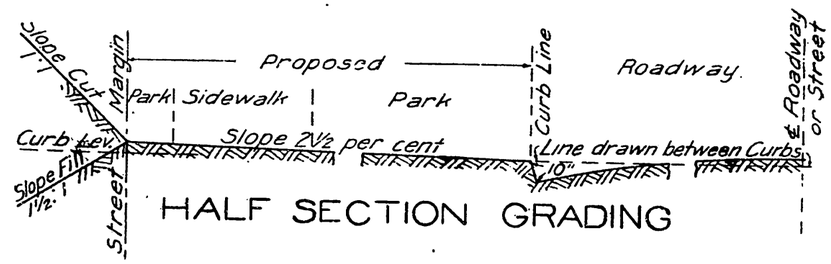
Should the City Engineer so direct, the contractor shall bed the lower half of the pipe in concrete, in which case twelve dollars ($12.00) per cubic yard shall be allowed for the concrete, which amount shall be in full for the concrete in place, including the additional excavation involved.

No. 2 Vitrified Clay Sewer Pipe shall conform to the standard specifications for sewer pipe, except that slight flaws, chips, etc., which in the opinion of the City Engineer do not impair the strength of the pipe, may be permitted.

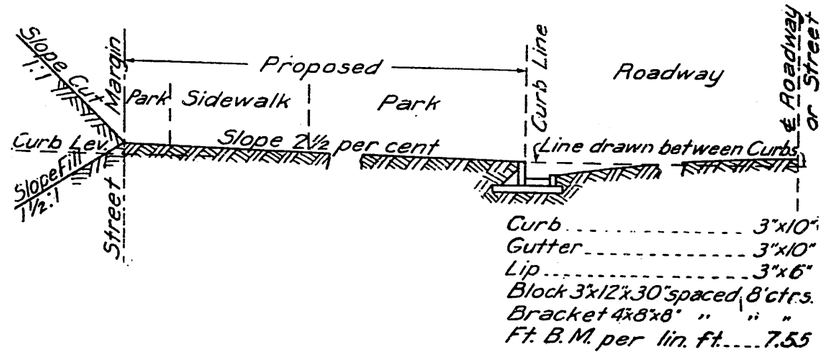
Payment for "Pipe Culvert" shall be made at the price bid per linear foot, and shall be in full for all labor and materials for the pipe in place, including the excavation and backfill.

81. MAINTENANCE

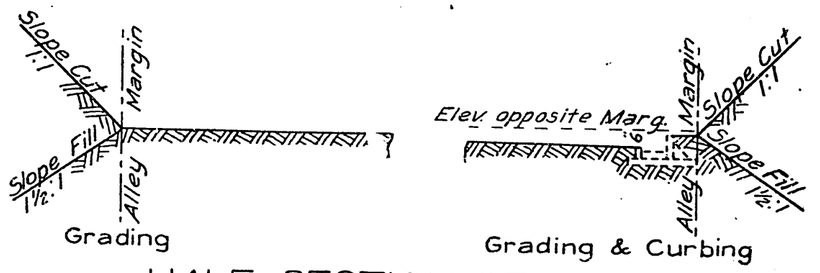
The contractor shall maintain the improvement in good condition until it has been accepted by the Board of Public Works, and shall receive no compensation therefor beyond the amount of the final estimate.



HALF SECTION GRADING



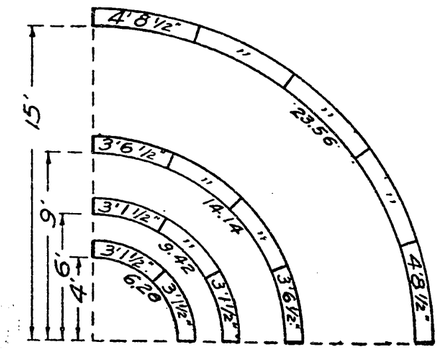
HALF SECTION GRADING & CURBING



HALF SECTION OF ALLEY

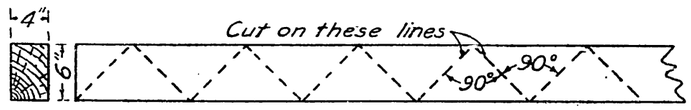
Width of Roadways in feet	18	25	36	44	58	68
Center Height in feet above line joining opposite curbs	0.1	0.25	0.4	0.6	0.7	0.9

CROWN OF ROADWAY
For Earth Roads

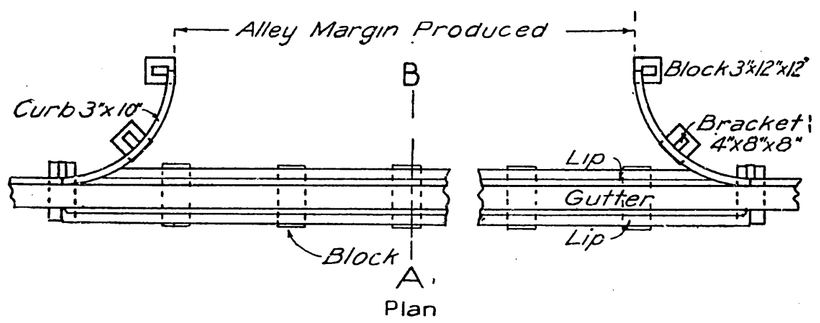


NOTE: For radii longer than 15' and shorter than 50' Gutter Boards shall be cut approximately in six foot (6') lengths. For radii longer than 50' they shall be cut in approximately eight foot (8') lengths.

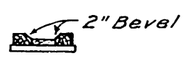
METHOD OF CUTTING GUTTER BOARDS



METHOD OF CUTTING BRACKETS

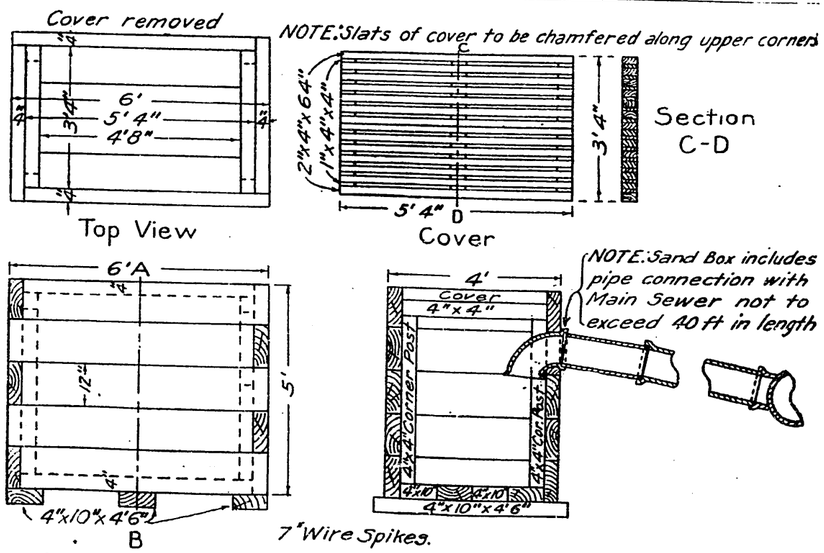


Gutter.....3"x10"
Lips.....6"x6"
Block 3"x12"x26"-4' C. to C.



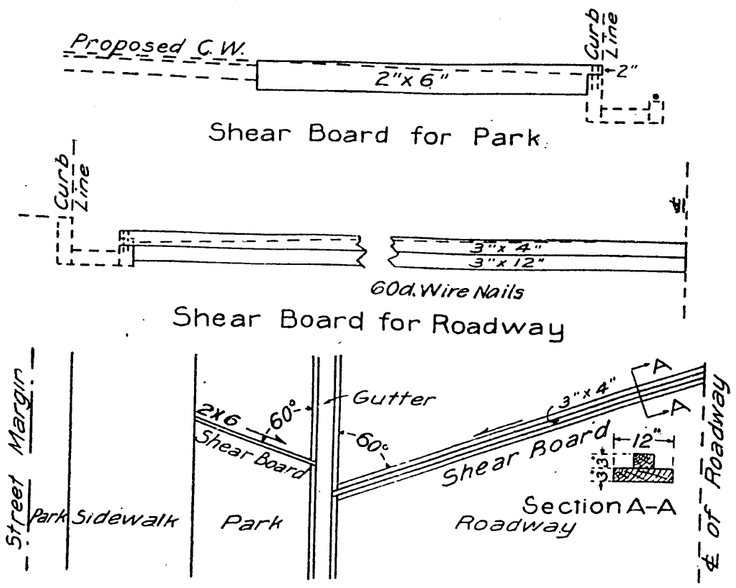
Section A-B

ALLEY GUTTER AND RETURNS

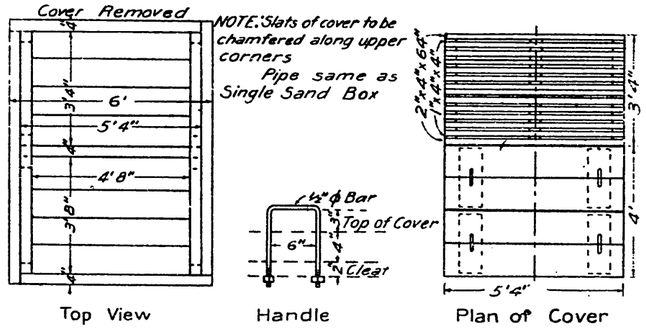


574 ft B.M for 5 ft depth
80 " " " per foot

SAND BOX

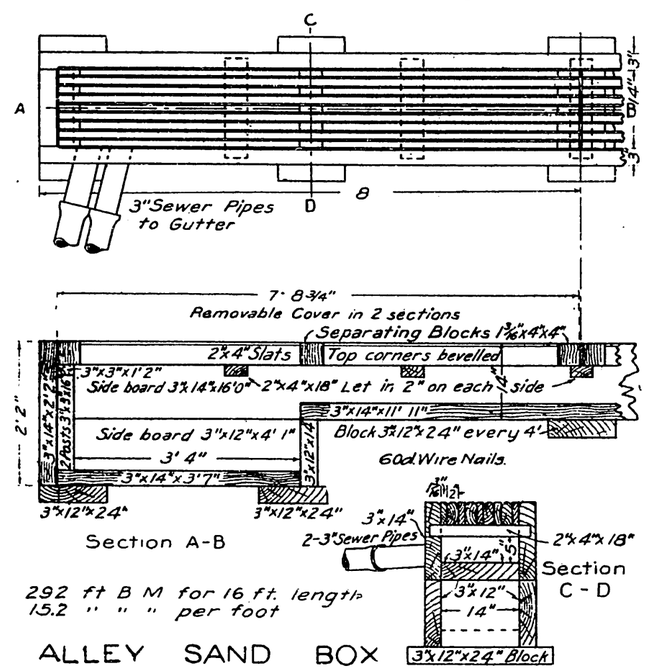


SHEAR BOARDS



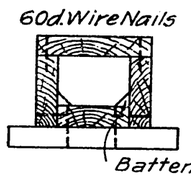
107.4 ft. B.M. for 5 ft. depth
11.7 " " " per foot

DOUBLE SAND BOX



292 ft B.M. for 16 ft. length
15.2 " " " per foot

ALLEY SAND BOX

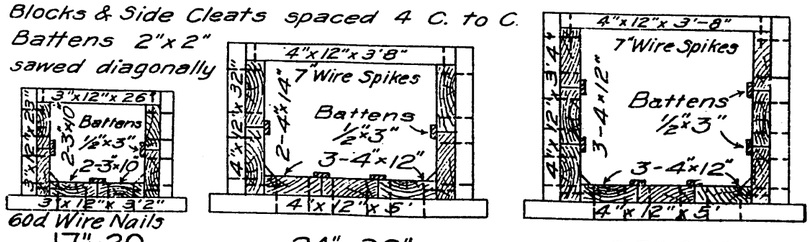


Size Inside	Cover	Sides	Bottom	Blocks	Ft. B.M. per lin. ft.
5"X 10"	3"x16"	3"X 8"	3"X 10"	3"x12"x24"	11.58
7"X 10"	3"x16"	3"X 10"	3"X 10"	3"x12"x24"	12.58
9"X 10"	3"x16"	3"X 12"	3"X 10"	3"x12"x24"	13.58
9" X 12"	3"x 18"	3"X 12"	3"X 12"	3"x12"x24"	14.58
11"X 12"	3"x18"	3"X 14"	3"X 12"	3"x12"x24"	15.58

Battens 2"x2" Sawed diagonally Blocks spaced 8' C. to C

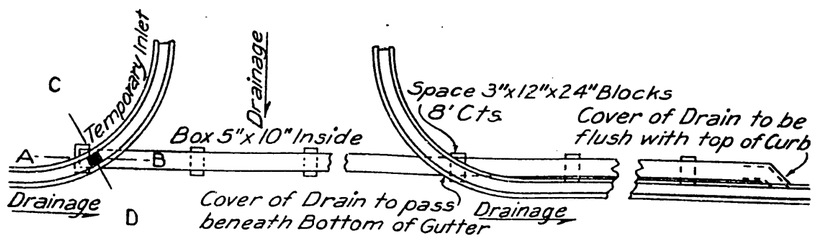
BOX DRAIN SECTION & BILL OF MATERIAL

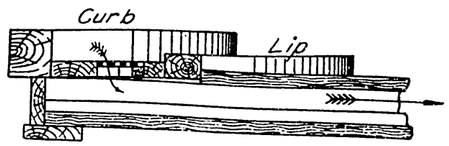
Blocks & Side Cleats spaced 4 C. to C.
Battens 2"x 2" sawed diagonally



27.4 B.M. per lin ft. 56.5 B.M. per lin ft. 63.4 B.M. per lin. ft

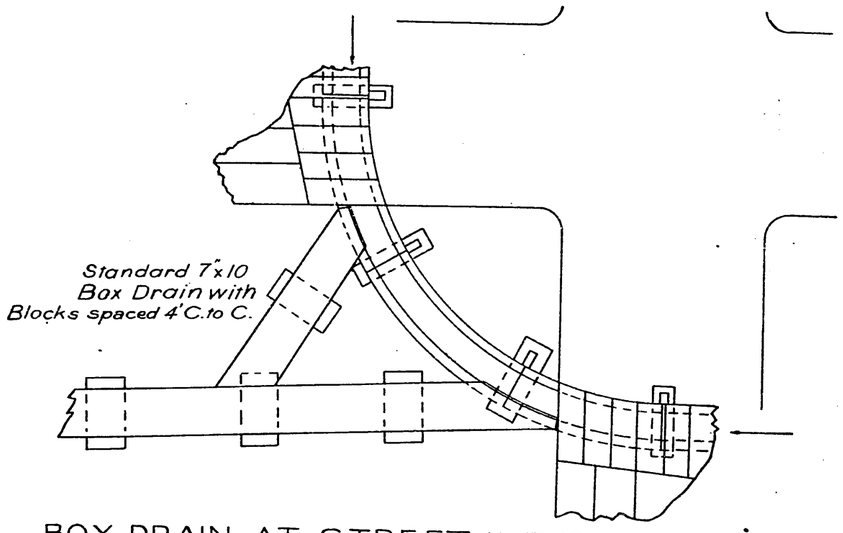
BOX DRAIN SECTIONS & BILL OF MATERIAL



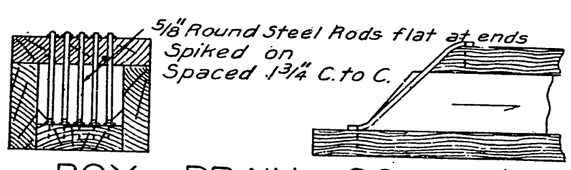


Section A-B

SPECIAL BOX DRAIN



BOX DRAIN AT STREET INTERSECTION

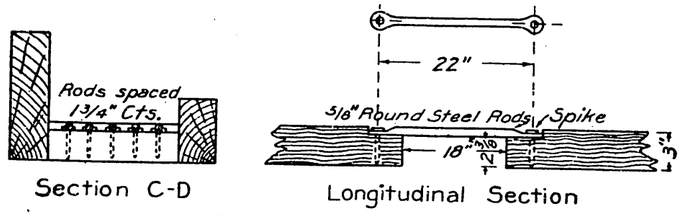


BOX DRAIN SCREEN

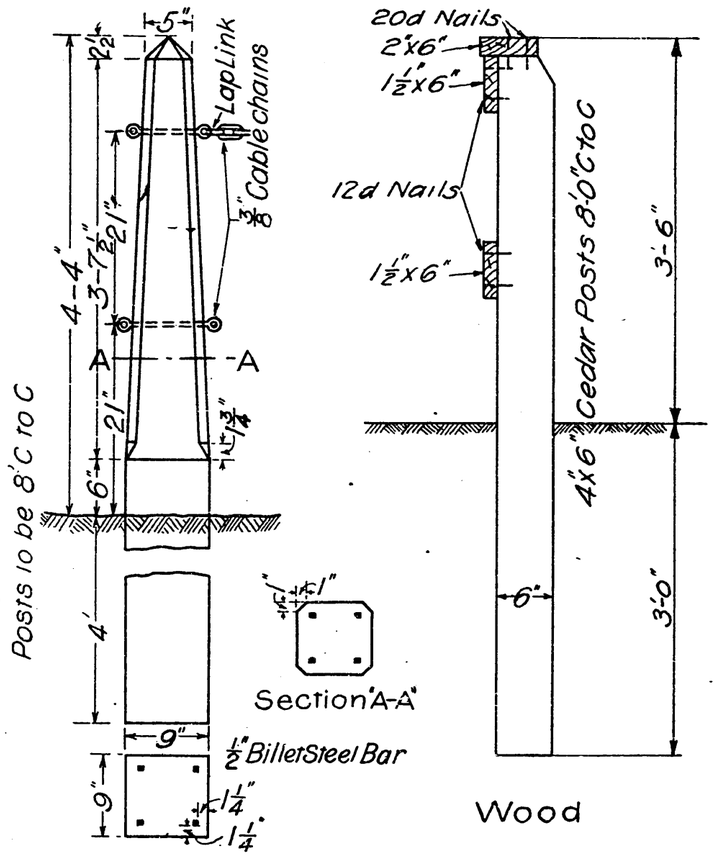
Gutter.....3"x10"
Lips.....6"x6"
Center Strip.....3"x3"
Block 3"x12"x30" every 8 feet

10.19 Ft. B.M. per lin. ft.

OPEN DRAIN

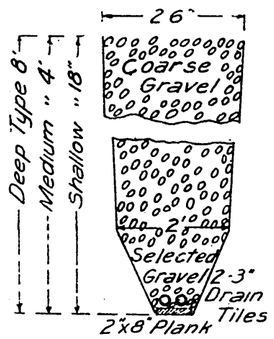


TEMPORARY INLET

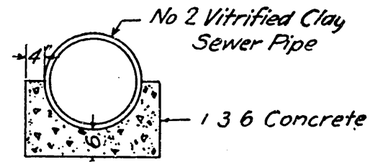


Concrete Post with Chains

FENCE



SUB DRAINS



PIPE CULVERT

SPECIFICATIONS
FOR
SIDEWALKS AND APPURTENANCES

82. CLEARING AND GRUBBING

Clearing and Grubbing shall include the removal, where necessary, of all brush, old sidewalks, plankings, sills, cross-walks, 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.

83. GRADING

All excavations for concrete sidewalks shall be made in accordance with the Standard Specifications for grading. All fills under such walks 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.

The price bid for concrete walks shall include in all cases the preparation of the sub-grade, and unless a bid is taken for earthwork, it shall also include any other earthwork. If, however, a bid is taken on earthwork, such bid shall cover all earthwork other than the preparation of the sub-grade.

84. TEMPORARY WOOD WALKS AND CROSS WALKS: (For plan, see page 61)

Where directed by the City Engineer, temporary wood walks shall be constructed of 2″x12″ planks dressed on one (1) side, laid lengthwise with the rough side up, and firmly nailed with 30-penny nails to 3″x 8″ blocks laid crosswise every eight (8) feet and properly bedded in the ground. On grades over 10%. or where directed by the City Engineer, battens ½″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.

85. WOOD SIDEWALKS (For plan, see page 62)

The covering planks of sidewalks shall be dressed on one (1) side, two (2) inches thick and uniformly eight (8) inches wide, sawed square at both ends and placed on a true line on both the

inner and outer edges of the walk with the dressed side up. They shall be nailed to the stringers with two 20-penny nails in each plank, at each bearing. Stringers shall be in lengths of 16, 24, or 32 feet, and shall rest on solid blocks, placed not more than eight (8) feet center to center and under every joint, all solidly bedded. The stringers shall be toe-nailed to each block with two 30-penny nails.

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

86. WOOD SIDEWALKS RELAID

The existing wood walks shall be relaid in accordance with the Standard Plans and Specifications for wood walks, using such of the old lumber as is suitable in the opinion of the City Engineer. The contractor shall pile and protect all lumber to be relaid and shall be responsible for the safe keeping of the same until it is used. The remaining part of the old walks shall be piled, burned or disposed of as directed by the City Engineer.

Payment for "Wood Sidewalks Relaid" shall be made at the price bid per M. ft. B. M. and shall include handling as specified above. Payment for new lumber which may be required shall be made at the price bid per M. ft. B. M. in place.

87. CROSS WALKS (For plan, see page 63)

(a) WOOD CROSS WALKS

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.

(b) CONCRETE CROSS WALKS (For plan, see page 63)

Concrete cross walks shall conform to the detail section shown on the plan. Materials and methods of construction shall conform to the standard specifications for concrete pavement, except that thorough tamping of the subgrade may be substituted for the rolling, and the surface may be finished with a wood float.

Forms shall be so constructed that a uniform curve will be obtained from curb to curb, and after removing forms the resulting space shall be tamped full of gravel.

Concrete cross walks shall be covered with earth as soon as sufficiently hardened and kept continuously wet for at least ten (10) days. When directed by the City Engineer, they shall be covered with a plank and opened to traffic. This plank and earth covering shall be maintained in place for a period of thirty (30) days.

Payment for "Concrete Cross Walks" shall be made at the price bid per square yard and shall include all subgrading and adjusting of existing roadway to conform to section shown on the

plan, gravel filling along the edge of cross walk, earth covering, wetting, plank covering and removal of same, in addition to all items regularly specified.

Measurement shall be made from back to back of the three-inch (3″) concrete curbs which shall be considered as part of the concrete cross walk.

88. REBUILDING WOOD CROSS WALKS

In rebuilding wood cross walks only such of the old lumber shall be used as is suitable in the opinion of the City Engineer. All new lumber required shall be paid for as new cross walk lumber. The method of construction shall be the same as for new cross walks.

Payment for "Rebuilding Wood Cross Walks" shall be made at the price bid per M. ft. B. M. and shall include removal, storage and replacing.

89. WOOD STAIRWAYS (For plan, see page 64)

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 toenailed 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 one (1) side and two (2) edges and nailed with two 10-penny nails at each stringer. Railing lumber shall be dressed on four (4) sides, and when in position shall be painted with two coats of White Wood paint, the quality of which is specified in Section No. 56.

Payment for "Wood Stairways" 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.

90. CONCRETE SIDEWALKS (For plan, see page 65)

(a) TWO COURSE CONCRETE SIDEWALKS

Two course concrete sidewalks shall consist of two courses: 1st, a concrete base three and one-half (3½) inches thick, composed of one (1) part Portland cement, three (3) parts sand and six (6) parts gravel; 2nd, a finishing or wearing course one-half (½) inch thick composed of one (1) part Portland cement and one and one-half (1½) parts sand.

(1) Subgrade and Forms

The subgrade shall be excavated to a depth of four (4) inches below the finished grade and thoroughly settled and compressed by wetting and tamping. To obtain a proper subgrade, a rigid template indicating four (4) inch depth shall be provided by the contractor. No template provided with adjustable attachments of any kind shall be used on the work. If any filling is necessary, it shall be done in accordance with the requirements for embankment as mentioned under grading.

The contractor shall provide forms of such shape and dimensions as may be required, made of surfaced lumber, and thoroughly wetted before placing the concrete. The cost of furnishing and setting forms shall be included in the price bid for "Concrete Sidewalks." After the forms are set accurately to the grades given,

the foundation shall be brought to the exact subgrade required and well wetted, including two (2) feet on each side of the subgrade, about twelve (12) hours before placing the concrete, and shall again be wetted just before placing the concrete.

(2) Laying the Base

The concrete shall be spread as soon as mixed, upon the prepared subgrade, in a layer of such depth that, after having been thoroughly compacted with iron-shod rammers seven (7) inches square and weighing not less than twenty (20) pounds, it shall be not less than three and one-half (3½) inches thick, and the upper surface shall be parallel to and not less than one-half (½) inch below the proposed surface of the completed walk. To insure this the concrete shall be struck with a template shod with a steel plate not less than one-eighth (⅛) inch in thickness. The concrete shall be thoroughly tamped or rammed until water appears on the surface.

(3) Laying and Finishing Wearing Course

After the bottom course is completed, and before the concrete has begun to set, the finishing or wearing course shall be laid. If mixed by hand, the correct proportion of sand and cement shall be thoroughly mixed dry until of one uniform color, and sufficient water added to make a mortar of proper consistency. If a machine is used, the work shall be done in accordance with Section No. 44. The mortar shall be colored by adding lampblack in the proportion of about three-quarters (¾) of a pound to one barrel of cement. The lampblack shall be thoroughly mixed with the cement mortar in such a manner as to produce a uniform and even shade satisfactory to the City Engineer. Special care shall be taken thoroughly to trowel down the mortar in order to secure a perfect bond with the concrete base. It shall then be carefully smoothed to a uniform surface and allowed to remain undisturbed.

All concrete shall be laid in short sections and immediately covered with the wearing surface. Neither concrete nor mortar shall be retempered under any circumstances. All mortar or concrete that has begun to set before ramming is completed shall be removed from the work.

All mortar or concrete which, in the opinion of the City Engineer, fails to show a proper bond, or that fails to set after a sufficient length of time, shall be taken up and replaced by the contractor at his own expense, with new mortar or concrete of proper quality.

(b) ONE COURSE CONCRETE SIDEWALKS

One course concrete sidewalks shall consist of a single course four (4) inches thick, composed of one (1) part Portland cement, two (2) parts sand, and three and one-half (3½) parts gravel.

The subgrade shall be prepared as specified for two course concrete sidewalks.

The concrete shall be mixed without an excess of water, placed in the forms and struck off with a straight edge. It shall then be rolled with a light sheet iron roller as prescribed for concrete pavements.

As soon as the surface can be troweled, it shall be troweled smooth with a steel trowel.

No lampblack shall be used in one-course concrete sidewalks.

Whenever "Concrete Sidewalks" are mentioned in these specifications, unless otherwise specified, such term shall be construed to mean "One Course Concrete Sidewalks."

(c) GENERAL REQUIREMENTS FOR SIDEWALKS

(1) **"V" Shaped Grooves** one-quarter (¼) of an inch in depth shall then be made with a suitable tool, dividing the walk into blocks two (2) feet square. The marking shall be done in a workmanlike manner; the transverse grooves shall be at right angles to the walk. On grades steeper than four (4) per cent, the surface shall be roughened by finishing with a coarse brush, or in such a manner as the City Engineer may direct.

(2) **Expansion Joints**

At all places in street intersections where the concrete sidewalks join the concrete or granite curb, at all street margins produced, and at such points approximately sixty (60) feet apart, as may be directed by the City Engineer, there shall be constructed in all sidewalks, at the time the concrete is placed, an expansion joint consisting of a strip of Carey's Elastite, or an equally efficient material, one-half (½) inch in thickness, four (4) inches in depth and in length equal to the full width of the walk.

(3) **Curing**

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 continuously wet for at least seven (7) days, and extra compensation shall not be allowed the contractor for such sprinkling beyond the price bid for concrete walks. Should the City Engineer so direct, the walks shall be covered to a depth of two (2) inches with suitable earth and kept moist by sprinkling for at least seven (7) days. Two and one-half (2½) cents per square yard shall be allowed for covering walks if so ordered, which amount shall include the covering, sprinkling, removing earth and cleaning walks.

(4) **Cement to be Used**

Not less than one (1) barrel of cement shall be used for every fifty (50) square feet of finished sidewalk.

All walks or driveways connecting with private entrances, or any extra work connected with or incidental to the complete performance of this contract shall be executed by the contractor, in accordance with these specifications.

After the walks have been completed and the forms and stakes removed, the slopes and parks shall be surfaced and smoothed to conform to the lines indicated on the plan.

All parking strips shall be sowed with white clover seed of good quality, using one pound of seed for each three hundred (300) square feet.

Whenever in the opinion of the City Engineer it is not the proper season of the year to plant clover seed, the City Engineer shall make an estimate of the cost of seed and planting and shall withhold the amount of such estimate from the final estimate of the contractor. The contractor shall, when directed by the City Engineer, seed the parking strips as specified above; upon the completion and acceptance of which he shall be paid the amount

previously withheld for this purpose. Should the contractor fail to seed the parking strips when directed, the City Engineer shall cause the work to be done and shall deduct the cost thereof from the amount withheld for seeding purposes. Should any portion of the amount withheld remain, it shall be paid to the contractor.

Before the final acceptance of the work, all concrete sidewalks shall be carefully inspected and sounded for defects, and all hollow cracked, or otherwise defective blocks shall be entirely removed and replaced by the contractor at his own expense. When such replacements are made in two course sidewalks the base shall be replaced with a 1:2:4 concrete.

No concrete sidewalk shall be constructed upon any embankment unless the City Engineer considers the same sufficiently settled to afford a stable foundation.

In case of rain, the walks shall be completely protected until the mortar is hard.

(d) PAYMENT

In determining the area of sidewalks laid, measurement shall be taken on the slope, and payment shall be made at the price bid for "Concrete Sidewalks," or "Two Course Concrete Sidewalks," per square yard in place, which shall include the cost of expansion joints and all other labor and material necessary to produce a finished walk.

91. CONCRETE SIDEWALKS REPLACED

The plans and specifications for new concrete walks shall apply in all respects.

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

92. CORRUGATED CONCRETE SIDEWALKS

(For plan, see page 67)

Where concrete sidewalks are laid on a grade of fifteen per cent (15%) or over and less than twenty per cent (20%) two (2) feet of concrete walk adjoining the property shall be corrugated. Where the grade is twenty per cent (20%) or over, the entire width of the sidewalk shall be corrugated. Corrugated sidewalks shall be two course or one course as specified. The materials, methods of construction and payment for corrugated concrete sidewalks shall be the same as specified for concrete sidewalks, except that corrugations in the top shall be formed with a template to produce the result shown in detail plans. Where two (2) feet of walk is corrugated, only that portion shall be paid for as corrugated walk.

(a) ASPHALT SAND COVERING

The surface of the walk shall be thoroughly clean and dry. With a suitable brush, apply a thin, even layer of hot 2-X Petro-Elastic or equal, and then immediately sow or scatter a thin layer of fine sand upon the hot asphalt. The surface thus treated shall be protected from use or injury until it is quite cool.

Payment for "Asphalt Sand Covering" shall be made at the price bid per square yard in place.

93. CONCRETE STAIRWAYS (For plan, see page 66)

The concrete and cement mortar for concrete stairways and coping shall be composed of materials of the same quality, mixed in the same proportions and in the same manner as specified for "Two Course Concrete Sidewalks." Special care shall be taken to secure a thorough bond between the cement mortar facing and the concrete base. The contractor shall replace all hollow or otherwise defective steps to the satisfaction of the City Engineer. 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 plans. One-half inch (½″) 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.

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

Concrete coping shall be paid for at the price bid per linear foot. 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 reinforcement rods, step armor and forms.

94. CONCRETE GUTTERS FOR STAIRWAYS
(For plan, see page 66)

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.

95 GALVANIZED IRON RAILING
(For plan, see page 66)

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 well galvanized. When in place, the railing shall be painted with two coats of any gray Metal Paint, the quality of which is specified in Section No. 56.

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.

96. THREE-INCH TILE DRAINS
(For plan, see page 67)

When directed, three-inch tile drains shall be constructed back of the sidewalks. The plank shall be laid to a true grade and the trench carefully filled to the top with screened gravel, small stones or other material approved by the City Engineer.

Payment for "Three-inch Tile Drains" shall be made at the price bid per linear foot and shall include the excavation gravel and plank.

97. THREE-INCH SEWER PIPE DRAINS
(For plan, see page 67)

Where directed three inch sewer pipe shall be laid under the concrete sidewalks, extending across the parking strip and through holes bored in the curb. Cutting of the curb will not be allowed. It shall be laid with cement mortar joints. The mortar shall be composed of one (1) part Portland cement and two (2) parts sand. It shall be laid close to the concrete and shall be solidly bedded in the ground. The connection to the gutter, the extension of the three (3) inch sewer pipe out through the concrete curb, and the construction of a coarse gravel inlet shall all be done in accordance with the Standard Plans.

Payment for "Three-inch Sewer Pipe 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.

98. WOOD ALLEY CROSSINGS (For plan, see page 68)

Wood Alley Crossings shall be constructed according to detail and shall conform to the specifications for "Planking." The ends of the planks shall be tightly fitted against the curb, and those planks which join the alley returns shall be cut on a circular line and laid in such a manner as to insure a tight joint.

Payment for "Wood Alley Crossings" shall be made at the price bid per M. ft. B. M. in place.

99. CONCRETE ALLEY CROSSINGS
(For plan, see pages 69 and 70)

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 grooved as shown on the plan.

The crossing shall then be covered with two inches (2″) of suitable earth and kept continuously wet for a period of ten (10) days. When directed by the City Engineer the crossing shall be covered with plank and opened to traffic. This plank and earth shall be maintained in place until thirty (30) days after the completion of the crossing.

Payment shall be made at the price bid per square yard, which shall include placing, wetting and maintaining the earth and plank and for removing the same.

100. PRIVATE ALLEY CROSSINGS

Private alley crossings shall be constructed according to the Standard Plans and Specifications. The price bid for alley crossings per square yard shall apply alike to public alley crossings and to such private alley crossings as the property owners in this improvement district may, during the progress of the work, direct the City Engineer to build.

Payment for "Private Alley Crossings" shall be made upon the same basis as for public alley crossings.

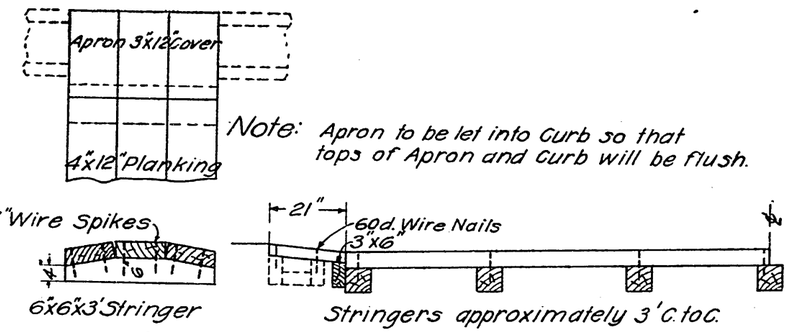
101. RESURFACING STREETS

Where sidewalks are constructed on streets that have previously been graded, the contractor shall resurface the roadway, slopes and parking strips as required in the Standard Specifications for "Surfacing Streets." 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 Streets" shall be included in the price bid per square yard for "Concrete Walks."

102. MAINTENANCE

The contractor shall maintain the improvement in good condition until it has been accepted by the Board of Public Works, and shall receive no compensation therefor beyond the amount of the final estimate.

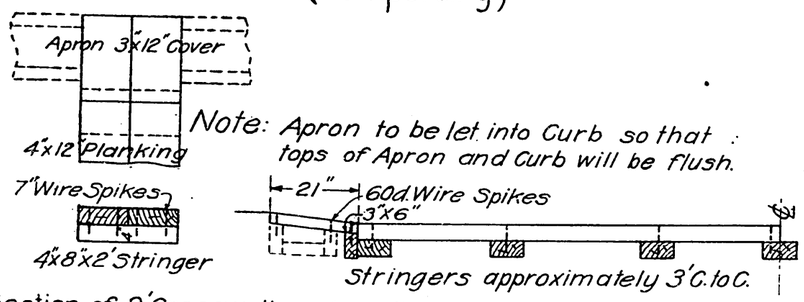


Section of 3' Cross Walk — Longitudinal Section of Apron and Cross Walk

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	758

Crosswalk Bill of Material including Aprons

3FT. WOOD CROSSWALK AND APRON (Temporary)

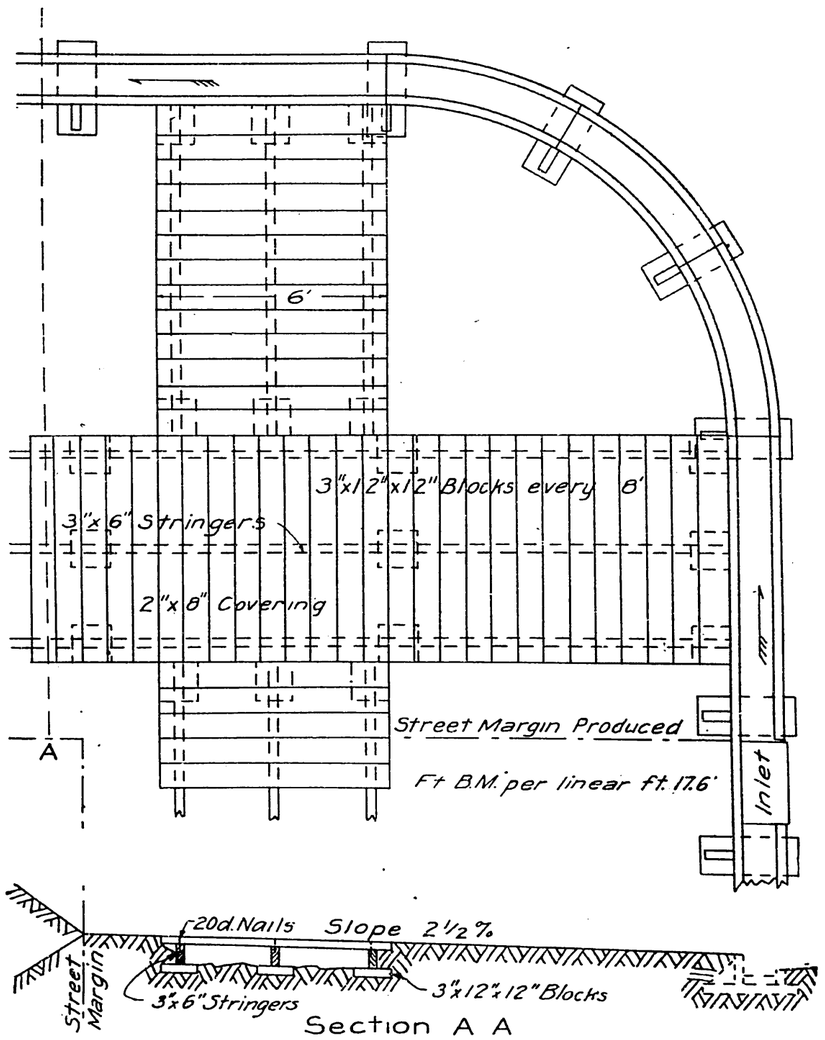


Section of 2' Crosswalk — Longitudinal Section of Apron and Crosswalk.

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

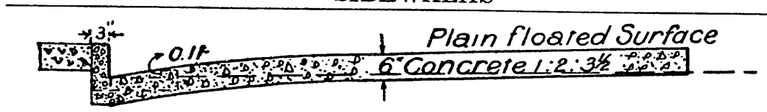
Crosswalk Bill of Material including Aprons.

2FT WOOD CROSSWALK AND APRON (Temporary)

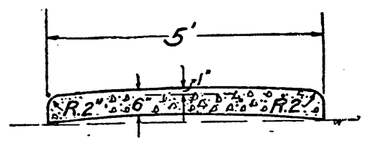


Section A A
6 Ft. Sidewalk, Curb and Gutter

WOOD SIDEWALK

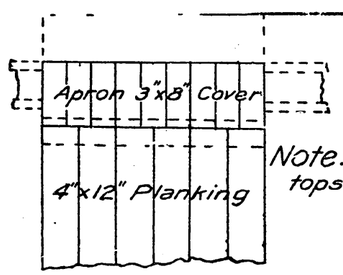


Longitudinal Half Section

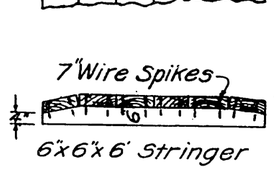


Cross Section

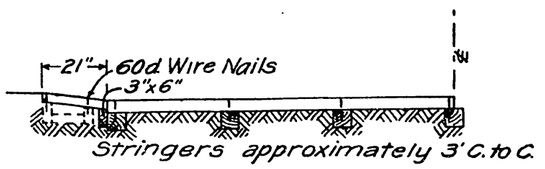
CONCRETE CROSSWALK



Note: Apron to be let into Curb so that tops of Curb and Apron will be flush



Section of 6' Cross Walk

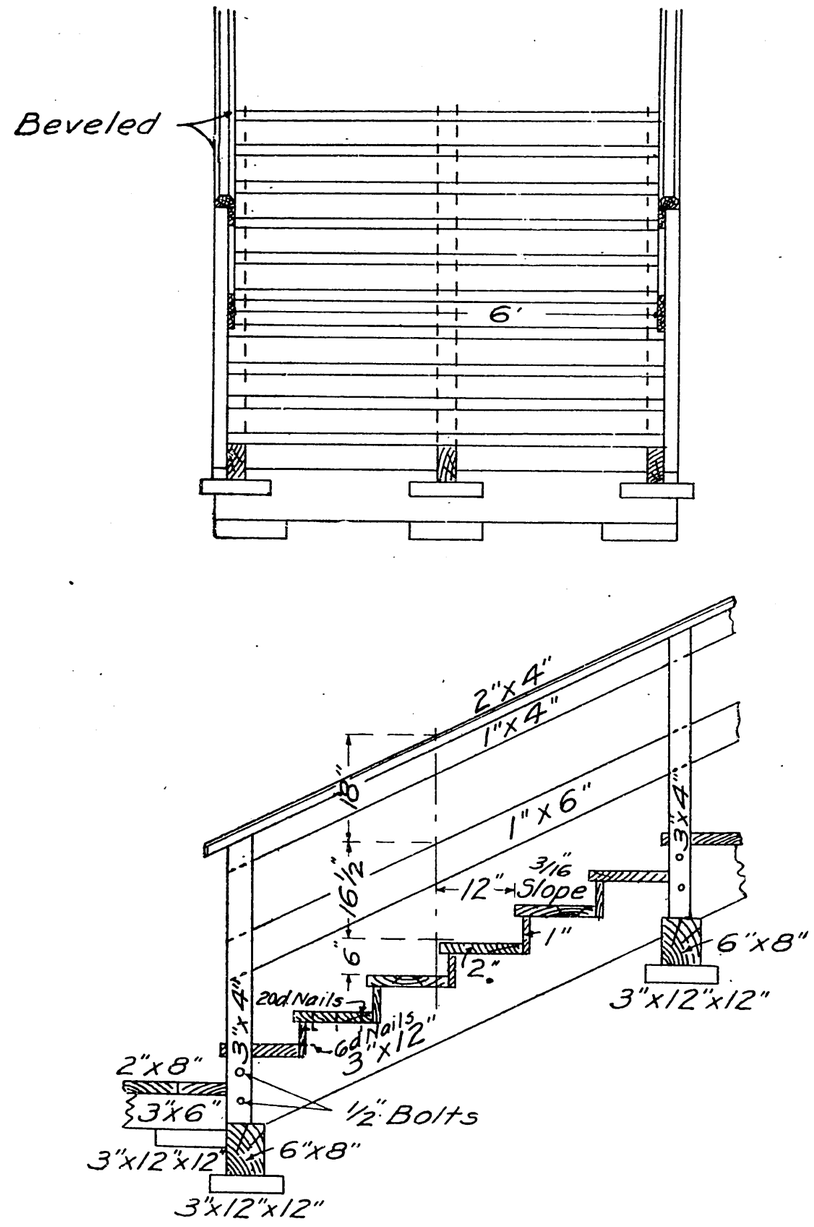


Longitudinal Section of Apron and Cross Walk

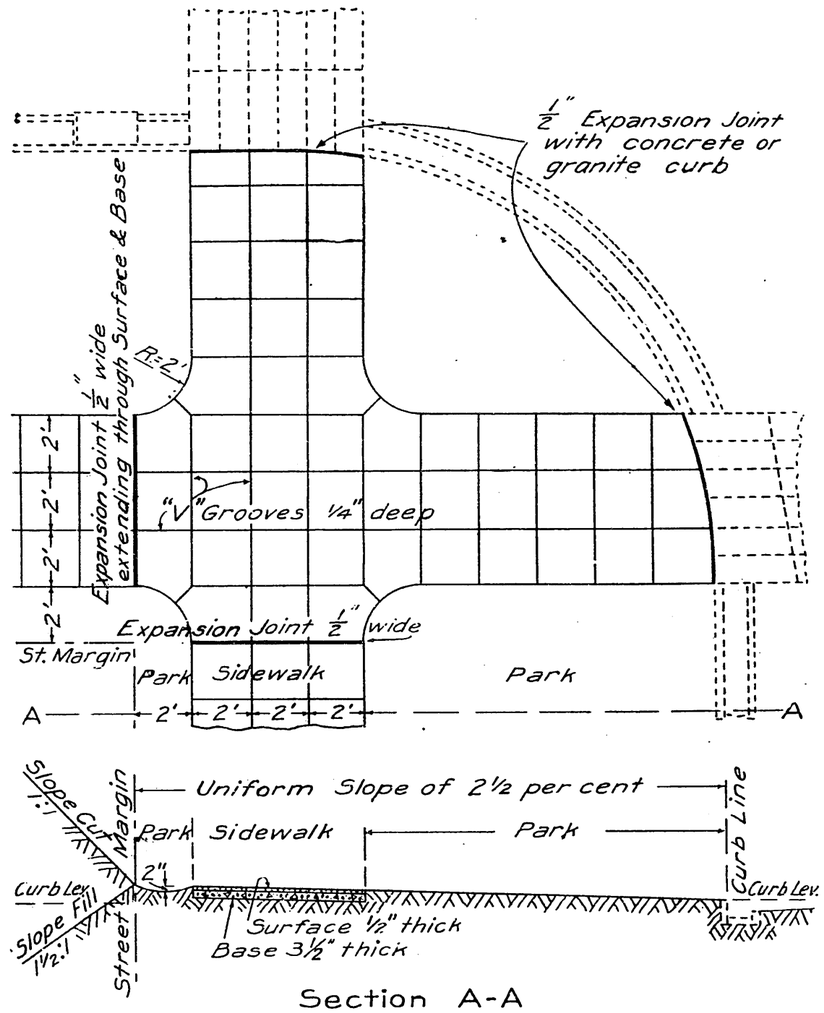
Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B. M. 6' Wide	567	663	771	819	927	975	1107	1203	1287	1383	1515

Crosswalks Bill of Material
Including Aprons

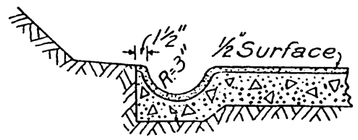
6FT WOOD APRON AND CROSSWALK



WOOD STAIRWAY



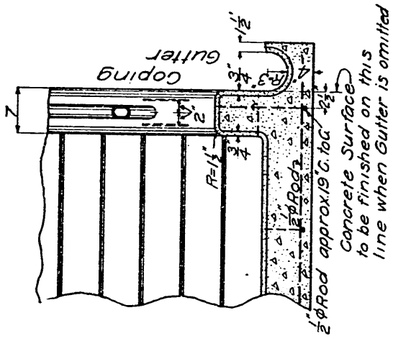
Section A-A
Concrete Sidewalk Intersection

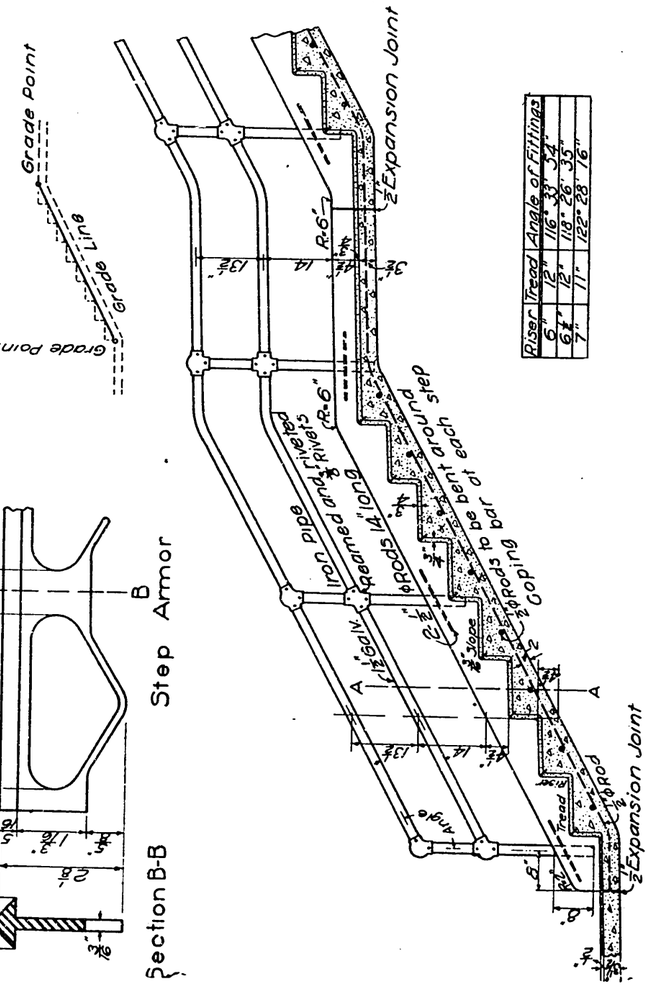


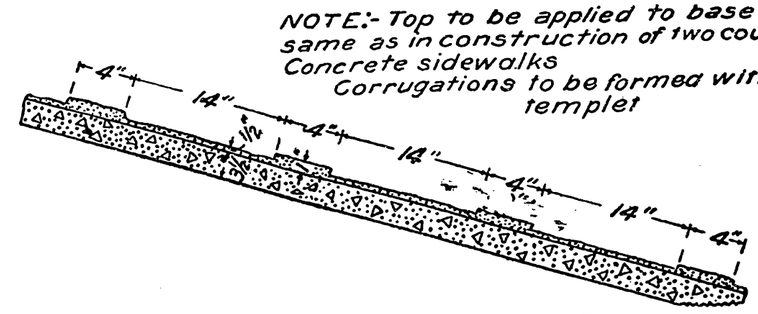
Section of Gutter with Concrete Walk

TWO COURSE CONCRETE SIDEWALK

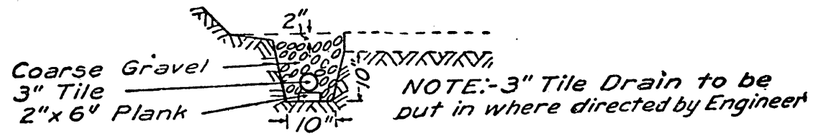
CONCRETE STAIRWAYS



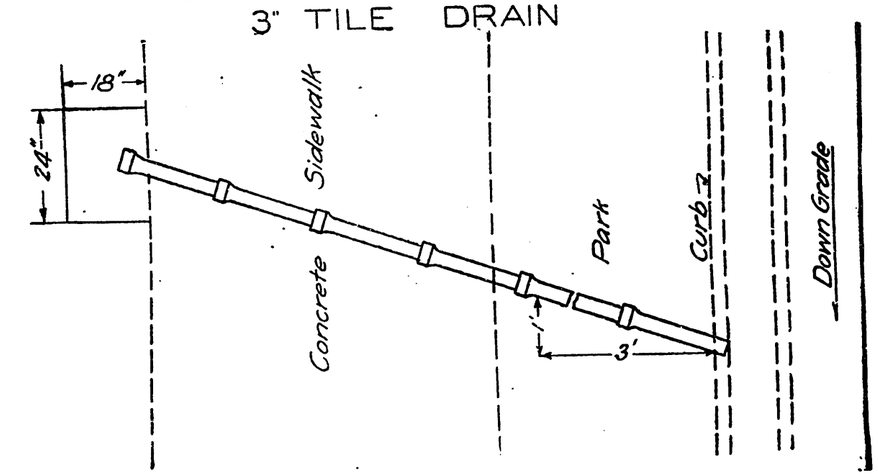


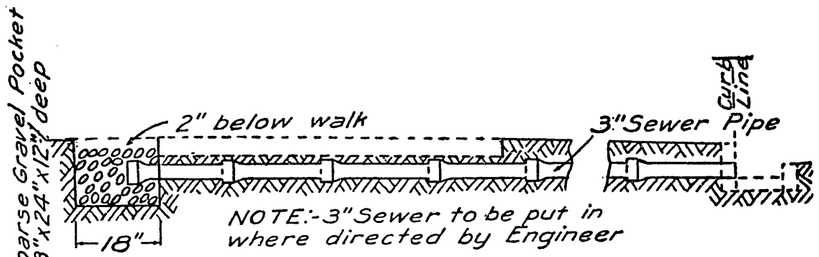


Two Course Corrugated Concrete Sidewalks
For use on grades over 20%

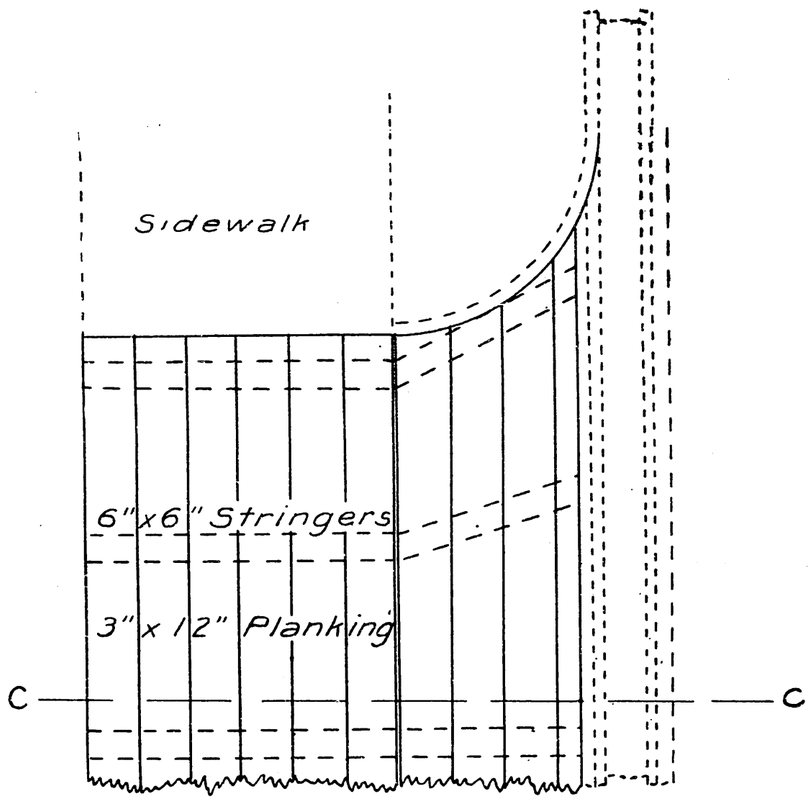


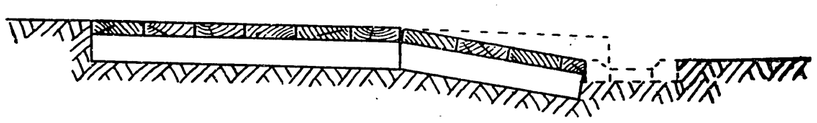
3" TILE DRAIN





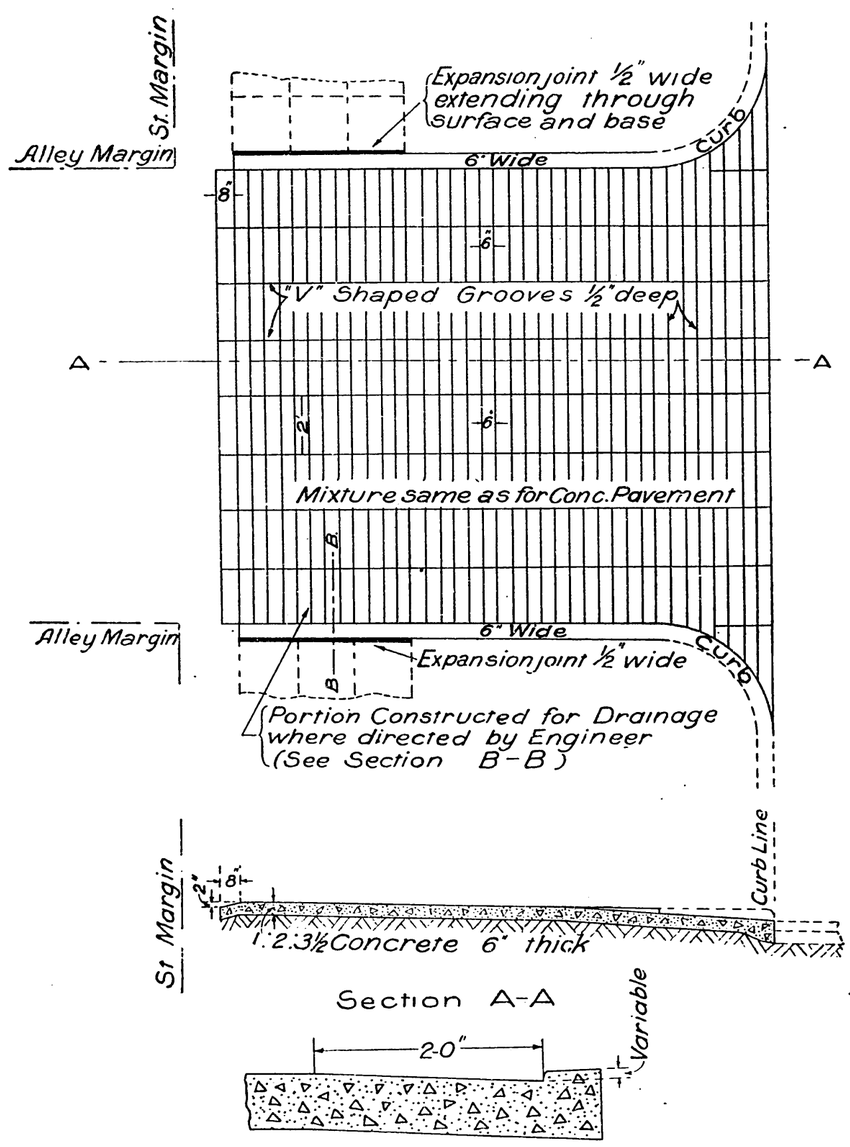
3" SEWER PIPE DRAIN





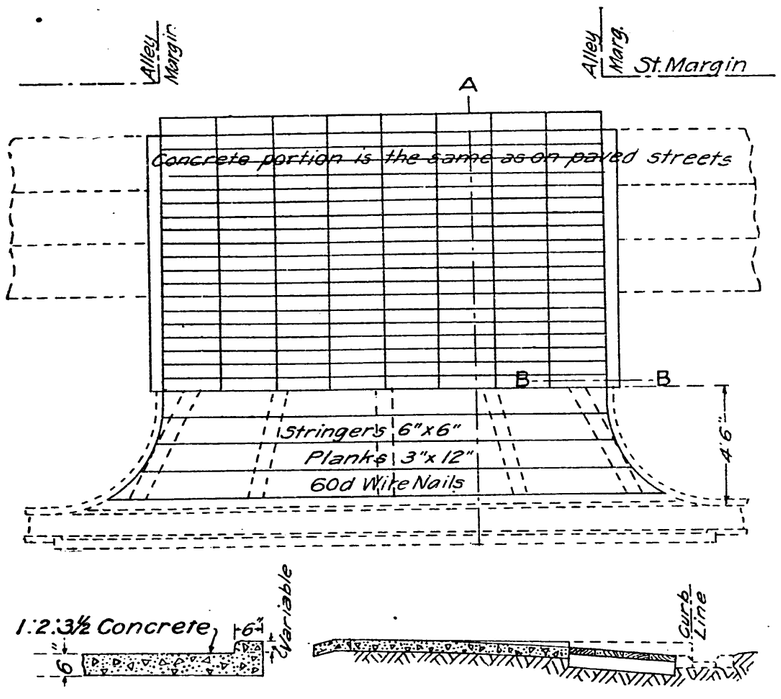
Section C-C

WOOD ALLEY CROSSING

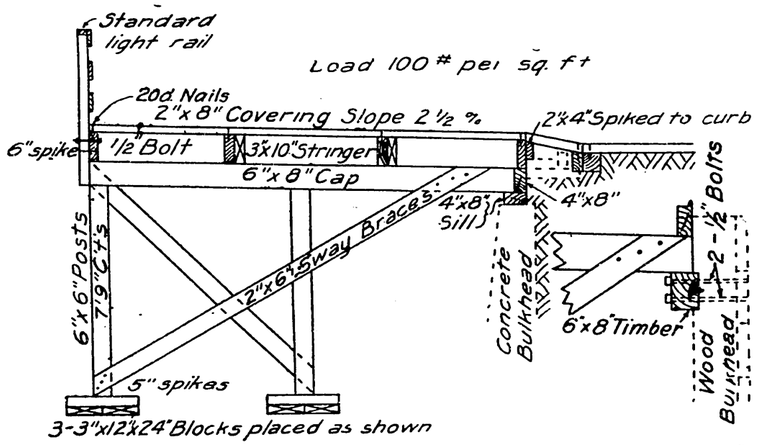


Section B-B

CONCRETE ALLEY CROSSING for Paved Streets



CONCRETE ALLEY CROSSING
For Unpaved Streets



SECTION OF SIDE WALK ON POSTS

SPECIFICATIONS
FOR
RETAINING WALLS

103. TIMBER BULLKHEADS

(For plans, see pages 76, 77 and 78)

The lumber for Timber Bulkheads shall conform in quality to the Standard Specifications in Section No. 53. The pieces shall be fitted, bedded and nailed in a manner satisfactory to the City Engineer. The posts shall be set in the excavation to the depth shown on the plans, or as directed by the City Engineer. In refilling these holes, the earth shall be tamped as specified for "Backfilling" in Section No. 110. "Dead Men" shall be bedded to the depth shown. No excavations, such as holes for posts, trenches for "Dead Men" or any other unexposed parts of the finished bulkhead shall be backfilled or covered until they have been fully inspected. All surfaces of lumber, which are not exposed to view in the completed structure, shall be painted with two (2) coats of hot Coal Tar Creosote Oil. The lagging shall be fastened to the posts with spikes of sufficient length to penetrate the post four (4) inches. There shall be two (2) spikes in each plank at each bearing. Where directed by the City Engineer, concrete of 1:3:6 mixture shall be placed under the posts.

Steel rods for anchors shall conform to the Standard Specifications for Billet Steel Concrete Reinforcement Bars, as specified in Section No. 62. Rods with upset ends shall have the upset made by upsetting the body of the rod. Welds shall not be made. After upsetting and before threading, all rods shall be properly annealed, Threads shall be United States Standard and shall be full and smoothly cut. Nuts shall be of United States Standard dimensions and shall fit the threads snugly. Threads shall be coated with white lead and tallow. Badly rusted or pitted rods shall not be accepted.

Cast iron washers shall conform in quality to the Standard Specifications for Cast Iron in Section No. 41.

Fir Blocks of the dimensions shown shall be placed under the cast iron washers.

All metal parts shall be well painted with two (2) coats of "P. & B." paint or its equal. Painting shall be done before placing the metal parts in the structure.

Payment for steel rods and nuts and cast iron washers shall be made at the price bid per pound for "Bulkhead Iron" and shall include excavation, backfilling and painting. Payment for all lumber in the structure shall be made at the price bid per M. ft. B. M. in place and shall include all excavation, painting, backfilling, spikes, cutting, fitting, etc. Payment for concrete footings shall be made at the price bid per cubic yard in place, and shall include the additional excavation involved.

104. CONCRETE RETAINING WALLS—PLAIN AND REINFORCED (For plans, see page 79)

(a) 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. 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 suitable tile or sewer pipe drain shall be laid and connected to the sewer, or given some other suitable point of discharge chosen by the City Engineer.

(b) EXTRA EXCAVATION

Extra Excavation shall be performed and paid for as specified in Section No. 68.

(c) FORMS FOR CONCRETE

Forms for concrete shall be well built, substantial and unyielding. They shall be properly braced and tied together by means of wire or rods, and they shall conform to the dimensions of the finished concrete. They shall be so constructed as to prevent bulging, or the leakage of mortar. For all exposed surfaces, the material used shall be dressed shiplap, or tongue and groove lumber, sound and free from loose knots or knot-holes. It shall be firmly nailed to the studding. For surfaces which are not to be exposed, rough lumber may be used. Angles or other details which may be sources of weakness in the masonry shall be rounded by providing fillets in the forms. Planking once used in the forms shall be cleaned and oiled before it is used again. The forms shall not be removed until permission is given by the City Engineer. In dry weather the forms shall be well wetted, before the concrete is placed, and all rubbish, sawdust or other foreign matter shall be removed. After the forms have been removed, projecting wires, bolts or other devices used for holding the forms, which appear on the face of the wall, shall be cut off one-fourth (¼) inch below the surface and the hole pointed with 1 to 2 mortar.

(d) CONCRETE

Concrete for retaining walls shall conform in quality and production to the Standard Specifications for "Concrete" in section No. 44, except that the mixture in each case shall be as shown on the plans or as modified by the City Engineer.

(e) PLACING CONCRETE

The concrete shall be deposited uniformly in layers, and the contractor shall provide sufficient labor to handle properly the output of the mixing machine. If there is any noticeable separation of the gravel from the mortar caused by wheeling in wheelbarrows or carts, or for any other reason not herein mentioned, the contractor shall remix the concrete materials before dumping them into the forms, and in any case where, in the opinion of the City Engineer, the section of the wall is such as to require it, the concrete shall be thoroughly remixed and graded before it is deposited. In each case the City Engineer shall determine whether or not the concrete may be deposited in the forms without the use of chutes. All concrete shall be thoroughly spaded as soon as deposited. The face of the wall shall be protected from gravel

pockets by spading back the gravel in such a manner so as to leave only mortar against the forms. Before any concrete is deposited on a previous day's work, the concrete in place shall be roughened, all laitance cleaned off, all sawdust and chips washed out with water and the surface covered with a layer of neat cement grout.

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 (⅓) 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.

(f) REINFORCEMENT STEEL

Reinforcement steel for concrete retaining walls shall conform to the requirements specified in Section No. 62. 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.

(g) Joints

Joints shall be made in all walls as indicated on the plans or where directed by the City Engineer. Where joints are required, the wall shall be built in alternate sections. For the purpose of keying the sections of the walls together, a recess shall be constructed in the ends of completed sections. This recess shall be four (4) inches deep and one-third (⅓) of the width of the wall, and it shall not be more than one (1) foot wide. On these exposed ends of the completed sections, just before pouring the intermediate ones, apply one coat of bituminous filler as specified in Section 47 and four (4) layers of No. 2 tarred roofing felt. Each layer of roofing felt shall be coated with pitch or asphalt as laid.

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.

Payments for joints and expansion joint materials shall be included in the price bid per cubic yard for concrete in the wall.

(h) FINISHING

As soon as the forms are removed, the surface of the wall shall be gone over with a chipping hammer and all projections brought down to an even surface. All wires shall be cut off one-fourth (¼) inch below the surface of the concrete and all holes, projections or rough spots pointed up with a mortar composed of one (1) part cement and two (2) parts sand. Care must be taken in removing the forms that edges, moldings, etc., are not damaged. The entire exposed surface shall then be thoroughly wetted and

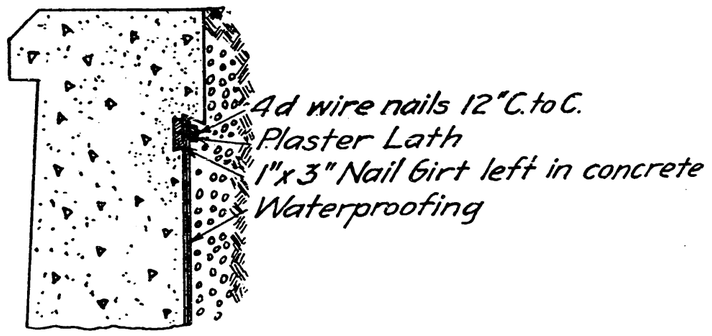
given a brush finish with a coat of thin mortar floated down with a wooden float.

Finishing shall be included in the price bid per cubic yard for concrete.

(i) WATERPROOFING

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 waterproofing 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"x 4" 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 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 any one 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 wall, 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.

(j) MATERIALS FOR WATERPROOFING

The felt herein specified 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 ashphalt as used in pavements.

The price bid for waterproofing per square yard shall be in full for all labor and material required to produce the finished result as herein specified.

(k) TILE DRAIN

When the waterproofing has been completed as specified above, a three (3) inch tile drain shall be laid along the heel at the foot of the wall and in any other location that the City Engineer may designate. Three (3) inch sewer pipe shall be laid from the drain to the sewer or as directed.

(l) BACKFILLING

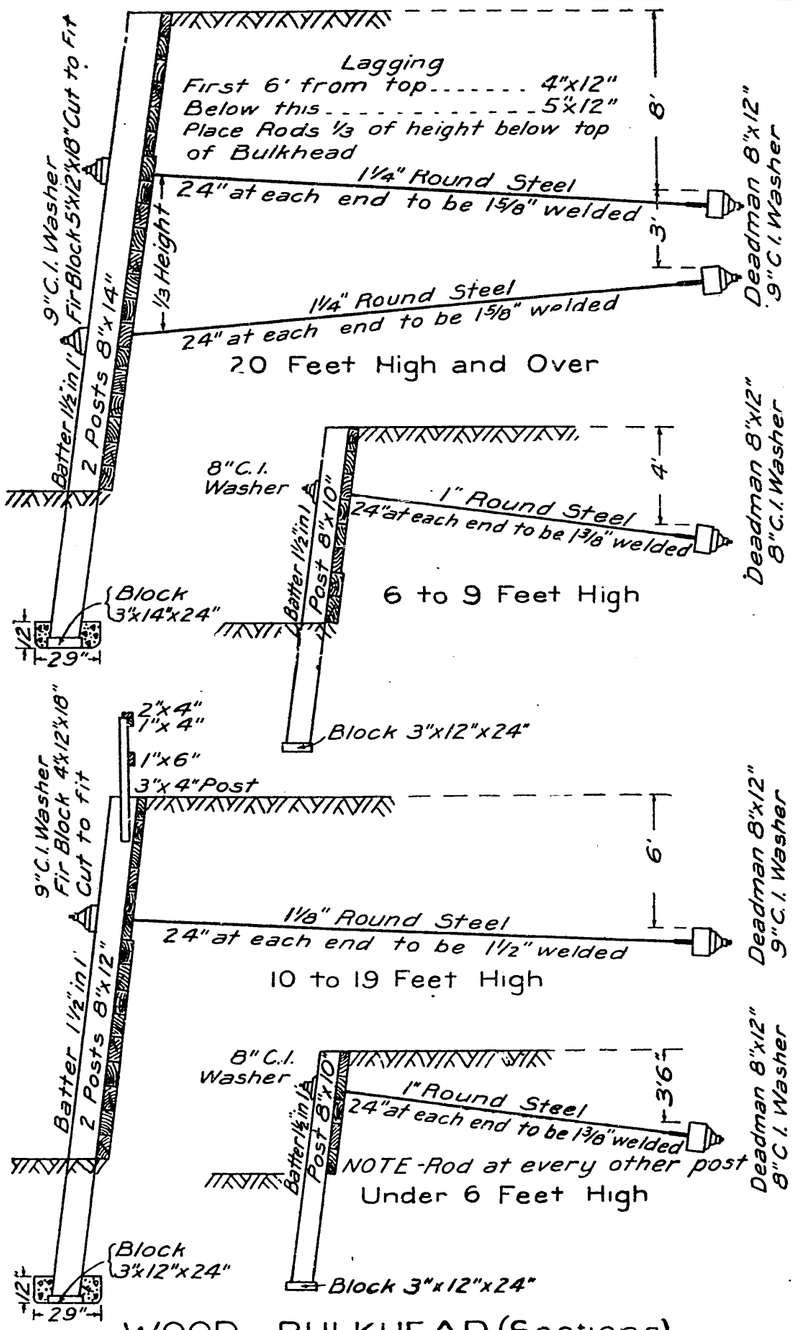
The backfilling for retaining walls shall be completed within ten (10) days after the waterproofing has been put on. It shall consist of two materials: First, a layer of gravel four (4) inches thick over the drain and against the waterproofing, and second, an earth fill. The gravel shall be placed with 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 and every layer shall be thoroughly rammed with a rammer ten (10) inches in diameter and weighing not less than forty (40) pounds. 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.

(m) PAYMENT

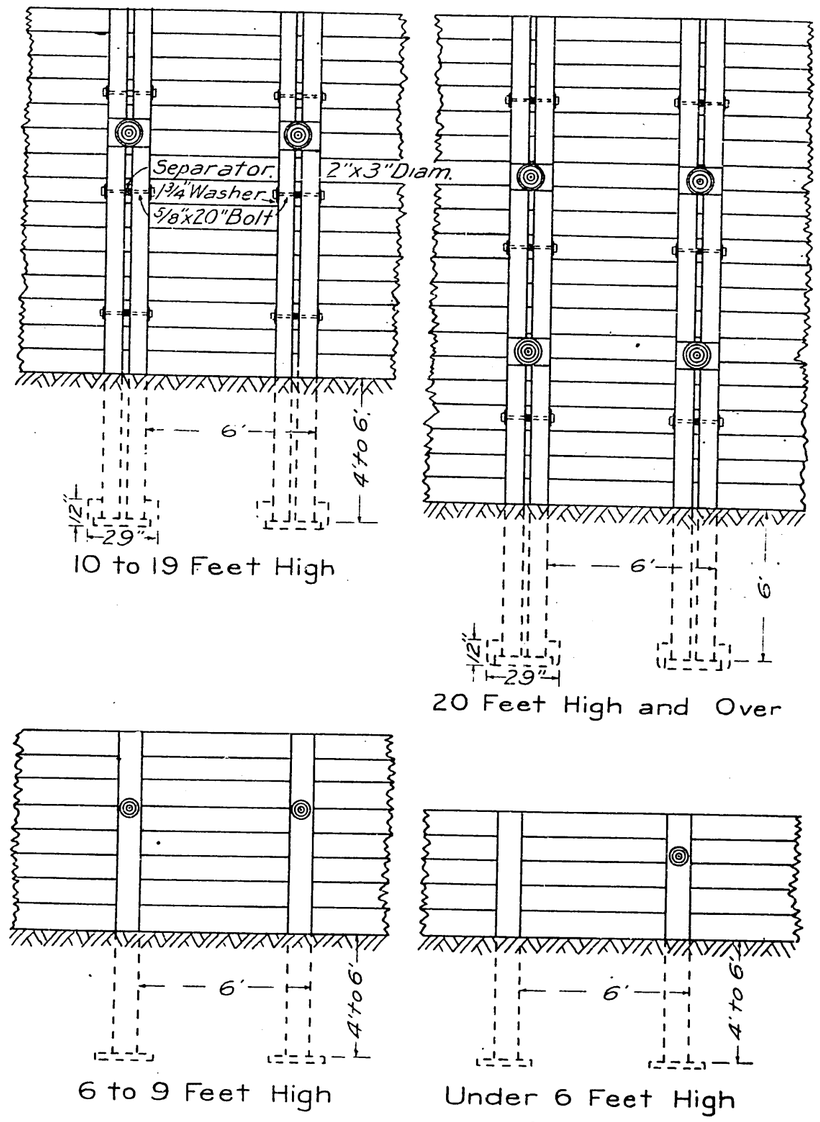
Payment for concrete retaining walls shall be made in the following manner for materials in place:

(1) Concrete per cubic yard.
(2) Steel Reinforcement per pound, according to Section 62-d.
(3) 3" Tile Drain per linear foot.
(4) 3" Sewer Pipe per linear foot.
(5) Waterproofing per square yard.
(6) Gravel per cubic yard.

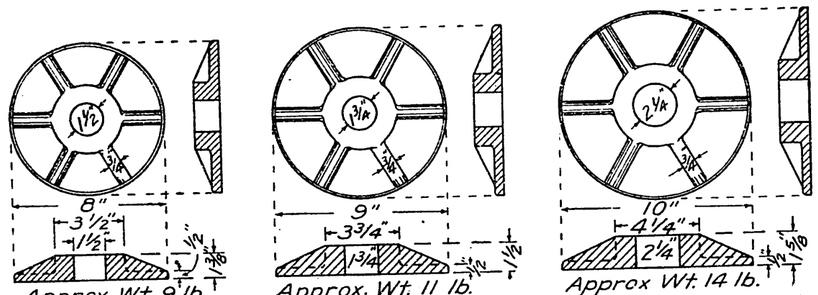
The payment for concrete at the price bid per cubic yard shall include payment for excavation, furnishing the material for and the construction of the forms, expansion joints, removing forms, finishing surfaces, backfilling and cleaning.



WOOD BULKHEAD (Sections)



WOOD BULKHEAD (Elevations)



Cast Iron Washers

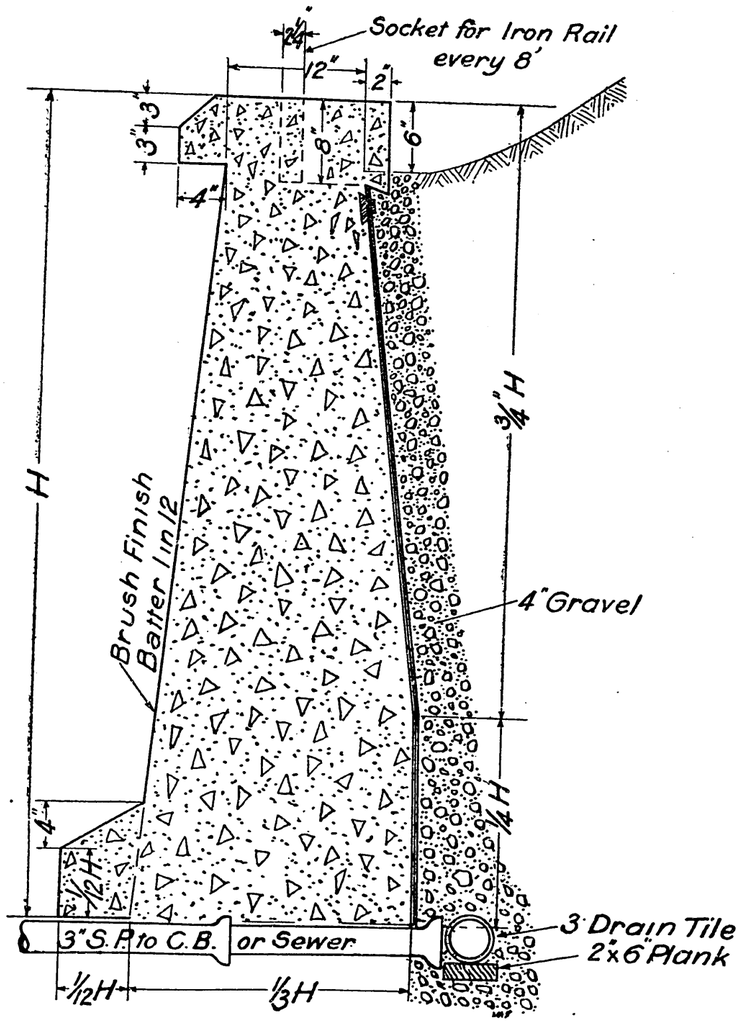
Material	Size Inches	Wt. per ft. in Pounds	Wt. of each in Pounds	Material	Size Inches	Wt. per ft. in Pounds	Wt. of each in Pounds
Rods	1	2.67		Nuts	1-3/8		2.5
"	1⅛	3.38		"	1½		3.2
"	1¼	4.17		"	1-5/8		4.0
"	1⅜	5.05		C.I. Washer	8		9.0
"	1½	6.01		" "	9		11.0
"	1⅝	7.05		" "	10		14.0
Separators	2x3 Dia.		3.7	W.I. Washer	1¾		0.1
Bolts	⅝x20		2.0				

Unit Weights

Height	Ft. B.M. per Ft. Length	Pounds Steel per ft. Length	Length of Rods	Height	Ft. B.M. per Ft. Length	Pounds Steel per Ft. Length	Length of Rods
4	33.9	6.0	15	15	134.8	22.2	22.5
5	40.1	6.0	15	16	142.4	23.0	24.0
6	46.3	12.0	15	17	150.1	23.9	25.5
7	52.4	12.0	15	18	157.8	24.8	27.0
8	58.6	12.0	15	19	165.4	25.6	28.5
9	64.7	12.0	15	20	193.6	58.7	30.0
10	96.4	18.0	15	21	201.7	60.8	31.5
11	104.1	18.8	16.5	22	209.8	62.9	33.0
12	111.8	19.7	18.0	23	217.9	65.0	34.5
13	119.4	20.5	19.5	24	226.0	67.0	36.0
14	127.1	21.4	21.0	25	234.1	69.0	37.5

Bill of Material

WOOD BULKHEAD



CONCRETE RETAINING WALL

SPECIFICATIONS FOR SEWERS AND APPURTENANCES

General Stipulations

105. 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.

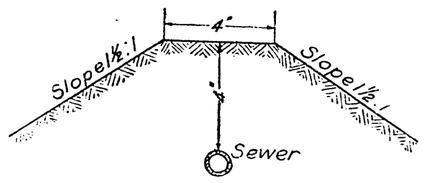
The alignment and grade of the sewer shall be indicated upon cross sills or timbers, four (4) inches by eight (8) inches by ten (10) feet long, except where sewers are eighteen (18) inches in diameter or less, in which case sills or timbers may be four (4) inches by eight (8) inches by eight (8) feet 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.

106. 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 and well tamped.

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



SEWER SECTION IN FILL

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, and no extra payment shall be made for straw beyond the price bid per linear foot for sewer.

When necessary the sides of the trench shall be braced and rendered secure by using either open or closed sheathing. The cost of all such sheathing shall be included in the price bid per linear foot for sewer, and no extra payment beyond such price shall be allowed.

All sewer pipe over twenty-four inches (24″) in diameter shall be laid in open trench.

Payment for trenching shall be included in the price bid per linear foot for sewer.

107. LUMBER LEFT IN TRENCH

Whenever, in the judgment of the City Engineer, the safety of either the street, the sewer constructed under this contract, or any other public utility, demands that the lumber used to support the sewer trench shall not be removed, this lumber shall be paid for at the rate of ten dollars ($10.00) per thousand feet board measure, based upon the actual measurement of the lumber left in the trench.

This payment shall be in full for all labor and material required to place the lumber in the position in which it may be left.

108. EXTRA EXCAVATION

Where called for, extra excavation shall be made and paid for according to the specifications for "Extra Excavation" in Section No. 68.

109. TUNNELING FOR PIPE SEWERS

Where pipe which is less than twenty-four (24) inches in diameter is used and the trench is ten (10) 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.

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

110. BACKFILLING

(a) BACKFILLING TRENCHES

Backfilling of trenches shall not be permitted until the cement in the pipe joints or in the 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 feet (200′) of 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 tamped with a shovel or light tamper; 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, and the material solidly tamped with appropriate tools, in such a manner as to avoid injuring or disturbing the completed sewer.

In the remaining portion of the backfill the earth shall be filled in and well rammed in layers not exceeding one (1) foot in thickness, up to the surface of the street.

The number of men filling shall not exceed the number of men ramming or tamping.

Walking on the pipe sewer shall not be allowed until at least one (1) foot of earth has been placed upon it. When the backfill has reached a depth of not less than one (1) foot over the top of the sewer, water settling may be used in place of ramming provided special permission has been given by the City Engineer.

Payment for backfilling trenches shall be included in the price bid for Sewers.

(b) 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 remaining four (4) feet of tunnel shall then be completely filled by working from either end. Voids over the pipe shall not be allowed. Payment for backfilling tunnels shall be included in the price bid for sewers.

111. BACKFILLING AND REPLACING PAVEMENT BY STREET DEPARTMENT

Whenever it is necessary to break through existing pavement for the purpose of constructing an outlet to a catch basin, side sewer, watermain, or any similar utility, in connection with a local improvement work which does not include pavement, the contractor shall open up the pavement, do the necessary excavating, and construct the utility. The backfilling of tunnels and trenches and the replacing of the pavement, however, shall be done in accordance with the provisions of Ordinances Nos. 17313 and 25150, which ordinances provide that the Superintendent of Streets and Sewers shall make repairs in pavements necessitated by reason of cuts and openings made therein in laying or relaying any gas, sewer, water, or other pipes or conduits by persons authorized by permit. Department bills shall be rendered for all such work done by the Department of Streets and Sewers, as outlined in Section 34.

Whenever it is necessary to break through existing pavement for the above purposes in connection with a local improvement work, the contract for which contains a paving item, the backfilling of trenches and replacement of the pavement according to the Standard Specifications shall be done by the contractor, and payment for the same shall be included in the price bid for the utility the construction of which necessitated breaking through the pavement.

The purpose of this section is to insure the proper replacement of pavements which have been opened by contractors who may not be equipped to do paving work.

112. MAINTENANCE

In all cases the contractor shall maintain the roadway over the completed sewer until the acceptance of the work by the Board of Public Works, and in no case shall the contractor be released until the roadway has been leveled or surfaced to the satisfaction of the City Engineer. Payment shall be included in the price bid for sewers.

SEWERS

113. PIPE SEWERS

(a) QUALITY OF THE PIPE

Sewer pipe shall conform to the Standard Specifications for Sewer Pipe as given in Section No. 60 under "Quality of Materials."

(b) 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 accepted pipes shall then be fitted together, matched and marked, before being lowered into the trench, and shall be laid as marked. 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. At each joint the interior of the bell shall be carefully wiped clean and the lower part well covered with cement mortar before the insertion of the spigot end. Special care shall be taken that the annular space at the sides and bottom, as well as the top of the joint, is well filled with mortar, which shall be thoroughly worked in.

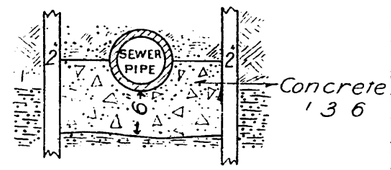
The cement mortar for filling the joints shall be composed of one (1) part cement and two (2) parts sand.

Mortar shall be thoroughly mixed just before being used and any mortar which has begun to set shall be thrown away.

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. Whenever joints in main pipe sewers, side sewers, and catch basin, inlet, or sand box connections are to be cemented, the contractor shall notify the City Engineer twenty-four (24) hours in advance. The City Engineer shall furnish an employee of the City of Seattle, skilled in laying sewer pipe, who shall cement the joints. Such employee shall be under the direction of the City Engineer and any labor so furnished shall be paid for as provided by Section 34.

The joints shall at all times be kept free from running water for at least twelve (12) hours after completion, and 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 before being cemented.



SEWER SUPPORT IN QUICKSAND

Where quicksand is encountered, the pipes shall be bedded in concrete, as shown, and paid for at the rate bid for the same per cubic yard; such payment shall be in full for furnishing and placing in position all material required.

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

The interior of the pipes shall be carefully cleaned from 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.

(c) 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 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 place the pipe, backfill the trench, restore the street surface and all other work necessary to give a finished result, in accordance with the specifications written herein.

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.

114. PIPE SEWERS RELAID

Sewer pipes shall be relaid where shown on the plans, or where directed by the City Engineer. Before the removal of the existing

sewer, satisfactory provision shall be made to take care of the sewage flow. The existing pipe shall be carefully removed and cleaned and protected from injury until relaid. Whenever in the process of removal, any breakage occurs, the contractor shall replace such broken pieces with new pipe. The pipe shall be relaid in accordance with the specifications for "Pipe Laying" hereinbefore written.

Payment for "Pipe Sewer Relaid" shall be made at the price bid per linear foot, and shall include the replacing with new pipe of any pieces broken during the work, and all excavation, backfilling and other work necessary to make a finished job. Measurement shall be taken on the slope as specified for new work.

115. BRICK SEWERS

(a) QUALITY OF BRICKS

Bricks for inverts shall be Class "A" Brick Blocks and those for arches, Class "B" Brick Blocks. When shown on the plans, the bricks for inverts and for arches shall be wedge shaped. Vertical fiber bricks shall not be used for brick sewers.

(b) BRICK LAYING

All bricks shall be thoroughly wetted immediately before being used. They shall be laid in straight courses, parallel to the axis of the sewer with "push" joints so as thoroughly to fill every joint with mortar. The mortar shall be composed of one (1) part Portland cement and two (2) parts of sand. Joints shall be of a uniform thickness as nearly as possible and not exceeding three-eighths (⅜) of one (1) inch. On the inside of the invert the joint shall not exceed one-eighth (⅛) of one (1) inch in thickness and on the sides and on the invert they shall be struck when laid. The upper arch shall be built upon strongly made centers. The crown of the arch shall be thoroughly keyed with stretchers. The centers shall not be withdrawn until the mortar is well set. The exterior surface of the upper arch shall be covered with a coat of mortar, not less than three-eighths (⅜) of one (1) inch in thickness. All brick work shall be thoroughly bonded. The unfinished ends of all sewers shall be racked back in courses. "Toothing" shall not be allowed. Slants, of the diameter shown on the plans shall be furnished by the contractor and set where directed at right angles to the main sewer in a neat and workmanlike manner, to the satisfaction of the City Engineer. Each slant shall be provided with an earthenware stopper.

(c) MEASUREMENT AND PAYMENT

Measurements of each size of brick sewers constructed shall be made on the slope from center to center of manholes. Payment shall be made at the price bid per linear foot and shall include the slants, excavating, sheathing, pumping, backfilling, and all other labor and material necessary for the finished work.

116. WOODEN BOX SEWERS

Wooden box sewers shall be constructed according to the details shown on the plans.

All lumber for sides and bottom shall be sized on one side and two edges. The box shall be laid to a true and even grade, securely nailed together and practically water-tight.

Payment for wooden box sewers shall be made at the price bid per M. ft. B. M. and shall include all excavations, backfilling and all other labor and material necessary for the completed work.

SEWER APPURTENANCES

117. 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.

Size of Wyes:	Size of Pipe:	Each
6″	8″	$ .60
6″	10″	.80
6″	12″	1.05
6″	15″	1.75
6″	18″	2.50
6″	21″	3.00
6″	24″	3.75
6″	30″	6.80

118. SIDE SEWERS

Side Sewers shall be constructed in accordance with the Standard Plans and Specifications for "Sewers," with the top of side sewer connections at the curb line not more than 1′ above the main sewer, unless otherwise directed. 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 6″ of the surface. A brass tag 1½″x3″ stamped "SEWER" in letters ¼″ 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" 2½″ high. The end of the side sewer next to the curb shall be laid in open trench and all side sewers shall terminate with wyes at the curb line. Backfilling in the trench or tunnel shall not be commenced until the work has been approved by the City Engineer. Existing side sewers shall be relaid when necessary in the manner provided for side sewers.

Whenever a new wye is to be inserted in an existing sewer, it shall be done by the Department of Streets and Sewers and paid for by department bills, as outlined in Section 34.

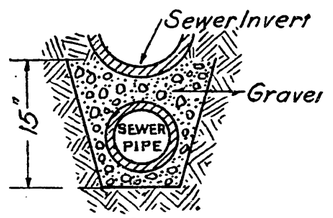
Payment for "Side Sewers" shall be made at the price bid per linear foot and shall include the payment for side sewer markers, marking the concrete walks or curbs, and wyes at the curb line. Side sewers shall be measured on the slope.

119. EXTENSION OF SIDE SEWERS

Property owners shall be permitted to extend side sewers in accordance with Ordinance No. 37671 and connect fixtures thereto as soon as she work in the street has set sufficirntly. Such permisgion shall not relieve the contractor from maintaining the street sewers until final release has been issued.

120. 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.



SEWER SUB DRAIN

Payment shall include all excavation, pipe, gravel, and other material, and shall be made at the price bid per linear foot. Measurement shall be made on the slope.

121. MANHOLES (For plans, see page 92)

Manholes may be constructed of Class "C" brick, concrete or concrete blocks.

The excavation for all manholes and flush tanks shall be sufficient to leave six (6) inches in the clear between their outer surfaces and the bank or timber used to support it. 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 three (3) parts sand. The covers of manholes shall be brought accurately to the grade given. The channels in manholes shall conform accurately to the sewer grade. In the case of pipe sewers, split pipe shall be used for the inverts of these channels where possible. Where a curve or some other condition prevents this, the channel shall be formed of bricks set on edge, with mortar. Brick channels shall be lined with cement mortar, one-quarter (¼) inch thick, mixed with one (1) part cement to one (1) part sand, exactly semi-circular and of the diameters of the pipes which they connect, tapering uniformly if these be of different sizes.

Manholes shall be provided with iron steps and a cast iron ring and cover, in accordance with the details shown.

All manhole, catch basin, flush tank or other covers to chambers shall have an even bearing all around on the frame.

Concrete for base or footing shall be composed of one (1) part Portland cement, two (2) parts sand and five (5) parts gravel.

Where the foundation is in hard pan, the City Engineer may order the modified form of manholes, as indicated by dotted lines on the plan, involving less excavation concrete and brick work. A deduction of five dollars ($5.00) from the price bid shall be made for each manhole so modified.

All manholes in ungraded streets shall be built to the proposed street grade shown on the plan, and also extended to the surface of the ground as hereinafter provided. (See "Manhole Extensions").

Where shown on the plan, existing manholes shall be readjusted in such manner as to permit a proper connection for the new sewer in accordance with the details given. The cost of such work, including all labor and material required, shall be included in the price bid per linear foot for the completed sewer, and no extra payment shall be allowed therefor.

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 plans and specifications.

122. DROP MANHOLES (For plan, see page 94)

The specifications hereinbefore written for Standard Manholes shall apply as well to Drop Manholes, with the addition of the particular details shown on the plan. The vertical sewer pipe and brick division wall shall be laid up with mortar joints along with the walls of the manhole, and the space around the pipe shall be filled with brick bats and mortar. 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 for "Drop Manholes" and shall include excavation, masonry, backfill, iron steps, castings, cast iron bend, vertical sewer pipe, specials, and all other labor and material necessary to complete the work according to specifications.

123. CONCRETE BLOCK MANHOLES

The contractor has the option of constructing the walls of the manholes of concrete blocks if he so desires. The concrete for the blocks shall be composed of one (1) part cement, two and one-half (2½) parts sand and five (5) parts gravel. All cement, sand and gravel used shall be of the same quality as specified for these materials in the Standard Specifications, and shall be mixed in a manner satisfactory to the City Engineer. Blocks shall be not less than six (6) inches thick on radial lines, they shall have vertical grooves in adjoining faces, and allowed to set thirty (30) days before being used. When thoroughly dried and immersed in water for twenty-four (24) hours the blocks shall not absorb more than five per cent (5%) of water by weight. Concrete blocks shall not be accepted unless they have been manufactured under the inspection of the City Engineer.

The blocks shall be set in one-half (½) inch of mortar composed of one (1) part cement and two (2) part sand. The end joints shall be completely filled with mortar and the grooves at the ends of the blocks filled flush with the top and well tamped.

Payment for the Concrete Block Manholes shall be made at the price bid for "Manholes" and shall include castings, excavations, backfilling and all labor and material necessary to complete the work according to plans and specifications.

124. BRICK FLUSH TANKS (For plan, see page 96)

The specifications for Manholes shall apply to flush tanks in regard to masonry and general requirement for castings, except that concrete blocks shall not be used.

Flush tanks shall be plastered on the inside with a coat of cement mortar one-quarter (¼) inch in thickness, mixed with one (1) part cement to one (1) part sand. Flushing apparatus shall conform to the detail plans. Other designs of flush tanks may be used, provided that detail plans thereof have been submitted to the Board of Public Works and have been approved by it. Flush tanks shall be connected to the nearest watermain by a one-half (½) inch galvanized iron pipe. The tap shall be furnished by the City Water Department and the contractor shall deposit with said department the sum of Eight Dollars ($8.00) in payment therefor. The contractor shall furnish and place in position a regulating device of a pattern approved by the City Engineer. Where there is no existing watermain, the contractor shall furnish and place in position the regulating device, together with sufficient length of one-half (½) inch galvanized iron pipe to project not less than two (2) feet beyond the tank. He shall deposit with the City Water Department the sum of Eight Dollars ($8.00) to cover the cost of making the connection when the watermain is laid. A one-half (½) inch rough "T" handle brass stop cock with nipple for attaching regulating device shall be furnished and set in place. The sniff-hole shall be provided with a suitable brass bushing.

Payment for flush tanks shall be made at the price bid each for "Flush Tanks" 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.

125. BRICK CATCH BASINS (For plan, see page 99)

Bricks used shall be Class "C". Catch basins shall be plastered on the inside with a coating of cement mortar one-quarter (¼) of an inch in thickness, mixed one (1) part Portland cement, to one (1) part sand. The bricks, brick laying and mortar shall correspond to that specified for brick manholes.

The connection made from the catch basin to the sewer shall be located to meet the requirements of the Public Utilities Department of Seattle, as shown by the 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.

All catch basins shall be provided with cast iron frames, covers, inlet gratings and outlet traps as shown on 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.

Payment for brick catch basins shall be made at the price bid each for "Catch Basins" or "Special Catch Basins," which shall include small pieces of curb, gutters and lips necessary to piece out the work around castings and all other labor and material necessary to complete the work according to specifications.

126. CONCRETE MANHOLES, FLUSH TANKS AND CATCH BASINS

The concrete shall be composed of one (1) part cement, three (3) parts sand and five (5) parts gravel. The materials used shall be of the same quality and mixed in the same manner as specified under Section No. 44. The concrete shall be 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 watertight. The contractor shall provide all necessary forms. Filling in around the work shall not be allowed until the concrete has thoroughly set. Any additional work necessary to construct concrete manholes, flush tanks or catch basins shall be made in accordance with the standard plans and specifications for brick manholes, flush tanks and catch basins. The catch basins and flush tanks must be water tight. The necks shall be constructed of Class "C" brick as shown on the detail plan.

Payment for Concrete Manholes, Flush Tanks and Catch Basins shall be made at the price bid each for "Manholes," "Flush Tanks" and "Catch Basins," and shall include all labor and material necessary to complete the work according to specifications.

127. WOOD MANHOLES For plan, see page 105)

Wood manholes shall be built according to the detailed plans shown herein. The lumber for the sides and bottom shall be sized on both edges and the box securely nailed together.

Payment for "Wood Manholes" shall be made at the price bid for each, and shall include excavation, back-fill and all other labor and material necessary to complete the work according to specifications.

128. WOOD MANHOLE EXTENSIONS

(For plan, see page 105)

In ungraded streets all manholes shall be extended from the proposed street grade to the surface of the ground, as shown on the plan or as directed by the City Engineer, by constructing an extension of wood which shall be built in all respects in accordance with the detail plans therefor.

Payment for "Wood Manhole Extensions" shall be made at the price bid per linear foot measured vertically, and shall include all labor and material necessary to complete the work according to specifications.

129. REBUILDING MANHOLES, CATCH BASINS, GATE CHAMBERS AND FLUSH TANKS

REBUILDING THEIR TOPS AND ADJUSTING THEIR COVERS

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 three (3) bricks in height or less, the work shall be classified and paid for at the rate bid each, for "Adjusting M. H. etc. Covers." Where the change is more than three (3) bricks 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 completed work.

130. 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.

131. INLETS (For plan, see page 106)

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 of the "U" shall be set one (1) inch below the surface of the pavement and care shall be taken that the pavement is brought down in order to lead all water quickly into the inlet.

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." The concrete around the inlets shall be 1:3:6.

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.

132. MOVING INLETS

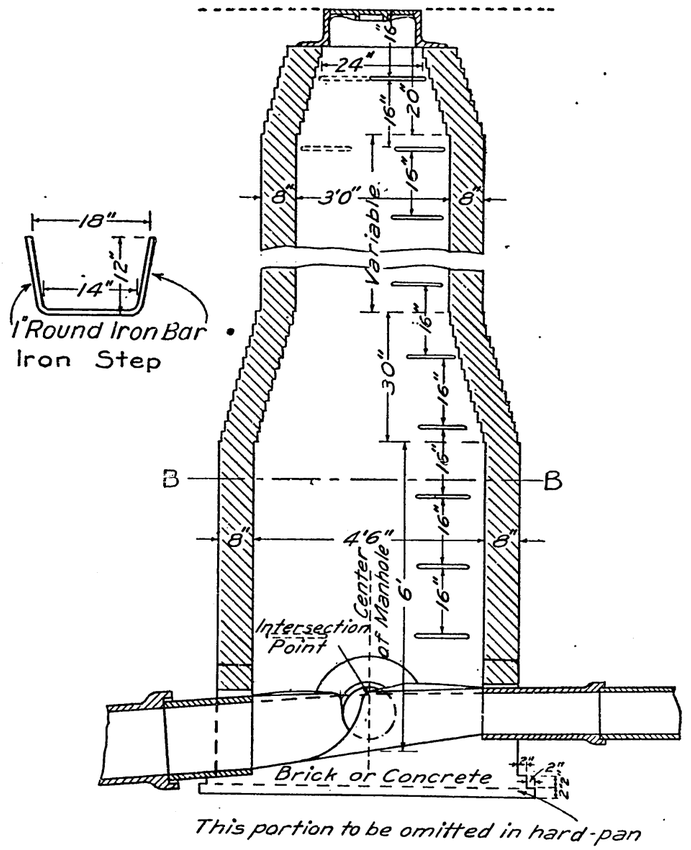
Existing inlets shall be moved to a new position, where shown on the plan or as directed by the City Engineer. The contractor shall furnish all new material required and reset such inlets in the manner specified for new work.

Payment for "Moving Inlets" shall be made at the price bid for each.

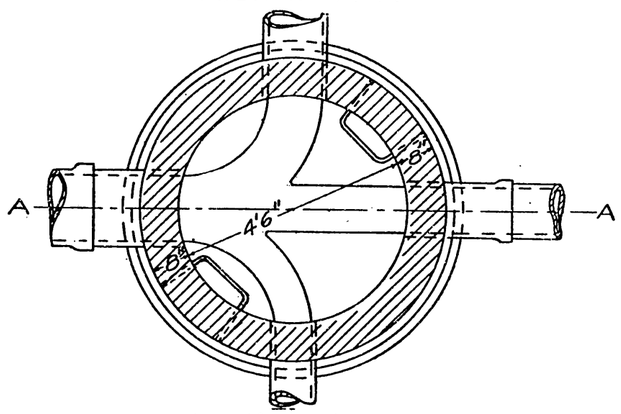
133. CURB INLETS (For plan, see page 107)

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 rail 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 mixed in the proportion of one (1) part Portland cement, three (3) parts sand and six (6) parts gravel.

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.

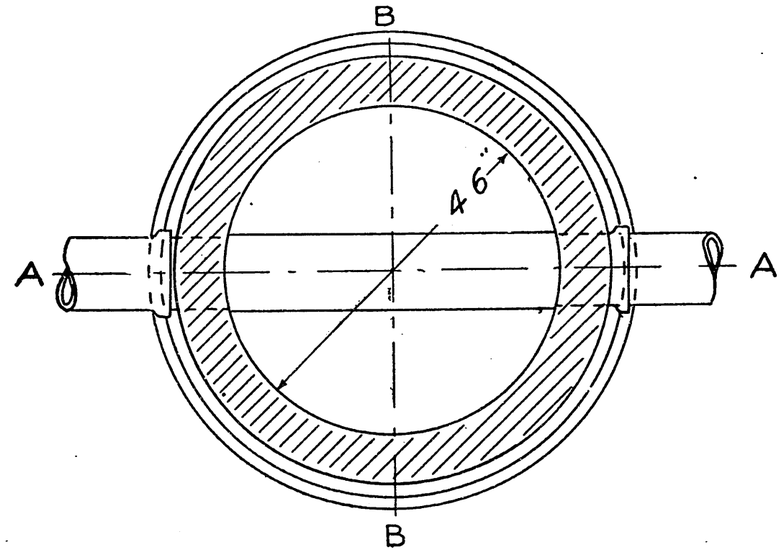


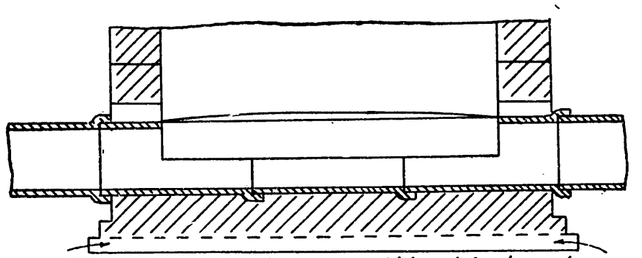
Section A-A



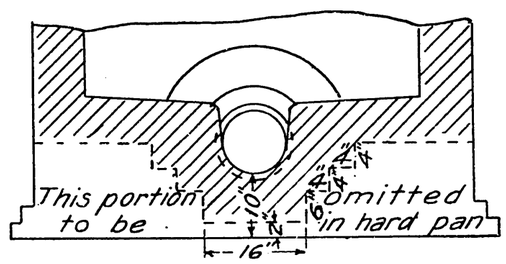
Section B-B

BRICK MANHOLE



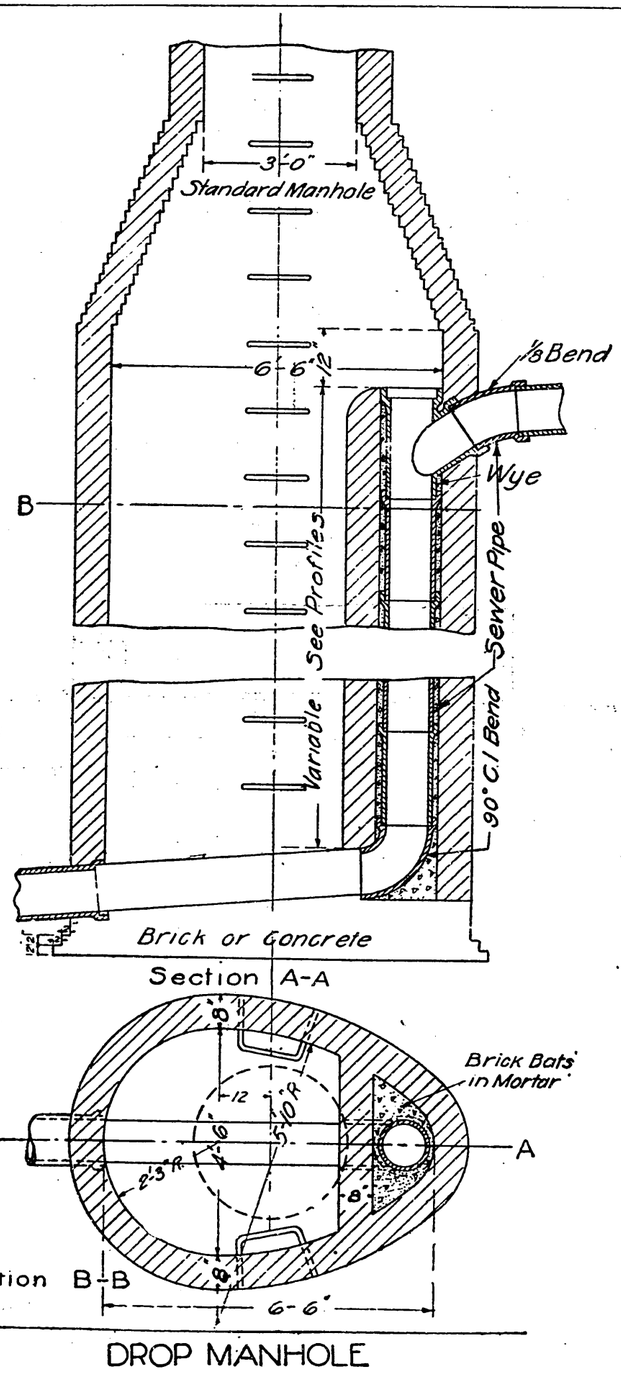


Section A-A

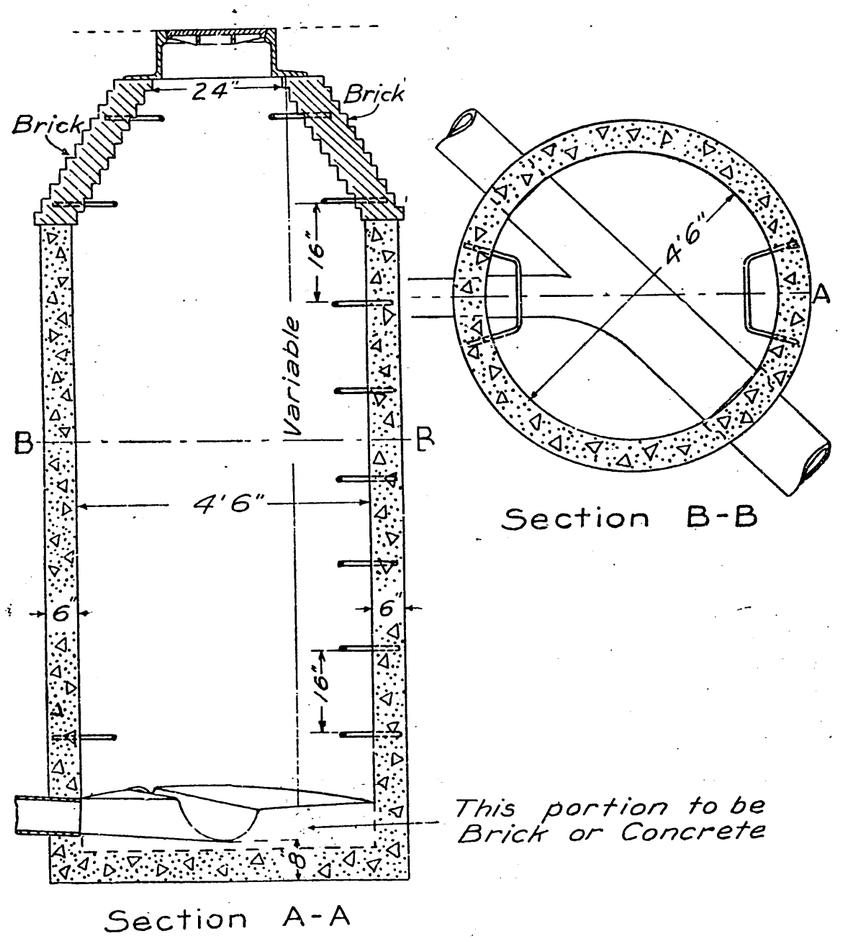


Section B-B

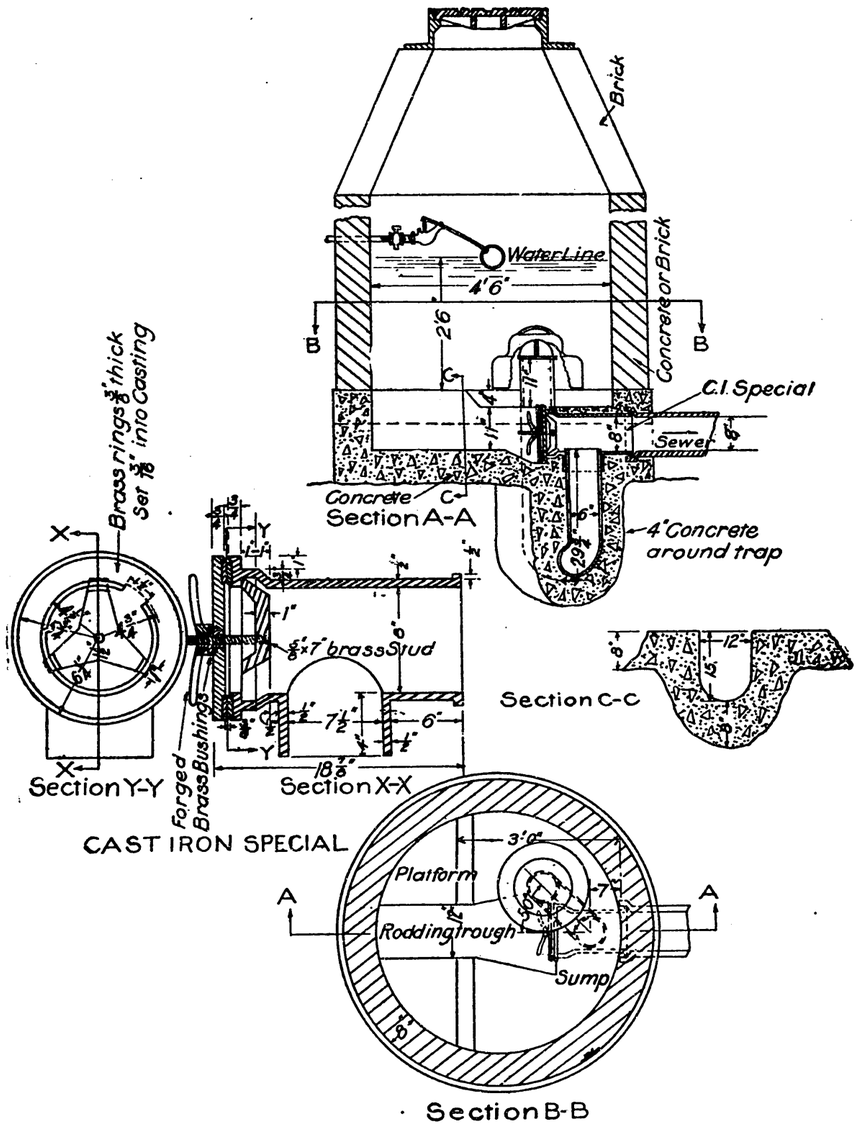
BOTTOM OF MANHOLE SHOWING MODIFIED FORM



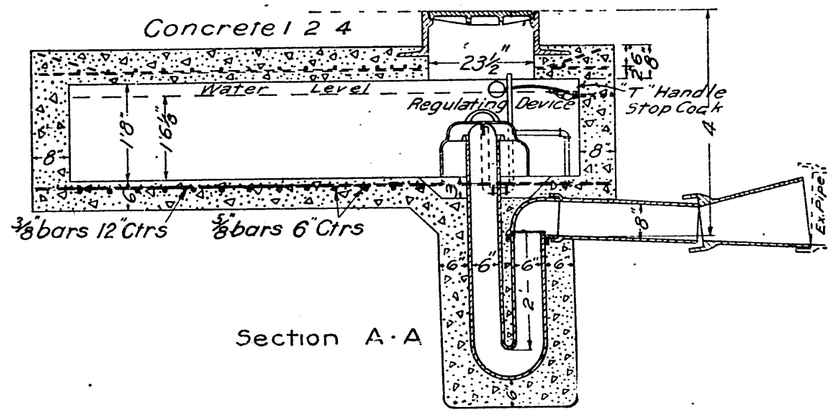
DROP MANHOLE

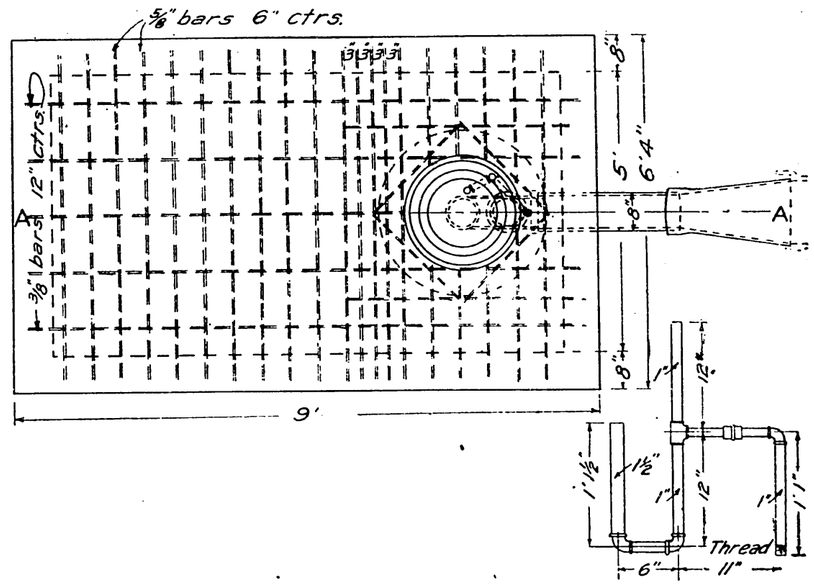


CONCRETE MANHOLE



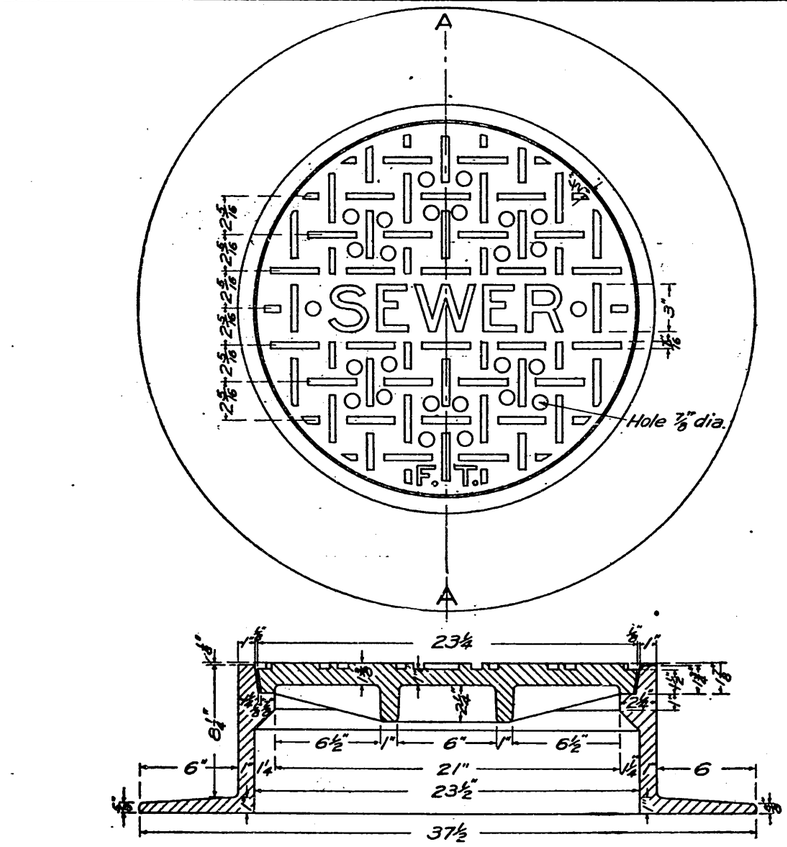
FLUSH TANK





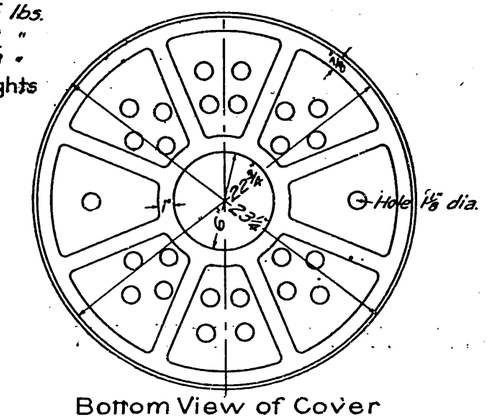
SHALLOW FLUSH TANK

Detail of Blow-off Trap

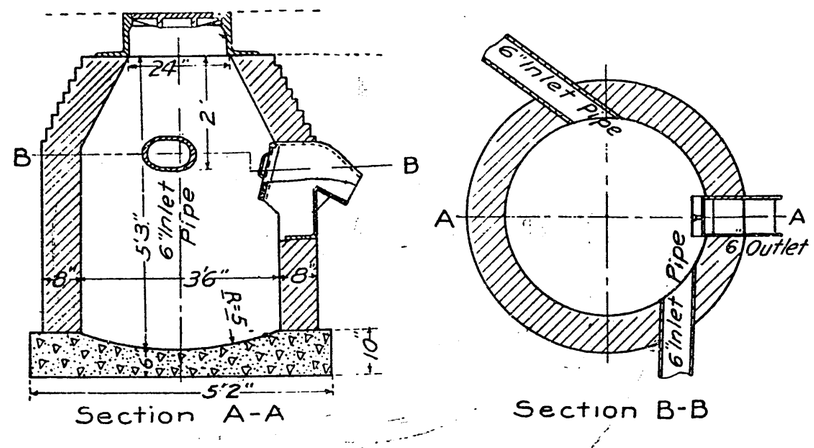


Ring	345 lbs.
Cover	153 "
Total	498 "

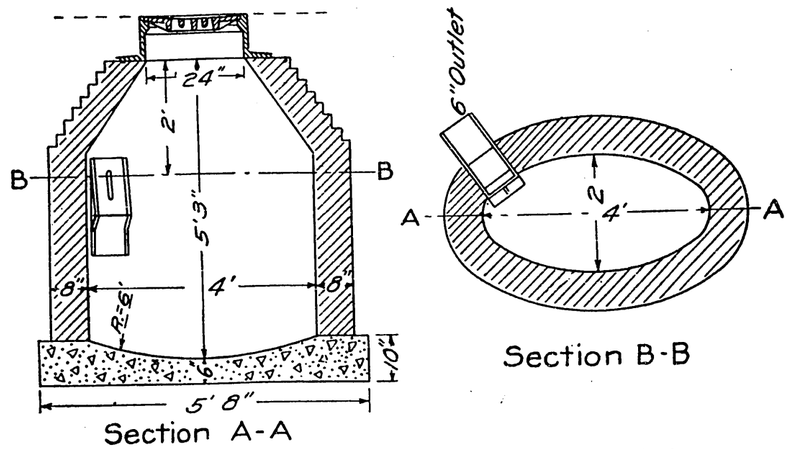
Approximate Weights



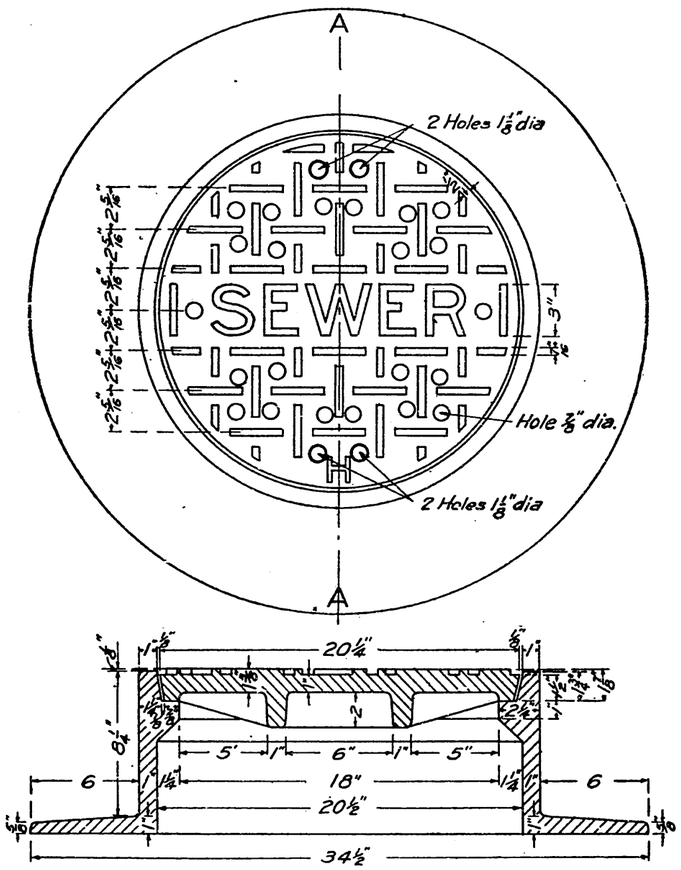
COVER FOR FLUSH TANK



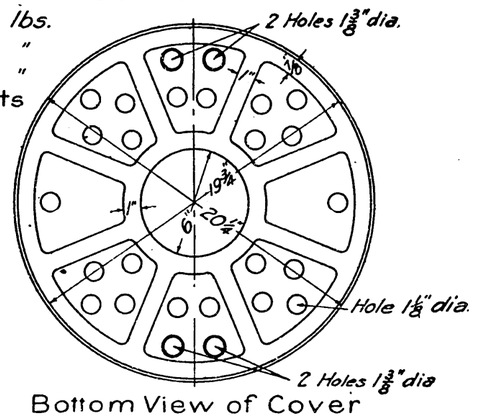
CATCH BASIN



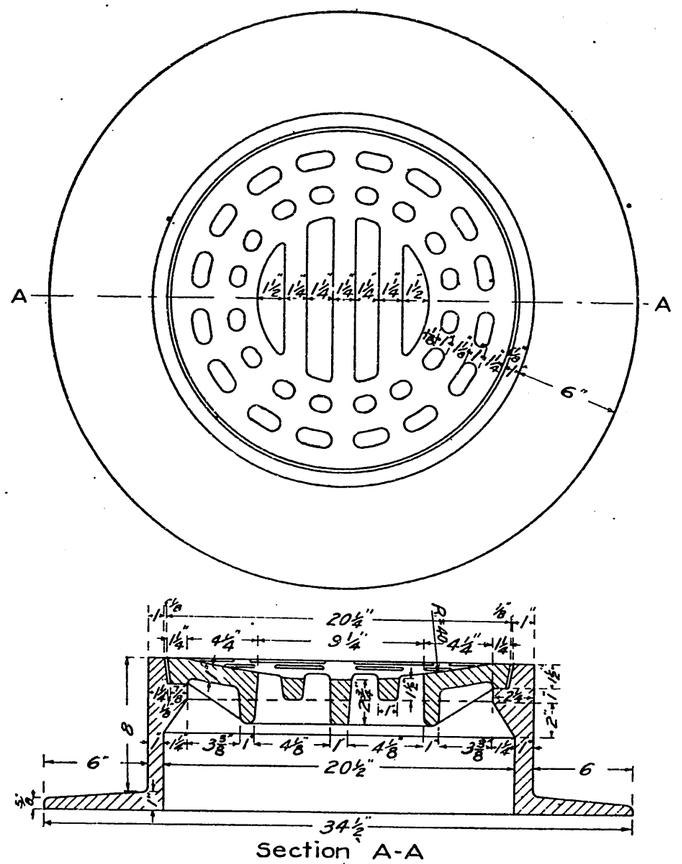
ELLIPTICAL CATCH BASIN

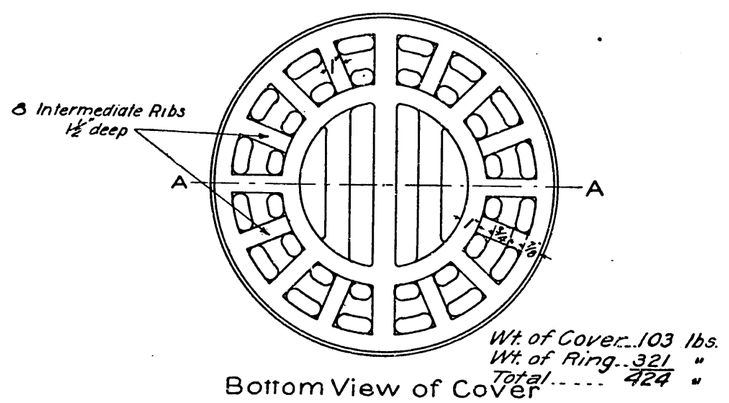


Ring 321 lbs.
Cover 116 "
Total 437 "
Approximate Weights

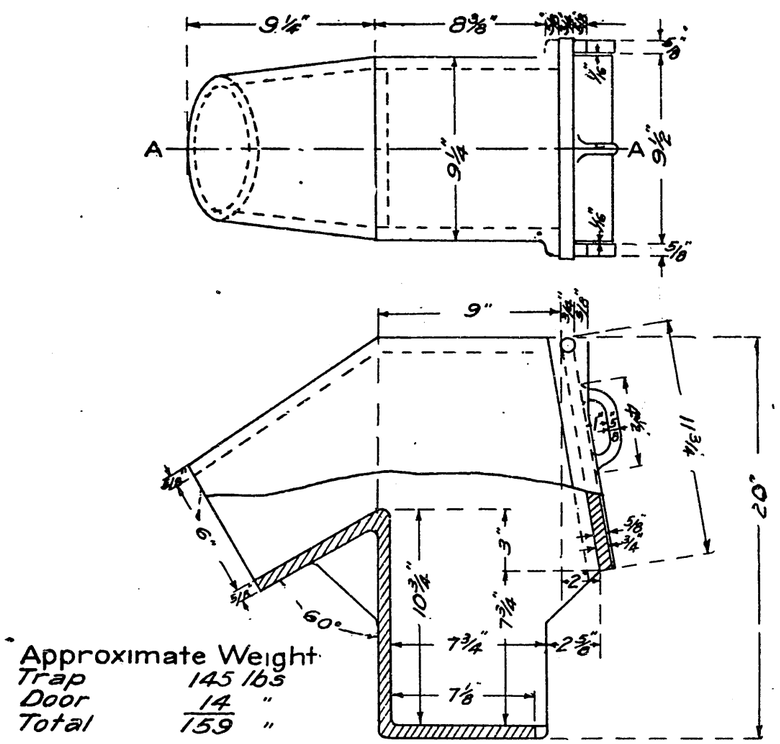


COVER FOR CATCH BASIN & MANHOLE

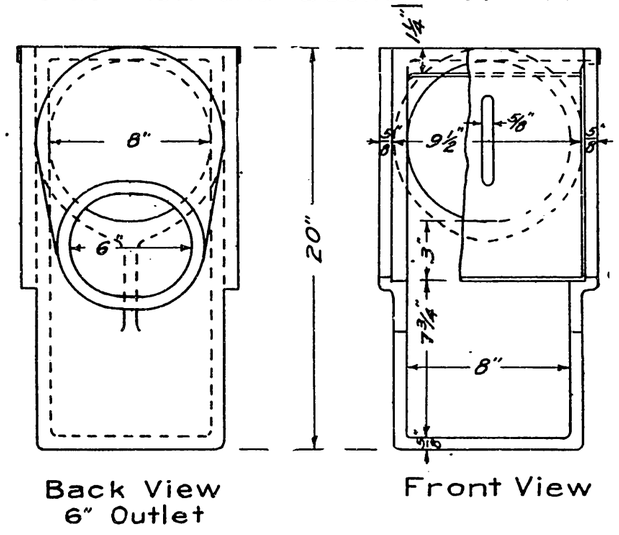




CATCH BASIN COVER - INLET TOP



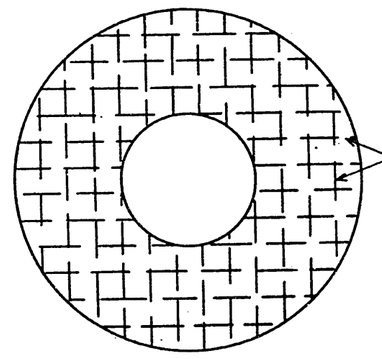
Side View and Section A – A



Back View
6" Outlet

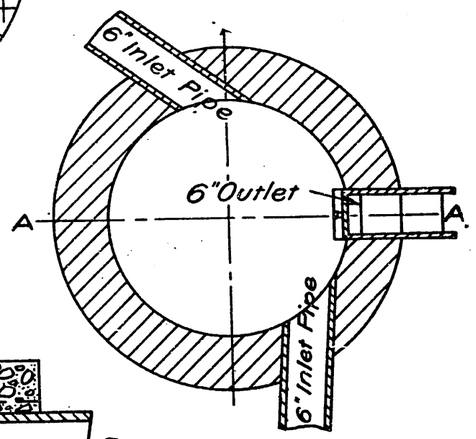
Front View

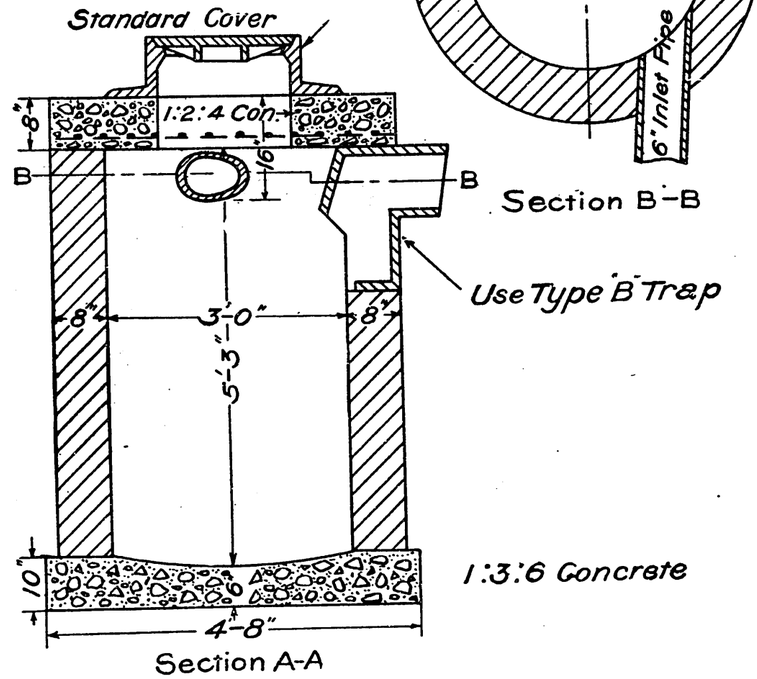
CATCH BASIN TRAP TYPE "A"



½" Corr. Billet-Steel Bars
4" Ctr. to Ctr.

Plan





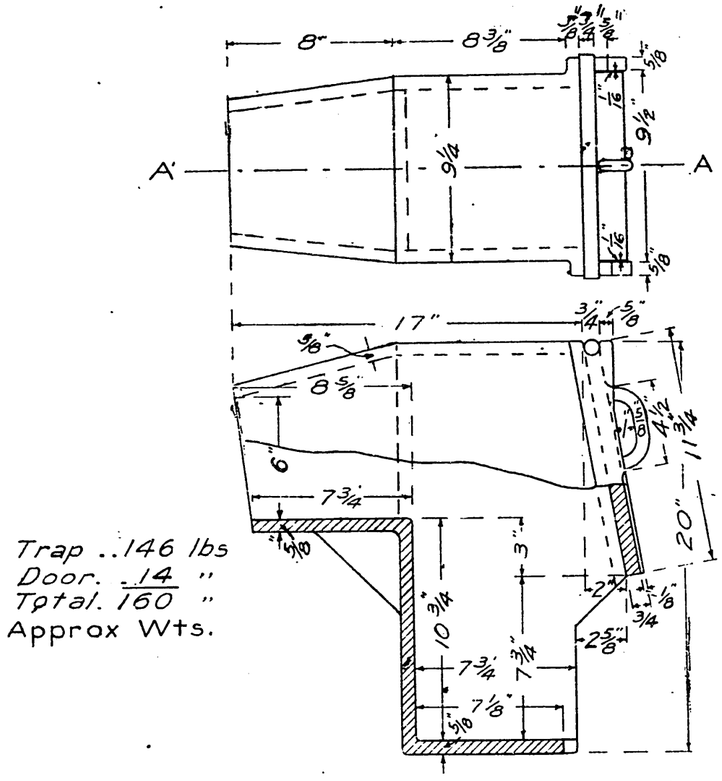
Section B–B

Use Type "B" Trap

1:3:6 Concrete

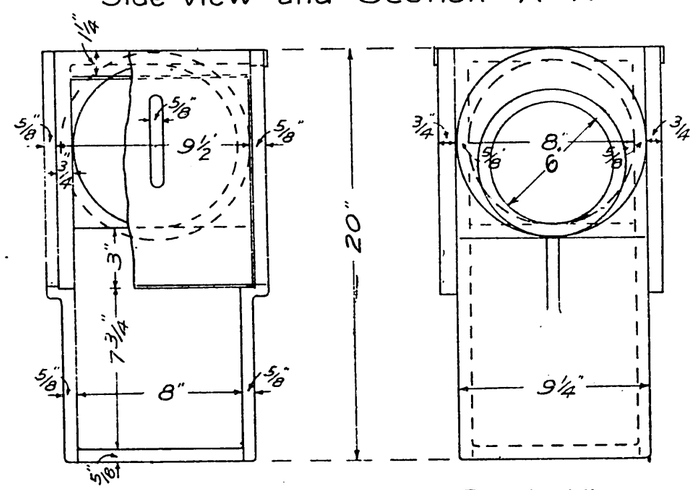
Section A-A

SPECIAL CATCH BASIN



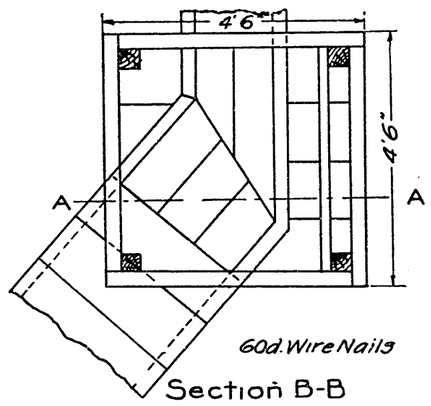
Trap ..146 lbs
Door. .14 "
Total. 160 "
Approx Wts.

Side View and Section A-A

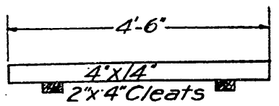


Front View Back View

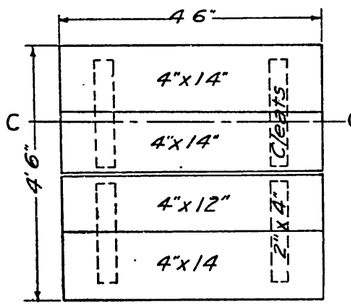
CATCH BASIN TRAP TYPE "B"



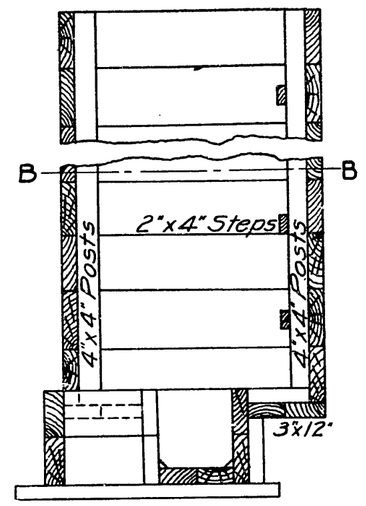
Section B-B



Section C-C

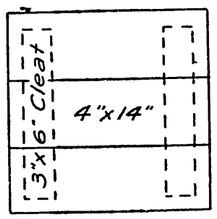


Top View of Cover

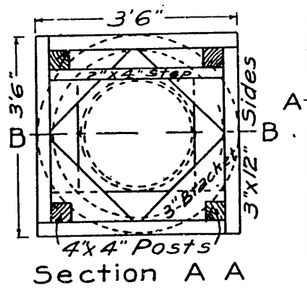


Section A-A

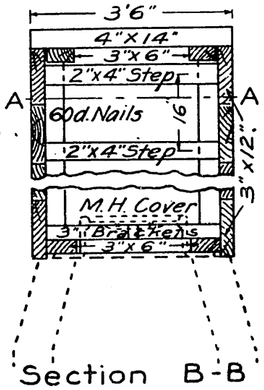
WOOD MANHOLE



Cover



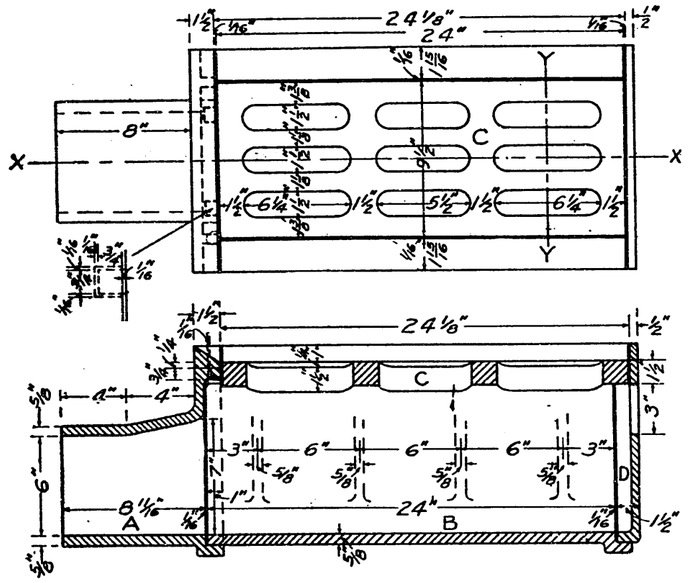
Section A A

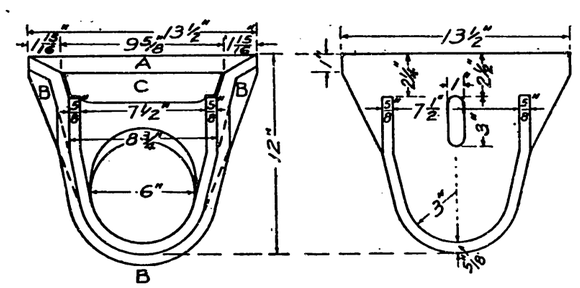


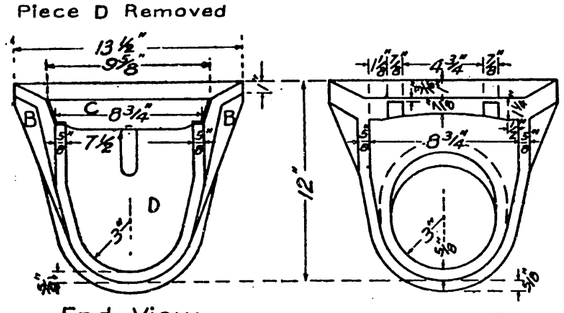
Section B-B

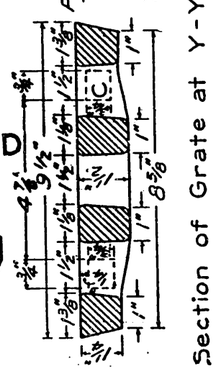
266 ft B.M for 4 depth
46 " " " per foot

WOOD. EXTENSION TO MANHOLE

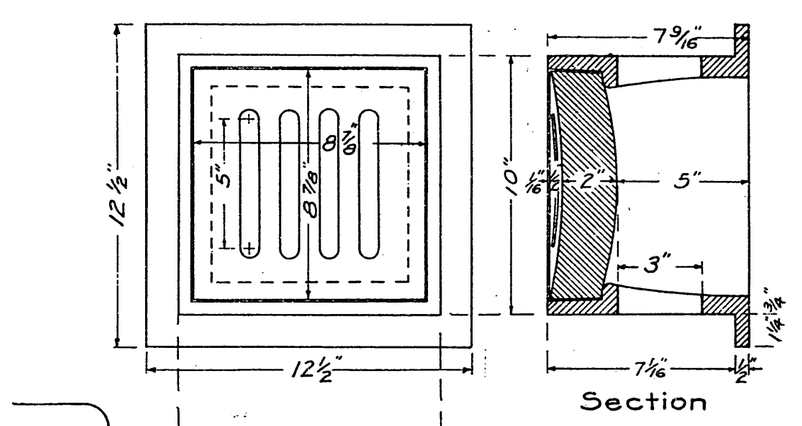








INLET

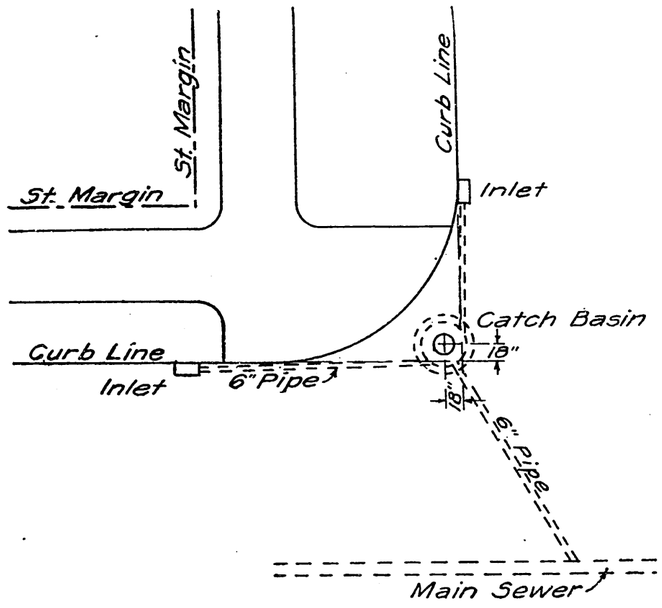


Transverse Section

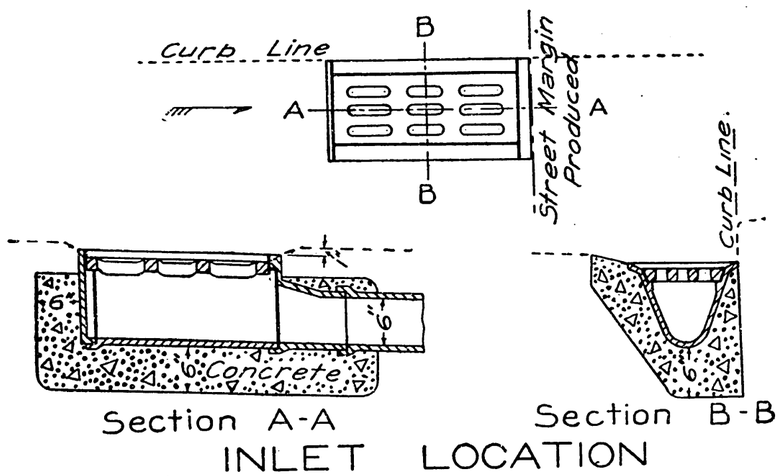
Approximate Weight

Cover	33 lbs.
Frame	65 "
Total	98 "

CURB INLET



CATCH BASIN LOCATION



INLET LOCATION

SPECIFICATIONS
FOR
WATERMAINS AND APPURTENANCES

General Stipulations

134. 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.

For 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 the pipe shall be laid in conformity with the grades shown on the profile, and no allowance shall 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 specials and special castings shall be set as shown on the plan or as directed by the City Engineer.

135. 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 on a fill, such fills shall be made of proper material and of such dimensions as to be not less than eighteen inches (18″) in depth over the top of the pipe, and four feet (4′) in width on top of the fill, with proper side slopes. 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 are to be constructed in accordance with the

details shown on the plans, or as directed by the City Engineer. Such work shall be paid for at the prices bid therefor as stated on the bid blanks for this improvement.

All parts of stumps that are within four (4) feet of the pipe shall be entirely removed. Boulders or rocks shall be removed to the width of the trench before the watermain is laid, and the cost of such removal shall be included in the price per linear foot of watermain laid.

Whenever it is necessary to break through existing pavements for the purpose of constructing a watermain, the backfilling and replacement of the pavement shall be done in accordance with the provisions of Section No. 111.

136. LUMBER LEFT IN TRENCH

For specifications regarding lumber left in trench, see Section No. 107 under Standard Specifications for "Sewers and Appurtenances."

137. EXTRA EXCAVATION

For specifications regarding Extra Excavation, see Section No. 68 under "Grading, Curbing and Appurtenances."

138. BACKFILLING

In 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 and carefully packed and well rammed with the proper tools for the purpose. Special care shall be taken in ramming not to injure the coating of the pipe.

Care shall be taken to give the pipe a solid bearing throughout its entire length. The earth filling above the pipe shall be sufficiently packed and rammed to prevent after settlement, and the material used shall be free from large stones. The trenches shall, in all cases, be refilled with the material furnished by their excavation, provided that it be of proper quality. In lieu of ramming, the trenches may be thoroughly water settled.

139. MAINTENANCE OF ROADWAY

After the trenches have been settled and before the final release of the contract, the street surface shall be restored and any surplus earth removed. In all cases the contractor shall maintain the roadway over the completed watermain for a period of thirty (30) days after the acceptance of the improvement by the Board of Public Works.

140. 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 specials 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 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 34 of General Stipulations.

141. SERVICE CONNECTIONS

As soon as a 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 crossings and where backfilling is specially 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.

142. 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 taken up and removed. All excavating, removing of old pipe and backfilling shall be performed by the contractor.

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.

WATERMAINS

143. CAST IRON PIPE

(a) DESCRIPTION OF PIPES:

The pipe shall be made with hub and spigot joints, and shall conform accurately to the dimensions given in the table on Page 113. They shall be straight, and be true circles in section, with their inner and outer surfaces concentric, and of the specified dimensions in outside diameter. The minimum allowable length is twelve (12) feet, exclusive of socket.

Pipe with thickness and weight intermediate between the classes in the table shall be made of the same outside diameter as the next heavier class. Pipe with thickness and weight less than shown by the table shall be made of the same outside diameter as the Class "A" pipe; and pipe with thickness and weight greater than any shown by the table shall be made of the same outside diameter as the Class "D" pipe.

All pipe having the same outside diameter shall have the same inside diameter at both ends. The inside diameter of the lighter pipe of each standard outside diameter shall be gradually increased for a distance of about six (6) inches from each end of the pipe so as to obtain the required standard thickness and weight for each size and class of pipe.

For pipe of each size for 4-inch to 24-inch inclusive there shall be two standards of outside diameter, and for pipe for 30-inch to 60-inch inclusive, there shall be four standards of outside diameter, as shown by the table.

For pipe 4-inch to 12-inch inclusive, one class of special castings shall be furnished, made from Class "D" pattern. Those having spigot ends shall have outside diameters of spigot ends midway between the two standards of outside diameter as shown by the table and be tapered back for a distance of 6 inches.

For pipe from 14-inch to 24-inch inclusive, two classes of special castings shall be furnished; Class "B" special castings with Classes "A" and "B" pipes, and Class "D" special castings with Classes "C" and "D" pipes; the former to have cast on them the letters "AB" and the latter "CD". For pipe 30-inch to 60-inch inclusive, four classes of special castings shall be furnished, one for each class of pipe, and have cast on them the letter of the class to which they belong.

Unless specially ordered, no water pipes or fittings of a lower class than Class "C" shall be used.

(b) TABLE OF WEIGHTS AND DIMENSIONS OF CAST IRON PIPE

Nominal Inside Diameter of Pipe in Inches	Class	Head in Feet	Thickness of Pipe in Inches	Depth of Lead Joint in Inches	Weight of Lead in Pounds per Joint.	Diameter of Sockets		Depth of Sockets		Actual Outside Diameter of Pipe in Inches	Weight of Pipe in Pounds per 12 Feet Length	Weight of Pipe in Pounds per 16 Feet Length
						Pipe, Inches	Special Castings Inches	Pipe, Inches	Special Castings Inches			
4	A	100	.42	2.25	9.00	5.60	5.70	3.50	4.00	4.80	240	315
4	B	200	.45	2.25	.....	5.80	5.70	3.50	4.00	5.00	260	340
4	C	300	.48	2.25	.....	5.80	5.70	3.50	4.00	5.00	280	365
4	D	400	.52	2.25	.....	5.80	5.70	3.50	4.00	5.00	300	390
6	A	100	.44	2.25	12.00	7.70	7.80	3.50	4.00	6.90	370	485
6	B	200	.48	2.25	.....	7.90	7.80	3.50	4.00	7.10	400	520
6	C	300	.51	2.25	.....	7.90	7.80	3.50	4.00	7.10	430	560
6	D	400	.55	2.25	.....	7.90	7.80	3.50	4.00	7.10	460	600
8	A	100	.46	2.25	15.00	9.85	10.00	4.00	4.00	9.05	515	675
8	B	200	.51	2.25	.....	9.85	10.00	4.00	4.00	9.05	570	745
8	C	300	.56	2.25	.....	10.10	10.00	4.00	4.00	9.30	625	815
8	D	400	.60	2.25	.....	10.10	10.00	4.00	4.00	9.30	670	875
10	A	100	.50	2.25	18.00	11.90	12.10	4.00	4.00	11.10	685	895
10	B	200	.57	2.25	.....	11.90	12.10	4.00	4.00	11.10	765	1000
10	C	300	.62	2.25	.....	12.20	12.10	4.00	4.00	11.40	850	1110
10	D	400	.68	2.25	.....	12.20	12.10	4.00	4.00	11.40	920	1205
12	A	100	.54	2.25	22.00	14.00	14.20	4.00	4.00	13.20	870	1140
12	B	200	.62	2.25	.....	14.00	14.20	4.00	4.00	13.20	985	1290
12	C	300	.68	2.25	.....	14.30	14.20	4.00	4.00	13.50	1100	1440
12	D	400	.75	2.25	.....	14.30	14.20	4.00	4.00	13.50	1200	1575
16	A	100	.60	2.75	42.00	18.40	18.40	4.00	4.00	17.40	1300	.....
16	B	200	.70	2.75	.....	18.40	18.40	4.00	4.00	17.40	1500	.....
16	C	300	.80	2.75	.....	18.80	18.80	4.00	4.00	17.80	1725	.....
16	D	400	.89	2.75	.....	18.80	18.80	4.00	4.00	17.80	1900	.....
20	A	100	.67	2.75	51.00	22.60	22.60	4.00	4.00	21.60	1800	.....
20	B	200	.80	2.75	.....	22.60	22.60	4.00	4.00	21.60	2100	.....
20	C	300	.92	2.75	.....	23.06	23.06	4.00	4.00	22.06	2500	.....
20	D	400	1.03	2.75	.....	23.06	23.06	4.00	4.00	22.06	2750	.....
24	A	100	.76	2.75	61.00	26.80	26.80	4.00	4.00	25.80	2450	.....
24	B	200	.89	2.75	.....	26.80	26.80	4.00	4.00	25.80	2800	.....
24	C	300	1.04	2.75	.....	27.32	27.32	4.00	4.00	26.32	3350	.....
24	D	400	1.16	2.75	.....	27.32	27.32	4.00	4.00	26.32	3680	.....
30	A	100	.88	2.75	75.00	32.74	32.74	4.50	4.50	31.74	3500	.....
30	B	200	1.03	2.75	.....	33.00	33.00	4.50	4.50	32.00	4000	.....
30	C	300	1.20	2.75	.....	33.40	33.40	4.50	4.50	32.40	4800	.....
30	D	400	1.37	2.75	.....	33.74	33.74	4.50	4.50	32.74	5400	.....
36	A	100	.99	3.00	89.00	38.96	38.96	4.50	4.50	37.96	4700	.....
36	B	200	1.15	3.00	.....	39.30	39.30	4.50	4.50	38.30	5450	.....
36	C	300	1.36	3.00	.....	39.70	39.70	4.50	4.50	38.70	6550	.....
36	D	400	1.58	3.00	.....	40.16	40.16	4.50	4.50	39.16	7500	.....
42	A	100	1.10	3.00	103.00	45.20	45.20	5.00	5.00	44.20	6150	.....
42	B	200	1.28	3.00	.....	45.50	45.50	5.00	5.00	44.50	7100	.....
42	C	300	1.54	3.00	.....	46.10	46.10	5.00	5.00	45.10	8600	.....
42	D	400	1.78	3.00	.....	46.58	46.58	5.00	5.00	45.58	9900	.....
48	A	100	1.26	3.00	117.00	51.50	51.50	5.00	5.00	50.50	8000	.....
48	B	200	1.42	3.00	.....	51.80	51.80	5.00	5.00	50.80	9000	.....
48	C	300	1.71	3.00	.....	52.40	52.40	5.00	5.00	51.40	10900	.....
48	D	400	1.96	3.00	.....	52.98	52.98	5.00	5.00	51.98	12600	.....
54	A	100	1.35	3.00	131.00	57.66	57.66	5.50	5.50	56.66	9600	.....
54	B	200	1.55	3.00	.....	58.10	58.10	5.50	5.50	57.10	11200	.....
54	C	300	1.90	3.00	.....	58.80	58.80	5.50	5.50	57.80	13700	.....
54	D	400	2.23	3.00	.....	59.40	59.40	5.50	5.50	58.40	16100	.....
60	A	100	1.39	3.00	146.00	63.80	63.80	5.50	5.50	62.80	11000	.....
60	B	200	1.67	3.00	.....	64.40	64.40	5.50	5.50	63.40	13250	.....
60	C	300	2.00	3.00	.....	65.20	65.20	5.50	5.50	64.20	16100	.....
60	D	400	2.38	3.00	.....	65.82	65.82	5.50	5.50	64.82	19000	.....

(c) ALLOWABLE VARIATION 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 shall 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 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.

(d) ALLOWABLE VARIATION IN THICKNESS:

For pipes whose standard thickness is less than one inch, the thicknes of metal in the body of the pipe shall not be more than .08 of an incch less than the standard thickness, and for pipes whose standard thickness is one inch or more, the variation shall not exceed .10 of an inch, except that for spaces not exceeding 8 inches in length in any direction, variations from the standard thickness of .02 of an inch in excess of the allowance above given may be permitted.

For special casting of standard patterns a variation of 50 per cent greater than allowed for straight pipes may be permitted.

(e) DEFECTIVE SPIGOTS MAY BE CUT:

Defective spigot ends on pipes 12-inches or more in 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 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 11 feet in length, exclusive of the sockets.

In case the length of the pipe differs from 12 feet, the standard weight of the pipe given in the table is to be modified in accordance therewith.

(f) SPECIAL CASTINGS:

All special castings shall be made in accordance with the Standard Specifications of the American Waterworks Association, adopted May 12, 1908, unless special details for same are furnished.

The diameters of the sockets and the external diameters of the spigot ends of the special castings shall not vary from the standard dimensions by more than .12 of an inch for the castings 16 inches or less in diameter; .15 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 on an inch for 48-inch, 54-inch and 60-inch.

When plugs are used they shall be furnished with yokes, put on in a manner satisfactory to the City Engineer. 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.

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. See Section No. 143-h.

(g) 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.

(h) 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 sall be ⅛-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 in Inches	Diameter of Flange in Inches	Thicknes of Flange Inches	Diameter of Bolt Circle in Inches	Number of Bolts	Diameter of Bolts in Inches	Length of Bolts in Inches
4	9	15/16	7½	8	⅝	2¾
5	10	15/16	8½	8	¾	3
6	11	1	9½	8	¾	3
8	13½	1⅛	11¾	8	¾	3¼
10	16	1 3/16	14¼	12	⅞	3½
12	19	1¼	17	12	⅞	3¾
16	23½	1 7/16	21¼	16	1	4¼
20	27½	1 11/16	25	20	1⅛	5
24	32	1⅞	29½	20	1¼	5½
30	38¾	2⅛	36	28	1⅜	6¼
32	41¾	2¼	38½	28	1½	6½
36	46	2⅜	42¾	32	1½	6½
42	53	2⅝	49½	36	1⅝	7½

Payment for special castings shall be made as noted under payment for cast iron pipe. In case any special castings are required which are not included in the original bill of material, they shall be paid for as bid per pound in place. In case of flanged special castings such payments shall include compensation for all necessary gaskets, bolts and machine work.

(i) MARKING:

Every pipe and special casting shall have distinctly cast upon it the initials of the maker's name. When cast especially to order, each pipe larger than 4-inch shall also have cast upon it figures showing the year in which it was cast, and a number signifying the order in point of time in which it was cast; the figures denoting the year shall be above and the number below, thus:

1919 1919 1919
1 2 3

The letters and figures shall be cast on the outside and not less than two inches in length and ⅛ of an inch in relief for pipes eight inches in diameter and larger. For smaller sizes of pipes the letters may be one-inch in length. The weight and the class letter shall be conspicuously painted in white on the inside of each pipe and special casting after the coating has become hard.

(j) ALLOWABLE PERCENTAGE OF VARIATION IN WEIGHT:

Pipe shall not be accepted which falls below the standard weight by more than 5 per cent for pipes 16 inches or less in diameter, and 4 per cent for pipes more than 16 inches in diameter, and no excess above the standard weight or more than the given percentage for the several sizes shall be paid for.

Special castings shall not be excepted which fall below the specified weight by more than 10 per cent for pipes 12 inches or less in diameter, and 8 per cent for larger sizes, except that curves, Y pieces and breeches pipe may be 12 per cent below the standard weight, and when castings are paid for by the pound no excess above the standard weight of more than the above percentage for the several sizes shall be paid for.

When directed by the City Engineer, the pipe or specials shall be hauled to a scale for weighing. If the weigts are within the above specified limits, the contractor shall be paid for the labor, hauling and weighing charges; if the pipe or specials prove to be of insufficient weight, the contractor shall bear the expense.

In any contract in which the total amount of pipe shall exceed ten (10) lengths, not over ten per cent (10%) of the total number of lengths shall be under weight.

(k) QUALITY OF IRON:

All pipes and special castings shall be made of cast iron of good quality and of such character as shall make the metal of the castings strong, tough and of even grain, and soft enough satisfactorily to admit of drilling and cutting. The metal shall be made without any admixture of cinder iron or other inferior metal, and shall be remelted in a cupola or air furnace.

The City Engineer shall have the right to make and break three bars from each heat or run of metal, and the test shall be based upon the average results of the three bars. Sould the dimensions of the three bars differ from those given hereafter a proper allowance therefor shall be made in the results of the tests.

(l) TESTS OF MATERIAL:

Specimen bars of the metal used, each twenty-six inches long by two inches wide and one inch thick, shall be made, without charge, as often as the City Engineer may direct and in default of definite instructions, the contractor shall make and test at least one bar from each heat or run of metal. The bars when placed flatwise upon supports twenty-four inches apart, and loaded in the center, shall support a load of 2,000 pounds, and show a deflection of not less than .30 of an inch before breaking; or, if preferred, tensile bars may be made which will show a breaking point of not less than 20,000 pounds per square inch.

(m) CASTING OF PIPE:

The straight pipes sall be cast in dry sand molds in a vertical position, with the hub end down.

The pipes sall not be stripped or taken from the pit while showing color of heat, but shall be left in the flasks for a sufficient length of time to prevent unequal contraction by subsequent ex posure.

(n) QUALITY OF CASTINGS:

The pipes and special castings shall be smooth. free from scales, lumps, blisters, sand holes and defects of every nature which unfit them for the use for which they are intended. Plugging or filling shall not be allowed.

(o) CLEANING AND INSPECTION:

All pipes and special castings shall be thoroughly cleaned and subjected to a careful hammer inspection immediately before they

are dipped and shall not be coated unless entirely clean and free from rust, and approved in these respects by the City Engineer.

(p) COATING:

Every pipe and special casting shall be coated inside and out 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 special 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..

(q) HYDROSTATIC TEST:

When the coating has become hard, the straight pipe shall be subjected to a proof by hydrostatic pressure and if required by the City Engineer, they shall also be subjected to a hammer test under this pressure.

The pressure to which the different sizes and classes of pipe shall be subjected are as follows:

	20-inch Diameter and larger Pounds per square inch	Less than 20-inch Diameter Pounds per square inch
Class A Pipe	150	300
Class B Pipe	200	300
Class C Pipe	250	300
Class D Pipe	300	300

(r) WEIGHING

The pipe and special castings shall be weighed for payment after the application of the coal-tar pitch varnish. If desired by the City Engineer, the special castings shall be weighed after their delivery; the weights so ascertained shall be used in the final settlement.

(s) CONDITION OF CASTINGS WHEN DELIVERED

All the pipe and other castings must be delivered in all respects sound and conformable to these specifications. The inspection 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.

(t) LEAD

All lead used for caulking of watermain joints and for any other purpose shall be pig lead of a quality equal to that commercially known as "Selby Lead." It must show on an analysis not less than 99½ per cent of metallic lead.

(u) OAKUM

The oakum used on all watermain work shall be of fine, long, uniform fibre, and equal in quality to that commercially known as "U. S. Navy Oakum."

(v) LAYING PIPE

After the trenches are completed to the required depth, the spigots of the pipe shall be so adjusted as to give uniform space all around, and if any pipe does not allow sufficient space it shall be replaced by one of proper dimensions. The joint shall at all times be not less in thickness and depth than that shown in the foregoing table of weights and dimensions. Gaskets of clean, sound hemp yarn or oakum braided or twisted and tightly drawn, shall be used to pack these joints.

(w) JOINTING

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 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 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.

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.

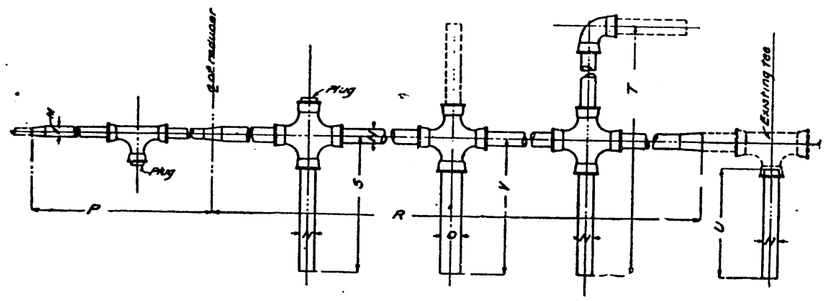
(x) FIELD TESTS

As soon as any section of pipe between any two gate valves is laid, or when directed by the City Engineer, the same shall be subjected to a hydrostatic test. The pressure shall be brought up to three hundred (300) pounds per square inch for four (4) inch, six (6) 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, and while under this pressure each pipe shall be thoroughly hammer tested from end to end. Any pipe which exhibits any defects shall be taken out and replaced by a sound pipe. All pumps, gauges 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 refilled and before the final release of contract, any defects appear, the contractor shall, at his own expense, correct such defects.

(y) MEASUREMENTS

Measurements for the estimate of pipe 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-T-U-linear feet of pipe of diameter 'N'
V-linear feet of pipe of diameter 'O'

(z) PAYMENT

Payment for "Cast Iron Pipe" shall be made at the price bid per linear foot and shall be in full for furnishing and laying the pipe, and all special castings shown on the plans, and this shall also include payment for all trenching, jointing, backfilling, restoring the street surface, relaying of pavement or planking (unless the backfilling and restoration of the paving is done by the Street Department as provided in Section 111), and all other ma-

terial and labor necessary for the completed work. In case any special castings shown on the plans are omitted in the work, a corresponding reduction shall 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 for "Extra Excavation" per cubic yard.

144. STEEL PIPE WATERMAINS—INCLUDING LAP WELDED, LOCK BAR AND RIVETED PIPE

(a) CLASSES OF STEEL

For the purpose of this specification, steel shall be divided into three classes, namely, steel for plates, steel for rivets and lock-bars, and steel for castings.

(b) STEEL FOR PLATES AND BARS

(1) Manufacture of Plates and Bars for Lock-Bars and Rivets:

The specifications for plates conform to the specifications of the American Society for Testing Materials, Serial Designation A30-16, for Firebox Steel. The specifications for rivets and lock-bars conform to Serial Designation A31-14.

Process: The steel shall be made by the open-hearth process.

(2) Chemical Properties and Tests for Plates and Bars for Lock-Bars and Rivets:

Chemical Composition: The steel shall conform to the following requirements as to chemical composition:

Elements Considered	Plate Steel	Rivet and Lock-Bar Steel
Carbon	0.12 to 0.25 per cent	
Manganese	0.30 to 0.50 per cent	0.30 to 0.50 per cent
Phosphorus		not over .04 per cent
Basic	not over 0.035 per cent	
Acid	not over 0.04 per cent	
Sulphur	not over 0.04 per cent	0.045 per cent
Copper	not over 0.05 per cent	

Ladle Analysis: An analysis of each melt of steel shall be made by the manufacturer to determine the percentage of the elements specified. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified.

Check Analysis: A check analysis may be made by the City Engineer from a broken tension test specimen representing each plate as rolled, or finished bars representing each melt. The chemical composition thus determined shall conform to the requirements specified.

(3) Physical Properties and Tests for Plates and Bars for Lock-Bars and Rivets:

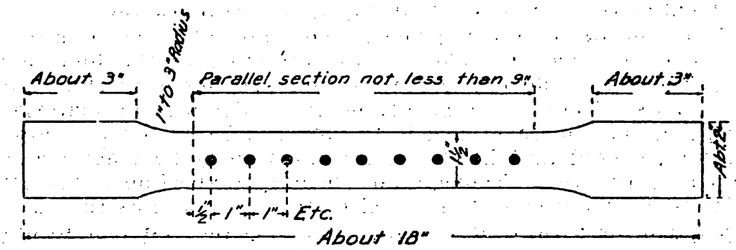
Tension Tests: The steel shall conform to the following requirements as to tensile properties:

Properties Considered	Plate Steel	Rivet and Lock-Bar Steel
Tensile Strength, lb. per sq. in.	52,000-62,000	45,000-55,000
Yield Point, Min., lb. per sq. in.	0.5 Tens. Str.	0.5 Tens. Str.
Elongations in 8″ Min. per cent.	1,500,000* Tens. Str.	1,500,000 Tens. Str. But need not exceed 30 per cent.

The yield point shall be determined by the drop of the beam of the testing machine.

Modifications in Elongation: For plates over three-quarters of an inch (¾″) in thickness, a deduction of 0.5 from the specified percentage of elongation shall be allowed for each one-eighth of an inch (⅛″) in thickness above three-quarters of an inch (¾″).

For plates one-quarter of an inch (¼″) or under in thickness, the elongation shall be measured on a gauge length of twenty-four (24) times the thickness of the specimen.



TENSION TEST SPECIMEN FOR STEEL PLATES

BEND TESTS

Cold Bend Tests: For plates, the test specimen shall bend cold through one hundred eighty degrees (180°) without fracture on the outside of the bent portion as follows: For material one inch (1″) or under in thickness, around a pin the diameter of which is equal to the thickness of the specimen; and for material over one inch (1″) in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen. In case of rivet and lock-bar steel, the test specimen shall bend cold through one hundred eighty degrees (180°) flat upon itself without fracture on the outside of the bent portion.

*See Modifications of Elongation.

The quench-bend test specimen for rivet or lock-bar steel, when heated to a light cherry red as seen in the dark (not less than 1200°F.) and quenched at once in water, the temperature of which is between eighty degrees (80°) and ninety degrees (90°) F., shall bend through one hundred eighty degrees (180°) flat upon itself without fracture on the outside of the bent portion.

Homogeneity Tests: For Fire-box steel, a sample taken from a broken tension-test specimen, shall not show any single seam or cavity more than one-quarter of an inch (¼″) long, in any of the three fractures obtained in the test for homogeneity, which shall be made as follows: The specimen shall be either nicked with a chisel or grooved on a machine, transversely, about one-sixteenth of an inch (1-16″) deep, in three places about two inches (2″) apart. The first groove shall be made two inches (2″) from the square end; each succeeding groove shall be made on the opposite side from the preceding one. The specimen shall then be firmly held in a vise, with the first groove about one-quarter of an inch (¼″) above the jaws, and the projecting end broken off by light blows of a hammer, the bending being away from the groove. The specimen shall be broken at the other two grooves in the same manner. The object of this test is to open and render visible to the eye any seams due to failure to weld up, to interposed foreign matter, or any cavities due to gas bubbles in the ingot. One side of each fracture shall be examined and the lengths of the seams and cavities determined, a pocket lens to be used if necessary.

Test Specimens: Tension-Test Specimens for plates shall be taken longitudinally from the bottom of the finished rolled material, and bend-test specimens shall be taken transversely from the middle of the top of the finished rolled material. The longitudinal test specimens shall be taken in the direction of the longitudinal axis of the ingot, and the transverse test specimens at right angles to that axis. They shall be of the full thickness of material as rolled, and shall be machined to the form and dimensions shown in the figure, except that bend-test specimens may be machined with both edges parallel. Tension and bend-test specimens for rivets and lock-bars shall be of the full size section of bars as rolled.

Number of Tests: For plates, one tension and one bend-test shall be made from each plate as rolled. For rivets and lock-bars, two tension, two cold-bend and two quench-bend tests shall be made from each melt, each of which shall conform to the requirements specified.

If any test specimen shows defective machining or develops flaws, it shall be discarded and another specimen substituted.

If the percentage of elongation of any tension-test specimen is less than that specified under "Physical Properties and Tests" and any part of the fracture is outside the middle third of the gage lengths, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

(4) Permissible Variations in Weights and Gage:

Permissible Variations for Plates—When Ordered to Thickness: The thickness of each plate shall not vary more than 0.01 inch under that ordered.

The overweight of each lot in each shipment shall not exceed the amount given in the following table for permissible overweights. One cubic inch of rolled steel is assumed to weigh 0.2833 pound.

Permissible Overweights of Plates Ordered to Thickness.

Ordered	Permissible Excess in Average Weights per Square Foot of Plates for Width Given, Expressed in Percentages of Nominal Weight.								
	Under 48 in.	48 in. to 60 in. Excl.	60 in. to 72 in. Excl.	72 in. to 84 in. Excl.	84 in. to 96 in. Excl.	96 in. to 108 in. Excl.	108 in. to 120 in. Excl.	120 in. to 132 in. Excl.	132 in. or over
Under ⅛...	9	10	12	14	.....	.....	.....	.....	.....
⅛ to 3/16 excl.	8	9	10	12	.....	.....	.....	.....	.....
3/16 to ¼ "	7	8	9	10	12	.....	.....	.....	.....
¼ to 5/16 "	6	7	8	9	10	12	14	16	19
5/16 to ⅜ "	5	6	7	8	9	10	12	14	17
⅜ to 7/16 "	4.5	5	6	7	8	9	10	12	15
7/16 to ½ "	4	4.5	5	6	7	8	9	10	13
½ to ⅝ "	3.5	4.	4.5	5	6	7	8	9	11
⅝ to ¾ "	3	3.5	4	4.5	5	6	7	8	9
¾ to 1 "	2.5	3	3.5	4	4.5	5	6	7	8
1 or over...	2.5	2.5	3	3.5	4	4.5	5	6	7

Permissible Variations for Rivets and Lock-Bars: The gage of each bar shall not vary more than 0.01 inch from that specified.

(5) Workmanship and Finish:

Workmanship: The finished bars shall be circular within 0.01 inch.

Finish: The finished material shall be free from injurious defects and shall have a workmanlike finish.

(6) Marking:

The name or brand of the manufacturer, melt or slab number, grade and lowest tensile strength for its grade specified in Section 144, b-3 under "Physical Properties and Tests," shall be legibly stamped on each plate. The melt or slab number shall be legibly stamped on each test specimen.

When specified on the order, plates shall be match-marked so that the test specimens representing them may be identified. When more than one plate is sheared from a single slab or ingot, each shall be match-marked so that they may each be identified with the test specimens representing them.

Each match-mark shall consist of two over-lapping circles, each not less than 1½ inches in diameter, placed upon the shear lines, and made by separate impressions of a single-circle steel die.

Match-marked coupons shall match with the sheets represented and only those which match properly shall be accepted.

Bars for rivets and lock-bars shall, when loaded for shipment, be properly separated and marked for identification, with the name

or brand of the manufacturer and the melt number. The melt number shall be legibly marked on each test specimen.

(7) Inspection and Rejection:

Inspection: The inspector representing the City Engineer shall have free entry at all times while work on the contracts of the City is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests, except check analysis and inspection, 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.

Rejection: Unless otherwise specified, any rejection based on tests made in accordance with the Check Analysis shall be reported within five (5) working days from the receipt of samples.

Material which shows injurious defects subsequent to its acceptance at the manufacturer's works shall be rejected, and the contractor shall be notified.

Rehearing: Samples tested in accordance with Check Analysis which represent rejected material, shall be preserved for two (2) weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the contractor may make claim for a rehearing within that time.

(c) FINISHED RIVETS

(1) Physical Properties and Tests for Rivets:

Tension Tests: The rivets, when tested, shall conform to the requirements as to tensile properties specified in Tension Tests, except that the elongation shall be measured on a gage length not less than four (4) times the diameter of the rivet.

Bend Tests: The rivet shank shall bend cold through one hundred eighty degrees (180°) flat on itself, without fracture on the outside of the bent portion.

Flattening Tests: The rivet head shall flatten, while hot, to a diameter two and one-half (2½) times the diameter of the shank, without fracture at the edges.

Number of Tests: When specified, one tension test shall be made from each size in each lot of rivets offered for inspection.

Three bend and three flattening tests shall be made from each size in each lot of rivets offered for inspection, each of which shall conform to the requirements specified.

(2) Workmanship and Finish:

Workmanship: The rivets shall be true to form, with heads concentric with the shanks, and shall be made in a workmanlike manner.

Finish: The finished rivets shall be free from injurious defects.

(3) Inspection and Rejection:

Inspection: The inspector representing the City Engineer shall have free entry at all times while work on the contract of the City is being performed, to all parts of the manufacturer's works which concern the manufacture of the rivets ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the rivets are being furnished in accordance with these specifications. All tests and inspection 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.

Rejection: Rivets which show injurious defects subsequent to their acceptance at the manufacturer's works shall be rejected, and the contractor shall be notified.

(d) PROTECTION OF METAL

All plates and rivets shall be kept free from rust, and under cover from the time of their manufacture until the pipe is dipped and coated. The plates shall be loaded under cover, at the place of manufacture, upon suitable cars satisfactory to the City Engineer or his authorized representative. They shall at no time be exposed to the weather or to moisture and shall be delivered under cover at the pipe shop. In case of accidental rust, either during transportation or the process of manufacture, the rust shall be removed from the plates at once by brushing with a stiff brush and scrubbing them with diluted acid, followed by mopping or brushing with a saturated solution of soda or other suitable alkali to remove the acid. This shall be continued until the rust has been removed. The alkali shall then be washed off and the plates thoroughly dried.

(e) STEEL CASTINGS:

(1) Manufacture of Steel Casings:

These specifications conform to the specifications of the American Society for Testing Materials, Serial Designation A 27-14. All requirements for Class "B" soft steel castings set forth therein, whether mentioned herein or not, shall govern in these specifications.

Process: The steel shall be made by the open-hearth process. Castings shall be allowed to become cold. They shall then be uniformly reheated to the proper temperature to refine the grain, and allowed to cool uniformly and slowly. If in the opinion of the City Engineer or his representatives a casting is not properly annealed, he may at his option require the casting to be re-annealed.

(2) Chemical Properties and Tests:

Chemical Composition: The steel shall conform to the following requirements as to chemical composition.

Elements Considered	
Phosphorus, Maximum per cent	0.05
Sulphur, Maximum per cent	0.05

Ladle Analysis: An analysis to determine the percentage of carbon, manganese, phosphorus, and sulphur shall be made by the manufacturer from a test ingot taken during the pouring of each melt ,a copy of which shall be given to the City Engineer or his representative. Drillings for analysis shall be taken not less than one-quarter of an inch (¼″) beneath the surface of the test ingot.

(3) Physical Properties and Tests:

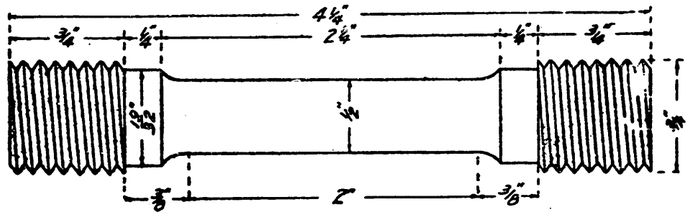
Tension Test: The steel shall conform to the following requirements as to tensile properties:

Properties Considered	
Tensile Strength lb. per sq. inch	60,000
Yield Point lb. per sq. inch	27,000
Elongation in 2 inches, per cent	22
Reduction in area, per cent	30

Yield Point: The yield point shall be determined by the drop of the beam of the testing machine.

Bend Tests: Test specimens shall bend cold through ninety degrees (90°) around a one inch (1″) pin without fracture on the outside of the bent portion.

Test Specimens: All test bars shall be annealed with the castings they represent. Tension test specimens shall be of the form and dimensions shown in the Figure.



TENSION TEST SPECIMEN FOR STEEL CASTINGS

(4) Workmanship and Finish:

The castings shall conform in every respect to the dimensions as shown on the plans. They shall be free from sponginess, shrinkage, sand holes, blow holes, gas holes or other injurious defects.

Any castings which show defects in machining or otherwise, which in the opinion of the City Engineer may impair their strength or water-tightness shall be rejected.

(f) MANUFACTURE OF PIPE

(1) Construction

The pipe shall be lap-welded, riveted, or lock-bar. It shall be manufactured of plates of the thickness given on the plans, and of full specified internal diameter at the small end of the sections. Each section of pipe as shipped shall be approximately thirty feet

in length except where shorter sections are necessary in order to produce the proper angles or curves in grade or alignment. These sections of pipe may be either of in and out courses or of taper courses. Longitudinal seams in riveted pipe shall be double riveted in plates ⅝ inch and less in thickness, in plates over ⅝ inch in thickness they shall be triple riveted.

In lapwelded pipe the longitudinal joint shall be a forge weld, made by heating with a fire and then hammering and welding. The oxy-acetylene process shall not be used. The efficiency of the welded joint and the lock-bar joint shall in any case be equal to that of riveted pipe as determined from the table.

All circular seams shall be single riveted.

(2) Riveting

The spacing and the dimensions of rivets shall be as shown in the following table:

Thickness of Plate Inches	Diameter of Pipe Inches	Diameter of Rivets Inches	Longitudinal Seam		No. of Rows	No. of Rivets Circular Seams	Distance of Rivets from edge of plate Inches	Maximum Head in Feet	Shop Test Pressure pounds per Square Inch
			Pitch of Rivets Inches	Distance between Rows Inches					
1/4	42	5/8	2 1/16	1 1/16	2	68	1 1/16	262	175
1/4	36	5/8	2 1/16	1 1/16	2	56	1 1/16	306	200
1/4	32	5/8	2 1/16	1 1/16	2	52	1 1/16	345	225
1/4	30	5/8	2 1/16	1 1/16	2	48	1 1/16	367	250
1/4	24	5/8	2 1/16	1 1/16	2	40	1 1/16	459	300
1/4	20	5/8	2 1/16	1 1/16	2	32	1 1/16	550	350
5/16	42	3/4	2 7/16	1 7/8	2	56	1 1/4	320	200
5/16	36	3/4	2 7/16	1 7/8	2	48	1 1/4	373	250
5/16	32	3/4	2 7/16	1 7/8	2	44	1 1/4	420	275
5/16	30	3/4	2 7/16	1 7/8	2	40	1 1/4	448	300
3/8	42	7/8	2 3/4	2 1/4	2	52	1 7/16	387	250
3/8	36	7/8	2 3/4	2 1/4	2	44	1 7/16	450	300
7/16	42	7/8	3 5/16	2	3	52	1 7/16	485	325

Allowable tension in plates, 14,000 lbs. per square inch, net section; allowable shear in rivets, 8,000 lbs. per square inch; allowable bearing of rivets, 16,000 lbs. per square inch.

Shop riveting shall be done with hot rivets by steam, compressed air, or hydraulic machinery, capable of exerting a slow pressure sufficient for the formation of perfect rivet heads. The rivet holes shall be punched from the side of the plate which is to be placed in contact with another, and all burrs caused by the punch on the lower side of the plate shall be removed by countersinking.

Field Riveting: All field rivets, for connecting lengths of pipe, attaching specials, etc., shall be air driven, from the outside of the pipe. Tools for "holding on" shall be operated by compressed air and be applied inside the pipe. All field joints shall be caulked

as specified below under "Caulking." As soon as each joint is caulked, it shall be cleaned and thoroughly painted with the field coating.

(3) Drifting:

Excessive drifting shall not be used to force rivet holes to coincide at any seam or lap, and all plates shall be rejected in which the holes cannot be made to receive a rivet of the specified diameter with such slight drifting or reaming as will not, in the opinion of the City Engineer, materially reduce the strength of the plates.

(4) Formation of Angles and Curves:

Where angles and curves occur in the alignment and grade of the pipe line, the plates shall be cut and punched to the lines required for forming a slight oblique angle at the circular seams. This shall be done for a sufficient number of courses to produce the given total deflection, or curvature required at any point. Copies of shop sheets shall be furnished the City Engineer before the manufacture of pipe.

(5) Caulking:

As soon as riveted, the pipe shall be properly caulked, both inside and outside, in a workmanlike manner, by the most approved pneumatic machines; all caulking shall be done by round-nosed caulking tools. Split caulking shall not be done.

(6) Hydrostatic Test:

Each section of pipe after completion and before coating, shall be subjected to a hydrostatic pressure equal to that shown in the table under shop tests. The pipe shall, during such test, be absolutely free from leaks and fractures.

(7) Cleaning:

Before the pipe sections are coated, they shall be thoroughly cleaned by a sandblast or other equally efficient means, so as to show in all parts the color of the metal.

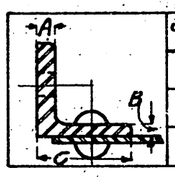
(8) Coating:

Immediately after being cleaned, and before any discoloration due to rusting has begun, the pipe shall be carefully inspected, and upon approval by the City Engineer, or his authorized inspector, the pipe shall be heated to a temperature of 400°F. and then coated by dipping vertically, in a bath of "Pioneer Mineral Rubber Pipe Coating," "Sarco Mineral Rubber Pipe Coating," or equal, at a temperature of 400 degrees F. The pipe, on being removed from the bath, shall present a thoroughly smooth and even surface, both on the inside and outside.

(g) FLANGES

All flanges on steel pipe shall be cast steel or forged steel, welded, plain face and corrugated finish. They shall be riveted to pipe ends according to specifications for riveting of circular

seams as shown in the table for shop riveting. The thickness and flange length in each case shall be as follows:



Size of Pipe	20"	24"	30"	32"	36"	42"	48"	54"	60"	66"	72"	78"
A	3/4"	7/8"	1"	1"	1 1/8"	1 1/8"	1 1/4"	1 1/4"	1 3/8"	1 1/2"	1 1/2"	1 1/2"
B	7/16"	7/16"	1/2"	1/2"	5/8"	5/8"	3/4"	3/4"	7/8"	1"	1"	1"
C	3 1/4"	3 3/8"	3 3/8"	3 3/8"	4 5/16"	4 5/16"	5"	5"	5"	5"	5"	5"

All other dimensions and drilling shall be the same as in Section No. 143-h.

Gaskets: Unless otherwise specified, all gaskets on steel pipe shall be No. 27 U. S. Gage Corrugated Copper Ring Gaskets, made in one piece.

(h) MANHOLES

Wherever shown on the profile, the contractor shall place steel manholes on the steel pipe, complete with covers, gaskets and bolts. The openings for said manholes shall be elliptical, fourteen (14) inches by sixteen (16) inches in diameter. The joints between the cover and the frame shall, in all cases, be made water-tight by facing the abutting surfaces and inserting a suitable gasket of sheet lead or corrugated copper.

(i) AIR VALVES

Air valves four (4) inches in diameter shall be placed on the pipe at points on the line as indicated on the profile. The valves shall be of the pattern known as the "Crispin Automatic Air and Vacuum Valve," or some other approved model, with one-half (½) inch bibb. Cast Steel branches having a flange on one end conforming to the circumference of the pipe and a standard 4-inch flange on the other end shall be used for attaching a 4-inch gate valve to the pipe. Air valves shall be attached to the pipe by bolting to the other end of the 4-inch double flanged gate valve.

(j) TRANSPORTATION

The pipes and specials, on completion at the shop, shall be transported to the line of the ditch. They shall be carefully loaded on cars, wagons or trucks with skids and blocking and protected from chafing of chains or ropes by rubber packing or other soft and yielding material. They shall be properly supported by struts or otherwise to protect joints from injury due to vibration while in transit.

When the coating has been destroyed or abraded on any portion of the pipe, it shall be restored with "Pioneer Mineral Rubber Field Coating," "Sarco Mineral Rubber Field Coating," or other material approved by the City Engineer. All damage or indentation of the pipes, either before or during the laying in the trench, shall be repaired to the satisfaction of the City Engineer or the pipe shall

be rejected. Before the laying of the pipe in the trench, the coating inside and outside shall be carefully examined and if injured, shall be repaired in the manner above specified. The ends of each length shall be carefully scraped inside and outside, and the coating entirely removed for a distance of three (3) inches to insure a perfect contact of metal.

As the work on the pipe progresses, it will be examined by the City Engineer, and under his direction the pipe shall be thoroughly cleaned, and all sacks, caulking tools, stones and other debris accumulated during construction, shall be removed. All defective caulking shall be remedied, imperfect rivets replaced and the coating renewed wherever necessary.

(k) FIELD TESTS

After the pipe has been laid in the trench, it shall be plugged at the ends and subjected to hydrostatic test in convenient sections of such lengths as the City Engineer may direct. Such test to be fifty (50) pounds per square inch in excess of the normal working pressure when in operation. In no case shall the test pressure be less than one hundred fifty (150) pounds per square inch. Caulking shall be continued until the pipe is tight at the required pressure.

The contractor shall find his own ways and means of furnishing water and appliances and material for testing, and the caps, plugs, etc., necessary for closing all openings in the pipe and branches. The closing of said openings shall in all cases be absolutely tight to prevent leakage of water into the trench. Should any pipe, special or appurtenance, break in making such test, it shall be replaced by the contractor at his own expense.

(l) BIDDING FORMALITIES

Bids on the pipe shall include the cost of supplying the material as specified, free from all charges, and shall include the cost of delivering all materials along the line of the trench, excavating the trench, backfilling, putting in place, making all connections and supplying materials therefor, digging all joint holes, and in every way putting the pressure pipe into proper shape for permanent use, and into the finished condition contemplated by the plans and specifications.

(m) MEASUREMENTS

Measurements for the estimate of steel pipe shall be made in the same way as for cast iron pipe, as described in Section No. 143. The method remains the same whether fittings are of cast iron, cast steel or steel plate.

(n) PAYMENT

Payment for Steel Pipe shall be made at the price bid per linear foot and shall be in full for furnishing and laying the pipe, and all special castings shown on the plans, and shall also include all trenching, riveting, backfilling, restoring the street surface, relaying of paving or planking, unless such paving is done by the

Street Department as provided in Section 111, and all other material and labor necessary for the completed work. In case any special castings shown on the plan are omitted in the work, a corresponding reduction shall be made from the estimate. Any excavation ordered by the City Engineer above that shown on the profiles or specified in Section No. 134, shall be paid for at the rate bid for "Extra Excavation" per cubic yard.

WATERMAIN APPURTENANCES

145. GALVANIZED IRON PIPE

The pipe shall be standard size, guaranteed wrought iron pipe, galvanized full weight, and equivalent in quality in every respect to the pipe manufactured by A. M. Byers & Co., Pittsburg. All pipe one and one-half inches (1½") and above in internal diameter shall be lap welded. All pipe less than and including 1¼ inches inside diameter may be butt welded. Steel pipe shall not be used. The weights shall not vary more than 5 per cent from the weights given in the following table:

For ½ in. inside diameter, wt. per ft.	.84 lbs.
For ¾ in. inside diameter, wt. per ft.	1.12 lbs.
For 1 in. inside diameter, wt. per ft.	1.67 lbs.
For 2 in. inside diameter, wt. per ft.	3.66 lbs.
For 2½ in. inside diameter, wt. per ft.	5.77 lbs.
For 3 in. inside diameter, wt. per ft.	7.54 lbs
For 3½ in. inside diameter, wt. per ft.	9.05 lbs.
For 4 in. inside diameter, wt. per ft.	10.72 lbs.

Connections shall be made to the main pipe line by means of a standard water pipe clamp with threaded outlet. When possible, connection is to be made to the main line at a tapped plug. All threads of screw connections are to be unbroken and cut full depth. Before connections are made threads shall be well covered with steamfitters' cement. The pipe shall be laid with a cover of not less than two (2) feet. All galvanized iron pipe when laid shall be subjected to hydrostatic pressure equal to 300 pounds per square inch.

Payment for galvanized iron pipe shall be made at the price bid per linear foot and shall include all trenching and filling, necessary bushings, clamps, fittings and all labor necessary to place the pipe in position.

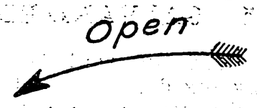
146. GATE VALVES

All gate valves up to and including 8" in diameter shall be iron bodied, bronze mounted, two faced valves, of either wedge or parallel faced, double disc type, of some standard make.

All gate valves of 10" diameter and over shall be iron bodied, bronze mounted, parallel faced, double disc valves of some standard make.

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 valves 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.

Valves and seat rings shall be of composition metal, and valve stems of phosphor bronze, of approved proportions. All valves must satisfactorily stand a test pressure of 300 pounds per square inch, either when closed or open, and the contractor shall furnish a certificate of such test for each valve used. All valves, except by-pass valves shall stand erect unless otherwise shown. By-pass valves shall lie on their sides. All valves shall be provided with a nut for a wrench and shall open by turning to the left and be marked with an arrow indicating the direction of opening.



All gate valves having a larger diameter than fourteen (14) inches shall be provided with a bevel gear and with by-pass from two (2) to four (4) inch, acording to the size of the valve.

After gate valves are delivered on the ground, but before they are placed in the line, they shall be cleaned and 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.

147. DISTRICT GATE VALVES

At any point in the system where two services 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 placing of and operating with a gate key.

148. BRICK VALVE CHAMBERS

(Fr plan, see pages 138-142)

Where shown on the plans, or where directed by the City Engineer, gate valves shall be enclosed in brick 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.

The brick used shall be of Class "C" and laid in Portland Cement mortar, mixed three (3) parts by volume of clean sand to one (1) part by volume of cement.

The concrete to be used in the base shall be of 1:3:5 proportion by volume. The concrete to be used in the reinforced concrete

top of large chambers shall be of 1:2:4 proportion by volume. The contractor may substitute monolithic concrete for brick in the walls of large chambers, in which case the proportion of concrete shall be the same as for the base.

Cast Iron covers shall be provided of design and size as shown in detail drawings, and also as designated in the bill of material. They shall conform in quality of material, coating, markings, and all other respects to special castings as specified elsewhere in these specifications under the heading of "Special Castings."

Payment: Valve chambers with reinforced concrete covers will be designated as large valve chambers and payment shall be made at the price bid for "Large Brick Valve Chambers." Other valve chambers will be designated as standard brick valve chambers, and payment shall be made at the price bid for "Standard Brick Valve Chambers."

The price bid shall include the four-inch sewer pipe drain, and the connection of the same to the sewer.

149. CONCRETE BLOCK VALVE CHAMBERS

The contractor has the option of constructing the walls of valve chambers of concrete blocks if he so desires. The concrete for the blocks shall be composed of one (1) part cement, two and a half (2½) parts sand and five (5) parts gravel. All cement, sand and gravel used shall be of the same quality as specified for these materials under "Quality of Materials," and shall be mixed in a manner satisfactory to the City Engineer. Blocks shall set thirty (30) days before being used. All blocks used on the cylindrical portion of the chamber shall be at least six (6) inches thick on radial lines, and have vertical grooves in adjoining faces. Conical blocks, thicker vertically than two and one-half (2½) inches shall not be allowed for drawing in the top unless they form the conical surface without any offset and in such cases the radial dimensions shall be at least six (6) inches. If blocks less than two and one-half (2½) inches in thickness are used, the radial dimensions shall be eight (8) inches and in such cases the conical portion of the chamber may be formed by offsetting the successive layers as in the case of brick valve chambers. Where pipes pass through the walls the blocks shall be cored out to the proper diameters. When thoroughly dried and immersed in water for twenty-four hours, the blocks shall not absorb more than five per cent (5%) of water, by weight. Tests shall be made from time to time as directed by the City Engineer.

The blocks shall be set in one-half (½) inch of mortar composed of one (1) part cement and two (2) parts sand. The end joints shall be completely filled with mortar and the grooves at the ends of the blocks filled flush with the top and well tamped.

Payment for concrete block valve chambers shall be made at the same price as bid for "Large Brick Valve Chambers," and "Standard Brick Valve Chambers," respectively.

150. WOOD VALVE BOXES (For plan, see page 143)

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.

151. HYDRANTS (For plans, see pages 144-152)

Hydrants shall be located as shown on the plans. 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.

All hydrants shall have bronze mountings, and be so arranged that all working parts can be removed without digging around or disturbing the barrel. They shall be set in a bed of broken stone or coarse gravel, unless the waste orifice is connected with the sewer. Hydrants shall be connected to the main with a section of 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 placed vertically near the hydrant and provided with a suitable cast iron valve box. 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 shall be rejected. 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 (¾") inside diameter.

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. If screw nipples or other fittings are necessary to accomplish this end, no extra payment shall be allowed for the same, but the cost thereof shall be included in the price bid for hydrants.

All gaskets required in connecting hydrants to the main shall be cloth insertion ring gaskets 1/16" thick.

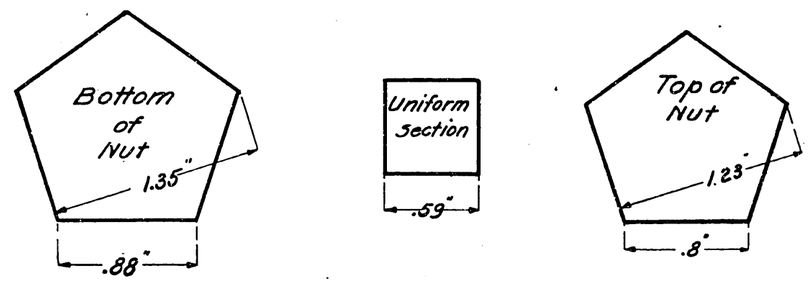
The cast iron tees for hydrant connections shall have lugs cast on the outlet for the insertion of rods to tie the hydrant to the main A cast iron hub and flange connection, made in accordance with standard drawings, shall be bolted on to each auxiliary hydrant gate valve. Hydrants shall be shackled to the main pipe by two iron rods attached at one end to 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 cost of these rods, together with all nuts necessary to attach them, shall be included in the price bid for pipe for hydrant connections. These rods shall be painted with two coats of "P. & B. Paint" or its equal.

The dimensions and details of hydrants shall be as follows:

	Standard size	Large size
Hydrant connection, C. I. Pipe, ins. diam.	6 inches	8 inches
Standpipe, minimum ins. diameter	6⅞ inches	8 inches
Length of hydrant from bottom of hydrant connection to sidewalk ring:		
For pipe lines 6 and 8 inches diameter	3½ feet	3½ feet
10 inches diameter	4 feet	4 feet
12 inches diameter	4½ feet	4½ feet
16 and 20 inches diameter	4 feet	4 feet
24 and 30 inches diameter	4½ feet	4½ feet
Valve opening—minimum diameter	5 inches	6¼ inches
Size of Auxiliary Gate Valve	6 inches	8 inches
Hose Nozzle, number and size	2-2½ inches	3-2½ in.
Thread (Nat. Board Fire Underwriters)	7½ per in.	
Outside diameter finished	3 1/16 inches	
Diameter at root of thread	2.8715 inches	
Pattern of thread	60° V thread	
Total length of threaded male nipple	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 in.	4.6263 in.
Threads per inch	6	6
Pattern of thread	60° V thread	
Total length threaded male nipple	1⅛ inches	1⅛ inches
Operating Nuts, same for both size hydrants		
Dimension in section as shown.		
Minimum height of nuts:		

	Standard size.	Large size
Square	⅝ inch	⅝ inch
Pentagon	1 1/16 inch	1 1/16 inch
Diameter of Shackle Rods	¾ inch	1 inch



The auxiliary gate valve and the portion of hydrants below the surface of the ground shall be thoroughly repainted with "P & B" paint or some other preparation approved by the City Engineer.

The portion above the ground shall be repainted with two coats of dark green, after the hydrants have been set and tested.

Hydrants shall be provided with an independent valve for each hose nozzle. 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.

Payment for hydrants shall be made at the price bid for each and shall include payment for the auxiliary gate valve, the hub and flange casting, all bolts, nuts and gaskets, laying, jointing, and setting thereof in place, all excavation and refilling, and all other materials and labor necessary.

152. CAST IRON VALVE BOXES

(For plan, see pages 148-149)

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. Cast Iron Valve Boxes will be designated as "Heavy Cast Iron Valve Boxes" and "Light Cast Iron Valve Boxes" as shown in cuts on pages .... and .... of these specifications.

Payment for "Cast Iron Valve Boxes" shall be made at the price bid for each in place for "Heavy Cast Iron Valve Boxes" and for "Light Cast Iron Valve Boxes."

153. HYDRANT CONNECTIONS

(For plan, see pages 144-147)

"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.

154. 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 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 iron 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, which shall be paid for at the rate bid for "Shackle Rods" per pound in place, and "Hydrant Connections," as mentioned in Section No. 153.

155. 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 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 iron rods shall be used.

Payment for "Moving 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, which shall be paid for at the rate bid for "Shackle Rods" per pound in place and for "Hydrant Connections" as mentioned in Section No. 153.

156. 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 for "Reconnecting Hydrants" 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.

157. HYDRANT DRAINS

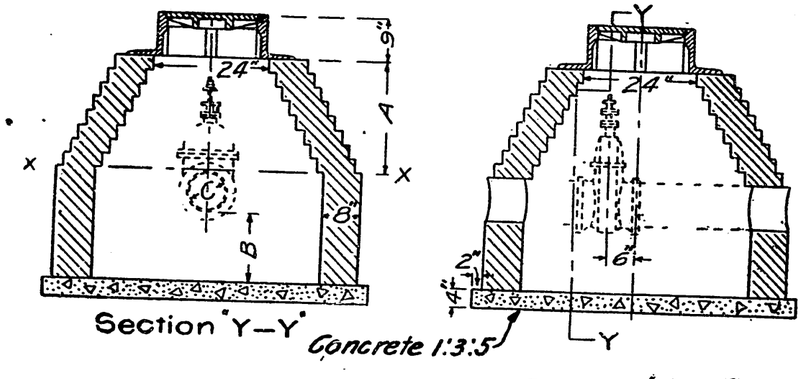
When ordered by the City Engineer, waste orifices of hydrants shall be connected to the sewer or other outlet, by ¾" galvanized wrought iron pipe, which shall conform in all respects to the requirements for "Galvanized Iron Pipe." as specified in Section No. 145.

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, back-filling, fittings and all labor necessary to place in position.

158. HYDRANT EXTENSIONS

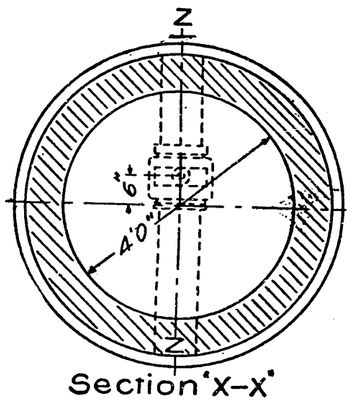
All two flanged extensions, such as vertical extensions in the barrel of hydrants, or horizontal extensions between the hydrant and auxiliary gate valve, shall conform in quality of material, coating, marking, and all other respects to special castings as specified elsewhere in these specifications under the heading of "Standard Specials" or "Special Castings." 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, which shall include payment for all machine work, extension of hydrant rods, bolts, nuts, washers and gaskets. Lengthening of hydrants to specified lengths with vertical hydrant extensions shall not be allowed except by permission from the City Engineer and in such cases no extra payment shall be allowed for vertical extensions, but they shall be included in the price bid for "Hydrants."



Section "Y–Y"

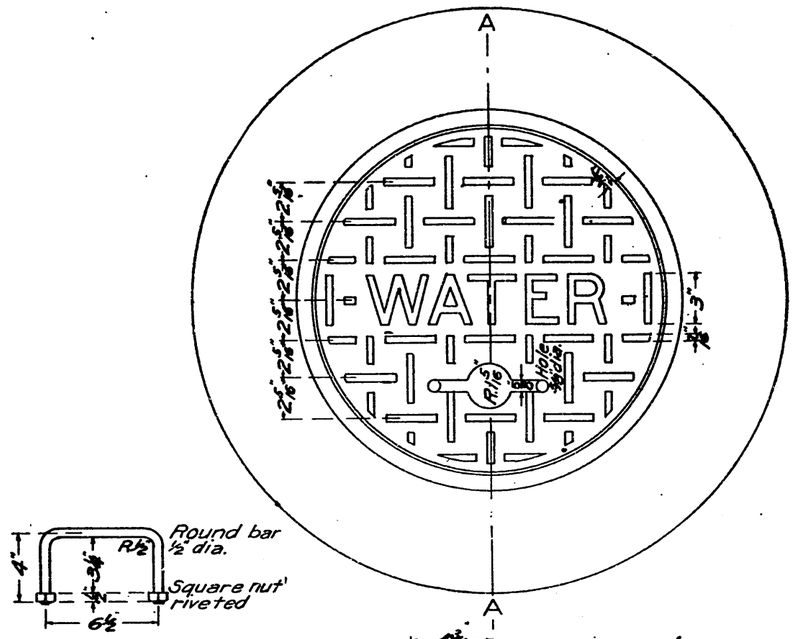
Section "Z–Z"



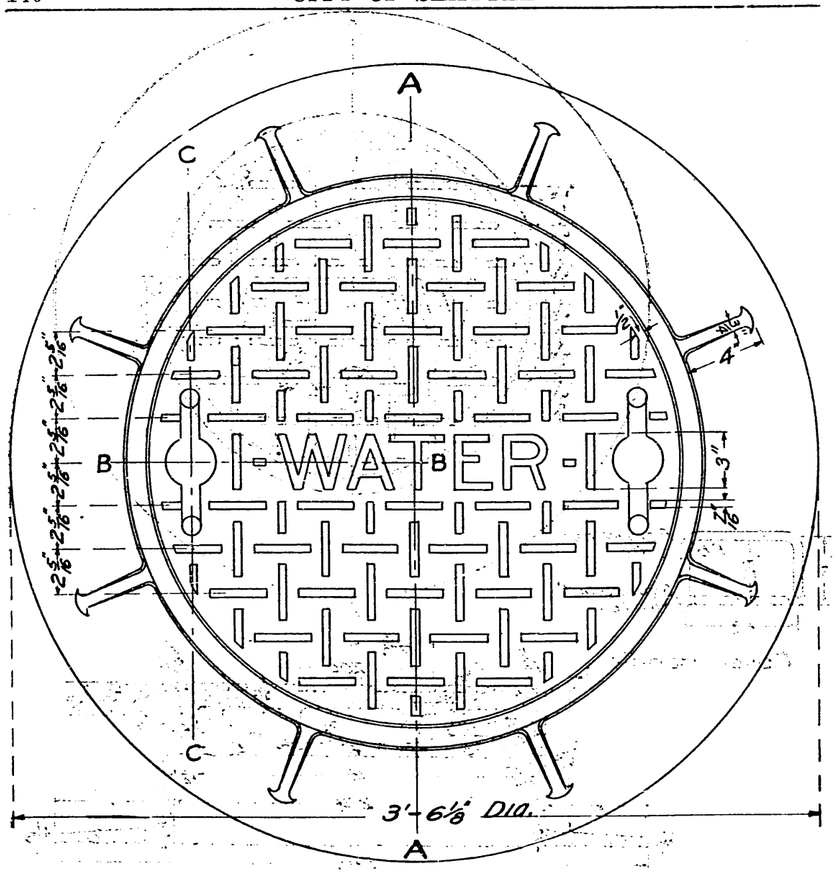
Section "X–X"

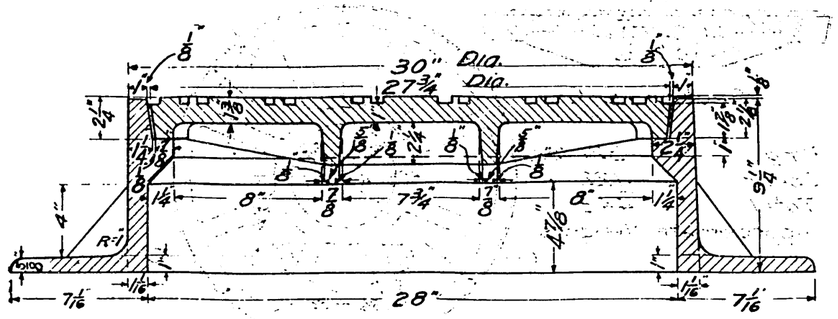
When	C = 8"	A = 23¾"	not	less
"	C = 10"	A = 28½"	"	"
"	C = 12"	A = 31"	"	"
"	C = 8"	B = 10"	"	"
"	C = 10"	B = 12"	"	"
"	C = 12"	B = 12"	"	"

STANDARD BRICK VALVE CHAMBER



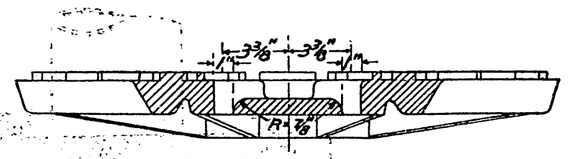
STANDARD VALVE CHAMBER COVER



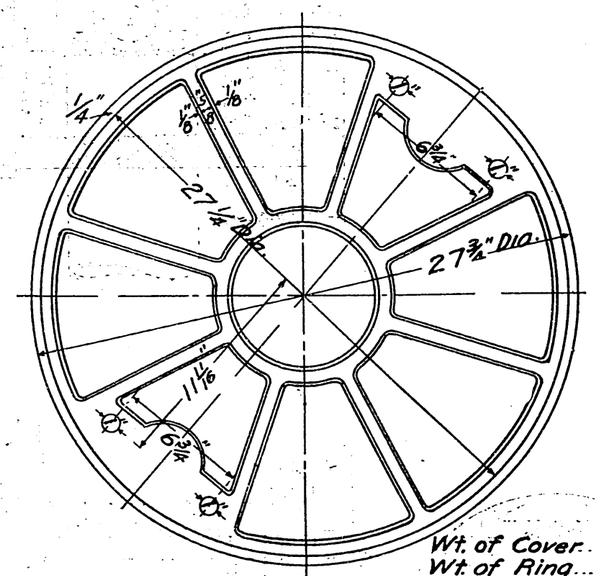


Section A-A

VALVE CHAMBER

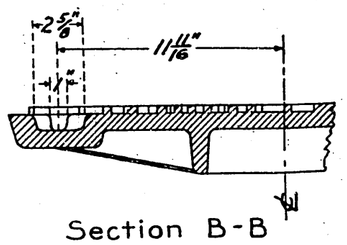


Section C-C

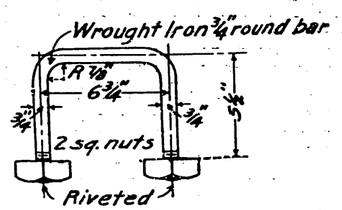


Bottom View

Wt. of Cover...217 lbs
Wt. of Ring...440 "
Total.....657 "

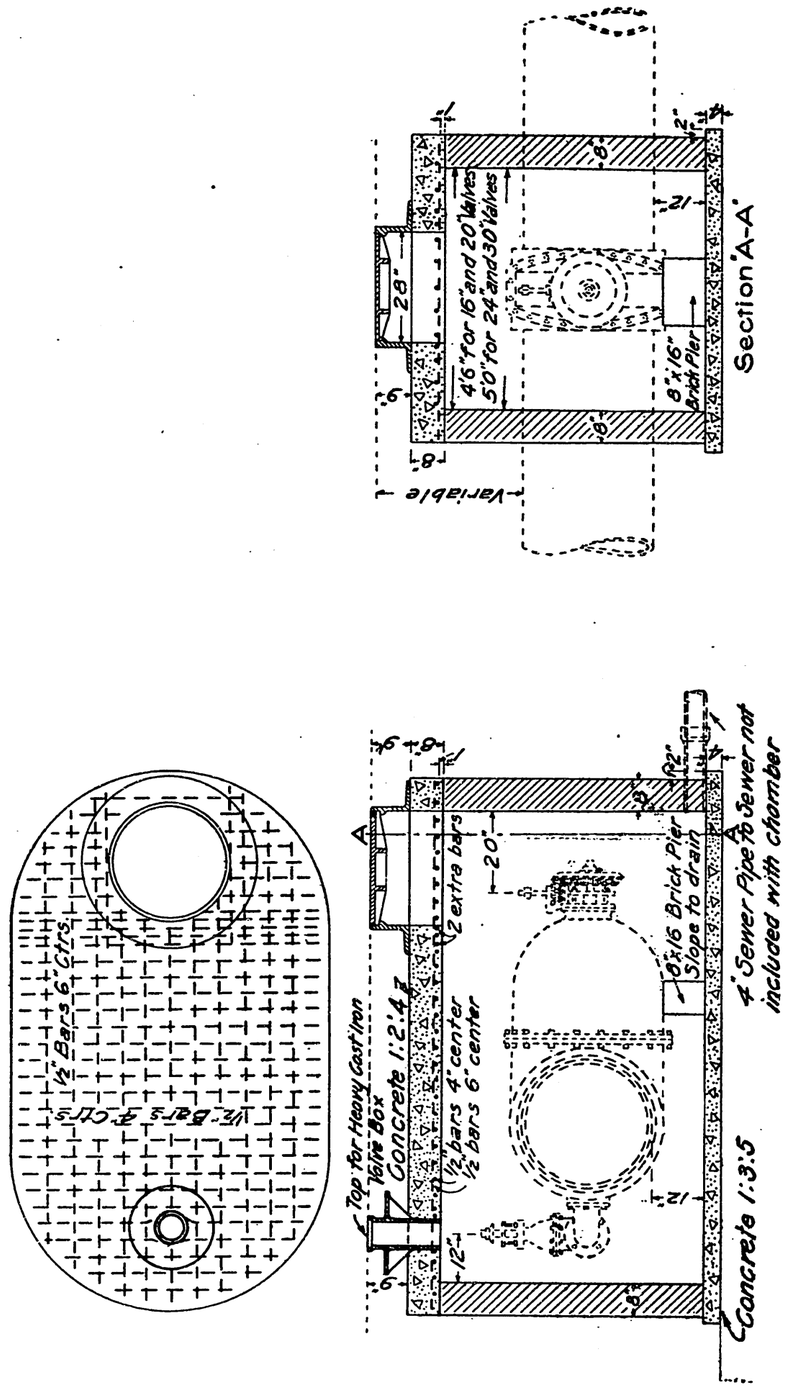


Section B-B

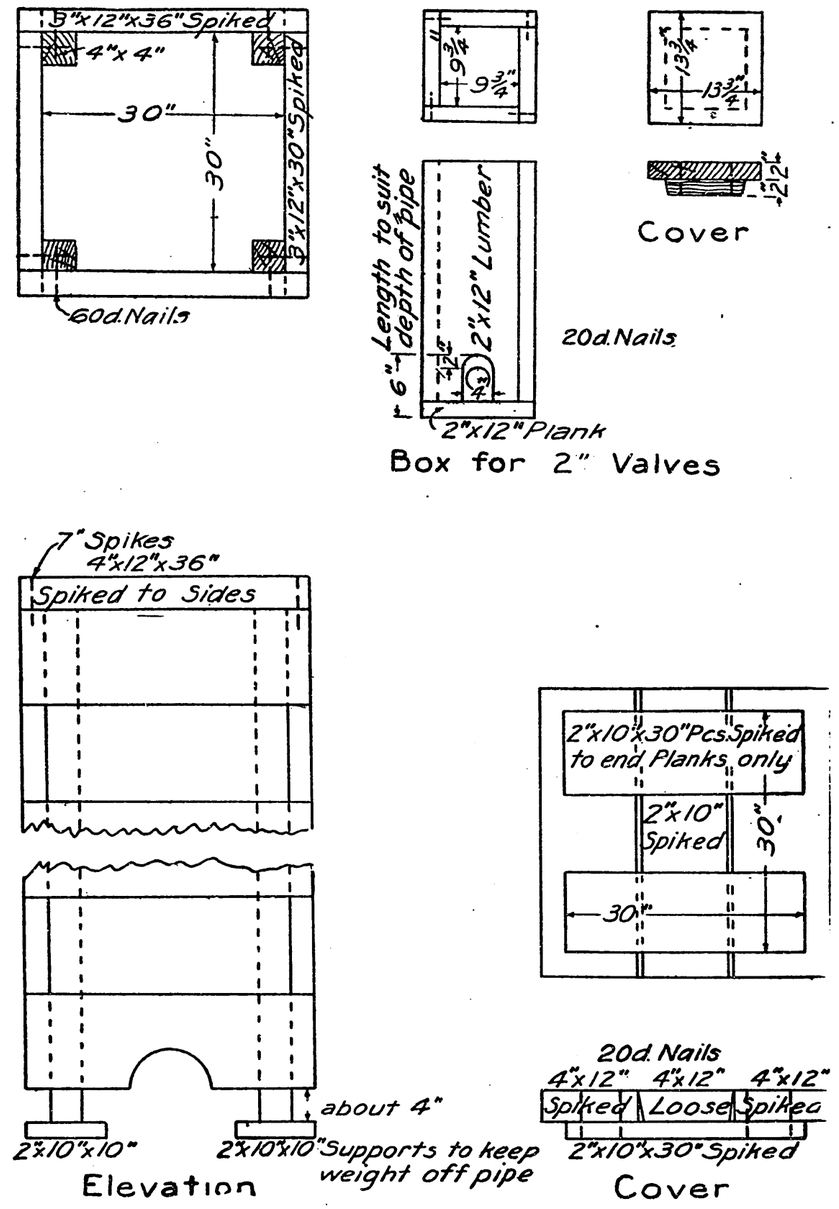


Handle

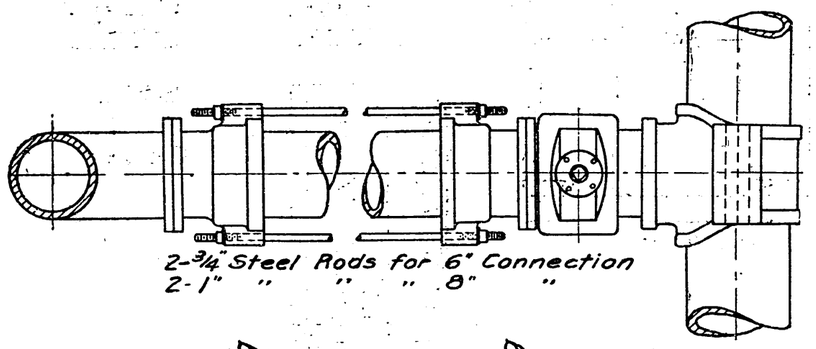
COVER (LARGE)



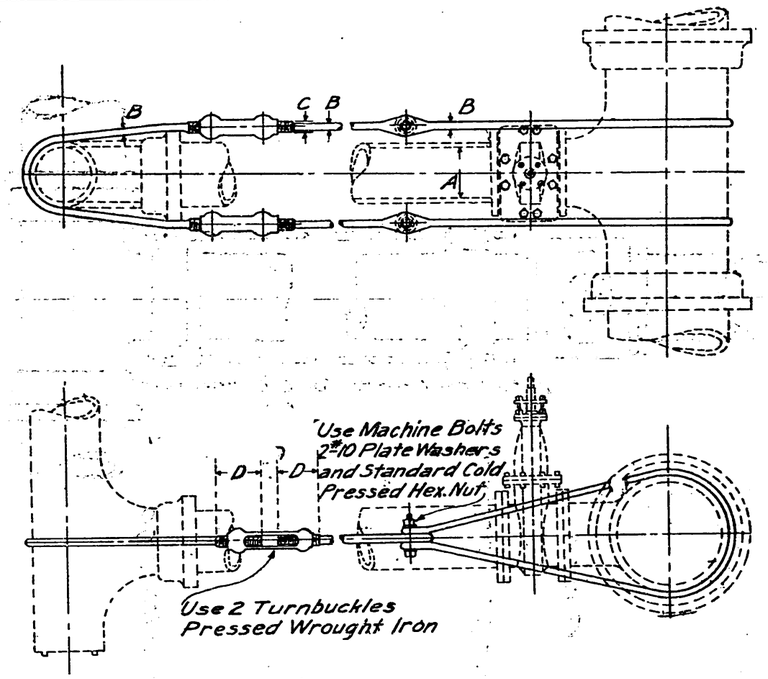
LARGE BRICK VALVE CHAMBER



WOOD VALVE BOX

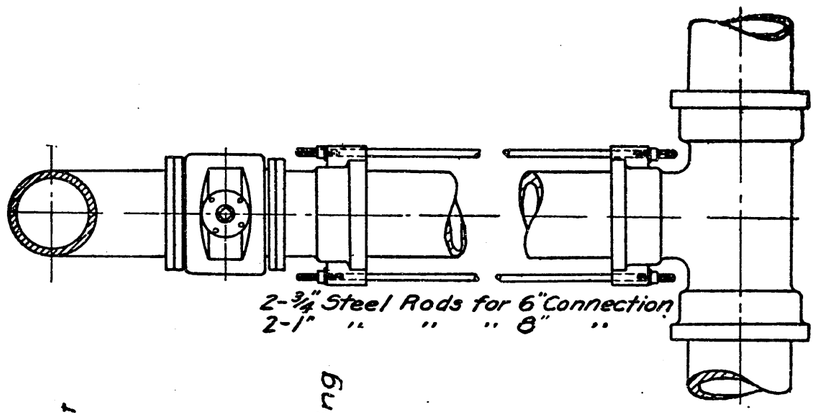


METHOD OF CONNECTING HYDRANT TO EXISTING MAIN USING SPLIT TEE

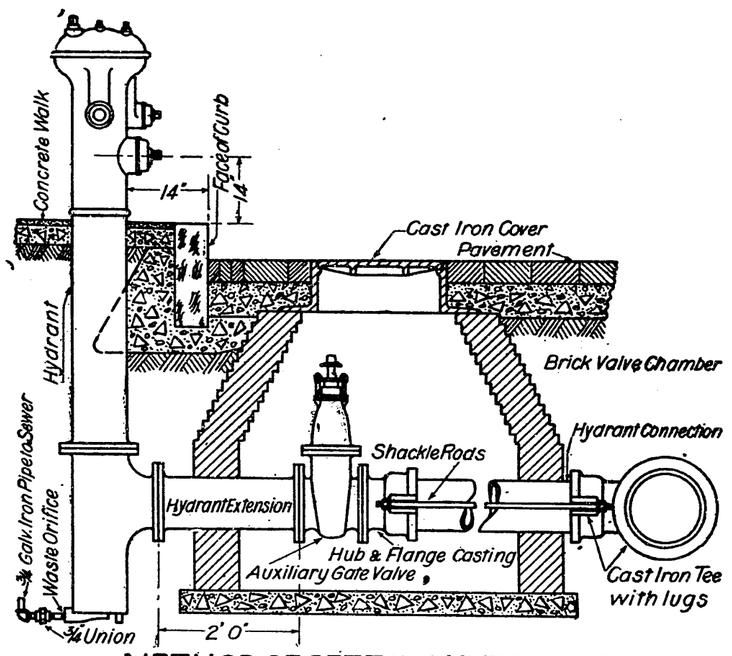


A	B	C	D	E	F
6"	3/4"	1"	4 1/2"	7/8"	3/4"
8"	1"	1 3/8"	5"	1 1/8"	1"

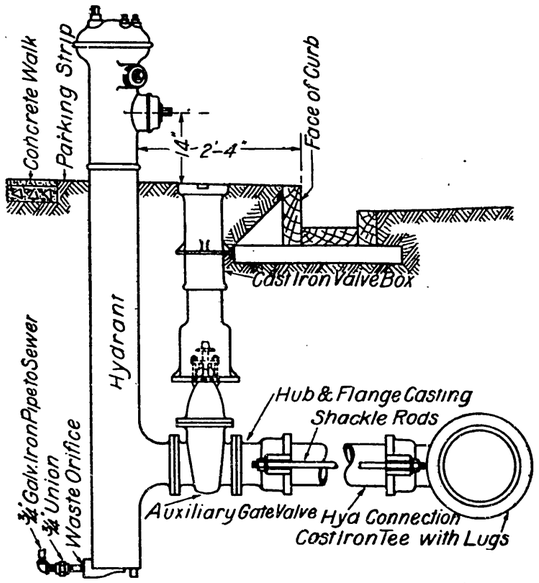
METHOD OF CONNECTING HYDRANT TO EXISTING MAIN WITH FLANGED OUTLET TEE



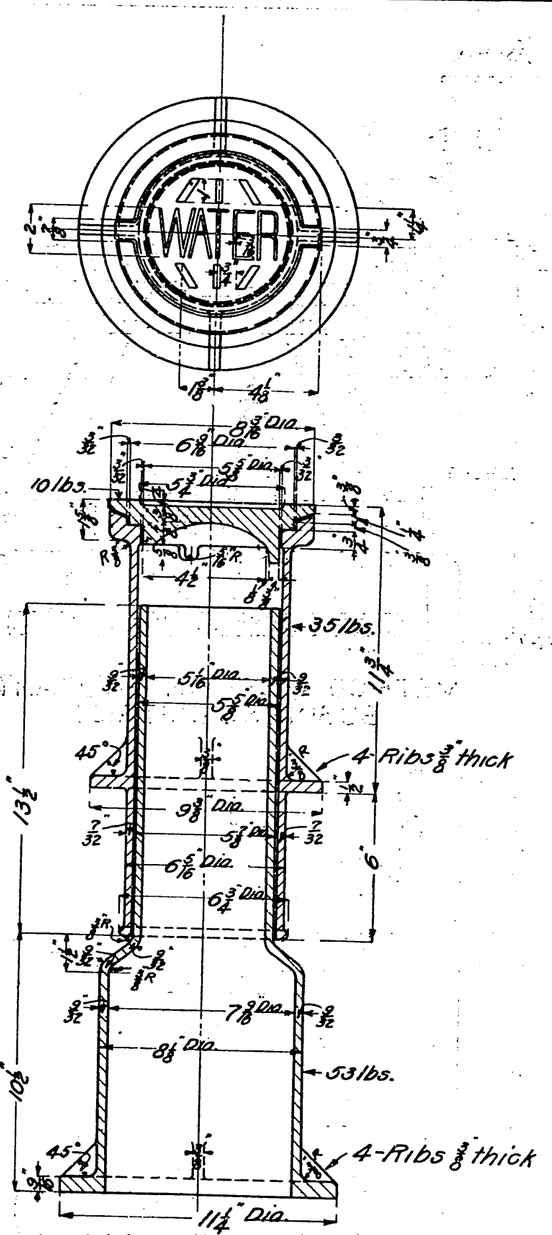
METHOD OF
CONNECTING HYDRANT TO NEW MAIN



METHOD OF SETTING HYDRANTS
BUSINESS DISTRICT

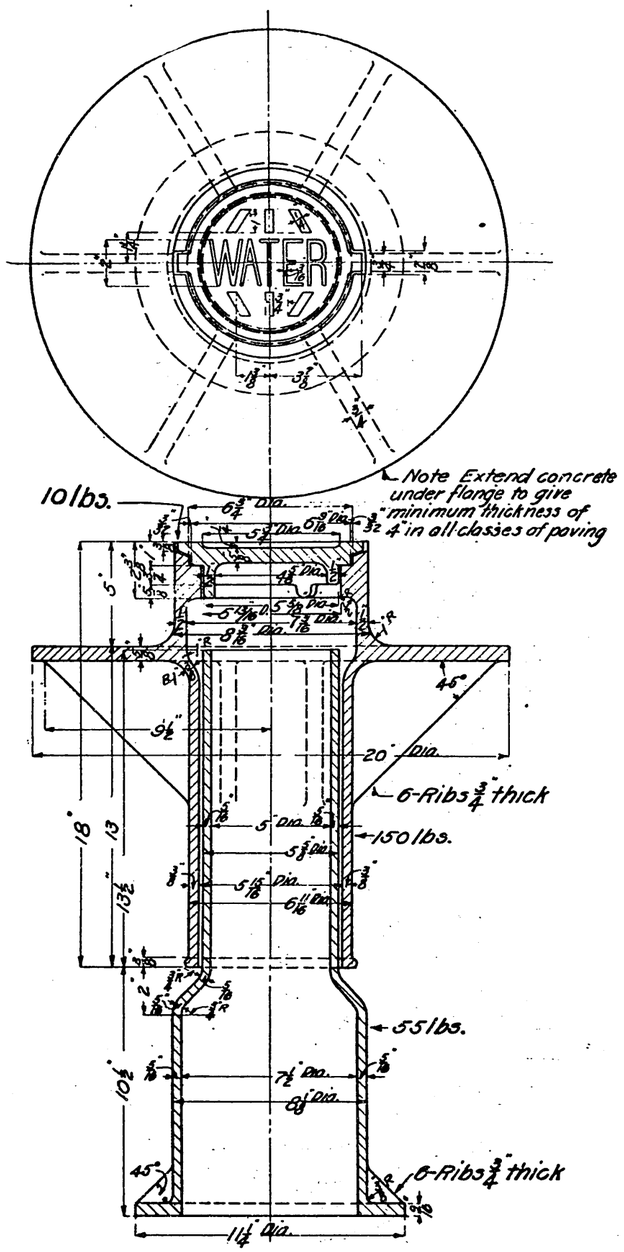


METHOD OF SETTING HYDRANTS
RESIDENCE DISTRICT



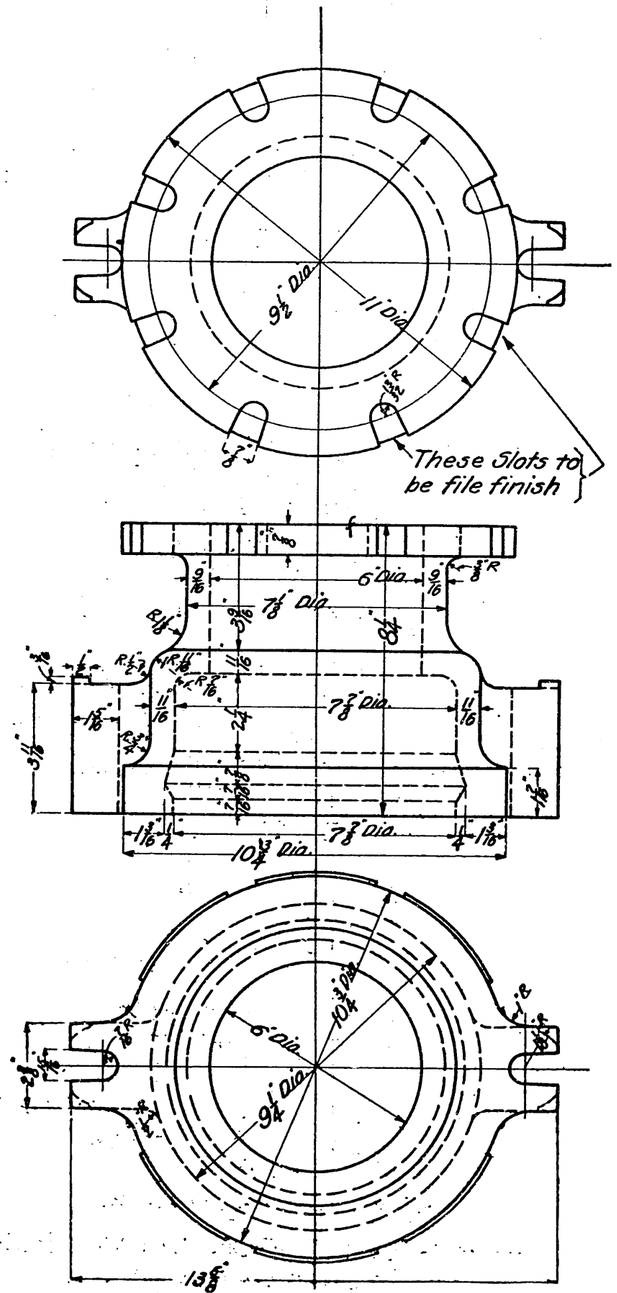
Approximate Weight 98 lbs.

LIGHT CAST IRON VALVE BOX
FOR PARKING STRIPS



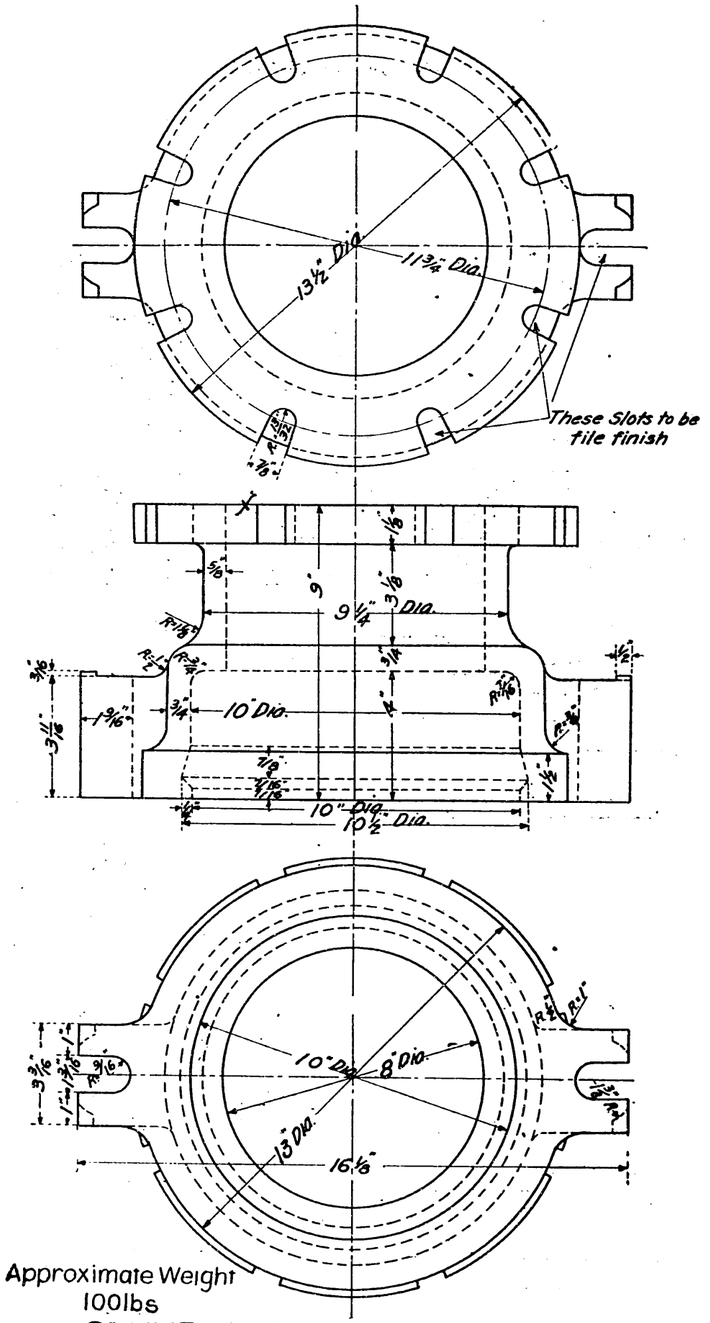
Approximate Weight 215 lbs.

HEAVY CAST IRON VALVE BOX
FOR ROADWAYS



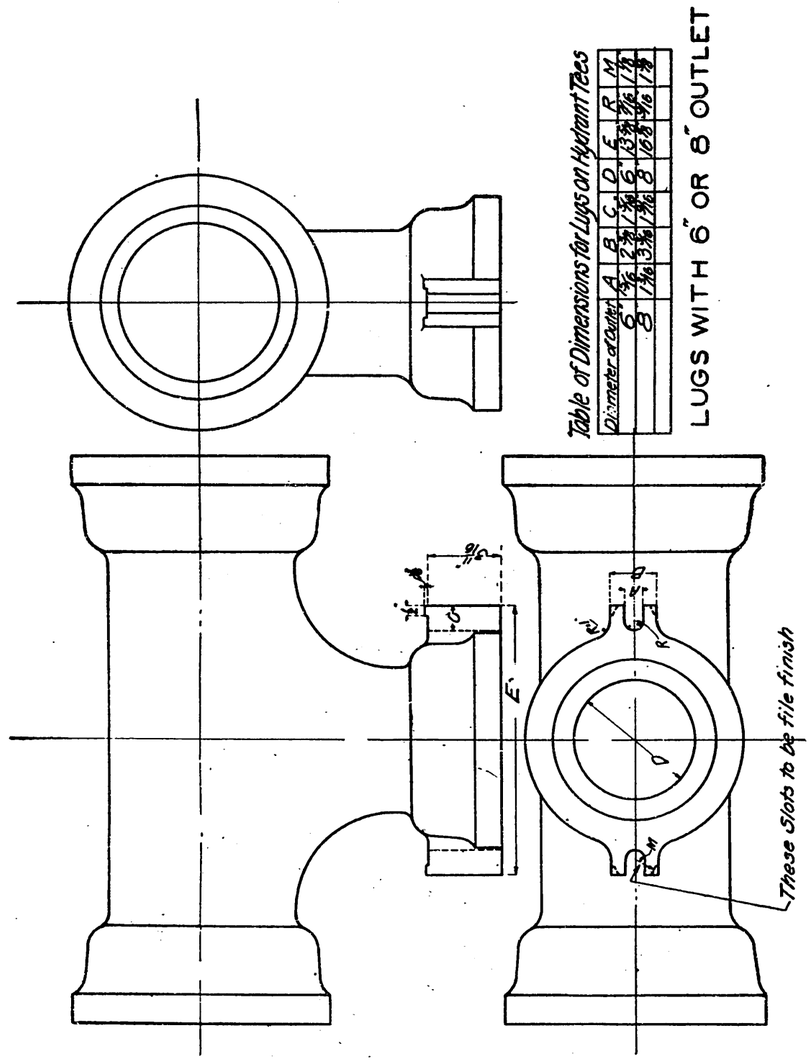
Approximate Weight 70 lbs.

6" HUB AND FLANGE CASTING



Approximate Weight 100 lbs

8" HUB AND FLANGE CASTING



SPECIFICATIONS FOR PAVEMENTS AND APPURTENANCES

General Stipulations

159. SUB-GRADING FOR PAVEMENT

After the surface of the street has been cleared and grubbed as specified herein under "Grading," all lumber, drains, dead pipes or other material not suitable for the foundation found more than one (1) foot below the sub-grade 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 No. 68.

The City Engineer shall be the sole judge as to what shall constitute unsuitable or improper materials to remain in the sub-foundation, 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 therefor. 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 sub-grading, and if the material required is available from waste material within a distance of six hundred (600) feet no allowance shall be made for refill. If the material required is available from waste material within one thousand (1000) feet but not within six hundred (600) feet, payment shall be made for the refill at the price bid per cubic yard for sub-grading. If the material required is not available within one thousand (1000) feet, or if suitable material cannot be obtained from the streets in this improvement district, payment 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. All embankments shall be made of suitable material spread in layers not exceeding one foot in thickness. 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 the City Engineer may direct. The ground shall be water settled where directed, and when in suitable condition, each layer shall be thoroughly rolled and compacted by the use of a road roller weighing not less than ten (10) tons and having a pressure of approximately three hundred seventy (370) pounds to the inch of tread. All sub-grades for paving and curbs shall be rolled to a width two (2) feet greater than the width of the pavement. Rolling shall begin after the sub-grading is out and shall continue until all settlement ceases. As it proceeds, all spots or sections settling below sub-

grade shall be brought up by filling in suitable material. This material shall then be water-settled and re-rolled. This process shall be continued until a hard and uniform surface has been obtained which conforms to the grade and cross-section required.

Any portion of the surface of the sub-grade which may be inaccessible to the road roller shall be thoroughly tamped with a rammer ten (10) inches in diameter, weighing not less than forty (40) pounds.

Payment for sub-grading for pavement shall be made at the price bid per cubic yard for "Sub-grading" and shall include payment for tamping, rolling, water-settling and for furnishing and operating the road roller.

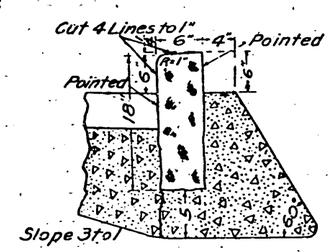
160. MEASUREMENT OF PAVEMENTS

Paved areas shall be measured on a horizontal plane and no deduction shall be made for expansion joints, castings or poles around which the pavement is laid.

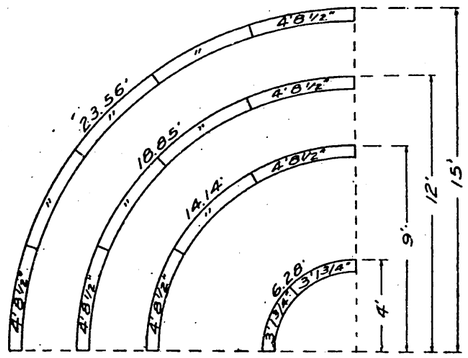
161. GRANITE CURBING

Granite Curbing shall conform to the specifications for Granite Curbing in Section No. 48 under "Quality of Materials."

All curbing shall be thoroughly clean and free from dirt when set. The contractor shall put in an expansion joint one-half (½) inch wide at each margin of all streets and alleys and at intervals not exceeding one hundred fifty (150) feet. These joints shall be made of Carey's Elastite or its equal. Trenches for curbs shall be carefully excavated at least five (5) inches below the bottom of the stone and shall be wide enough to receive the concrete footing and backing as shown on the plans. The concrete at the face of the stone shall be brought up and made continuous with the concrete in the pavement foundation. The amount of concrete back of the curb stone shall be not less than that shown on the standard plan and of the same proportions as the base for pavements.



GRANITE CURBING



GRANITE RETURNS

The joints between stones shall be neatly pointed with cement mortar consisting of one (1) part cement and two (2) parts sand, immediately after they are set.

Payment for Granite Curbing shall be made at the price bid per linear foot in place, and shall include expansion joints, and all other labor and material necessary. Measurement shall be made along the face of the curb.

162. CONCRETE CURBING

Concrete curbing shall be composed of one (1) part Portland cement, three (3) parts sand and six (6) parts gravel. The lumber for forms shall be dressed on the edges and on the side next to the concrete and shall be set securely so that the curbing, when completed, conforms accurately to line and grade. Forms for curved curbing shall be constructed of metal or of two (2) layers of one-half (½) inch plank.

After the concrete has been deposited, it shall be spaded back from the face of the form to a depth of not less than eight (8) inches and to a width of not less than three-fourths (¾) of an inch at the top. The space thus formed shall be filled with cement mortar, mixed with one (1) part Portland cement to one and one-half (1½) parts of sand. The concrete and mortar shall then be thoroughly spaded and tamped. The top layer shall be three-fourths (¾) of an inch in thickness, consisting of a coat of cement mortar mixed as previously specified. It shall be applied immediately, and thoroughly troweled down to a smooth and uniform finish. Special care shall be taken to secure a perfect bond with the concrete.

Wherever two (2) inch holes are to be made for drains, the contractor shall provide 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. They shall be fastened securely in place.

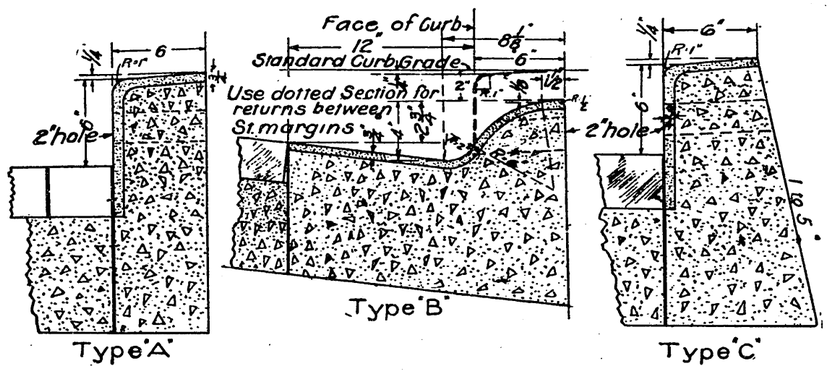
At street intersections, the back face of all plain or armored concrete curbing shall be finished in a vertical plane down to a depth of five (5) inches below the top. From this point on to the bottom, the curb shall have the same size and dimensions as elsewhere.

At street intersections, type "B" Concrete Curbing shall be raised from four (4) inches to six (6) 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.

After the forms have been removed, any defects on the top of the curbing shall be corrected. Any faults or interstices shall be filled with cement mortar and smoothed so that the top and face of the curbing, for a depth of eight (8) inches, and in the case of type "B" curbing, the entire face and gutter, is free from defects. The contractor shall protect the curbing from all damage due to traffic and the weather. In hot, dry weather, the curbing shall be kept moist by sprinkling as often as directed by the City Engineer. The contractor shall put in an expansion joint of Carey's Elastite or its equal one-half (½) inch thick at each margin of all streets

and alleys, and at intervals not exceeding one hundred fifty (150) feet.

Payment for concrete curbing shall be made at the price bid per linear foot, type "A", "B", or "C" "Concrete Curbing" in place and shall include payment for the expansion joints and the two-inch weep holes and all other labor and material necessary. Measurement shall be made along the face of the curb, except in the case of type "B" curbing where measurement will be made on a line parallel to, and six (6) inches from the back of the curb.



CONCRETE CURBING

163. ARMORED CONCRETE CURBING

Armored concrete curbing shall be constructed in precisely the same manner as specified for Concrete Curbing, except that proper provision shall be made for the insertion of the armor. The armor shall conform to the specifications for Curb Armor in Section 45 under "Quality of Materials." This armor shall be accurately placed on the edge of the curbing and shall connect smoothly with the top and sides. After the bar is in place, the cement mortar top, while still soft, shall be thoroughly troweled and smoothed.

On all curved curbing, the armor shall be held in place by means of suitable clamps until the concrete is hard. As soon as the forms are removed, all projections shall be rubbed down and the armor cleaned to the satisfaction of the City Engineer. Expansion joints shall be constructed as provided for under "Concrete Curbing."

Payment for "Armored Concrete Curbing" shall be made at the price bid per linear foot, type "A" or "C" in place, and shall include payment for furnishing and placing the armor and expansion joints. Measurements shall be made along the face of the curb.

164. GRANITE CURBING RESET

Where shown on the plans, the existing granite curbing shall be reset. The material and workmanship shall be the same in all respects as that specified in Section No. 161 for "Granite Curbing."

Payment for "Granite Curbing Reset" shall be made at the price bid per linear foot and shall include payment for the removal, storage and resetting of the granite stones. Any pieces that are broken by the contractor during the process shall be replaced by new materials according to specifications, at his own expense.

165. CONCRETE BASE FOR PAVEMENTS

Concrete base for pavements shall be laid from five (5) to eight (8) inches thick as called for on the plan of the improvement. In composition and production, the concrete shall conform in all respects to the Standard Specifications for "Concrete" as written in Section No. 44 under "Quality of Materials."

The area of 1:3:6 pavement base constructed per barrel of cement shall not exceed the following:

For 5″ Base, 6.73 sq. yds.
For 6″ Base, 5.60 sq. yds.
For 7″ Base, 4.81 sq. yds.
For 8″ Base, 4.20 sq. yds.

The sub-grade shall be thoroughly saturated about twelve (12) hours, before placing the concrete and shall be wetted again immediately before placing the concrete. An iron shod template, cut to the exact curve of the pavement, shall be dragged just ahead of the concrete work. This template shall strike off the earth at the exact elevation of the sub-grade.

In case sand or other easily displaced material forms the sub-grade, the contractor shall make his bid price cover the cost of the additional concrete required.

In no case will the City Engineer permit the template to be raised or adjusted to compensate for possible compaction or settlement of sub-grade where concrete is placed.

The concrete shall be deposited by means of bottom dump buckets or other method approved by the City Engineer, in such a manner that it will not disturb the grade prepared for it. It shall be distributed by means of shovels, struck by a steel shod strikeboard, tamped with a steel shod template and rolled with a light sheet steel roller as specified for Concrete Pavement, Section 171. The design of the strikeboard, template and roller shall be approved by the City Engineer. Along curbs and where inaccessible to the roller, the surface shall be floated with a long handled wood float.

The last section of concrete base laid each day shall be laid against a rigid template or board to insure a true vertical joint.

All grade stakes and necessary templates shall be furnished by the contractor and the stakes shall be set by the City Engineer. These stakes shall be maintained in place by the contractor until ordered removed by the City Engineer. The holes shall then be filled with concrete and tamped flush with the surrounding surface.

All concrete base for pavements, when not immediately covered with brick, shall be kept wet continuously for a period of ten (10) days after it is laid.

An allowance shall be made on monthly estimates for concrete base laid but not covered with pavement as follows:

5 inch base, .90 per sq. yd.
6 inch base, 1.10 per sq. yd.
7 inch base, 1.30 per sq. yd.
8 inch base, 1.50 per sq. yd.

These allowances shall be withdrawn from the monthly estimates as soon as the base is covered. Payment for concrete base, sprinkling, water charges, etc., shall be included in the price paid for pavement per square yard in place.

166. ADDITIONAL CONCRETE BASE

Wherever directed by the City Engineer, the base shall be laid to an extra thickness. In material and workmanship the laying of additional base shall conform to the specifications for "Concrete Base for Pavements."

Payment for "Additional Base" shall be made at the price bid per square yard for each and every extra inch in thickness laid.

167. BRICK GUTTERS

Whenever the roadway pavement is to be bituminous material, wood blocks or stone blocks, the brick gutters adjacent to the curb shall be immediately laid upon the freshly placed base as prescribed for brick pavement. Unless otherwise specified, class "A" brick shall be used.

The surface of the gutter shall conform accurately to the grade and section of the finished pavement.

All joints shall be grouted immediately as prescribed for brick pavement.

No wearing surface shall be laid until the base and gutter have set for fifteen (15) days.

Measurement and payment shall be made for "Brick Gutters" in the same manner as specified for paved areas.

PAVEMENTS

168. ASPHALT PAVEMENT (For plan, see page 186)

Asphalt pavement shall consist of: First, a layer of concrete of the thickness specified; second, a binder course one (1) inch in thickness, and third, a wearing course, two (2) inches in thickness.

(a) REFINED ASPHALT

The asphalt employed in the preparation of the asphaltic cement for use in the asphalt paving mixture shall be either a solid natural bitumen or a California oil asphalt that has been in use in the paving industry for at least five (5) years. It shall be so refined as to be uniform in every respect, and of a character recognized as being suitable for asphaltic paving cement. It shall have been freed as far as possible from all foreign and organic matter and volatile oils. At least ninety-nine per cent (99%) shall be soluble in cold carbon bisulphide, not less than ninety-eight and five-tenths per cent (98.5%) in cold carbon tetrachloride, and at least sixty per cent (60%) and not more than eighty per cent (80%) in cold paraffine naphtha of sixty-two degrees (62°) Baume. It shall also be soluble to the extent of not less than thirty per cent (30%) and not more than seventy-five per cent (75%) in cold paraffine naphtha of eighty-eight degrees (88°) Baume.

It shall not flash below four hundred fifty degrees (450°) F. and its melting point shall not be lower than one hundred twenty-five degrees (125°) F.

It shall not contain more than one and one-half per cent (1½%) of fine soot or carbon. The penetration of this refined asphalt shall, under no consideration, be less than sixty-five degrees (65°) nor more than eighty-five degrees (85°) Dow. The average penetration shall be seventy-eight degrees (78°) Dow. All penetrations to be made upon samples at seventy-seven degrees (77°) F. When twenty (20) grams are placed in an oven at a temperature of three hundred twenty-five degrees (325°) F. for a period of five (5) consecutive hours, the loss shall not be greater than five per cent (5%) by weight, and the penetration of the residue shall not be less than fifty per cent (50%) of that of the original sample.

In addition, the refined asphalt shall be subject to such further tests as shall be deemed necessary by the City Engineer. The tests shall be made under conditions and by methods employed in the City Engineer's Testing Laboratory.

The bitumen contained therein shall be of a ductile and cementitious character, suitable to make, on proper admixture with the sand or mineral aggregate, a durable and satisfactory asphaltic paving cement, and shall be satisfactory to the City Engineer in all respects.

For every lot or shipment of refined asphalt used upon this contract, the contractor shall furnish a statement giving the selling agent or company, the refinery that refined the asphalt or prepared the flux, the field or locality from which the crude oil, asphalt or flux was obtained, and a report of tests or penetration from the refinery of each lot or run, with numbers corresponding to the batch or lot numbers plainly marked upon the barrel or container. This report shall be delivered to the department laboratory at least ten (10) days, exclusive of Sundays or other legal holidays, prior to any attempt to fill the plant kettles or make any other disposition of the shipment of refined asphalt. It is further provided that this notice shall be sent to the City Engineer's Department Laboratory upon receipt of the asphalt at the contractor's plant yards.

(b) FLUX:

The oils used in the manufacture of the asphaltic cement shall be a petroleum from which the lighter oils have been removed by distillation. It shall be freed from coke and other impurities, and have a specific gravity of not less than nine degrees (9°) or more than twelve and nine-tenths degrees (12.9%) Baume and fire test of four hundred fifty degrees (450°) F. It shall not contain more han ten per cent (10%) by weight of paraffine.

The flux or petroleum product shall be a residue from the distillation of California or other suitable petroleum, with air or steam agitation at a temperature not to exceed six hundred twenty degrees (620°) F.

It shall have the following characteristics:

1. Soluble in carbon bisulphide to the extent of ninety-nine per cent (99%), and in eighty-eight degrees (88°) naphtha to the extent of ninety per cent (90°).

2. Free from water, and shall not flash below four hundred fifty degrees (450°) Fahrenheit, in a New York State open oil tester, and shall have density of not less than ninety-eight-hundreds (.98)-(12.9° Baume) nor more than one and five-hundreds (1.05)-(9.3° Baume) at twenty-five degrees (25°) Centigrade, when referred to water at the same temperature.

3. It shall volatize not more than fifteen per cent (15%) of oil when heated for five (5) hours at three hundred twenty-five degrees (325°) Fahrenheit according to the method employed by the City Engineer's laboratory.

4. The residue from heating the oil in the same way to four hundred degrees (400°) Fahrenheit for seven (7) hours shall be a soft flux, having a penetration of not less than one hundred thirty degrees (130°) with the Dow Penetration Machine.

5. Not yielding more than six per cent (6%) fixed carbon on ignition.

6. Under the microscope, beneath a cover glass, it shall appear free from insoluble or suspended matter.

(c) ASPHALTIC CEMENT

The refined asphalt, or asphalt and flux, where flux is required, shall be melted together at a temperature of not more than three hundred fifty degrees (350°) Fahrenheit. After the ashphalt is thoroughly melted, agitation shall be maintained either by live steam or on air blast for not less than one (1) hour before and continually while using the asphaltic cement in the paving mixtures.

The asphaltic cement shall have a consistency or penetration as indicated by the New York or Dow Penetration Machines of about seventy-eight degrees (78°) for light traffic streets and sixty-five degrees (65°) for heavy traffic streets when taken at a temperature of seventy-seven degrees (77°) Fahrenheit. If in the opinion of the City Engineer the finished asphaltic cement does not prove of proper consistency, after proper heating and agitation, it shall be modified by the addition of flux or melted asphalt as may be necessary.

It is further provided that, should the loss of consistency or penetration be ten per cent (10%) or more of the refined asphalt penetration, a fluxing material shall not be used and the asphaltic cement shall be immediately removed from the melting kettles and removed from the plant yard.

(d) SAND USED IN ASPHALT MIXTURE

The sand used in asphalt mixtures shall be clean, hard-grained, moderately sharp and free from rust, clay or organic matter.

The sand shall all pass an eight mesh screen and shall be graded uniformly within the following limits:

Retained on No.	10	mesh screen	0	to	2%
Retianed on No.	20	mesh screen	1	to	6%
Retained on No.	30	mesh screen	4	to	8%
Retained on No.	40	mesh screen	7	to	15%
Retained on No.	50	mesh screen	11	to	19%
Retained on No.	80	mesh screen	28	to	40%
Retained on No.	100	mesh screen	14	to	18%
Retained on No.	200	mesh screen	10	to	17%
Passing No.	200	not more than			3%

The sand shall be delivered to the plant in sufficient quantities to allow of proper sampling and testing before using in asphalt mixture.

It is further provided that all sand shall be inspected and accepted before being delivered or dumped in front of the drum feed elevators.

(e) FILLER USED IN ASPHALT MIXTURE

The filler used in asphalt mixtures shall be ground from hard limestone or hard silica stone containing not less than eighty per cent (80%) of calcium carbonate or ninety-five per cent (95%) pure silica.

It shall be ground so that one hundred per cent (100%) shall pass a No. 80 screen and not less than eighty-five per cent (85%) shall pass a No. 200 screen.

Samples of the unground lime or silica rock and of the finished product shall be delivered to the City Engineer when required.

(f) WEARING SURFACE

Asphalt wearing surface shall be composed of the asphaltic cement, sand, and the filler, mixed in such proportions as will produce a tough, compact and durable pavement; but in no case shall the percentage of the bitumen in the wearing surface, soluble in carbon bisulphide, be less than twelve per cent (12%) and to meet special requirements of the other ingredients of this mixture, the percentage of asphalt may be increased by the City Engineer, but in no case shall the percentage exceed fourteen per cent (14%). All percentages are by weight and determined by laboratory analysis.

The sand and the asphaltic cement shall be heated separately by means of suitable apparatus to about three hundred degrees (300°) Fahrenheit, and never above three hundred fifty degrees (350°) Fahrenheit. Special care shall be taken that the sand is heated uniformly throughout. The filler shall be thoroughly mixed with heated sand, in the necessary proportions, before the asphaltic cement is added. The combined sand and filler shall then be mixed with the asphaltic cement at the required temperature, in the proper proportions, and by suitable apparatus for not less than one

(1) minute after adding the asphaltic cement. The machine shall be operated at such speed as will give the best results. It is further provided that any batch or mixture which has been heated to a greater temperature than three hundred fifty degrees (350°) F. shall be dumped and removed from the plant. Such over-heated material shall not be used in the street.

(g) BINDER

The binder course shall consist of suitable, clean, broken stone, passing a one (1) inch screen, not less than five per cent (5%) or more than ten per cent (10%) of which shall pass a No. 10 screen. To this may be added not more than twenty per cent (20%) of fine gravel that will pass a three-quarter (¾) inch ring. To this shall be added not less than ten per cent (10%) or more than twenty per cent (20%) of clean suitable sand, elsewhere described in these specifications. All percentages stated are by weight. The stone shall be heated by passing through revolving heaters at a temperature not exceeding three hundred degrees (300°) Fahrenheit, and then thoroughly mixed by machinery with asphaltic cement of suitable temperature and consistency and in such proportions that the resulting binder posesses life and gloss without an excess of asphaltic cement. Should the binder appear dull from over-heating or lack of cement, it shall be rejected.

(h) TRANSPORTATION AND LAYING OF BINDER

The binder mixture prepared in the manner above described shall be brought to the street at a temperature between two hundred fifty degrees (250°) Fahrenheit and three hundred degrees (300°) Fahrenheit and shall be covered with canvas while in transit.

On reaching the street, it shall at once be dumped on the previously swept concrete and then be deposited roughly in place by means of hot shovels, after which it shall be spread uniformly with hot rakes and then at once be compacted thoroughly by rolling so that the depth of the finished binder shall not be at any place less than one (1) inch.

In rolling the binder an eight (8) ton roller weighing approximately two hundred seventy (270) pounds to the inch of tread shall be used. The rolling shall be continued while the binder is in a hot plastic condition.

Such portions of the binder as it may be impossible to roll shall be thoroughly rammed with hot iron tampers.

Should the binder show rich patches after rolling, these shall be removed and replaced with suitable material.

Should the binder appear to be loose or breaking up, the loose and broken material shall be removed and replaced with new binder.

Under no consideration shall loose or broken binder be bound together by a so-called cushion coat of surface material.

The upper surface of the binder course shall be made exactly parallel with the surface of the finished pavement, and the whole course when finished shall be compact and the particles bound firmly together.

The surface of the binder shall be kept clean and bright by use of planking when necessary or by cleaning the wheels of the wagons or trucks before driving over the surface.

(i) PAINT COAT

Paint coat shall be used only where particularly specified. The paint shall consist of sixty-two degrees (62°) Baume naphtha and any satisfactory asphalt cement free from mineral matter, and of such consistency as will give an average penetration of one hundred twenty-five degrees (125°) Dow at seventy-seven degrees (77°) Fahrenheit. The asphalt cement shall be dissolved in the naphtha while soft and warm, in such proportions that the resulting paint gives a glossy surface after evaporation of the latter, but which at the same time can be applied so as to form as thin a coating as possible. The proportions will vary, depending upon the temperature at which the paint is made, but shall be about two hundred forty (240) pounds of asphalt cement to fifty (50) gallons, or one barrel of naphtha.

(j) APPLYING PAINT COAT

The concrete foundation shall be swept carefully and cleaned thoroughly of all foreign matter. The paint coat shall be applied to the concrete only when it is absolutely dry. It shall be spread by means of a suitable spray pump so that fifty (50) gallons will cover not less than three hundred fifty (350) or more than four hundred (400) square yards of the concrete surface.

No more of the surface of the foundation shall be painted than can be covered with asphalt surface mixture within a few hours after the application. All paint coat shall be covered with asphalt surface the same day it is spread. Under no circumstances shall the paint coat be allowed to become dirty, or shall the surface mixture be applied more than five (5) hours after the painting has been done.

Owing to the inflammability of naphtha, the paint shall be prepared at a safe distance from all fire or flame and applied to the surface of the concrete with the same precautions.

(k) TRANSPORTATION AND LAYING OF WEARING SURFACE

The wearing surface shall be covered with canvas in transit and delivered on the work, at a temperature at the destination, regardless of the length of haul or temperature of the air, of not less than two hundred seventy-five degrees (275°) F. nor more than three hundred forty degrees (340°) F. The contractor shall make such provisions for transportation as will secure this condition. On reaching the street it shall be dumped at once upon a spot outside of the space on which it is to be spread.

It shall be spread immediately over the binder course with hot shovels and rakes having teeth three and one-half (3½) inches long, in such manner as to give a uniform and regular grade and to such depth that after having received its final compression it will have a net thickness of not less than two (2) inches. The raking shall extend to the full depth of the top to the end that the mixture shall be of uniform density throughout.

The contractor shall furnish a template of a pattern approved by the City Engineer for testing the depth and the surface of the asphalt top after raking. The template shall allow for not less

than five-eighths (⅝) inch compression in the final surface. The template shall be used at intervals not greater than four (4) feet. Care shall be taken to set the template at right angles to the curb.

After having been spread, the mixture shall be compressed by a suitable five-ton (5) asphalt roller weighing approximately one hundred sixty-eight (168) pounds to the inch of tread. This shall be followed immediately by an eight-ton asphalt roller weighing approximately two hundred seventy (270) pounds per inch of tread. The rolling shall be continued as long as it makes any impression on the surface, but in no case for less than five (5) hours for each one thousand (1,000) square yards of pavement.

Portland Cement shall be swept over the surface of the pavement after the rolling has been completed.

It is further provided that asphalt surface mixture shall not leave the plant after 2:30 p. m., without the special consent of the City Engineer.

(l) WEARING SURFACE FOR BRIDGES

The binder course shall be prepared and laid as above specified, and then thoroughly swept free from rubbish. Upon this shall be laid an asphalt wearing surface composed of asphaltic cement, sand and filler. The asphaltic cement shall have a penetration of not less than seventy-five degrees (75°) nor more than eighty-five degrees (85°), with a general average of eighty degrees (80°) Dow, when taken at a temperature of seventy-seven degrees (77°) F. The sand and filler shall be mixed in proportions that will show upon analysis not less than thirteen per cent (13%) and not more than fifteen per cent (15%) of asphaltic cement; not less than twelve per cent (12%) and not more than sixteen per cent (16%) of filler shall pass a two hundred (200) mesh screen. All percentages stated herein, are by weight. The mixture of sand and filler shall produce a tough, compact and durable pavement.

(m) GENERAL REQUIREMENTS

It is further provided that not more than three per cent (3%) of the filler passing the two hundred (200) mesh screen shall be composed of mineral matter other than the limestone or silica filler described herein.

All exposed surfaces of castings shall be cleaned and then painted with one coat of hot asphalt. All exposed surfaces of gutters and curbs that come in contact with asphalt pavement shall be painted with one coat of hot asphalt, special care being taken in painting curbs not to paint above the top of the gutter line.

The main or large rolls of the asphalt rollers used on this improvement shall be true cylinders. Any rolls showing bulges or depressions under a straight edge applied anywhere across the face shall not be used on the pavement.

All portions of the pavement surface not accessible to the roller shall be compressed by tamping and smoothed with hot irons.

Special care shall be taken to tamp the hot asphalt mixture thoroughly around any projecting manhole or catch basin covers.

Special care shall also be taken to prevent the iron rakes, shovels, tampers, rollers, etc., from becoming overheated.

No binder or wearing surface shall be laid in rainy weather or if the surface of the concrete or binder is wet.

The contractor shall not apply oil upon the interior of wagon or truck bodies used for hauling asphaltic mixtures on this improvement.

(n) SAMPLE OF ASPHALT TOP

The contractor for this improvement shall remove a section of the asphalt topping at least six (6) inches square from some part of the previous day's work, where designated by the City Engineer. Immediately after removing such sample, the space shall be refilled with new paving material and finished in a workmanlike manner to conform with the surrounding surface.

The price bid per square yard for asphalt pavement shall include the cost of removing daily samples and refilling the space with new pavement.

(o) REQUIREMENTS FOR FINISHED PAVEMENT

Whatever the character of the asphalt used or the method of mixing or the method of manipulation and laying, the finished pavement shall conform to the following requirements:

The pavement when laid down shall be dense, fine-grained, hard and durable, with a specific gravity of not less than two and twelve-hundreds (2.12). It shall be free from checks or honeycomb, smooth and of even surface, free from depression or unevenness showing more than three eights (⅜) inch under a four-foot straight edge. It shall contain no water, no appreciable amount of light oils, or matter volatile at a temperature of three hundred degrees (300°) F.

The mineral matter of the finished pavement, upon analysis, shall be graded within the following limits. One hundred per cent (100%) shall pass a No. 8 mesh screen.

From	0	to	2%	shall be retained on a	No.	10 Screen
From	1	to	6%	shall be retained on a	No.	20 Screen
From	4	to	8%	shall be retained on a	No.	30 Screen
From	8	to	15%	shall be retained on a	No.	40 Screen
From	11	to	19%	shall be retained on a	No.	50 Screen
From	28	to	40%	shall be retained on a	No.	80 Screen
From	14	to	18%	shall be retained on a	No.	100 Screen
From	11	to	17%	shall be retained on a	No.	200 Screen
From	11	to	15%	shall pass a		No. 200 Screen

The asphaltic cement shall in no case show less than twelve per cent (12%) or more than fourteen per cent (14%) by weight upon analysis. The proportions and physical and chemical properties of the oil and asphalt and the asphaltic cement, sand and filler in the wearing surface, shall be such as to provide the above described results, and shall be satisfactory in all respects to the City Engineer.

(p) ASPHALT ALLEYS

The surface of the asphalt pavement for a width of one (1) foot on each side of the center line of the alley shall be painted with asphaltic cement and ironed in with hot irons.

Payment for this work shall be included in the price bid for asphalt pavement.

(q) ASPHALT GUTTERS

On all streets where asphalt is used for gutters, a strip not less than eighteen (18) inches in width along the gutter line shall be painted with a coat of hot asphaltic cement and ironed in with hot irons.

Asphalt gutters shall be measured as asphalt pavement, and the cost of painting and ironing the eighteen (18) inch strips shall be included in the price bid for asphalt pavement.

(r) GENERAL REQUIREMENTS OF OPERATION OF ASPHALT PLANTS

Before beginning the operation of the plant, the City Engineer will assign, at the expense of the improvement district in which the asphalt is to be laid, a man skilled in the testing and mixing of asphalt paving mixtures, whose duty it shall be to supervise the testing, preparation and mixing of the various ingredients that enter into the making of a first-class asphalt paving mixture, and a part of whose duty it shall be to see that none but competent men are employed in the various departments about the plant.

To facilitate the necessary test, and to provide for proper control of the plant work, the contractor shall provide a room convenient to the plant, well protected from dust and atmospheric changes. It shall be of approximately one hundred fifty (150) square feet floor area and at least nine (9) feet high from floor to ceiling. It shall be provided with telephone connection with the City Engineer's Office, with city water, gas, etc. There shall also be a closet in this room, large enough for the penetration work. This closet shall be so arranged that the temperature can be raised to seventy-seven degrees (77°) Fahrenheit within thirty (30) minutes and maintained at that temperature constantly for a period of at least four (4) hours during any variation of weather and temperature which may occur while asphalt pavements are permitted to be laid.

This room shall further be fitted up properly with the following testing apparatus for making penetration and other necessary tests:

Penetrometer: One apparatus, either of the Dow or New York Testing Laboratory Penetrometer Type.

Time-measuring Device: A clock or pendulum for accurately measuring seconds.

Sieves: At least two sets of standard Howard & Moorse, eight (8) inch brass-bound sieves, from ten (10) to two hundred (200) mesh to the linear inch inclusive, as follows:

10 mesh to the linear inch
20 mesh to the linear inch
30 mesh to the linear inch
40 mesh to the linear inch
50 mesh to the linear inch
80 mesh to the linear inch
100 mesh to the linear inch
200 mesh to the linear inch

These sieves shall be in nests of eight, with tight covers and dust pan, all to be approved by the City Engineer.

With the above sieves shall be provided a balance or scale suitable for quickly and accurately weighing the percentages of the different sand residues remaining or passing the different mesh sieves.

Thermometers: Six Asphalt thermometers shall be provided with a range of from two hundred degrees (200°) to four hundred degrees (400°) F., and six thermometers with a range of from two hundred degrees (200°) to six hundred degrees (600°) F.

Tin Boxes: Five hundred (500) seamless tin boxes of about three (3) ounce capacity.

Paper and Bags: One roll (1)—about forty pounds—of good manila wrapping paper and one hundred (100) sample-bags of about one (1) pound capacity.

All the above apparatus and supplies shall be subject to the approval of the City Engineer. Since the conditions under which asphalt pavements are being used, may vary, and since the ingredients used may change from time to time, other tests may be prescribed by the City Engineer. The apparatus for these tests shall be furnished by the contractor free of cost to the city, upon the written request of the City Engineer.

Each melting kettle shall be provided with some efficient means of agitation, to be approved by the City Engineer.

The following quantities of paving materials shall be in the yard, tested and accepted before work is begun:

(1) 200 cu. yds. of sand
(2) 100 cu. yds. of binder material
(3) 200 tons of refined asphalt
(4) 20 tons of asphalt flux or residum oil
(5) 10 tons of filler.

Before signing the contract, the contractor shall designate the plant or plants which he expects to use in the preparation of the asphalt mixture for this particular contract. After the City Engineer has certified as to the acceptability of the plant or plants for the work in question, a change shall not be made except upon written permission from the City Engineer.

There shall be installed, in the plant and yards, such contrivances and machinery as will insure the operation of the plant with the least amount of dust, noise, smoke and nuisance to the surrounding community; there shall be installed, convenient for the use of the plant employees, a satisfactory sanitary toilet; and the yard and plant shall be provided with hose water plugs and fire extinguishing apparatus so as to reduce the fire risk to the plant and neighboring buildings to the least amount possible under the circumstances; and it shall be the duty of the contractor at all times to so maintain the plant or plants that he is operating in a clean, sanitary manner, and to produce the least amount of nuisance and produce the least amount of fire risk to the surrounding property, and to proceed at once to remedy any existing defects upon the written request of the City Engineer.

Before acceptance of the plant, a thorough inspection of all equipment and machinery shall be made by the City Engineer, and a certificate must be obtained from him showing that the testing room is satisfactory and that it contains the required apparatus. Any defects appearing after such certificate has been issued and permission given to proceed with the work shall be immediately removed and if not removed, the permission to use the plant shall be revoked.

The mixing platform shall be provided with all the necessary light, ventilation and safeguards. Provision shall be made for a clear view of any part of the mixer or mixing room. Provision shall also be made for the least possible amount of floating dust and smoke. It is further provided that the mixer and all parts of the mixer and mixing platform or room shall be in every way satisfactory to the City Engineer.

The mixer shall be operated in such a manner that the asphalt binder and surface material shall be mixed thoroughly. The surface materials shall be mixed at the rate of seventy (70) to ninety (90) revolutions for a period of not less than one (1) minute, after all the materials are in the machine.

As a means of ready communication between the street and plant inspectors, it is provided that the truck driver, teamster or whoever may be in charge of the materials to be delivered either to or from the plant or street, shall, if communication is desired by either inspector, receive and deliver said communication carefully and promptly to either the street or plant inspector as may be directed.

It is further provided that failure promptly to deliver such communications shall be deemed sufficient cause for the immediate removal of such offending truck driver, teamster or whoever may be in charge of the materials sent to or from the plant or street.

All materials or mixtures condemned at the plant shall be immediately removed from the plant yards as directed by the plant inspector.

It is further provided that the failure of the plant to deliver the finished materials in accordance with these specifications, shall be deemed sufficient cause for the immediate shutting down of the plant.

(s) PAYMENT

Payment for "Asphalt Pavement" shall be made at the price bid per square yard and shall include the concrete base, binder course or paint coat, wearing surface and all labor and materials required to furnish the complete pavement contemplated by the plan for the improvement.

169. ASPHALTIC CONCRETE PAVEMENT

(For plan, see page 186)

Asphaltic Concrete Pavement shall consist of: First, a layer of concrete of the thickness specified; and second, a wearing course two (2) inches in thickness.

(a) MATERIALS AND EQUIPMENT

The materials and equipment necessary for laying this pavement shall conform in all respects to the material and equipment as

specified for "Standard Asphalt Pavement" except as herein otherwise noted.

(b) CRUSHED ROCK OR GRAVEL

Crushed rock or gravel shall be made of clean gravel or stone, hard, durable and uniform in quality. It shall show a coefficient of wear in excess of ten (10), as determined by the Deval abrasion test, and a hardness in excess of fifteen (15), as determined by the Dorry hardness test. All tests shall be under the conditions and methods employed in the United States Road Materials Laboratories.

The rock shall be crusher run and shall contain all the fine material. The resulting product shall all pass a one-half (½) inch screen.

It is further provided that where gravel is crushed for this work, no gravel shall be fed to the crusher smaller than one (1) inch in diameter.

(c) CRUSHED ROCK SCREENINGS

Crushed rock screenings shall be of the same quality of stone as previously described, and so graded that one hundred per cent (100%) shall pass a 1¼-inch screen and 100% be retained on a No. 8 screen.

(d) SAND AND FILLER

Sand and filler used in asphaltic concrete mixture shall be of the same quality and grading as specified for Asphalt Pavement.

(e) WEARING SURFACE

The wearing surface shall consist of sand, crushed rock or crushed gravel screenings, filler and asphaltic cement.

To insure the maintenance of an even grading in this mixture, three or more divisions shall be made of the various sized particles in the aggregate.

The sand and crushed rock entering into the mixture shall be thoroughly dry. The sand, rock and asphaltic cement shall be maintained at approximately the same degree of temperature at the time of mixing. Proper portions of these materials, together with the asphaltic cement shall be weighed accurately, and the mixing so handled that each particle of this aggregate shall be coated thoroughly and evenly with asphaltic cement, and an even distribution of the various sizes or aggregate in the mixtures accomplished. The method and time of mixing shall conform to the requirements for Asphalt Pavement.

(f) TRANSPORTATION AND LAYING OF WEARING SURFACE

The wearing surface shall be hauled to the street in suitable covered conveyances. It shall be spread on the prepared, clean, dry base by shoveling and raking in a manner that shall insure an evenly graded mixture, and which when thoroughly tamped and rolled shall show an even, true surface.

The rolling shall be performed with eight (8) and twelve (12) ton rollers continuously until the mixture is cold and in all cases to continue for two (2) hours after initial rolling. Rollers of the

required sizes may be rented from the Street or Park Departments. The final thickness of the asphaltic concrete wearing surface shall be not less than two (2) inches.

The temperature of the mixture at the time of placement in the street shall be not less than two hundred degrees (200°) Fahrenheit and at no time greater than three hundred degrees (300°) Fahrenheit.

(g) REQUIREMENTS FOR FINISHED PAVEMENT

Whatever the character of the asphalt used, the method of mixing, or the method of manipulation and laying, the finished pavement shall conform to the following requirements:

The pavement when laid, shall be dense, hard and durable. It shall be free from checks or honey-comb and free from depressions or unevenness, showing more than three eighths (⅜) inch under a four-foot straight edge.

The mineral matter of the finished pavement, upon analysis, shall be graded within the following limits:

Rock passing 1¼ inch, retained on ½ inch,	15 to 22%
Rock passing ½ inch, retained on ¼ inch,	12 to 20%
Rock passing ¼ inch, retained on ⅛ inch,	12 to 20%
Sand passing 8-mesh screen and retained on 200 mesh	25 to 40%
Rock dust filler passing 200 mesh	12 to 16%

The asphaltic cement shall in no case show less than seven per cent (7%) or more than eleven per cent (11%) by weight.

(h) PAYMENT:

Payment for "Asphaltic Concrete Pavement" shall be made at the price bid per square yard and shall be in full for all labor and material necessary for the complete pavement, including the concrete base.

170. BRICK PAVEMENT (For plan see page 186)

Brick pavement shall consist of a concrete base of such thickness as required by the plans and specifications for the improvement, upon which a wearing surface of brick of specified quality and thickness shall immediately be placed, the joints between the bricks being grouted at once as hereinafter described.

(a) BRICKS

Unless otherwise specified, the bricks shall conform to the specifications for vertical fibre bricks, Section 40.

The bricks shall be handled carefully, during transportation, piling along the street and delivering to the bricklayers. Chipped or dirty bricks will be rejected. The bricks shall be piled along the street in such a manner and at such a time as will give the City Engineer's Inspector sufficient time to inspect them before being laid. When requested, the contractor shall furnish labor to move and sort the bricks during inspection. Condemned bricks shall be removed immediately from the work.

(b) BASE

The base shall conform in thickness and profile to the dimensions shown on the plan of the improvement.

It shall be composed of one (1) part cement, three (3) parts sand, and five (5) parts gravel.

It shall be constructed in all respects as specified for concrete base for pavement, Section 165.

One barrel of cement shall make not over the following amounts of completed base:

Of 5″ base, 6.26 sq. yds.
Of 6″ base, 5.22 sq. yds.
Of 7″ base, 4.62 sq. yds.
Of 8″ base, 3.92 sq. yds.

(c) LAYING BRICKS

Immediately following the final rolling of the base, the bricks shall be laid carefully with the end fiber (wire cut surface) exposed. Each course shall break joints with adjacent courses. Courses shall be laid in true lines and at right angles to the curb, except at intersections where they shall be laid as directed by the City Engineer. Broken bricks shall not be used except in starting or ending a course, or in fitting around castings, and no pieces less than one-half (½) brick shall be used.

The bricks shall be fitted carefully around all castings appearing in the surface of the pavement. The tops of all such castings shall be brought to a true grade and shall, when finished, be flush with the surface of the pavement.

One (1) by twelve (12) inch boards shall be used for the brick layers to work upon. No walking or wheeling over the newly laid bricks will be allowed. Bricks shall be delivered from the piles along the curb to the brick layers by means of a mechanical or gravity roller conveyor.

After laying and before rolling, the bricks shall be inspected and all soft, chipped or badly shaped bricks removed and replaced. The contractor, when requested, shall sprinkle the surface lightly to assist in detecting soft bricks.

(d) ROLLING

As soon as inspected the surface shall be rolled with a hand roller about thirty (30) inches long and weighing approximately seven hundred fifty (750) pounds, or of such weight as the City Engineer may direct. The rolling shall be, first, at right angles to the curb; second, parallel to the curb; third, diagonally both ways; and, lastly, one width of the roller parallel and close to the curb. Such other rolling shall be done as may be directed by the City Engineer.

(e) GROUTING

Grouting shall be performed immediately following the rolling of the bricks. Should any excess water appear along the curbs, it shall be removed by taking up a few bricks and baling or pumping. The grout shall be composed of one (1) part Portland cement, one and one-half (1½) parts, sand, and enough water to produce the

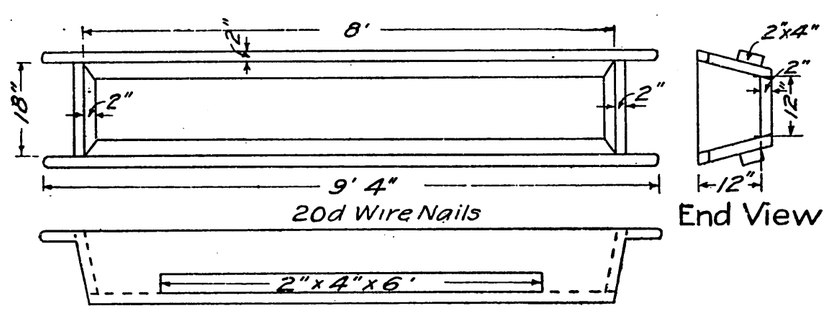
required consistency. The sand shall conform to the specifications for grouting sand, Section 59(c.)

Grout shall be mixed in an approved type of mixing machine or by hand. If mixed by hand, the type of mixing box shown shall be used, and the sand and cement shall be mixed dry until the mass assumes an even color, before adding the water. Batches shall not exceed one sack of cement, and the proper amount of sand. From the time the water is added until the last drop is removed and placed on the pavement, the grout shall be kept in consant motion by stirring to the bottom.

As soon as the grout is mixed thoroughly to the consistency of thin cream, it shall be poured onto the pavement and brushed into the joints. From the moment it strikes the pavement it shall be kept in motion and thoroughly broomed into the joints. If mixed by hand, one box shall be provided for each fifteen (15) feet of width of pavement.

The grouting shall be carried forward, the full width of the pavement, for a distance of fifty (50) or sixty (60) feet, when the crew shall cover the same ground in the same manner, using a grout of slightly thicker consistency.

If the grout shows a tendency to thicken, the pavement shall be sprinkled lightly ahead of the grouting, using a sprinkling can with fine perforations or a fine spray nozzle.



Side View

GROUT BOX

When the grouting is complete, all joints shall be filled completely to the level of the surface of the bricks and no excess grout shall remain on the pavement.

(f) EXPANSION JOINTS

Expansion joints shall be placed along the face of each curb and across the street every thirty (30) feet and at the end of each days work. Precast material for these joints shall be one-fourth (¼) inch thick and at least one-half (½) inch wider than the total depth of the pavement. It shall be in one length or stapled together with suitable sized belt staples, and held in place against a solid wood header placed perpendicular to the pavement. At the end of each day's work this header shall be left in place until work is resumed.

Precast expansion material one-half (½) inch thick and at least as wide as the thickness of the pavement shall be placed around all castings appearing in the surface of the pavement.

Before the pavement is opened to traffic, all expansion material shall be neatly trimmed to a line one-fourth (¼) inch above the pavement surface.

No payment will be allowed for expansion joints beyond the price bid per square yard for completed pavement.

(g) CURING.

As soon as the grout has attained its final set, the pavement shall be covered with two (2) inches of suitable sand and kept wet continuously for thirty (30) days. No payment will be allowed for covering, wetting, or subsequently cleaning the pavement, beyond the price bid per square yard.

The pavement shall be closed to traffic for sixty (60) days.

(h) MAINTAINING TRAFFIC

When directed by the City Engineer, the contractor shall cover such crossings or portions of the pavement as directed with suitable plank laid upon the two (2) inch sand covering, maintain the same in proper condition to allow traffic to pass over it, and remove and neatly pile the timber along the curb at the time of cleaning the pavement.

For so maintaining traffic, the contractor will be paid as follows:

When the lumber used is old lumber belonging to the City of Seattle: At the price bid per M. ft. BM. for "Plank Covering—Old Lumber."

When the lumber used is new lumber furnished by the contractor: At the price bid per M. ft. BM. for "Plank Covering—New Lumber."

When furnished by the contractor, the lumber shall be new.

When any plank covering is used more than once on any improvement, it shall be classified and paid for as "Plank Covering—Old Lumber."

When piled along the curbs at the time of finally cleaning the street, the lumber shall be the property of the City of Seattle.

(i) PAYMENT

Brick pavement shall be paid for at the price bid per square yard for "Brick Pavement," and shall include all labor and material necessary to construct the pavement ready for use according to these specifications.

171. CONCRETE PAVEMENT (For plan see page 186)

Concrete Pavement shall consist of concrete mixed according to the Standard Specifications and in the following proportions: One (1) part Portland Cement, two (2) parts sand, and three and one-half (3½) parts gravel.

The average amount of pavement to be constructed per bbl. of cement shall not exceed the following:

In 5″ Concrete Pavement not over 4.31 sq. yds. per bbl.
In 6″ Concrete Pavement not over 3.59 sq. yds. per bbl.
In 7″ Concrete Pavement not over 3.08 sq. yds. per bbl.
In 8″ Concrete Pavement not over 2.69 sq. yds. per bbl.
In 9″ Concrete Pavement not over 2.39 sq. yds. per bbl.

The City Engineer will compare the calculated amount of cement required according to these specifications and plans attached hereto with the amounts actually used in each section between successive transverse expansion joints, as determined by the actual count of the number of bags of cement used in each section. If the amount of cement in any three (3) adjacent sections is less by more than two per cent (2%), or if the amount of cement used in one section is less by more than five per cent (5%) of the amount hereinbefore specified, the contractor shall remove all such sections and replace the same with new materials, according to these specifications, at his expense.

(a) SUBGRADE

The subgrade shall be prepared as specified under subgrading, and about twelve (12) hours before the concrete is placed, it shall be thoroughly saturated, and again wetted just before placing the concrete.

Immediately preceding the placing of the concrete, the subgrade shall be dragged with a heavy iron shod template as specified for "Concrete Base," Section 165, and so constructed that the ends of same shall ride on the side forms.

(b) FORMS

The side forms shall be not less than three inches (3″) in width and of a depth equal to the thickness of the pavement. They shall be placed accurately to line and grade and held rigidly in place, with no stakes projecting above the top surfaces. They shall break joints on opposite sides of the roadway. Where directed these forms shall be left in place and such forms left in place will be paid for at the price bid per M. ft. B. M. for "Form Timber Left in Place."

(c) PLACING CONCRETE

The concrete shall be placed by means of a bottom dumping bucket or other device approved by the City Engineer. It shall be spread evenly with the aid of shovels, and all faces against side forms or headers shall be thoroughly spaded.

The concrete shall then be struck off with a steel shod strike board, which shall be as heavy as can be handled by two men, and which shall be cut accurately to fit the pavement surface. This strike board shall be fitted with handles at each end, and shall be worked along the pavement with a longitudinal and crosswise motion until within three (3) feet of an expansion joint, when it shall be lifted and the concrete surface struck away from the joint.

This strike board shall be followed by a similar and lighter one.

At transverse expansion joints, the pavement shall be struck off at right angles to the street, using a long handled split float six (6) inches wide and six (6) feet in length, notched in the center to allow for the expansion joint material. Extreme care shall be used to insure equal elevation of the pavement on both sides of the joint.

After the concrete has been struck off as specified, it shall be rolled in a transverse direction with a light sheet steel 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 and back, lifted and moved forward one-half (½) its length and the process continued. The operation shall be repeated if ordered by the City Engineer.

Finally, the surface shall be floated either with a six (6) inch canvas belt moved forward with a sawing motion, or a flexible plank not over one (1) inch in thickness with handles on each end, operated in the same manner.

(d) EXPANSION JOINTS

Expansion joints shall be placed along the face of each curb and across the street every thirty (30) feet and at the end of each day's work. Precast material for these joints shall be one-fourth (¼) inch thick and at least one-half (½) inch wider than the total depth of the pavement. It shall be in one length or stapled together with suitable sized belt staples, and held in place against a solid wood header placed perpendicular to the pavement. At the end of each day's work this header shall be left in place until work is resumed.

Precast expansion material one-half (½) inch thick and at least as wide as the thickness of the pavement shall be placed around all castings appearing in the surface of the pavement.

Before the pavement is opened to traffic, all expansion material shall be neatly trimmed to a line one-fourth (¼) inch above the pavement surface.

No payment will be allowed for expansion joints beyond the price bid per square yard for the completed pavement.

(e) CURING

The contractor shall keep the pavement wet continuously for thirty (30) days, and closed to traffic for sixty (60) days after laying.

The contractor may use, at his option, any one of the three following methods of keeping the pavement wet for the required period:

(1) **Ponding:**

By constructing earth dams across and along the margin of the pavement to maintain a minimum depth of two inches (2″) of water over the pavement at all times.

(2) **Sprinkling:**

By means of continuous sprinklers covering all portions of the pavement between the hours of 6 A. M. and 8 P. M.

(3) **Covering:**

Covering with two inches (2″) of suitable earth or sand and keeping the covering wet continuously.

The price bid per square yard of pavement in place shall include the wetting and the removal of the covering and cleaning of the pavement at the proper time.

Should the contractor, in the opinion of the City Engineer, fail properly to carry out the provisions of these specifications regarding curing of concrete pavements, the City Engineer shall cause the work to be done and shall deduct the cost of same from any moneys due or to become due the contractor.

When directed by the City Engineer, the contractor shall cover such crossings or portions of the pavement as directed with two (2) inches of sand and suitable plank, and maintain and remove the same as specified for "Brick Pavement," Section 170. Payment for such plank covering shall be made as specified in Section 170. When sand covering is ordered on concrete pavement by the City Engineer, the same shall be paid for at the price bid per cubic yard for "Sand Covering."

(f) PAYMENT

Payment for concrete pavement without curbs shall be made at the price bid per square yard for "Concrete Pavement," and shall be in full for all labor and material necessary to construct the pavement ready for the traffic according to these specifications.

172. CONCRETE PAVEMENT WITH INTEGRAL CURB

(For plan, see page 186)

Concrete pavement with integral curb shall be constructed in all respects as specified for concrete pavement without curbs except that the side form shall be placed at the back of the curb and at an elevation determined by the intersection of the back line of the curb and the pavement surface projected.

Immediately following the final belting or floating, the curb forms, which shall be of a design approved by the City Engineer, shall be placed true to line and grade and at once filled with the same grade of concrete as used in the pavement. Care shall be taken to spade the curb concrete well into that previously placed and against both sides of the curb form.

The upper surface of the curb shall be troweled smooth and the back corner edged to a radius of one-half inch (½″). Curb concrete shall be placed in all cases not more than forty-five (45) minutes later than the placing of the pavement concrete.

Wherever two inch (2″) holes are to be made for drains, the contractor shall provide 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.

At street intersections, the height of type "B" Integral Curb shall be raised to six (6) inches as specified for type "B" Concrete Curbing in Section 162.

All expansion joints in the pavement shall extend entirely through the curb.

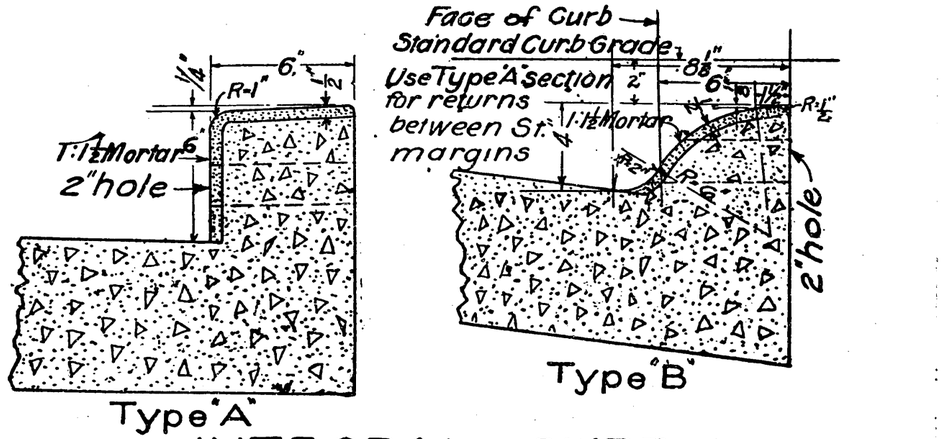
Concrete pavement with integral curbs shall be cured and closed to traffic as specified for concrete pavement without curbs. The curbs shall be covered with earth and kept wet continuously for ten (10) days.

Payment for concrete pavement with integral curb will be made at the price bid per square yard for "Concrete Pavement With Integral Curb," and shall be in full for all labor and material necessary to construct the pavement ready for traffic according to these specifications.

When the curb is of Type "B," measurement shall be made to lines parallel to and six inches (6″) from the back line of the curb.

Payment for integral curbs shall be made at the price bid per linear foot for "Integral Curb" Type "A" or "B", and shall be in full for all labor and material necessary to construct the curb ready for use according to these specifications.

When specified, Type "A" Integral Curb shall be armored as provided for Concrete Curb. Payment shall be made at the price bid per linear foot for "Armored Integral Curb" and shall be in full for all labor and material necessary to construct the curb ready for use according to these specifications. The variable curb at street intersections shall be paid for as type "B" curbing.



INTEGRAL CURB

173. GRANITE OR SANDSTONE BLOCK PAVEMENT

(For plan, see page 186)

Granite or sandstone block pavement shall consist of, 1st, a concrete base; 2nd, a two (2) inch sand cushion, and 3rd, a surface of granite or sandstone blocks.

(a) LAYING THE GRANITE OR SANDSTONE BLOCKS

The concrete base shall be dry and cleaned of dirt or rubbish. Upon the base thus prepared, a cushion of sand about two (2) inches thick shall be spread. On this sand the blocks shall be laid in straight and even courses. The surface of the pavement shall be as smooth as possible. Unless otherwise directed, the courses shall be laid at right angles to the line of the street. Blocks shall be laid so as to give close joints, and the longitudinal joints shall be broken by a lap of at least three (3) inches. Sufficient sand shall be used under each block to bring it fully up to the crown and grade of the roadway. After they have been rammed thoroughly as hereinafter

specified, pieces of blocks shall be fitted carefully around all manholes, catch basins, inlets and other castings. Except around castings, no pieces shall be less than one-half (½) a block.

All blocks not uniform in width, or laid improperly, shall be taken out and proper ones set in their places. The blocks shall then be rammed thoroughly in a satisfactory manner to a firm, unyielding bed. The finished surface shall be parallel to the required grade and crown. Blocks broken in process of ramming shall be removed and replaced by sound material. Rammers used in compacting the block shall be of the size and make specified by the City Engineer. No ramming shall be done within fifteen (15) feet of the face of the paving that is being laid.

(b) EXPANSION JOINTS

Expansion joints conforming in all respects to the requirements specified in Section No. 170 under "Brick Pavement," shall be constructed likewise on all Granite or Sandstone Block Pavement.

(c) GROUTING AND CURING

Grouting and Curing of Granite or Sandstone Block Pavement shall be performed in the same manner and with the same materials specified in Section No. 170 for "Brick Pavement."

(d) PAYMENT

Payment for "Granite Block Pavement" or "Sandstone Block Pavement" shall be made at the price bid per square yard in place, and this shall include payment for the concrete base, sand cushion, granite or sandstone blocks, expansion joints, grouting, covering, sprinkling and final cleaning, and all other labor and material necessary to produce the finished pavement required by these specifications.

174. CREOSOTED WOOD BLOCK PAVEMENT

(For plan, see page 186)

Creosoted Wood Block Pavement shall consist of, 1st, a concrete base; 2nd, a bituminous paint coat, and 3rd, a wearing surface of creosoted wood blocks.

(a) CONCRETE BASE

The concrete base shall be laid in accordance with the method prescribed in these specifications for concrete base, under Section No. 165, except that the finished surface shall be so even and uniform as to show no appreciable variation in the surface of the pavement after the blocks are laid.

(b) PAINT COAT

After the concrete base has set thoroughly, a coat of bituminous paint shall be applied. The materials for this paint coat shall conform to the specifications for "Filler" in Section No. 47. This coat shall be applied hot, and, with the aid of squeegees, it shall be spread evenly over the surface to a depth of approximately one-eighth (⅛) inch.

(c) LAYING THE BLOCKS

The blocks shall be laid at an angle of ninety degrees (90°) with the curb line, except that three (3) courses shall be laid parallel and next to the curb, to form a gutter. All joints shall be broken by a lap of not less than three (3) inches. Not less than half (½) a block shall be used in any case, and split blocks shall be used only to break joints in starting courses. In laying blocks, care shall be taken to keep the course straight and as close together as possible. As soon as blocks are delivered to the street and unless they are to be laid within twenty-four (24) hours, they shall be piled closely and covered properly to protect them from the sun or rain.

(d) EXPANSION JOINTS

Expansion Joints one-half (½) inch in thickness shall be placed between the curb and the first course of gutter blocks. This joint shall be of a depth equal to two-thirds (⅔) the depth of the blocks and placed ahead of the block laying. Expansion joints one-half (½) inch in thickness and of a depth equal to the depth of the blocks, shall be placed around all castings appearing in the surface of the pavement. All expansion joints shall be made of Carey's Elastite or its equal. No allowance shall be made for expansion joints beyond the price bid for the pavement per square yard.

(e) APPLYING THE BITUMINOUS FILLER

After the street has been cleaned of all chips and other debris, a bituminous filler shall be applied while hot, and worked into the joints by means of squeegees, in sufficient quantities to fill all interstices to within approximately three-quarters (¾) of an inch of the top. This bituminous material shall conform to the Standard Specifications for "Filler" in Section No. 47.

(f) FINISHING

After the filler has been applied, the street shall be covered with coarse concrete sand in sufficient quantity to fill the remaining portions of the interstices between the blocks, and to leave at least one-eighth (⅛) of an inch spread uniformly over the entire surface.

(g) PAYMENT

Payment for "Creosoted Wood Block Pavement" shall be made at the price bid per square yard in place, and this shall include payment for the concrete base, bituminous paint coat, creosoted wood blocks, filler, sand covering, protection, final cleaning and all other labor and material necessary to produce the finished pavement required by these specifications.

175. CORRUGATED CREOSOTED WOOD BLOCK PAVEMENT

On streets having a grade of over four and one-half per cent (4½) wood block pavement shall be laid with creosoted wood strips alternating each course of wood blocks. In this case, the

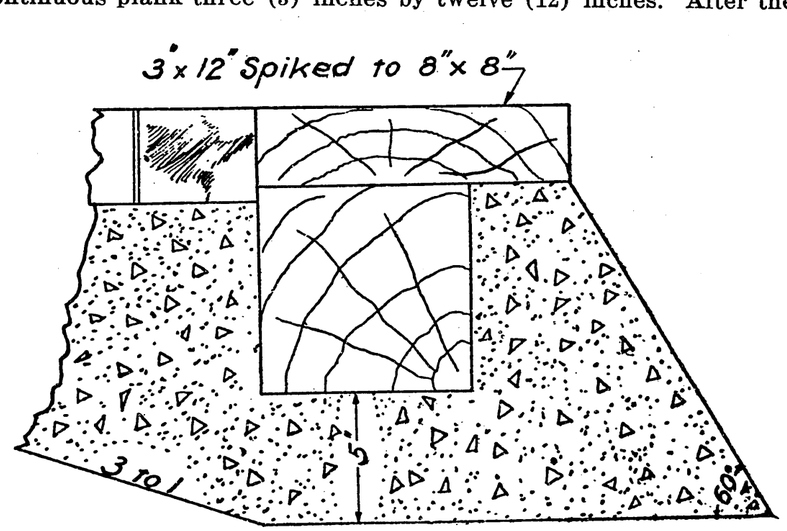
courses shall always be laid at right angles to the curb line. The strips shall show complete saturation of black oil and shall not be treated in the same charge with the blocks. They shall be from three (3) to six (6) feet long, one-half (½) inch thick, and in width one-half (½) inch less than the vertical dimension of the wood blocks. They shall set on edge between all courses of wood blocks, and the joints shall be filled in the manner specified above under "Creosoted Wood Block Pavement."

Payment for "Corrugated Creosoted Wood Block Pavement" shall be made at the price bid per square yard in place, and this shall include payment for the concrete base, bituminous paint coat, creosoted wood blocks and strips, filler, sand covering, protection, final cleaning and all other labor and material essential to a finished pavement.

PAVEMENT APPURTENANCES

176. WOOD STOPS

Wood Stops shall consist of a continuous timber solidly bedded in concrete as shown on the detail plan, upon which is spiked a continuous plank three (3) inches by twelve (12) inches. After the



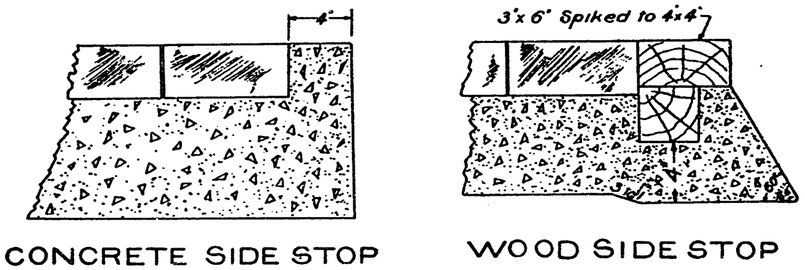
WOOD STOP

setting of the concrete, the earth surrounding such stops shall be surfaced properly and tamped to the level of the general surface.

Payment for "Wood Stops" shall be made at the price bid per linear foot for the completed work.

177. SIDE STOPS

Side stops of the type designated shall be constructed in accordance with the detail plan.

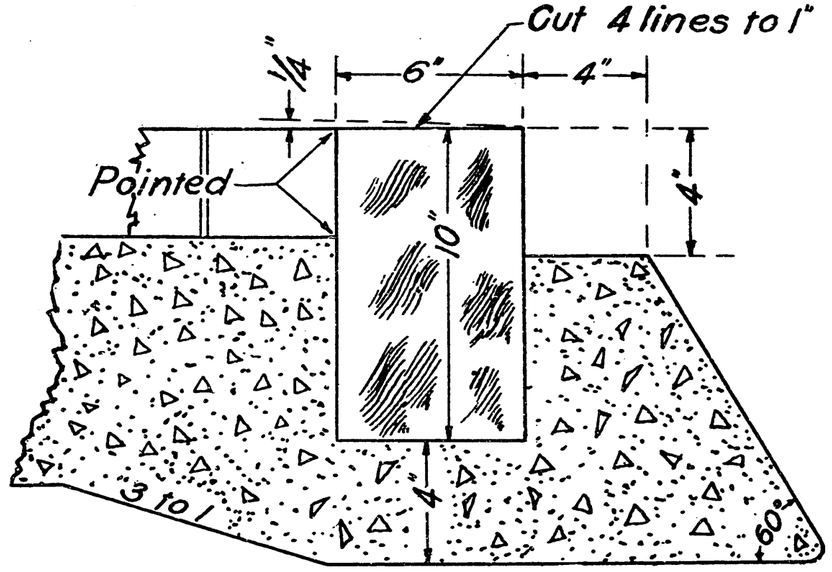


CONCRETE SIDE STOP WOOD SIDE STOP

Payment for side stops shall be made at the price bid per linear foot for "Concrete Side Stops" or "Wood Side Stops."

178. GRANITE STOPS

Granite Stops shall conform in quality to "Granite Curbing" as written in Section No. 48 under Quality of Materials, and shall be constructed in accordance with the detail plan. In material and



GRANITE STOP

construction the concrete around the stop shall conform to the requirements for "Concrete Base for Pavement."

Payment for "Granite Stops" shall be made at the price bid per linear foot for the completed work.

179. BRICK ALLEY CROSSINGS (For plan, see page 187)

Brick Alley Crossings shall conform in all respects, including the concrete base, measurement and payment, to the foregoing specifications for Brick Pavement.

180. GRANITE OR SANDSTONE ALLEY CROSSINGS (For plan, see page 187)

Granite or Sandstone Alley Crossings shall conform in all respects, including the concrete base, measurement and payment, to the foregoing specifications for Granite or Sandstone Block Pavement.

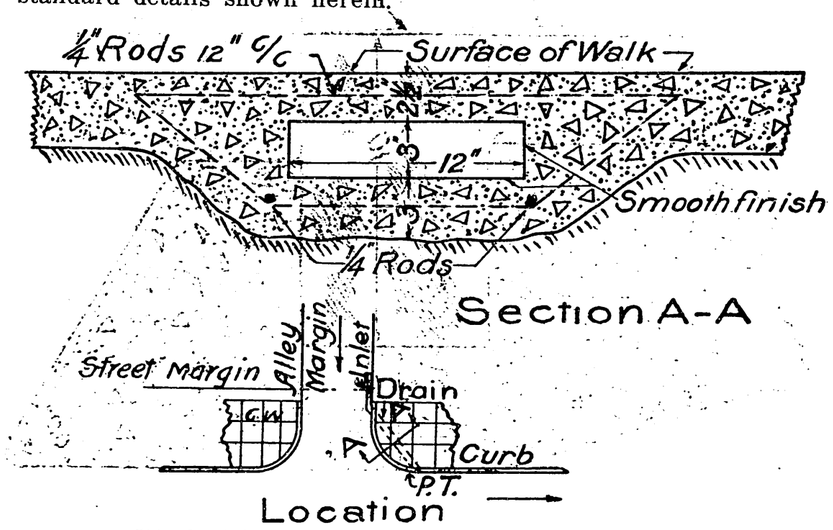
181. PRIVATE ALLEY CROSSINGS

The price bid for alley crossings shall apply alike to public alley crossings and such private alley crossings as the property owners in the improvement district may direct the City Engineer to build during the progress of the work.

Private Alley Crossings shall be constructed according to the Standard Plans and Specifications, and payment therefor shall be made in the same manner as for public alley crossings.

182. CONCRETE ALLEY DRAINS

Where shown on the plans or where directed by the City Engineer, concrete alley drains shall be constructed according to the standard details shown herein.



CONCRETE ALLEY DRAIN

The composition and production or the concrete and finish for smooth surfaces shall conform in all respects to the Standard Specifications for "Concrete Walk." In case the curb is granite, the outlet end shall be a neatly chiseled opening through the curb. The sides and bottom of the drain shall be finished smoothly. A standard inlet set according to standard specifications shall be connected to this drain.

Payment for "Concrete Alley Drains" shall be made at the price bid for each, and this shall include payment for the inlet, replacing concrete walks, and all other labor and material necessary to complete the drain according to details and specifications. Provided, however, that when Concrete Alley Drains are constructed in connection with new concrete walk, that the walk over the concrete alley drain shall be paid for as concrete walk.

183. PAVEMENT RELAID

Whenever it is necessary for any reason to take up and relay brick, stone or wood block pavements, the existing surface shall be taken up and the materials shall be cleaned and piled carefully. In case the adjustment can be made to the satisfaction of the City Engineer without the removal of the base, additional thickness of concrete may be ordered as required. The cushion shall then be spread and the brick or blocks replaced in accordance with the Standard Specifications for new work. In the case of brick, the cushion shall be one (1) to three (3) mortar and in the case of stone, or wood blocks, as specified for new pavements.

Payment shall be made at the rate bid for "Pavement Relaid on Existing Base," or "Pavement Relaid on New Base," as the case may be, which shall be in full for all labor and material necessary to complete the work, including the furnishing of new bricks or blocks to replace any which are broken or are otherwise unfit for use.

184. PAVEMENT REPLACED

Whenever it is necessary to replace existing pavement with other or similar material, the existing pavement shall be removed, including the concrete base if necessary. If not necessary, such additions shall be made to it, in the way of building up, as are required. The new material shall then be laid in accordance with the Standard Specifications.

Payment shall be made at the rate bid for "Pavement Replaced on Existing Base" and "Pavement Replaced on New Base" as the case may be, which shall be in full for all labor and material necessary to complete the work.

185. RELAYING WOOD SIDEWALKS

Where directed by the City Engineer, the existing wood sidewalks shall be taken up carefully and the lumber therefrom piled and protected until used. After the completion of the curbing, the sidewalks shall be rebuilt, using as much old lumber as may be suitable, with such additional new lumber as may be required. All lumber shall be laid as provided in the Standard Specifications of the City of Seattle for "Wood Sidewalks."

Where directed by the City Engineer, existing wood sidewalks and landings are to be extended to the new curbs. The covering planks shall be two (2) inches by eight (8) inches, dressed on the upper side. All lumber shall be cut, fitted and nailed as provided in the Standard Specifications for "Wood Sidewalks."

The work of relaying, reconstructing, or extending sidewalks shall be paid for per M. ft. B. M. of lumber in the finished structure, as hereinbefore stated, and bids shall be submitted for "Wood Walks" and "Wood Walks Relaid."

186. REPLACING CONCRETE SIDEWALKS

Where directed by the City Engineer, the existing concrete sidewalks shall be repaired or extended. All such work shall be done according to the Standard Specifications for "Concrete Walks" as written in Section No. 90.

187. MONUMENT CASES (For plan, see page 188)

The material shall conform to the general requirements of these Standard Specifications for cast iron. The City Engineer shall set the monuments, but the contractor shall furnish the concrete in which the same are set.

Payment for "Monument Cases" shall be made at the price bid for each, including the concrete in which the monument case is set.

188. ADJUSTMENT OF CAST IRON VALVE BOXES

Payment for "Adjusting Cast Iron Valve Boxes" shall be included in the price bid for pavement.

189. ADJUSTMENT OF MANHOLE, CATCH BASIN, ETC., COVERS

Manhole, catch basin, or similar covers, 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.

Payment shall be made at the price bid for each, as specified in Section 129.

190. ADJUSTING INLETS

Existing inlets shall be adjusted where necessary to the proper elevation. 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 at the price bid for each.

191. GRAVEL SUB-BASE

Gravel shall be laid as directed by the City Engineer. Coarse concrete gravel shall be used for this purpose.

Payment shall be made at the price bid per cubic yard in place.

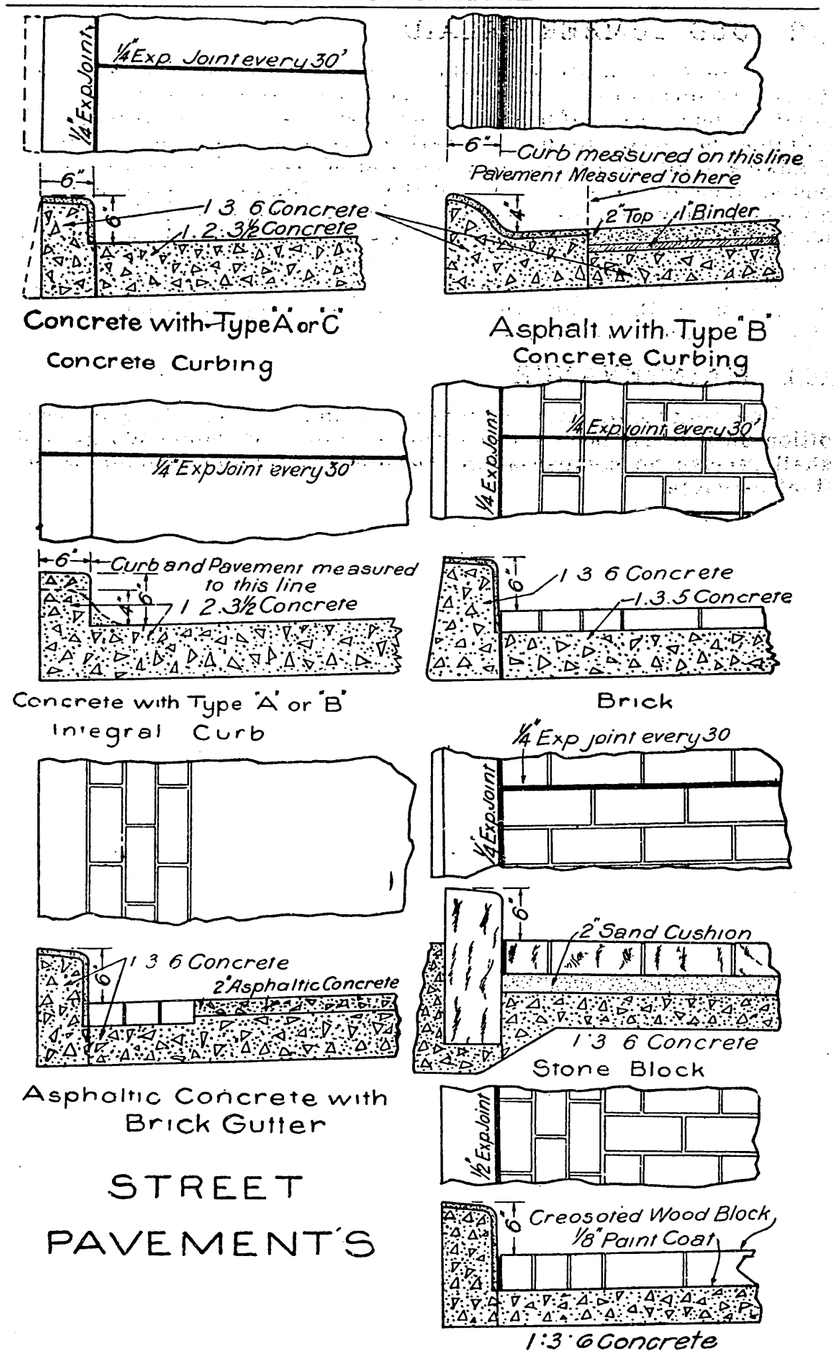
192. OLD LUMBER RELAID

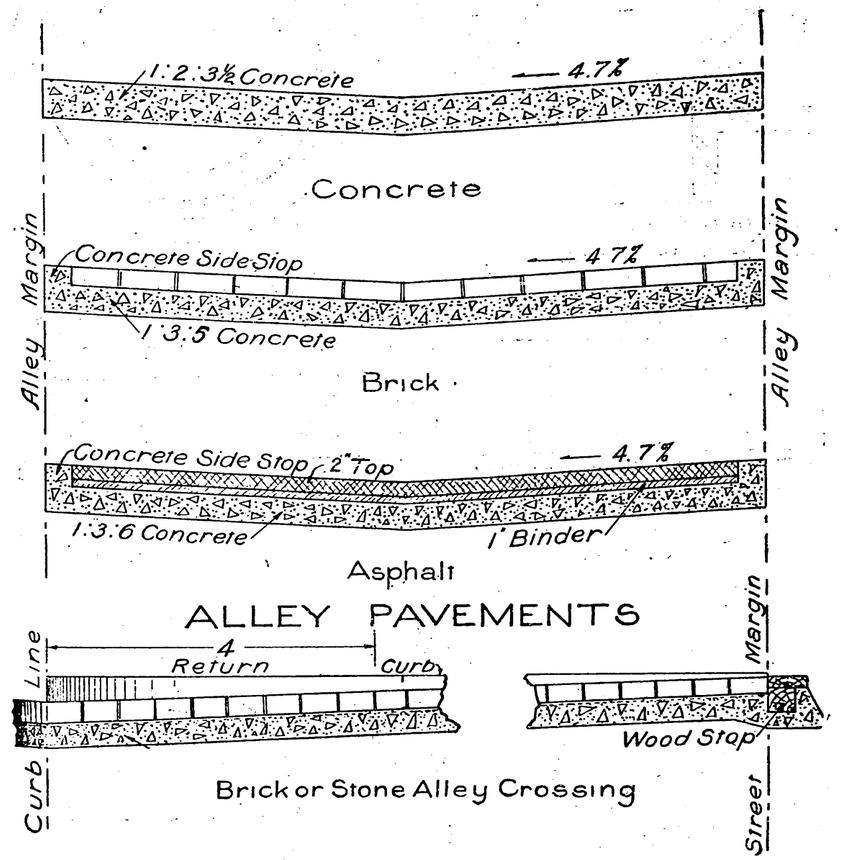
The surfaces of all connecting streets, roadways or walks which do not conform to the general surface of the finished improvement, shall be made to conform to such finished surface by filling with suitable material or by excavating, as the same may require. Planking shall be brought to grade and adjusted to form a continuous surface, to the satisfaction of the City Engineer. Such adjacent streets as may be designated by the City Engineer, shall be planked with the lumber taken from the existing planking, curbs, gutters and cross-walks.

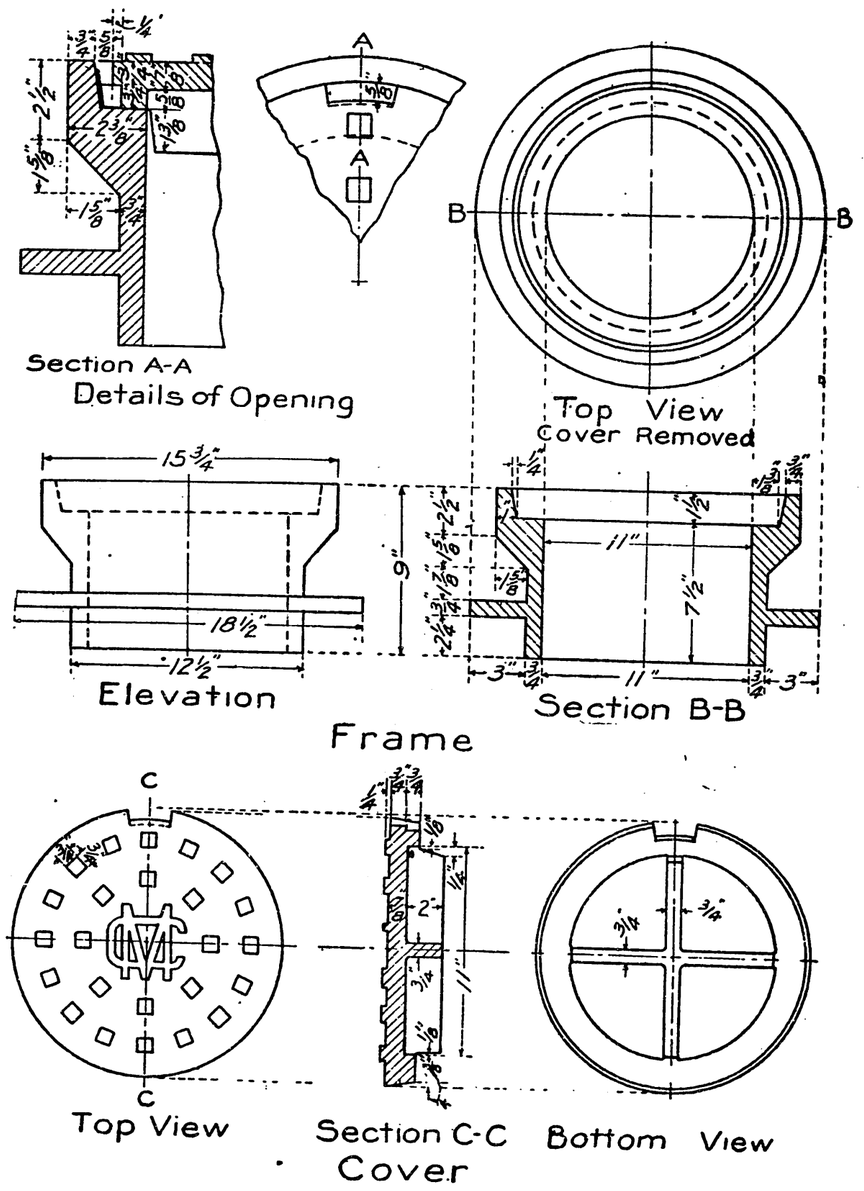
Payment for "Old Lumber Relaid" shall be made at the price bid per M. ft. B. M., and the thickness of the lumber shall be considered as four (4) inches.

193. MAINTENANCE

The contractor shall maintain the improvement in good condition until it has been accepted by the Board of Public Works, and shall receive no compensation therefor beyond the amount of the final estimate.


1/4" Exp. Joint every 30'
1/4" Exp Joint
6"
1 3 6 Concrete
1 2 3½ Concrete
Concrete with Type "A" or "C"
Concrete Curbing
1/4" Exp Joint every 30'
6"
Curb and Pavement measured to this line
1 2 3½ Concrete
Concrete with Type "A" or "B"
Integral Curb
1 3 6 Concrete
2" Asphaltic Concrete
Asphaltic Concrete with Brick Gutter
STREET PAVEMENTS
6"
Curb measured on this line
Pavement Measured to here
2" Top
1" Binder
Asphalt with Type "B"
Concrete Curbing
1/4" Exp Joint every 30'
1/4" Exp Joint
6"
1 3 6 Concrete
1 3 5 Concrete
Brick
1/4" Exp joint every 30
1/4" Exp Joint
6"
2" Sand Cushion
1 3 6 Concrete
Stone Block
1/2" Exp Joint
6"
Creosoted Wood Block
1/8" Paint Coat
1:3:6 Concrete


1:2:3½ Concrete
4.7%
Concrete
Alley Margin
Concrete Side Stop
4.7%
1 3 5 Concrete
Brick
Concrete Side Stop
2" Top
4.7%
1:3:6 Concrete
1" Binder
Asphalt
ALLEY PAVEMENTS
4
Return
Curb
Line
Curb
Margin
Wood Stop
Street
Brick or Stone Alley Crossing



MONUMENT CASE

SPECIFICATIONS

FOR

PLANKING AND TIMBER TRESTLES

194. PLANKING OR REPLANKING

(For plan, see page 193)

All lumber shall conform to the Standard Specifications in Section No. 53 under "Quality of Materials."

(a) SUBGRADE FOR PLANKING

That portion of the roadway which is to be planked shall be graded to bring the surface of the ground to the proper elevation and condition. Subgrading shall be construed to mean all excavation or embankment, either on the street or the approaches, which may be necessary to accomplish this result. The contractor shall find his own borrow pits from which to obtain such earth as may be needed in excess of the excavation. Objectionable earth shall not be used on the grade.

Payment for "Subgrading for Planking" shall be included in the price paid for "Lumber" per M. ft. B. M.

(b) LAYING THE STRINGERS AND PLANKING

The stringers shall be bedded solidly in the subgrade prepared as previously specified, and, except where otherwise especially directed by the City Engineer, their upper surfaces shall be a depth below the finished surface equal to the thickness of the planking. The earth shall be tamped thoroughly under and around all stringers. In the case of a muddy or springy sub-grade, the contractor shall furnish sand or cinders for tamping.

The planking shall be dressed on one side, of the thickness shown on the plan and laid with the heart side down, provided that where pieces of approximately square sections are specified such pieces shall be laid with the grain of the wood vertical. Each plank shall be spiked to the stringers with spikes of such length as will give a penetration of at least four (4) inches into the stringers. Every plank shall be spiked to the stringers with two spikes at each end and one at every intervening stringer, staggered. One spike in each end stringer and the spike in alternate intermediate stringers, when driven, shall be inclined in the opposite direction to all the others.

All curb and gutter boards shown on the plan, with all necessary blocking and nailing, shall be furnished and laid according to the Standard Specifications in Section No. 69 for "Wood Curbs and Gutters." The planking shall be shaped and fitted to the gutters and the edges beveled.

At certain points shown on the plan where corners are to be turned or the planking is to be fitted to curves of the street railway portion, the planking shall be laid by use of fan-shaped pieces cut to fit.

The contractor shall make all necessary adjustments to existing cross-walks, planking, curbs and gutters, and manhole, catch-basin and similar covers.

"Planking" shall be interpreted to mean the construction of a plank roadway on a street not previously so improved, and "Replanking" the replacing of worn out planking with new lumber.

(c) RESURFACING THE STREET

After the planking and appurtenances have been constructed as specified above, the contractor shall resurface the streets according to the manner specified in Section No. 101, under "Sidewalks."

(d) PAYMENT

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

Payment for "Planking" or "Replanking" shall be made at the price bid per M. ft. B. M. for planking in place, and this shall include payment for subgrading, etc., and resurfacing.

195. TEMPORARY PLANKING AND TEMPORARY PLANKING RELAID

When planking is to be laid more than once on an improvement, it shall be classified and paid for as temporary planking. It shall be laid in conformity with the Standard Plans and Specifications for new plankng except that one spike is sufficient for each stringer. When this planking is ordered removed by the City Engineer to another part of the improvement, the contractor shall then take up and transport the lumber, relaying the same in accordance with the above specifications for temporary planking, unless this is known to be the final location, in which case the nailing shall be in accordance with the Standard Specifications.

Payment for "Temporary Planking" shall be made at the price bid per M. ft. B. M. and shall include all labor and material necessary for the first laying. Subsequent laying shall be paid for each as "Temporary Planking Relaid," which shall include payment for all work and material involved in moving the planking from one location to the other.

196. RELAYING PLANKING

The existing planking shall be relaid according to the Standard Plans and Specifications for new planking. As much of the old lumber as the City Engineer pronounces suitable shall be relaid. The contractor shall pile up and protect all lumber to be relaid, and in case any is lost, he shall replace the same with new material in accordance with Section No. 65 of these specifications. The lumber that is not relaid shall be disposed of as directed by the City Engineer.

Payment for "Relaying Planking" shall be made at the price bid per M. ft. B. M. in place, based on a thickness of four (4) inches and shall include payment for handling and disposing of lumber which, in the opinion of the City Engineer, is of no further value.

197. TIMBER TRESTLES

All lumber shall conform to the Standard Specifications in Section No. 53 under "Quality of Materials."

(a) PILING

Piling shall conform to the Standard Specifications for Piling in Section No. 57. Before any piles which are to remain in the completed structure are ordered or driven, the contractor shall determine the length required by driving a sufficient number of test piles for this purpose. In case he fails to do this, piles ordered by him of insufficient length for proper driving shall be at his risk. Piles shall be located accurately and driven plumb in the position indicated. They may be driven either by gravity or steam hammers, but shall have their butts protected by metal bands, cushions or other means of preventing damage, and shall be handled and driven in a manner that insures them against injury. Where the strata are of such a nature that driving is liable to injure the piles, they may, when authorized by the City Engineer, be jetted down to solid ground. Piles shall be driven to practical refusal, but under no conditions shall a pile have less than a four-foot penetration. Practical refusal is here understood to mean, driven to such a depth that the last five (5) blows of a three thousand (3000) pound hammer, freely falling fifteen (15) feet upon the solid, unbroomed head of the pile, shall not produce an average penetration greater than one-half (½) inch for each blow. For other weights of hammers and for steam hammers, the penetration for practical refusal as above defined, may be determined from the following formulas:

(1) **Gravity Hammers**

S=W H/30,000—1.0; average for each of last five (5) blows.

(2) **Steam Hammers**

S=W H/30,000—0.1; average for each of last twenty (20) blows.

Where S=penetration in inches; W=weight of the falling hammer in pounds; H=height of fall in feet.

Piles shall be cut off at the required elevation, cut-offs being on a true line in order to give the caps a firm and even bearing. The tops of all piles shall be chamfered neatly so as not to project beyond the edge of the caps. All points of contact between timbers, such as the tops of piles and posts and bearings of caps on piles or posts and all stringers and caps, and also the chamfered portions of all piles, shall be coated thoroughly on both faces with hot "Coal Tar Creosote Oil."

(b) POSTS

Where posts are used instead of piles, they shall be of the dimensions shown on the plans.

(c) CAPS

Caps shall be placed on the piling so as to bring their ends in line. They shall be drift-bolted to each pile or post with drift bolts three-fourths (¾) inch in diameter and of sufficient length to penetrate at least ten (10) inches into the pile or post.

(d) STRINGERS

Stringers shall be dressed on one edge. They shall be furnished and laid on the bents, and dimensioned and spaced as shown on the plan. Each stringer shall be at least thirty-two (32) feet in length, and, excepting the outer stringers, shall be laid on the caps so as to make the lap joints alternate between succeeding caps. The outside stringers shall be butt joints. All stringers shall be toe-nailed to each cap with two (2), forty (40) penny nails.

(e) 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.

(f) SIDEWALKS

Sidewalks shall be constructed in accordance with Section No. 85.

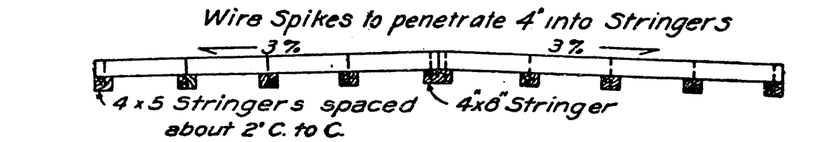
(g) RAILING (For plan, see page 194)

The lumber for wood railing shall be sized on four (4) sides and nailed according to details. When erection is completed, it shall be painted with two (2) coats of white wood paint, the quality of which is specified in Section No. 56.

(h) 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." Payment for caps, posts, stringers, decking, sidewalks, etc., shall be made at the price bid per M. ft. B. M. in place. These prices shall include payment for all lumber and oil, hardware, and all other labor and material necessary to complete the structure according to the Plans and Specifications.

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.



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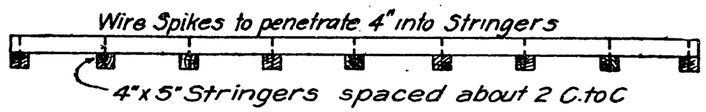

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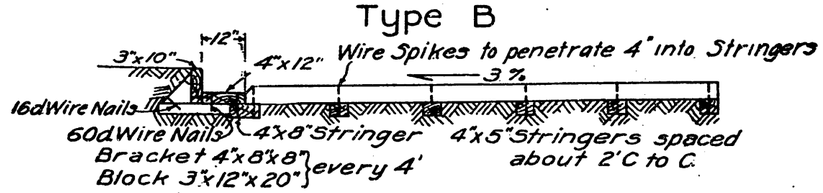

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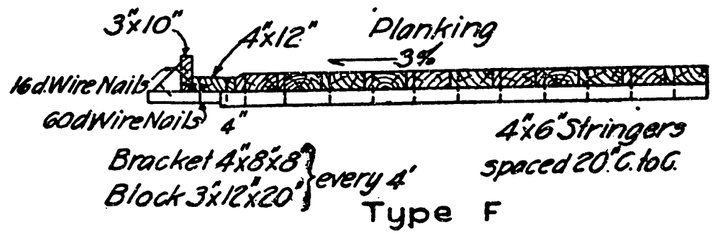

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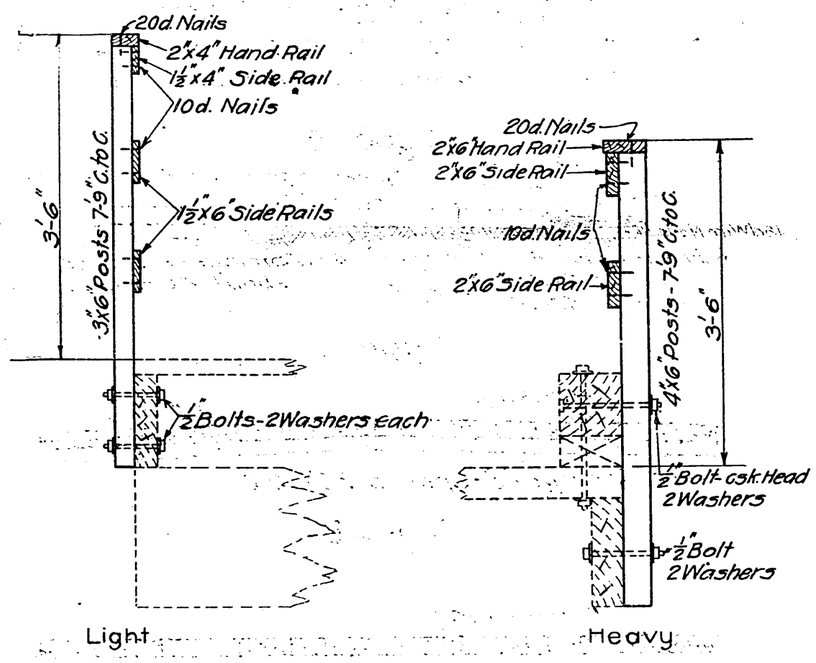
PLANKING SECTIONS



WOOD RAILING

Examined and approved by the

BOARD OF PUBLIC WORKS, May 9, 1919.

L. B. YOUNGS,
Chairman.

Attest:
C. B. BAGLEY,
Secretary.

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