

***File 733.1.1***

**CITY OF SEATTLE**

**DEPARTMENT OF PUBLIC WORKS**

*Return to City Engineer's Vault.*

**STANDARD PLANS**

**AND**

**SPECIFICATIONS**

**CITY OF SEATTLE**  
**DEPARTMENT OF PUBLIC WORKS**

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**STANDARD PLANS**  
**AND**  
**SPECIFICATIONS**

**Fourth Edition**

**PREPARED BY THE CITY ENGINEER**

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**APPROVED BY THE BOARD OF PUBLIC WORKS**  
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Lowman & Harford Co.  
SEATTLE

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  - (i) Payment

## 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.

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

### 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:

- A. C. .... Alley Crossing
- 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. C. P.	Centrifugally Cast Pipe
C. W.	Concrete Sidewalks
C. to C.	Center to Center
C. L.	Center Line
Cor. C. W.	Corrugated Concrete Sidewalks
Con.	Concrete
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
C. I. V. B.	Cast Iron Valve Box
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
Hyd.	Hydrant
Hyd. Ext.	Hydrant Extension
I. C.	Integral Curb
L.	Length
L. C. Cable	Lead Covered Cable
Loc.	Location
L. P.	Lamp Post
M.	Margin
M. C.	Monument Case
M. H.	Manhole
N.	North
O. D.	Open Drain
Pav.	Pavement
P. B. T.	Post Base Transformer
Prop.	Proposed

P. S.	Pipe Sewer
Plk.	Planking
Pos.	Position
Pvt. A. C.	Private Alley Crossing
R. C. Wire	Rubber Covered Wire
Reconn.	Reconnect
Reb.	Rebuild
Repl.	Replace
S.	South
S. C. P.	Sand Cast Pipe
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 and 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. 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, provided, however, that no payment shall be made for unauthorized work or material not shown on the plans or specified.

## 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.

The contractor shall erect and maintain at all times, while men are employed upon the work, a building where workmen may take their lunches, change clothes, etc., and he shall provide toilet facilities and such first aid equipment as is required by the laws of the State of Washington.

#### **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, as determined from the files of the Civil Service Commission, for work of like nature. 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 eighty-five per cent. (85%) to be paid to such contractor, as provided in this contract, or from any other sum or sums due said contractor.

#### **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 and shall maintain the same for a period of thirty (30) days after the final acceptance of the improvement by the Board of Public Works and shall replace and make good all damaged work that may be evidenced. But the acceptance of the work, and the release of the same, shall not prevent the City from making claim against the contractor for any uncompleted or defective work if the same is discovered within two years from the date of such release. The fact that an inspector was present during the progress of any construction, 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, with the approval of the Board of Public Works, shall make a fair and equi-



table 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, with the approval of the Board of Public Works, and a price for such extra work has not been agreed upon, it shall be paid for at the actual cost of field supervision, labor and material required, with the addition of fifteen per cent (15%) to cover profit, use of tools, and payments to the State of Washington as required by the Workmen's Compensation Act. No claims for extras under this contract will be allowed unless a memorandum of such work signed by the contractor and approved by the City Engineer or his representative be furnished the latter as soon as possible, and in any event not later than the 20th of the month following.

### 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. Any person so discharged shall have the right of appeal to the Board of Public Works.

### 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 forty-eight (48) hours after he has been notified of their rejection. If this condition is not strictly complied with, the City Engineer reserves the right to have such rejected materials removed by other parties and the cost of such removal shall be deducted from any moneys which may be or become due and payable to the contractor.

### 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 and 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 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.

The contractor will be allowed to operate hydrants only by the use of a hydrant wrench or key made to fit the hydrant valve stems, and any damage resulting to city hydrants while in use by the contractor will be repaired by the Water Department, and the cost of such repairs shall be paid by the contractor.

Hydrants will be inspected by the Water Department prior to the beginning of work upon any contract.

### 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 require-

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

The contractor shall inform himself as to the existence and location of any underground 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.

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

## 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.

He shall erect and maintain such crossings over excavations and across streets under improvement, as are necessary to accommodate vehicular and pedestrian traffic.

The contractor shall erect and maintain suitable timber bulkheads to confine earth from trenches or other excavations, in order to encroach upon sidewalks or paved roadways as little as possible.

## 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 completely barricade each street, alley, driveway, or other unprotected place leading to the improvement with barriers as shown on page 14.

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 pro-

posal 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**

There shall be reserved from the moneys earned by the contractor on estimates during the progress of the improvement or work, a sum equal to 15% of such estimates, said sum to be retained for a period of thirty days following the final acceptance of said improvement or work as completed; provided, however, that where in any improvement or work the contract price shall exceed \$200,000, but 10% shall be reserved on estimates in excess of said sum, or where the aggregate of previous estimates equals or exceeds said amount. No improvement shall be deemed completed until the Board of Public Works shall have filed with the City Clerk a statement signed by a majority of the members of said Board, declaring the same to have been completed.

During the time allowed 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 preceding month by the contractor, which estimate shall contain a statement of the amount of money due the contractor and of the amount of money found by the Board, upon vouchers certified to it, due the city for service rendered or material furnished the contractor in the performance of the contract by any of its departments.

After the expiration of the time allowed by the Board of Public Works for the completion of said contract, no estimate other than the final estimate shall be issued. 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, accounting and collection, 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 or as extended by the Board of Public Works for the completion of the contract shall be borne by the contractor.

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 such estimate less the percentage to be retained therefrom as here-



in provided, less any amount shown on such estimate to be due the city for service rendered or material furnished the contractor in the performance of the contract by any of its departments, and he shall also deliver to the City Treasurer money or warrants sufficient to pay the sums so shown to be due the city.

After the expiration of the thirty days following the final acceptance of said improvement or work, and the expiration of the time for the filing of lien claims as provided by law, said reserve or all amounts thereof in excess of a sufficient sum to meet and discharge the claims of material, men and laborers who have filed their claims as provided by law, together with a sum sufficient to defray the cost of such action and to pay attorney's fees, shall be paid to said contractor, provided, however, that no payment shall be made to the contractor in any event of any part of said reserve until the City Engineer shall certify to the City Comptroller that the thirty days since the completion of the work have elapsed and that no uncompleted or defective work has been discovered for which the City makes claim, and in case the City Engineer shall report any claim of the City by reason of uncompleted or defective work, the cost of perfecting such uncompleted or defective work shall be retained until the same shall have been perfected or arranged to the satisfaction of the Board of Public Works; provided, further, that no payment shall be made for any portion of said reserve nor shall the warrants therefor begin to bear interest until the contractor shall have deposited with the City Treasurer a sufficient amount of money in cash to cover the cost of engineering, advertising, accounting and collection, together with any other proper charges against the contractor, including any bill due the City or any of its departments, as shown by the final estimate.

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 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 the 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 and the Board of Public Works to that effect in writing. If said contractor shall not within five (5) days thereafter take such measures as will, in the judgment of the said City Engineer, insure the satisfactory 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.

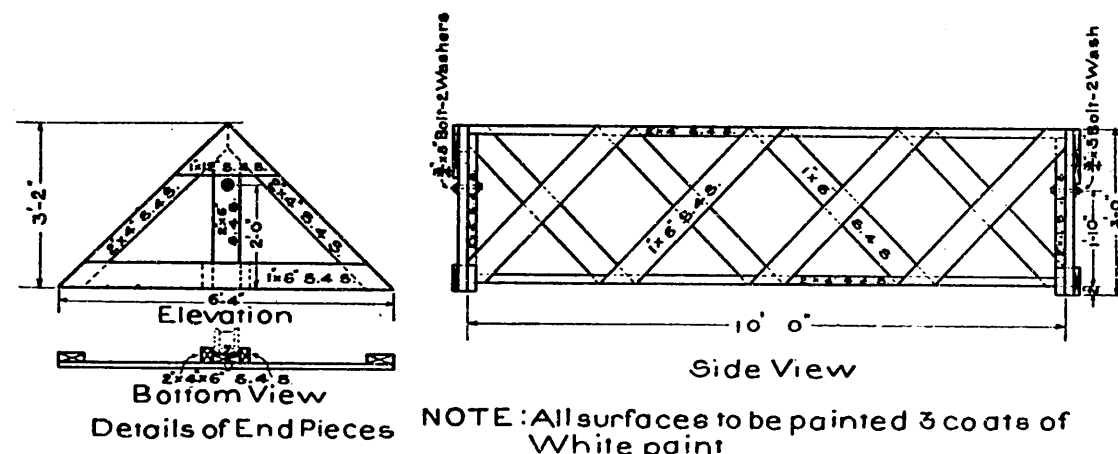
If the contractor shall abandon or breach said contract or shall fail or refuse to comply with any of the provisions of the same, or shall neglect or refuse to comply with the instructions of the City Engineer relative thereto, the Board of Public Works shall have the right to declare said contract breached and forfeited by the con-

tractor, 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.



STREET BARRICADE

## QUALITY OF MATERIALS

### 40. BRICKS

Bricks shall conform in shape and dimensions to the standard plans shown on page 16.

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.

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:

#### (a) CLASS "A"

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

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

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

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

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

#### (b) CLASS "B"

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

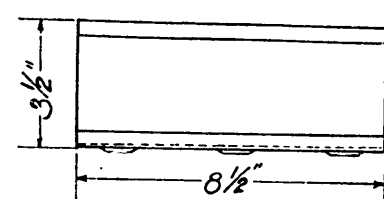
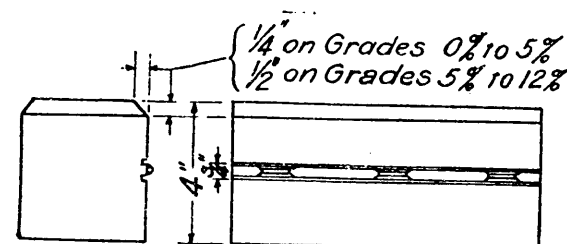
This class of bricks shall be used for sewer arches and where otherwise specified.

#### (c) CLASS "C"

Bricks in this class may be class "A" or "B" bricks which, because of lack of vitrification or irregularity in shape, have been rejected as unfit for paving or brick sewer purposes, or they may

be common hard burned building brick or concrete brick. They shall show less than ten per cent (10%) absorption after twenty-four (24) hours immersion in water. They shall be evenly burned and not unduly warped. They shall be free from large lumps or pebbles exceeding three-eighths inch ( $\frac{3}{8}$ " in diameter.

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



PAVING BRICK.

#### 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 Specification 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 ( $\frac{1}{2}$ " 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	"

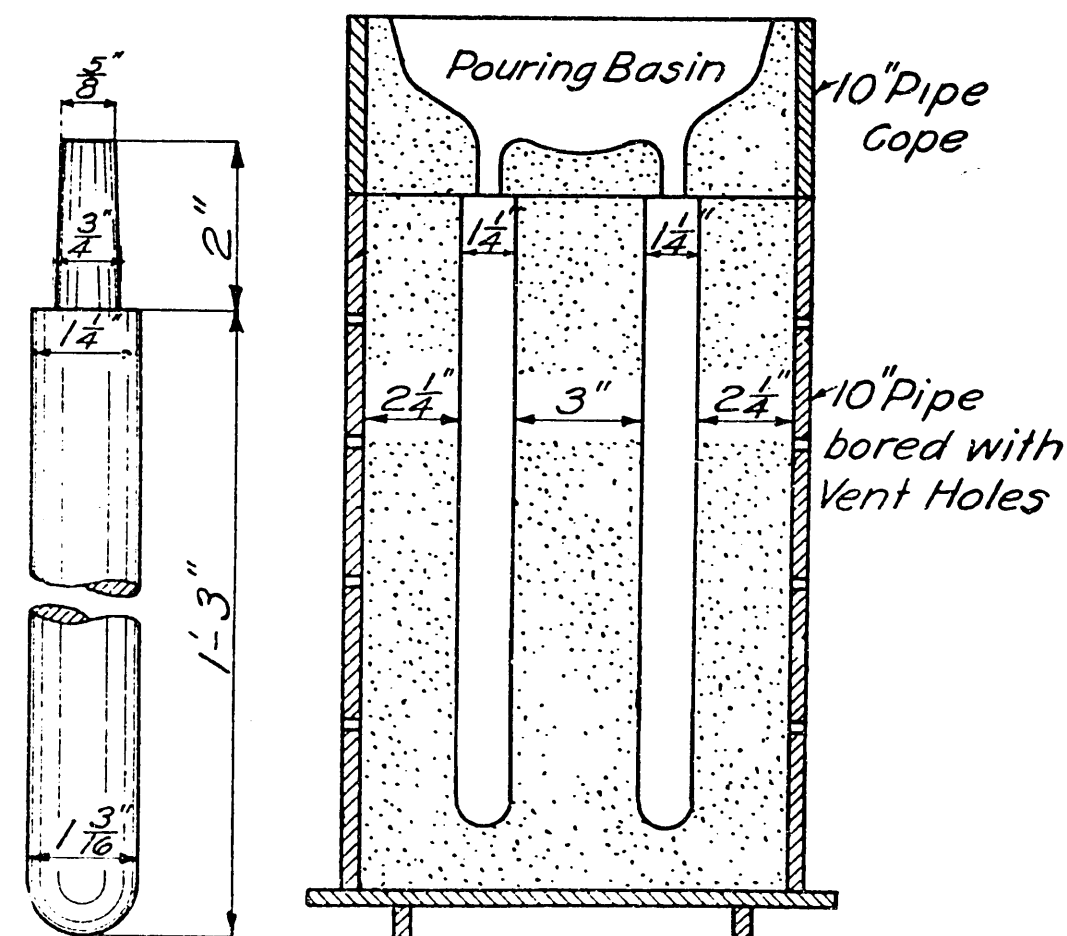
#### (d) QUALITY OF IRON

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 ( $1\frac{1}{4}$ ") in diameter and fifteen inches (15") long. The mold for the bar 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.

Pattern



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. 136 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 qualities. It shall be delivered on the work in original packages with the factory name thereon. All cement shall be delivered in advance in such quantity as to afford the engineer opportunity to make tests and the contractor shall notify the City Engineer immediately of

such delivery, if purchased in small lots, and if purchased in 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 four (4) cubic feet. Variations greater than two per cent (2%) less than the specified weights, determined by taking the average weight of ten (10) sacks selected at random from the shipment shall be sufficient cause for rejection.

**(b) FINENESS**

A No. 200 sieve shall retain not more than eighteen per cent (18%) by weight.

All testing shall be done in conformity with the methods and practice prescribed by the American Society for Testing Materials.

**(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 Ottawa 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 ( $\frac{1}{2}$ ) 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**

This oil, 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.

**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 specified. All ingredients shall be measured separately and measurements shall be of loose material by volume.

Sand and gravel shall be measured in precise measuring hoppers of approved design, or in wheelbarrows, or batch boxes mounted on trucks, the struck measurement of which is such that one batch box or an even number of wheelbarrow loads constitutes the correct quantity of each material for one batch of concrete of the proportions specified.

When using wheelbarrows 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, or batch boxes, shall be loaded flush with the top and struck before dumping. When the hopper of any mechanical loader is used to measure material, such hopper shall be automatically struck. Four (4) sacks of cement, each weighing ninety-four (94) pounds net, shall be considered equivalent to four (4) 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 metal measuring box 12"x12"x12", holding one (1) cubic foot, to represent the volume of one (1) sack of cement.

The number of sacks of cement to be used for one batch of concrete shall be brought to the mixer upon a hand truck or wheel-

barrow, from which they shall be lifted and emptied into the skip or hopper, and all sacks for one batch shall be emptied before the load for the next batch is brought up.

Whenever requested by the City Engineer, the contractor shall furnish a man to count the empty sacks in the presence of the City Engineer or his representative, and after being counted the empty sacks shall be removed from the immediate vicinity of the mixer.

**(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. The water content of all concrete will be controlled by the results of slump tests, and the contractor shall assist the City Engineer's representative in making such tests whenever requested.

**(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 or dump trucks. 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. Only the City Engineer shall regulate this apparatus.

The contractor shall keep the interior of the drum of the mixer free from the incrustations of concrete. Whenever the pickup and throwover blades in the drum have been worn down three-fourths of an inch ( $\frac{3}{4}$ ") they shall be replaced by new blades.

If a boom and 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.

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

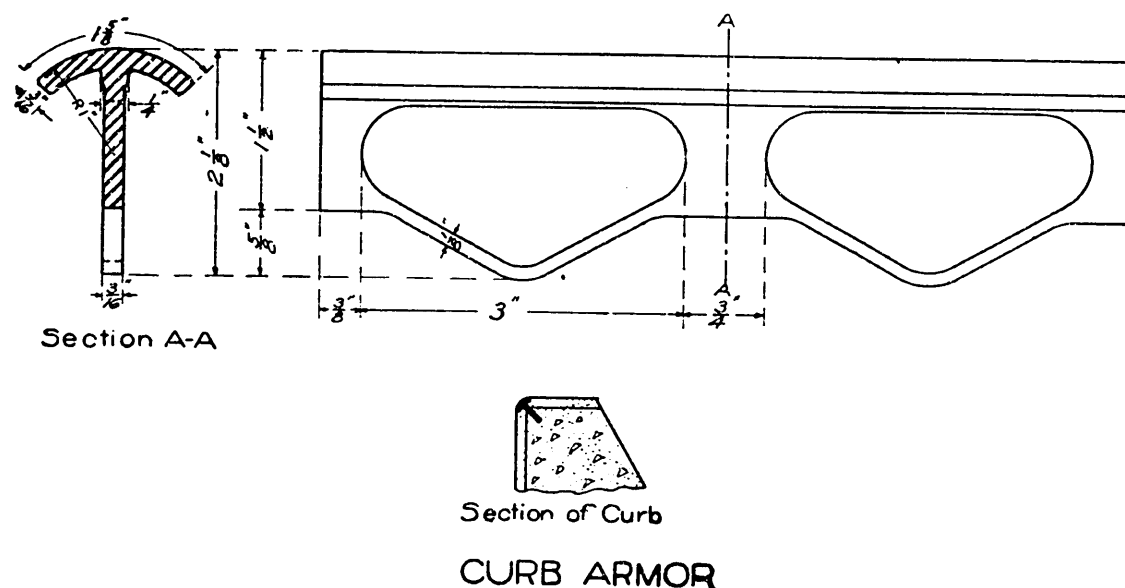
#### 45. CONDUIT

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

#### 46. 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 galvanized as specified in Section 49. 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.



#### 47. EXPANSION JOINT MATERIALS

Expansion joints shall be constructed of precast expansion joint material composed of a combination of asphalt and felt, or asphalt and fiber, and approved by the City Engineer.

Should the contractor desire to use any make of expansion joint material which has not been so approved, he shall furnish and deliver samples of such material to the City Engineer's laboratory where the same will be tested and upon the results of such tests will be accepted or rejected.

#### 48. FILLER FOR BRICK PAVEMENT

Bituminous filler for brick pavement shall be of the brand known as 2X Petroelastic or the equivalent.

#### 49. GALVANIZED MATERIAL

All material which is described in these specifications, or indicated on the drawings as being "galvanized," shall have a zinc coating equivalent to that produced by the following process: All pieces shall be entirely immersed for at least four hours in a solution of one (1) part of sulphuric acid and nineteen (19) parts of water. On removal from the solution the pieces shall be thoroughly brushed and washed with clean water. They shall then be immersed in an alkaline solution for a time sufficient to neutralize the acid completely. They shall then be washed with a jet of clean water and allowed to dry. After drying they shall be immersed in a bath of molten zinc covered with sal-ammoniac. The coating shall be complete, uniform and smooth. The galvanizing shall be done after all cutting of threads, shop-work or bending has been done and the pieces are ready to be placed in the structure. Threads, however, may be cut deeply before galvanizing and recut after galvanizing to insure fitting of bolts and nuts, provided such recutting does not expose the steel, and curb armor may be rolled to the curb radius after galvanizing.

#### 50. GRAVEL

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

##### (a) STRUCTURAL GRADE

100% shall pass a two (2) inch screen.

Not less than 96% shall pass a one and one-half (1 1/2) inch screen.

Not less than 77% nor more than 99% shall pass a one (1) inch screen.

Not less than 30% nor more than 50% shall pass a one-half (1/2) inch screen.

Not more than 15% shall pass a one-fourth (1/4) inch screen.

**(b) PAVING GRADE**

For paving and mass concrete construction:

Not less than 95% shall pass a two and one-half (2½) inch screen.

Not less than 40% nor more than 60% shall pass a one (1) inch screen.

Not less than 15% nor more than 30% shall pass a one-half (½) inch screen.

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. LEAD COVERED CABLE**

Lead covered cable shall conform in all respects in insulation, lead sheath, and other details to the requirements of the "National Electric Code Standard Specifications."

**54. 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, Rail 3, 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 "Structural Timbers, par. 212" 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 (¾) inch wide or six (6) 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 heartwood 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.

Roadway planking shall be surfaced on the heart side of the piece and laid with the rough side up.

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.** Lumber to be creosoted shall conform in all respects to the requirements for lumber in Section 54. 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. 59, except that the temperature of the creosote shall at no time exceed two hundred (200) degrees F. 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 ( $\frac{3}{4}$ ) 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.

**55. NAILS AND SPIKES**

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

SIZE	NAILS			SPIKES		
	Length in Inches	Diameter in Inches	Approx. Number per lb.	Length in Inches	Diameter in Inches	Approx. Number per lb.
4d	1 $\frac{1}{2}$	.099	316	.....	.....	.....
5d	1 $\frac{3}{4}$	.099	271	.....	.....	.....
6d	2	.113	181	.....	.....	.....
7d	2 $\frac{1}{4}$	.113	161	.....	.....	.....
8d	2 $\frac{1}{2}$	.131	106	.....	.....	.....
9d	2 $\frac{3}{4}$	.131	96	.....	.....	.....
10d	3	.148	69	.....	.....	.....
12d	3 $\frac{1}{4}$	.148	63	.....	.....	.....
16d	3 $\frac{1}{2}$	.162	49	.....	.....	.....
20d	4	.192	31	.....	.....	.....
30d	4 $\frac{1}{2}$	.207	24	.....	.....	.....
40d	5	.225	18	.....	.....	.....
50d	5 $\frac{1}{2}$	.244	14	.....	.....	.....
60d	6	.263	11	.....	.....	.....
.....	.....	.....	.....	7	$\frac{5}{16}$	7
.....	.....	.....	.....	8	$\frac{3}{8}$	6
.....	.....	.....	.....	9	$\frac{7}{16}$	5
.....	.....	.....	.....	10	$\frac{9}{16}$	4
.....	.....	.....	.....	12	$\frac{5}{8}$	3

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

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

**56. OAKUM**

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

**57. PAINT****(a) PAINT FOR METALS**

Paint for metals shall consist of the best grade of pigments, ground with pure raw linseed oil. Where desirable, in the opinion of the City Engineer, pure turpentine driers may be added, but not to exceed 10% by weight. The use of commercial driers, volatile thinners, or pigments containing sulphides, nitrites, soluble salts, free water, or inert fillers, will not be permitted.

Pigments shall be composed of pure red lead, pure white carbonate of lead, or a natural pure graphite containing not less than 85% carbon.

The selection of the pigment, coloring material, and formula will be entirely within the discretion of the City Engineer.

The purity of all materials shall conform to the requirements of the American Society for Testing Materials.

The contractor shall furnish and deliver to the City Engineer's laboratory samples of all paint materials at least ten (10) days before proceeding with the work of applying paint.

**(b) PAINT FOR WOOD**

Paint for wood shall consist of pure white carbonate of lead, mixed with pure raw linseed oil, and not to exceed ten per cent (10%) by weight of suitable turpentine drier. At least ten (10) days 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 in this improvement, and the contractor shall not proceed with the painting of any wood until he has been notified that the ingredients are satisfactory.

**58. 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.

## 59. PILING, CREOSOTED

### (a) BEFORE TREATMENT

The piling to be creosoted shall conform in all respects to the requirements specified for "Piling" in Section No. 58, 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 shall the piling be subjected to a temperature greater than two hundred twenty degrees Fahrenheit (220°F).

### (c) CREOSOTE OIL

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

## 60. RUBBER COVERED WIRE

### (a) STANDARD

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

### (b) FOR UNDERGROUND USE

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

### (c) TESTS

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

## 61. SAND

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

### (a) STRUCTURAL GRADE

100% shall pass a No. 4 screen.  
Not less than 40% nor more than 60% shall pass a No. 30 screen.

### (b) PAVING GRADE

For concrete paving, curbs, etc., sand shall be graded as follows:

100% shall pass a one-fourth (¼) inch screen.  
Not less than 20% nor more than 35% shall pass a No. 30 screen.

### (c) FOR MORTAR

For mortar 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.

### (d) 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
1/4"	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

## 62. 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"	5/8"
8"	3/4"
10"	7/8"
12"	1"
15"	1 1/4"
18"	1 1/2"
21"	1 3/4"
24"	2"
30"	2 1/2"

(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 laboratory. 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	6 1/2
15"	30	7 1/2
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 striped to a depth of approximately one-half inch (1/2"). 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 pressure applied to the upper bearing block:

Diameter	pounds per lin. ft.
6"	1,000
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"	1 1/2"
18"	1 3/4"
21"	2"
24"	2 3/8"
30"	3"
36"	3 1/2"

(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 steamed-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 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.

**63. STEEL REINFORCEMENT BARS**

Steel concrete reinforcement bars shall be billet steel bars, conforming to the specifications of the American Society for Testing Materials, Serial Designation A15-14, except for the place of making tests. The City Engineer reserves the right to designate the place for making tests.

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

**(a) 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.

**(b) 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%).

**(c) 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	1,250,000
	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  $\frac{3}{4}$ " in thickness or diameter, a deduction of one (1) from the percentage of elongation specified above shall be made for each increase of  $\frac{1}{8}$ " in thickness or diameter above  $\frac{3}{4}$  inch. For all bars under  $\frac{7}{8}$  inch in thickness or diameter, a deduction of one (1) from the percentage of elongation specified above shall be made for each decrease of  $\frac{1}{8}$  inch in thickness or diameter below  $\frac{7}{8}$  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  $\frac{3}{8}$  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.

**(d) ALLOWABLE 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.

**(e) FINISH**

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

**(f) 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. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

**(g) 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	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$
Weight per ft. in lbs.	.20	.49	.86	1.35	1.94	2.64	3.43	4.34	5.35

**64. STRUCTURAL STEEL FOR BRIDGES**

Structural steel for bridges, unless otherwise specified, shall conform to the specifications of the American Society for Testing Materials, Serial Designation A7-24.

**65. 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.



## SPECIFICATIONS FOR GRADING, CURBING AND APPURTENANCES

### 66. 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 whatsoever 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 crosswalks, 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.

### 67. 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 specifications for the improvement. In addition to the applica-

tions made prior to the opening of bids, the contractor shall comply with all requests made subsequently, provided the earth has not been already removed from the excavation. The contractor shall not remove any material from the district, until he has ascertained that no more material is required by the property owners within the local improvement district. Where earth is placed on private property by direction of the City Engineer the contractor will not be required to haul the same a greater distance than six hundred (600) feet.

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

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

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

#### (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 this improvement district, and within a distance not exceeding thirteen hundred (1300) feet no allowance shall be made for refill. If suitable material cannot be obtained from the streets in this improvement district, within thirteen hundred (1300) feet, payment for refill shall be made at a price per cubic yard agreed upon by the contractor and the City Engineer.

#### (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. Payment for "Rock Excavation" shall be made at the price bid per cubic yard for the same and shall be in payment for all solid rock or loose boulders exceeding one-half ( $\frac{1}{2}$ ) cubic yard in volume.

#### 68. SURFACING ROADWAYS AND PARKING STRIPS

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

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

#### 69. EXTRA EXCAVATION

Extra Excavation shall include all excavation beyond that specified or shown on the standard or special plans, which may be necessary to secure a proper foundation for structures, for special trenching or extra depth of trenches; provided, however, that additional excavation in connection with grading of subgrading, which is caused by the changing of the street grade, or the removal of unsuitable material, as specified under Sect. 67 (d), shall be paid for as earthwork or subgrade and not as extra excavation.

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

#### 70. CONCRETE CURB AND GUTTER

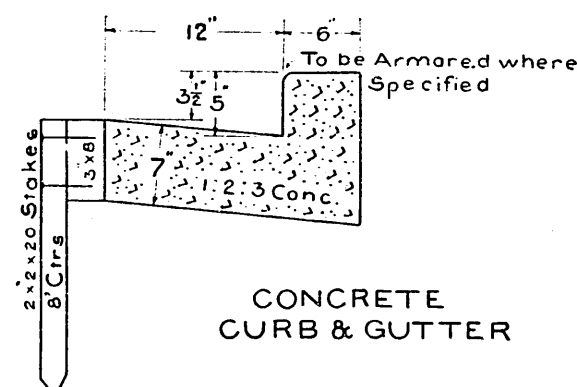
Concrete curb and gutter shall be constructed of concrete mixed according to the Standard Specifications in the following proportions: one (1) part cement, two (2) parts sand, and three (3) parts gravel.

The subgrade shall be thoroughly tamped and shall be wet before placing concrete, as specified for concrete pavement. The gutter surface shall be floated and brushed in a longitudinal direction with a soft brush. The curb shall be finished and provided with weep holes as specified for concrete curb. Concrete alley cross-

ings and private concrete alley crossings shall be constructed with concrete curb and gutter, as specified with concrete pavement, except that the gutter portion of private crossings shall be seven (7) inches thick, and the entire crossing, including the gutter, shall be paid for as Private Alley Crossing.

One-quarter ( $\frac{1}{4}$ ) inch expansion joints shall be placed through the concrete curb and gutter each side of alley crossings and at intervals of twenty (20) feet. Concrete curb and gutter shall be cured by covering with earth and keeping the same wet for ten (10) days.

Concrete Curb and Gutter will be paid for at the price bid per linear foot for "Concrete Curb and Gutter" or "Armored Concrete Curb and Gutter," and shall include the three by eight (3 x 8) inch form and stakes left in place.



## 71. WOOD CURBS AND GUTTERS (For plan, see page 44)

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.

## 72. 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."

## 73. SHEAR BOARDS (For plan, see page 45)

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.

## 74. SAND BOXES (For plan, see pages 45 and 46)

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

## 75. ALLEY SAND BOXES (For plan, see page 46)

The outlet consists of two four (4) 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.

## 76. SEWER PIPE DRAINS (For plan, see page 49)

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. The lower half of 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 for the size and type specified, and shall include inlets and excavation and backfilling of the trench with gravel.

### 77. BOX DRAINS (For plan, see page 47)

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 ( $\frac{1}{4}$ ") 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.

### 78. 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.

### 79. CONCRETE POST FENCE (For plan see page 49)

Where shown on the plan or where directed by the City Engineer, the contractor shall construct a concrete post fence. The posts shall be precast of concrete of the proportions shown, with smooth, dense surfaces. Rails shall conform to the specifications for structural timbers.

Payment for "Concrete Post Fence" shall be made at the price bid per linear foot, which shall be in full for all labor and material necessary to construct the fence according to the Standard Plans.

### 80. WOOD FENCE (For plan, see page 49)

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. 57.

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

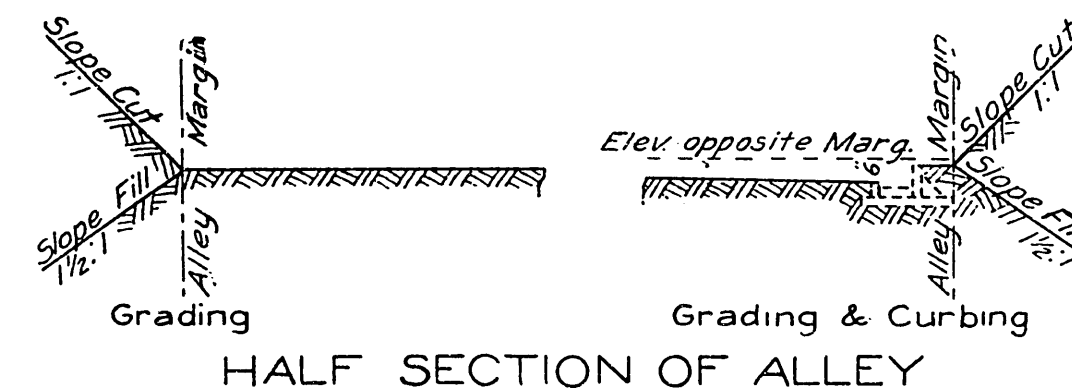
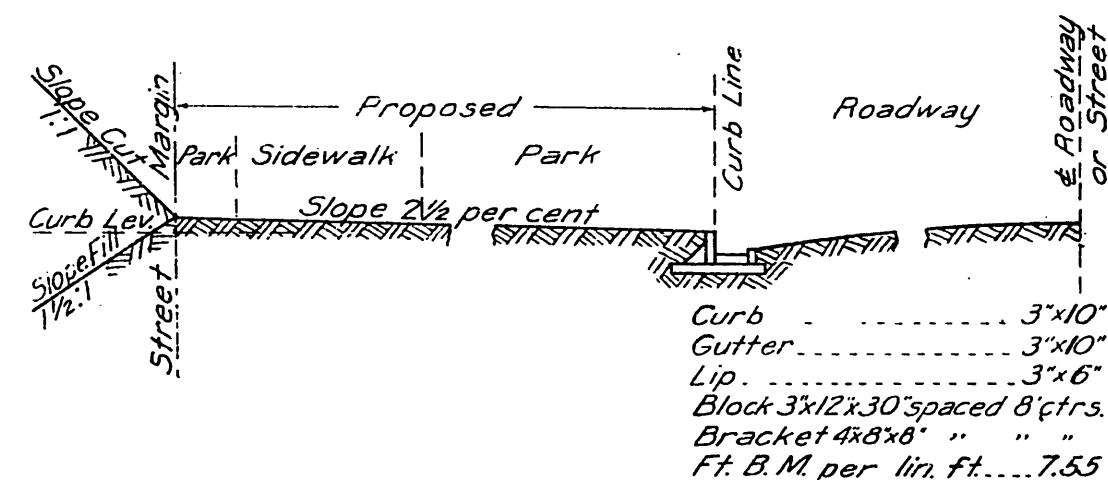
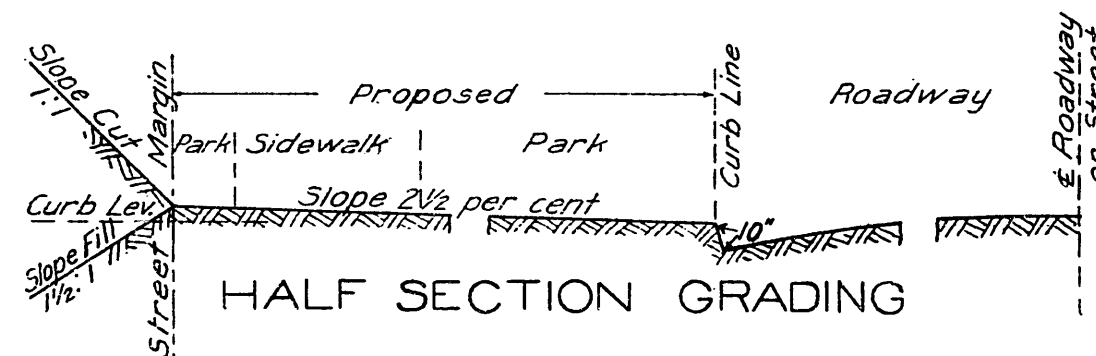
### 81. PIPE CULVERT (For plan, see page 49)

Culverts shall be constructed of No. 2 vitrified clay sewer pipe, or concrete 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. 107.

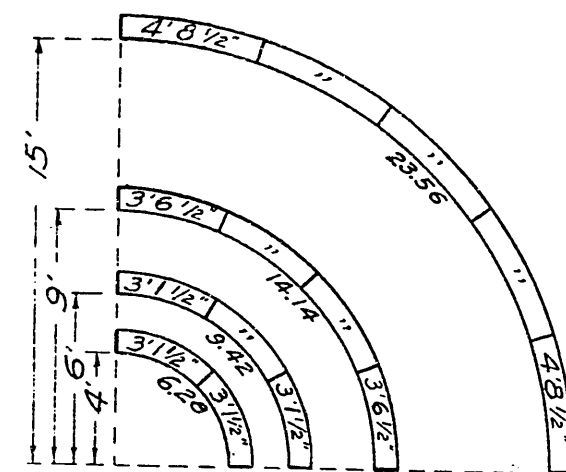
Should the City Engineer so direct, the contractor shall bed the lower half of the pipe in concrete, in which case twelve dollars (\$12.00) per cubic yard shall be allowed for the concrete, which amount shall be in full for the concrete in place, including the additional excavation involved.

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.

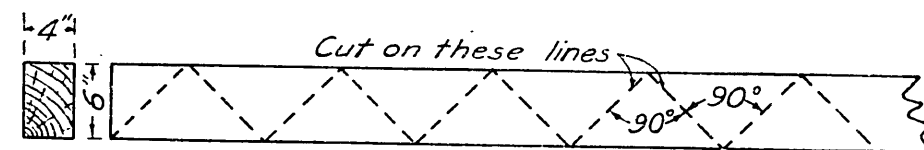




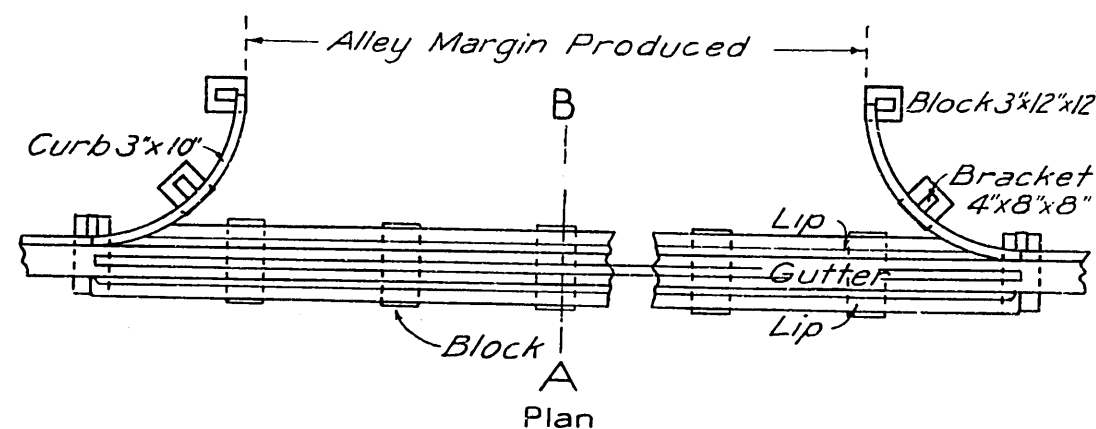


NOTE: For radii longer than 15' and shorter than 50' Gutter Boards shall be cut approximately in six foot (6') lengths. For radii longer than 50' they shall be cut in approximately eight foot (8') lengths.

METHOD OF CUTTING GUTTER BOARDS



METHOD OF CUTTING BRACKETS

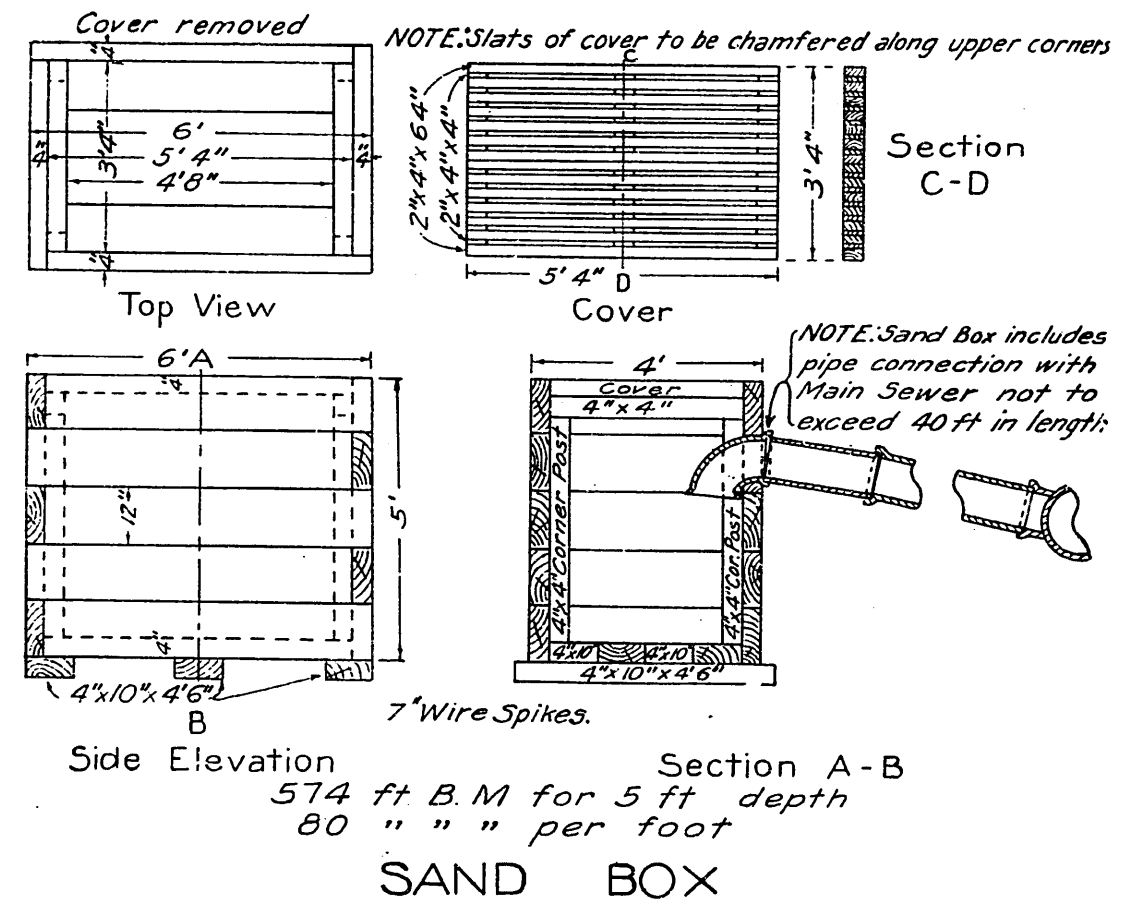


Gutter.....3"x10"  
Lips.....6"x6"  
Block 3"x12"x26"-4'C.to C.  
Center Strip 3"x3"

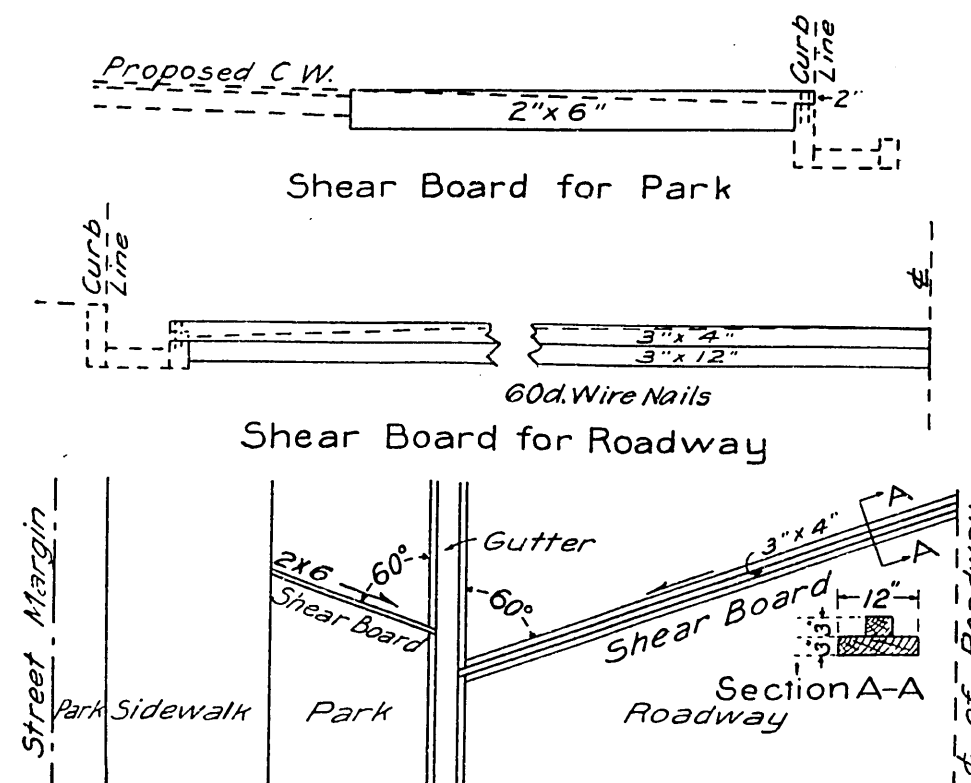
2" Bevel

Section A-B

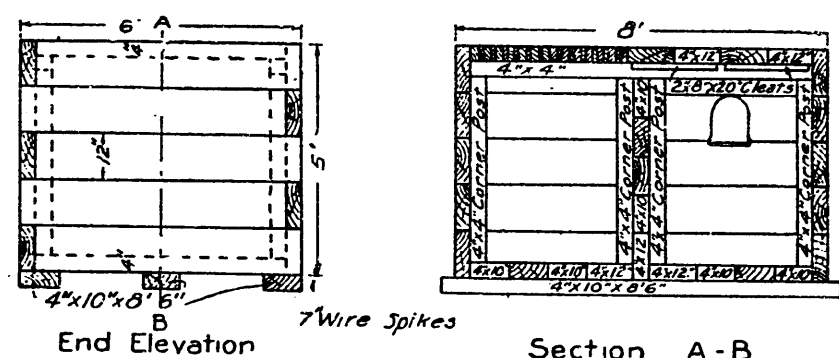
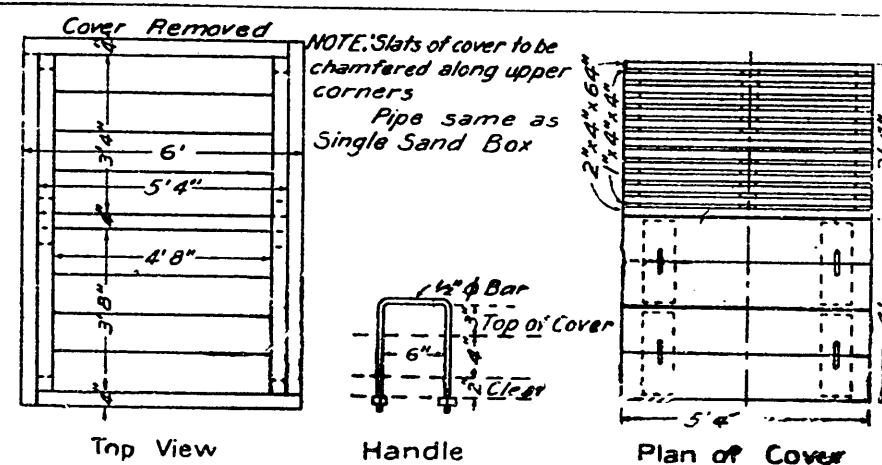
ALLEY GUTTER AND RETURNS



SAND BOX

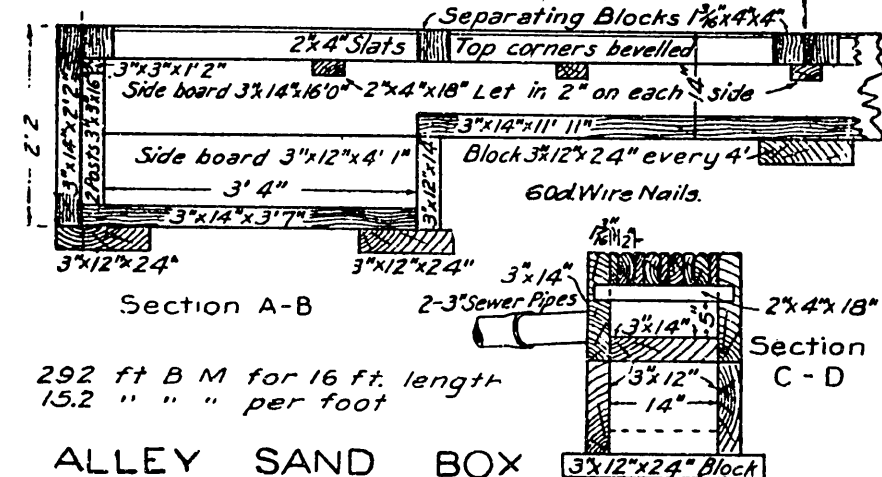
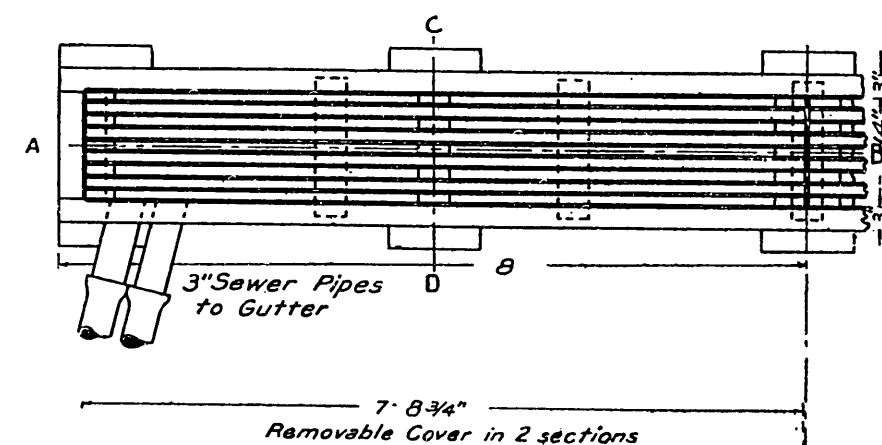


SHEAR BOARDS



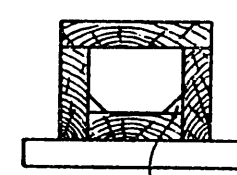
1074 ft. B.M. for 5 ft. depth  
117 " " " per foot

## DOUBLE SAND BOX



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

## ALLEY SAND BOX

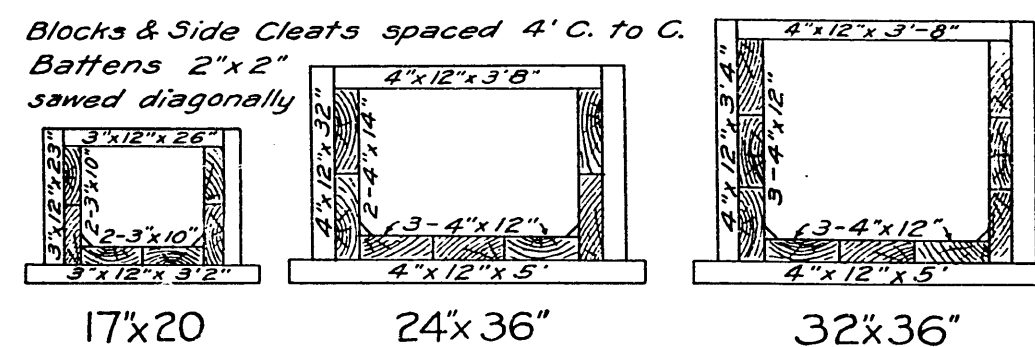


Size Inside	Cover	Sides	Bottom	Blocks	Ft. B.M. per lin. ft.
5" x 10"	3" x 16"	3" x 8"	3" x 10"	3" x 12" x 24"	11.58
7" x 10"	3" x 16"	3" x 10"	3" x 10"	3" x 12" x 24"	12.58
9" x 10"	3" x 16"	3" x 12"	3" x 10"	3" x 12" x 24"	13.58
9" x 12"	3" x 18"	3" x 12"	3" x 12"	3" x 12" x 24"	14.58
11" x 12"	3" x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

Battens 2" x 2" Sawn diagonally. Blocks spaced 8" C. to C.

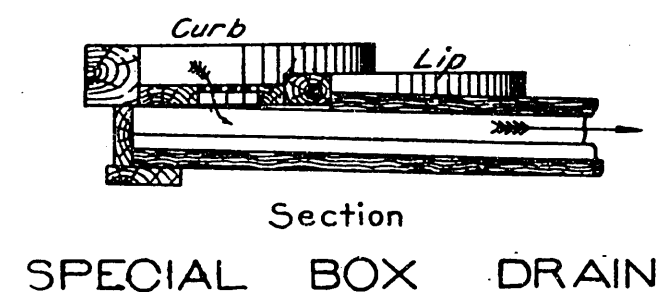
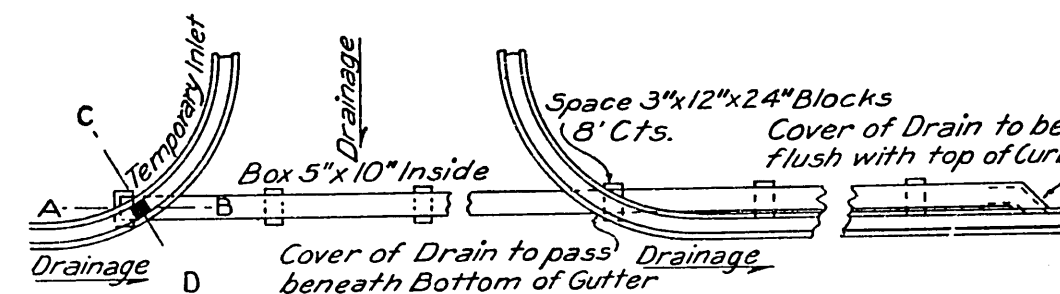
## BOX DRAIN SECTION AND BILL OF MATERIAL

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



27.1' B.M. per lin. ft. 56' B.M. per lin. ft. 62.7' B.M. per lin. ft.

## BOX DRAIN SECTIONS &amp; BILL OF MATERIAL





## SPECIFICATIONS FOR SIDEWALKS AND APPURTENANCES

### 82. CLEARING AND GRUBBING

Clearing and Grubbing shall include the removal, where necessary, of all brush, old sidewalks, planking, 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 58)

Where directed by the City Engineer, temporary wood walks shall be constructed of 2"x12" rough plank, laid lengthwise, and firmly nailed with 30-penny nails to 3"x8" blocks laid crosswise every eight (8) feet and properly bedded in the ground. On grades over 10%, or where directed by the City Engineer, battens 1/2"x2" shall be nailed to the planks eighteen (18) inches apart with four 8-penny nails to each batten.

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

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

### 85. CROSSWALKS (For plans, see page 59)

#### (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 59)

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 and opened to traffic as soon as sufficiently hardened and this covering maintained for ten (10) 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 including gravel filling along the edge of cross walks.

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 walks.

### 86. WOOD STAIRWAYS (For plan, see page 60)

The blocks shall be well bedded in the ground at the proper elevation so as to bring the finished structure to grade. The stringers shall be toe-nailed to the sills with four 30-penny nails at each bearing. The treads shall be dressed on one (1) side and two (2) edges and nailed with three 20-penny nails to each stringer. The risers shall be dressed on 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. 57.

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

**87. CONCRETE SIDEWALKS** (For plan, see page 61)**(a) TWO COURSE CONCRETE SIDEWALKS**

Two course concrete sidewalks shall consist of two courses: 1st, a concrete base three and one-half ( $3\frac{1}{2}$ ) inches thick, composed of one (1) part Portland cement, two and one-half ( $2\frac{1}{2}$ ) parts sand and five (5) parts gravel; 2nd, a finishing or wearing course one-half ( $\frac{1}{2}$ ) inch thick composed of one (1) part Portland cement and one and one-half ( $1\frac{1}{2}$ ) parts sand. Sand and gravel shall be of structural grade, as specified under "Quality of Materials."

**(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 and shod with iron shall be dragged over the subgrade. No template provided with adjustable attachments of any kind shall be used on the work. 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 ( $3\frac{1}{2}$ ) inches thick, and the upper surface shall be parallel to and not less than one-half ( $\frac{1}{2}$ ) 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 ( $\frac{1}{8}$ ) 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 ( $\frac{3}{4}$ ) 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 satis-

factory 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 rettempered 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.

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

**(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 (3) parts gravel.

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

Sand and gravel shall be of structural grade as specified under "Quality of Materials."

The concrete shall be mixed without an excess of water, placed in the forms and struck off with a heavy iron shod straight edge. It shall then be rolled with a light wire mesh 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.

**(c) GENERAL REQUIREMENTS FOR SIDEWALKS**

(For plan, see page 61)

(1) **"V" Shaped Grooves** one-quarter ( $\frac{1}{4}$ ) 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. All edges shall be edged to a radius of one-quarter ( $\frac{1}{4}$ ) of an inch. After trowelling, and before jointing or edging, the surface of the walk, on grades of 4% or less shall be lightly brushed in a transverse direction with a soft brush. On grades of over 4% the surface shall be finished with a stipple brush or as the City Engineer may direct.

**(2) Expansion Joints**

At all places where concrete sidewalks adjoin or abut against concrete or granite curb, at all street margins produced around all poles, and at such points approximately thirty (30) feet apart, as the City Engineer may direct, there shall be constructed in all



sidewalks at the time the concrete is placed, an expansion joint consisting of a strip of Expansion Joint Material as specified under "Quality of Materials" one-quarter ( $\frac{1}{4}$ ) inch in thickness, four (4) inches in depth and in length equal to the full width of the walk; or the full distance in which the walk is in contact with the curb.

### (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 wet by hosing the day on which it was laid and the following day. Payment for curing shall be included in the price bid for concrete 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.

Before the final acceptance of the work, all concrete sidewalks shall be carefully inspected and sounded for defects, and all hollow, cracked, frostbitten, 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. Canvas to insure this protection shall during the rainy season, be on hand ready to use before the contractor will be permitted to proceed with the construction of any concrete walks.

### (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 "One 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.

## 88. 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.

## 89. CORRUGATED CONCRETE SIDEWALKS

(For plan, see page 63)

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 walks is corrugated, only that portion shall be paid for as corrugated walk.

When the corrugations are added after the main walk has been laid and rodded, care shall be taken to score that portion of the walk upon which the raised strip is to be placed to insure a perfect bond.

### (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.

## 90. CONCRETE STAIRWAYS (For plan, see page 62)

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 ( $\frac{3}{16}$ ) 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 ( $\frac{1}{2}$ ") 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.

#### 91. CONCRETE GUTTERS FOR STAIRWAYS

(For plan, see page 62)

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.

#### 92. GALVANIZED IRON RAILING (For plan, see page 62)

The upright posts shall be securely set in the concrete so that the entire railing shall be thoroughly rigid and firm. The fittings shall be made of the best quality malleable iron. The pipe and fittings shall be galvanized as specified under "Quality of Materials." When in place, the railing shall be painted with two coats of gray Metal Paint, the quality of which is specified in Section No. 57.

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.

#### 93. SIDEWALK DRAINS (For plan, see page 63)

Where directed three (3) inch sewer pipe of vitrified clay or concrete shall be laid under the concrete sidewalks, extending across the parking strip and through holes 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 curb, and the construction of a coarse gravel inlet shall all be done in accordance with the Standard Plans.

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

#### 94. CONCRETE ALLEY CROSSINGS

(For plan, see page 64)

Concrete alley crossings shall be constructed where shown on the plan or where directed by the City Engineer.

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

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

The crossing shall then be covered with suitable earth and kept continuously wet for a period of ten (10) days.

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

#### 95. PRIVATE CONCRETE ALLEY CROSSINGS

(For plan, see page 65)

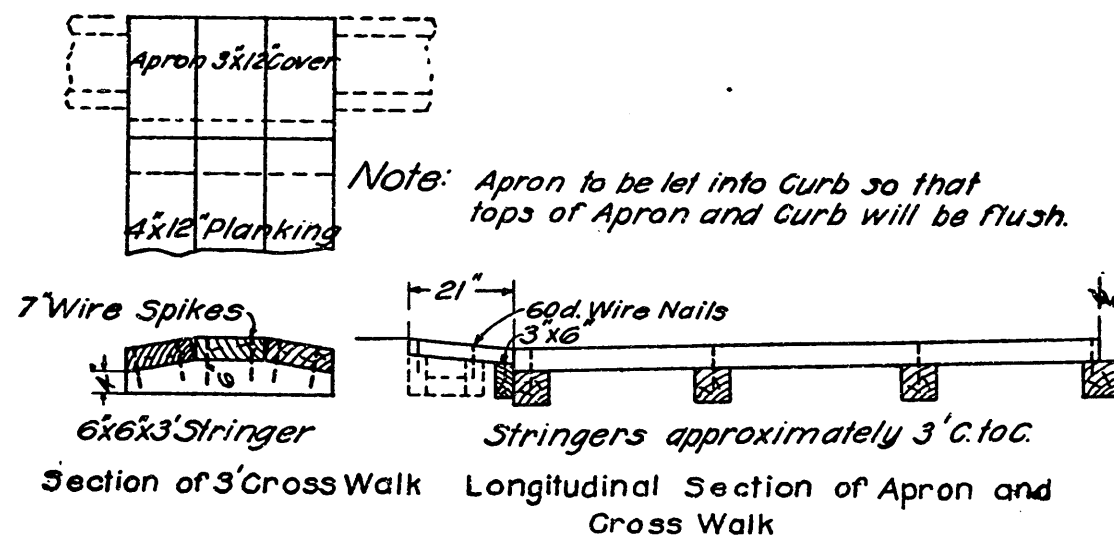
Private alley crossings constructed through concrete walks as part of the walk construction shall be constructed as shown on the Standard Plan. The surface between expansion joints shall be brushed with a soft brush and edged, but not jointed into two (2) feet squares. Curing shall be done as specified for "Concrete Walks."

Payment for "Private Concrete Alley Crossings" shall be made at the price bid per square yard and shall include the excavation.

#### 96. RESURFACING SLOPES AND PARKING STRIPS

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

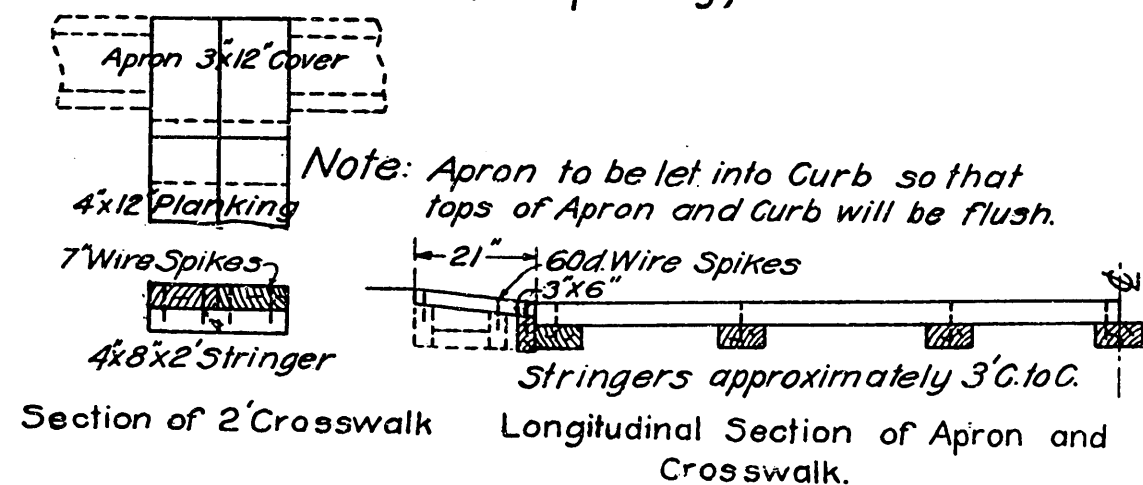
Payment for "Resurfacing Slopes and Parking Strips" shall be included in the price bid per square yard for "Concrete Walks."



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

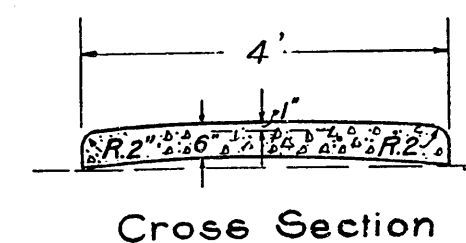
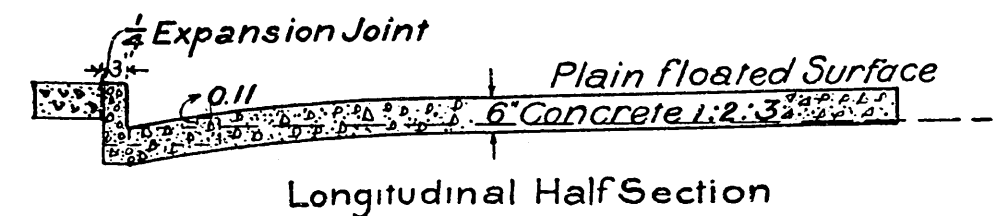
### 3FT. WOOD CROSSWALK AND APRON (Temporary)



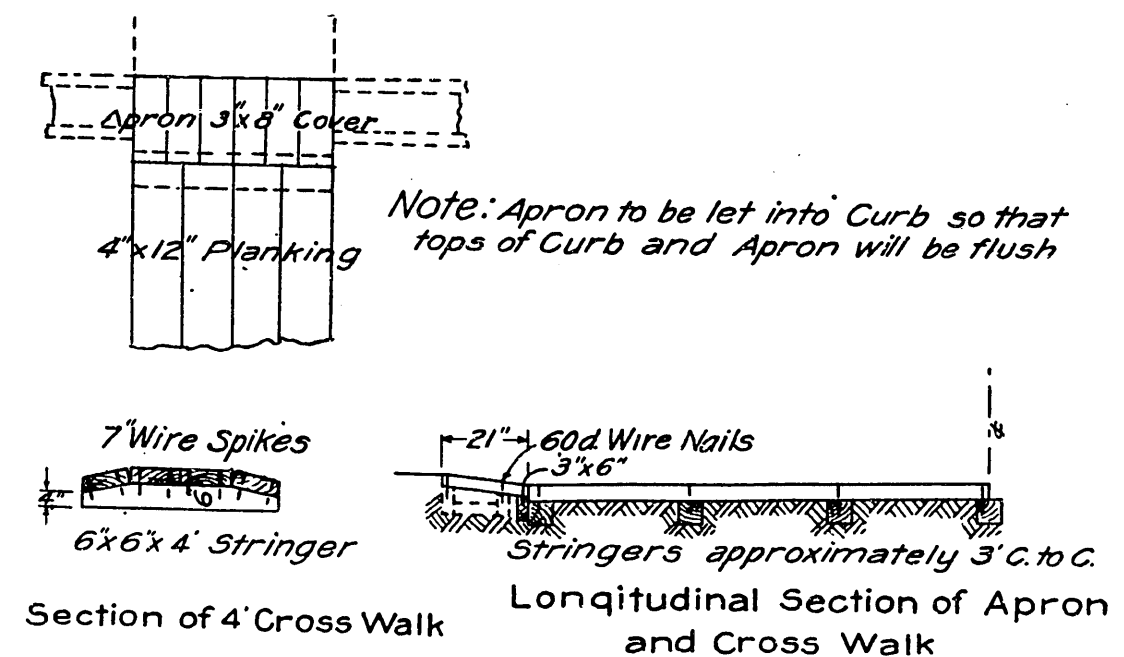
Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B.M. 2' wide	184	216	251	267	302	318	360	392	419	451	494

Crosswalk Bill of Material  
including Aprons.

### 2FT WOOD CROSSWALK AND APRON (Temporary)



### CONCRETE CROSSWALK

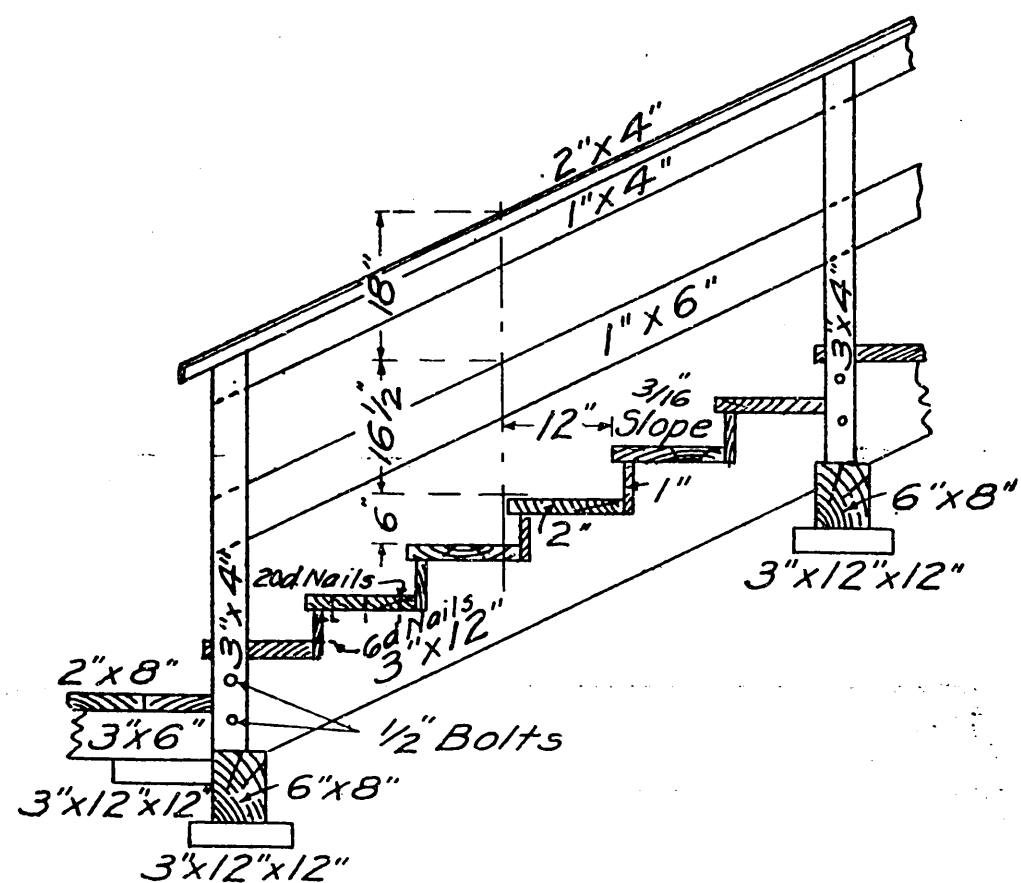
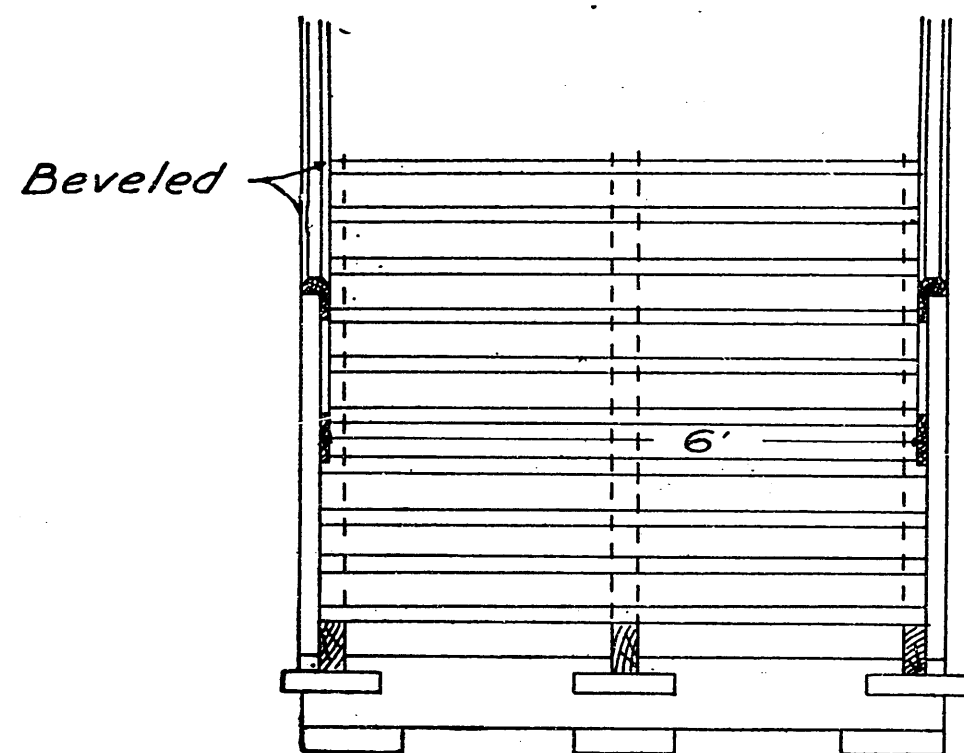


Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B. M. 4' Wide	414	478	550	582	654	686	774	838	894	958	1046

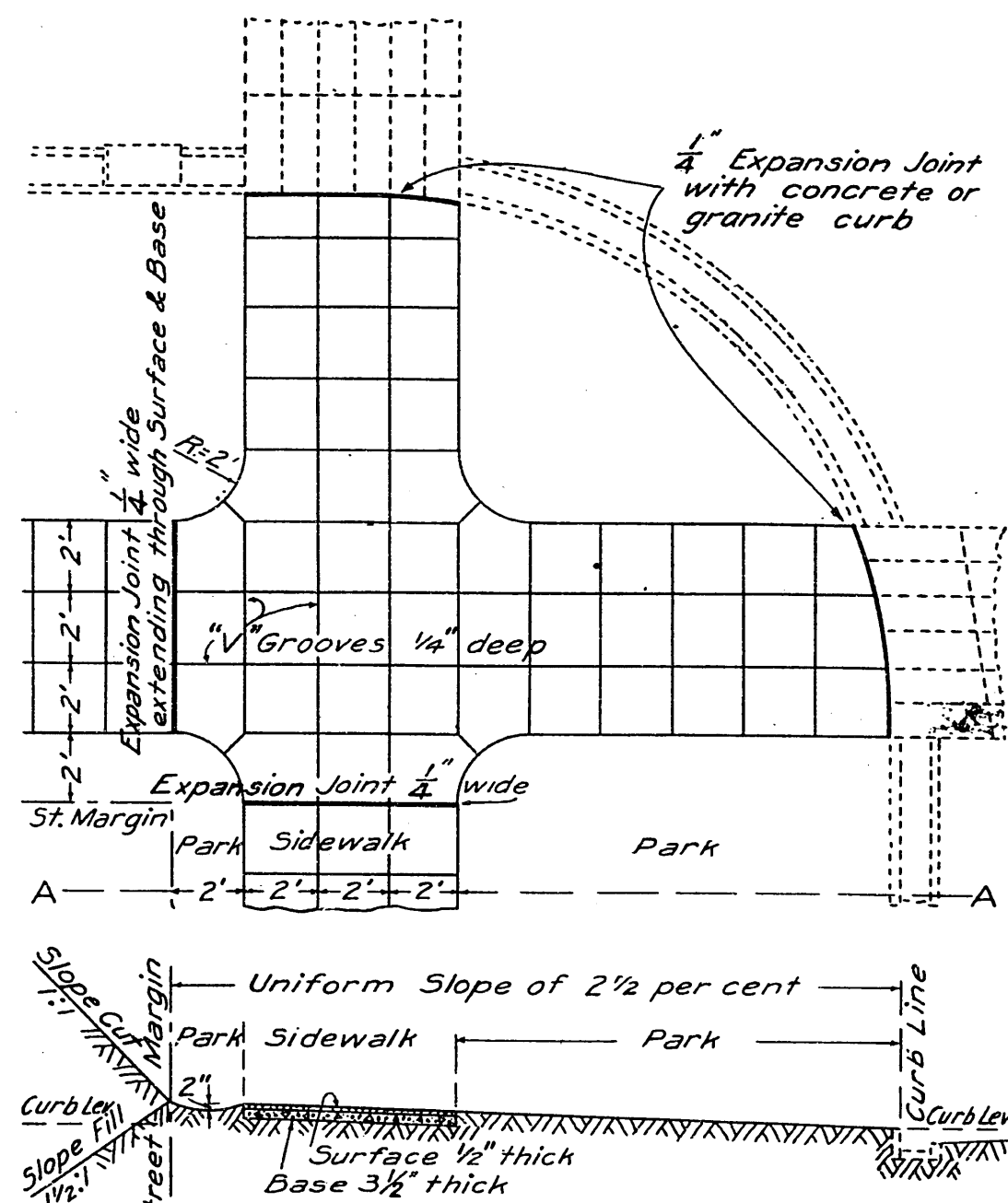
Crosswalks Bill of Material  
Including Aprons

### 4 FT. WOOD APRON AND CROSSWALK





WOOD STAIRWAY



Section A-A  
Concrete Sidewalk Intersection



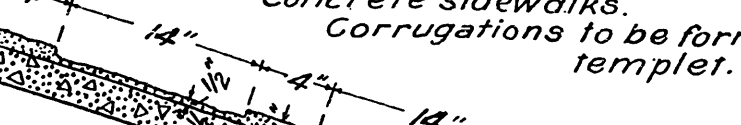
Section of Gutter with Concrete Walk  
TWO COURSE CONCRETE  
SIDEWALK

## TWO COURSE CONCRETE SIDEWALK



same as in construction of two concrete sidewalks.

Corrugations to be formed with templet.

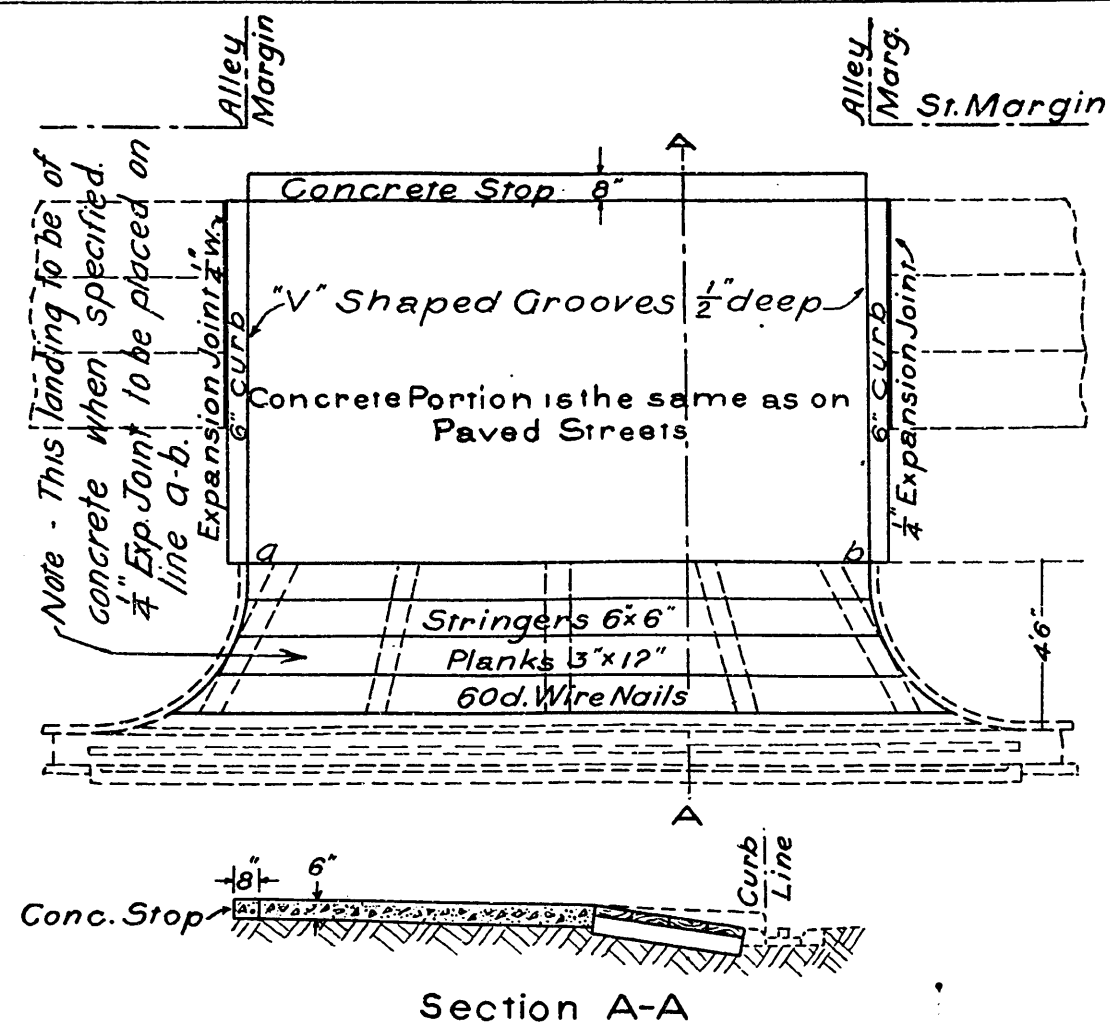


A diagram of a curb ramp. The ramp is divided into three sections: Concrete, Sidewalk, and Park. The ramp starts at a sidewalk with a width of 24" and a height of 18". The ramp has a total length of 3' and a vertical rise of 1'.

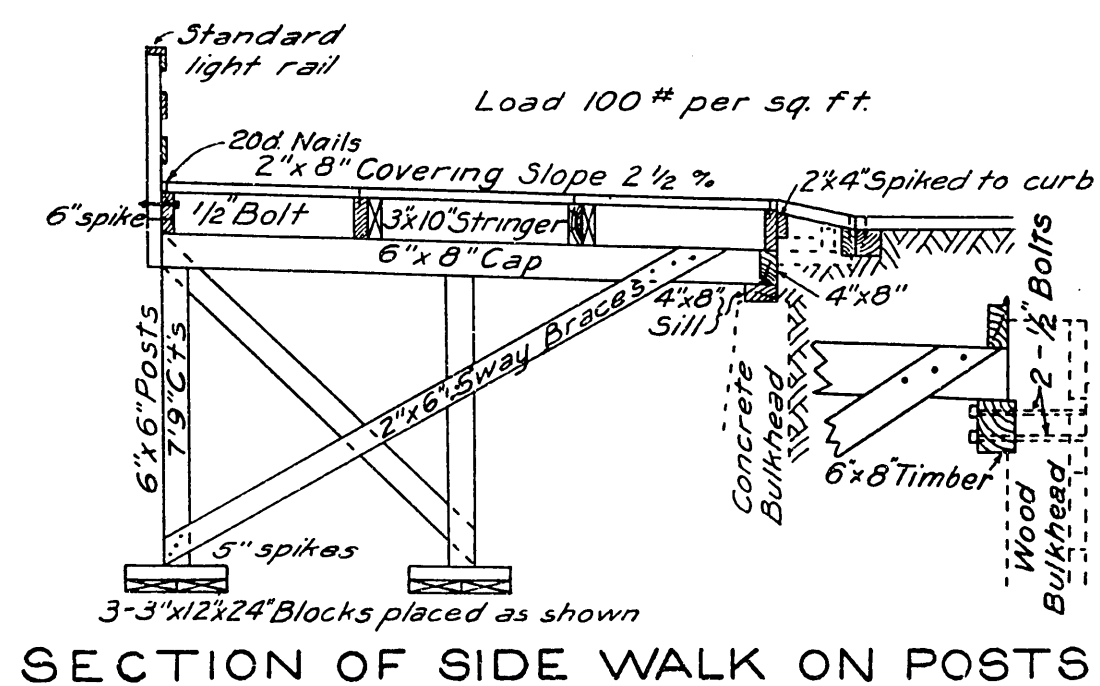
Coarse Gravel Pocket,  
18" x 24" x 12" deep

NOTE:- 3" Sewer to be put in where directed by Engineer

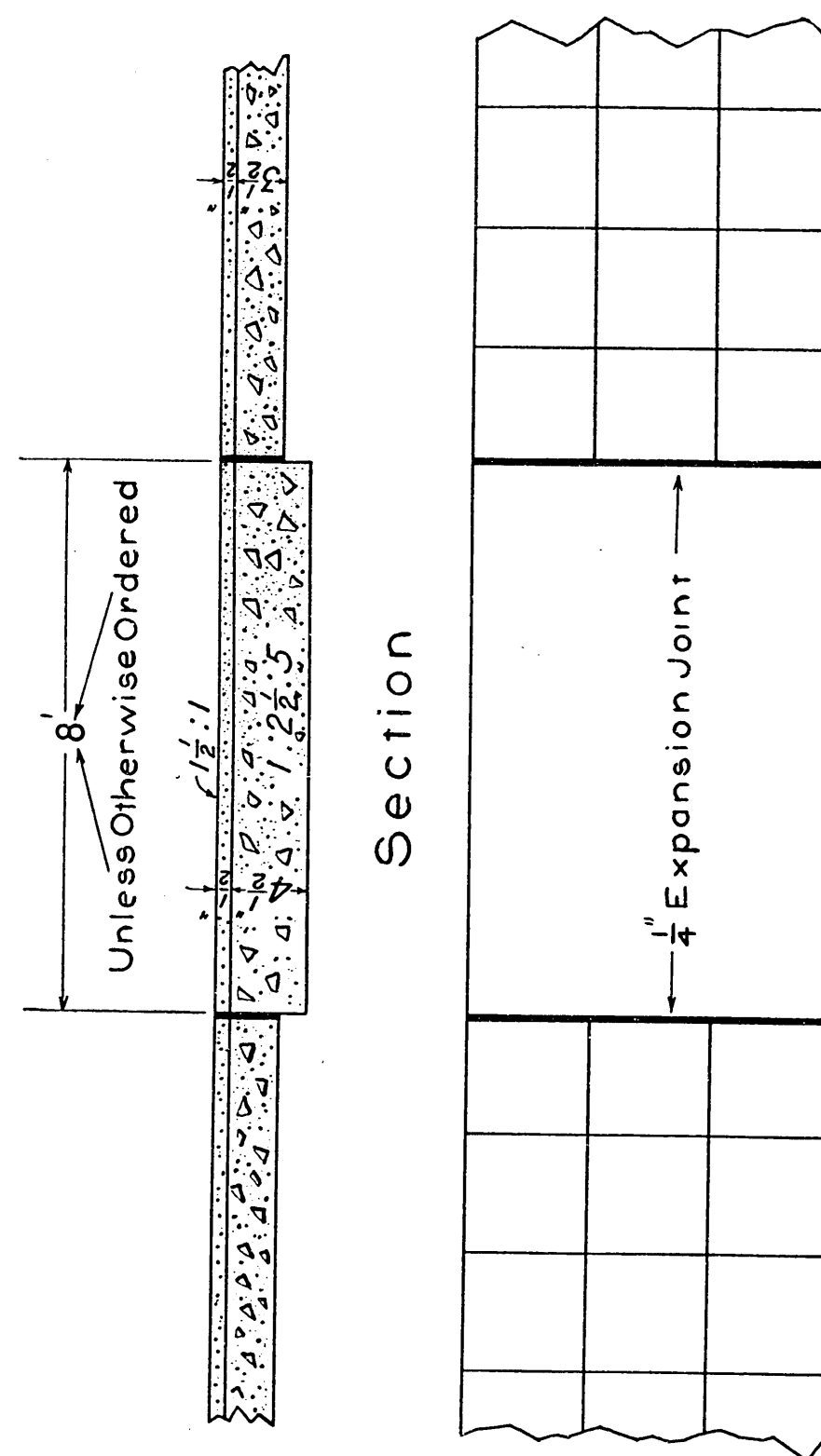
SIDE WALK DRAIN



Section A-A  
CONCRETE ALLEY CROSSING  
For Unpaved Streets



SECTION OF SIDE WALK ON POSTS



Section  
Plan  
PRIVATE ALLEY CROSSING  
Constructed with Conc. Walk

## SPECIFICATIONS FOR RETAINING WALLS

### 97. TIMBER BULKHEADS

(For plans, see pages 71, 72 and 73)

The lumber for Timber Bulkheads shall conform in quality to the Standard Specifications in Section No. 54. 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. 104. "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. 63. 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.

### 98. CONCRETE RETAINING WALLS — PLAIN AND REINFORCED (For plans, see page 74)

#### (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. 69.

#### (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 wet before pouring concrete, for a sufficient length of time to take up all shrinkage and kept wet until the concrete is poured. 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 ( $\frac{1}{4}$ ) inch below the surface, or cut off flush and punched 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 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 ( $\frac{1}{3}$ ) the width of the wall at that point, and shall run the full length of all work in progress. In all walls, the forms, moldings, etc., along the finished sides shall be kept clean of all dry mortar or concrete which would mar the appearance of the finished wall.

#### (f) REINFORCEMENT STEEL

Reinforcement steel for concrete retaining walls shall conform to the requirements specified in Section No. 63. 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, precast expansion joint material as specified under "Quality of Materials," Section 46, one-half ( $\frac{1}{2}$ ) inch thick shall be used. The walls shall be poured one section at a time. The joint material shall be accurately cut to fit the bulkhead between sections, and nailed to the bulkhead with 6d nails. These nails shall be driven into the lumber only enough to hold the material in place, the heads being embedded in the concrete. The bulkheads between sections shall be removed not sooner than twelve (12) hours after the concrete has been poured, and the nail points clinched into the joint material.

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

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 ( $\frac{1}{4}$ ) 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, and finally brushed smooth in one direction.

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



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 asphalt 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) SEWER PIPE

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

#### (l) BACKFILLING

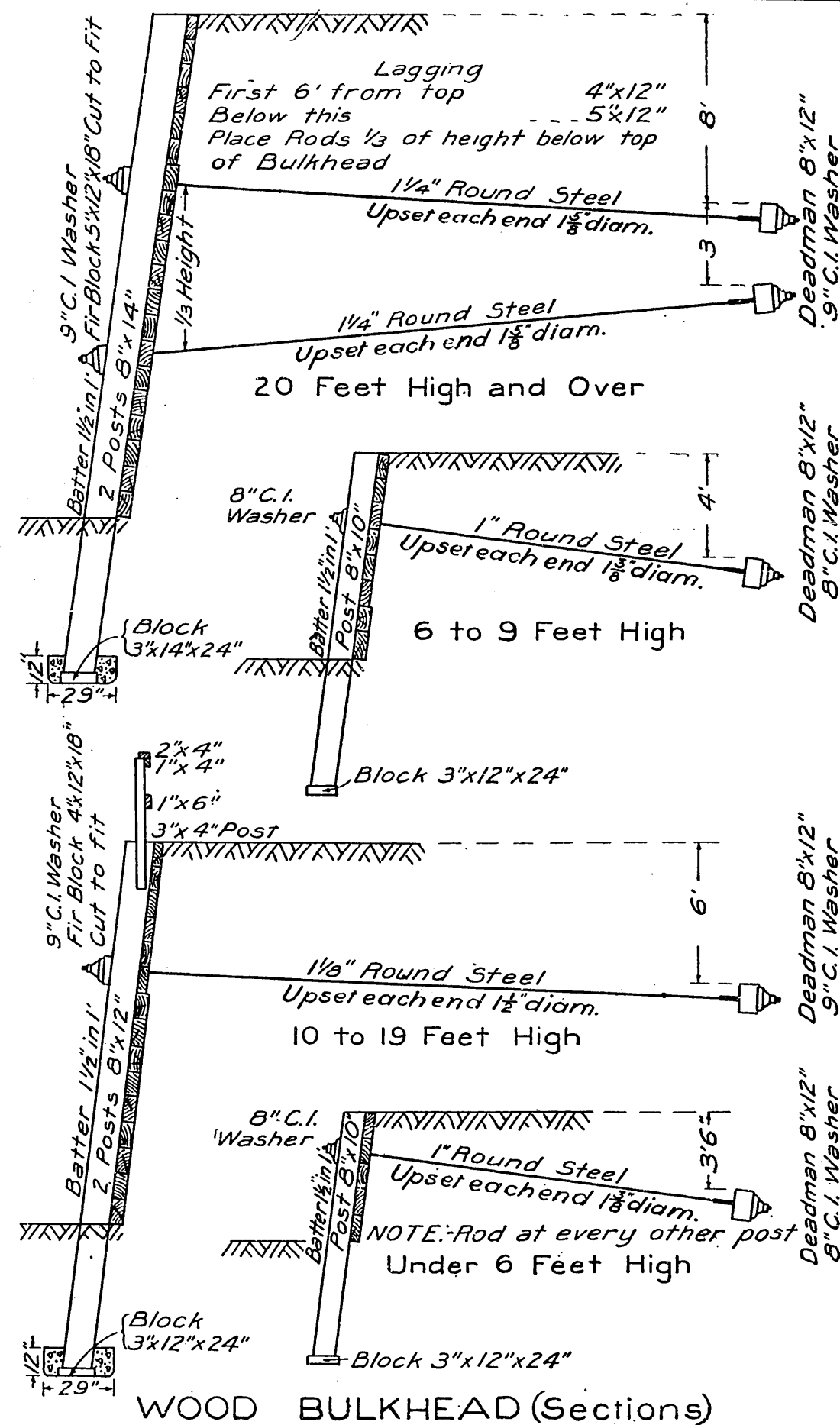
The backfilling for retaining walls shall be completed within ten (10) days after the waterproofing has been put on. It shall consist of two materials: First, a layer of gravel four (4) inches thick over the drain and against the waterproofing, and second, an earth fill. The gravel shall be placed with 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.

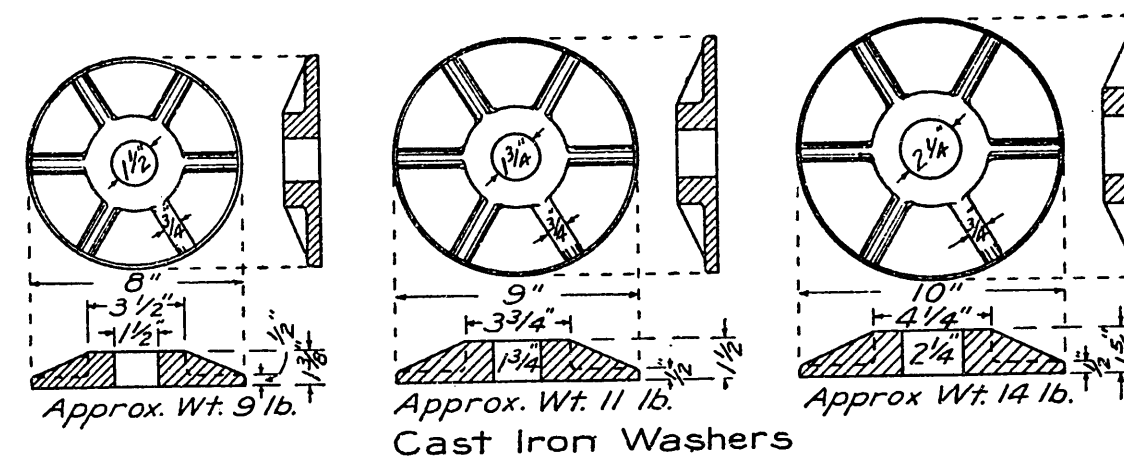
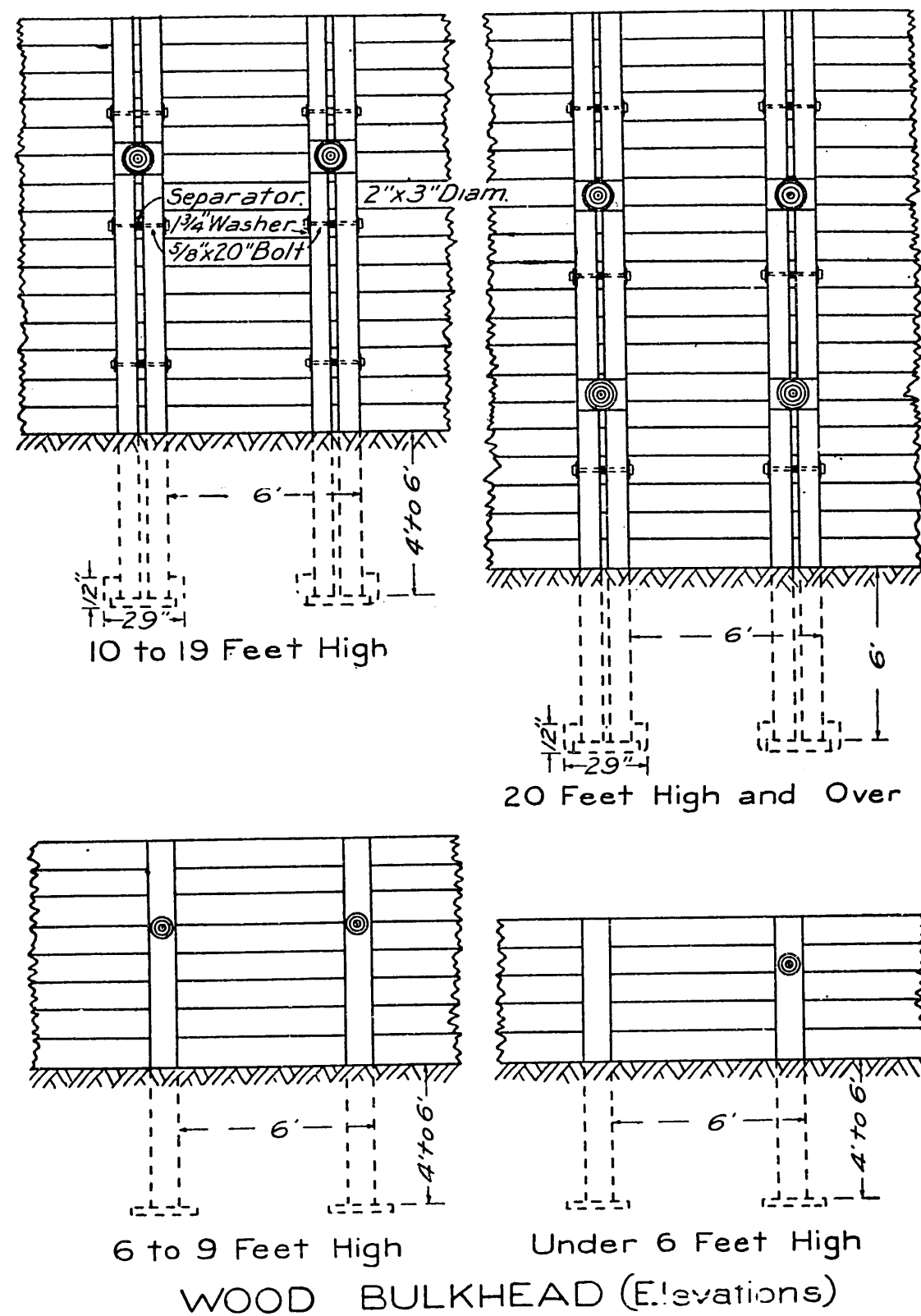
#### (m) PAYMENT

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

- (1) Concrete per cubic yard, computed by the prismatic formula.
- (2) Steel Reinforcement per pound.
- (3) Sewer Pipe per linear foot, of size specified.
- (4) Waterproofing per square yard.
- (5) 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.



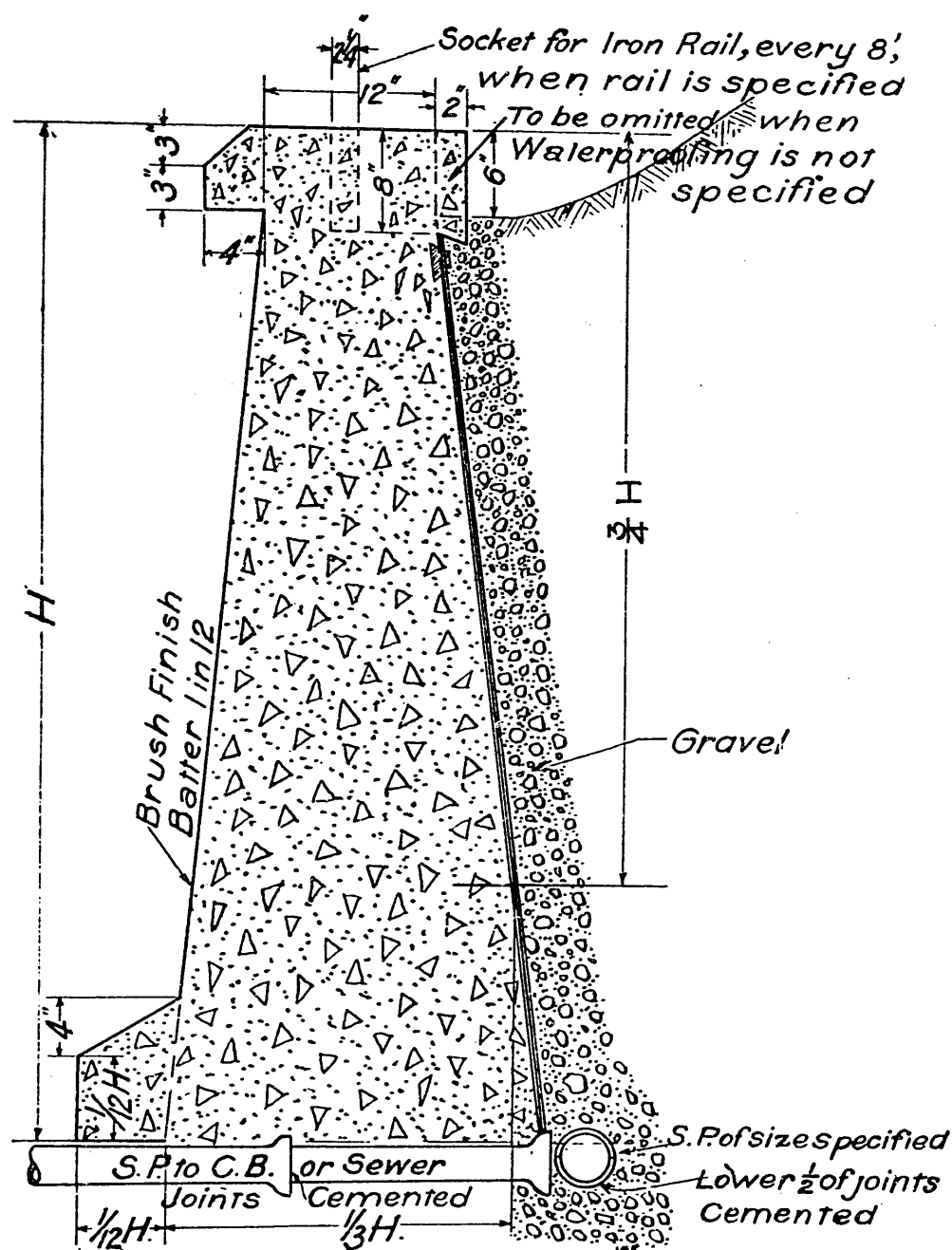


Material	Size Inches	Wt. per ft. in Pounds	Wt. of each in Pounds	Material	Size Inches	Wt. per ft. in Pounds	Wt. of each in Pounds
Rods	1	2.67		Nuts	1 3/8		2.5
"	1 1/8	3.38		"	1 1/2		3.2
"	1 1/4	4.17		"	1 5/8		4.0
"	1 3/8	5.05		C.I. Washer	8		9.0
"	1 1/2	6.01		"	9		11.0
"	1 5/8	7.05		"	10		14.0
Separators	2 x 3 Dia.		3.7	W.I. Washer	1 3/4		0.1
Bolts	5/8 x 20		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	173.6	26.7	30.0
10	70.8	18.0	15	21	181.7	27.8	31.5
11	76.9	18.0	16.5	22	189.8	28.9	33.0
12	83.0	19.7	18.0	23	197.9	29.9	34.5
13	89.1	20.5	19.5	24	206.0	30.9	36.0
14	95.2	21.4	21.0	25	214.1	31.9	37.5

Bill of Material  
WOOD BULKHEAD



# CONCRETE RETAINING WALL

## SPECIFICATIONS FOR SEWERS AND APPURTENANCES

## General Stipulations

## 99. ALIGNMENT AND GRADE

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

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

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

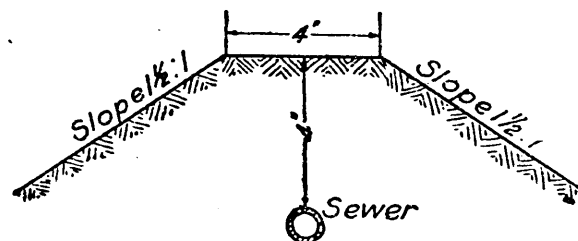
## 100. TRENCHING FOR PIPE SEWER

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 masonry are being constructed or the pipe laid.



SEWER SECTION IN FILL

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.

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

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

#### 101. 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 materials required to place the lumber in the position in which it may be left.

#### 102. EXTRA EXCAVATION

Where called for, extra excavation shall be made and paid for according to the specifications for "Extra Excavation" in Section No. 69.

#### 103. TUNNELING FOR PIPE SEWERS

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

less than one (1) foot wider than the external diameter of the sewer pipe.

Wherever water is not available for water settling the backfill, no tunneling will be allowed.

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

#### 104. 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.



## 105. 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 paving 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.

## 106. RESTORING ROADWAY

The contractor shall fill all trenches and other excavations as above specified and remove all surplus earth. He shall shape the roadway to conform to the original cross section, after which the Department of Streets and Sewers will do such graveling as may be necessary, and the cost of such graveling will be paid for as provided in Section 34.

## SEWERS

### 107. PIPE SEWERS

#### (a) QUALITY OF THE PIPE

Sewer pipe shall conform to the Standard Specifications for Sewer Pipe as given in Section No. 62 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

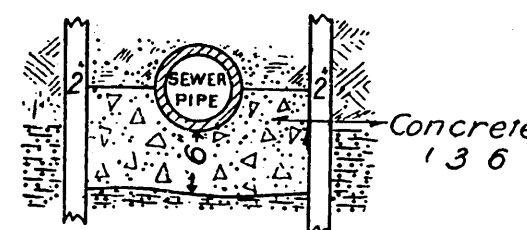
thereof conforms accurately to the grades and alignment given by the City Engineer. All adjustment to line and grade shall be done by scraping away or filling in the earth under the body of the pipe, and not by blocking or wedging up. Great care shall be exercised that the pipe has a full, solid bearing 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.

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. Payment for "Rock Excavation" shall be made as specified in Section 67.

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.

### 108. BRICK SEWERS

#### (a) QUALITY OF BRICKS

Bricks for inverts shall be Class "A" Bricks and those for arches, Class "B" Bricks. When shown on the plans, the bricks for inverts and for arches shall be wedge shaped.

#### (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 ( $\frac{3}{8}$ ) of one (1) inch. On the inside of the invert the joint shall not exceed one-eighth ( $\frac{1}{8}$ ) 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 ( $\frac{3}{8}$ ) 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

Measurement 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.

### 109. 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

### 110. 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

### 111. SIDE SEWERS

Side Sewers shall be constructed where shown, or where directed by the City Engineer upon application of the abutting property owners, in accordance with the Standard Plans and Specifications for "Sewers," with the top of side sewer connections at the curb line one (1) foot above the main sewer. All ends of the side sewers shall be marked by a No. 12 galvanized iron wire fastened to the end of the pipe and extending vertically to within six (6) inches of the surface. A brass tag  $1\frac{1}{2}$ "x3" stamped "SEWER" in letters  $\frac{1}{4}$ " high shall be attached to the surface end of wire. When concrete curb is constructed on an improvement calling for side sewers, the top of the curb shall be stamped with the letter "S"  $2\frac{1}{2}$  inches high, and the brass tag may be omitted.

The entire length of the side sewer except four (4) feet adjoining the main sewer shall be in open trench. Backfilling in the trench or tunnel shall not be commenced until the work has been approved by the City Engineer, and such backfilling shall be done as specified for "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. Whenever such wye is shown on the plan the contractor shall make the excavation, furnish the wye, and do all other work except inserting the wye in the main sewer.

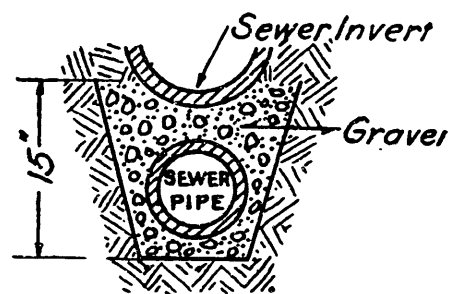
Payment for "Side Sewers" shall be made at the price bid per linear foot and shall include the payment for side sewer markers, or marking the concrete curbs. Side sewers shall be measured on the slope.

### 112. EXTENSION OF SIDE SEWERS

Property owners shall be permitted to extend side sewers in accordance with Ordinance No. 49831 and connect fixtures thereto as soon as the work in the street has set sufficiently. Such permission shall not relieve the contractor from maintaining the street sewers until final release has been issued.

**113. 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 SUB DRAIN**

sewer the connections between the subdrain and the sewer shall be filled with concrete or brick work, surfaced and finished, in the same manner as the sewer.

Payment shall 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.

**114. MANHOLES** (For plans, see pages 88 and 89)

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 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 ( $\frac{1}{4}$ ) 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 base or footing shall be composed of one (1) part Portland cement, two and one-half ( $2\frac{1}{2}$ ) 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.

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.

**115. DROP MANHOLES** (For plan, see page 90)

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.

**116. 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 ( $2\frac{1}{2}$ ) 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 ( $\frac{1}{2}$ ) 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 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.

**117. BRICK FLUSH TANKS** (For plan, see page 92)

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 ( $\frac{1}{4}$ ) 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 ( $\frac{1}{2}$ ) 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 Twelve Dollars (\$12.00) 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 ( $\frac{1}{2}$ ) 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 Twelve Dollars (\$12.00) to cover the cost of making the connection when the watermain is laid. A one-half ( $\frac{1}{2}$ ) 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.

**118. BRICK CATCH BASINS** (For plan, see page 95)

Bricks used shall be Class "C". Catch basins shall be plastered on the inside with a coating of cement mortar one-quarter ( $\frac{1}{4}$ ) 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 "Inlet Top 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.

**119. ELLIPTICAL CATCH BASINS, SPECIAL CATCH BASINS, AND CATCH BASINS WITH SPECIAL INLET TOP** (For plan, see pages 95, 99 and 105)

Shall be constructed according to the Standard Plans. Workmanship and materials shall conform in all respects to those prescribed for Brick Catch Basins. Catch Basins with Special Inlet Top shall be constructed as specified for Brick Catch Basins, the brick top being shaped to fit the special casting shown on page 95.

Payment for "Elliptical Catch Basins," "Special Catch Basins," or "Catch Basins with Special Inlet Top," will be made at the price bid each complete, as specified for Brick Catch Basins.

**120. 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 water-tight. 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.

**121. WOOD MANHOLES** (For plan, see page 101)

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.

**122. WOOD MANHOLE EXTENSIONS**

(For plan, see page 101)

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.

### 123. 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 less than one (1) foot, the work shall be classified and paid for at the rate bid each, for "Adjusting M. H. etc. Covers." Where the change is one foot or more in height, but does not involve the entire reconstruction of the manhole, catch basin, gate chamber, or flush tank, then the work shall be classified, and paid for at the price bid per linear foot for "Rebuilding M. H. etc. Tops." Measurements shall be taken from top to bottom of new brick work. Where the entire reconstruction of the manhole, catch basin, gate chamber or flush tank is made, the work shall be classified and paid for at the price bid each for "Rebuilding Manholes, Catch Basins, Gate Chambers or Flush Tanks." The payment made on any of the above items shall be in full for all labor and material in the completed work.

### 124. 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.

### 125. INLETS (For plan, see page 102)

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 flush with the surface of the pavement.

The connection from the inlet to the catch basin, whether the inlet is new or existing, shall be made in a straight line with no bends whatever and shall successfully admit of "rodding." 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.

### 126. 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.

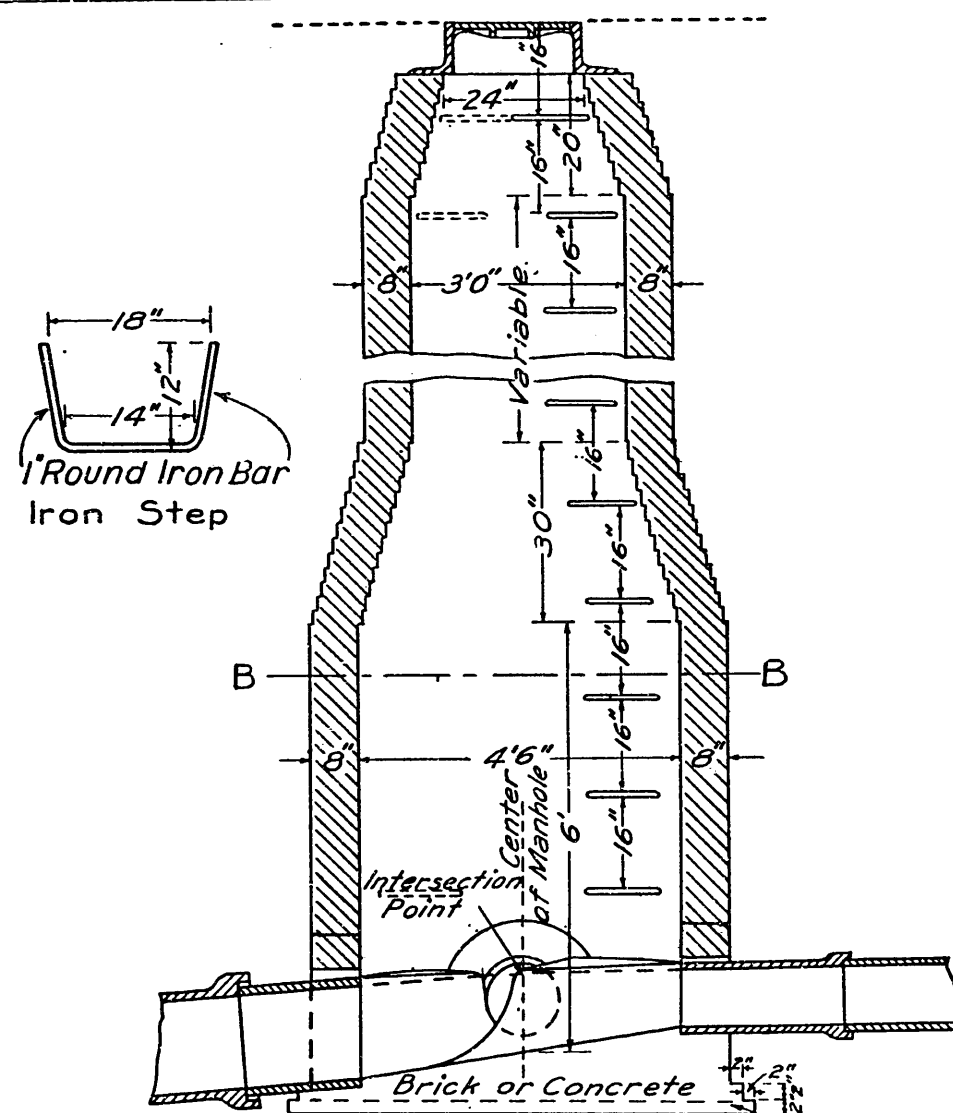
Payment for "Moving Inlets" shall be made at the price bid for each.

### 127. CURB INLETS (For plan, see page 103)

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.

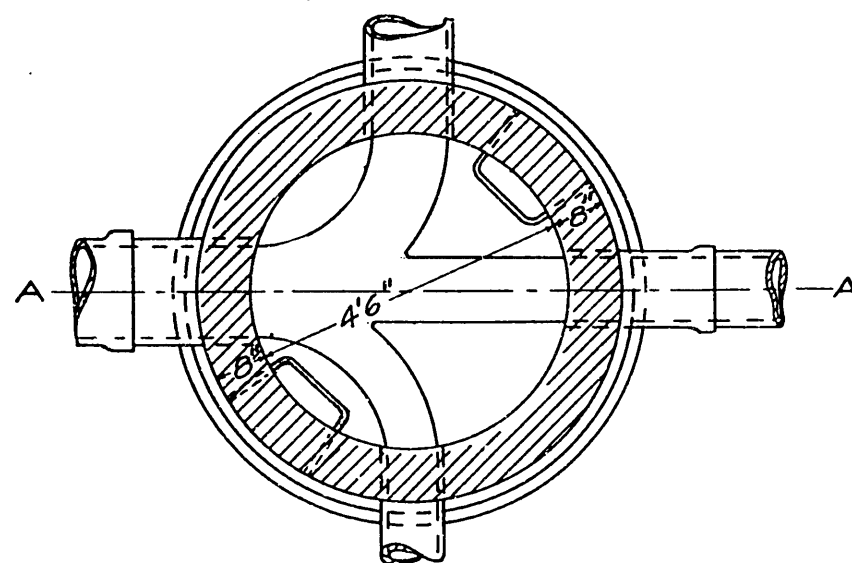
Payment for "Curb Inlets" shall be made at the price bid for each, and shall include all labor and material necessary to complete the work according to specifications.



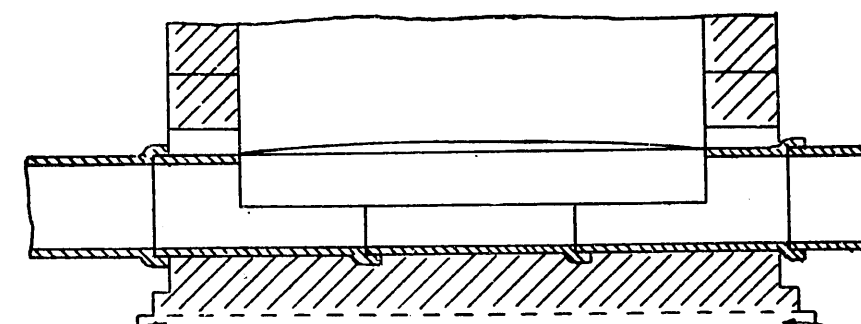
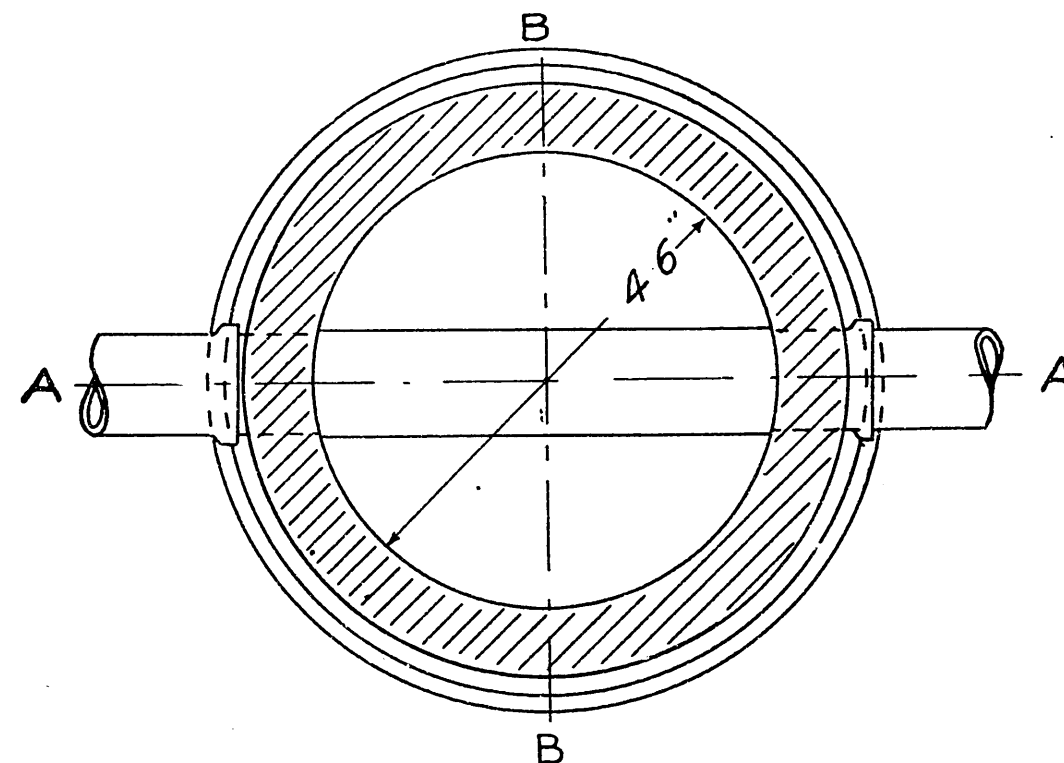


*This portion to be omitted in hard-pan*

Section A-A

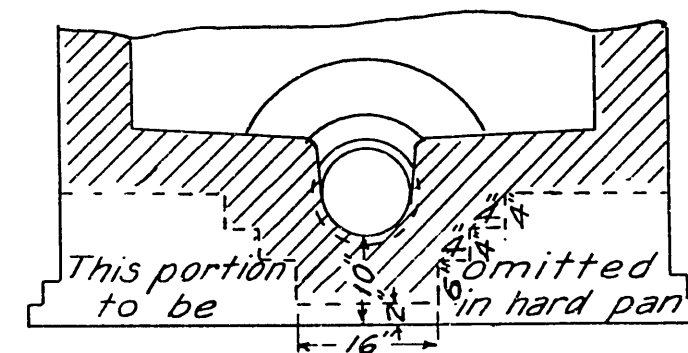


Section B-B  
BRICK MANHOLE



*This portion to be omitted in hard-pan*

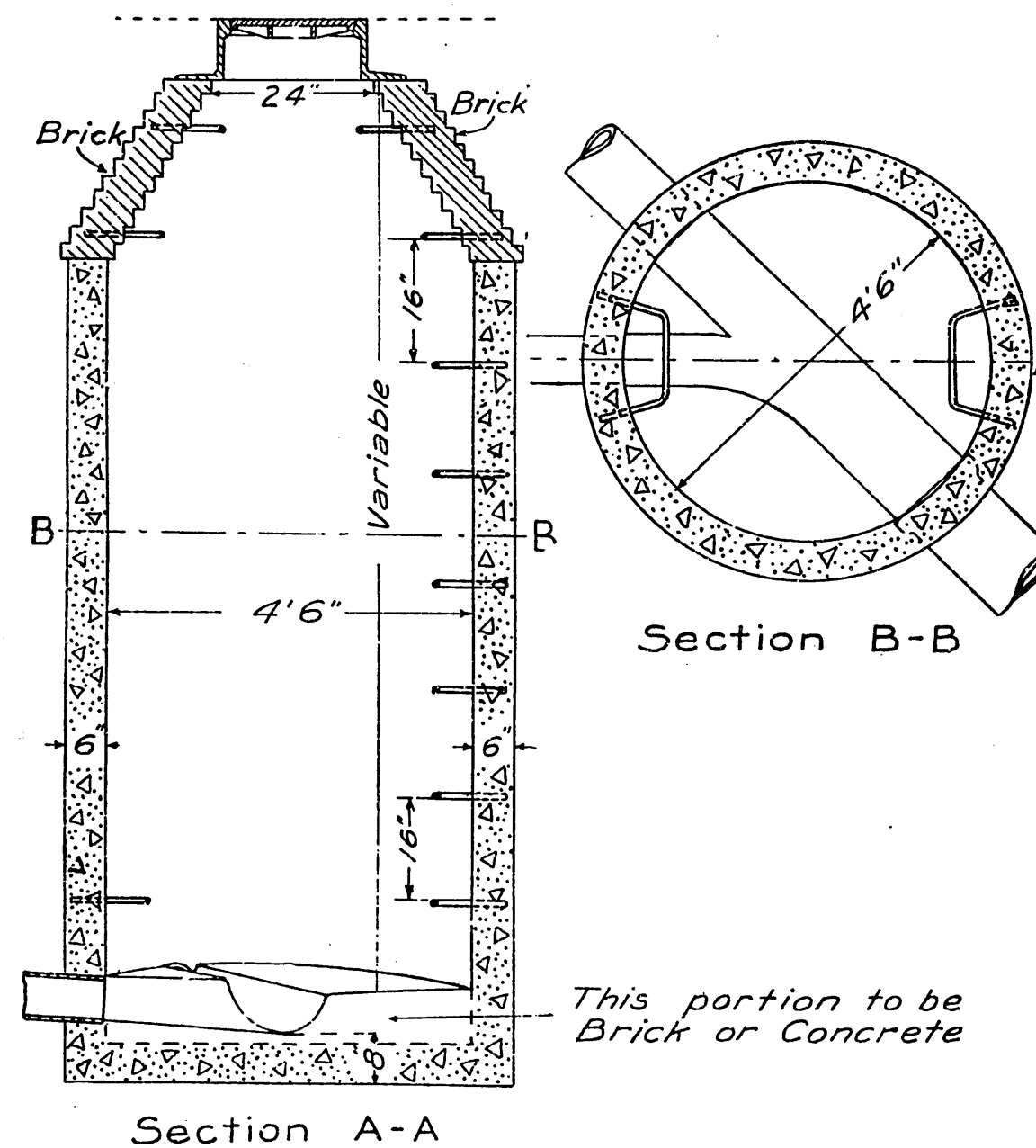
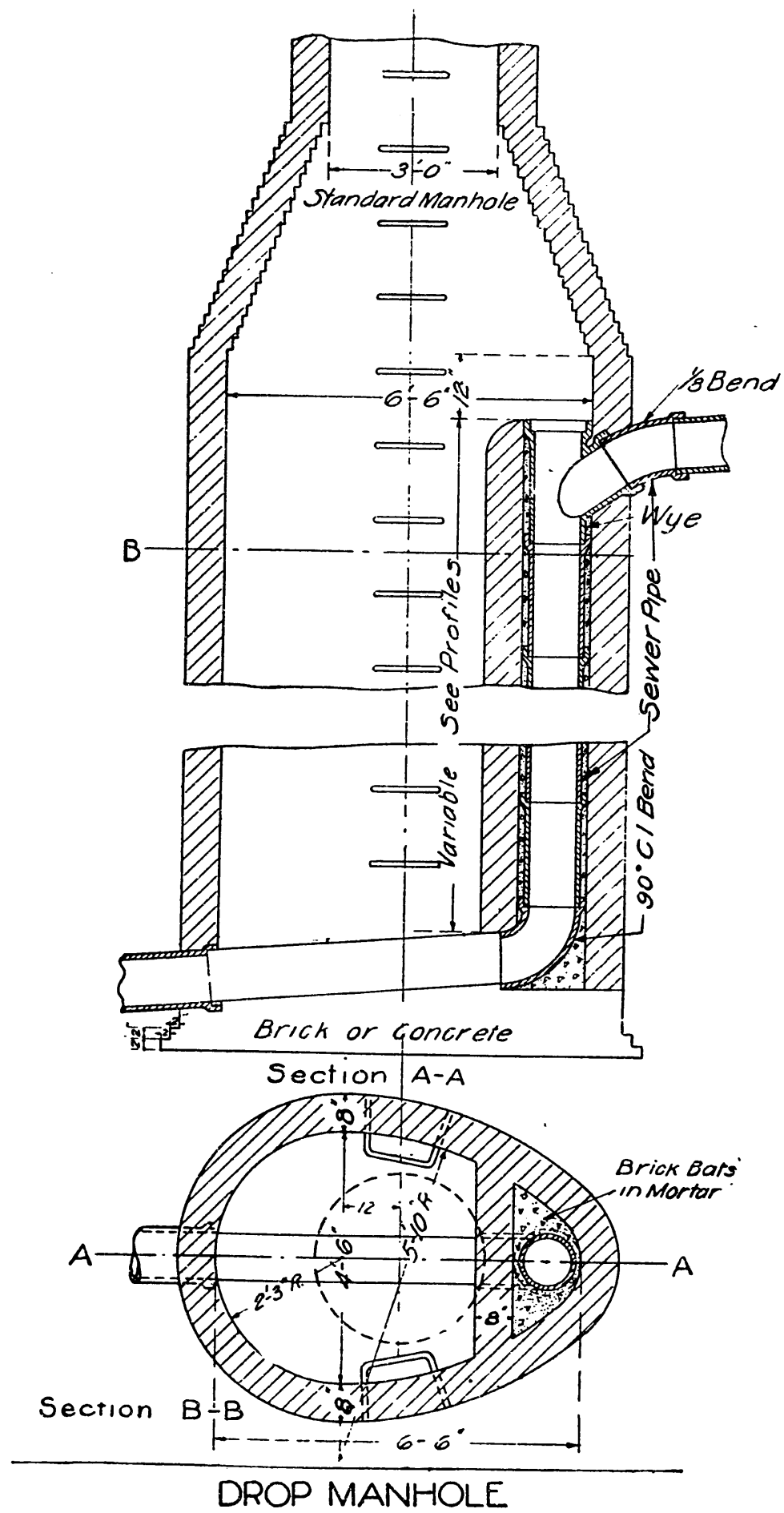
Section A-A



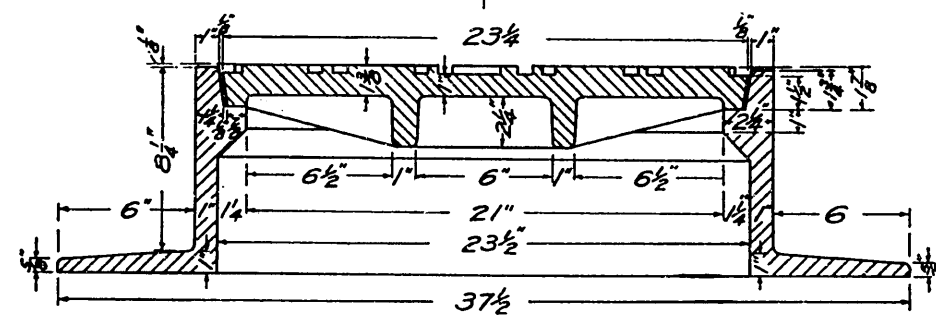
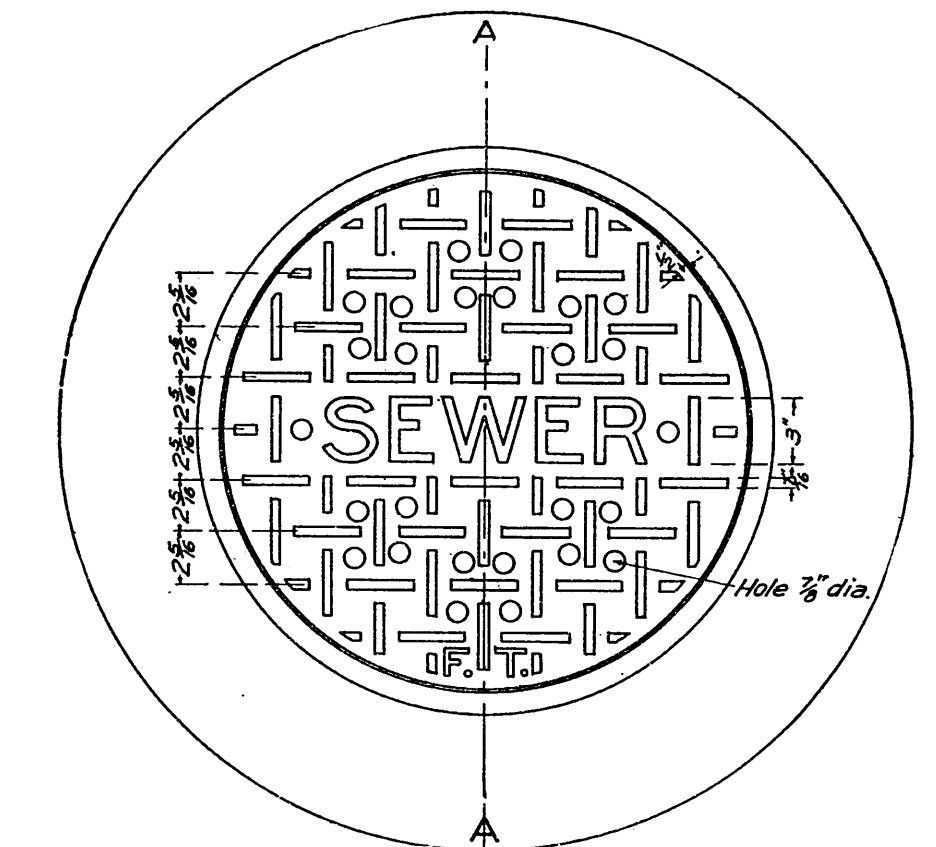
Section B-B

BOTTOM OF MANHOLE  
SHOWING MODIFIED FORM



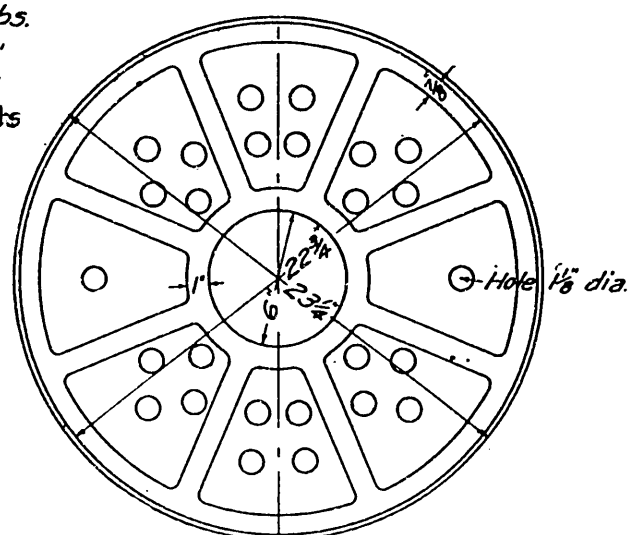




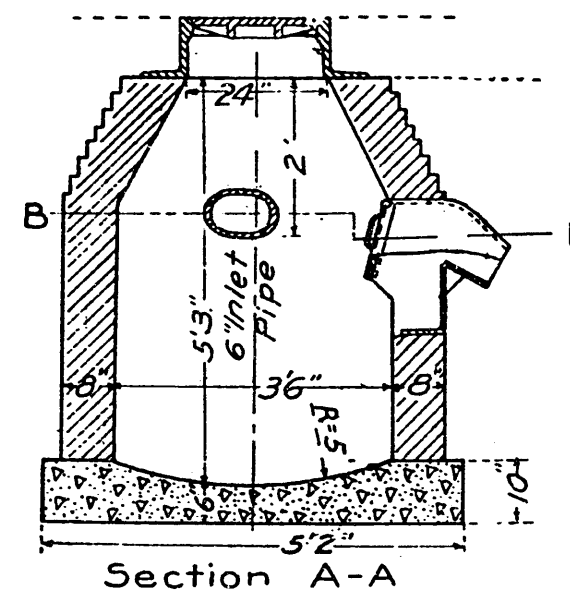


Section A-A

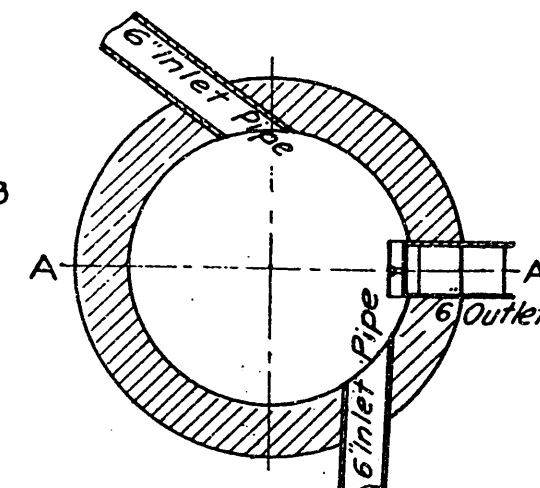
Ring 345 lbs.  
Cover 153 "  
Total 498 "  
Approximate Weights



Bottom View of Cover  
COVER FOR FLUSH TANK

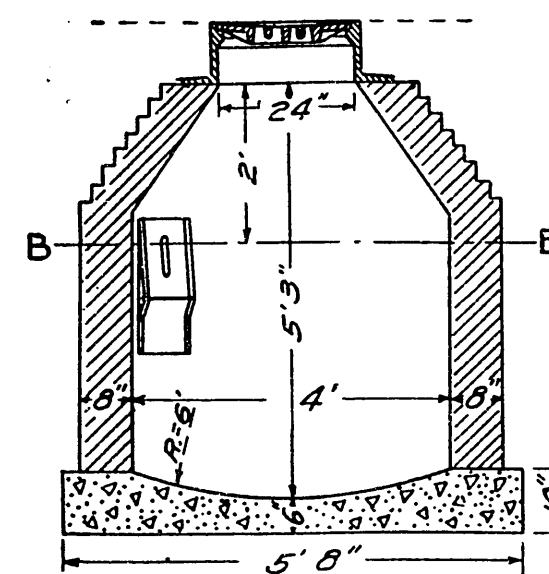


Section A-A

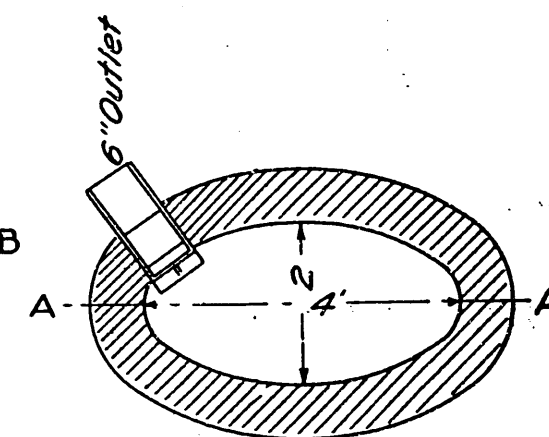


Section B-B

CATCH BASIN

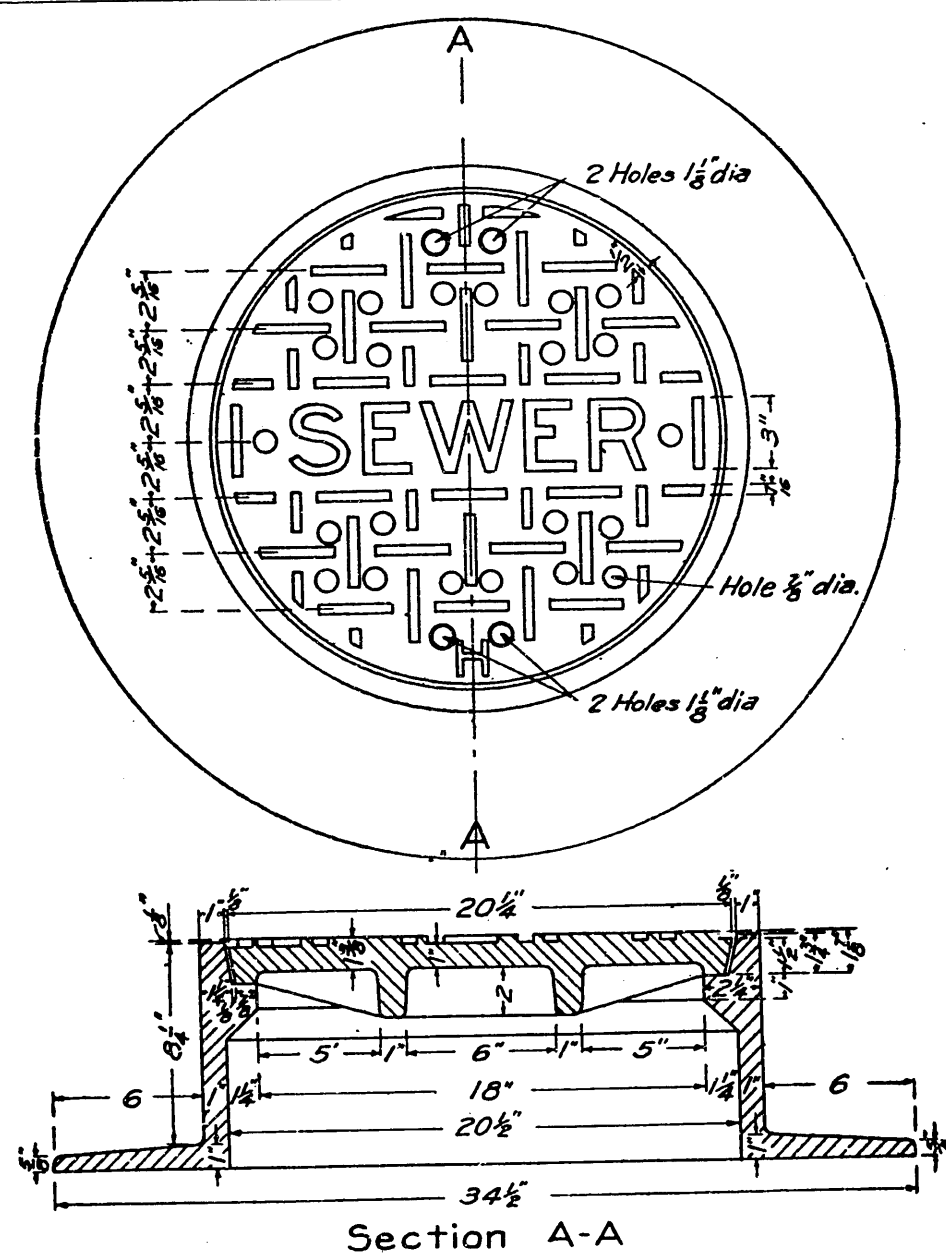


Section A-A

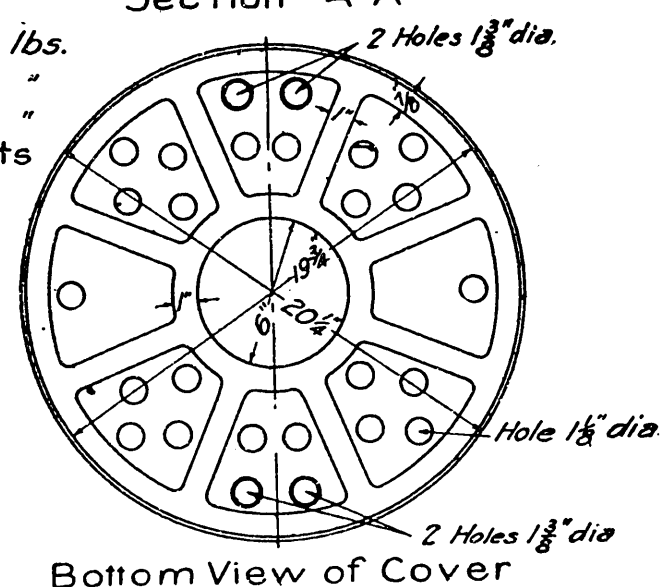


Section B-B

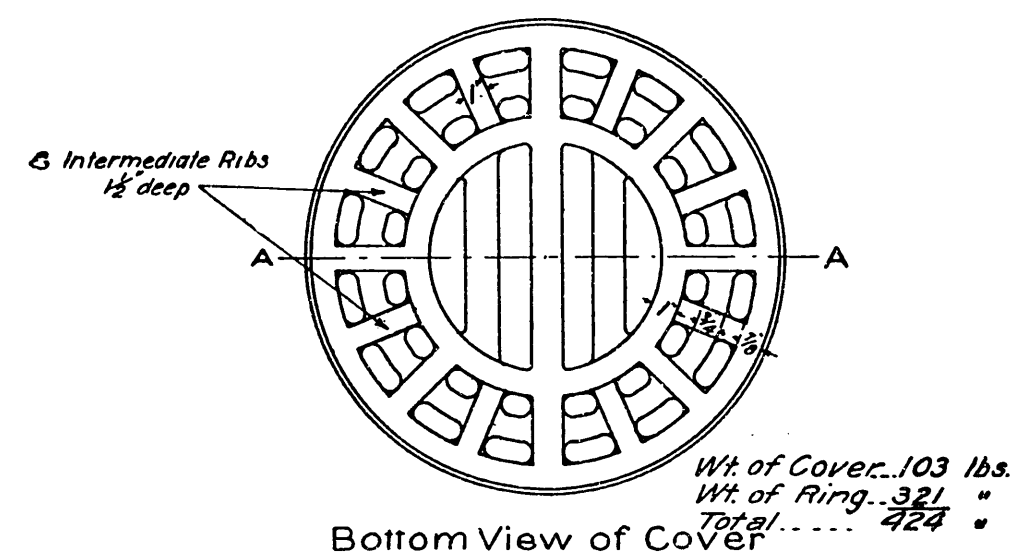
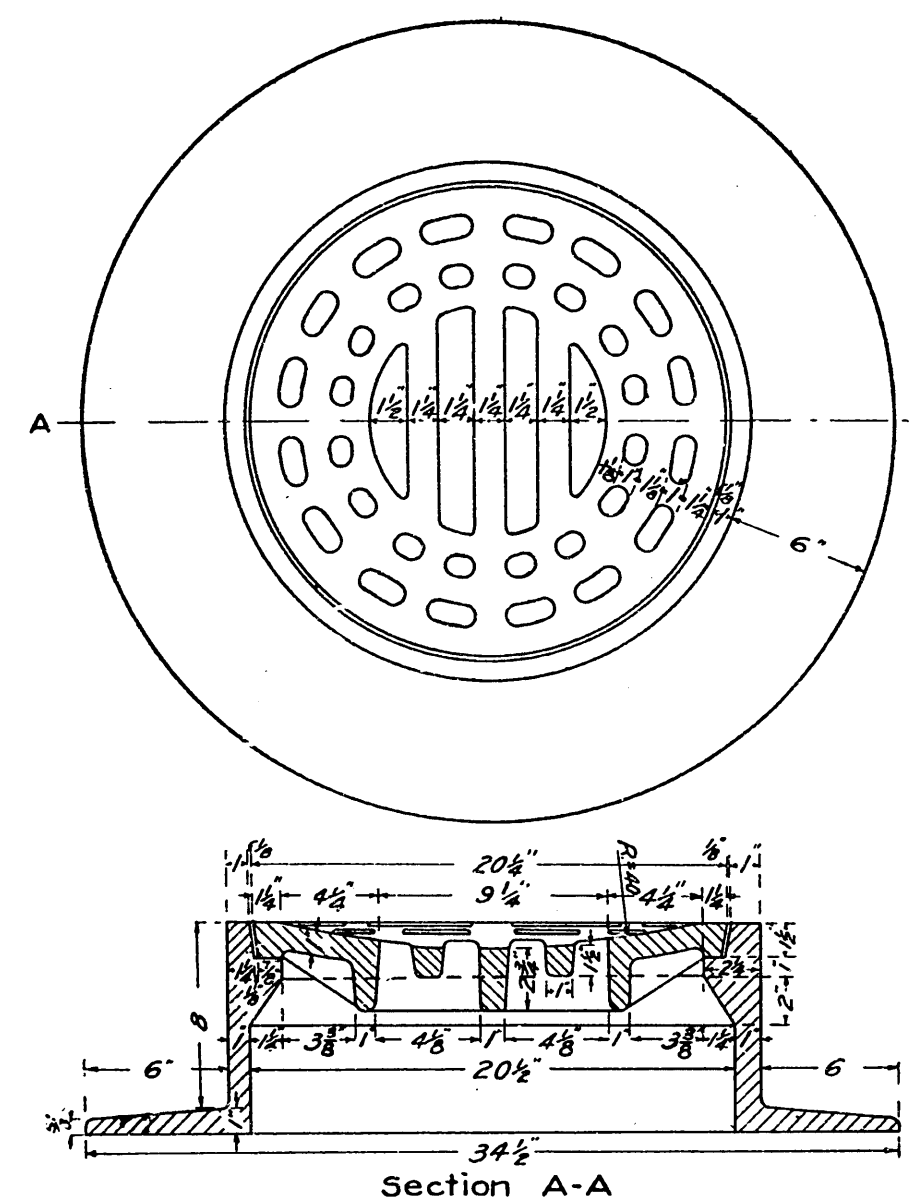
ELLIPTICAL CATCH BASIN



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

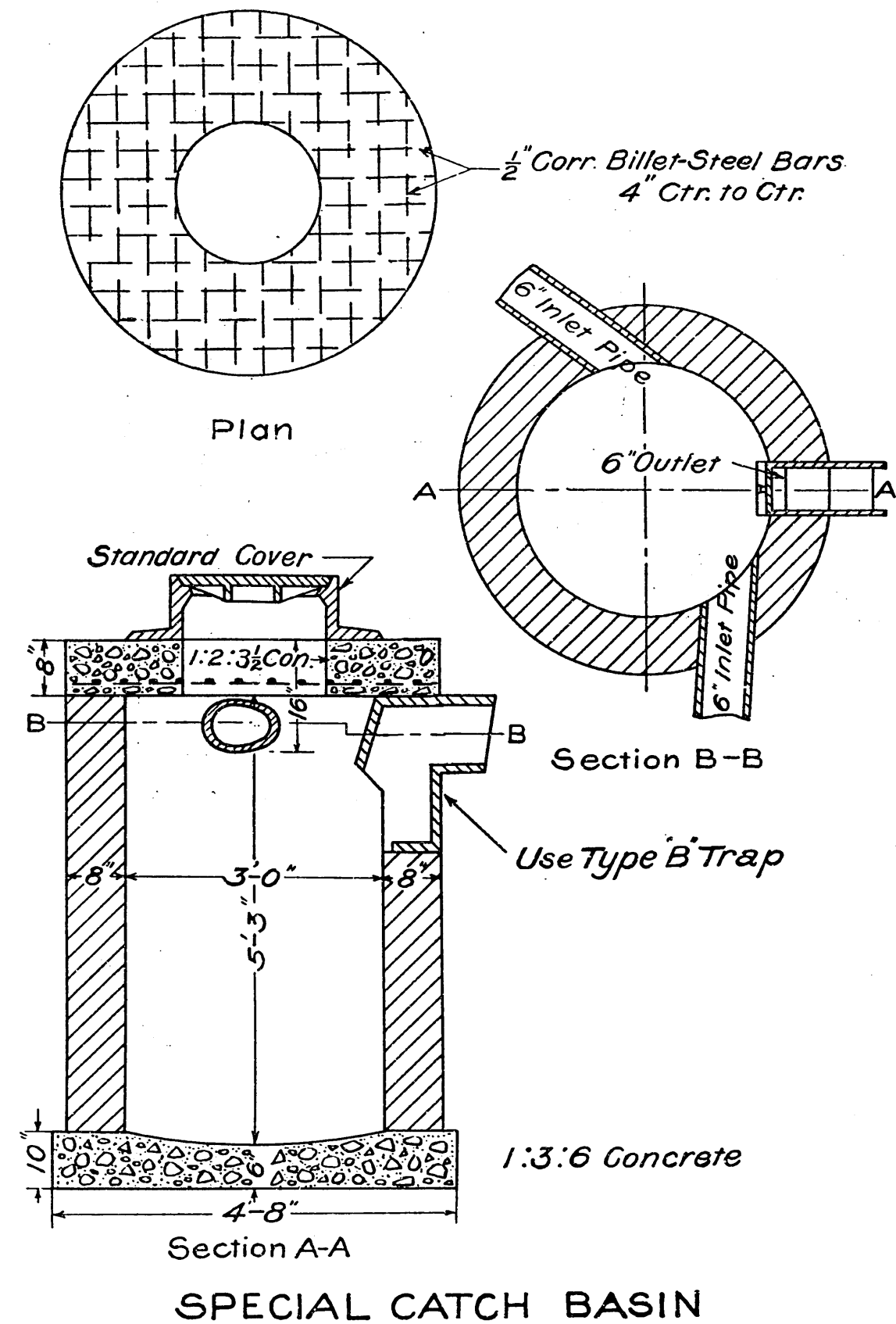
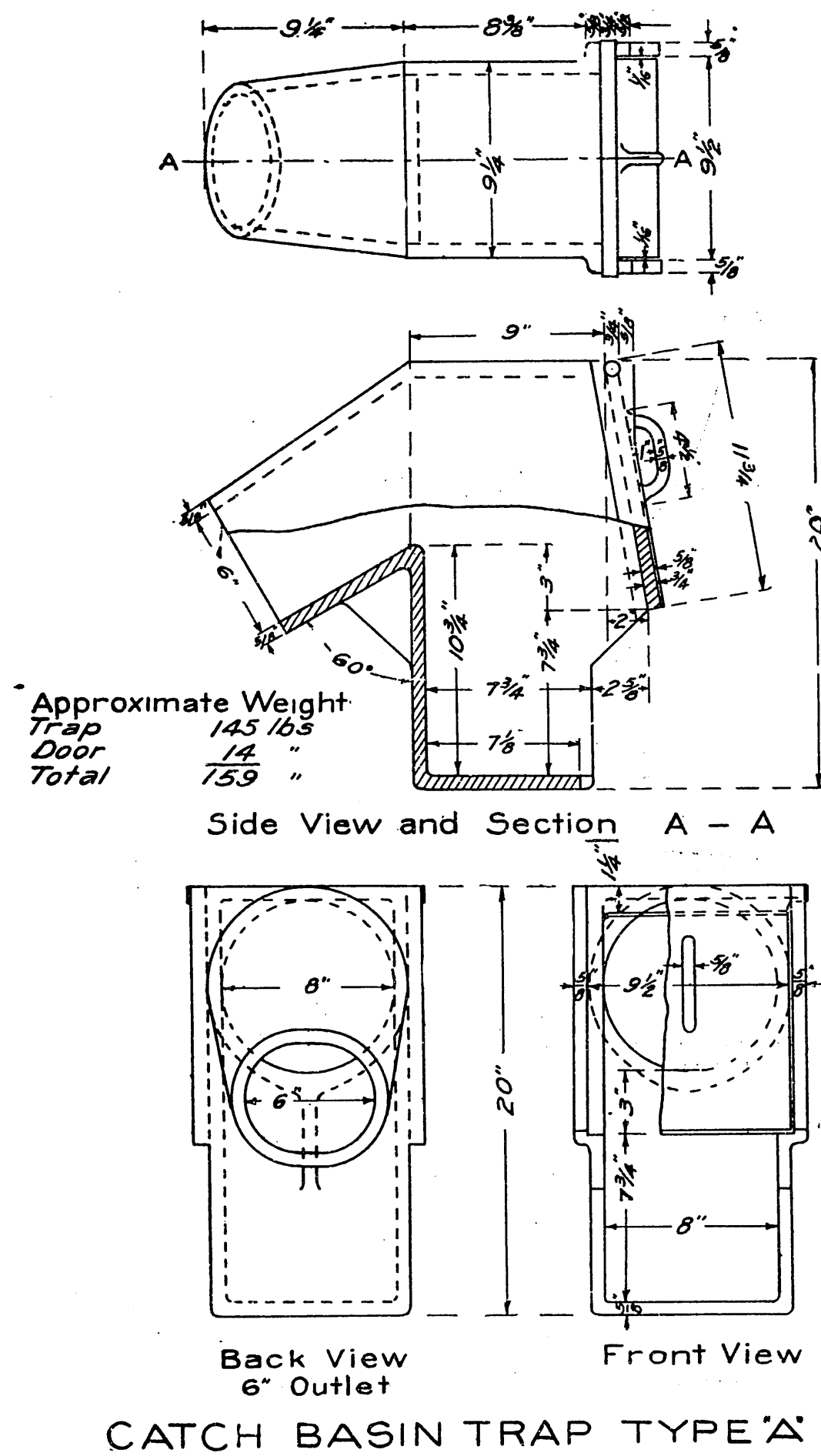


COVER FOR CATCH BASIN &amp; MANHOLE

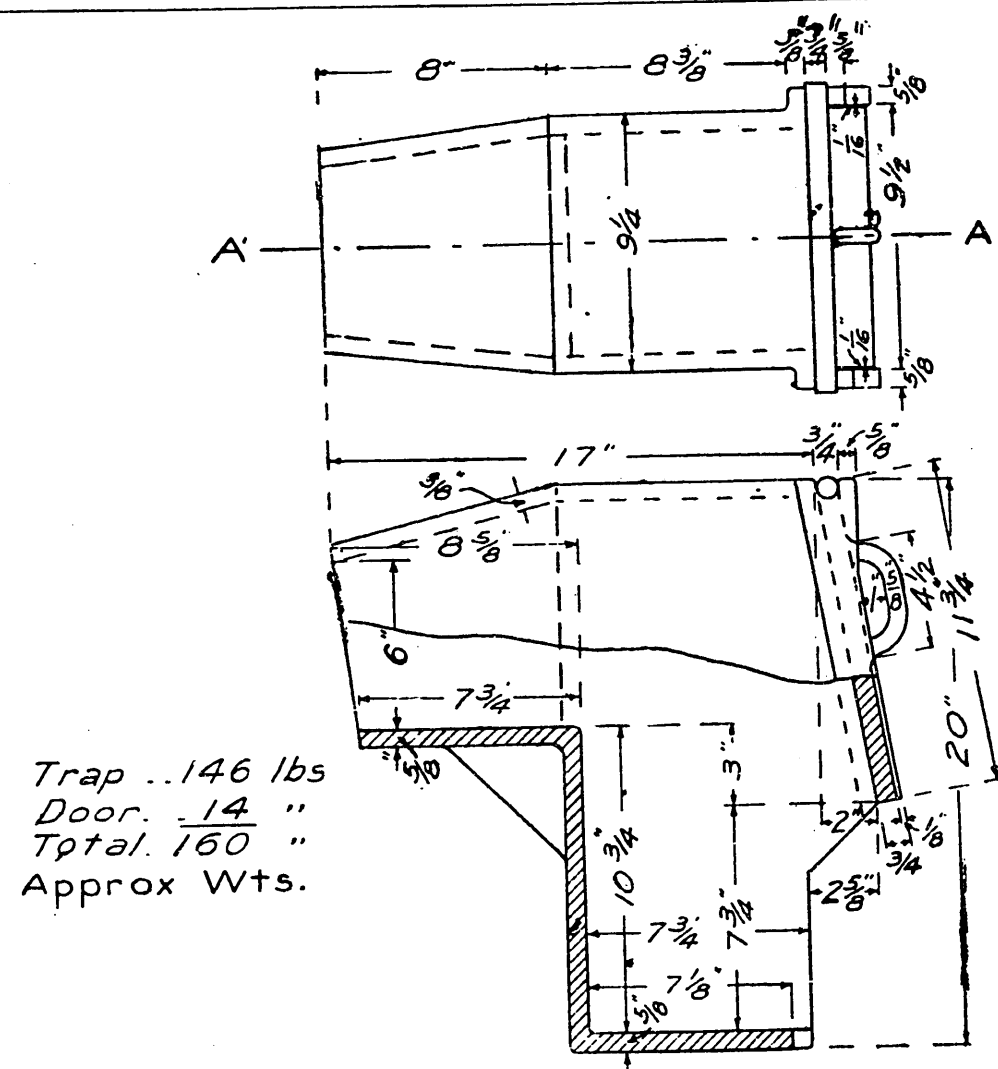


Wt. of Cover 103 lbs.  
 Wt. of Ring 321 "  
 Total 424 "

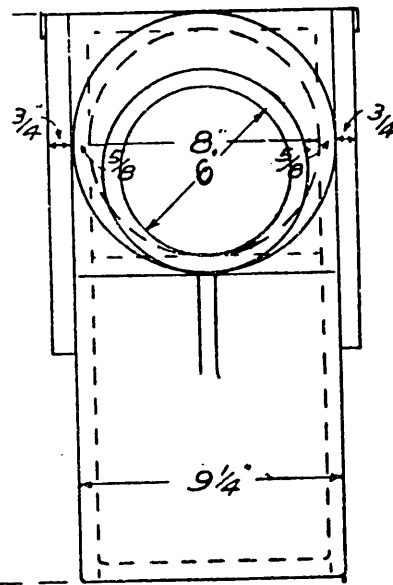
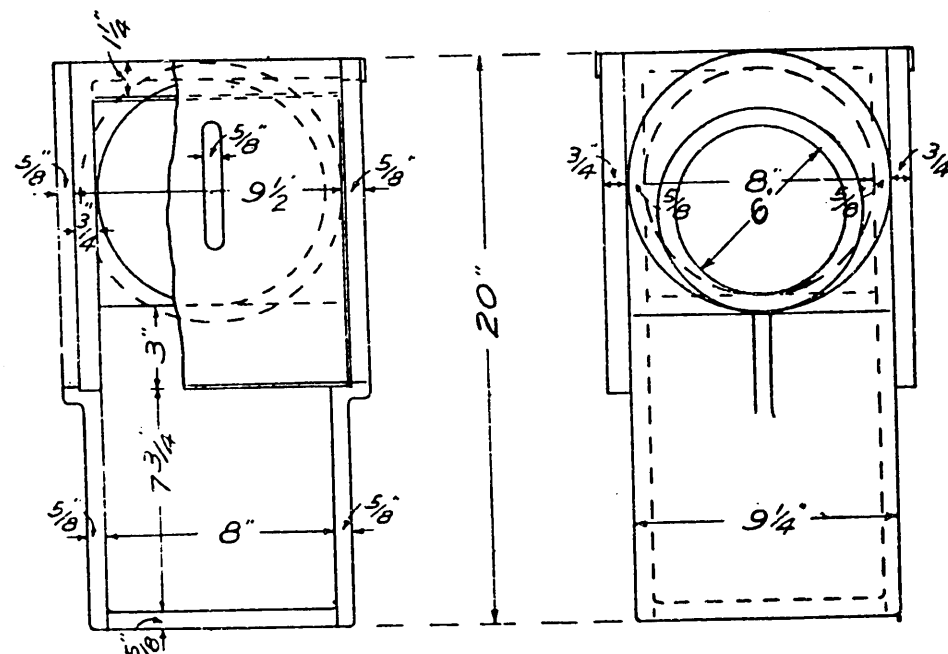
CATCH BASIN COVER - INLET TOP



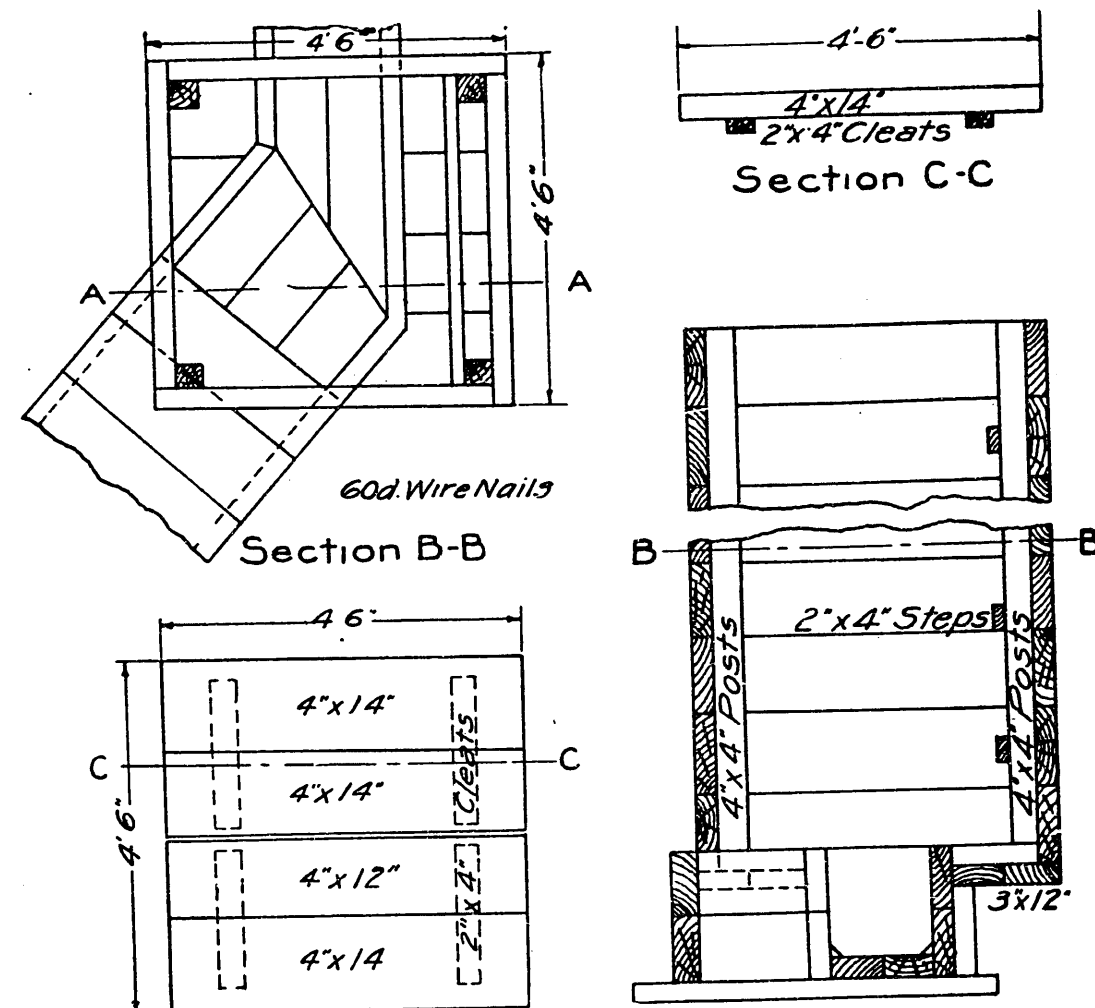




Side View and Section A - A

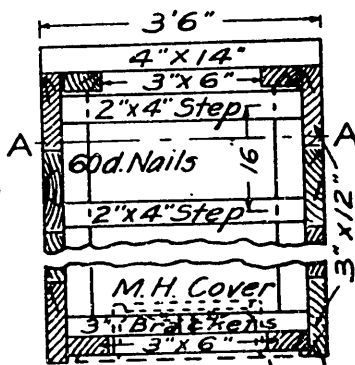
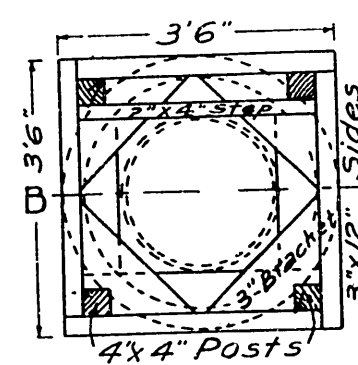
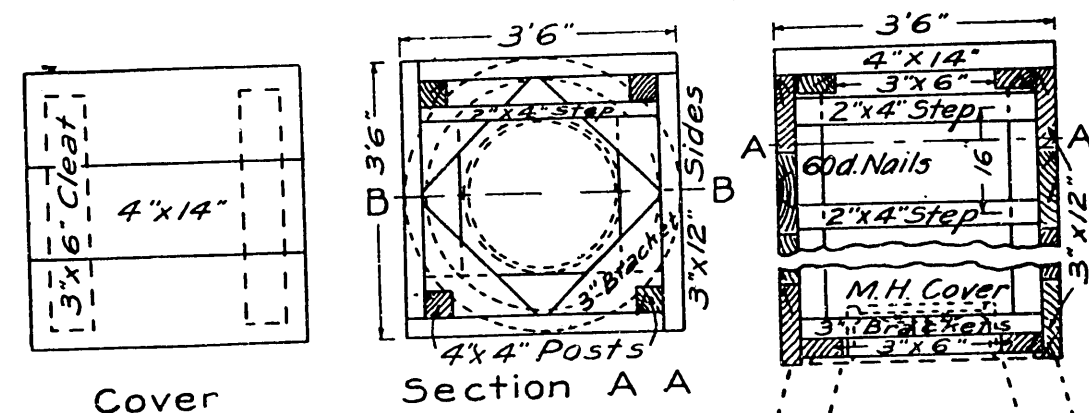


CATCH BASIN TRAP TYPE "B"



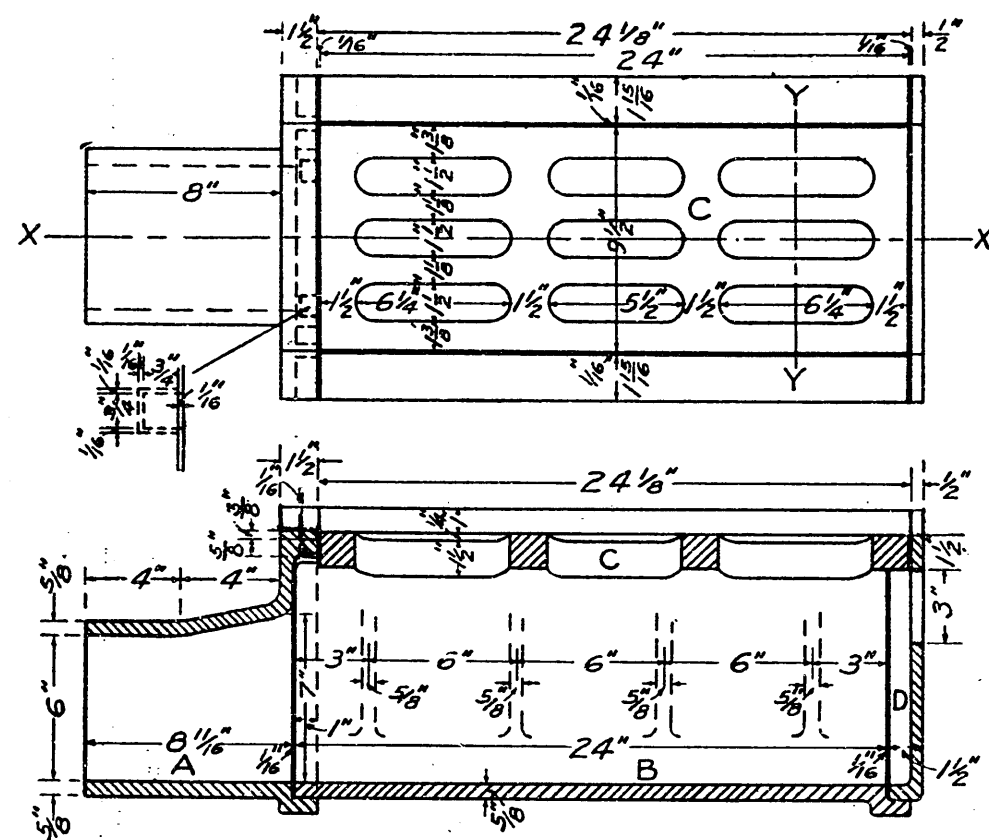
Top View of Cover      Section A-A  
WOOD MANHOLE

WOOD MANHOLE

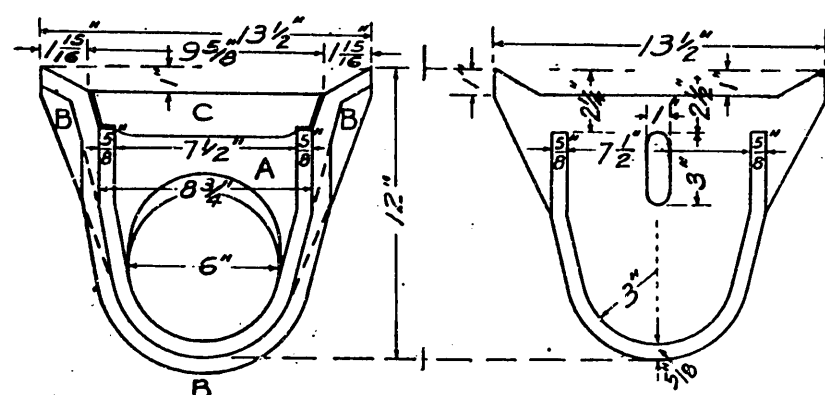


266 ft B.M for 4 depth  
46 " " per foot

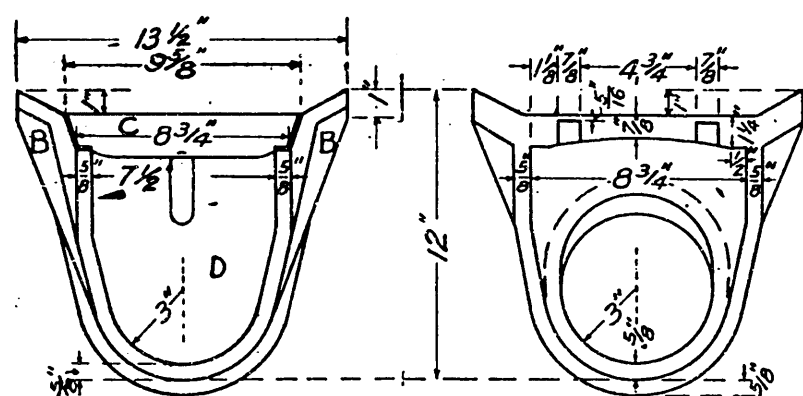
WOOD. EXTENSION TO MANHOLE



Section X-X

End View  
Piece D Removed

Inner View of Piece D

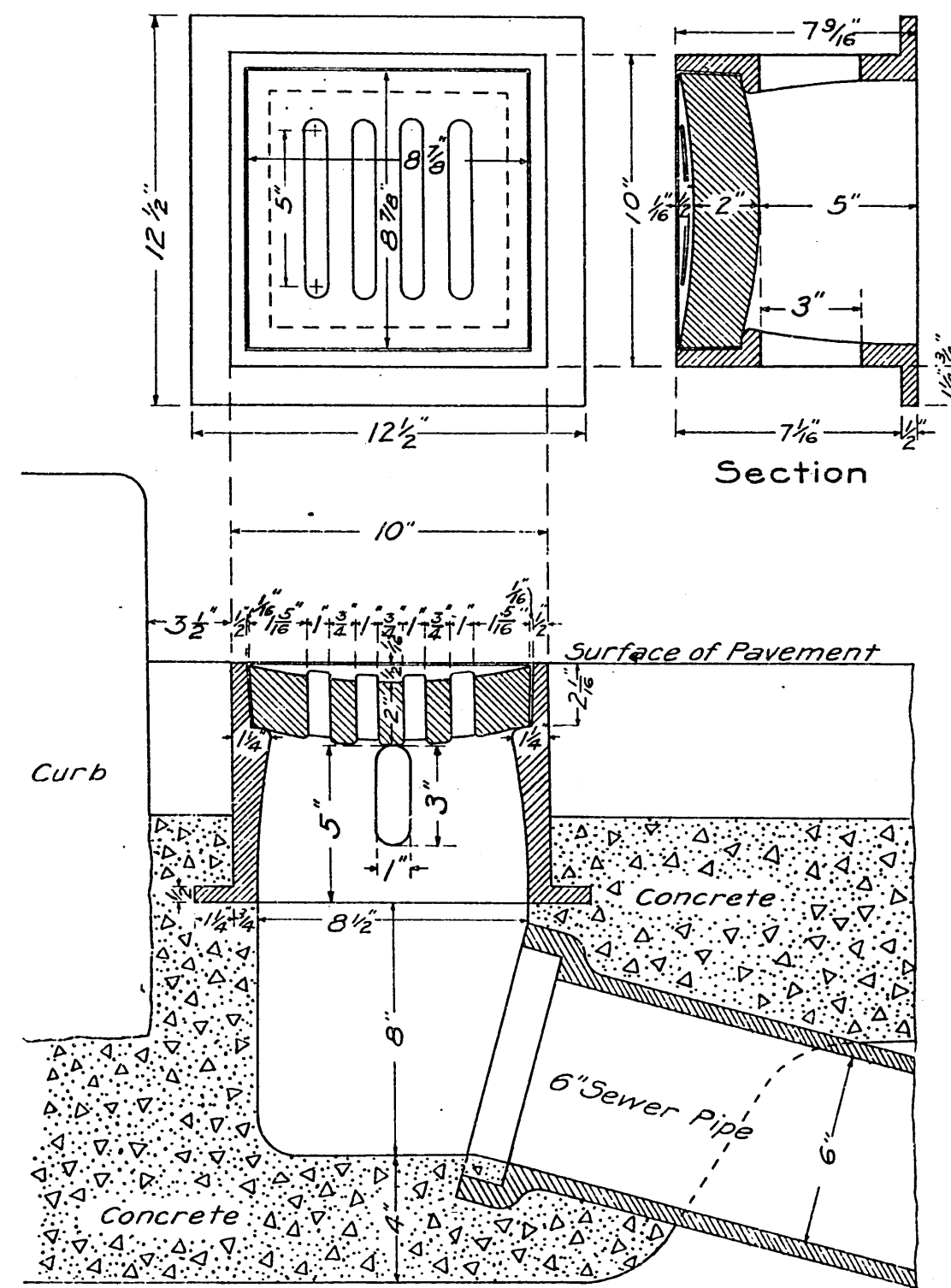
End View  
Piece A Removed

Inner View of Piece A

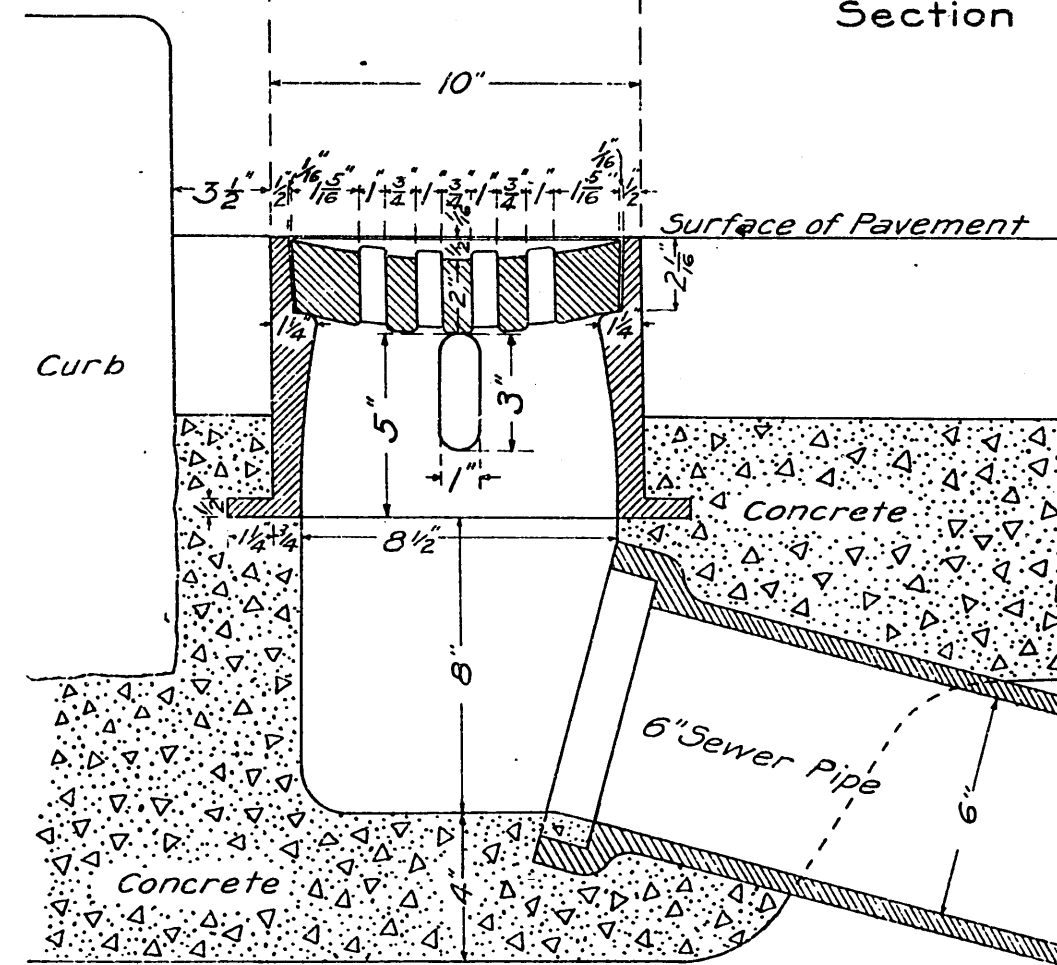
INLET

Piece A... 49 lbs.  
" B... 139 "  
" C... 60 "  
" D... 14 "  
Total... 262 "  
Approx. Wts.

Section of Grate at Y-Y



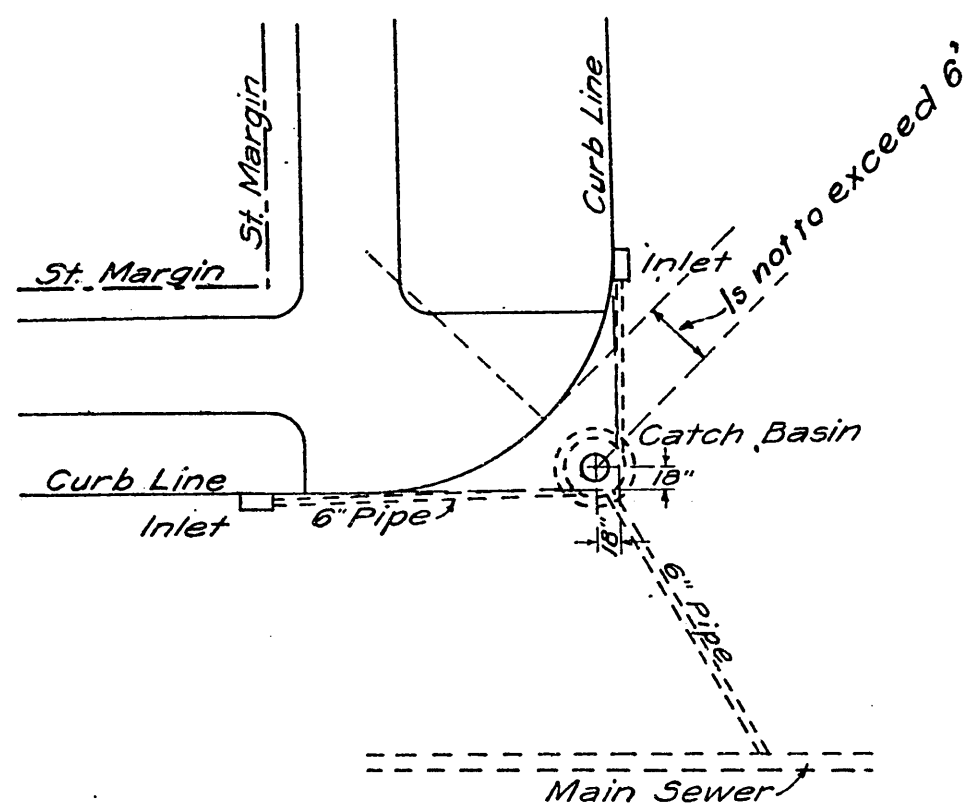
Section



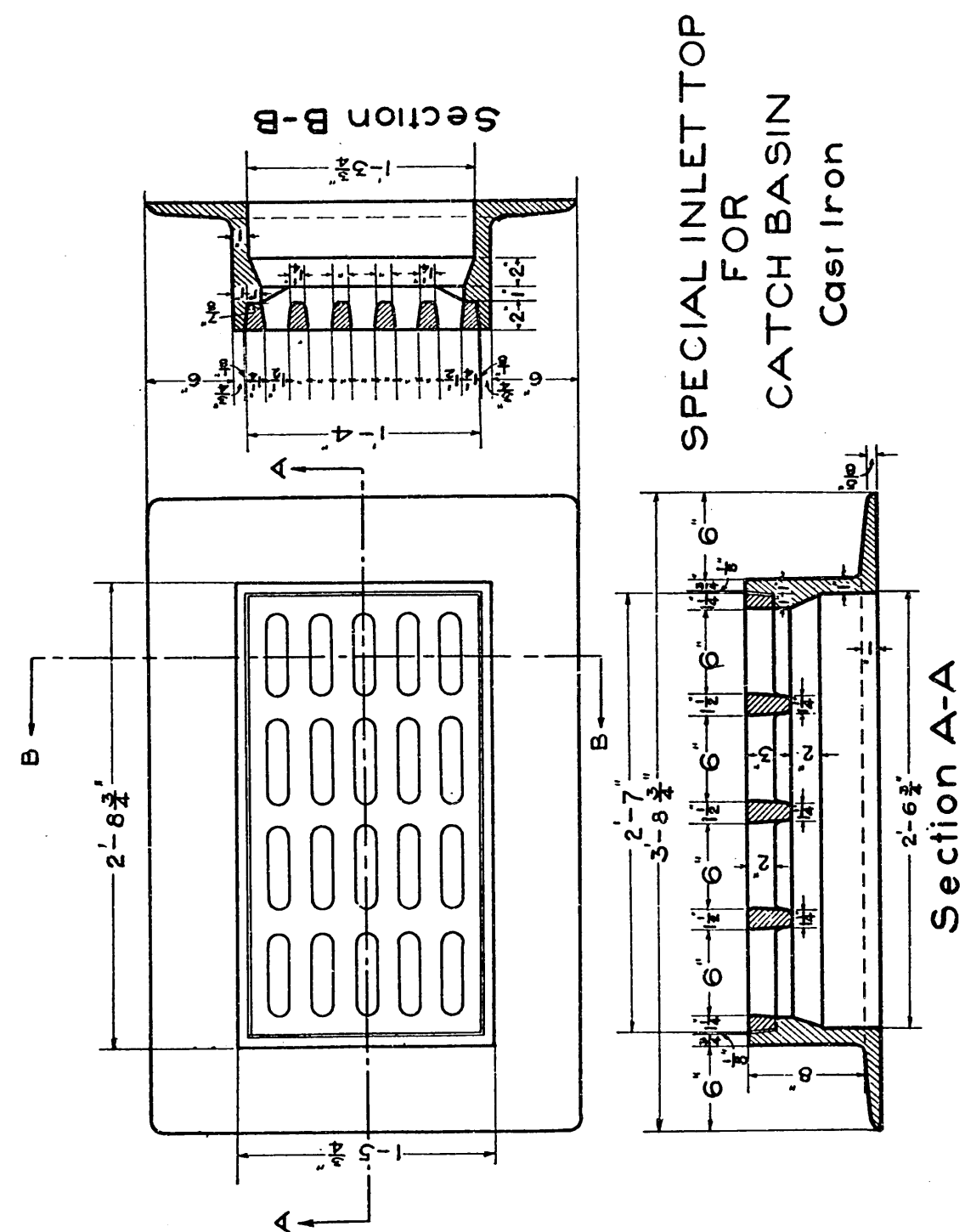
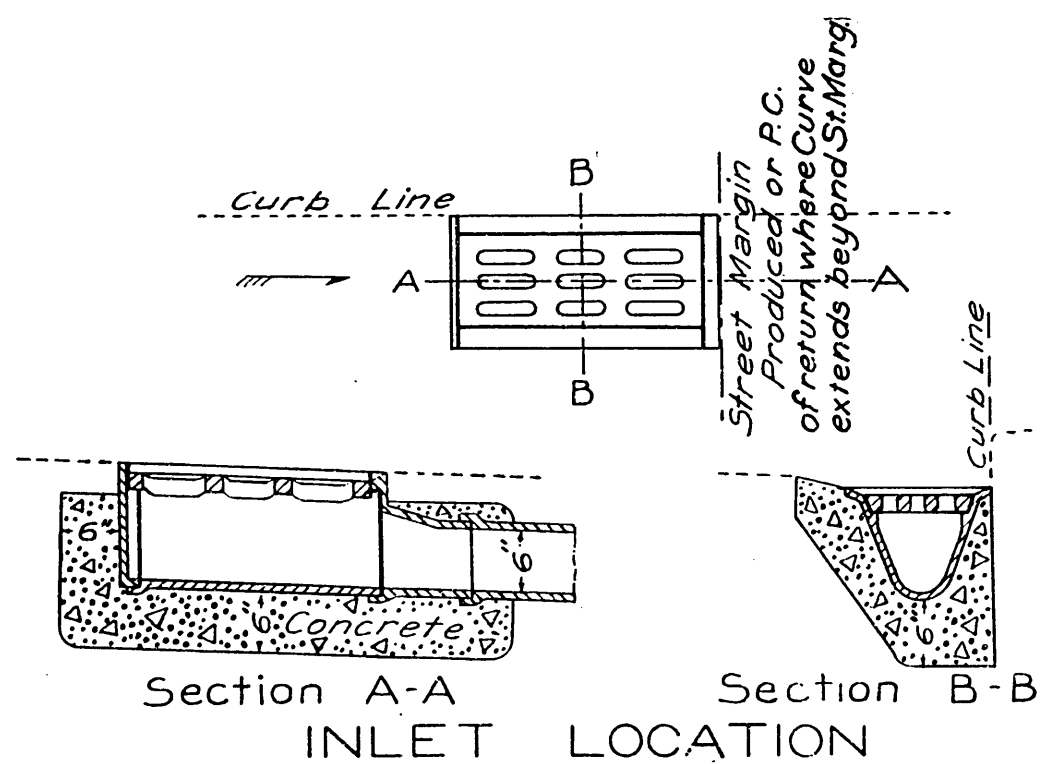
Transverse Section

Approximate Weight  
Cover... 33 lbs.  
Frame... 65 "  
Total... 98 "

CURB INLET



### CATCH BASIN LOCATION



## SPECIFICATIONS FOR WATERMAINS AND APPURTENANCES

### General Stipulations

#### 128. 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 a profile will be furnished and the pipe shall be laid in conformity with the grades shown on the profile. No allowance will be made for extra excavation beyond the price bid per linear foot of pipe in place. The pipe shall conform accurately to the alignment and grades given. Gate valves, hydrants, standard fittings and special castings shall be set as shown on the plan or as directed by the City Engineer.

#### 129. 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. Whenever water occurs in the bottom of the trench it shall be sufficiently drawn off to obtain a firm bed for the pipe, and to admit of proper caulking. The contractor shall bear all expense arising from the draining of the trenches.

Wherever the pipe is to be laid above the existing ground surface, a fill shall be made of proper material and of such dimensions as to be not less than eighteen (18) inches in depth over the top of the pipe, and four (4) feet in width on top of the fill, with proper side slopes. Before laying the pipe the fills shall be properly compacted by tamping or otherwise, as may be directed by the City Engineer. The cost of such filling shall be included in the price bid per linear foot for the pipe complete. Any culverts or box drains which may be necessary through fills shall be con-

structed 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 stumps and parts of stumps that are within four (4) feet of the pipe line shall be entirely removed and burned or otherwise disposed of. Boulders or rocks shall be either entirely removed or cut out to the width of the trench before the watermain is laid, and the cost of such removal of stumps and boulders, and the disposal of the same, 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. 105.

#### 130. EXTRA EXCAVATION

For specifications regarding Extra Excavation, see Section No. 69, under "Grading, Curbing and Appurtenances."

#### 131. 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. It shall be carefully packed and well rammed with the proper tools for the purpose or thoroughly water settled. 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. Where trenches are less than eighteen (18) inches in depth, measured from the top of the pipe to the surface of the ground, a fill shall be made to provide not less than eighteen (18) inches of cover over the top of the pipe, and the cost of such fill shall be included in the price bid per linear foot for the pipe in place.

#### 132. CONNECTIONS TO EXISTING MAINS

All connections to watermain 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.

### 133. 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 or other 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.

### 134. REMOVAL OF OLD PIPE

The contractor shall give proper care and protection during construction to any water pipes or mains in use. As soon as service connections have been taken care of by the Water Department, all the old pipe which may be located within the trench for the new pipe shall be carefully taken up and removed. All excavating, removing of old pipe and backfilling shall be performed by the contractor.

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.

### 135. RESTORING ROADWAY

The contractor shall fill all trenches and other excavations as above specified and remove all surplus earth and debris. He shall shape the roadway to conform to the original cross-section, after which the Department of Streets and Sewers will do such graveling as may be necessary and the cost of such graveling will be paid for as provided in Section 34.

## WATERMAINS

### 136. CAST IRON PIPE

#### (a) SAND CAST PIPE

##### (1) 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 110. 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 length of sand cast pipes shall be 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 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 fittings 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 fittings shall be furnished; Class "B" fittings with Classes "A" and "B" pipes, and Class "D" fittings 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 fittings shall be furnished, one for each class of pipe, and have cast on them the letter of the class to which they belong.



## WATERMAINS

TABLE OF WEIGHTS AND DIMENSIONS OF SAND CAST PIPE

Nominal Inside Diam. of Pipe in Inches	Class	Head in Feet	Thickness of Pipe in Inches	Depth of Lead Joint in Inches	Approx. Wgt. Lead in Lbs. per Joint	Diameter of Sockets		Depth of Sockets		Actual Outside Diam. of Pipe in Inches	Wgt. of Pipe in Lbs. per 12 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
4	B	200	.45	2.25	-----	5.80	5.70	3.50	4.00	5.00	260
4	C	300	.48	2.25	-----	5.80	5.70	3.50	4.00	5.00	280
4	D	400	.52	2.25	-----	5.80	5.70	3.50	4.00	5.00	300
6	A	100	.44	2.25	12.00	7.70	7.80	3.50	4.00	6.90	370
6	B	200	.48	2.25	-----	7.90	7.80	3.50	4.00	7.10	400
6	C	300	.51	2.25	-----	7.90	7.80	3.50	4.00	7.10	430
6	D	400	.55	2.25	-----	7.90	7.80	3.50	4.00	7.10	460
8	A	100	.46	2.25	15.00	9.85	10.00	4.00	4.00	9.05	515
8	B	200	.51	2.25	-----	9.85	10.00	4.00	4.00	9.05	570
8	C	300	.56	2.25	-----	10.10	10.00	4.00	4.00	9.30	625
8	D	400	.60	2.25	-----	10.10	10.00	4.00	4.00	9.30	670
10	A	100	.50	2.25	18.00	11.90	12.10	4.00	4.00	11.10	685
10	B	200	.57	2.25	-----	11.90	12.10	4.00	4.00	11.10	765
10	C	300	.62	2.25	-----	12.20	12.10	4.00	4.00	11.40	850
10	D	400	.60	2.25	-----	12.20	12.10	4.00	4.00	11.40	920
12	A	100	.54	2.25	22.00	14.00	14.20	4.00	4.00	13.20	870
12	B	200	.62	2.25	-----	14.00	14.20	4.00	4.00	13.20	985
12	C	300	.68	2.25	-----	14.30	14.20	4.00	4.00	13.50	1100
12	D	400	.75	2.25	-----	14.30	14.20	4.00	4.00	13.50	1200
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

## (2) Allowable Variations in Diameter of Pipes and Sockets:

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

## (3) Allowable Variation in Thickness:

For pipes whose standard thickness is less than one inch, the thickness of metal in the body of the pipe shall not be more than .08 of an inch 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.

## (4) Defective Spigots May Be Cut:

Defective spigot ends on pipes 12 inch 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.

## (5) Standard Fittings and Special Castings:

All standard fittings and 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 shall not vary from the standard dimensions by more than .12 of an inch for 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 of an inch for 48-inch, 54-inch and 60-inch.

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

(6) **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.

(7) **Table of Flange Drillings:**

Note—These dimensions are good for all pressures up to and including 200 pounds per square inch. Diameters of bolt holes shall be  $\frac{1}{8}$ -inch larger than diameter of bolts. Bolts shall have hexagon nuts and square heads. All flanges shall be plain face and machined.

Diameter of Pipe Inside in Inches	Diameter of Flange in Inches	Thickness of Flange in Inches	Diameter of Bolt Circle in Inches	Number of Bolts	Diameter of Bolts in Inches	Length of Bolts in Inches
4	9	15/16	7 1/2	8	5/8	2 3/4
5	10	15/16	8 1/2	8	3/4	3
6	11	1	9 1/2	8	3/4	3
8	13 1/2	1 1/8	11 3/4	8	3/4	3 1/4
10	16	1 3/16	14 1/4	12	7/8	3 1/2
12	19	1 1/4	17	12	7/8	3 3/4
16	23 1/2	1 7/16	21 1/4	16	1	4 1/4
20	27 1/2	1 11/16	25	20	1 1/8	5
24	32	1 7/8	29 1/2	20	1 1/4	5 1/2
30	38 3/4	2 1/8	36	28	1 3/8	6 1/4
32	4 3/4	2 3/8	38 1/2	28	1 1/2	6 1/2
36	46	2 3/4	43 3/4	32	1 1/2	6 1/2
42	53	2 5/8	49 1/2	36	1 5/8	7 1/2

Payment for standard fittings shall be made as noted under payment for cast iron pipe. In case any castings are required which are not included in the original bill of material, they shall be paid for as bid per pound in place for special castings.

Special Castings shall include any cast iron special fittings required for this improvement or any standard fittings which are necessary and ordered by the City Engineer but which are not included in the plans and specifications.

Payment for "Special Castings" shall be made at the price bid per pound in place. In case of flanged special castings, such payments shall include compensation for all necessary gaskets, bolts and machine work.

(8) **Marking:**

Every pipe and 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  $\frac{1}{8}$  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 casting after the coating has become hard.

(9) **Allowable Percentage of Variation in Weight:**

Pipe will 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.

Standard fittings or special castings will not be accepted which fall below the specified weight by more than 10 per cent for castings 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 percentages for the several sizes shall be paid for.

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

(10) **Quality of Iron:**

All pipes, standard fittings, 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 to admit of satisfactory 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.

(11) **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.

(12) **Casting of Pipe**

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

(13) **Quality of Castings:**

The pipes and 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.

**(14) Cleaning and Inspection:**

All pipes and 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.

**(15) Coating:**

Every pipe and 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 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.

**(16) 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		Less than 20-inch Diameter	
Pounds per square inch		Pounds per square inch	
Class A Pipe.....	150.....	.....	300
Class B Pipe.....	200.....	.....	300
Class C Pipe.....	250.....	.....	300
Class D Pipe.....	300.....	.....	300

**(b) CENTRIFUGALLY CAST PIPE**

**(1) Description of Pipe:**

The pipe shall be centrifugally cast iron and of the bell and spigot type joint. They shall be straight and true circles in section, with their inner and outer surfaces concentric and as cast shall be at least twelve (12) feet in laying length, exclusive of the bell. All pipes shall accurately conform to the dimensions given in the following table.

**DIMENSIONS OF CENTRIFUGALLY CAST PIPE**

Nominal Inside Diameter of Pipe in Inches	Class	Thickness of Pipe in Inches	Weight of 12-Ft. Length
4	50	.26	161
4	150	.31	186
4	250	.35	206
6	50	.30	266
6	150	.35	303
6	250	.39	331
8	50	.31	368
8	150	.38	436
8	250	.46	511
10	50	.34	489
10	150	.42	586
10	250	.51	694
12	50	.37	629
12	150	.46	759
12	250	.55	889
14	50	.44	839
14	100	.50	921
14	150	.55	1055
14	200	.62	1174
16	50	.45	987
16	100	.52	1122
16	150	.60	1314
16	200	.66	1431
18	50	.48	1180
18	100	.56	1354
18	150	.64	1574
18	200	.71	1727
20	50	.50	1367
20	100	.59	1584
20	150	.69	1887
20	200	.76	2058

No pipe will be accepted which falls below the above specified weights by more than 5 per cent for 4 inch to 16 inch sizes, or by more than 4 per cent for larger sizes.

**(2) Allowable Variation in Diameter of Pipes and Sockets:**

All bells shall be tested by circular gauges. No pipe will be received which is defective in joint room, or which varies from

the standard dimensions in the inside diameter of the bells more than .06 of an inch for pipe of a nominal inside diameter of 6" to 12" inclusive.

**(3) Allowable Variation in Thickness:**

The variations allowed above or below the standard thickness as given in the accompanying table shall not be greater than:

.045 of an inch for 4" or 6" diameter
.05 of an inch for 8" diameter
.055 of an inch for 10" diameter
.06 of an inch for 12" diameter
.08 of an inch for larger sizes

**(4) Allowable Variation in Length:**

Not to exceed ten (10%) per cent of the pipe may be cut to have a laying length of not less than eleven (11) feet.

**(5) Marking:**

Each pipe shall have marked upon it, with white paint, or by a label pasted on it, the maker's mark or name, the weight, and the words "Centrifugally Cast," or an equivalent mark which will identify the type of pipe and the class to which it belongs.

There shall be cast, or painted on the outside of the body of the pipe with white paint, the year in which it was cast, and a number signifying the order in point of time in which the pipe was cast.

**(6) Quality of Iron:**

All pipes shall be made of iron of good quality. The metal shall be made without any admixture of cinder iron or other inferior metal, and shall be re-melted in a cupola or air furnace before casting into the pipe.

**(7) Tests of Material:**

Out of each day's cast tensile bars shall be cut from the wall at the spigot end of the pipe after the pipe has been annealed and shall be tested for tensile strength, and shall show a breaking point of not less than 30,000 pounds per square inch.

The City Engineer shall have the right to make and break three bars from the pipe and the tests shall be based on the average result of the three bars.

**(8) Tests of Pipe:**

All pipe after a general inspection shall be subject to a water pressure test for the various classes as follows:

Class 50.....	100 lbs.
Class 100.....	200 lbs.
Class 150.....	300 lbs.
Class 200.....	400 lbs.
Class 250.....	500 lbs.

While under pressure all pipe shall be subjected to a hammer test and any pipe showing defects by leaking, sweating, or otherwise, will be rejected.

**(9) Casting of Pipe:**

All pipe shall be cast centrifugally in machines in accordance with an approved process and, after being withdrawn from said machines, all pipe shall be subjected to such heat in an annealing furnace as shall make the metal in the pipe strong, tough and soft enough to satisfactorily admit of drilling and cutting.

The pipe shall be tested for hardness by a Brinnell portable testing machine, and shall not show hardness above 224 on such machine.

**(10) Coating:**

Every pipe shall be coated as specified for sand cast pipe.

**(11) Standard Fittings and Special Castings:**

All "Standard Fittings and Special Castings" for use with centrifugally cast pipe shall conform to the specifications for like castings for use with "Sand Cast Pipe."

**(12) Joints:**

The depth of joints, and the approximate amount of lead per joint, for various sizes of centrifugally cast pipe shall conform to the dimensions and weights shown in the table for "Sand Cast Pipe," page 110.

**(c) MANUFACTURER RESPONSIBLE FOR SHOP TESTS**

Whenever for any reason, the City of Seattle does not have an inspector at the foundry where cast iron pipe for any contract under these specifications is being manufactured, the contractor shall furnish all tools and machines necessary and make all shop tests herein specified for the class of pipe being manufactured; and he shall, when requested, furnish the City Engineer with a sworn statement that such tests have been made together with the results of the same.

**(d) WEIGHING**

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

**(e) 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.

**(f) LEAD**

Lead shall conform to the specifications for "Lead," Section 52.







## WATERMAIN APPURTENANCES

### 137. 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 and one-half (2½) 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.

### 138. 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, and

having a tensile strength of not less than 50,000 pounds per square inch. All valves shall 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 twelve (12) inches shall be provided with a bevel gear and with by-pass. Sixteen (16), eighteen (18), and twenty (20) inch valves shall have three (3) inch by-pass; twenty-four (24) and thirty (30) inch valves shall have four (4) inch by-pass; thirty-six (36) and forty-two (42) inch valves shall have six (6) inch by-pass; and forty-eight (48) inch valves shall have eight (8) inch by-pass.

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.

### 139. 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.

### 140. BRICK VALVE CHAMBERS

(For plan, see pages 128 to 132)

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 1:3:6 proportion by volume. The concrete to be used in the reinforced concrete top of large chambers shall be of 1:2:3½ proportion by volume. The contractor may substitute monolithic concrete for brick in the walls or large chambers, in which case the proportion of concrete shall be 1:2½:5.

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."

Payment for the four (4) inch Valve Chamber Drain, and the connection of the same to the sewer, will be made at the price bid per linear foot for "4-inch Valve Chamber Drain."

#### 141. 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.

#### 142. WOOD VALVE BOXES (For plan, see page 133)

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.

#### 143. HYDRANTS (For plans, see pages 134-141)

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 will 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.

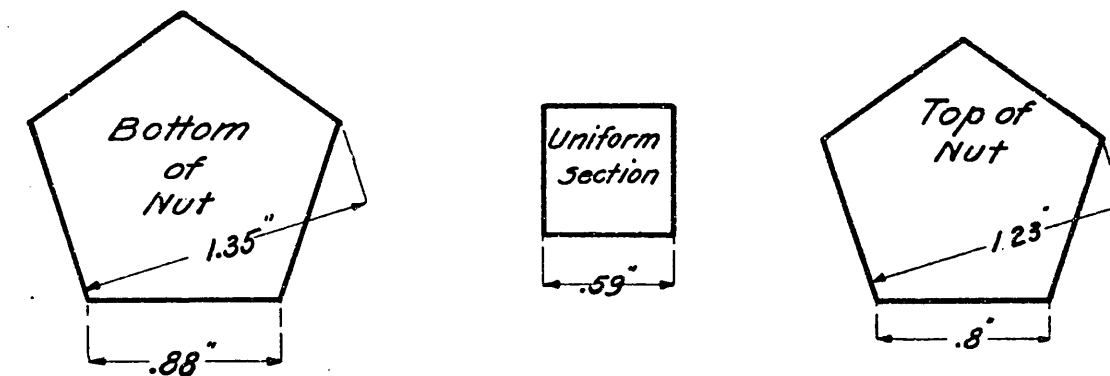
When hydrants cannot be connected to drains at the time of setting, the threaded waste orifice shall be so placed on the hydrant barrel that future connection can be made without disturbing the hydrant. If screw nipples or other fittings are necessary to accomplish this end, no extra payment shall be 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.....	6 $\frac{7}{8}$ inches	8 inches
Length of hydrant from bottom of hydrant connection to sidewalk ring:		
For pipe lines 6 and 8 inches diameter.....	3 $\frac{1}{2}$ feet	3 $\frac{1}{2}$ feet
10 inches diameter .....	4 feet	4 feet
12 inches diameter .....	4 $\frac{1}{2}$ feet	4 $\frac{1}{2}$ feet
16 and 20 inches diameter.....	4 feet	4 feet
24 and 30 inches diameter .....	4 $\frac{1}{2}$ feet	4 $\frac{1}{2}$ feet
Valve opening—minimum diameter .....	5 inches	6 $\frac{1}{4}$ inches
Size of Auxiliary Gate Valve.....	6 inches	8 inches
Hose Nozzle, number and size .....	2-2 $\frac{1}{2}$ inches	3-2 $\frac{1}{2}$ in.
Thread (Nat. Board Fire Underwriters) 7 $\frac{1}{2}$ 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.....	4 $\frac{7}{8}$ inches	
Diameter at root of thread.....	4.6263 in.	
Threads (Pacific Coast).....	6 per in.	
Pattern of thread .....	60°V thread	
Total length threaded male nipple.....	1 $\frac{1}{8}$ inches	
Operating Nuts, same for both size hydrants		
Dimension in section as shown.		
Minimum height of nuts:		
	Standard size.	Large size.
Square .....	$\frac{5}{8}$ inch	$\frac{5}{8}$ inch
Pentagon .....	1 $\frac{1}{8}$ inch	1 $\frac{1}{8}$ inch
Diameter of Shackle Rods .....	$\frac{3}{4}$ 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 having a manganese bronze stem 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, cast iron valve boxes, the hub and flange castings, all bolts, nuts and gaskets, laying, jointing, and setting thereof in place, all excavation and refilling, and all other materials and labor necessary.

#### 144. CAST IRON VALVE BOXES

(For plan, see page 137)

Cast Iron Valve Boxes shall be provided where shown on the plans, as for auxiliary gate valves on hydrants or where directed by the City Engineer.

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

#### 145. HYDRANT CONNECTIONS

(For plan, see pages 134-136)

"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.

#### 146. 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 steel rods shall be used.

Payment for "Resetting Hydrants" shall include payment for all labor and material necessary to place and connect the hydrant in its new position, but shall not include payment for new shackle rods or new pipe for hydrant connections, which shall be paid for at the rate bid for "Shackle Rods" per pound in place, and "Hydrant Connections," as mentioned in Section No. 145.

#### 147. 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. 145.

#### 148. 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.

#### 149. HYDRANT DRAINS

When ordered by the City Engineer, waste orifices of hydrants shall be connected to the nearest sewer or other outlet, by  $\frac{3}{4}$ " galvanized wrought iron pipe, which shall conform in all respects to

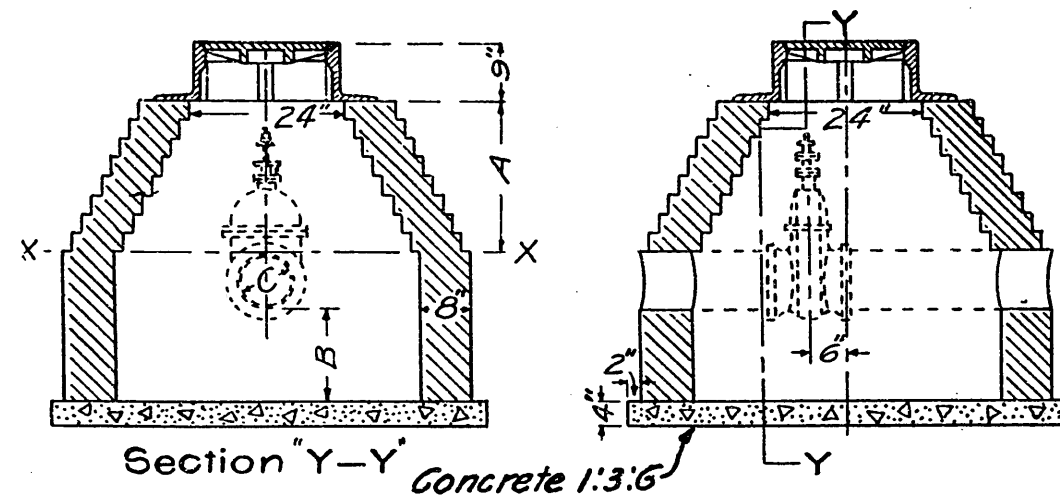
the requirements for "Galvanized Iron Pipe," as specified in Section No. 137.

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.

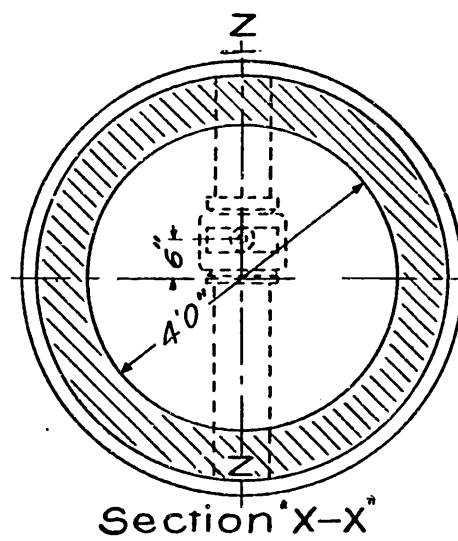
#### 150. HYDRANT EXTENSIONS

All two flanged extensions, such as vertical extensions in the barrel of hydrants, or horizontal extensions between the hydrant and auxiliary gate valve, shall conform in quality of material, coating, marking, and all other respects to special castings as specified elsewhere in these specifications. In all cases the contractor shall see that the drilling in flanges of extensions will fit the drilling in the flanges of hydrant barrels or gate valves, as the case may be, and in no case shall the City be held responsible for any error in these drillings. The length of the vertical extensions shall be determined after the hydrant is in place.

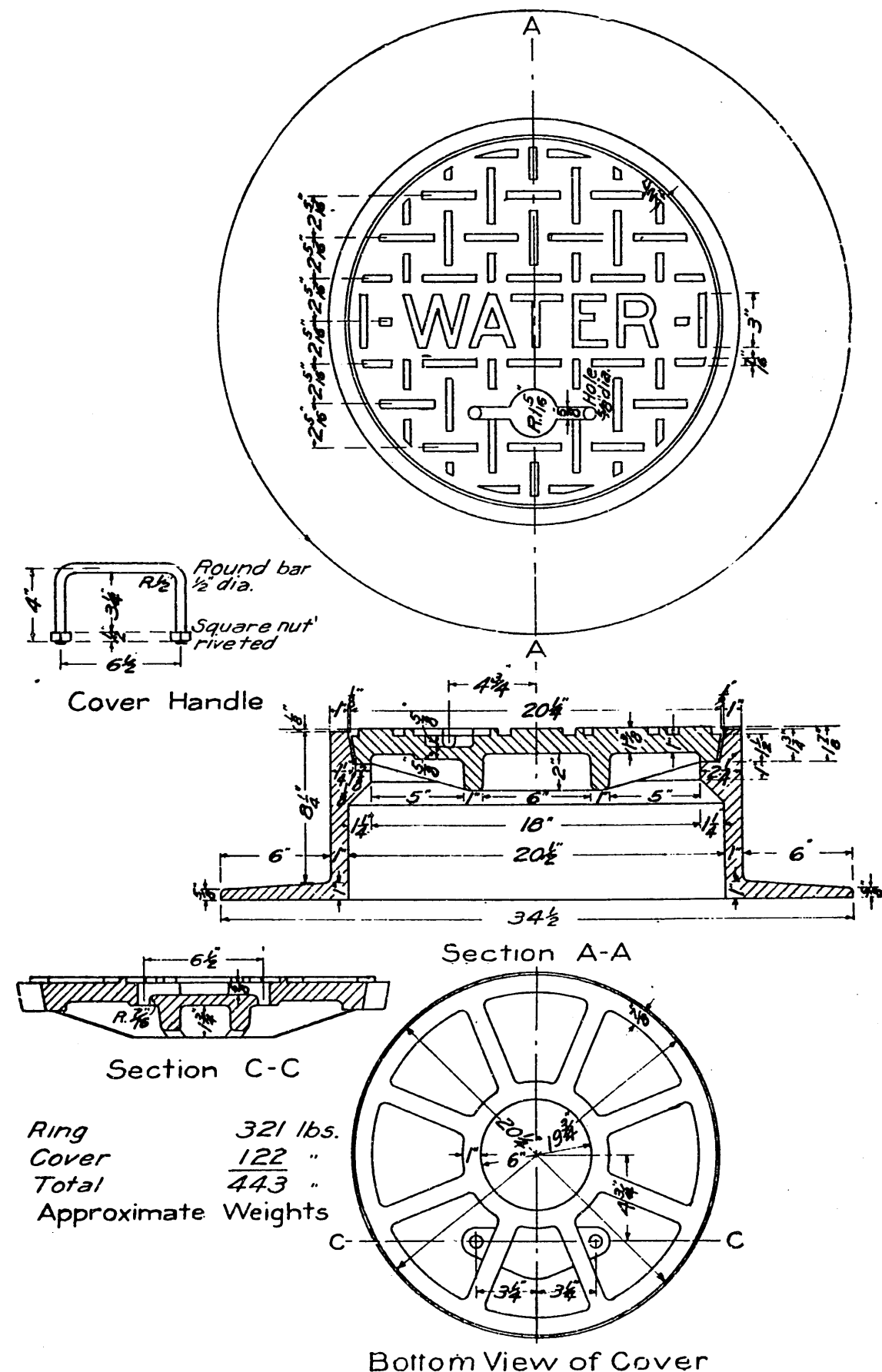
Payment for vertical or horizontal hydrant extensions shall be made at the price bid for "Hydrant Extensions" per pound in place, which shall include payment for all machine work, extension of hydrant rods, bolts, nuts, washers and gaskets. Lengthening of hydrants to specified lengths with vertical hydrant 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."



When  $C = 8"$   $A = 23\frac{3}{4}"$ , not less  
 "  $C = 10"$   $A = 28\frac{1}{2}"$  " "  
 "  $C = 12"$   $A = 31"$  " "  
 "  $C = 8"$   $B = 10"$  " "  
 "  $C = 10"$   $B = 12"$  " "  
 "  $C = 12"$   $B = 12"$  " "

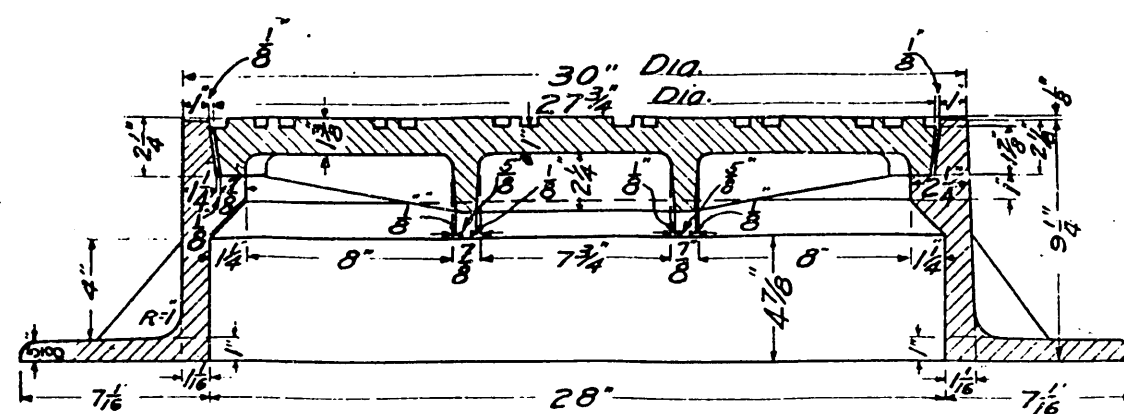
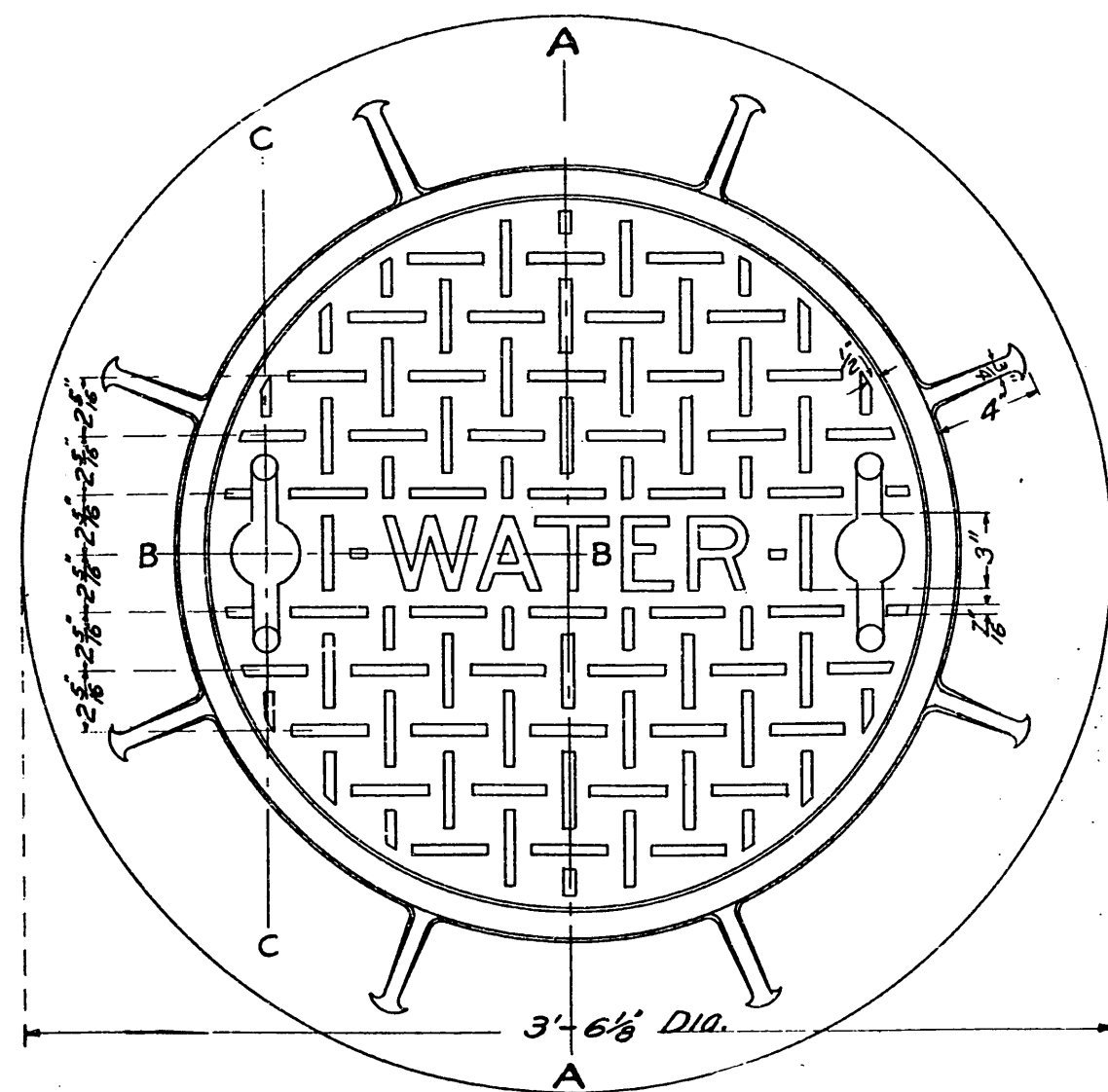


STANDARD BRICK VALVE CHAMBER



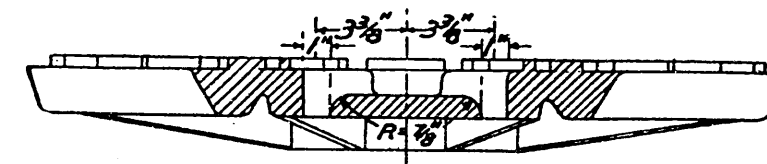
Ring 321 lbs.  
 Cover 122 "  
 Total 443 "  
 Approximate Weights



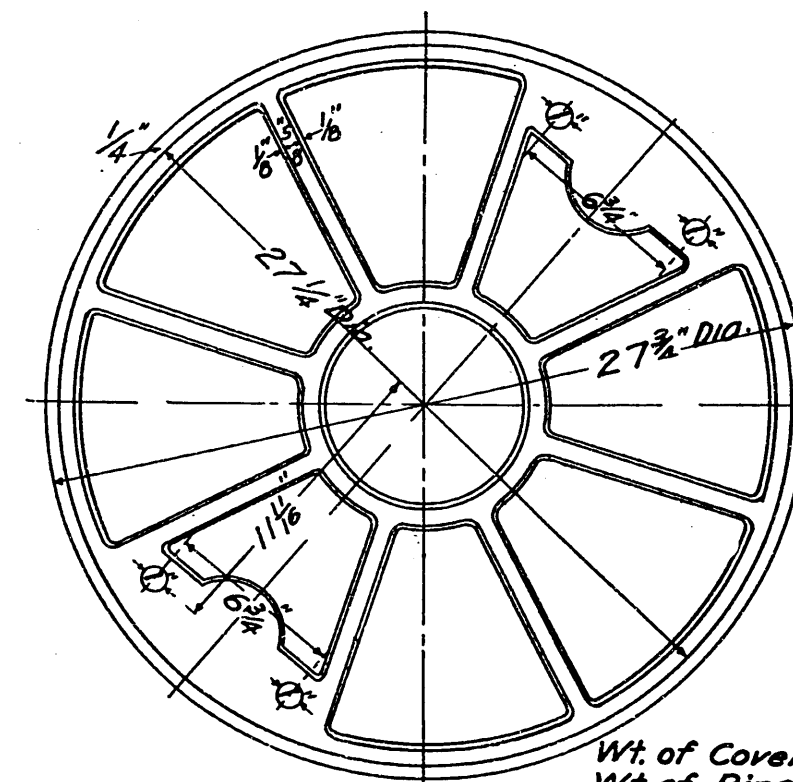


Section A-A

VALVE CHAMBER

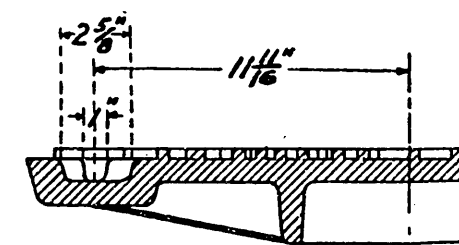


Section C-C

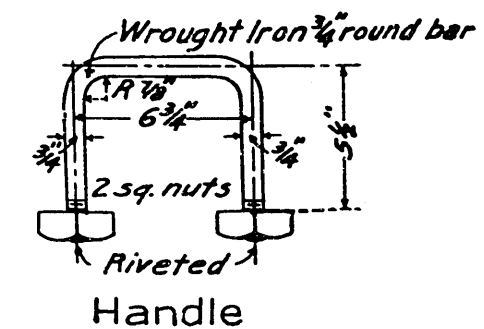


Bottom View

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



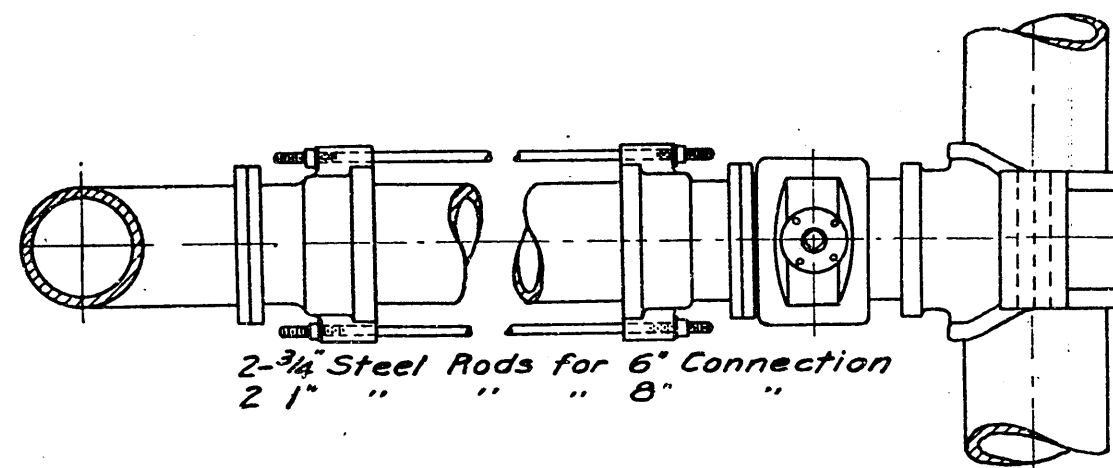
Section B-B



Handle

COVER (LARGE)





Hydrant

Hub and Flange Casting

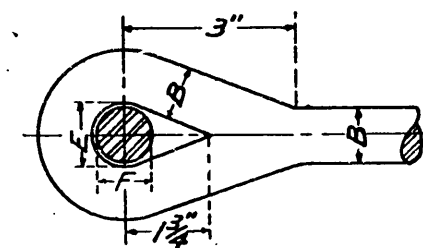
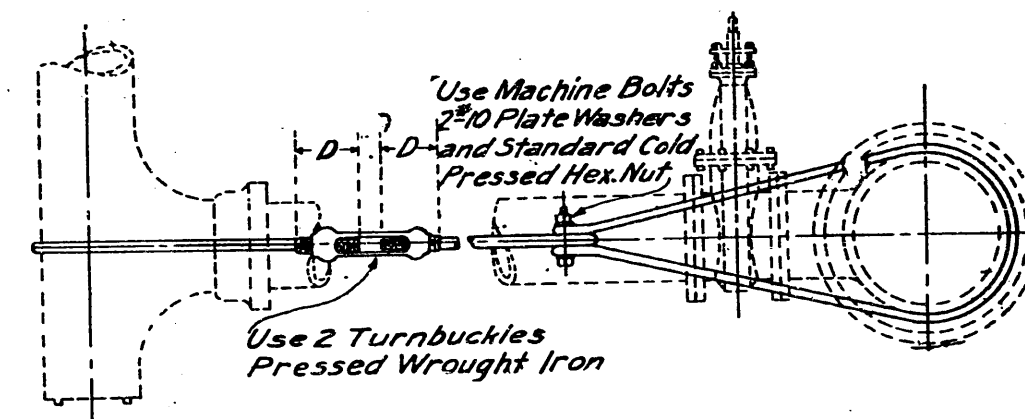
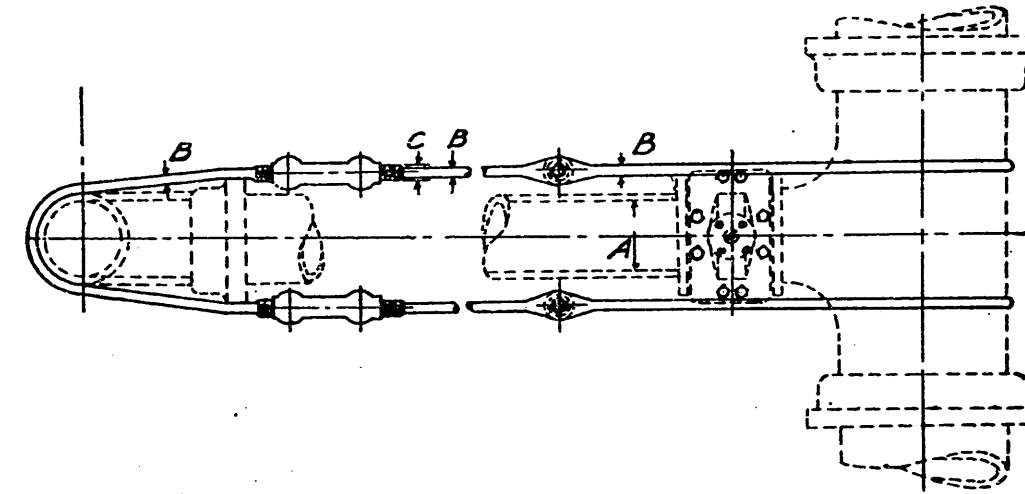
Hub and Flange Casting

Gate

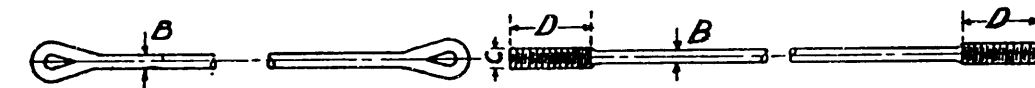
Flange or Converse Joint

Split Tee

METHOD OF CONNECTING HYDRANT  
TO EXISTING MAIN USING SPLIT TEE

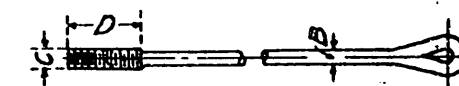


Bend Rod & Weld  
as shown above



Steel Rod as shown with welded  
eyes each end as shown in details  
Two for each Yoke

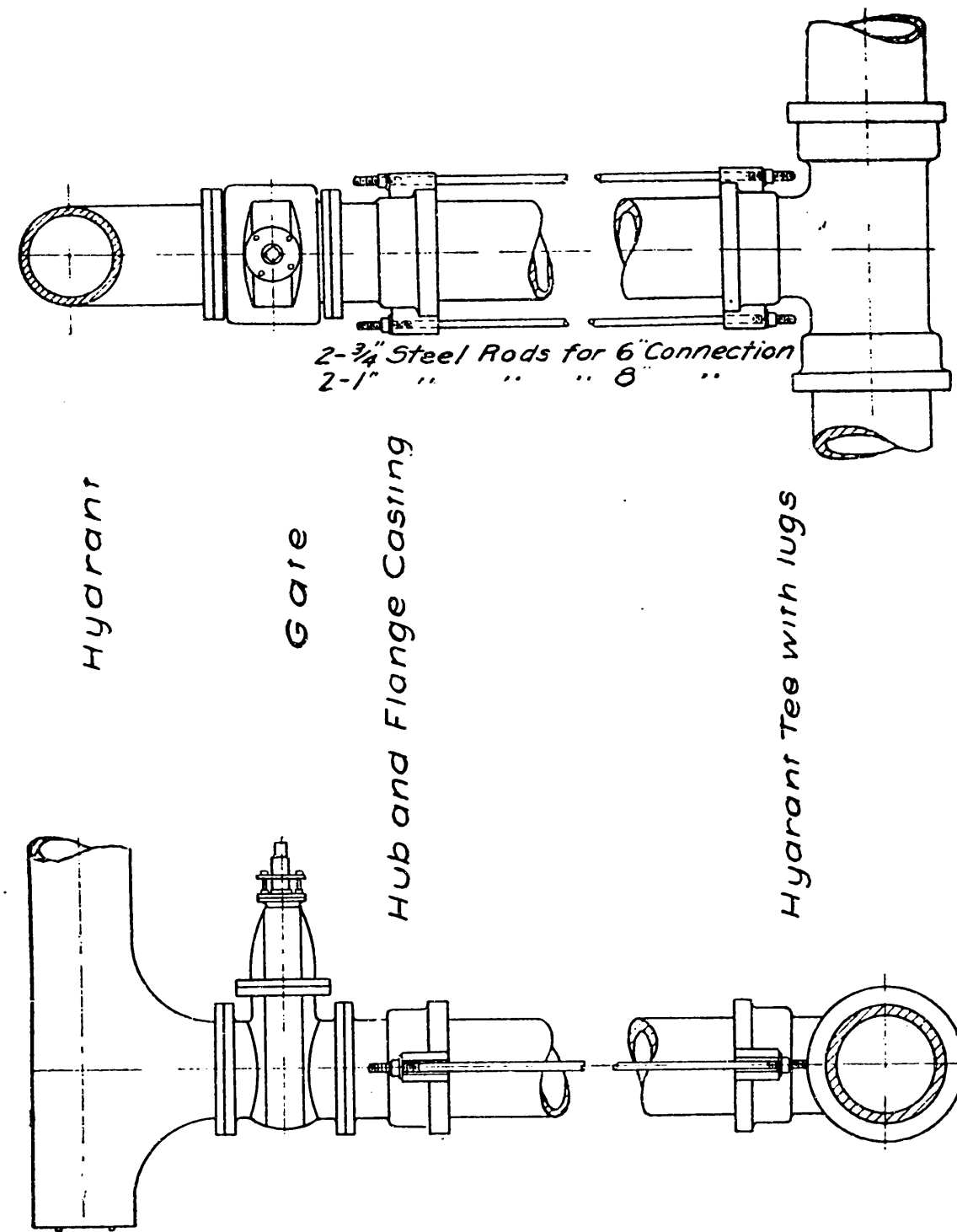
Steel Rods as shown upset each  
end Standard Left hand threads  
One for each Yoke



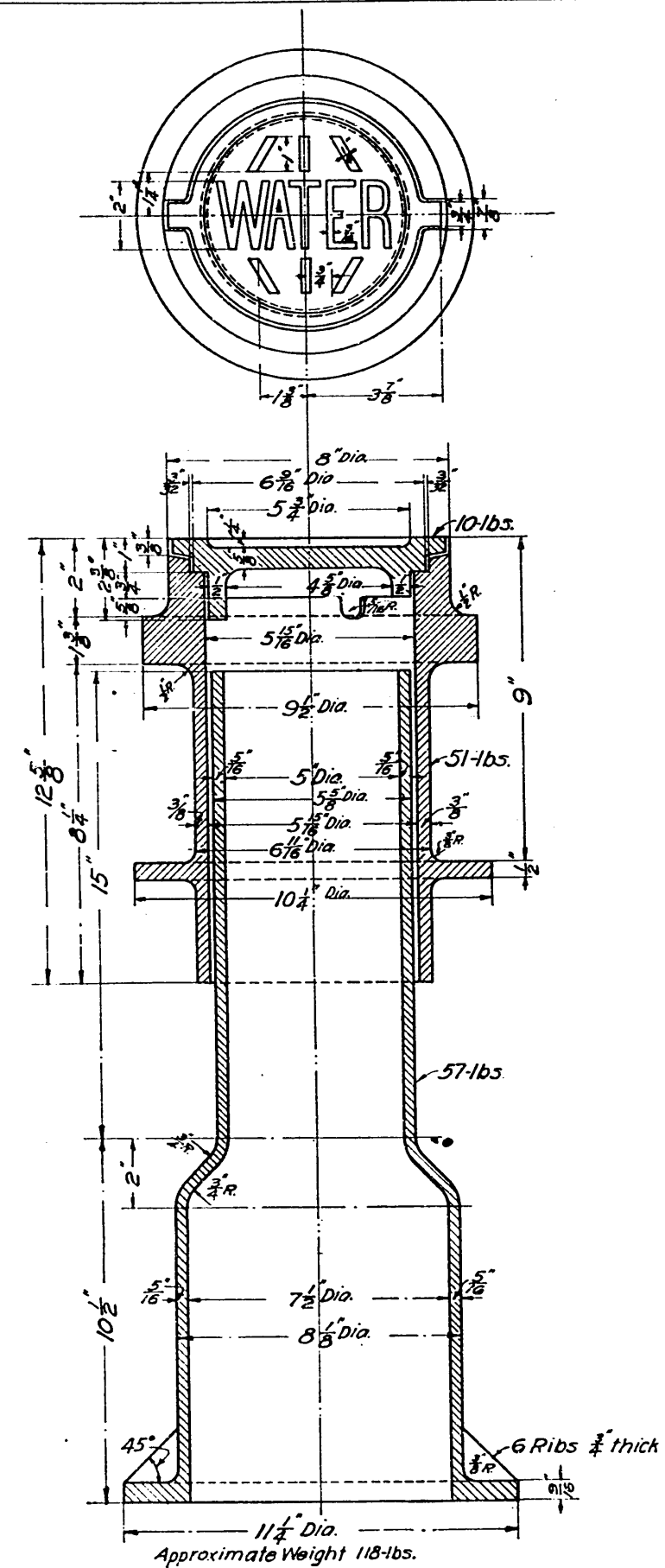
Steel Rod as shown welded  
eye one end and upset  
other end Std. Right hand  
thread  
Two for each Yoke

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"

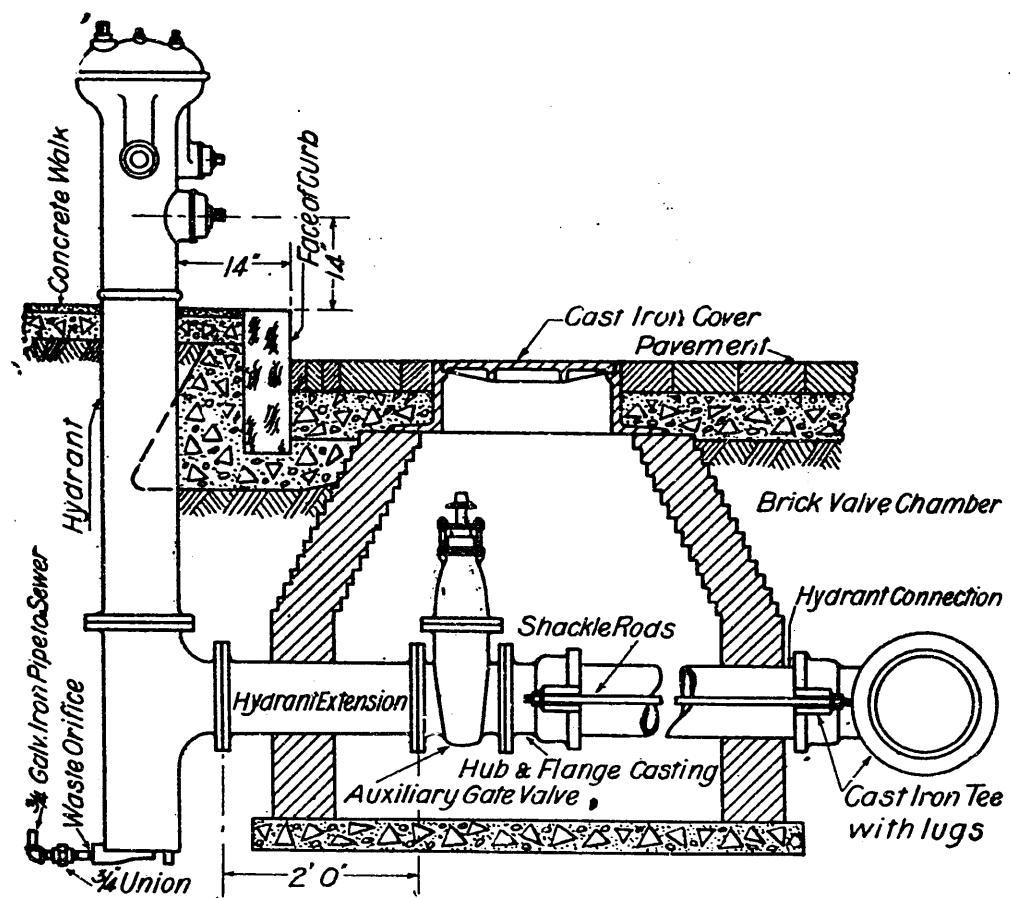
METHOD OF CONNECTING  
HYDRANT TO EXISTING MAIN  
WITH FLANGED OUTLET TEE



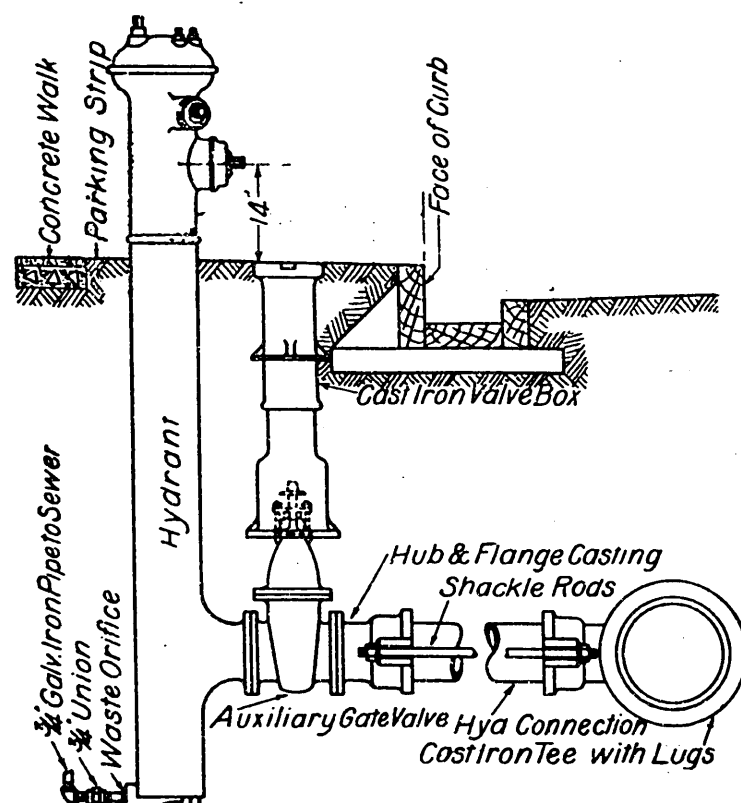
METHOD OF  
CONNECTING HYDRANT TO NEW MAIN



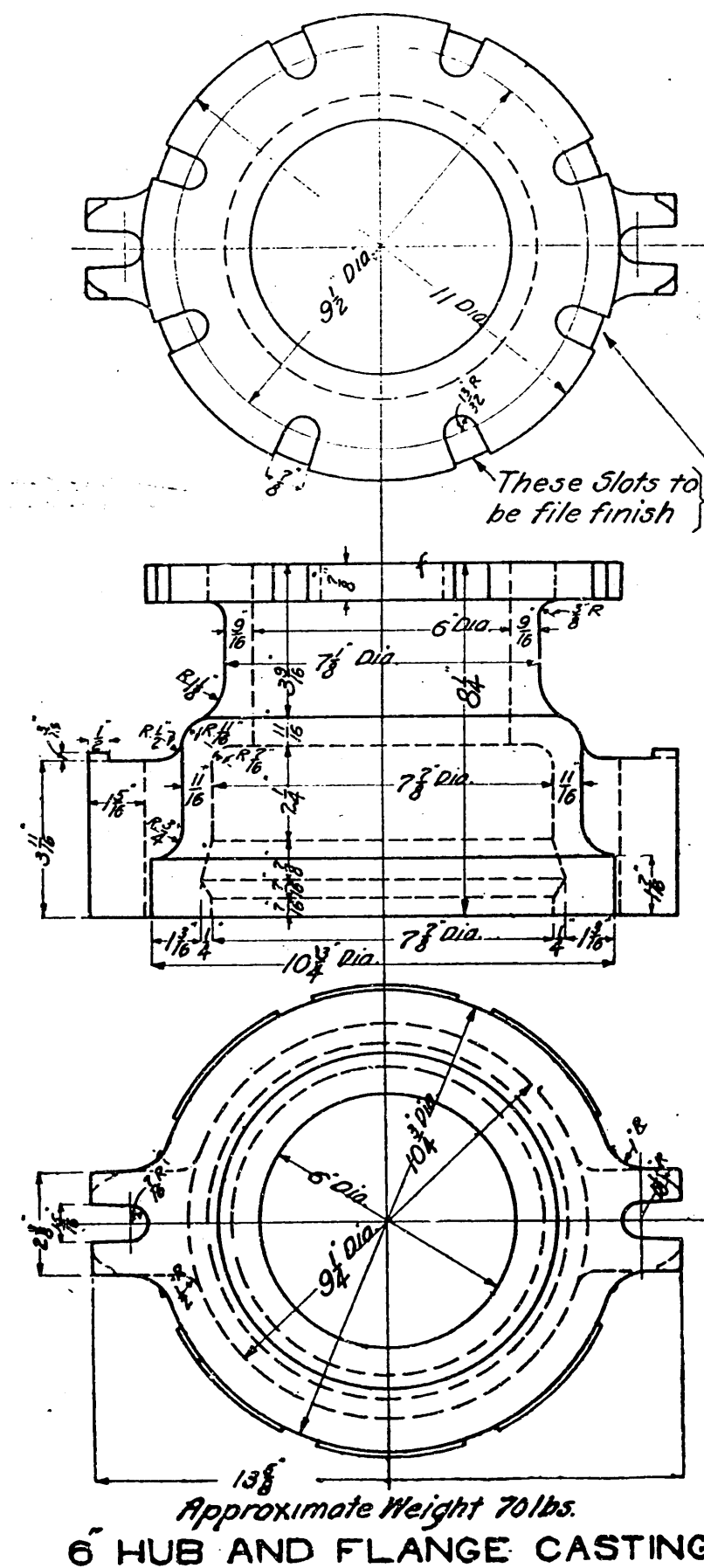
CAST IRON VALVE BOX



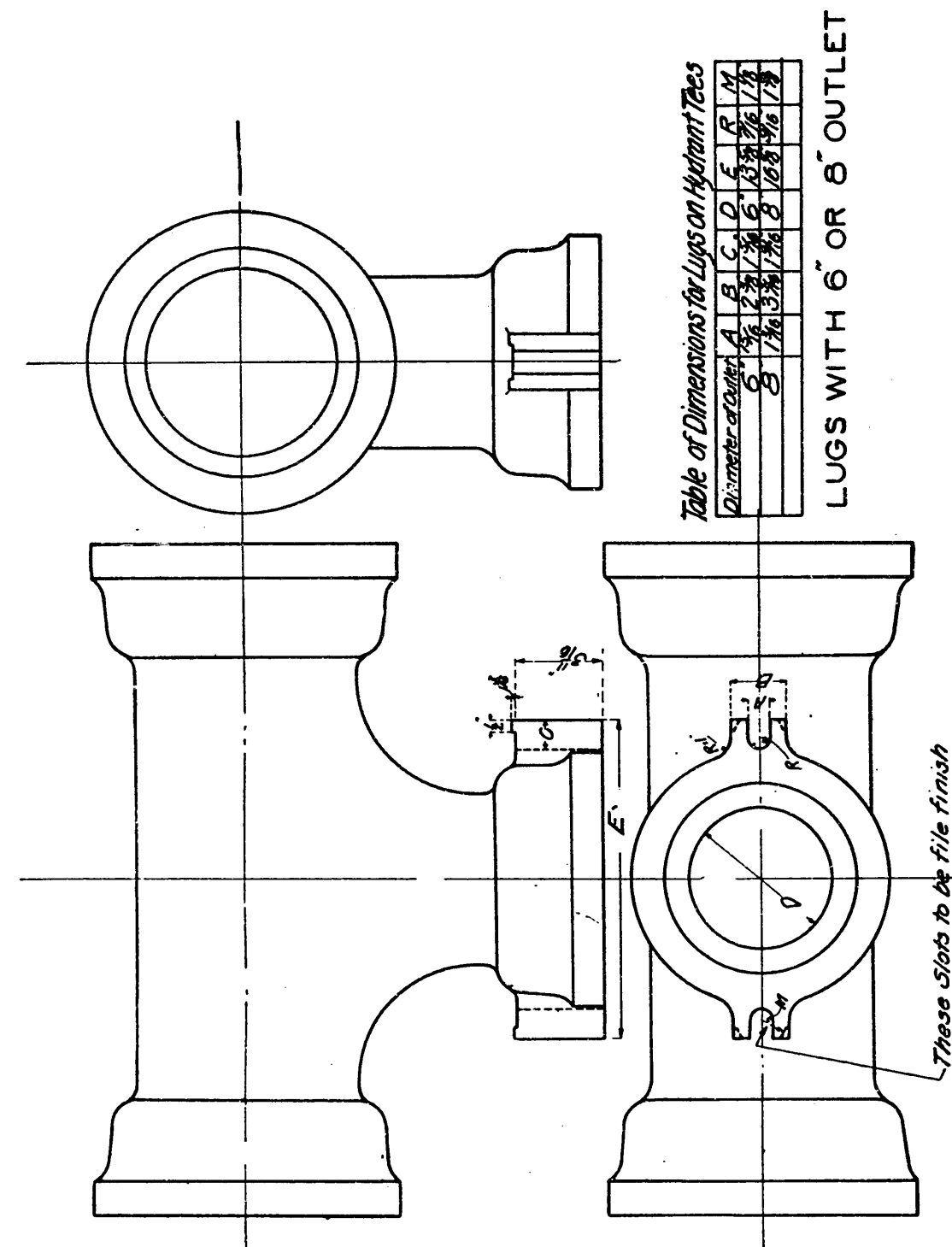
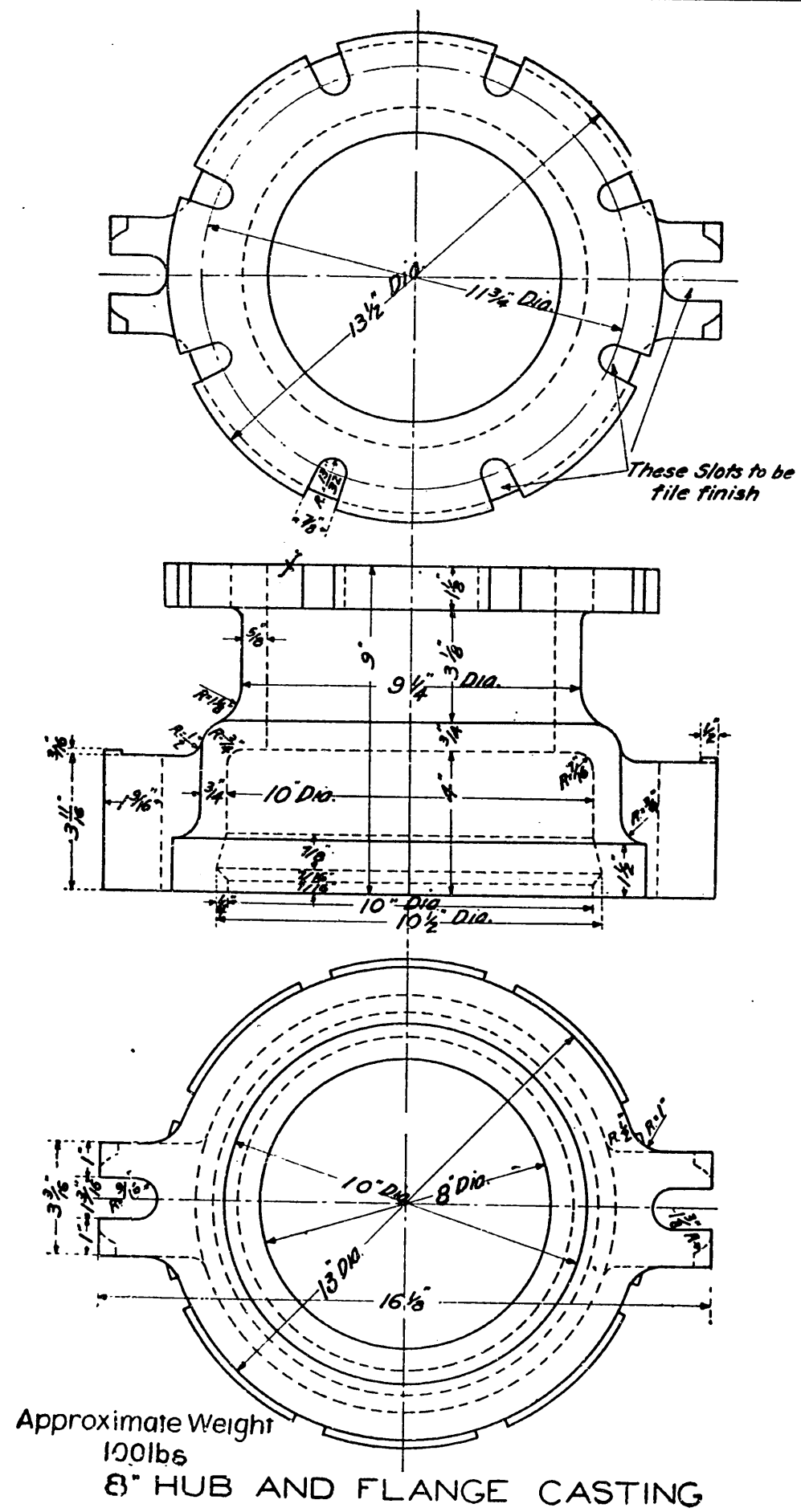
**METHOD OF SETTING HYDRANTS  
BUSINESS DISTRICT**

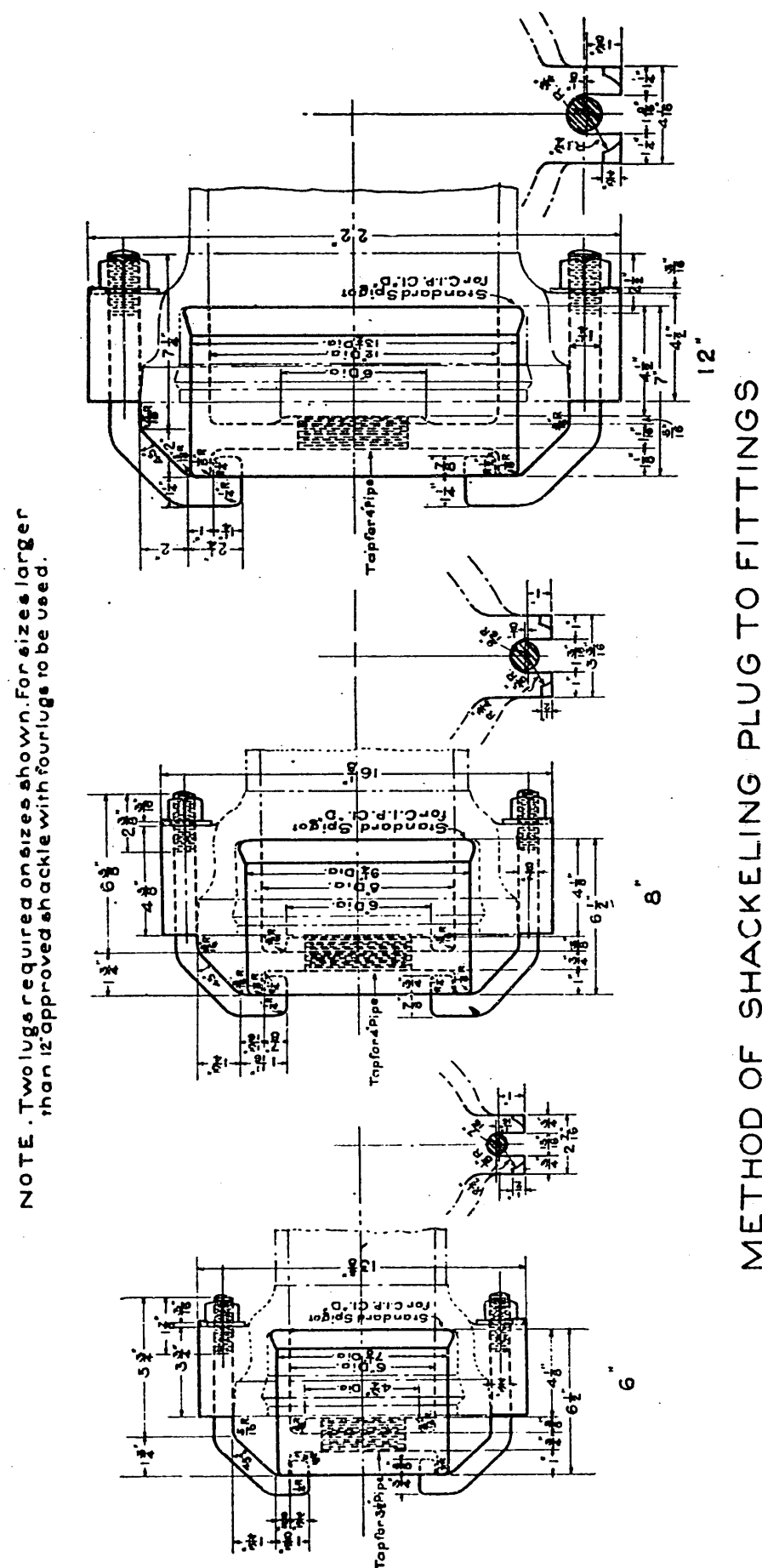


**METHOD OF SETTING HYDRANTS  
RESIDENCE DISTRICT**









## SPECIFICATIONS FOR PAVEMENTS AND APPURTENANCES

### General Stipulations

#### 151. MEASUREMENT OF PAVEMENTS

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

#### 152. PARKING STRIPS

All fill in parking strips shall be made of the best available soil selected from the improvement. Before filling, all concrete, gravel, wood, and other debris shall be removed.

All parking strips shall be graded on a true plane from the new curb to the existing portion of the parking strip. Parking strips shall be finally cleaned and raked and roadways cleaned up, not later than ten (10) days after street is open to traffic.

#### 153. WASHING PAVEMENT

Before the work is released, the pavement shall be washed clean with a fire hose or street flushing machine, and all manholes, catch basins, flush tanks, valve chambers, etc., thoroughly cleaned.

#### 154. SUBGRADING FOR PAVEMENT

Clearing shall be done as specified under "Grading," and all stumps, crosswalks, old curbs and gutters, planking, trees or any other obstruction shall be removed. Whenever any pavement adjoins or abuts against any wood or concrete header, stop, or side stop, the same shall be removed and the cost of such removal shall be included in the price bid for clearing.

After the surface of the street has been cleared and grubbed as specified above, all lumber, drains, dead pipes or similar material not suitable for the foundation found more than one (1) foot below the subgrade of the street, shall be removed by the contractor by trenching or otherwise, as directed by the City Engineer, and shall be paid for as "Extra Excavation" under the terms of Section 69. Such material found within one (1) foot of the subgrade shall be removed by the contractor as part of the subgrading.

The City Engineer shall be the sole judge as to what shall constitute unsuitable or improper materials to remain in the subfoundation, and in order to ascertain the presence of unsuitable materials he shall cause holes or trenches to be dug, of such dimensions and lengths and in such directions and to such depths as he deems necessary. If sinking spots develop, the City Engineer shall require the same to be excavated to sufficient depth to investigate and determine the cause of such sinking and the necessary remedy 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 subgrading, and if the material required is available from waste material within this improvement district, no allowance shall be made for refill. If suitable material cannot be obtained from the streets in this improvement district, payment for refill shall be made at a price per cubic yard agreed upon by the contractor and the City Engineer.

No other payments whatsoever shall be made on the above work. All embankments exceeding one (1) foot in height shall be sluiced into place, or rolled to the satisfaction of the City Engineer, in six (6) inch layers.

All waste material removed during subgrading operations shall be disposed of as specified for Grading, Section 67, except that when earth is placed upon private property by application, and the quantity required is less than one hundred (100) cu. yds., the owner of such property shall provide a means of crossing walks or other improvements. The contractor shall furnish all material for embankment not found within the district covered by this contract. Embankment slopes shall be dressed to a uniform line and shall have such inclinations as are shown on the plans, or as the City Engineer may direct.

#### (a) FORMS

The side forms shall be of steel, or of surfaced lumber not less than four (4) inches stock width and of a depth equal to or greater than the thickness of the pavement. Forms shall be placed accurately to line and grade, and held rigidly in place by means of stakes not more than four (4) feet apart and driven down flush with, or below, the top surface of the form. The inside stakes shall not be removed until after the subgrade has been dragged and concrete deposited against the side form. The side forms shall be blocked up at intervals of not over six (6) feet with blocks having a bearing of at least six by eight (6 x 8) inches on the solid ground. Concrete walk landings shall be kept free of earth or debris.

Where directed, the side forms shall be left in place and such forms left will be paid for at the price bid per M. Ft. B. M. for "Form Lumber Left in Place."

#### (b) ROLLING

Rolling shall be done after the forms have been placed and while the fine grading is being done, and immediately thereafter. Subgrade shall be thoroughly wetted the day before rolling. Contractor may, at his option, use a five (5) ton, three-wheeled gas roller, having a minimum pressure of two hundred forty (240) pounds to the inch of tread on the back wheels, or he may use a steam roller having the same or greater pressure per inch of tread. Rolling shall be continued until the subgrade has been brought to the correct elevation, which shall be determined by dragging the subgrade with a template resting on the side forms. Any low spots indicated by dragging with the template shall be filled and rolled until brought to correct elevation. Any soft or muddy spots, due to

rains, or the water settling of ditches or other excavations, which develop during rolling, shall be shoveled out, refilled with suitable material and rolled as specified, at the contractor's expense. Rolling shall be done as close to the side or curb forms as practicable.

Intersections shall be fine graded after all material has been hauled through them, and rolled as specified above. Where necessary the Engineer will set temporary subgrade stakes to serve as a guide during fine grading of intersections just prior to rolling.

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

After the rolling has been completed as herein specified, the contractor shall, in the presence of the City Engineer or his representative, check the subgrade by means of a template resting on the side forms, and no concrete materials shall be deposited upon the subgrade until the same has been checked and approved. During the hauling of material, should ruts develop, they shall be filled with suitable material and re-rolled.

In order to comply with these specifications, the contractor shall have upon the work, and shall continually use, at all times while fine subgrading is being done, or while material is being hauled in, a roller conforming to these specifications.

All excavation for side sewers, catch basins, or any other excavation whatsoever which exceeds two (2) feet in depth below the subgrade shall be completed, backfilled, and water settled before rolling. All minor excavations such as are necessary for the adjustment of castings and which do not exceed two (2) feet in depth below the subgrade shall be completed, backfilled, and hand tamped not less than twenty-four (24) hours before placing concrete. All castings except monument cases shall be set or adjusted to grade at least twenty-four (24) hours before placing concrete.

Care shall be taken while subgrading is being done that earth does not get into manholes, and all manholes shall be cleaned within twenty-four (24) hours after the adjacent earth in the subgrade has been removed.

About twelve (12) hours before the concrete is placed, the subgrade shall be thoroughly saturated, and again wetted just before placing the concrete.

Immediately preceding the placing of concrete pavement or concrete base the subgrade shall be dragged with a heavy iron shod template, operated by means of a power attachment on the mixer, and so constructed that the ends of the same ride on the side forms, the template remaining normal to the roadway during operation, and the cutting edge being made of a three by three (3 x 3) inch angle iron with a vertical leg flush with the forward face of the template. Special attention is called to the fact that no earth shall be placed on the subgrade after it has been rolled. In the event that the contractor considers the subgrade low, the drag shall be carried back, sand shoveled in, and the subgrade re-dragged. This

sand shall be furnished by contractor at his own cost and expense. During the subgrading of any street, the contractor shall locate and reference with stakes or painted marks on the concrete walks all drains leading to the curb. When the curb is constructed all such drains shall be connected to two (2) inch galvanized sheet metal weep holes through the curb. The drain connection to the weep holes will be paid for at the price bid for "Sidewalk Drain."

**(c) APPROACHES**

Wherever this improvement joins an existing unpaved street, the contractor shall make such approach excavations as are necessary or as are ordered by the City Engineer, and such excavations will be paid for at the price bid for "Subgrading."

**(d) PAYMENT**

Payment for subgrading for pavement shall be made at the price bid per cubic yard for "Subgrading," and shall include payment for tamping, rolling, sluicing, and for furnishing and operating the roller.

## PAVEMENTS

### 155. SHEET ASPHALT PAVEMENT

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 (1½) per cent of fine soot or carbon. The penetration of this refined asphalt shall, under no consideration, be less than fifty (50°) degrees nor more than seventy (70°) degrees Dow. The average penetration shall be sixty (60°) degrees 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 mement, 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) ASPHALTIC CEMENT**

The refined asphalt shall be melted at a temperature of not more than three hundred fifty degrees (350°) Fahrenheit. After the asphalt is thoroughly melted, agitation shall be maintained either by live steam or an 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 of penetration as indicated by the New York or Dow Penetration Machine of about sixty-five (65) degrees for light traffic streets and fifty (50) to sixty (60) degrees for heavy traffic streets when taken at a temperature of seventy-seven (77) degrees 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 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.

**(c) 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%
Retained on No. 20 mesh screen	0 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.

#### (d) 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%) or 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

#### (e) 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.

#### (f) 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 ( $\frac{3}{4}$ ) inch ring. To this shall be added not less than ten per cent (10%) nor 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 in such proportions that the resulting binder possesses 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.

#### (g) 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.

#### (h) 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.

#### (i) 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.

#### (j) 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 contractors 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 (20) 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.

#### (k) 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.

#### (l) 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.

**(m) 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.

**(n) 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 hundredths (2.12). It shall be free from checks or honeycomb, smooth and of even surface, free from depression or unevenness showing more than three eighths ( $\frac{3}{8}$ ) 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.

**(o) 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.

**(p) 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.

**(q) 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.

The proportions and weights determined by the City Engineer from an analysis of the material shall be strictly adhered to by the plant operators.

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 Howe and Morse, 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 defect 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.

#### (r) 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.

### 156. ASPHALTIC CONCRETE PAVEMENT

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 ( $\frac{1}{2}$ ) 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  $\frac{1}{4}$ -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 ( $\frac{3}{8}$ ) 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 $1\frac{1}{4}$ inch, retained on $\frac{1}{2}$ inch,	15 to 30%
Rock passing $\frac{1}{2}$ inch, retained on $\frac{1}{4}$ inch,	15 to 30%
Rock passing $\frac{1}{4}$ inch, retained on $\frac{1}{8}$ inch,	12 to 20%
Sand passing 8-mesh screen and retained on	
200 mesh	25 to 35%
Rock dust filler passing 200-mesh	12 to 16%
Asphaltic Cement	8 to 12%

The proportions shall be varied within the limits designated, as directed by the City Engineer.

The asphaltic cement shall in no case show less than seven per cent (7%) nor 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 a complete pavement, including the concrete base.

**157. BRICK PAVEMENT**

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 be placed, the joints between the bricks being grouted at once as hereinafter described.

**(a) BRICKS**

Unless otherwise specified, paving bricks shall conform to the specifications for Class "A" 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 streets 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.

Nothing herein contained shall be construed as a waiver of the right of the City Engineer to reject any unsuitable bricks after they have been laid.



**(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, two and one-half (2½) parts sand, and five (5) parts gravel.

It shall be constructed in all respects as specified for concrete base for pavement, Section 160.

The amount of base laid in one day shall not exceed the amount which can be covered with brick in one day.

**(c) CUSHION**

The brick surface shall be laid in a cushion of mortar, whenever in the judgment of the City Engineer the base has set up enough to be worked upon, but in no case later than twenty-four hours after the base is laid. This cushion shall be composed of one (1) part of cement to three (3) parts of sand, mixed in a concrete mixer, to such consistency as may be directed, and laid to a depth of three-fourths (¾) of an inch. The mortar shall be laid in advance of the brick work only far enough to keep ahead of the actual bricklaying. The mortar shall be rodded with a template to obtain a uniform surface conforming to the surface of the pavement.

**(d) LAYING BRICKS**

Immediately following the placing of the cushion, the bricks shall be carefully laid. 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.

**(e) 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.

**(f) 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 61.

Grout shall be mixed in an approved type of mixing machine,

As soon as the grout is mixed thoroughly to the consistency of thin cream, it shall be poured onto the pavement from buckets, and brushed into the joints. From the moment it strikes the pavement it shall be kept in motion and thoroughly broomed into the joints.

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.

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.

A suitable rubber squeegee shall be used in the final grouting of the brick.

**(g) EXPANSION JOINTS**

Expansion joints one-quarter (¼) of an inch thick, of material as specified under "Quality of Materials," shall be placed along each curb, and along each side of a street railway portion when each portion is paved. Expansion joints shall extend entirely through the pavement.

**(h) CURING**

Curing shall be done as specified for Concrete Pavement.

**(i) MAINTAINING TRAFFIC**

The contractor shall provide sand and plank crossings, where directed by the City Engineer, according to the specifications for maintaining traffic on concrete pavement, Section 159 (e).

**(j) 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.

**158. STREET RAILWAY PAVEMENT**

(For plan, see page 176)

Where shown on the plan or where directed by the City Engineer, the contractor shall pave the street railway portion of the street, according to the standard plan shown herein.



The work shall be done, one track at a time, for such distance as the City Engineer may direct, the other track being used to carry two-way traffic.

Whenever the contractor is ready to commence any street railway paving, he shall notify the City Engineer at least five (5) days in advance. The City Engineer will then have one track and ties removed by the Street Railway Department, after which the contractor shall immediately excavate and roll the subgrade as specified under subgrading.

The City Engineer will then have the Street Railway Department place and line up the new rails, after which the contractor shall immediately pour the concrete base, place the brick surface and cure the same, as specified for "Brick Pavement."

Payment for "Street Railway Pavement" shall be made at the price bid per square yard and shall be in full for all material and labor necessary to produce the finished improvement, except the work of the Street Railway Department as herein stated.

### 159. CONCRETE PAVEMENT

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 (3) parts gravel.

The amount of pavement to be constructed per barrel of cement shall not exceed the following:

- In 5" Concrete Pavement not over 4.46 sq. yds. per bbl.
- In 6" Concrete Pavement not over 3.71 sq. yds. per bbl.
- In 7" Concrete Pavement not over 3.18 sq. yds. per bbl.
- In 8" Concrete Pavement not over 2.78 sq. yds. per bbl.
- In 9" Concrete Pavement not over 2.47 sq. yds. per bbl.

The contractor may expect to obtain the above maximum allowable areas of pavement per barrel of cement only when subgrade and other conditions are ideal; and in no case, because of low or sandy subgrade, or for any reason whatsoever, will he be allowed to vary the ratio of cement to aggregate, or to raise the subgrade template.

#### (a) PLACING CONCRETE

Upon the subgrade prepared as specified under "Subgrading," the concrete shall be placed by means of a bottom dumping bucket, dump truck, or other device approved by the City Engineer.

It shall be spread evenly with shovels, and spaded along the forms with a perforated spade, after which it shall be struck off and thoroughly tamped with a steel shod tamping rod four (4) inches wide. Such rod shall be cut to the exact crown of the roadway, fitted with handles at each end, and of such a depth or trussed in such a manner as to be rigid. After thoroughly tamping the concrete as specified above, it shall be rolled with a light wire mesh roller, ten (10) inches in diameter and five (5) feet long, weighing approximately one hundred (100) pounds. This roller shall be constructed of number six (6) steel wire mesh with openings ap-

proximately one-half ( $\frac{1}{2}$ ) inch square. The rolling shall be continued until mortar has been worked to the entire surface of the panel.

After striking off with the steel shod tamping rod, and rolling, a shaping rod of similar construction to the tamping rod, two and one-half ( $2\frac{1}{2}$ ) inches thick shall be worked forward and across the width of the roadway with a sawing motion, keeping a small amount of mortar ahead of it at all times. When directed by the City Engineer rolling shall again be done following the shaping rod.

The interval between through expansion joints shall then be floated transversely with a panel float twenty (20) feet long, approximately ten (10) inches wide, constructed with a one-eighth ( $\frac{1}{8}$ ) inch steel plate on the bottom. This float shall be trussed in such a manner as to be rigid and shall be fitted with two handles at each end. It shall be dragged across the pavement until the steel face of the float shows contact with the pavement surface throughout its entire length. It shall then be moved ahead fourteen (14) feet, allowing a six (6) foot lap.

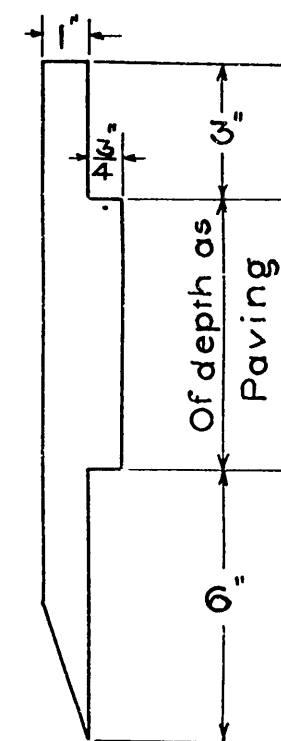
A ten (10) foot split float, of similar construction to the panel float, and notched in the center shall then be dragged across the pavement at each through joint. The final finish shall be given the pavement surface with a vertical grain board, one by six (1 x 6) inches in cross section, and twenty (20) feet long, stiffened on the back by means of a two by four (2 x 4) on edge. This shall be fitted with handles at each end and worked across the pavement the

minimum number of times necessary to leave a uniform finish.

For intersections and other warped surfaces where it is impracticable to use the tamping and shaping rods, the contractor shall furnish intersection grade stakes as shown. Such stakes may be made of wood or iron and shall be driven down until the bottom of the projecting block rests upon the Engineer's subgrade stake and kept in place until the concrete has been placed and floated to the next stake. Floats of two by twelve (2 x 12) inch plank, two (2) feet long and fitted with handles shall be used in lieu of the tamping and shaping rods in all intersections.

The joints and sides of the panels shall be edged with an edger showing an eight (8) inch margin; provided, however, that where integral curb is specified the sides of the panels adjacent to the curb need not be edged.

All vertical curves and all intersections, insofar as it is practicable and where directed by the City Engineer, shall be floated and



INTERSECTION  
GRADE STAKE

finished as above specified, substituting a flexible one by six (1 x 6) inch finishing board for the stiffened one.

On grades of seven (7) percent or over, after finishing, the surface shall be brushed transversely to give a degree of roughness satisfactory to the City Engineer.

Should an excess of water appear on the pavement surface during the finishing process, the contractor shall use a dry mixture of one (1) part cement and one and one-half ( $1\frac{1}{2}$ ) parts sand in sufficient quantity to absorb the excess of water, and should the concrete become so hard that sufficient mortar for finishing cannot be worked to the surface, the contractor shall use a mortar of one (1) part cement and one and one-half ( $1\frac{1}{2}$ ) parts sand in sufficient quantity to permit the finishing of the pavement according to these specifications.

The contractor shall furnish sufficient skilled men to operate the above specified tools in an efficient manner and at a speed sufficient to keep pace with the mixer, or he shall limit the mixer output to the amount which can be properly finished by the men furnished. Four men shall, at all times, be used to operate the tamping and shaping rods.

#### (b) EXPANSION JOINTS

Expansion joints shall conform to the specifications for expansion joint material, Section 47. They shall be placed as follows:

For roadways twenty (20) feet or less in width, a joint one (1) inch wider than the thickness of the pavement, hereinafter referred to as a "Through Joint," and three-eighths ( $\frac{3}{8}$ ) of an inch thick, shall be placed transversely across the roadway, at intervals equal to the largest multiple of the roadway width which does not exceed forty (40) feet. The interval between through joints shall be finished and immediately following the final floating, it shall be divided into square sections by cutting a groove with a heavy tee iron in the fresh concrete, and inserting a strip of one-quarter ( $\frac{1}{4}$ ) inch joint material two (2) inches into this groove. Such a joint shall hereinafter be referred to as a "Dummy Joint."

For roadways over twenty (20) and less than thirty (30) feet wide, through joints three-eighths ( $\frac{3}{8}$ ) of an inch thick shall be placed transversely across the street every thirty (30) feet and the thirty (30) foot sections thus formed shall be divided longitudinally along the center line of the roadway, and transversely every fifteen (15) feet by means of dummy joints.

Roadways thirty (30) feet or more in width shall be constructed in two operations. Through and dummy expansion joints shall be constructed in each half as specified for roadways twenty (20) feet or less in width, and a dummy joint shall be inserted between the two halves of the roadway. Transverse joints shall be staggered. The second half of the roadway shall not be commenced until the first half has set ten (10) days. The first half shall be thoroughly cleaned immediately after finishing the second half.

The edges of the panels adjacent to the center line of the roadway shall be constructed, and the extra concrete paid for, as specified for pavement adjoining Street Railway, page 171.

Where integral curb is specified, dummy joints shall be ex-

tended through the upper portion of the curb by stapling a piece of joint material upon the two (2) inch strip.

Joints in intersections and other irregular areas shall be placed as directed by the City Engineer; the areas of the panels thus formed shall be, whenever practicable, less than three hundred (300) square feet.

All through joints not placed in one piece shall be securely stapled together by means of clinched staples. Through joints shall be placed normal to the pavement and held in position by means of a notched expansion board which shall not be pulled until concrete has been placed on both sides of the joint.

Where concrete pavement adjoins the street railway portion of a roadway, a through joint one-quarter ( $\frac{1}{4}$ ) of an inch thick shall be placed between the concrete pavement and the street railway portion when such street railway portion is paved.

Whenever a street or alley pavement adjoins or abuts against an existing approach, masonry wall, or building, a through expansion joint one-quarter ( $\frac{1}{4}$ ) of an inch thick shall be placed between the pavement and such structure.

At the end of each day's run a wooden header conforming to the width and proper crown of the roadway and four (4) inches thick, protected on top by a one-eighth ( $\frac{1}{8}$ ) inch steel or iron plate, shall be used as a guide to obtain the proper crown to the pavement, and left in place until paving is resumed.

#### (c) CURING

As soon as the finished pavement can be sprinkled without injury to same, it shall be covered with burlap sheets at least two (2) feet wider than the roadway and sprinkled with a hose and spray nozzle. The contractor shall supply sufficient burlap to cover an entire day's run, allowing a two (2) foot lap for each sheet. This covering shall be kept constantly wet, and maintained in place until a system of continuous sprinklers shall be installed the following morning. Sprinklers shall be "Babcock" sprinklers, or equal. Sprinklers shall be operated day and night without interruption, for a period of ten (10) consecutive days. On very flat grades the contractor may at his option cure the pavement by constructing earth dams across and along the edges of the same and maintaining a depth of not less than two (2) inches of water over the entire surface of the pavement for ten (10) days. The pavement shall be closed to traffic for twenty-one (21) days. At the end of twenty-one (21) days the pavement shall be opened to traffic, but such opening to traffic shall in no way relieve the contractor of his responsibility to maintain same against all defects or damage of whatever nature until its acceptance by the Board of Public Works.

All waters used for curing pavement shall be taken directly from hydrants. The use of meters will not be allowed.

#### (d) REINFORCING STEEL IN PLACE

Reinforcing Steel shall be one-half ( $\frac{1}{2}$ ) inch square corrugated billet steel bars, according to Section 63. Steel shall be used to reinforce pavement around castings, over outlet pipes of inlets, and where needed in pavement, as directed by the City Engineer.

Payment is to include cutting and bending of steel where necessary to length and shape, as directed by the City Engineer, and to be in full for steel in place.

The above specifications do not cover steel used in reinforced concrete pavement. Where a bid is called for on "Reinforced Concrete Pavement," such bid shall include the steel in the amount and position as specified by the City Engineer.

#### (e) 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 a 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 at the price bid per M. ft. B. M. for "Plank Covering—New Lumber."

When any plank covering is used more than once on any improvement, it shall be classified and paid for as "Plank Covering Reused."

When piled along the curbs at the time of finally cleaning the street, the lumber shall be the property of the local improvement district.

Sand covering shall be paid for at the price bid for "Sand Covering" per cubic yard, and where such sand covering is used more than once, it will be paid for as "Sand Covering Reused" per cubic yard for each time used. The price bid for "Sand Covering" or "Sand Covering Reused" shall include the final removal of the sand.

#### (f) PAYMENT

Payment for Concrete Pavement shall be made at the price bid per square yard for "Concrete Pavement," and shall be in full for all labor and material except reinforcing steel necessary to construct the pavement ready for traffic, according to these specifications.

Reinforcing steel shall be paid for at the price bid per pound for "Reinforcing Steel in Place."

### 160. 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. It shall be composed of concrete mixed according to the Standard Specifications in the following proportions: One (1) part of cement, two and one-half (2½) parts of sand, and five (5) parts of gravel.

The area of 1:2½:5 pavement base constructed per barrel of cement shall not exceed the following:

For 5" Base.....	6.44 Sq. Yds.
For 6" Base.....	5.36 Sq. Yds.
For 7" Base.....	4.60 Sq. Yds.
For 8" Base.....	4.01 Sq. Yds.

Concrete base shall be placed, finished, and covered with burlap, in all respects as specified for concrete pavement except that edging will not be required and expansion joints shall be placed as required by the specifications for the type of pavement of which the base is to form a part.

All concrete base for pavements, when not immediately covered with brick, shall be kept wet continuously for a period of ten (10) days after laying, as specified for Concrete Pavement.

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.....	1.30 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 shall be made at the price bid for "Concrete Base" per square yard.

### 161. 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.

### 162. ALLEY PAVEMENTS (For plan, see page 172)

The construction of Alley Pavements shall be done in every particular as specified for Pavements of like character, except that one rod may be used for tamping and shaping the concrete and the rolling of the subgrade shall be done before the forms have been placed. In order to make such rolling effective, the contractor shall, before subgrading the alley, reference all slope stakes upon offset stakes or existing buildings or walls and from these references he shall fine grade the alley just prior to rolling. The rolling shall leave the surface true to elevation as specified for "Pavements." In alleys the subgrade drag may be operated by hand.

### PAVEMENT APPURTENANCES

#### 163. CONCRETE CURB

Concrete Curb shall be constructed according to the plan.

After the concrete has been deposited, it shall be well spaded on both face and back to full depth of curb with a perforated spade, to secure a smooth and uniform finish. The top of the curb shall be troweled smooth and finished with a stipple brush. It shall then be jointed into five (5) foot sections.

Two (2) inch weep holes through the curb shall be provided for all existing drains. Where no drains exist, similar weep holes

shall be placed through the curb where street is in cut, approximately sixty (60) feet apart.

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

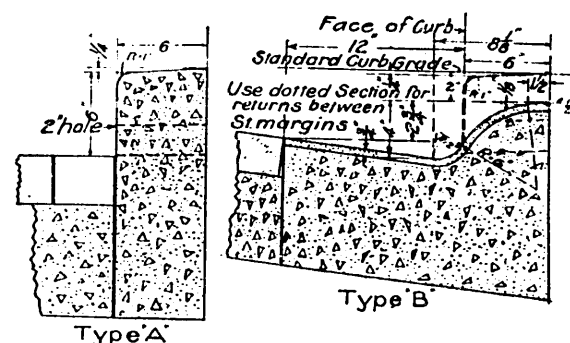
Concrete curb along concrete pavement shall be constructed after the pavement has been completed and sufficient time has elapsed to insure the proper curing of the concrete.

Transverse expansion joints of the same thickness as used in the pavement shall be placed in the curb opposite each expansion joint in the pavement.

At street intersections, type "B" Concrete Curb 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 shall be corrected. Any faults or interstices shall be filled with cement mortar and smoothed so that the top and face of the curb are free from defects. The contractor shall protect the curb from all damage due to traffic and the weather. In hot, dry weather, the curb shall be kept moist by sprinkling as often as directed by the City Engineer.

Payment for concrete curb shall be made at the price bid per linear foot, type "A" or "B," "Concrete Curb" in place and shall include payment for the expansion joints and the two (2) inch weep holes and all other labor and material necessary. Measurement shall be made along the face of the curb, except in the case of Type "B" curb where measurement will be made on a line parallel to and six (6) inches from the back of the curb.



CONCRETE CURB

#### 164. ARMORED CONCRETE CURB

Armored concrete curb shall be constructed in precisely the same manner as specified for Concrete Curb 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 46 under "Quality of Materials." The armor shall be accurately placed on the edge of the curb and shall connect smoothly with the top and sides.

On all armored curb, 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 Curb."

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

#### 165. INTEGRAL CURB

Whenever Integral Curb is to be constructed with concrete pavement, the pavement side forms shall be placed at the back of the curb, and at an elevation determined by the intersection of the back line of the curb and the pavement surface projected.

Immediately following the final floating, the curb forms shall be placed true to line and grade and at once filled with the same grade of concrete as used in the pavement. The back forms shall be of four (4) inch lumber and the face forms shall be of three (3) inch lumber. The back forms shall be securely toenailed to the lower pavement form, and in the case of Type "A" Integral Curb, the face form shall be spaced with six (6) inch spreaders, and held by means of an iron yoke every four (4) feet.

Care shall be taken to spade the curb concrete well into that previously placed and against both sides of the curb form.

Weep holes shall be placed as provided for "Concrete Curb." The top of integral curb and armored integral curb shall be finished as specified for "Concrete Curb."

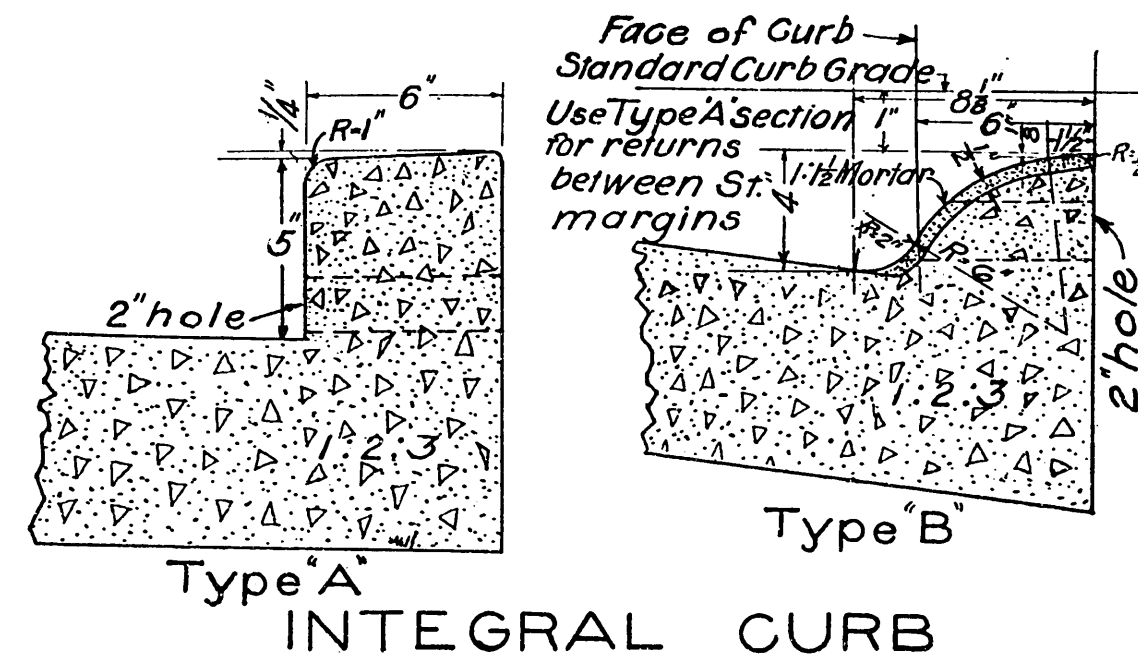
At street intersections, the height of type "B" Integral Curb shall be raised to five (5) inches as specified for type "B" Concrete Curb in Section 163.

All through expansion joints in the pavement shall extend entirely through the curb. All dummy joints in the pavement shall extend through the upper portion of the curb.

When the curb is of Type "B," measurement shall be made to lines parallel to and six (6) inches from the back line of the curb.

Payment for integral curb 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 Type "A," 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.



INTEGRAL CURB



**166. BRICK GUTTERS**

Whenever the roadway pavement is to be bituminous material, the brick gutter adjacent to the curb shall be laid upon the 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.

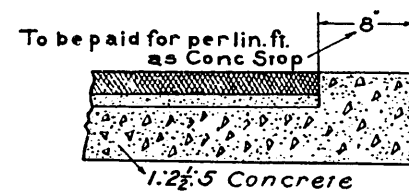
All joints shall be grouted immediately as prescribed for brick pavement.

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

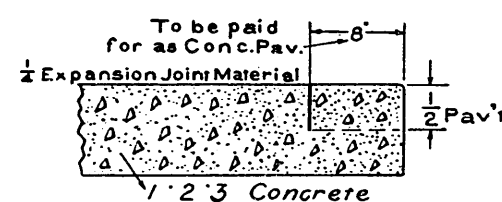
Measurement and payment shall be made for "Brick Gutters" in the same manner as specified for paved areas.

**167. CONCRETE STOP AND CONCRETE SIDE STOP**

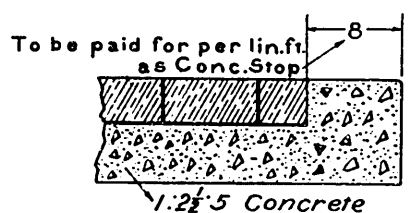
Concrete stop and concrete side stop shall be constructed where shown on the plan, and will be measured with, and paid for as pavement.



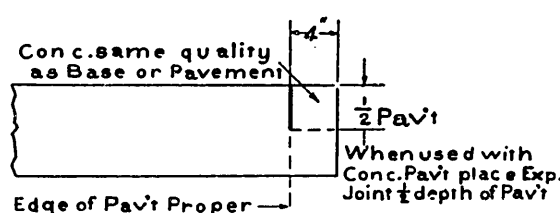
With Asphalt, Asph. Conc.  
PAVEMENT



With Concrete Pav't



With Brick Pav't



Concrete Side Stop  
CONCRETE STOPS

**168. ALLEY CROSSINGS** (For plan, see page 174)

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

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

The surface of concrete alley crossings shall be struck off with a heavy steel shod strike board and floated with a wood float. The surface shall then be brushed in a transverse direction.

Payment for Alley Crossings shall be made at the price bid per square yard for "Concrete Alley Crossings" or "Brick Alley

Crossings," and shall be in full for constructing the crossing to conform in all respects with the specifications for Pavement of the same character, including the subgrading.

**169. PRIVATE ALLEY CROSSING**

(For plan, see page 175)

Private alley crossing shall be constructed according to the plan. They shall be constructed where shown, or where directed by the City Engineer, upon application of the abutting property owners. Such applications shall be honored when the same are received before the adjoining pavement has been constructed.

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

A metal or wood form shaped to the proper reverse curve shall be placed along the curb line to obtain a proper face on the warped portion of the alley crossing.

The warped portion of the alley crossing shall be troweled by hand and the entire surface of the crossing brushed in a transverse direction.

Measurement for curb shall stop at point "A." All paved surfaces between points "A" and from face of curb produced to end of alley crossing, including warped surface, shall be paid for as "Private Alley Crossing," at bid price per square yard, which price shall include subgrading.

**170. ALLEY CATCH BASIN** (For plan, see page 172)

Alley Catch Basins shall be constructed where shown on the plans, or where directed by the City Engineer. They shall be constructed according to the Standard Plan.

Payment will be made at the price bid for each, for "Alley Catch Basins," and shall include all labor and material necessary to construct the catch basin according to these specifications.

**171. 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, or, where such work is not covered, with the original construction.

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.



**172. 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.

**173. 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 Standard Specifications for "Concrete Walks" as written in Section No. 87.

**174. MONUMENT CASES.** (For plan, see page 173)

The material shall conform to the general requirements of these Standard Specifications for cast iron. The City Engineer shall set the monuments.

Payment for "Monument Cases" shall be made at the price bid for each, including the concrete in which the monument case is set.

**175. ADJUSTMENT OF CAST IRON VALVE BOXES**

Payment for "Adjusting Cast Iron Valve Boxes" shall be included in the price bid for pavement.

**176. 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 123.

**177. 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.

**178. GRAVEL SUB-BASE**

Gravel shall be laid as directed by the City Engineer. Pit run gravel, free from clay or loam and so graded that 100% shall pass a two and one-half (2½) inch screen and not more than thirty (30%) per cent shall pass a one-quarter (¼) inch screen, may be used for this purpose.

Payment shall be made at the price bid per cubic yard for "Gravel in Place."

**179. OLD LUMBER RELAID**

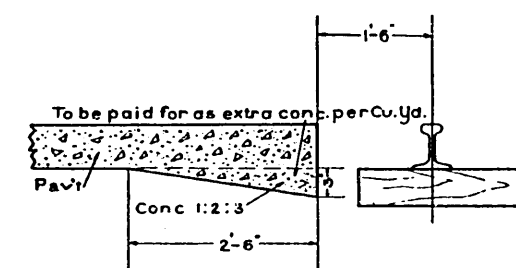
The surfaces of all connecting streets, roadways or walks which do not conform to the general surface of the finished improvement shall be made to conform to such finished surface by filling with suitable material or by excavating, as the same may require. Planking shall be brought to grade and adjusted 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.

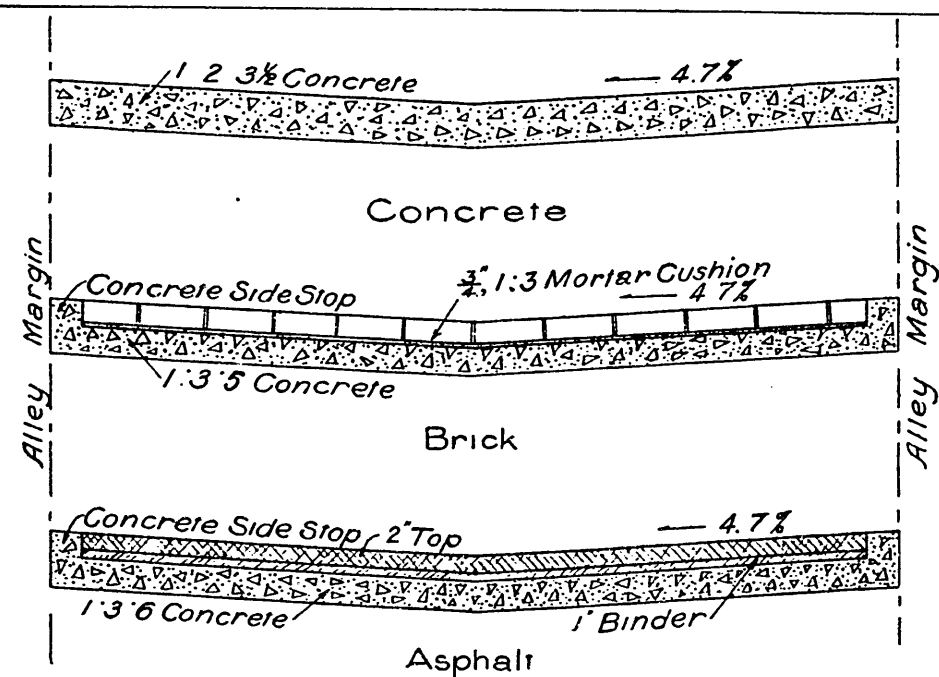
**180. EXTRA CONCRETE ADJOINING STREET RAILWAY**

Pavement adjoining proposed or existing street railway tracks shall be constructed in accordance with the detailed section shown on the plan. The side form shall extend to the bottom of the concrete, and the subgrade drag shall be constructed so as to shape the trench to the dimensions shown.

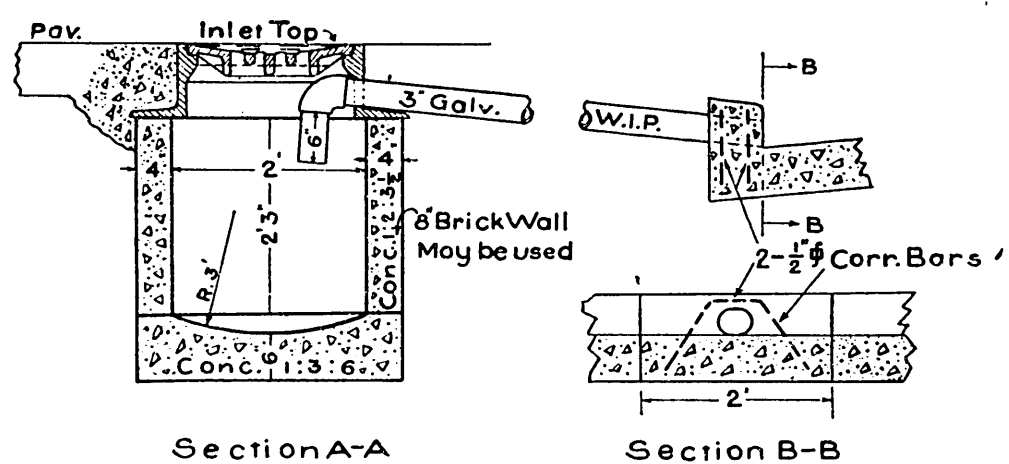
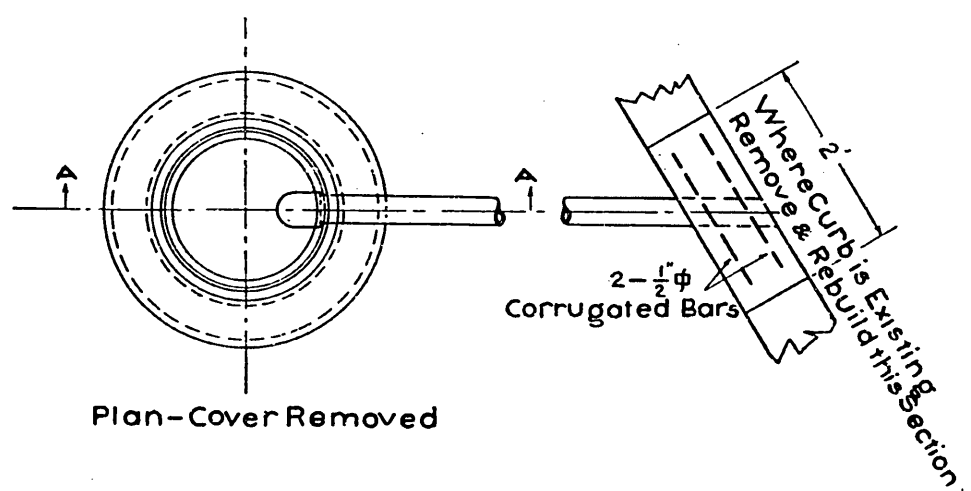
Payment for the "Extra Concrete" for additional depth below the bottom of the pavement, shall be paid for at the price bid per cubic yard in place, such price to include the necessary trenching, form work and one-quarter (¼) inch expansion joint extending to the bottom of the concrete at each expansion joint in the roadway portion.



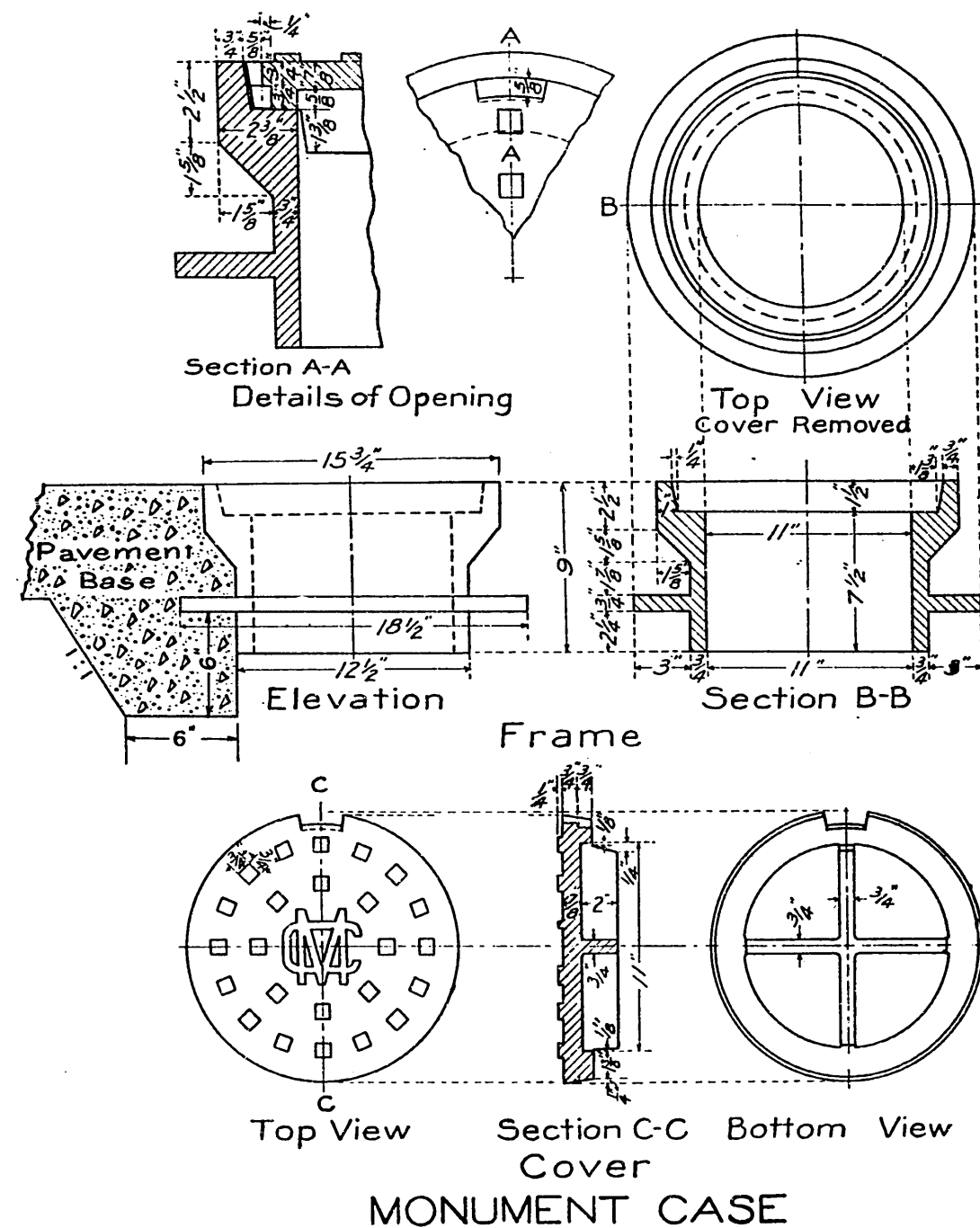
SECTION OF PAV. ADJOINING ST. RY

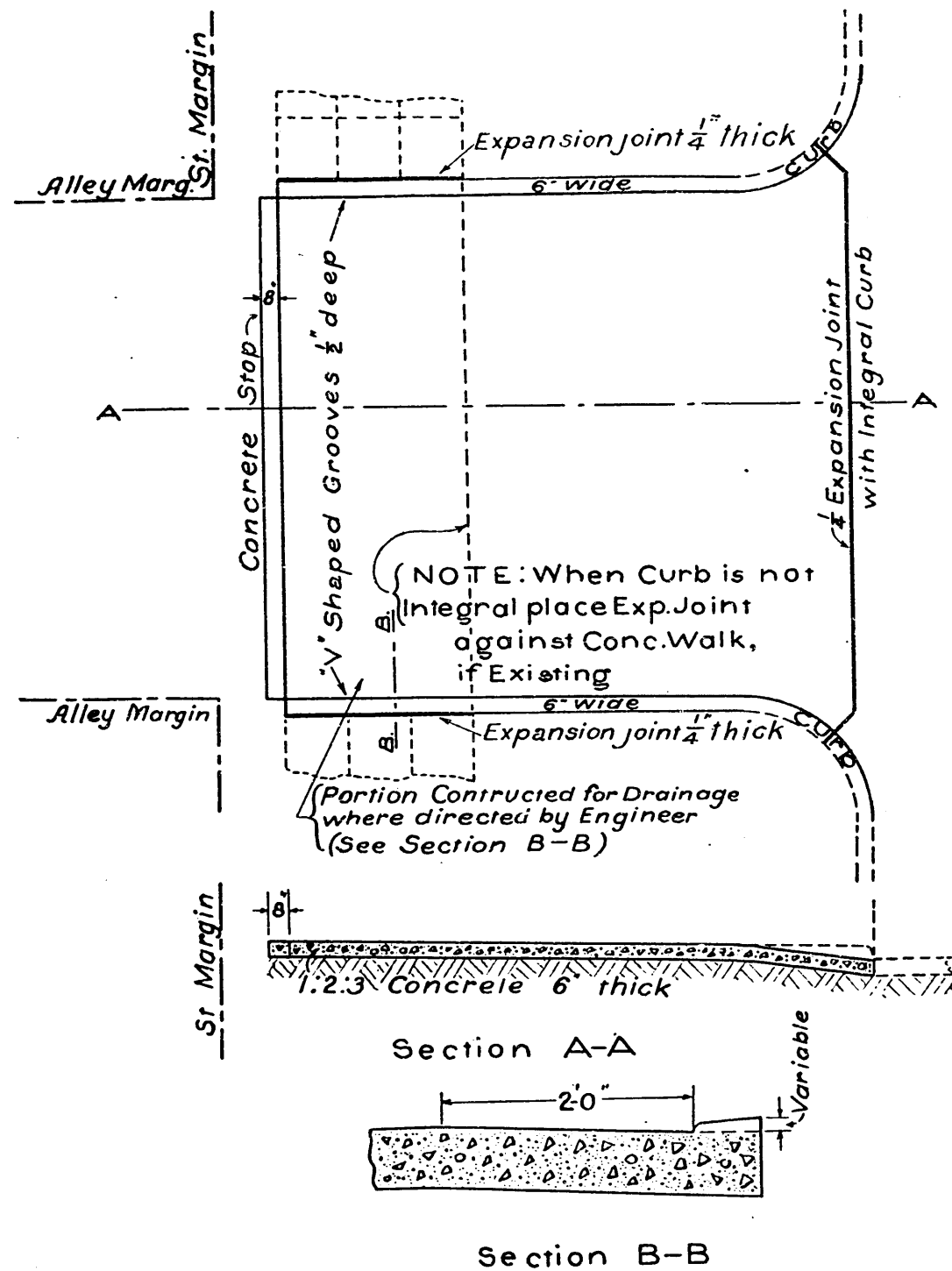


## ALLEY PAVEMENTS

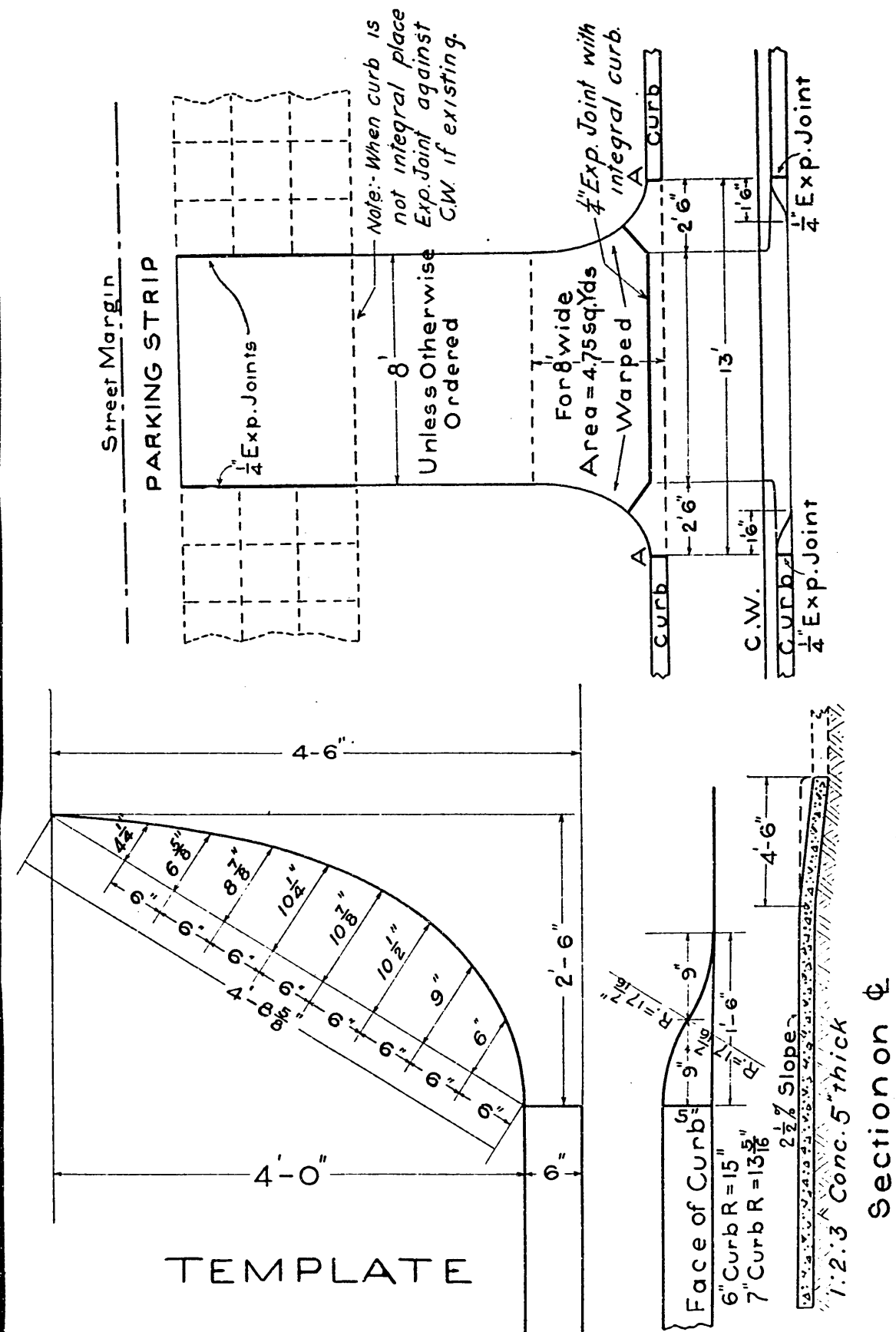


## ALLEY CATCH BASIN





CONCRETE ALLEY CROSSING  
For Paved Streets

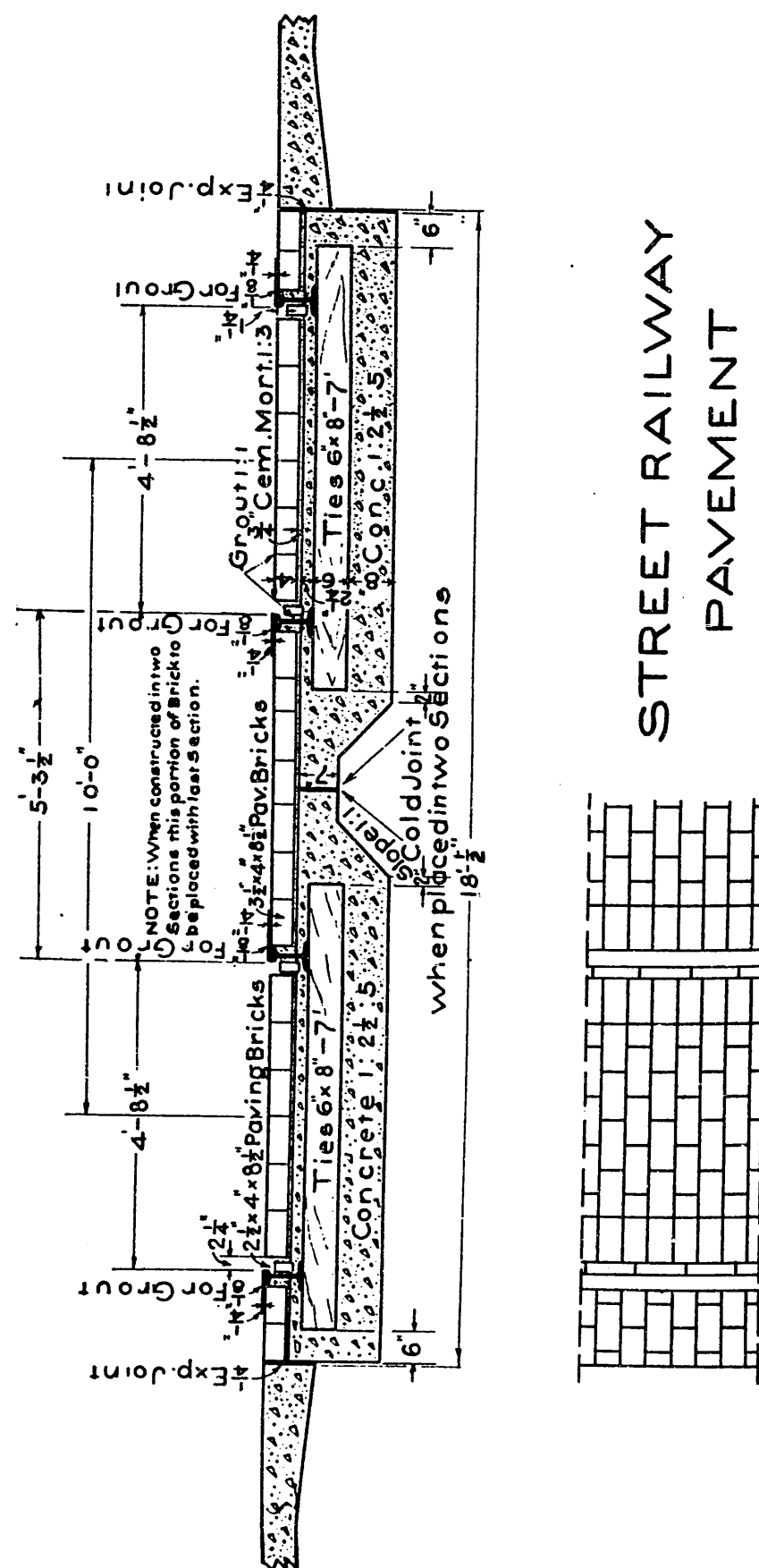


TEMPLATE

Section on  $\Phi$

PRIVATE ALLEY CROSSING

For Paved Streets



STREET RAILWAY  
PAVEMENT

## SPECIFICATIONS

For

## STREET LIGHTING

### General Stipulations

#### 181. WORK INCLUDED

This work shall consist of the installation of a lighting system with all necessary ducts, manholes, posts, transformers, primary and secondary cables, and other appurtenances required to make a complete system in accordance with the Standard Specifications accompanying plans, and as hereinafter more particularly specified.

#### 182. MEASUREMENT

All conduits, wire, and cable shall be measured in place, and no allowance shall be made for waste. The locations given in the specifications and plans are approximate only, and such changes as are necessitated by the interference of other systems shall not be considered as extra work.

#### 183. PAVEMENT AND SIDEWALK REPAIRING

All damage done to, or openings cut in, concrete walks, pavement or alley crossings during the progress of the work shall be repaired by the contractor under the direction of the City Engineer, using for such repairs materials conforming to the requirements of the Standard Specifications of the City of Seattle, for concrete sidewalks, pavement, and alley crossings. The cost of repairing such concrete walks, alley crossings, or pavement, shall be included in the prices bid for various items; provided, however, that the work of backfilling and replacing the pavement will be done by the Street Department in accordance with Section 105 of the Standard Specifications; and further provided, that the cost of such work and material shall be paid by the contractor without reimbursement other than his unit prices for various items.

#### 184. MANHOLES

All manholes shall conform in location, arrangement, material and detail to the general plans for the improvement and to detail plan on page 184.

Each manhole shall be connected and drained to the sewer as shown on plans, using a four (4) inch sewer pipe with cement joints and "P" trap. The floor shall be sloped to this trap and a strong bronze cone screen provided at the entry.

A five-eighths ( $\frac{5}{8}$ ) inch galvanized steel eye bolt for "drawing in" shall be placed opposite and immediately below each duct entry in all manholes. They shall be fitted with a nut and three-eighths by four ( $\frac{3}{8}$  x 4) inch washer or plate bedded in the concrete wall.

Eight (8) "Nordyke" hangers shall be securely fastened in concrete walls where directed.

At all duct entries to manholes, the conduit shall stop about one-half ( $\frac{1}{2}$ ) inch back of the inside face of manhole wall and shall have a bushing on end of conduit and concrete beveled back.

Manholes shall be paid for at the rate bid for "Manholes" complete, the price so paid to be in full payment for all mortar, concrete, castings, bolts, trap, screen, hangers, and all other material and labor required to produce a finished improvement.

"Four (4) Inch Manhole Drain" shall be paid for at the price bid per linear foot, and shall be in full for drain in place.

### 185. HAND HOLES

Hand holes shall be constructed according to detail plan, page 185. The price bid for "Hand Hole" shall be in full for hand hole constructed in place where shown on plan.

### 186. CONDUIT

All conduit shall be of the size specified and shall conform to the requirements for conduit, Section 45.

#### (a) TRENCHING AND LAYING OF DUCTS

A trench of the width and depth required shall be dug and conduit laid with a cover of eighteen (18) inches.

Conduit shall be laid either by laying same in open trench, through openings cut in concrete walks, alley crossings, or pavement where necessary, or by driving or jacking conduit under alley crossings or pavement. Jetting with water will not be permitted.

All conduit laid in open parking area or under concrete walk shall be laid in open trench.

Whenever ducts are installed in basements under concrete sidewalk they shall be supported at intervals of not over ten (10) feet by iron straps securely fastened to the "I" beams supporting the sidewalk.

All joints shall be made water-tight with red lead. All ducts shall have their ends well reamed to remove rough edges, and the threads shall be gone over with a die to make a joint having the ends of ducts touching when the coupling is tight. A steel spring mandrel having a diameter one-fourth ( $\frac{1}{4}$ ) inch less than that of the duct, shall be drawn through after conduit is in place.

All bends in conduit shall be made in a bending machine, machine to be of such a type as to secure a smooth bend having a radius of at least six (6) times the internal diameter of the duct, provided, however, that no bend shall have a radius of less than twelve (12) inches.

Where shown on the plans, a primary conduit of size specified shall be installed from each manhole to a point ten (10) feet above the ground on the existing pole carrying the aerial feed wire. Sufficient conduit and the necessary potheads shall be supplied by the contractor to allow for the Light Department making the connection

to the existing feed wire, near top of pole. Cost of extending conduit, installing cable, and making the connection to feed wire shall be included in the Light Department charges, and shall be paid for as specified in Section 34.

Where shown on the plans a primary conduit of the size specified shall be laid to an existing manhole or handhole, and the primary cable installed to such manhole or handhole. The connection of such primary cable to the existing circuit will be made by the Light Department and shall be paid for as specified in Section 34.

#### (b) BONDING

All conduits shall be bonded together to form a complete metallic conductor, by means of an approved ground clamp, or by means of a copper strap with brass bolts. Ground clamps shall have a conductivity of not less than that of a No. 6 B. & S. Gauge copper wire.

At posts, ground clamps or copper straps shall be attached to conduits within the concrete foundation.

At handholes, conduits shall be bonded together by means of a copper strap bolted to conduit and bedded in the concrete wall.

At manholes, each conduit shall have a copper strap bolted thereon, copper strap embedded in the concrete wall, and extending into the manhole. A No. 0 B. & S. Gauge copper wire shall be soldered to the copper straps and extended to street car rail, whenever there is a street railway track adjacent to the manhole. Bond wire shall have good electrical and mechanical connection to the rail.

Payment for the above ground connections shall be included in the price bid for conduits.

#### (c) BACKFILLING AND EXCESS EARTH

After the laying of the conduit, in open trench, the trench shall be refilled and tamped hard, and the excess earth removed and all sidewalks replaced, in accordance with the Standard Plans and Specifications of the City of Seattle for similar work. Sidewalks shall be replaced in complete squares, no patching being permissible, and all ground or parking strips left in as good condition as found.

#### (d) PAYMENT

Payment for "Conduit" shall be made at the price bid per linear foot in place, for each size specified, and shall be in full for all labor and material including the replacing of walks and pavement.

### 187. OIL FUSE CUT-OUTS

Contractor shall install "Standard Subway Type" D. & W. Oil Fuse Cut-Outs, Type D-10B, No. 246103, Western Electric Catalogue, or equal, on primary side of transformers.

Oil fuse cut-outs shall be securely fastened to the wall of manholes.

Each cut-out shall be provided with fuses of such capacity as designated by the City Engineer.



Payment for each "Oil Fuse Cut-out" shall be made at the price bid, and shall be in full for each cut-out in place.

### 188. TRANSFORMERS

All transformers on any improvement shall be of the same make and characteristics in design and regulation, and of the capacity specified.

They shall be of a make and type satisfactory to the City Engineer.

Temperature rise and insulation test shall be in accordance with latest Standardization Rules of the A. I. E. E.

All transformers shall be of the subway type, air cooled, oil insulated, with water-tight covers.

The primary shall be wound for a working pressure of 2500 volts effective alternating current. The ratio shall be 10 to 1 and 20 to 1, i. e., 2500 to 250 and 2500 to 125 volts.

The primary side of the transformer shall be connected to the oil fuse cut-outs with single conductor lead cable of size and insulation equal to that of the primary cable specified.

From the secondary side of the transformer a duplex lead covered cable of capacity equal to the total capacity of all circuits leading to lamp posts, shall lead into a secondary distribution cabinet. This cabinet shall be constructed of No. 10 gauge galvanized sheet iron with all joints soldered. All cable and wire entrances shall be made water-tight with rubber gaskets or condulets. This cabinet shall contain fuse blocks, or cut-outs, complete with enclosed cartridge fuses, one cut-out being provided for each secondary circuit to lamps. Fuses shall be of such capacity as designated by the City Engineer. The distribution cabinet shall be connected by means of copper strap to the ground wire in the manhole. All connections shall be soldered.

All cables, splices, cut-outs, and mountings, on primary side of transformers shall be painted red. All other wires, cables, distribution cabinet, and fittings in manholes shall be painted with black asphaltum paint.

Payment shall be made for "Transformers" at the price bid each, for the size specified, and shall be in full for the transformer installed, including the secondary distribution cabinet, fuse blocks, fuses, and the connections from the oil fuse cut-outs to the transformer, and from the transformer to the distribution cabinet.

### 189. POST BASE TRANSFORMERS

The contractor shall furnish and connect in each pole base, one transformer of the capacity specified, having the following characteristics:

Ratio: 250 to 15 with taps for 16 and 17 volts on the secondary.  
Bidder required to state and guarantee the full load losses.  
Temperature rise after 12 hours' operation on full load, 40° Centigrade.

They shall be of the dry type, enclosed in a metal box filled with an approved insulating compound, elastic at ordinary temperatures. Leads shall be brought out through porcelain tubes. All terminals shall be soldered and taped. Transformers shall be made with separate coils for primary and secondary, capable of withstanding a puncture test of 2500 volts between primary and secondary or from either coil to core.

Each post base transformer shall have mounted thereon a two-pole, porcelain, enclosed fuse cut-out, equipped with "Economy Renewable," or equal, fuses of such capacity as the City Engineer may direct. Post base transformers shall have short legs, about one (1) inch in length, in order to raise transformer above post base foundation.

All leads shall be numbered, the numbers being stamped into the metal container; and a brass plate stamped with the capacity of the transformer, the maker's name, and the various combinations of leads to give required secondary voltages; shall be soldered to the transformer.

Payment shall be made for "Post Base Transformers" at the price bid for each, with cut-out and fuses in place in the post base.

### 190. POSTS (For plan, see pages 186, 187, 188)

Posts shall conform in all details to the plan. They shall be of the type specified. Posts shall be poured complete in one operation and shall be made of Portland Cement Concrete, mixed according to Standard Specifications. Concrete shall be in the proportions of one (1) part cement to three (3) parts aggregate.

The concrete post shall be poured in forms made of cast iron, steel or aluminum. Forms shall be rigid and securely braced and machined smooth inside before pouring concrete post. Forms shall be painted on the inside with Form Oil or other compound so as to prevent the sticking of the form to the concrete post when being removed.

All concrete posts shall be manufactured by the centrifugal process. To eliminate all air pockets and bubbles, concrete shall be poured into mold in a slow but continuous stream while the mold is being revolved at a speed of approximately two hundred and fifty (250) revolutions per minute. A smooth, uniform and dense finish must be obtained. No patching after forms are removed will be permitted.

After forms are completely filled with concrete, they shall be spun at above rate of speed for at least thirty (30) minutes, or a sufficient length of time so that post will sustain its own weight if forms were to be removed.

After forms are removed the concrete posts shall be cured at least ten (10) days with water. This shall be done by wrapping with burlap and sprinkling continuously.

After this ten (10) days curing in water, posts shall be cured an additional twenty (20) days dry, before being moved or installed.

Spiral reinforcing shall be assembled mechanically and tied securely to the one-half ( $\frac{1}{2}$ ) inch reinforcing bars with No. 16 gauge iron wire, or welded to same.

In order to maintain correct position of reinforcing steel in form while concrete is being poured, spacers shall be attached to reinforcing bars. One spacer shall be placed at center of post and a spacer near each end of post. Spacers shall be made of No. 6 gauge iron wire and securely wired to one-half ( $\frac{1}{2}$ ) inch vertical bars. Ends of wires making up spacer shall be cut to "V" shape, and wires shall be of correct length to abut against form.

Each post shall be given two (2) coats of concrete paint, conforming in quality to "Bay State," the color to be a creamy gray, subject to approval of the City Engineer.

The first coat of the above paint shall be put on before post has been set in place. Second coat of paint shall be put on after system has been tested out and is ready for operation.

After the posts have been set and plumbed, they shall be grouted on the foundation with equal parts of cement and plaster sand, poured from the inside of the post base, and worked out until the entire post has a uniform bearing. The contractor shall cover the projecting anchor bolt and nut with a thick coating of asphaltic paint and immediately cover with sand.

Payment for "Posts" shall be made at the price bid for each, and shall be in full for the post in place, including all material and labor necessary to manufacture and place the post ready to receive the post furnishings, and to paint the same.

#### 191. CONCRETE POST FOUNDATION

Concrete post foundations shall be of the dimensions shown on the standard plan. The concrete shall be mixed according to the Standard Specifications and in the proportion of one (1) part cement to two and one-half ( $2\frac{1}{2}$ ) parts sand to five (5) parts gravel.

Forms shall be used to keep the foundation true to shape and specified dimensions for a distance of at least six (6) inches down from the top of the foundation. Below this point the concrete may be poured against the earth walls of the excavation.

Payment for post foundations shall be made at the price bid for "Concrete Post Foundation" per cubic yard in place and shall include the furnishing and placing of the anchor bolts and covering the same with asphalt and sand as herein specified.

#### 192. RUBBER COVERED WIRE

All rubber covered wire shall be of the sizes specified, or shown on the plans, and of the quality specified in Section 60.

All joints in rubber covered wire shall be thoroughly soldered, the solder being properly "sweated" in, making the joint equal to the wire in conductivity. The joint shall then be thoroughly taped, making the insulation equal to that of the rest of the wire. The insulation of the joint shall be made as impervious to moisture as that of the rest of the wire. No joints will be allowed in conduit.

Tests, as specified, will be made by the City Engineer after all joints have been finished.

Payment for "Rubber Covered Wire" shall be made at the price bid per linear foot of single conductor in place, for each size of wire specified, and no allowance will be made for waste.

#### 193. LEAD COVERED CABLE

All lead covered cable shall be of the sizes specified, or shown on the plans, and of the quality specified in Section 53.

All joints made in primary lead covered cable shall be made in a workmanlike manner, using a one-eighth ( $\frac{1}{8}$ ) inch lead sleeve properly "wiped" and filled with hot compound of approved make. After the first filling soaks in, the joint shall be refilled.

The sleeve shall be made thoroughly dry and air-tight. Primary lead covered cable shall be tested at 7500 volts for five minutes, between conductors, and between conductors and lead sheath.

All joints in secondary lead cable shall be made as specified for rubber covered wire.

The lead sheath on cable shall not be cut lower than three (3) inches above the top of conduit in the post base or hand hole. Where lead sheath terminates, the cable shall be tightly taped with three (3) windings of "P & B" tape extending two and one-half ( $2\frac{1}{2}$ ) inches each way from the end of the lead sheath. The tape then to be warmed with blow torch or otherwise until it becomes a sticky compact mass.

Secondary lead covered cable shall be tested for five minutes, between conductors, and between conductors and lead sheath. No. Six (6) or larger shall be tested at two thousand (2000) volts, and cables smaller than No. Six (6) shall be tested at fifteen hundred (1500) volts.

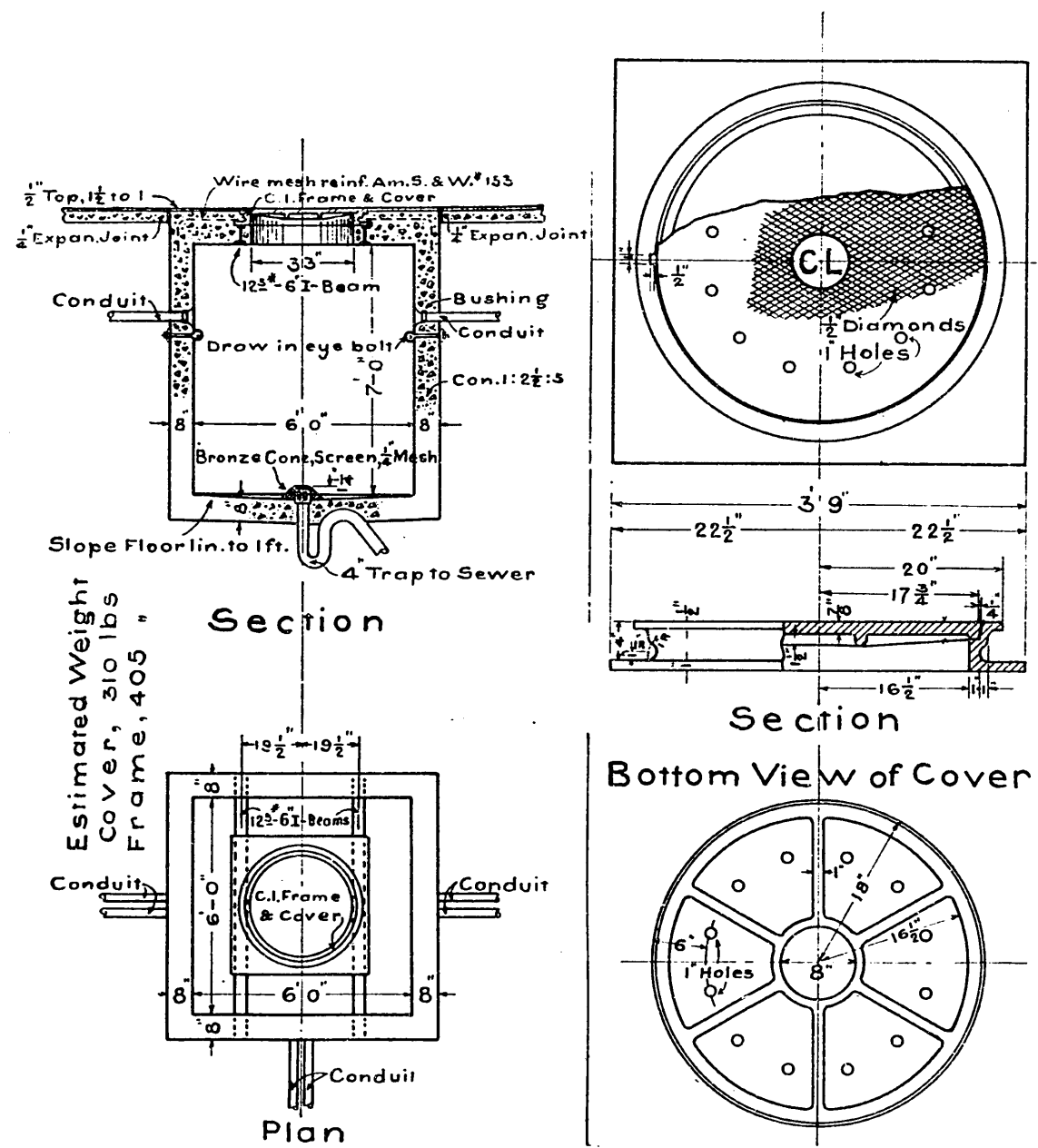
No joints or splices will be permitted in primary or secondary lead covered cable in conduit.

Payment for "Lead Covered Cable" shall be made at the price bid per linear foot in place for each size or type specified, and no allowance will be made for waste.

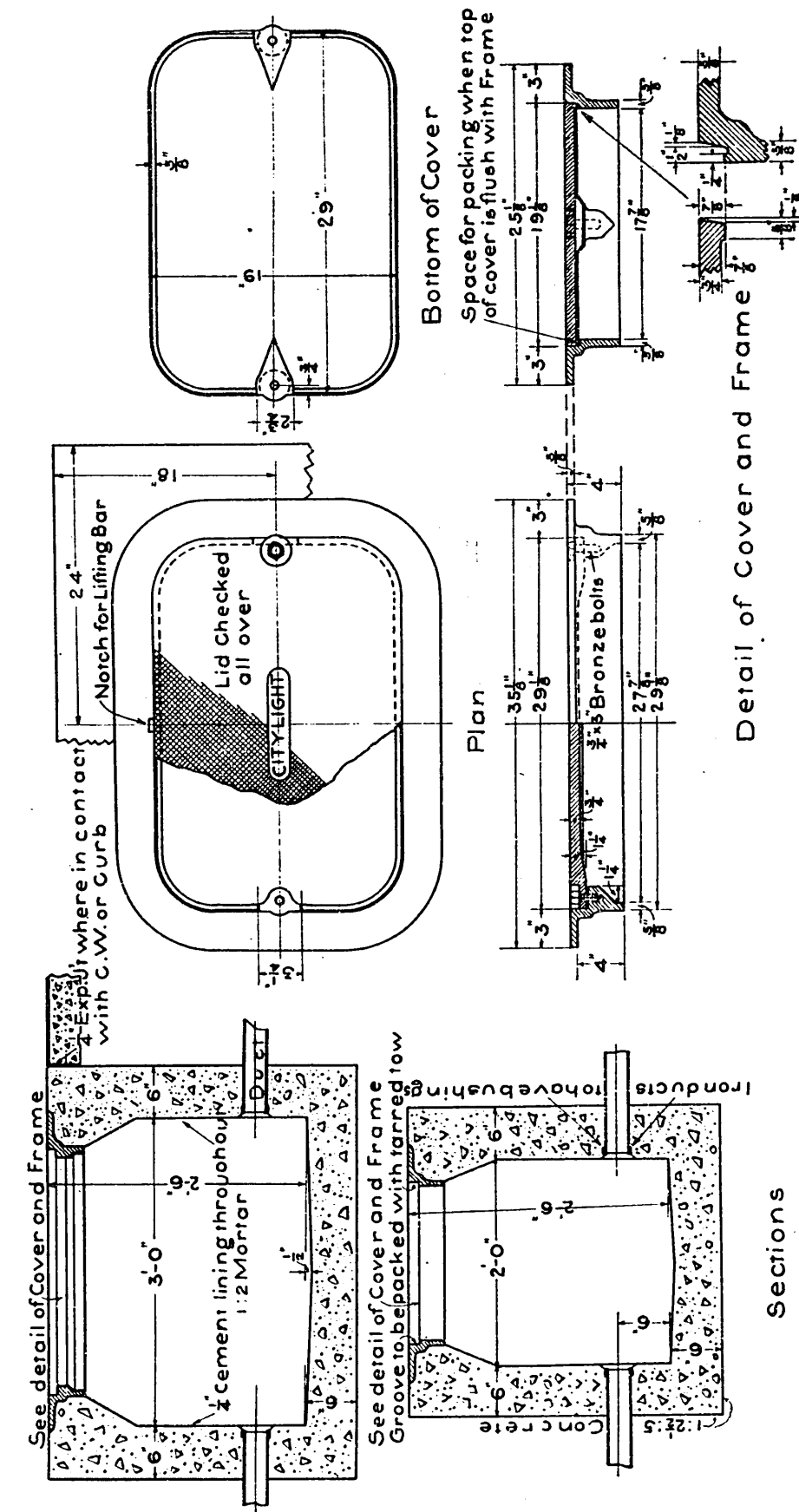
#### 194. POST FURNISHINGS

Post furnishings shall include the cast iron bracket or capital, the complete light assembly, and the post wiring; all as specially specified or shown on the plans for the improvement. Brackets shall be dipped in red lead at the foundry and painted with two coats of metal paint of the same color as used on the posts.

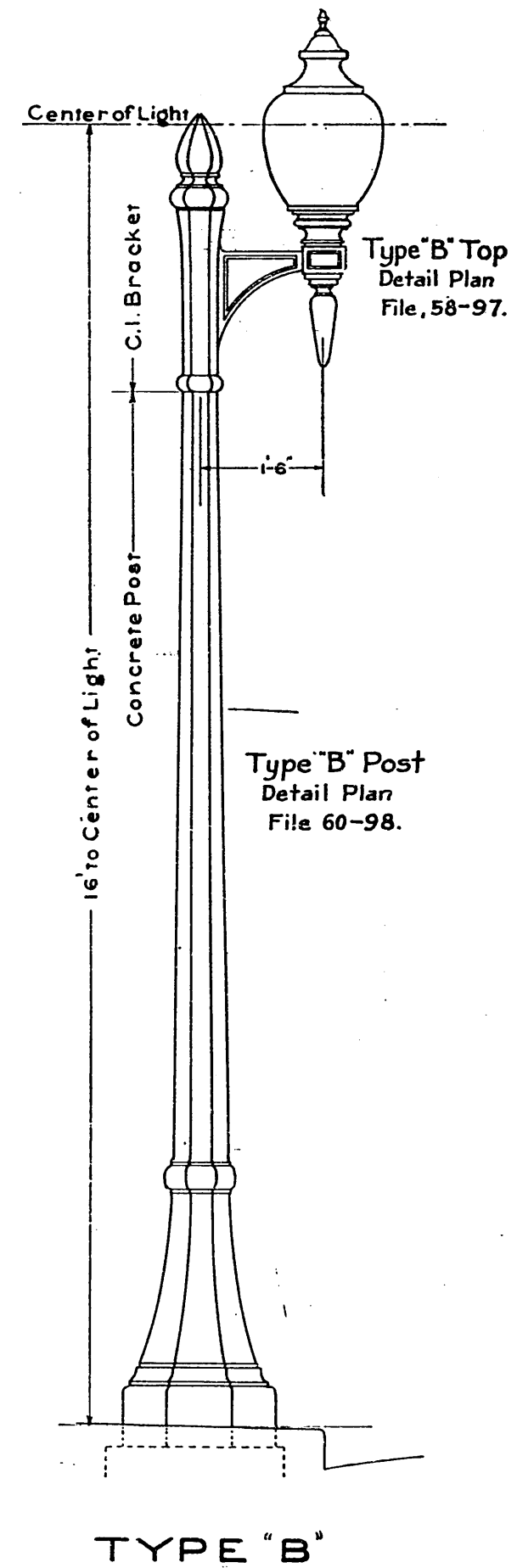
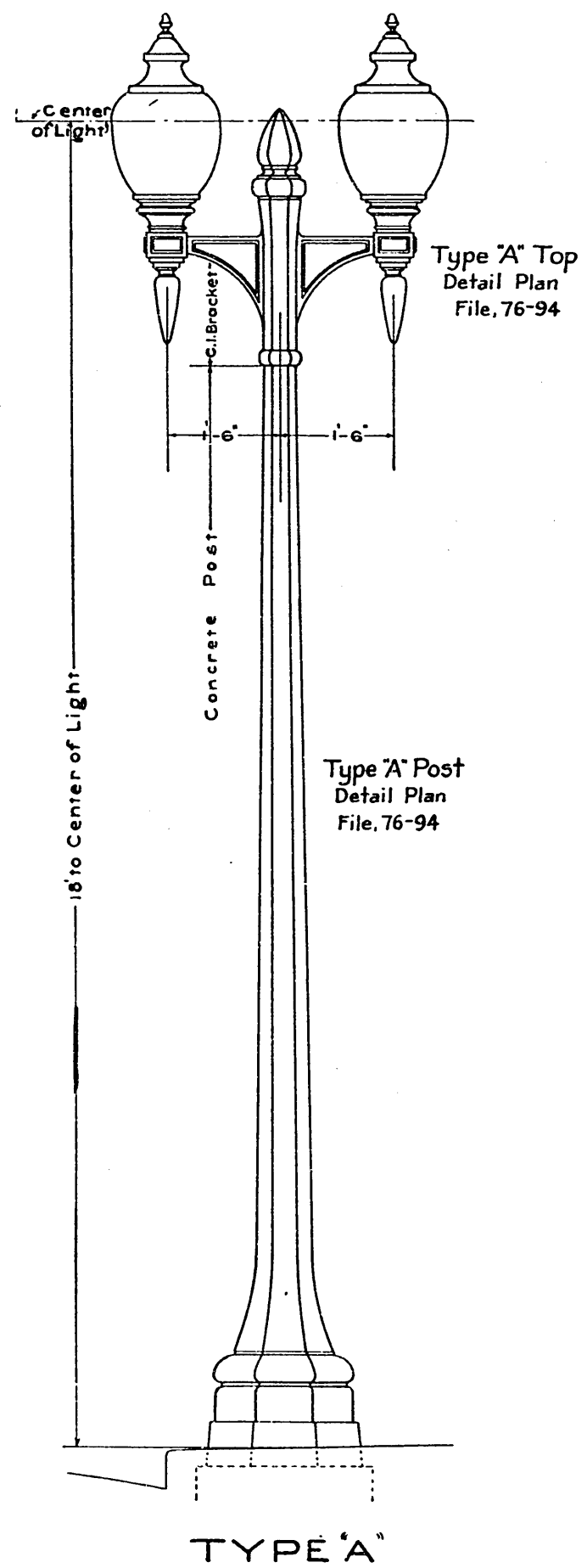
Payment for "Post Furnishings" shall be made at the price bid for the furnishings for each post completely installed ready to operate.

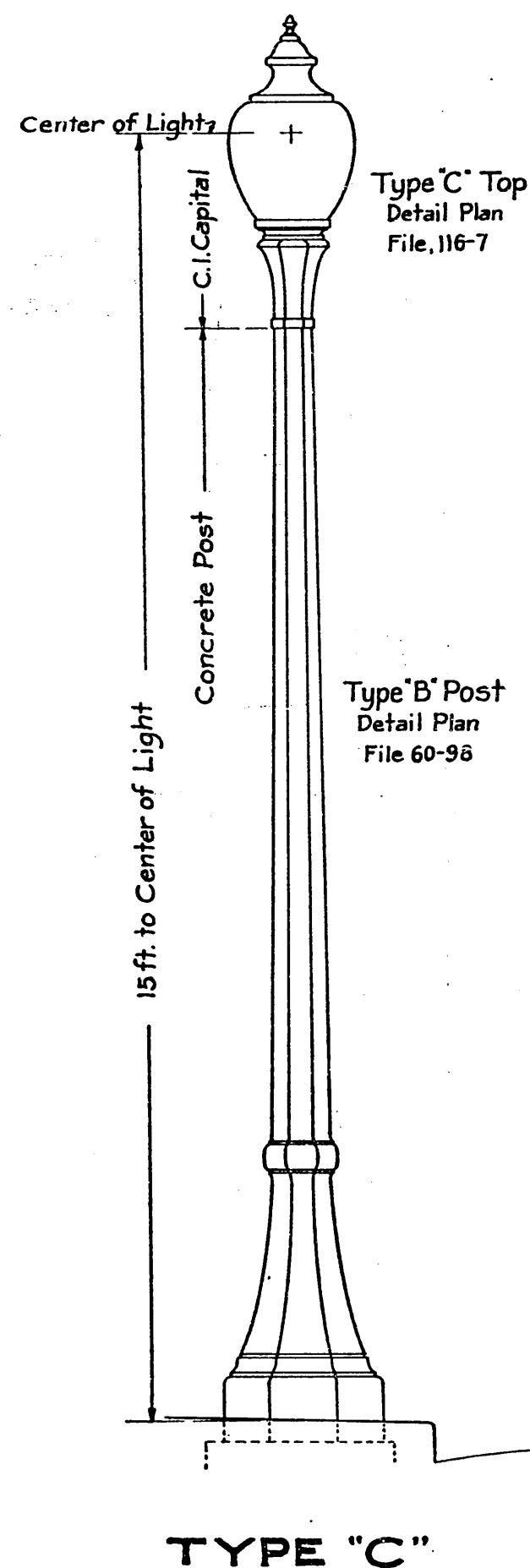


MANHOLE  
STREET LIGHTING SYSTEM



HANDHOLE-STREET LIGHT SYSTEM





## SPECIFICATIONS

### FOR

## PLANKING AND TIMBER TRESTLES

### 195. PLANKING OR REPLANKING

(For plan, see page 193)

All lumber shall conform to the Standard Specifications in Section No. 54 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. 71 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 street in a workmanlike manner.

**(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.

**196. 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 planking 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.

**197. 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. 66 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.

**198. TIMBER TRESTLES**

All lumber shall conform to the Standard Specifications in Section No. 54 under "Quality of Materials."

**(a) PILING**

Piling shall conform to the Standard Specifications for Piling in Section No. 58. 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 ( $\frac{1}{2}$ ) 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 portion 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 ( $\frac{3}{4}$ ) 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 toenailed 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 the detail plan.

(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. 57.

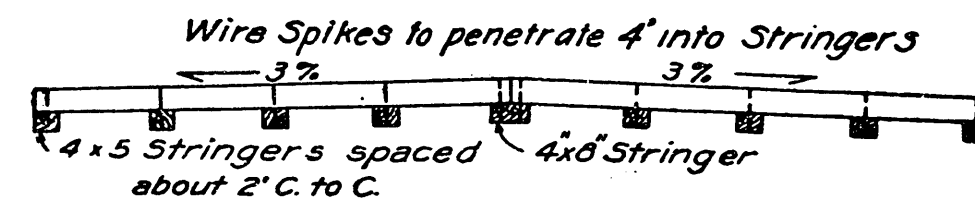
(h) **COATING POINTS OF CONTACT**

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."

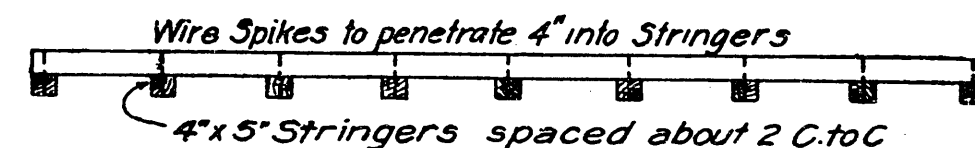
(i) **PAYMENT**

Payment for "Piling" shall be made at the price bid per linear foot of pile in place. Piles shall be measured downward from the "cut-off." Braces shall be measured over all, no reduction being made for diagonal cuts. Test piles when used in the structure will be paid for. Payment for caps, posts, stringers, braces, 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, nails, bolts, and all other labor and material necessary to complete the structure according to the Plans and Specifications.

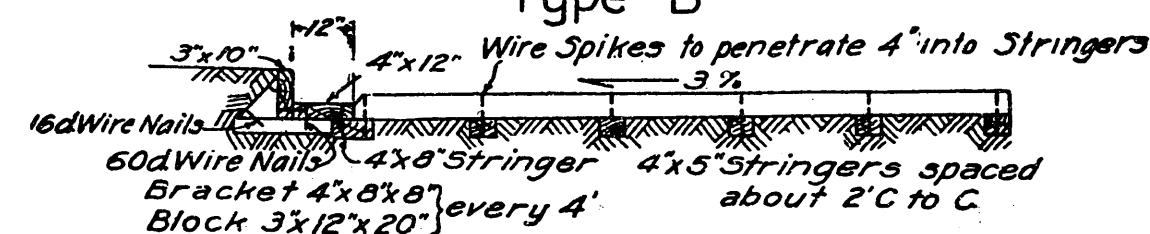
Payment for wood railing shall be made at the price bid per linear foot in place for "Light Wood Railing" or "Heavy Wood Railing," and this price shall include payment for all material, cutting, fitting, etc., painting and protection.



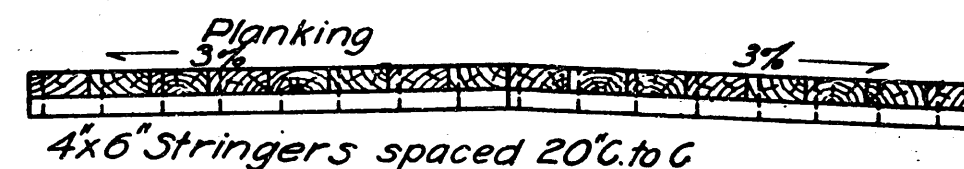
Type A



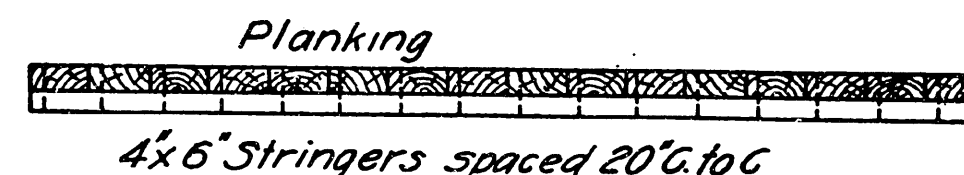
Type B



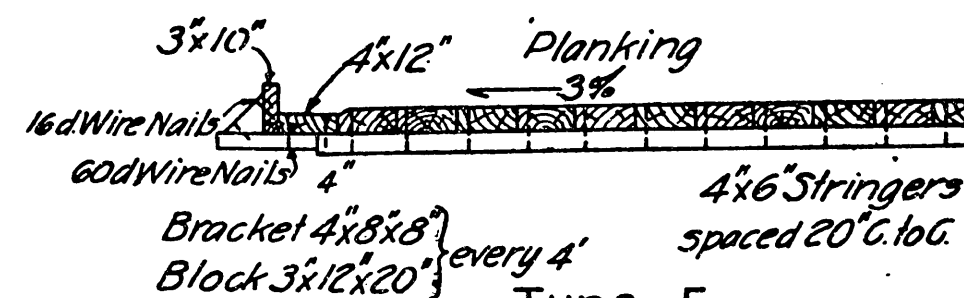
Type C



Type D

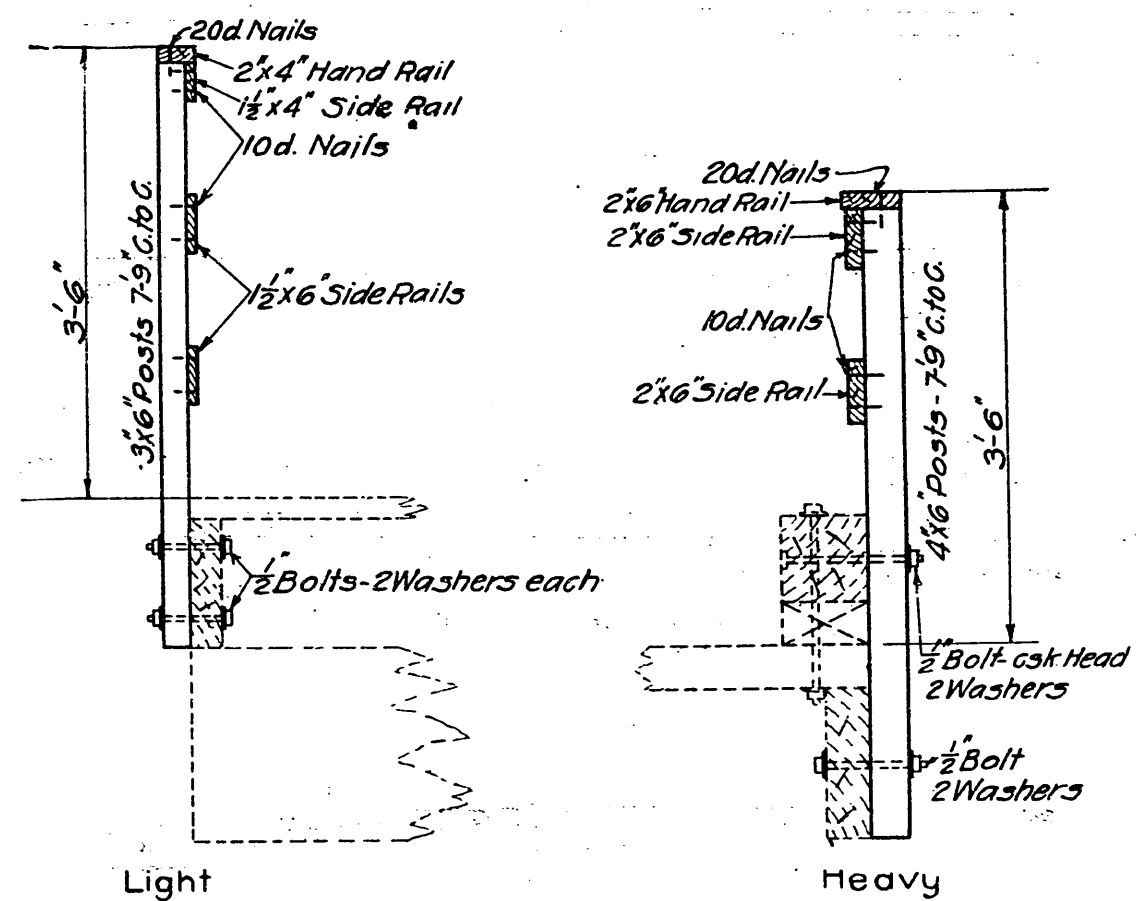


Type E



Type F

**PLANKING SECTIONS**



WOOD RAILING

Examined and Approved by the

BOARD OF PUBLIC WORKS, March 12th, 1926.

C. B. BAGLEY,  
Secretary.

GEO. F. RUSSELL,  
Chairman.

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