

1932

CITY OF SEATTLE
DEPARTMENT OF PUBLIC WORKS

STANDARD PLANS
AND
SPECIFICATIONS

Fifth Edition
PREPARED BY THE CITY ENGINEER

APPROVED BY THE BOARD OF PUBLIC WORKS
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CONTENTS

GENERAL STIPULATION APPLICABLE TO ALL CONTRACTS

- Section 1. Plans and Specifications Part of Contract.
2. Dimensions.
3. Meaning of Terms.
4. Abbreviations.
5. Errors and Omissions.
6. Bidders to Make Examination.
7. Quantities Furnished to Bidders.
8. Fees and Royalties.
9. Contract—When to Take Effect.
10. Assignment of Contract.
11. Subletting of Contract.
12. Orders to Begin Work.
13. Use of Streets.
14. Workmen.
15. Rates of Wages.
16. Payment of Wages.
17. Hours of Labor.
18. Contractor Responsible for Work Done.
19. Changes in Plan and Quantities.
20. Claims for Extras.
21. Inspection and Testing of Materials.
22. Laying Out of Work.
23. Use of Water, Light and Power.
24. Interference with Existing Utilities.
25. Protection to Work and Property.
26. Preservation of Monuments.
27. Damage to Existing Improvements.
28. Protection to Utilities.
29. Provision for Sewer, Water and Gas. Connections.
30. Provision for Water Courses.
31. Maintaining Traffic.
32. Contractor to Maintain Guards.
33. Injunctions.
34. Interference with Other Contracts.
35. Extension of Time.
36. Bills of City Departments against Local Improvement Districts—How paid.
37. Industrial Insurance.
38. Estimates and Payments.
39. Decision of Questions.
40. Forfeiture of Contract.
41. Persons to Whom Contracts are Forbidden.

QUALITY OF MATERIALS

42. Alloys
 (a) Aluminum Alloy
 (b) Bronze Alloy

43. Brick
 - (a) Class "A"
 - (b) Class "B"
 - (c) Class "C"
 - (d) Concrete Bricks
44. Bridge Hardware
45. Cast Iron
46. Cement
 - (a) Volume of Sack
 - (b) Tests
 - (c) High Early Strength Cement
47. Centrifugal Concrete Pipe
 - (a) Dimensions
 - (b) Forms
 - (c) Concrete
 - (d) Reinforcement
 - (e) Joints
 - (f) Tests
 - (g) Contractor to Submit Detailed Plans
48. Coal Tar Creosote Oil.
49. Concrete
 - (a) Classification
 - (b) Manufacture
 - (c) Finish for Structural Concrete
50. Conduit
51. Curb Armor
52. Expansion Joint Material
53. Filler for Brick Pavement
54. Galvanized Material.
55. Gravel.
 - (a) Structural Grade
 - (b) Paving Grade
56. Lamp Black.
57. Lead
58. Lead Substitutes
59. Lead Covered Cable
 - (a) Primary Lead Covered Cable
 - (b) Secondary Lead Covered Cable
60. Lumber
 - (a) Grade Requirements
 - (b) Additional Requirements
 - (c) Inspection
61. Lumber Creosoted
 - (a) Materials
 - (b) Seasoning
 - (c) Preparation for Treatment
 - (d) Plant Equipment
 - (e) Treatment
 - (f) Penetration
 - (g) Amount of Preservative
 - (h) Condition after Treatment
 - (i) Pipe Staves
62. Nails and Spikes

63. Oakum
64. Paint
 - (a) General Requirements
 - (b) Raw Materials
 - (c) Paint Formulas
65. Piling
 - (a) Concrete Piling
 - (b) Timber Piling
66. Piling Creosoted
 - (a) Before Treatment
 - (b) Creosote Oil
 - (c) Treatment
 - (d) Amount of Creosote
 - (e) Penetration
 - (f) Condition after Treatment
67. Rubber Covered Wire
 - (a) Standard
 - (b) For Underground Use
 - (c) Tests
68. Sand
 - (a) Structural Grade
 - (b) Paving Grade
 - (c) For Mortar
 - (d) For Plaster and Grout
69. Sewer Pipes
 - (a) Vitrified Clay
 - (b) Concrete
70. Steel Castings
71. Steel Forgings
72. Steel Reinforcement Bars
 - (a) Manufacture
 - (b) Chemical Properties and Tests
 - (c) Physical Properties and Tests
 - (d) Allowable Variation in Weight
 - (e) Finish
 - (f) Inspection and Rejection
73. Structural Steel
74. Water

SPECIFICATIONS FOR GRADING, CURBING AND APPURTENANCES

75. Clearing and Grubbing
76. Stripping
77. Earthwork
 - (a) Slope Stakes
 - (b) Excavation
 - (c) Embankment
 - (d) Removing Unsuitable Material
 - (e) Measurement and Payment
78. Surfacing Roadways and Parking Strips
79. Extra Excavation
80. Concrete Curb and Gutter
81. Wood Curb and Gutter

- 82. Wood Curbs and Gutters Adjusted
- 83. Shear Boards
- 84. Sand Boxes
- 85. Sewer Pipe Drains
- 86. Box Drains
- 87. Rock Pockets
- 88. Concrete Post Fence
- 89. Reflector Signal
- 90. Wood Fence
- 91. Pipe Culverts
- 92. Underpinning

SPECIFICATIONS FOR SIDEWALK AND APPURTENANCES

- 93. Clearing and Grubbing
- 94. Grading
- 95. Temporary Wood Walks and Cross Walks
- 96. Cross Walks
 - (a) Wood Cross Walks
 - (b) Concrete Cross Walks
- 97. Wood Stairways
- 98. Concrete Sidewalks
 - (a) Two-course Concrete Walks
 - (b) One-course Concrete Walks
 - (c) General Requirements for Sidewalks
 - (d) Payment
- 99. Concrete Sidewalks Replaced
- 100. Corrugated Concrete Sidewalk
- 101. Concrete Stairways
- 102. Concrete Gutters for Stairways
- 103. Galvanized Iron Railing
- 104. Sidewalk Drains
- 105. Concrete Alley Crossings
- 106. Private Concrete Alley Crossings
- 107. Resurfacing Slopes and Parking Strips

SPECIFICATIONS FOR CONCRETE RETAINING WALLS

- 108. Gravity Retaining Walls
 - (a) Foundation
 - (b) Extra Excavation
 - (c) Forms for Concrete
 - (d) Concrete
 - (e) Placing Concrete
 - (f) Reinforcing Steel
 - (g) Joints
 - (h) Finishing
 - (i) Waterproofing
 - (j) Materials for Waterproofing
 - (k) Sewer Pipe
 - (l) Backfilling
 - (m) Payment
- 109. Concrete Crib Bulkhead
- 110. Reinforced Concrete Walls

SPECIFICATIONS FOR SEWERS AND APPURTENANCES

GENERAL STIPULATIONS

- 111. Alignment and Grade
- 112. Trenching for Pipe Sewer
- 113. Lumber left in Trench
- 114. Extra Excavation
- 115. Tunneling for Pipe Sewers
- 116. Backfilling
 - (a) Backfilling Trenches
 - (b) Backfilling Tunnels
- 117. Backfilling and Replacing Pavement by Street Department
- 118. Restoring Roadway

SEWERS

- 119. Pipe Sewers
 - (a) Quality of the Pipe
 - (b) Pipe Laying
 - (c) Jointing
 - (d) Measurement and Payment
- 120. Brick Sewers
 - (a) Quality of Bricks
 - (b) Brick Laying
 - (c) Measurement and Payment
- 121. Reinforced Concrete Sewers
- 122. Wooden Box Sewers
- 123. Extra Wyes
- 124. Side Sewers
- 125. Standard Connections
- 126. Extension of Side Sewer
- 127. Sewer Sub-drain
- 128. Manholes
 - (a) Brick Manholes
 - (b) Concrete Block Manholes
 - (c) Concrete Manholes
 - (d) Payment
- 129. Drop Manholes
- 130. Flush Tanks
- 131. Catch Basins
- 132. Elliptical Catch Basins, Special Catch Basins, and Catch Basins with Special Inlet Top
- 133. Wood Manholes
- 134. Wood Manhole Extensions
- 135. Rebuilding Manholes, Catch Basins, Gate Chambers and Flush Tanks
- 136. Moving Catch Basins
- 137. Inlets
- 138. Moving Inlets
- 139. Curb Inlets

SPECIFICATIONS FOR WATERMAINS AND APPURTENANCES **GENERAL STIPULATIONS**

- 140. Alignment, Grade and Cover
- 141. Trenching
- 142. Extra Excavation
- 143. Backfilling
- 144. Connections to Existing Mains
- 145. Service Connections
- 146. Removal of Old Pipe
- 147. Restoring Roadway

WATERMAINS

- 148. Cast Iron Pipe
 - (a) Sand Cast Pipe
 - (b) Centrifugally Cast Pipe
 - (c) Manufacturer Responsible for Shop Tests
 - (d) Weighing
 - (e) Condition of Castings when Delivered
 - (f) Lead
 - (g) Lead Substitutes
 - (h) Oakum
 - (i) Laying Pipe
 - (j) Jointing
 - (k) Field Tests
 - (l) Measurement
 - (m) Payment
- 149. Galvanized Wrought Pipe
 - (a) Iron Pipe
 - (b) Steel Pipe
 - (c) Installation
 - (d) Payment
- 150. Gate Valves
- 151. District Gate Valves
- 152. Valve Chambers
- 153. Wood Valve Boxes
- 154. Hydrants
- 155. Cast Iron Valve Boxes
- 156. Hydrant Connections
- 157. Resetting Existing Hydrants
- 158. Moving Existing Hydrants
- 159. Reconnecting Existing Hydrants
- 160. Hydrant Drains
- 161. Hydrant Extensions
- 162. Special Castings
- 163. Blocking

SPECIFICATIONS FOR PAVEMENT AND APPURTENANCES **GENERAL STIPULATIONS**

- 164. Measurements of Pavement
- 165. Grading Parking Strips

- 166. Washing Pavement
- 167. Subgrading for Pavement
 - (a) Forms
 - (b) Scarifying and Rolling Subgrade
 - (c) Planking Subgrade
 - (d) Approaches
 - (e) Payment

PAVEMENTS

- 168. Concrete Pavement
 - (a) Placing Concrete
 - (b) Expansion Joints
 - (c) Curing
 - (d) Reinforcing Steel in Place
 - (e) Extra Concrete under Pavement
 - (f) Maintaining Traffic—Plank Covering
 - (g) Payment
- 169. Concrete Base for Pavements
- 170. Additional Concrete Base
- 171. Concrete Wearing Surface for Trestles
- 172. Sheet Asphalt Pavements
 - (a) Refined Asphalt
 - (b) Asphaltic Cement
 - (c) Sand used in Asphalt Mixture
 - (d) Filler used in Asphalt Mixture
 - (e) Wearing Surface
 - (f) Binder
 - (g) Transportation and Laying of Binder
 - (h) Paint Coat
 - (i) Applying Paint Coat
 - (j) Transportation and Laying of Wearing Surface
 - (k) Wearing Surface for Bridges
 - (l) General Requirements
 - (m) Sample of Asphalt Top
 - (n) Requirements for Finished Pavement
 - (o) Asphalt Alleys
 - (p) Asphalt Gutters
 - (q) General Requirements of Operation of Asphalt Plants
 - (r) Payment
- 173. Asphaltic Concrete Pavement
 - (a) Materials and Equipment
 - (b) Crushed Rock or Gravel
 - (c) Crushed Rock Screenings
 - (d) Sand and Filler
 - (e) Wearing Surface
 - (f) Transportation and Laying of Wearing Surface
 - (g) Requirements for Finished Pavement
 - (h) Payment
- 174. Brick Pavement
 - (a) Bricks
 - (b) Base
 - (c) Cushion

- (d) Laying Bricks
- (e) Rolling
- (f) Grouting
- (g) Expansion Joints
- (h) Curing
- (i) Maintaining Traffic
- (j) Payment
- 175. Street Railway Pavement
- 176. Alley Pavement

PAVEMENT APPURTENANCES

- 177. Concrete Curb
- 178. Armored Concrete Curb
- 179. Integral Curb
- 180. High Curb
- 181. Brick Gutters
- 182. Concrete Stop and Concrete Side Stop
- 183. Alley Crossings
- 184. Private Alley Crossings
- 185. Alley Catch Basin
- 186. Pavement Relaid
- 187. Pavement Replaced
- 188. Replacing Concrete Sidewalks
- 189. Monument Cases
- 190. Adjustment of Cast Iron Valve Boxes
- 191. Adjustment of Manhole, Catch Basin, etc., Covers
- 192. Adjusting Inlets
- 193. Gravel Sub-base
- 194. Extra Concrete adjoining Street Railway
- 195. Safety Island
- 196. Warning Beacons
- 197. Traffic Lines

SPECIFICATIONS FOR ORNAMENTAL STREET LIGHTING

GENERAL STIPULATIONS

- 198. Work Included
- 199. Measurement
- 200. Pavement and Sidewalk Repairing
- 201. Manholes
- 202. Handholes
- 203. Conduit
 - (a) Trenching and Laying of Ducts
 - (b) Bonding
 - (c) Backfilling and Excess Earth
 - (d) Payment
- 204. Lead Covered Cable
- 205. Rubber Covered Cable
- 206. Oil Fuse Cut-Outs
- 207. Transformers
- 208. Posts
 - (a) Material
 - (b) Reinforcement
 - (c) Manufacture
 - (d) Payment

- 209. Post Furnishings
- 210. Concrete Post Foundation
- 211. Post Base Transformers
- 212. Street Signs

SPECIFICATIONS FOR TIMBER STRUCTURES

- 213. Timber Structures
 - (a) Material
 - (b) Construction Details
 - (c) Measurement and Payment

SPECIFICATIONS FOR REINFORCED CONCRETE STRUCTURES

GENERAL STIPULATIONS

- 214. Work Included
- 215. Foundations
 - (a) Excavation
 - (b) Piling
 - (c) Concrete
 - (d) Anchor Bolts
- 216. Superstructures
 - (a) Order of Construction
 - (b) Falsework
 - (c) Forms
 - (d) Reinforcing Steel
 - (e) Concrete

SPECIFICATIONS FOR STEEL STRUCTURES

- 217. Materials
 - (a) Storage of Materials
 - (b) Straightening Material
 - (c) Workmanship and Finish
- 218. Mill and Shop Inspection
 - (a) Notice of Rolling and Fabrication
 - (b) Facilities for Inspection
 - (c) Rejection
 - (d) Measuring Camber
 - (e) Mill Orders and Shipping Statements
 - (f) Weighing
 - (g) Loading and Unloading
- 219. Workmanship
 - (a) Shop Work
 - (b) Erection
 - (c) Painting
 - (d) Measurement and 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.

The contract shall be held to cover any and all work, labor, implements and materials, including the use of compressed air for whatsoever purpose used, and all other special methods of construction that could reasonably be required properly and satisfactorily to complete the work indicated. The work shown on the detailed plans and not mentioned in the special specifications, or vice versa, shall be done the same as if shown by both, and in case of conflict the decision of the City Engineer shall determine which will govern.

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.	Brick 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
Cond.	Conduit
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. B. (etc.) #	C. B. (etc.) moved to pos. shown
C. I. P.	Cast Iron Pipe
C. I. V. B.	Cast Iron Valve Box
Cr.	Cross
C. R.	Curb Radius
C. X. W.	Con. Cross Walks
D. B.	Drift Bolt
E.	East
Ell. C. B.	Elliptical Catch Basin
Elev.	Elevation
Exc.	Excavation
Em.	Embankment
Ex.	Existing
F. A. H. H.	Fire Alarm Handhole
F. A. L. P.	Fire Alarm Lamp Post
F. T.	Flush Tank
G. V.	Gate Valve
Gal. I. P.	Galvanized Iron Pipe
Gal. S. P.	Galvanized Steel Pipe
H. E. S.	High Early Strength
H. H.	Handhole
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
Pri.	Primary
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
Sec.	Secondary
Sew.	Sewer
Sp.	Special
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
Trans.	Transformers
V. Ch.	Valve Chamber
W.	West
W. B.	Warning Beacon
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. ERRORS AND OMISSIONS.

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

6. BIDDERS TO MAKE EXAMINATION

Bidders must make their own examination, investigation and research regarding the location of the proposed improvement, the proper method of doing the work, and all conditions affecting the

work to be done and labor and material needed thereon, and the contractor agrees that he has satisfied himself by his own investigation and research regarding all of such conditions, and that his conclusion to enter into the proposed contract is based upon such investigation and research and not on the estimate of quantities or other information prepared by or furnished by the City Engineer, and that he will make no claim against the City because any of the estimates, tests or representations of any kind affecting the work made by any officer or agent of the City may prove to be in any respect erroneous.

7. 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.

8. FEES AND ROYALTIES

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

9. 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.

10. ASSIGNMENT OF CONTRACT

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

11. SUBLETTING OF CONTRACT

Any person or persons, or any firm or corporation, entering into a sub-contract or other agreement with the contractor to furnish labor or material for or upon any improvement constructed under these specifications, shall be deemed an employee of the contractor; and any such person or persons, or the employees of any such firm or corporation, when employed directly upon such im-

provement, shall be subject to all the provisions respecting workmen, orders, rates and payment of wages, hours of labor, and all other provisions regarding employees herein specified.

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

12. 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.

13. USE OF STREETS

The contractor shall secure a permit from the Department of Streets and Sewers to occupy with machinery, tools or materials any street areas outside the boundaries of this improvement district.

14. WORKMEN

The contractor shall erect and maintain, at all times while men are employed upon the work, a building where workmen may take their lunches, change clothes, etc., and he shall provide such sanitary facilities and first aid equipment as are, or may be, required by the laws of the State of Washington and the ordinances of the City of Seattle. All workmen employed shall be competent and skilled in the performance of the special work to which they may be assigned. Whenever the contractor is not present on the work orders may be given to the superintendent or overseer who may have immediate charge thereof. If any person employed on the work shall refuse or neglect to obey the directions of the City Engineer, or, in the opinion of the City Engineer shall be incompetent, unfaithful, disorderly or otherwise unsatisfactory, he shall, upon the order of the City Engineer, be at once discharged and not again employed upon any part of the work. Any person so discharged shall, however, have the right of appeal to the Board of Public Works, whose decisions shall be final and conclusive.

15. RATES OF WAGES

The contractor shall pay, or cause to be paid, to his employees, on the work herein specified, not less than the going rate of wages paid by the City of Seattle as determined from the effective records of the City for work of like character, or such rate as shall have been prescribed by ordinance, in any event not less than the minimum prescribed by the City Charter. He shall, on said work, give preference to citizens of the United States and residents of the City of Seattle who are heads of families in the manner and to the extent required by the charter and ordinances of the City.

16. PAYMENT OF WAGES

The contractor agrees to perform said contract according to the terms, conditions and stipulations, and to pay as they become due all just claims for all work and labor performed on or about said work, and all skill or labor and material purchased for or furnished in the execution of the contract, and further agrees

to comply with all the provisions of state law and with all the requirements of the charter and ordinances of the City and the amendments thereto; and the City of Seattle may withhold from payments due to the contractor under this contract such sums as will fully cover such claims, and such retained sums shall not be paid to the contractor until a sufficient release from such claimant, endorsed by the surety of said contractor, shall be presented to and approved by the Board of Public Works to guarantee that the provisions of this section have been fully complied with.

The City Comptroller shall not pay to the contractor any portion of the amount due on this contract, unless at the time of payment 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.

17. HOURS OF LABOR

Except in cases of extraordinary emergency, no work shall be performed on Sundays or holidays and no employe of any contractor shall be required to work longer than eight (8) hours in any one calendar day. 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 such work to be rejected and the contract to be cancelled.

18. 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.

19. 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 equitable estimate of the amount to be allowed therefor, which shall be accepted as final by both parties to such contract.

20. 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.

21. INSPECTION AND TESTING OF MATERIALS

All material shall be subject to inspection by the City Engineer. He shall select samples of such material and subject the same to such tests as may be necessary to determine whether their qualities conform to the requirements herein specified, and he shall accept or reject the materials in accordance with the results of such tests. Such tests shall be repeated as frequently as may be necessary to insure the rejection of all materials which fail to comply with the provisions of the plans and specifications. All materials rejected by the City Engineer shall be removed from the work and adjacent surroundings, by the contractor at his own expense, within forty-eight (48) hours after he has been notified of their rejection. If this condition is not strictly complied with, the City Engineer reserves the right to have such rejected materials removed by other parties and the cost of such removal shall be deducted from any moneys which may be or become due and payable to the contractor.

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

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

22. 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.

23. 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.

24. INTERFERENCE WITH EXISTING UTILITIES

Whenever an existing public utility interferes with the actual construction of any improvement and the moving of the same has

not been specially included in the contract, such public utility shall be moved by the department, district, or other agency, charged with the operation of the same.

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

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

25. 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.

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

Payment for above work will be included in the price per linear foot for pipe or other utility in place.

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

26. 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.

27. DAMAGE TO EXISTING IMPROVEMENTS

All damage done to existing improvements during the progress of the work, through fault or negligence of the contractor, shall be repaired by the contractor under the direction of the City Engineer. Materials for such repair must conform to the requirements of these specifications. If upon being ordered, the contractor fails to furnish the necessary labor and materials for such repairs, the City Engineer may cause said necessary labor and materials to be furnished by other parties, and the cost thereof shall be deducted from any moneys which may be or become due and payable to the contractor by reason of work performed or materials furnished for any part of this improvement. No payment to the contractor shall be made for this work.

28. PROTECTION TO UTILITIES

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

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

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

Provided, however, that whenever the contractor elects to construct a main sewer by means of a trenching machine or power shovel, all water services crossing the sewer line will be removed for the passage of such machine and replaced after the excavation has been completed. This work will be done by the Water Department and the cost thereof shall be borne by the local improvement district and paid for as outlined in Section 36. This provision shall apply to water services only and shall not include watermains.

29. 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.

30. PROVISION FOR WATER COURSES

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

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

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

31. 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.

32. CONTRACTOR TO MAINTAIN GUARDS

The contractor shall erect and maintain good and sufficient guards, barricades, signals, and standard "Street Closed" and "Detour" signs at all unsafe places on the work, and shall indemnify and save harmless the City of Seattle from all suits and actions of every name and description brought against the City for, or on account of, any injuries or damages received or sustained by any party or parties by reason of the failure to erect or maintain such guards, barricades or signals, or by reason of any negligence of said contractor or his agents or employees, in carrying on said work, or on account of any act or omission of said contractor in the performance of said work; and so much of the money which shall be due the contractor under and by virtue of the contract for this improvement as shall be considered necessary by 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 16.

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

33. 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 im-

practicable 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.

34. 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.

35. 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.

36. BILLS OF CITY DEPARTMENTS AGAINST LOCAL IMPROVEMENT DISTRICTS—HOW PAID

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

37. 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 Section 7676, Remington Compiled Statutes 1927 Suppl., or any amendment thereto, (Workmen's Compensation Act) on account of this contract before payment is made to him by the City on any estimate, and final payment shall not be made until the contractor shall have complied with the provisions of this section.

38. 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 fifteen per cent. (15%) of such estimates, as a trust fund for the protection and payment of any person or persons, mechanics, sub-contractors or material men who shall perform any labor upon such contract or the doing of said work, and all persons who shall supply such person or persons or sub-contractors with provisions and supplies for the carrying on of such work. Said fund shall be retained for a period of thirty (30) days following the final acceptance of said improvement or work as completed, and every person performing labor or furnishing supplies towards the completion of said improvement or work, shall have a lien upon such fund so reserved; provided, such notice of the lien of such claimant shall be given in the manner and within the time provided by the laws of the State of Washington; provided, however, that where in any improvement or work the contract price shall exceed Two Hundred Thousand Dollars (\$200,000.00), but ten per cent (10%) shall be reserved on estimates in excess of said sum, or where the aggregate of previous estimates equals or exceeds said amount. No improvement shall be deemed completed until the Board of Public Works shall have filed with the City Clerk a statement signed by a majority of the members of said Board, declaring the same to have been completed.

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

After the issuance of the estimate by the City Engineer, the City Comptroller shall, on or about the 25th day of the month, deliver to the contractor money or warrants, in an amount equal to such estimate less the percentage to be retained therefrom as herein provided. After the expiration of thirty (30) days following the final acceptance of said improvement or work and the

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

Such warrants shall be drawn against the local improvement district fund and shall bear interest at the rate of seven per cent. (7%) per annum from the date of issuance until redeemed; Provided, that warrants shall not bear interest after one hundred twenty (120) days from the time fixed in the proposal and contract for the completion of the contract.

If the work is completed within the time fixed by the Board of Public Works, or any extension thereof, and there is no money available for payment of contractors' warrants at the expiration of the one hundred twenty (120) day period above mentioned, the contractor may be paid by separate non-interest bearing warrants, a sum equivalent to interest at seven per cent. (7%) per annum on outstanding warrants from the date when interest on such warrants ceased to the date when funds are available for the redemption thereof.

If an extension of time is granted for the completion of the contract and the work is not completed when the extension period has expired, the contractor may be paid by separate non-interest bearing warrants, a sum equivalent to interest at seven per cent. (7%) per annum on outstanding warrants from the day when interest ceased, as above mentioned, to a date one hundred twenty (120) days from the date on which the extension period expires.

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

All warrants issued shall be redeemed in cash, in order of issuance within one hundred twenty (120) days after the completion and acceptance of the contract, so far as payment into the local

improvement district fund shall permit. Warrants not so redeemed in cash shall except as otherwise herein provided be redeemed in order of their issuance in local improvement district bonds, if the mode of payment is "Payment by Bonds," or, if the mode of payment be "Immediate Payment," by the issuance of local improvement district fund warrants with interest at seven per cent. (7%) per annum from date of issuance until redeemed.

39. DECISION OF QUESTIONS

To prevent all disputes and litigation it is understood that all questions arising as to the proper performance and amount of work to be paid for under this contract, shall be subject to the decision of the City Engineer. In case of non-compliance with the contract in any manner the City Engineer may suspend such work at any time. In case of default or failure properly to perform such work, the City Engineer shall have the power to adjust all differences as to damages or prices which the contractor should pay to the City according to the just and reasonable interpretation of this contract. In all such matters the decision of the City Engineer shall be final and conclusive between the parties hereto, subject to the approval of the Board of Public Works.

40. FORFEITURE OF CONTRACT

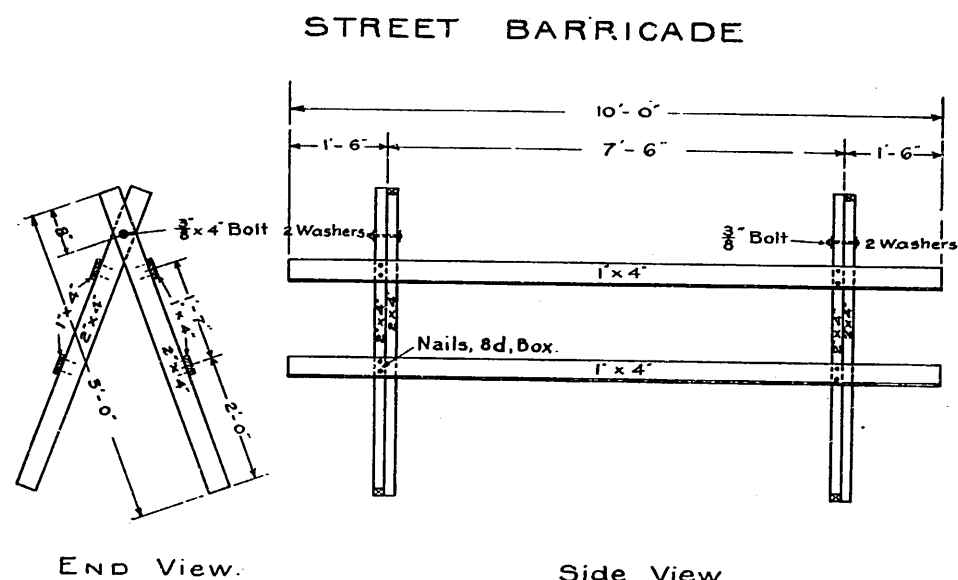
If at any time the City Engineer is of the opinion that the work is unnecessarily delayed and will not be finished within the prescribed time, he shall notify the contractor and the Board of Public Works to that effect in writing. If said contractor shall not within five (5) days thereafter take such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

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

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

41. 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.



Note: All lumber to be No. 1 Fir, S4S.
All surfaces to be painted with 3 coats of White Paint

QUALITY OF MATERIALS

42. ALLOYS

(a) ALUMINUM ALLOY

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

(b) BRONZE ALLOY

Bronze alloy for Street Lighting Standards and other ornamental uses shall be composed of 88 per cent copper, 7 per cent tin, 3 per cent zinc, and 2 per cent lead.

43. BRICKS

Bricks shall conform in shape and dimensions to the standard plans shown on page 18.

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

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

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

(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.

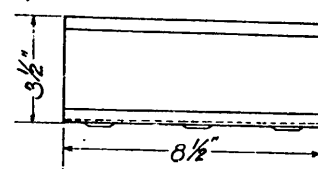
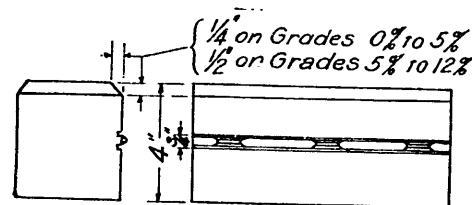
(c) CLASS "C"

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.

(d) CONCRETE BRICKS.

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



PAVING BRICK.

44. BRIDGE HARDWARE

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

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

45. CAST IRON

All iron castings, with the exception of watermain castings, shall conform to the requirements of the A. S. T. M. Standard Specifications for Gray Iron Castings, Serial Designation A-48-29, and all subsequent amendments and additions thereto.

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

Iron castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other

defects in positions affecting their strength and value for the service intended. Cast iron frames and covers for manholes, flush tanks, monument cases, valve chambers or other roadway appurtenances, shall be machined so as to have perfect contact around the entire circumference.

All castings shall be coated as specified in Section 148 under Cast Iron Pipe Watermains.

46. CEMENT

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

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

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

(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) TESTS

All tests shall be made in conformity with the A. S. T. M. Specifications, Serial Designation C-9-30 and all subsequent amendments and additions thereto, and no cement shall be used which fails to conform to said specifications.

(c) HIGH EARLY STRENGTH CEMENT**(1) General Requirements**

High early strength cement shall conform to the requirements of the A. S. T. M. Standard Specifications and Tests for Portland Cement, Serial Designation C9-30 with the exception that the percentage of sulphuric anhydride may be greater than 2.00 per cent but shall not exceed 2.75 per cent. It shall be a cement of the best quality, dry and free from lumps and all foreign material. It shall be a cement which usage has proved to possess the proper qualifications and uniformity for the work intended.

(2) Additional Requirements

In addition to the above requirements for High Early Strength Cement, the average compressive strength of not less than four 6"x12" cylinders, made in accordance with the A. S. T. M. Standard Method of Making Compression Tests of Concrete, Serial Designation C 39-27, and proportioned as described below, shall be equal to or higher than the following:

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

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

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

The aggregates used in the above test shall conform to the requirements for Sand, Section 68 and Gravel, Section 55 of these Specifications and they shall be graded as follows:

(3) Sand

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

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

(4) Gravel

Passing 2" Square opening.....	100%
" 1½" " "	96%
" 1" " "	63%
" ¾" " "	38%
" ⅝" " "	15%
" ¼" " "	0

(5) Acceptance of Cement

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

47. CENTRIFUGAL CONCRETE PIPE

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

(a) DIMENSIONS

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

Internal Diameter	Wall Thickness
33".....	2⅞"
36".....	3⅛"
39".....	3½"
42".....	3¾"
45".....	3⅞"
48".....	4⅛"
51".....	4¼"
54".....	4½"
57".....	4¾"
60".....	5"
72".....	5½"

(b) FORMS.

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

(c) CONCRETE

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

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

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

(d) REINFORCEMENT

Reinforcement shall conform to the provisions of Sec. 72. Circumferential reinforcement shall be placed in the center of the wall in pipe designed for pressure, and elliptically in pipe for sewer use. In the latter case, the major and minor axes shall be marked on the pipe. Reinforcement shall be sufficient to take all tensile stresses developed in the walls of the pipe under full working load without exceeding 16,000 lbs. per square inch.

(e) JOINTS.

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

(f) TESTS

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

(g) CONTRACTOR TO SUBMIT DETAILED PLANS

Before any centrifugal concrete pipe will be accepted upon any contract where such pipe is specified, the contractor shall submit

to the City Engineer for approval, detailed plans showing the amount and position of the reinforcement and the method of jointing.

48. COAL TAR CREOSOTE OIL

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

The creosote shall be a distillate of coal-tar or coke-oven tar.

It shall not contain more than 3% of water.

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

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

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

Up to 210° C, not more than 5%

Up to 235° C, not more than 25%

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

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

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

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

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

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

All of the fractions up to 315° C. shall contain at least 1% of tar acids.

The specific gravity of the fraction between 235° C and 315° C shall not be lower than 1.025 and specific gravity of the fraction between 315° C. and 355° C. shall not be lower than 1.085 at 38° C. compared with water at 15.5° C.

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

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

49. CONCRETE

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

(a) CLASSIFICATION

Concrete mixes shall be divided into five classes: "A", "B", "C", "D" and "E".

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

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

The weights of aggregates specified for the various classes of concrete are based upon an average moisture content of 5% in the sand and 1% in the gravel, and a specific gravity of 2.66. The City Engineer reserves the right to make corrections in said specified weights wherever tests show the moisture content to be abnormal or the specific gravity to vary appreciably from that above stated. The City Engineer further reserves the right to change the proportions of the various sizes of aggregates, provided, however, that the ratio of the weight of cement to the total weight of aggregate shall remain as specified.

(1) Class "A" Concrete:

Class "A" concrete shall be produced by mixing as hereinafter specified, cement, sand and gravel in the following proportions:

Cement (1 sack).....	94 Lbs.
Sand	152 Lbs.
Gravel	252 Lbs.

Unless otherwise specified, structural grade aggregates shall be used, and the mixing time shall be two minutes.

(2) Class "B" Concrete:

Class "B" concrete shall be produced by mixing, as hereinafter specified, cement, sand and gravel in the following proportions:

Cement (1 sack).....	94 Lbs.
Sand	170 Lbs.
Gravel	284 Lbs.

Unless otherwise specified, structural grade aggregates shall be used, and the mixing time shall be two minutes.

(3) Class "C" Concrete:

Class "C" concrete shall be produced by mixing, as hereinafter specified, cement, sand and gravel, in the following proportions:

Cement (1 sack).....	94 Lbs.
Sand	216 Lbs.
Fine Gravel	200 Lbs.
Coarse Gravel	112 Lbs.

For concrete pavement, Class "C" concrete shall be made from paving grade aggregates, and the mixing time shall be one minute. For one-course concrete sidewalks, Class "C" concrete shall be made from structural grade aggregates, using 312 lbs. of structural grade gravel, and the mixing time shall be one minute. For all other uses, unless otherwise specified, Class "C" concrete shall be manufactured as specified for concrete pavement.

(4) Class "D" Concrete:

Class "D" concrete shall be produced by mixing, as hereinafter specified, cement, sand and gravel in the following proportions:

Cement (1 sack).....	94 Lbs.
Sand	240 Lbs.
Fine Gravel	246 Lbs.
Coarse Gravel	139 Lbs.

Unless otherwise specified, paving grade aggregates shall be used and the mixing time shall be one minute.

(5) Class "E" Concrete:

Class "E" Concrete shall be produced by mixing, as herein-after specified, cement, sand, and gravel, in the following proportions:

Cement (1 sack).....	94 Lbs.
Sand	300 Lbs.
Fine Gravel	303 Lbs.
Coarse Gravel	169 Lbs.

Unless otherwise specified, paving grade aggregates shall be used and the mixing time shall be one minute.

Whenever special specifications require the use of paving grade aggregate in Class "A" or Class "B" concrete, the specified weight of gravel shall be used in the proportion of one pound of fine gravel to 0.56 pounds of coarse gravel.

Whenever special specifications require the use of structural grade aggregate in Class "C", Class "D" or Class "E" concrete, an amount of gravel equal to the sum of the weights specified for fine and coarse gravel, for the class of concrete involved, shall be used.

(b) MANUFACTURE

(1) Proportioning Materials:

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

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

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

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

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

Whenever requested by the City Engineer, the contractor shall furnish a man to count the empty sacks in the presence of the

City Engineer or his representative, and after being counted the empty sacks shall be removed from the immediate vicinity of the mixer.

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

(2) Mixing:

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

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

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

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

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

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

When a boom and bucket attachment is used the bucket shall be kept in good order so that mortar will not leak out when the doors are closed.

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

The intent of these specifications is to permit concrete for any class of work to be mixed either on the immediate site of its final deposition, or at a central mixing plant and delivered to the work in an approved manner. The City Engineer, however, reserves the

right to reject any and all concrete which arrives upon the work in a separated or partially set condition or in any condition which makes it inferior to concrete mixed on the work, regardless of the fact that an inspector was present when the concrete was mixed.

(c) FINISH FOR STRUCTURAL CONCRETE

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

(1) Class "A" Finish

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

(2) Class "B" Finish

The surface shall, after all irregularities have been corrected as specified for Class "D" finish, be thoroughly wetted, brushed with a neat cement grout, and immediately rubbed with a coarse carborundum stone. The paste thus formed shall be shaped with a clean brush and allowed to set for 24 hours. It shall then be rubbed down with a pad of carborundum paper or similar abrasive and thoroughly washed.

(3) Class "C" Finish

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

(4) Class "D" Finish

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

50. CONDUIT

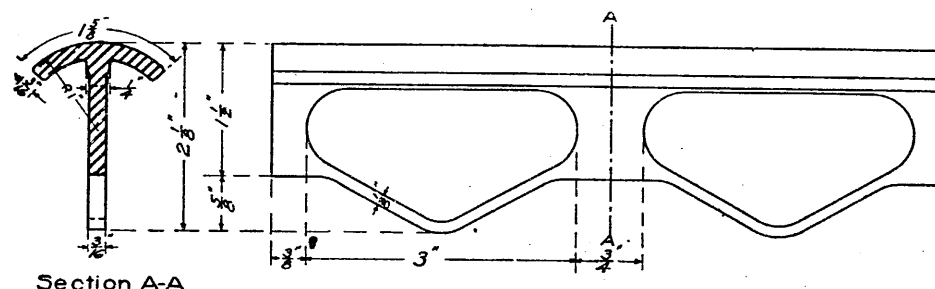
All metal conduit for electric wires or cables shall be galvanized or Sherardized wrought iron conduit bearing the underwriters' inspection stamp.

51. 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 re-

quirements for billet steel concrete reinforcement bars. The metal shall be galvanized as specified in Section 54. 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.



Section A-A



Section of Curb

CURB ARMOR

52. EXPANSION JOINT MATERIALS

Expansion Joint Material shall be "Carey's Elastite," or equal.

53. FILLER FOR BRICK PAVEMENT

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

54. 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.

55. 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 2-inch screen.

Not less than 95% shall pass a 1½ inch screen

Not less than 48% nor more than 80% shall pass a 1 inch screen

Not less than 30% nor more than 60% shall pass a ¾ inch screen

Not less than 12% nor more than 34% shall pass a ½ inch screen

Not more than 8% shall pass a ¼ inch screen

(b) PAVING GRADE**(1) Coarse Gravel**

Not less than 95% shall pass a 3 inch screen

Not less than 81% shall pass a 2½ inch screen

Not less than 45% nor more than 85% shall pass a 2 inch screen

Not more than 15% shall pass a 1½ inch screen

(2) Fine Gravel

Same as structural grade gravel.

(3) Combined Grading

Not less than 98% shall pass a 3 inch screen

Not less than 94% shall pass a 2½ inch screen

Not less than 82% nor more than 95% shall pass a 2 inch screen

Not less than 57% nor more than 75% shall pass a 1½ inch screen

Not less than 32% nor more than 55% shall pass a 1 inch screen

Not less than 20% nor more than 40% shall pass a ¾ inch screen

Not less than 8% nor more than 23% shall pass a ½ inch screen

Not more than 5% shall pass a ¼ inch screen

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

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

56. LAMP BLACK

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

57. LEAD

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

58. LEAD SUBSTITUTES

When specified, joints in cast iron pipe shall be poured with a

lead substitute. Such substitutes shall be "Leadite", "Hydrotite" or other substitute approved by the Board of Public Works. The depth of such joint shall be as specified for lead joints.

59. LEAD COVERED CABLE**(a) PRIMARY LEAD COVERED CABLE**

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

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

For 5000 volt cable—4/32 inch around each conductor with a 4/32 inch belt of the same material. The lead sheath shall be 7/64 inch thick.

For 3000 volt cable—3/32 inch around each conductor with a 3/32 inch belt of the same material. The lead sheath shall be 3/32 inch thick.

(b) SECONDARY LEAD COVERED CABLE

All secondary lead covered cable shall be manufactured for a normal operating voltage of 600. The cable shall be round triplex, unless otherwise specified. All conductors of secondary cable shall conform to requirements of conductors of primary cable. Each conductor shall be insulated with rubber. The thickness of the insulation, quality of materials, etc., shall be as specified in the National Electric Code of the National Board of Fire Underwriters. The lead sheath shall be 4/64 inch thick for conductors of size No. 8 A. W. G. and 5/64 inch thick for conductors of sizes No. 6 and No. 4. Other sizes shall be governed by the specifications of the Association of Edison Illuminating Companies for "Impregnated Paper Insulated, Lead Covered Underground Cable," as submitted in their latest report.

All secondary lead covered triplex cable from transformers to secondary fuse boxes shall have impregnated paper or varnished cambric insulation of a thickness of 3/64 inch around each conductor, and a 3/64 inch belt of the same material. Single conductors shall be insulated with 3/32 inch of the same material. The lead sheath shall be 5/64 inch thick.

In all respects not mentioned in these specifications the paper insulation shall conform to the specifications of the Association of Edison Illuminating Companies for "Impregnated Paper Insulated, Lead Covered Underground Cable", as submitted in their latest report.

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

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

60. LUMBER

Timber and lumber shall conform to the following requirements:

All timber and plank in permanent structures shall be Douglas Fir, and conform to the Standard grading and dressing rules for Douglas Fir, adopted by the West Coast Lumberman's Association, July 1, 1929, with subsequent amendments thereto.

(a) GRADE REQUIREMENTS

Unless otherwise noted on the plans, lumber for various uses shall be of the following grades:

For Pipe Staves—Pipe Stave Stock.

For Truss Members, Floor Beams, Caps, Posts and Stringers—Structural Grade.

All other lumber, except as otherwise specified—No. 1 Common

(b) ADDITIONAL REQUIREMENTS

In addition to the above requirements, the following additional requirements shall govern the selection of lumber for the various uses, as follows:

(1) Heart Requirements

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

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

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

(2) Seasoning

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

(c) INSPECTION

The contractor shall apply to the mill from which timber is purchased, for inspection of the timber by the Pacific Lumber Inspection Bureau or the West Coast Lumberman's Association, and shall furnish the City Engineer with a certificate as to the grade of the timber. This certificate of inspection, however, shall not constitute an acceptance of the material and the City Engineer reserves the right to reject all timber that does not comply with the specifications.

61. LUMBER CREOSOTED

(a) MATERIALS

Timber and lumber shall conform to the requirements for untreated materials and shall be inspected prior to treatment.

The preservatives used shall conform to the requirements of Section 48.

(b) SEASONING

(1) Air Seasoning

Materials to be treated preferably shall be air seasoned until

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

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

(2) Oil Seasoning for Douglas Fir

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

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

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

(c) PREPARATION FOR TREATMENT

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

(d) PLANT EQUIPMENT

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

(e) TREATMENT

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

(f) PENETRATION

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

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

Treatment per Cubic foot (Full Cell)					
Sizes	8 lbs.	10 lbs.	12 lbs.	14 lbs.	16 lbs.
2 x 4.....	$\frac{3}{16}$ "	$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "
2 x 6.....	$\frac{3}{16}$ "	$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "
2 x 8.....	$\frac{3}{16}$ "	$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "
2 x 12.....	$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "
3 x 6.....	$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "
3 x 12.....	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "
4 x 6.....	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "
4 x 12.....	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "
6 x 6.....	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "
6 x 8.....	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "
8 x 8.....	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "
8 x 10.....	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "
8 x 12.....	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "
8 x 16.....	$\frac{7}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "
10 x 12.....	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "
12 x 12.....	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "

and larger

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

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

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

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

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

(g) AMOUNT OF PRESERVATIVE

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

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

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

(h) CONDITION AFTER TREATMENT

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

(i) PIPE STAVES

Pipe staves, of material air or kiln dried before milling, shall, unless otherwise specified, be treated by the empty cell process with 8 lbs. of creosote retained per cubic foot of net section.

Method of treatment to be such as to eliminate distortion and to produce clean staves with no excess of creosote. Minimum penetration of creosote shall be one quarter ($\frac{1}{4}$) inch.

62. 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	$\frac{1}{8}$	7
				8	$\frac{3}{8}$	6
				9	$\frac{3}{8}$	5
				10	$\frac{3}{8}$	4
				12	$\frac{3}{8}$	3

Except where otherwise specified, it is the intention of these specifications that wherever nails or spikes are called for in any structure, they shall be of such length as will most nearly conform to the following rule: The nails or spikes shall penetrate the second piece of timber to a depth which is one and one-eighth ($1\frac{1}{8}$) times the thickness of the first piece, provided that the nail or spike shall fail to pass entirely through 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.

63. OAKUM

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

64. PAINT

(a) GENERAL REQUIREMENTS.

(1) Sampling Raw Materials

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

(2) Acceptance of Raw Materials

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

(3) Process of Manufacture

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

(4) Hand Mixing

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

(5) Addition of Turpentine.

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

(6) Weight Variation

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

(7) Quantity of Drier

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

(b) Raw Materials

Raw materials for paint shall conform to the requirements of the Standard and Tentative Standard Specifications of the American Society for Testing Materials under the Serial Designations shown below but with the exceptions noted. These specifications shall be superseded by any amended specification later adopted by said society.

- (1) Red Lead pigment and paste, Serial Designation D 83, except that the minimum percentage of true red lead-

(Pb₃O₄) shall be ninety-seven (97). In all other respects the pigment and paste shall conform to the specifications for the ninety-five (95) per cent grade.

- (2) White Lead pigment and paste, Serial Designation D 81.
- (3) Lampblack pigment and paste, Serial Designation D 209.
- (4) Prussian Blue pigment and paste, Serial Designation D 261.
- (5) Ocher pigment and paste, Serial Designation D 85.
- (6) Aluminum Powder for paint, Serial Designation D 266-28T. The powder shall be equal in luster to "Albron" brand Standard Varnish Aluminum Bronze Powder manufactured by Aluminum Company of America.
- (7) Lemon Chrome Yellow pigment and paste, Serial Designation D 211.
- (8) Zinc Oxide pigment and paste, Serial Designation D 79.
- (9) Lithopone pigment and paste, Serial Designation D 208. The behaviour on exposure to light, the mixing properties with raw linseed oil, the final consistency with this vehicle, and the brightness and tinting strength (or hiding power) shall be not less than that of "Albalith" brand lithopone as manufactured by the New Jersey Zinc Company.
- (10) Raw Linseed Oil, Serial Designation D 234. The minimum iodine number shall be not less than 177.
- (11) Turpentine, Serial Designation D 13. The material shall be either gum spirits of turpentine or steam distilled wood turpentine.
- (12) Liquid Drier shall conform to the United States Government specification for Liquid Paint Drier, Federal Specifications Board Standard Specification No. 20 and all subsequent additions and amendments thereto.
- (13) Spar Varnish shall be that known to the trade as "long oil spar varnish".

(c) PAINT FORMULAS

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

- (1) Formula No. A-1, Red Lead Shop Coat for Steel.
 Red Lead (dry pigment)..... 100 pounds
 Raw Linseed Oil..... 3.00 gallons
 Liquid Drier 1.5 pints
 Weight per gallon..... 27.2 pounds
 Turpentine, to be added as required on the work, not to exceed 0.6 pint per gallon of above paint.

- (2) Formula No. B-1, Brown First Field Coat for Steel.
 Red Lead (dry pigment)..... 100 pounds
 Lampblack (dry pigment)..... 1.0 pounds
 Raw Linseed Oil..... 3.6 gallons
 Liquid Drier 1.0 quart
 Weight per gallon..... 24.8 pounds
 Turpentine, to be added as required on work, not to exceed 0.75 pint per gallon of above paint.
- (3) Formula No. C-1, Black Second Field Coat for Steel.
 Red Lead (dry pigment)..... 50 pounds
 Lampblack (dry pigment)..... 8.4 pounds
 Prussian Blue (dry pigment)..... 4.3 pounds
 Raw Linseed Oil..... 11.5 gallons
 Liquid Drier 2.0 quarts
 Weight per gallon..... 11.4 pounds
 Turpentine, to be added as required on the work, not to exceed 0.5 pint per gallon of above paint.
- (4) Formula No. C-2, Gray Second Field Coat for Steel.
 White Lead (dry pigment)..... 100.0 pounds
 Lampblack (dry pigment)..... 3.0 ounces
 French Ochre (dry pigment)..... 5.0 ounces
 Raw Linseed Oil 5.75 gallons
 Liquid Drier 1.0 pint
 Weight per gallon..... 19.0 pounds
 Turpentine, to be added as required on the work, not to exceed 0.5 pint per gallon of above paint.
- (5) Formula No. D-1, Aluminum Paint for Guard Rails.
 Aluminum Powder 2.0 pounds
 Spar Varnish 1.0 gallon

Aluminum Paint shall be mixed on the work and only enough for one day's use shall be mixed at a time. The weighed amount of powder shall be placed in a suitable mixing container and the measured volume of vehicle then poured over it. The powder shall be incorporated by vigorous stirring with a paddle.

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

65. PILING

(a) CONCRETE PILING

Concrete piling shall be manufactured as specified under Reinforced Concrete Structures, Section 215.

(b) TIMBER 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) annual rings per inch and thirty-five per cent (35%) summer wood.

66. PILING, CREOSOTED

(a) BEFORE TREATMENT

The piling to be creosoted shall conform in all respects to the requirements specified for "Piling" in Section 65, 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.

Piling in which the sapwood at any point is less than three-quarters (¾) inch in thickness, shall be separately treated.

(b) CREOSOTE OIL

The oil shall conform to the Standard Specifications for coal tar creosote oil in Section 48.

(c) TREATMENT

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

(d) AMOUNT OF CREOSOTE

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

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

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

(e) PENETRATION

Unless otherwise specified, the minimum penetration determined as specified for timber in Section 61 shall be as follows:

Full-cell Process: After retention of 12 lbs. per cubic foot—minimum ¾ inch of creosoted wood.

Empty-cell Process: After retention of 8 lbs. per cubic foot—minimum ¾ inch of creosoted wood.

(f) AFTER TREATMENT

The piling shall be free from excessive heat checks or other

defects which would impair its usefulness or durability for the purposes intended. Piles, when bored at any point in the length of the pile, shall have a minimum penetration of 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.

67. 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.

68. 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 sieve.

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

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

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

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

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

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

Not more than 5% shall pass a No. 100 sieve

(b) PAVING GRADE

100% shall pass a No. 3 sieve

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

Not less than 74% nor more than 98% shall pass a No. 6 sieve

Not less than 63% nor more than 88% shall pass a No. 8 sieve

Not less than 40% nor more than 62% shall pass a No. 14 sieve

Not less than 20% nor more than 37% shall pass a No. 28 sieve

Not less than 6% nor more than 21% shall pass a No. 48 sieve

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

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

(c) FOR MORTAR

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

(d) FOR PLASTER AND GROUT

For plaster and grout one hundred per cent (100%) shall pass a No. 8 sieve and not less than fifty per cent (50%) nor more than eighty per cent (80%) shall pass a No. 28 sieve. Wherever sieves are mentioned in these specifications they shall have a square effective opening in inches as follows:

STANDARD SIEVES

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

69. SEWER PIPES

(a) VITRIFIED CLAY

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. Unless otherwise specified all sewer pipe shall be double strength.

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

Internal Diameter	Thickness (Double Strength)	Thickness (Triple Strength)
6".....	5/8"	
8".....	1 1/8"	
10".....	7/8"	
12".....	1 1/2"	1 3/8"
15".....	1 3/4"	1 7/8"
18".....	1 1/2"	1 3/4"
21".....	1 3/4"	2 1/8"
24".....	2"	2 1/8"
30".....	2 1/2"	2 3/4"
36".....	2 5/8"	3"

(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 three per cent (3%) by weight. Tests indicating greater values than this will result in the rejection and cull marking as hereinbefore described. 5%

(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: 15

Internal Diameter	Fracture at not less than (pounds per square inch)	No percolation at 15 lbs. per sq. in. for (minutes)
6"	70	5
8"	60	5
10"	50	5
12"	50	6½
15"	50	7½
18"	40	9
21"	40	10
24"	35	10
30"	25	12
36"	25	12

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

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

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

(b) CONCRETE

The concrete shall have a cement content of not less than that specified for Class "B" Concrete.

Concrete sewer pipes may be manufactured by the centrifugal process as specified in Section 47 or by any process which will produce a concrete of equivalent density and quality.

(1) **Dimensions:** Concrete sewer pipes shall have a minimum wall thickness as follows:

Internal Diameter	Wall Thickness
6"	7/8"
8"	1"
10"	1¼"
12"	1½"
15"	1¾"
18"	2"
21"	2¼"
24"	2½"
30"	3"

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

70. STEEL CASTINGS

Steel castings shall conform to the requirements of the A. S. T. M. Standard Specifications for Steel Castings; Class B, Medium Grade, Serial Designation A27-24, and all subsequent amendments and additions thereto, and supplemented by the following paragraphs:

All steel castings shall be thoroughly annealed unless otherwise provided.

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

Blow holes appearing upon finished castings shall be so located that a straight line laid in any direction will not cut a total

length of cavity greater than one inch in any one foot, nor shall any single blow hole exceed one inch in any dimension or have an area greater than one-half square inch. Minor defects which do not impair the strength, may with the approval of the City Engineer, be welded by an approved process. The defects shall be removed to solid metal by chipping, drilling or other satisfactory methods and, after welding, shall be annealed, if required by the City Engineer. Castings which have been welded without the City Engineer's permission shall be rejected.

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

No sharp unfilleted angles or corners will be allowed.

71. STEEL FORGINGS

Steel forgings shall conform to the requirements of the A. S. T. M. Standard Specifications for Carbon Steel Forgings for Locomotives, Serial Designation A-19-27 and all subsequent amendments and additions thereto.

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

72. STEEL REINFORCEMENT BARS ¹⁵

Steel concrete reinforcement bars shall be billet steel bars, conforming to the specifications of the American Society for Testing Materials, Serial Designation A-16-30 and all subsequent amendments and additions thereto, 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—		
	1,400,000	1,250,000
Minimum per cent.....	tens. str.	tens. str.

The yield points 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.

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

73. STRUCTURAL STEEL

Structural Steel (including rivet steel) shall conform to the requirements of the A. S. T. M. Standard Specifications for Structural Steel for Bridges, Serial Designation A-7-29 and all subsequent amendments and additions thereto, and supplemented by the following paragraphs:

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

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

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

74. 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

75. CLEARING AND GRUBBING

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

All wood cross-walks, curbs, gutters and other lumber which may be of use for planking streets, shall be removed in such manner as to sustain as little damage as possible, and shall be carefully piled and guarded until used. 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.

76. STRIPPING

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

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

77. 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 applications made prior to the opening of bids, the contractor shall comply with all requests made subsequently, provided the earth has not been already removed from the excavation. The contractor shall not remove any material from the district, until he has ascertained

that no more material is required by the property owners within the local improvement district. Where earth is placed on private property by direction of the City Engineer the contractor will not be required to haul the same a greater distance than six hundred (600) feet.

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

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

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

(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 loose rock or boulders less than one-half ($\frac{1}{2}$) cubic yard in volume, encountered during the work, all water settling, rolling and tamping of embankments or subgrades, and all other labor and material necessary for the complete work. Where the excavation exceeds the embankment, payment shall be made for excavation only. Where the embankment exceeds the excavation, payment shall be made for embankment only, and allowance shall not be made for shrinkage of the materials used for filling or for settlement of the underlying ground. Solid rock or boulders over one-half ($\frac{1}{2}$) cubic yard in volume will be paid for as "Rock Excavation." Solid rock will include all rock in ledge formation that cannot be removed except by drilling and blasting and all boulders containing more than one-half ($\frac{1}{2}$) cubic yard.

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

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

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

Where no bid is taken for "Rock Excavation" the following prices will be paid:

For improvements involving grading—\$1.00 per cubic yard.

For improvements involving trenches, ditches and excavation for structures—\$4.00 per cubic yard.

78. 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."

79. EXTRA EXCAVATION

Extra Excavation shall include all excavation beyond that specified or shown on the standard or special plans, which may be necessary to secure a proper foundation for structures, for special trenching or extra depth of trenches; provided, however, that additional excavation in connection with grading or subgrading, which is caused by the changing of the street grade, or the removal of

unsuitable material, as specified under Sect. 77, 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. When no bid is taken on this item payment for any extra excavation found necessary shall be made at the rate of \$2.50 per cu. yd.

80. CONCRETE CURB AND GUTTER

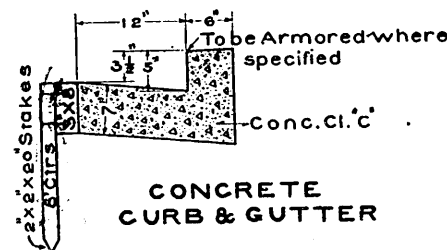
Concrete curb and gutter shall be constructed of Class "C" concrete.

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

One-quarter ($\frac{1}{4}$) inch expansion joints shall be placed through the concrete of curb and gutter each side of alley crossing and at intervals of twenty (20) feet.

A one-quarter ($\frac{1}{4}$) inch through joint shall also be placed between each alley crossing and the existing concrete walk. 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.



81. WOOD CURB AND GUTTER (For plan, see pages 53-54.)

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.

82. 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."

83. SHEAR BOARDS (For plan, see page 56).

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.

84. SAND BOXES (For plan, see page 55).

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

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

85. SEWER PIPE DRAINS (For plan, see page 55).

Sewer pipes for drains shall be of the same quality as specified under "Sewers." The pipe shall be laid to a straight line and grade

and solidly bedded in the ground. They shall be provided with such inlets as may be ordered.

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

86. BOX DRAINS (For plan, see page 57).

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.

87. 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.

88. CONCRETE POST FENCE (For plan see page 55).

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

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.

89. REFLECTOR SIGNAL (For plan, see page 59).

Reflector signals shall be installed where shown on the plan. Payment shall be made at the price bid for each in place complete, including the concrete post. When the concrete post is a part of a concrete post fence, constructed as a portion of the same contract, no deduction in measurement of the latter will be made.

90. WOOD FENCE (For plan, see page 55).

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 64.

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

91. PIPE CULVERT (For plan, see page 55).

Culverts shall be constructed of vitrified clay sewer pipe, reinforced concrete pipe or concrete pipe as specified. It shall be installed 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 119.

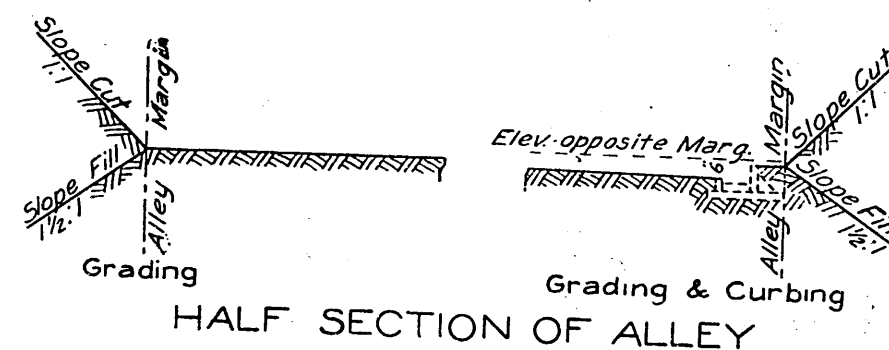
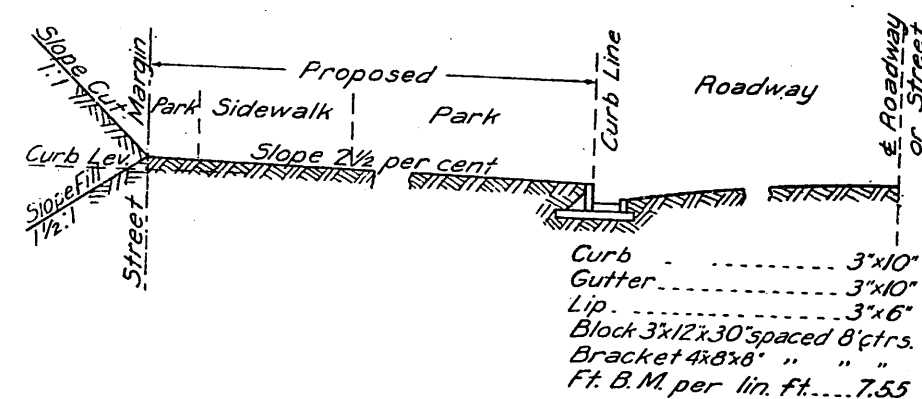
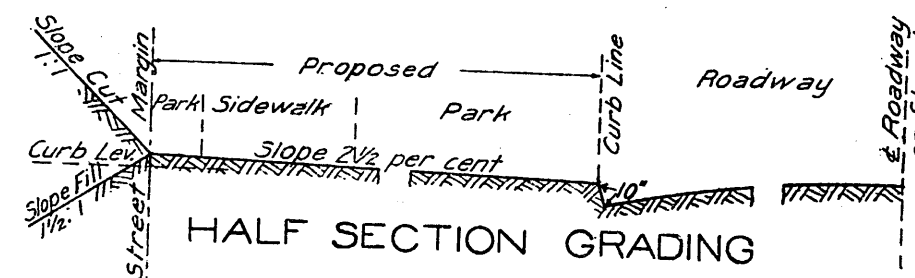
Should the City Engineer so direct, the contractor shall bed the lower half of the pipe in concrete, in which case twelve dollars (\$12.00) per cubic yard shall be allowed for the concrete, which amount shall be in full for the concrete in place, including the additional excavation involved.

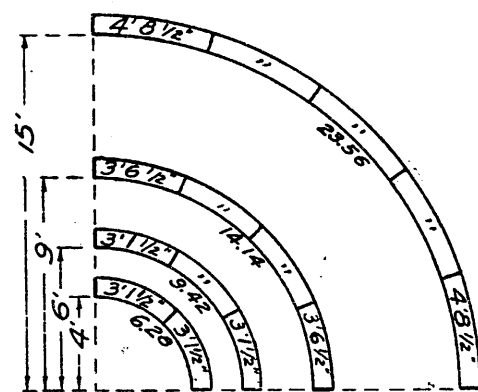
Payment for "Pipe Culvert" shall be made at the price bid per linear foot, and shall be in full for all labor and materials for the pipe in place, including the excavation and backfill.

92. UNDERPINNING

Where directed by the City Engineer existing structures left above grade shall be supported by concrete foundations or footings, or wooden posts and sills.

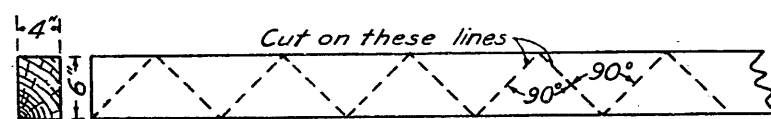
Payment for underpinning shall be made at the price bid per cubic yard for "Concrete Underpinning", and per M. Ft. B. M. for "Timber Underpinning." When no bid is taken for underpinning concrete underpinning shall be paid for at \$12.00 per cu. yd. and timber underpinning at \$30.00 per M. Ft. B. M.



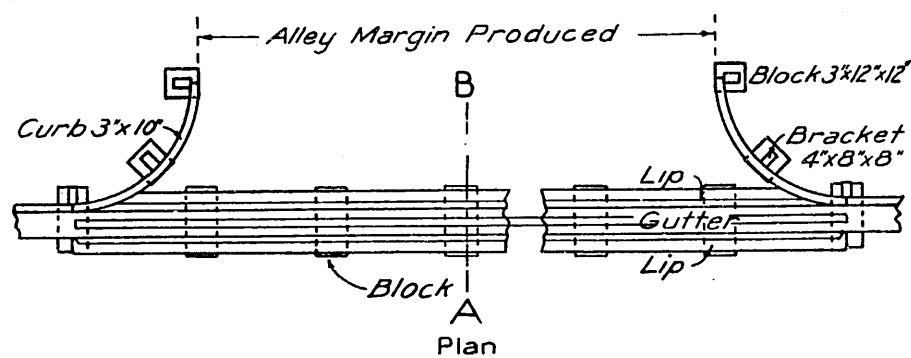


NOTE: For radii longer than 15' and shorter than 50' Gutter Boards shall be cut approximately in six foot (6') lengths. For radii longer than 50' they shall be cut in approximately eight foot (8') lengths.

METHOD OF CUTTING GUTTER BOARDS



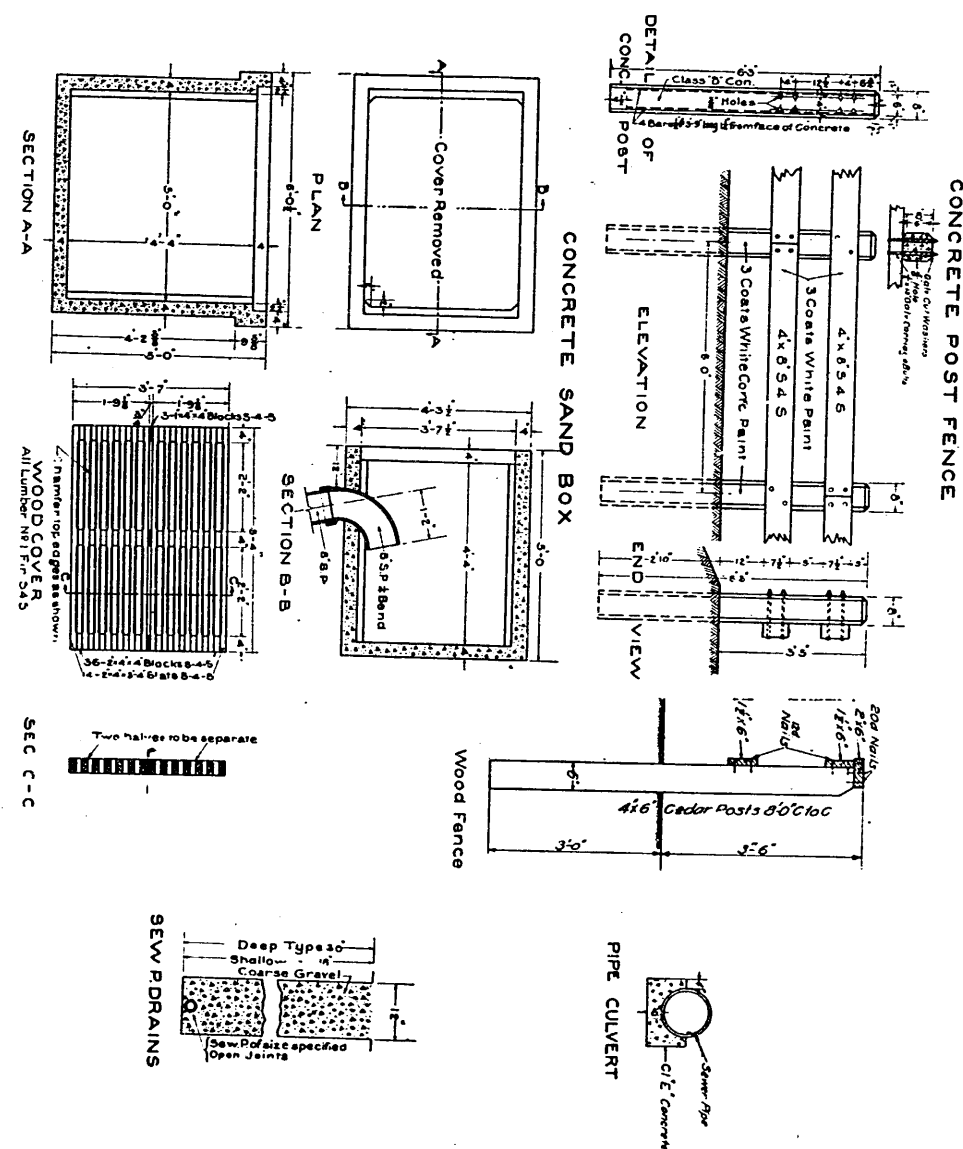
METHOD OF CUTTING BRACKETS



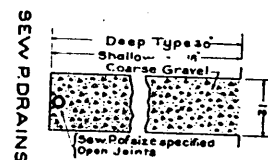
Gutter.....3'x10"
Lips.....6'x6"
Block 3'x12'x26'-4' C to C
Center Strip 3'x3"

2" Bevel
Section A-B

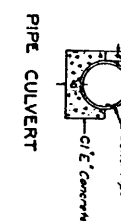
ALLEY GUTTER AND RETURNS



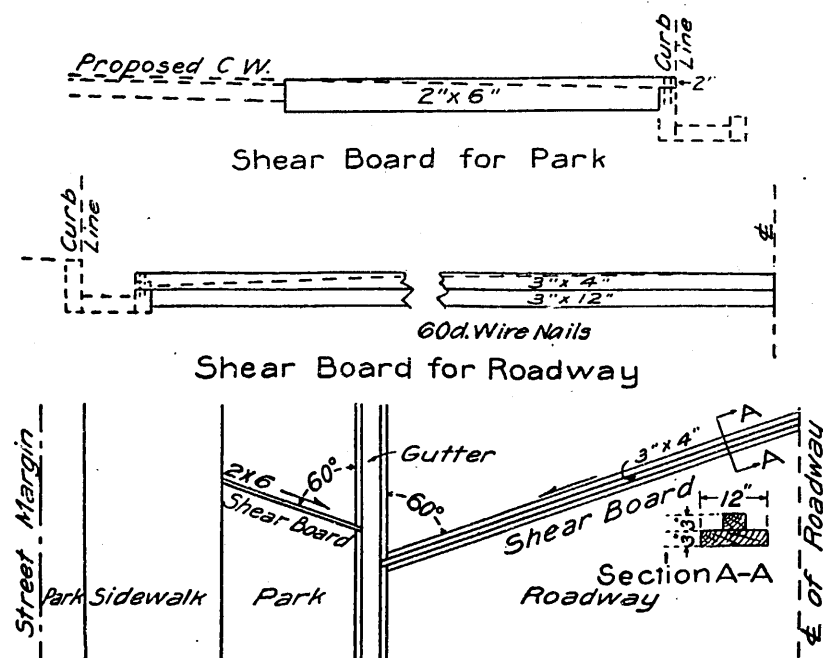
CONCRETE POST FENCE



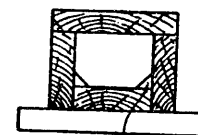
SEWER DRAINS



PIPE CULVERT



SHEAR BOARDS

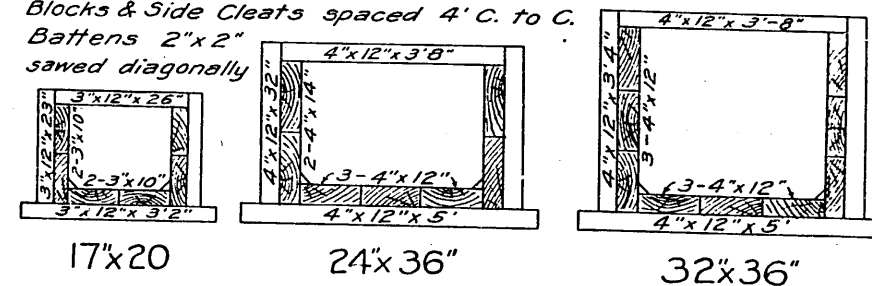


Size Inside	Cover	Sides	Bottom	Blocks	Ft. B.M. per lin. ft.
5"x10"	3"x16"	3"x8"	3"x10"	3"x12"x24"	11.58
7"x10"	3"x16"	3"x10"	3"x10"	3"x12"x24"	12.58
9"x10"	3"x16"	3"x12"	3"x10"	3"x12"x24"	13.58
9"x12"	3"x18"	3"x12"	3"x12"	3"x12"x24"	14.58
11"x12"	3"x18"	3"x14"	3"x12"	3"x12"x24"	15.58

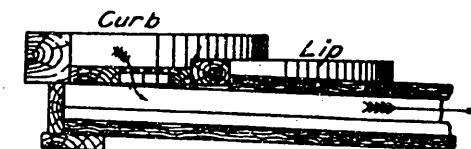
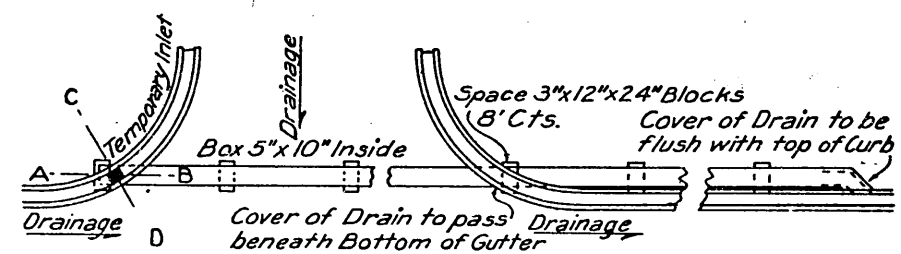
Battens 2"x2" Sawn diagonally. Blocks spaced 8' C. to C.

BOX DRAIN SECTION AND BILL OF MATERIAL

Blocks & Side Cleats spaced 4' C. to C.
Battens 2"x2" 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 & BILL OF MATERIAL

Section
SPECIAL BOX DRAIN

SPECIFICATIONS

FOR

SIDEWALKS AND APPURTENANCES

93. 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.

94. 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.

95. TEMPORARY WOOD WALKS AND CROSS WALKS (For plan, see page 68).

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.

96. CROSSWALKS (For plans, see page 68).

(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 69).

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.

97. WOOD STAIRWAYS (For plan, see page 70).

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 64.

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.

98. CONCRETE SIDEWALKS (For plan, see page 71).

(a) TWO COURSE CONCRETE SIDEWALKS

Two course concrete sidewalks shall consist of two courses: 1st, a concrete base three and one-half (3 1/2) inches thick, composed of Class "D" concrete; 2nd, a finishing or wearing course one-half (1/2) inch thick composed of one (1) part Portland cement and one and one-half (1 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 tem-

plate 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 49. 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 satisfactory to the City Engineer. Special care shall be taken thoroughly to trowel down the mortar in order to secure a perfect bond with the concrete base. It shall then be carefully smoothed to a uniform surface and allowed to remain undisturbed.

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

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

(b) ONE COURSE CONCRETE SIDEWALKS

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

One course concrete sidewalks shall consist of a single course four (4) inches thick, composed of Class "C" Concrete.

Lampblack shall be added to and mixed with the concrete in the proportion of one (1) pound of lampblack to one and one-half ($1\frac{1}{2}$) barrels of cement.

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 roller as prescribed for concrete pavements.

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

(c) GENERAL REQUIREMENTS FOR SIDEWALKS

(For plan, see page 71).

(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, in the case of 6 ft. walks and twenty (20) inches square in the case of 5 ft. walks. 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 Class "C" 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 "Two Course Concrete Sidewalks," per square yard in place, which shall include the cost of expansion joints and all other labor and material necessary to produce a finished walk.

99. 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.

100. CORRUGATED CONCRETE SIDEWALKS

(For plan, see page 73).

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.

Corrugations shall be completed within forty-five (45) minutes after rodding the walk.

101. CONCRETE STAIRWAYS (For plan, see page 72)

Concrete stairways may be either "One Course" or "Two Course" at the contractors option.

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 "One Course Concrete Sidewalks" or "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.

102. CONCRETE GUTTERS FOR STAIRWAYS (For plan, see page 72).

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.

103. GALVANIZED IRON RAILING (For plan, see page 72).

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 64.

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.

104. SIDEWALK DRAINS (For plan, see page 73).

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. When no bid is taken on sidewalk drains the same shall be paid for at the rate of \$0.20 per Lin. Ft.

105. CONCRETE ALLEY CROSSINGS (For plan, see page 74).

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 sub-grade shall conform in all respects to the Standard Specifications for concrete pavement, except that thorough tamping of the sub-grade 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. When constructed in conjunction with pavement alley crossings shall be cured as specified for concrete pavement.

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

106. PRIVATE CONCRETE ALLEY CROSSINGS (For plan, see page 75).

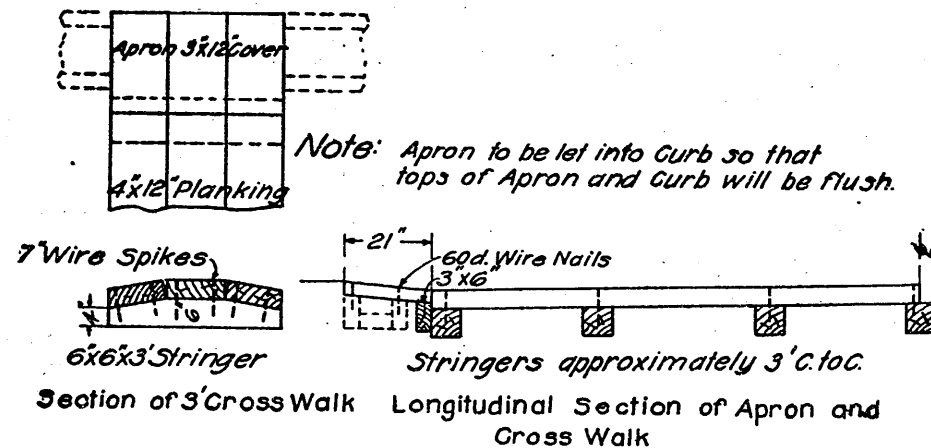
Private alley crossings constructed through concrete walks as part of the walk construction shall be constructed as shown on the Standard Plan. They shall be one course or two course as specified for concrete walks. The surface between expansion joints shall be brushed with a soft brush and edged, but 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.

107. 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.

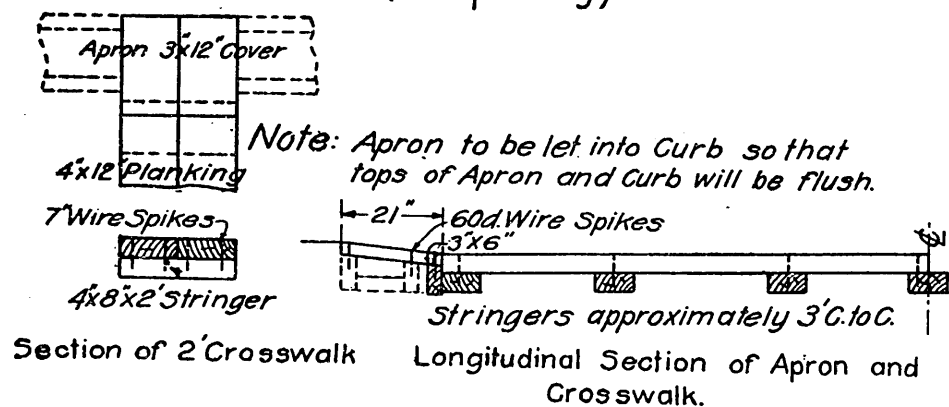
Payment for "Resurfacing Slopes and Parking Strips" shall be included in the price bid per square yard for "Concrete Walks."



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	534	602	644	692	758

Crosswalk Bill of Material
including Aprons

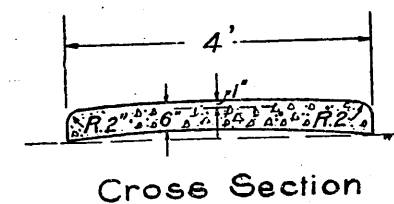
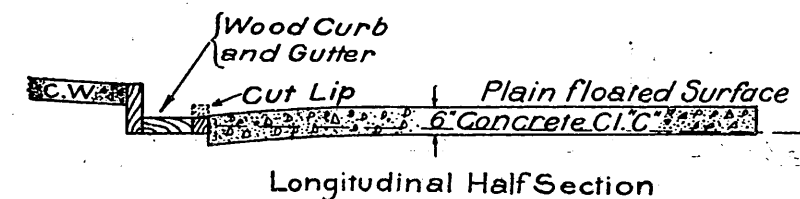
3FT. WOOD CROSSWALK AND APRON (Temporary)



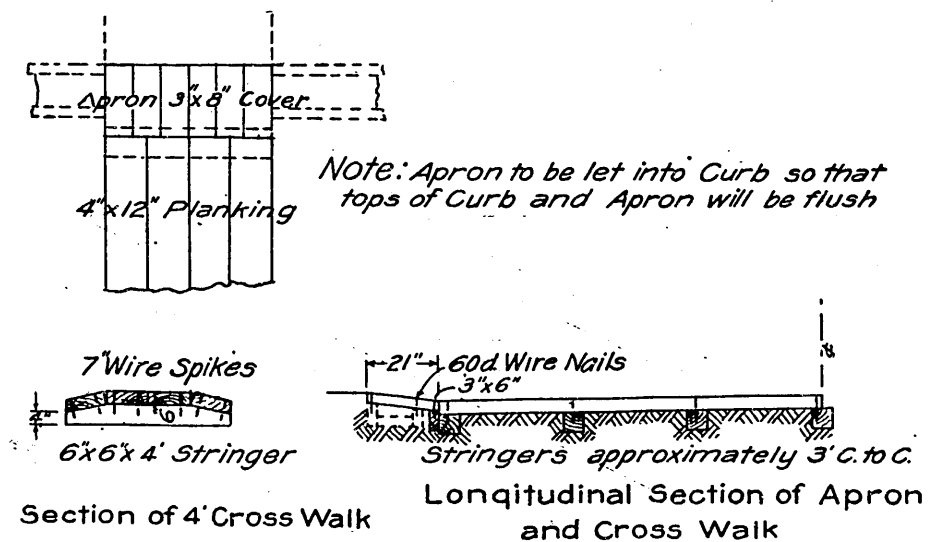
Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B.M. 2' Wide	184	216	251	267	302	318	360	392	419	451	494

Crosswalk Bill of Material
including Aprons.

2FT WOOD CROSSWALK AND APRON (Temporary)



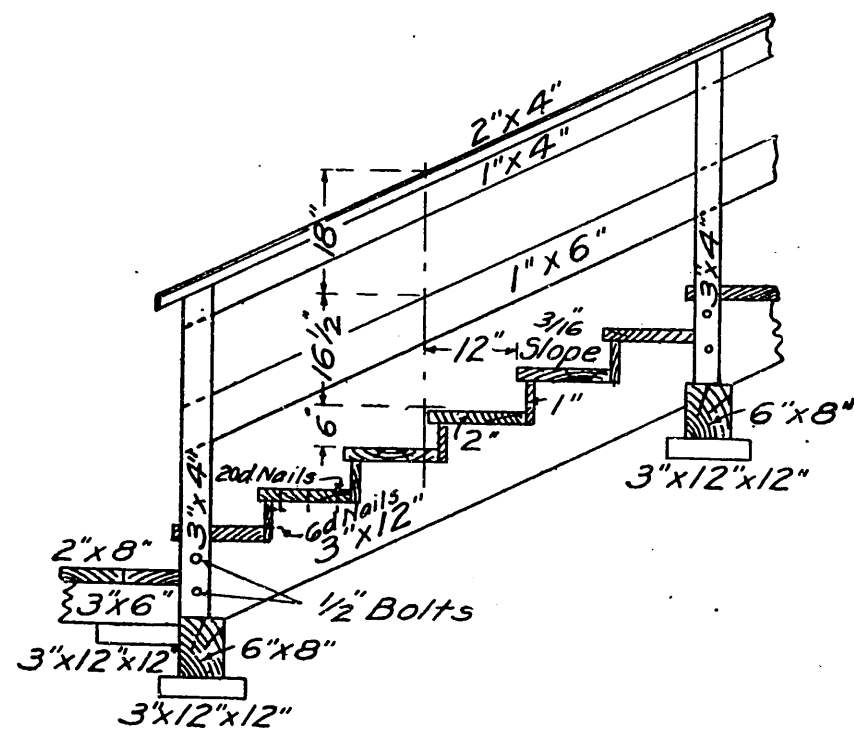
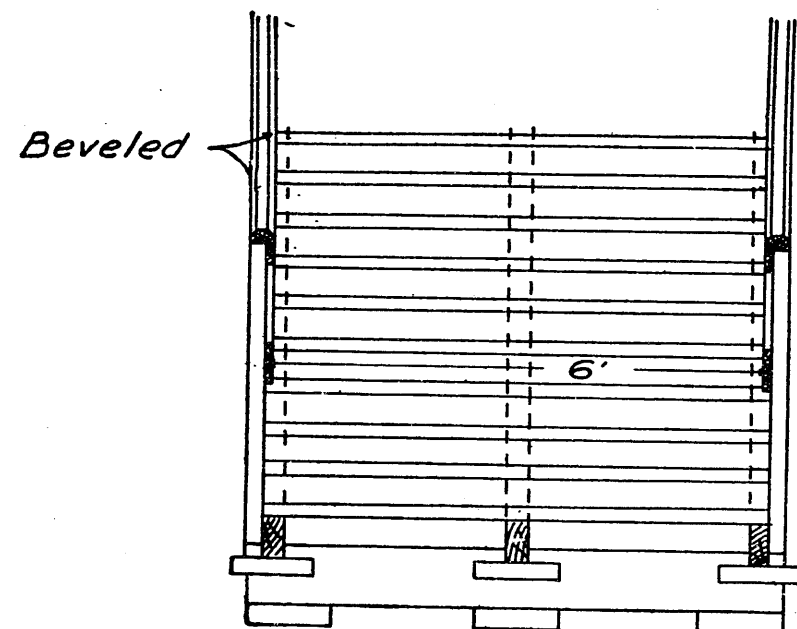
CONCRETE CROSSWALK



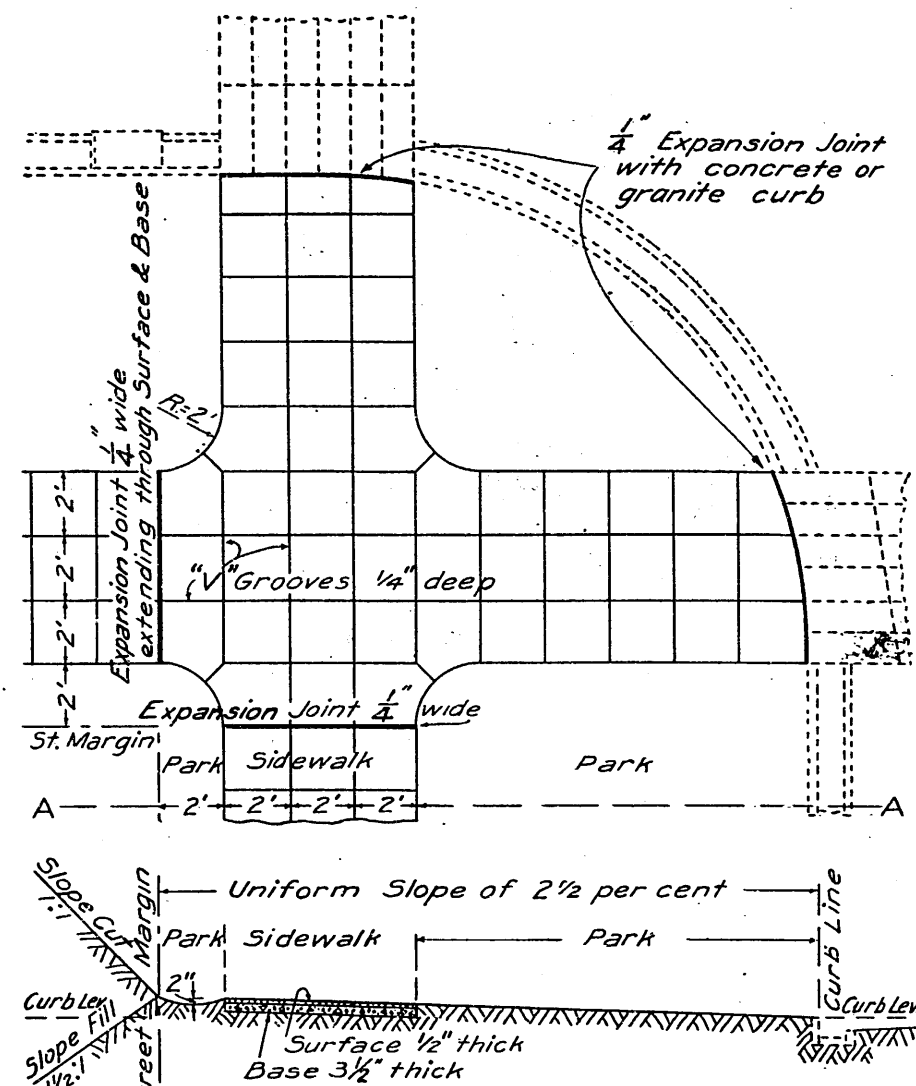
Width of Roadways	18	22	25	27	30	32	36	40	42	46	50
Length of Crosswalk	15	19	22	24	27	29	33	37	39	43	47
No. of Stringers	7	7	9	9	11	11	13	13	15	15	17
Feet B. M. 4' Wide	414	478	550	582	654	686	774	838	894	958	1046

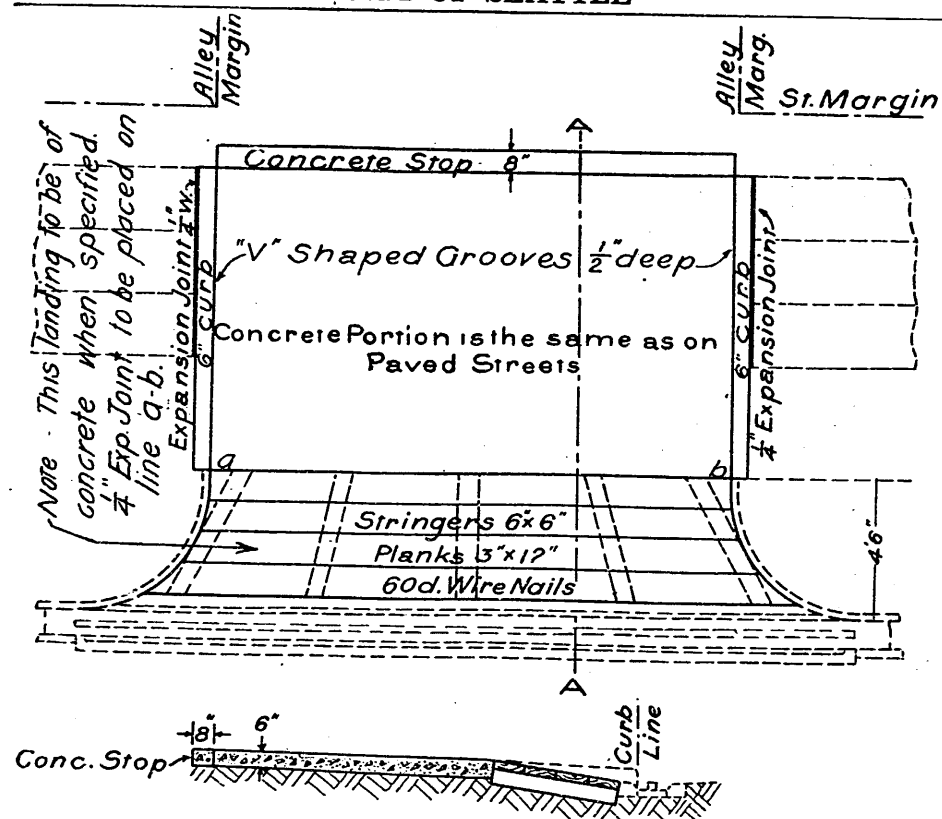
Crosswalks Bill of Material
Including Aprons

4FT. WOOD APRON AND CROSSWALK



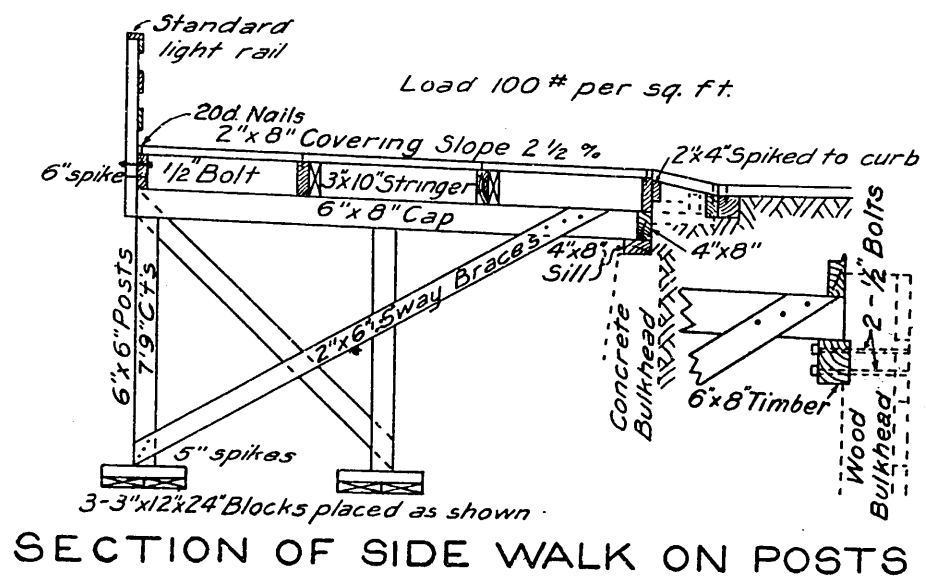
WOOD STAIRWAY

Section A-A
Concrete Sidewalk Intersection

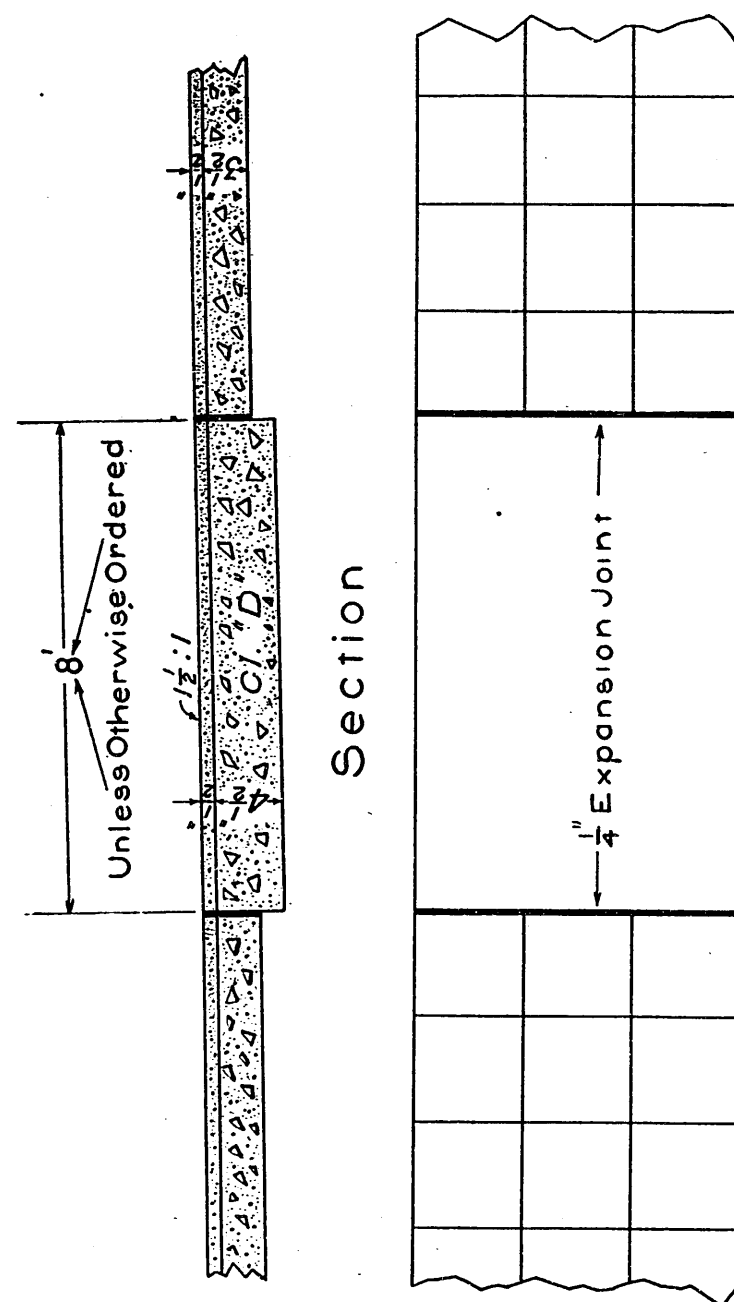


Section A-A

CONCRETE ALLEY CROSSING For Unpaved Streets



SECTION OF SIDE WALK ON POSTS



Section

Plan

PRIVATE ALLEY CROSSING

Constructed with 2 Course Conc. Walk

SPECIFICATIONS FOR CONCRETE RETAINING WALLS

108. GRAVITY RETAINING WALLS (For plan see page 81).

(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 79.

(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 49, except that the class 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) REINFORCING STEEL

Reinforcing steel for concrete retaining walls shall conform to the requirements specified in Section No. 72. 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 52, 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 given a Class "C" finish.

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

(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 gravity retaining walls shall be made in the following manner for materials in place:

- (1) Concrete per cubic yard, computed by the prismoidal 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.

109. CONCRETE CRIB BULKHEAD

(For plans, see pages 82, 83).

Concrete Crib Bulkhead shall be constructed of such combinations of pre-cast stretchers, headers and header blocks as will most nearly conform to the profile shown on the improvement plan.

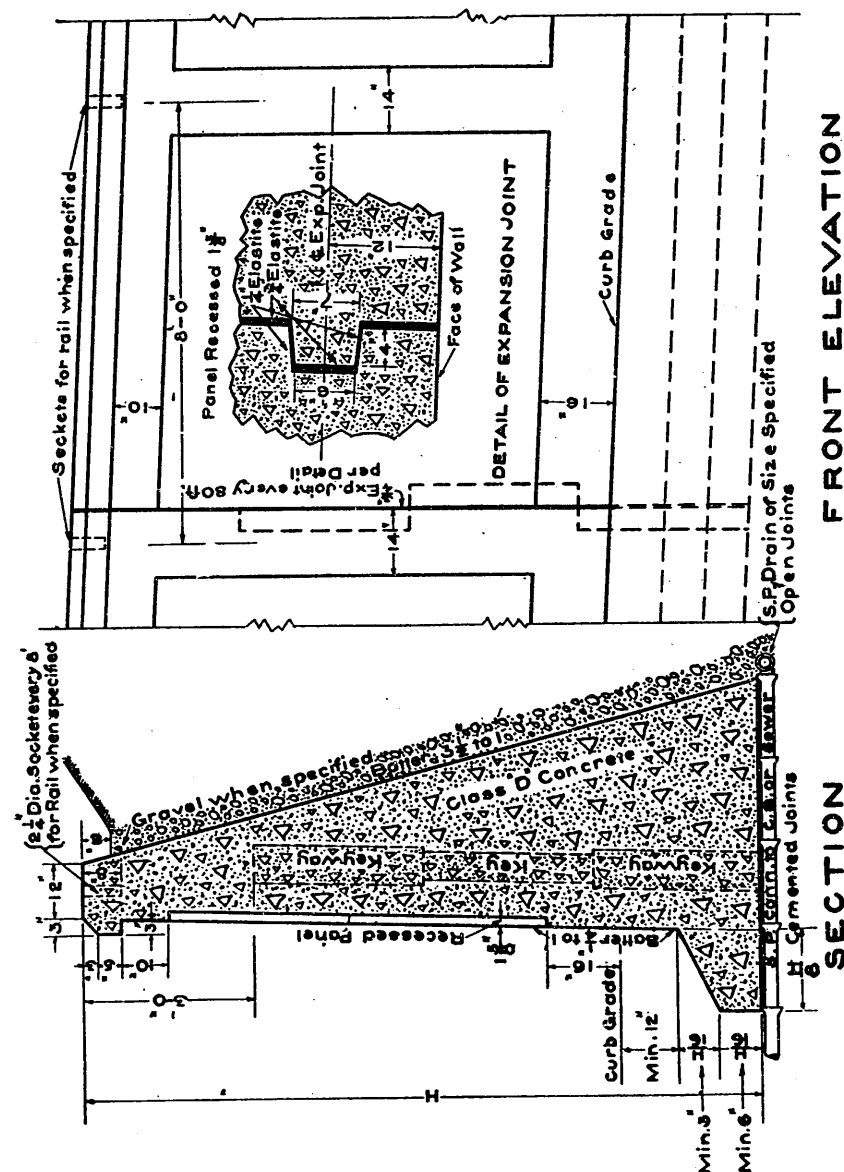
The pre-cast units shall be manufactured from Class "B" concrete. Reinforcing steel shall be accurately placed and tied. Units shall be kept continuously wet for ten (10) days after pouring, and shall not be used until at least twenty-one (21) days old. Two (2) day steam curing may be substituted for water curing, in which case the units may be used when fourteen (14) days old.

Payment for Concrete Crib Bulkheads shall be made at the price bid, each, for "Stretchers", for "Headers", and for "Header Blocks". The price bid shall include all labor and material necessary to manufacture and place the units, all necessary excavation and all backfilling.

110. REINFORCED CONCRETE WALLS

Reinforced concrete retaining walls shall be constructed in conformity with the special plans and according to the specifications for Reinforced Concrete Structures.

GRAVITY RETAINING WALL



SPECIFICATIONS FOR SEWERS AND APPURTENANCES GENERAL STIPULATIONS

111. 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.

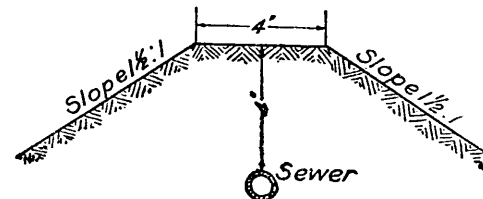
112. TRENCHING FOR PIPE SEWER

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

The completed trench shall be kept not less than thirty (30) feet ahead of the pipe layers. The trenches shall be at least six (6) inches wider on each side, or a total width of twelve (12) inches more than the exterior diameter of the pipe. If rock is excavated it shall be removed to a depth of six (6) inches below the bottom of the bell and the trench refilled with sand or gravel and well tamped. Such refill shall be paid for at the price bid for "Gravel in Trench".

The contractor shall furnish all necessary machinery for the work and shall pump, bail or otherwise remove any water

which accumulates in the trenches. He shall perform all work necessary to keep the trenches clear of water while the foundations and the masonry are being constructed or the pipe laid.



SEWER SECTION IN FILL

ment 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 twenty-four inches (24") or more in diameter shall be laid in open trench.

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

113. 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 fifteen dollars, (\$15.00) 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.

114. EXTRA EXCAVATION

Where called for, extra excavation shall be made and paid for according to the specifications for "Extra Excavation" in Section 79.

115. TUNNELING FOR SEWERS

Where pipe which is less than twenty-four (24) inches in diameter is used and the trench is twelve (12) feet or more in depth, tunneling may be resorted to. Open trenches between tunnels shall be not less than eight (8) feet in length; and tunnels shall be not more than twelve (12) feet long. Tunnels shall be not less than

four (4) feet high, and two (2) feet wide, nor shall any tunnel be less than one (1) foot wider than the external diameter of the sewer pipe.

Tunnels longer than 12' will be permitted where the sewer is under pavement or other obstructions. Such tunnels shall be back-filled by means of pneumatic tampers.

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

116. BACKFILLING

(a) BACKFILLING TRENCHES

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

The material used for backfilling around and to a point one

(1) foot above the top of the sewer, shall be clean earth or sand free from all gravel or stones which will not pass through a one (1) inch ring.

The space between the pipe and the bottom and sides of the trench shall be filled by hand and thoroughly 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.

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

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

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 tunnels shall then be backfilled as specified for trenches.

117. 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 36.

All cleaning up and removal of debris shall be done by the contractor.

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 tunnels and 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 or working underneath 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.

118. 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 36.

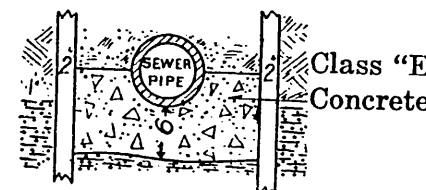
119. PIPE SEWERS

(a) QUALITY OF THE PIPE

Sewer pipe shall conform to the Standard Specifications for Sewer Pipe as given in Section 69 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 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.



SEWER SUPPORT
IN QUICKSAND

Where quicksand is encountered, and when so ordered by the City Engineer, 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 cemented in place shall be used to close the open end. The inclination given each wye, unless otherwise directed by the City Engineer, shall be about thirty (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.

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.

(c) JOINTING

Unless otherwise specified all sewer pipes shall be jointed with cement mortar mixed in the proportion of one (1) part cement to one and one-half (1½) parts sand.

(1) Cement Joints

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 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.

(2) Bituminous Joints

When so specified sewer pipes shall be jointed with bituminous joints prepared in the following manner.

Sewer pipes shall be fitted with self-sealing, tapered type joints, which shall be made by fitting the spigots and sockets of all pipes with a collar of mastic compound composed of asphalt and a filler of finely ground inert mineral matter. This compound shall be flexible at freezing, softening at 212°F., and flowing at 300°F. It shall possess a proper degree of hardness to prevent penetration of root growth and still allow sufficient resiliency to withstand slight ground movement and distortions. Penetration shall show by test at 77°F., to be not under 7 and not over 9.

A collar of this jointing material shall be cast into the socket. The spigot end of the pipe shall be fitted with a collar or ring of the same material cast on the end of the pipe and of the same taper as the socket jointing material, and of such size that when pressed firmly into the socket portion of the pipe, a tight fit be-

tween the socket end of the pipe and the spigot end of the pipe will be made. All pipe shall be absolutely dry when collar is moulded thereon.

When laying pipes, precast jointing materials shall be painted with Oronite Priming Solution, or its equal, which will cause the surface of the socket portion of the joint and the surface of the spigot portion of the joint to become softened or tacky. The pipes shall be pressed firmly together, causing the two joints to become one homogeneous body.

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

(d) 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 77.

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.

120. 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.

Below the springline the contractor will be required to place one-half (½) inch of mortar, laying the brick upon this mortar bed, so that all joints between brick will be completely filled with mortar. Joints shall be of a uniform thickness as nearly as possible and not exceeding three-eighths (¾) of one (1) inch. On the inside of the invert the joint shall not exceed one-eighth (⅛) of one (1) inch in thickness and on the sides and on the invert they shall be struck when laid. The upper arch shall be built upon strongly made centers. The crown of the arch shall be thoroughly keyed with stretchers. The centers shall not be withdrawn until the mortar is well set. The exterior surface of the upper arch shall be covered with a coat of mortar, not less than three-eighths (¾) 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, cemented in place.

(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.

121. REINFORCED CONCRETE SEWERS

Monolithic reinforced concrete sewers shall be constructed in conformity with the special plan and according to the specifications for Reinforced Concrete Structures.

122. 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

123. EXTRA WYES

Whenever the number of wyes authorized and ordered by the City Engineer for any size of pipe exceeds the number of wyes shown on the plan for that size of pipe the following amounts shall be allowed for each extra wye so used, and no reduction shall be made from the length of pipe as measured.

6"	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

124. SIDE SEWERS

Side Sewers shall be constructed where shown, or where directed by the City Engineer upon application of the abutting property owners, in accordance with the Standard Plans and Specifications for "Sewers," with the top of side sewer connections at the curb line one (1) foot above the main sewer. All ends of the side sewers shall be marked by a No. 12 galvanized iron wire fastened to the end of the pipe and extending vertically to within six (6) inches of the surface. A brass tag $1\frac{1}{2} \times 3$ stamped "SEWER" in letters $\frac{1}{4}$ " high shall be attached to the surface end of wire. When concrete curb is constructed on an improvement calling for side

sewers, the top of the curb shall be stamped with the letter "S" $2\frac{1}{2}$ inches high, and the brass tag may be omitted.

The entire length of the side sewer except four (4) feet adjoining the main sewer shall be in open trench. Provided however, that side sewers exceeding fourteen (14) feet in depth may be constructed by tunneling. Tunnels shall not exceed twelve (12) feet in length and shall be backfilled as provided for tunnels for main sewers. Backfilling in the trench or tunnel shall not be commenced until the work has been approved by the City Engineer, and such backfilling shall be done as specified for "Sewers."

Whenever a new wye or other opening is to be inserted in an existing sewer, either for a side sewer, or other connection, it shall be done by the Department of Streets and Sewers and paid for by department bills, as outlined in Section 36. The contractor shall make the excavation, furnish the wye, and do all other work except inserting the wye or other opening in the main sewer.

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

125. STANDING CONNECTIONS

(For plan see page 116).

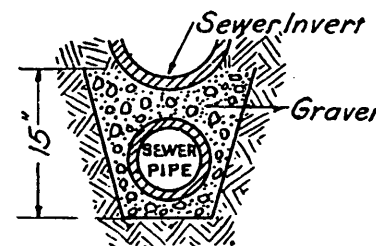
Standing connections shall be constructed as shown on the standard plan. They shall be of the size specified. Payment shall be made for "Standing Connections" at the price bid each complete. Connections above and beyond the wye shall be paid for at the price bid for "Side Sewers, per lineal foot."

126. 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.

127. 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.



SEWER SUB DRAIN

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

Payment shall 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.

128. MANHOLES

(For plans, see pages 97, 98 and 101).

Manholes may be constructed of Class "C" brick, concrete or concrete blocks at the contractor's option.

The excavation for all manholes shall be sufficient to leave six (6) inches in the clear between their outer surfaces and the earth or timber used to support it.

(a) BRICK MANHOLES

Brick shall be wetted just before being used and laid with shove joints, and special care shall be taken to see that all joints are well filled. The mortar shall be composed of one (1) part Portland cement and two (2) parts sand. The covers of manholes shall be brought accurately to the grade given. 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 Class "E" Concrete.

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.

(b) 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 Class "B". 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. 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.

Blocks shall be kept wet for ten days and shall not be laid sooner than 14 days after manufacture. Two day steam curing

may be substituted for water curing, in which case blocks may be laid five days after manufacture. 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.

(c) CONCRETE MANHOLES

Concrete manholes may be substituted for brick or concrete block manholes.

The concrete shall be Class "D". The materials used shall be of the same quality and mixed in the same manner as specified under Section 49. The concrete shall be spaded sufficiently to produce dense concrete, free from air bubbles. It shall have a smooth surface next to the inner form and shall be laid continuously in order to form a monolithic mass. All forms shall be watertight. The contractor shall provide all necessary forms. Filling in around the work shall not be allowed until the concrete has thoroughly set.

(d) PAYMENT

Payment for manholes, whether built of brick, concrete, or concrete blocks, shall be made at the price bid each for "Manholes" and shall include the excavation, backfilling, castings, the construction of inverts, and all other labor and material necessary for their completion in accordance with the plans and specifications.

129. DROP MANHOLES

(For plan, see pages 99, 100).

The specifications hereinbefore written for Standard Manholes shall apply as well to Drop Manholes, with addition of the particular details shown on the plan. Special care shall be exercised in water settling the backfill around the manhole and in connecting the vertical pipe to the sewer above.

Payment for Drop Manholes shall be made at the price bid each for "Drop Manholes" and shall include excavation, masonry, backfill, iron steps, castings, cast iron pipe and specials, and all other labor and material necessary to complete the work according to specifications.

130. FLUSH TANKS

(For plan, see pages 102, 103).

Flush tanks may be either of the syphon type or the ejector type at the option of the contractor.

Flush tanks may be constructed of brick, concrete, or concrete blocks, at the contractor's option.

The specifications for Manholes shall apply to flush tanks in regard to masonry and general requirements for castings.

Flush tanks shall be connected to the nearest watermain using a $\frac{1}{2}$ " galvanized iron pipe for the connection to syphon type tanks, or a $1\frac{1}{4}$ " galvanized iron pipe for the connection to ejector type tanks. All connections shall be installed by the contractor with

the exception of the connection to the existing main. Such connection shall be made by the Water Department and the contractor shall deposit with said department the sum of \$12.00 in the case of a $\frac{1}{2}$ " tap or \$25.00 in the case of a $1\frac{1}{4}$ " tap in payment therefor.

Flush tanks shall be plastered on the inside with a coat of cement mortar one-quarter ($\frac{1}{4}$) inch in thickness, mixed with one (1) part cement to one (1) part sand.

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

131. CATCH BASINS

(For plan, see page 105).

Catch Basins shall be constructed of brick, concrete, or concrete blocks.

The specifications for manholes shall apply to catch basins in regard to masonry, and the general requirements for castings.

All 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 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.

132. ELLIPTICAL CATCH BASINS, SPECIAL CATCH BASINS, AND CATCH BASINS WITH SPECIAL INLET TOP (For plans, see pages 105, 109 and 115)

Shall be constructed according to the Standard Plans. Workmanship and materials shall conform in all respects to those prescribed for Catch Basins. Catch Basins with Special Inlet Top shall be constructed as specified for Catch Basins, the top being shaped to fit the special casting shown on page 115.

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 Catch Basins.

133. WOOD MANHOLES

(For plan, See page 111).

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.

134. WOOD MANHOLE EXTENSIONS

(For plan, see page 111).

In ungraded streets all manholes shall be extended from the proposed street grade to the surface of the ground, as shown on the plans 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.

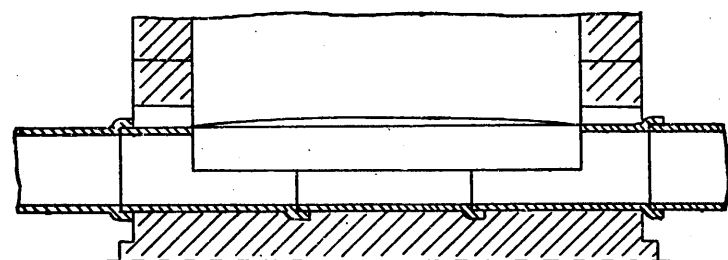
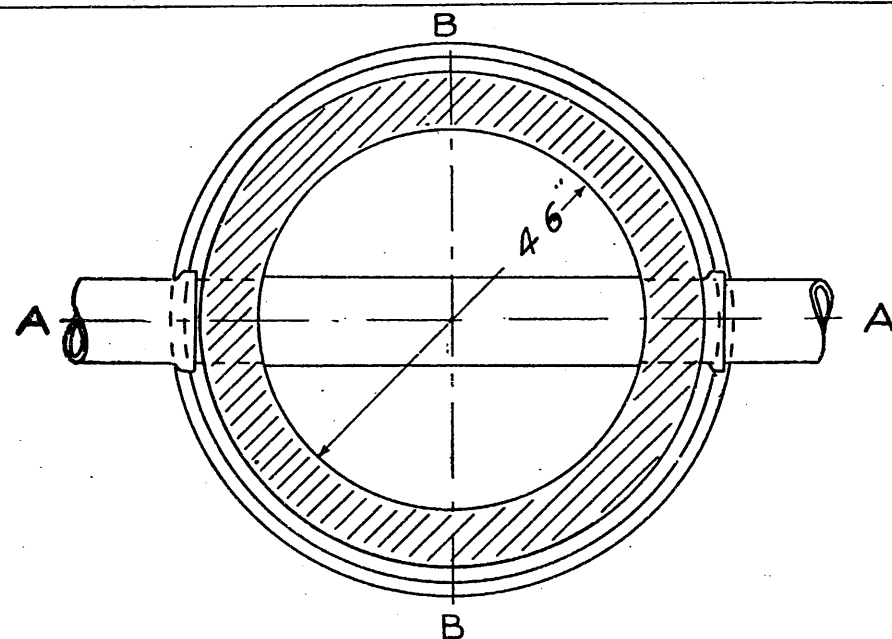
135. REBUILDING MANHOLES, CATCH BASINS, GATE CHAMBERS AND FLUSH TANKS

REBUILDING THEIR TOPS AND ADJUSTING THEIR COVERS

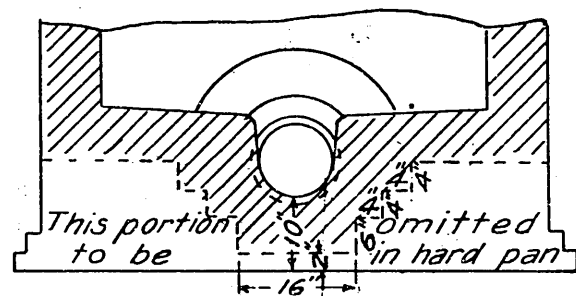
Where shown on the plan or as directed by the City Engineer, the existing manholes, catch basins, gate chambers or flush tanks shall be rebuilt to the new grade, either by tearing down or building up, or both. The contractor may use such of the old material as is suitable and shall furnish all new material 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 complete work. When no bid is taken upon rebuilding tops, this item shall be paid for at the rate of \$5.00 per Lin. Ft.

136. 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.



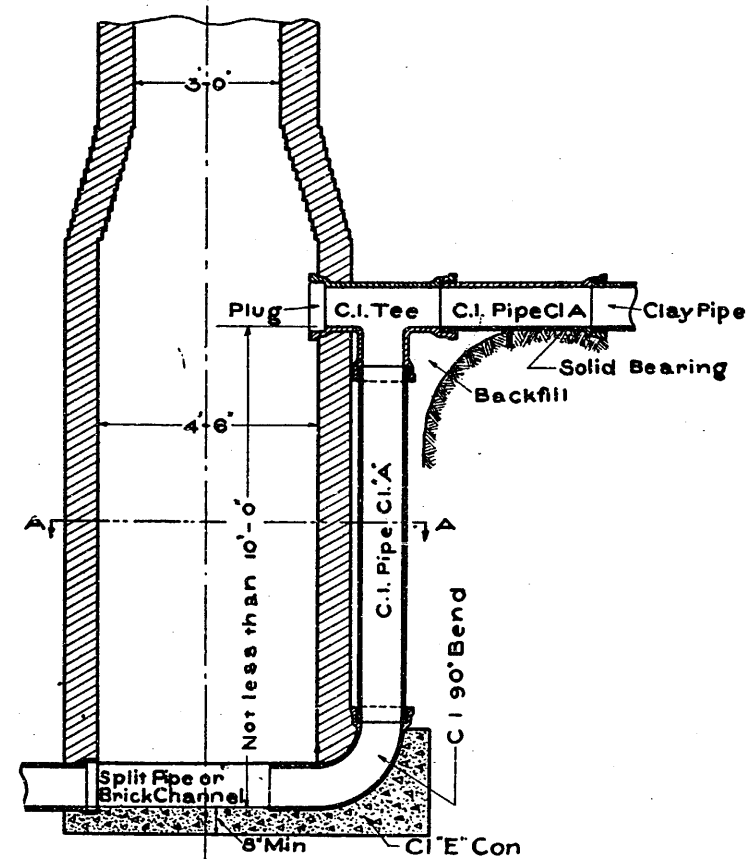
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Section A - A



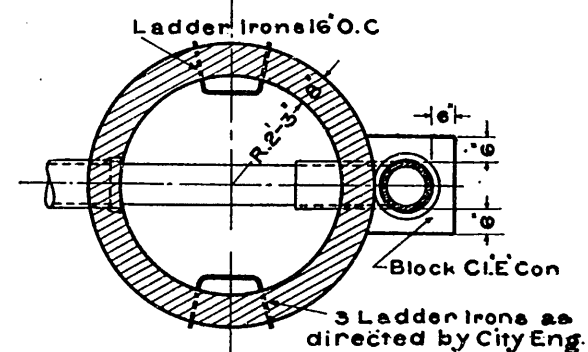
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Section B - B

BOTTOM OF MANHOLE
SHOWING MODIFIED FORM

Std M.H. top and Cover



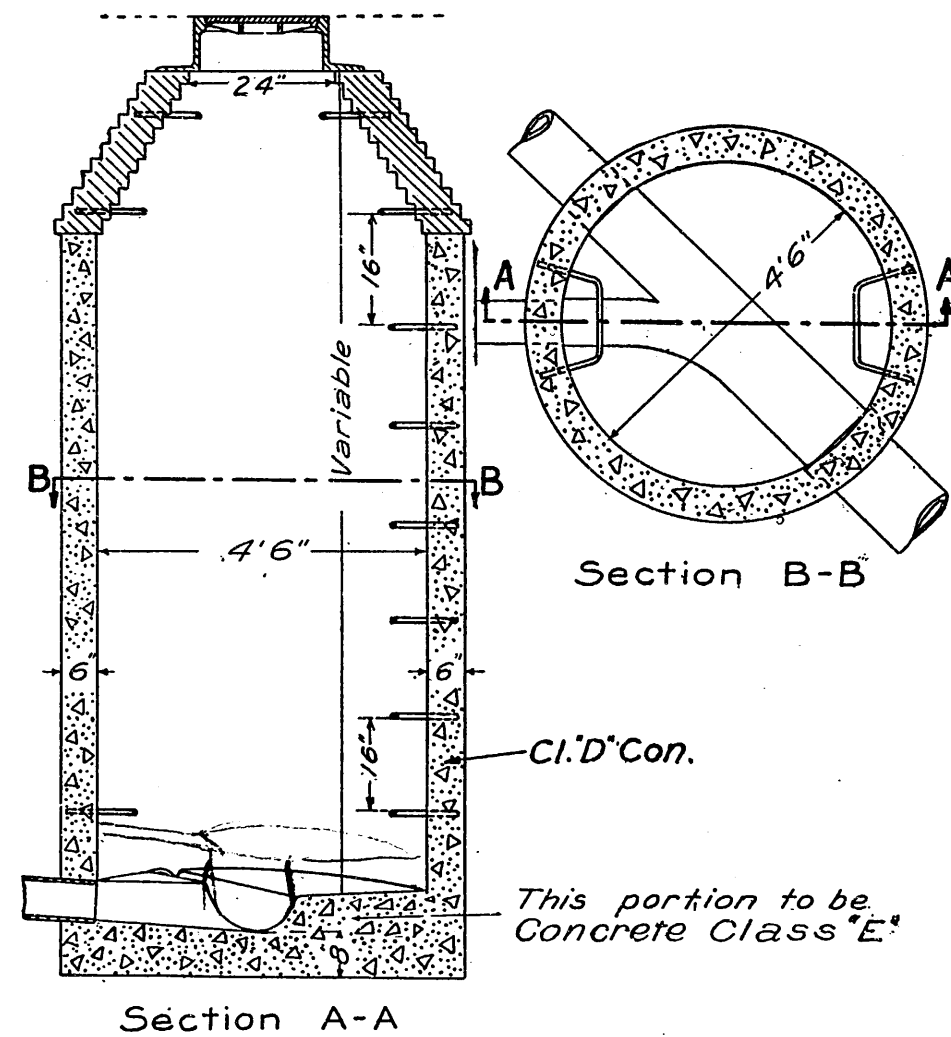
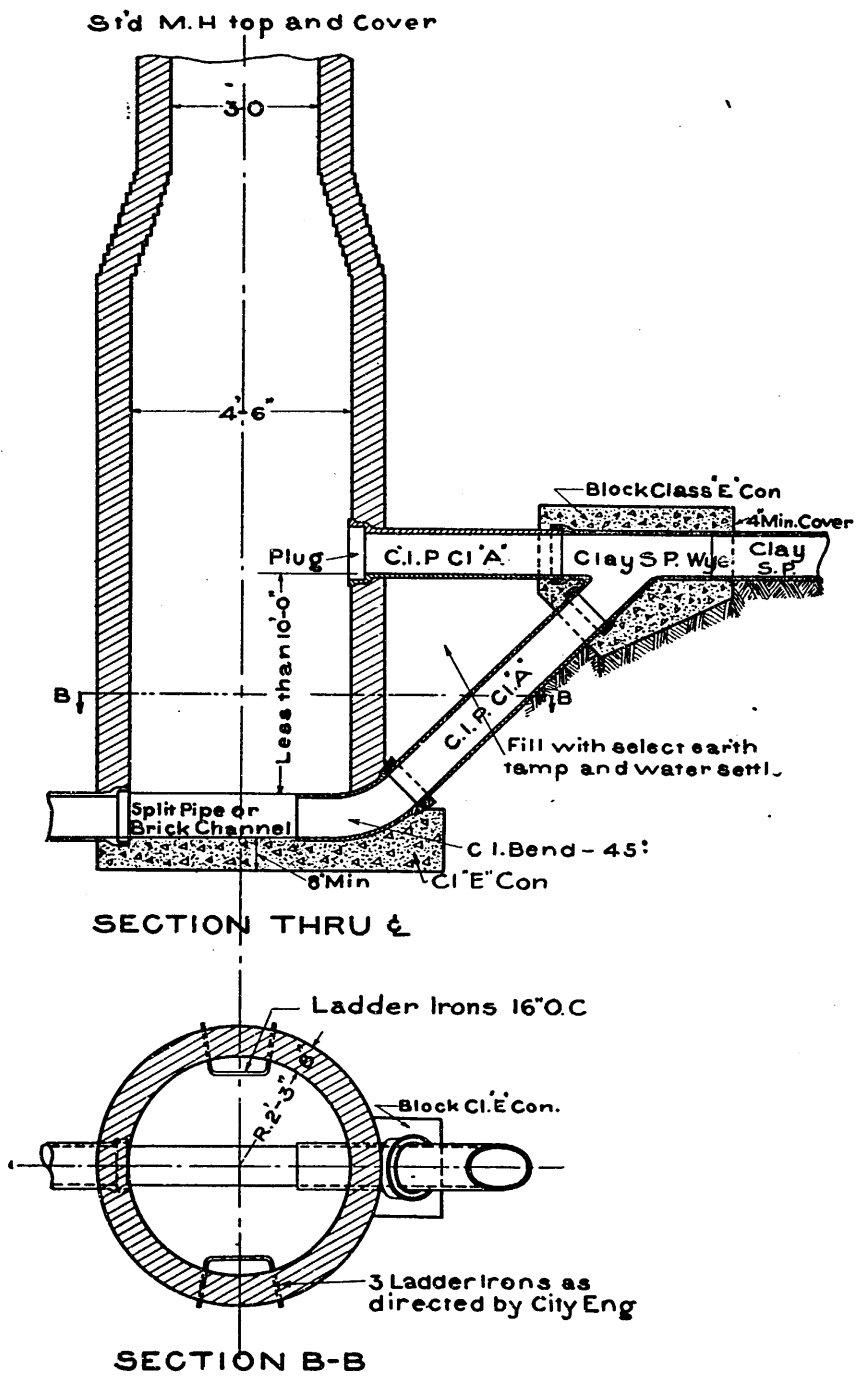
SECTION THRU

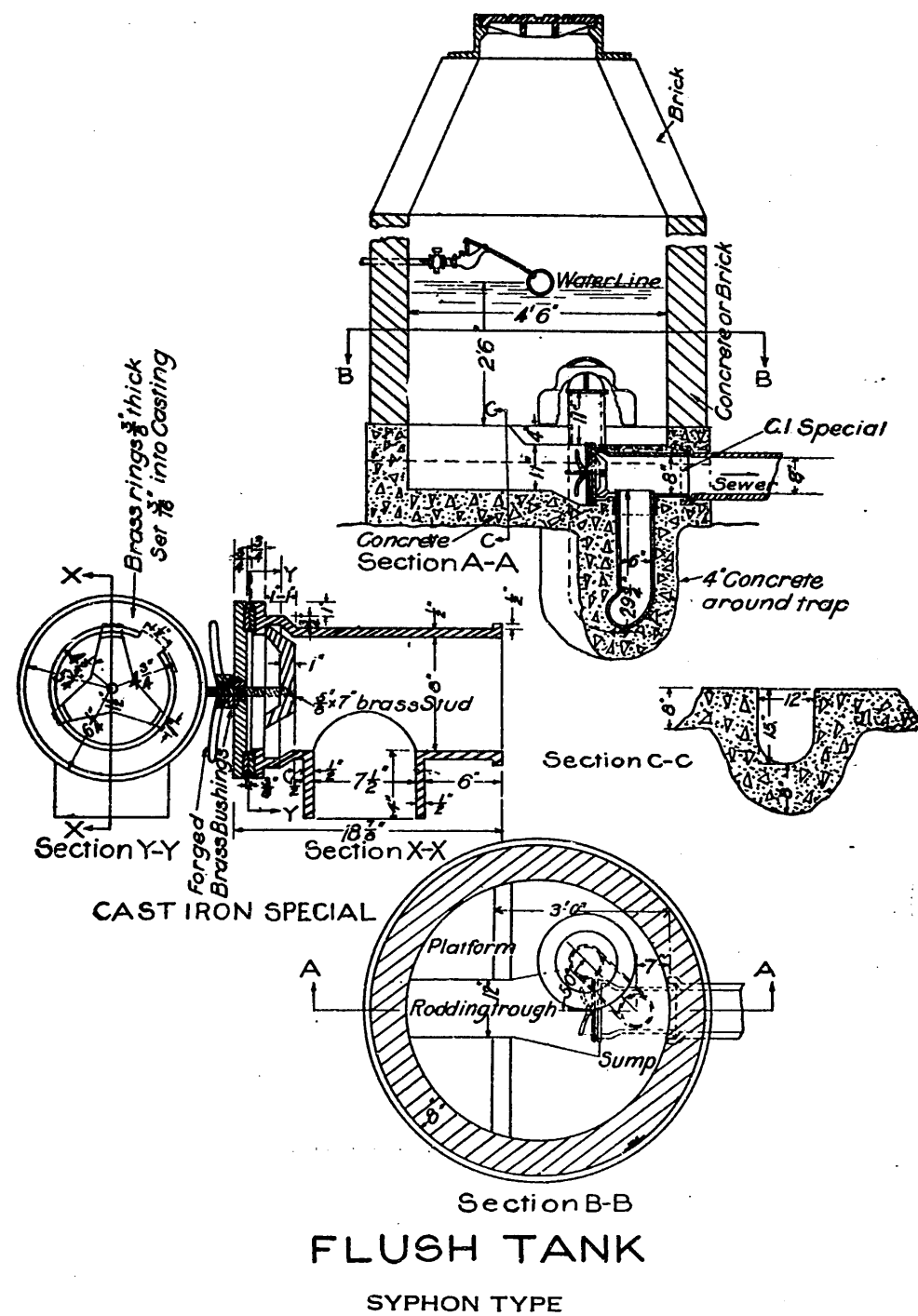


SECTION A-A

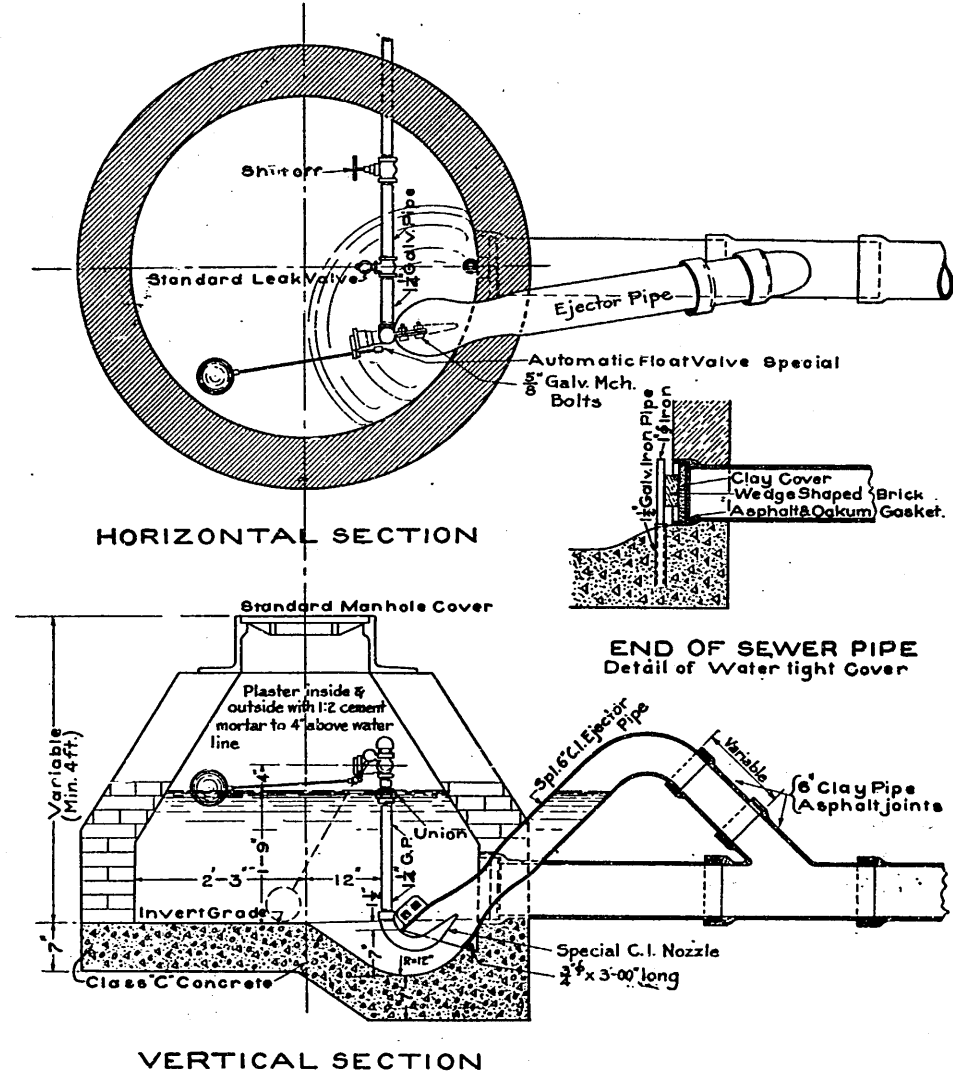
DROP MANHOLE

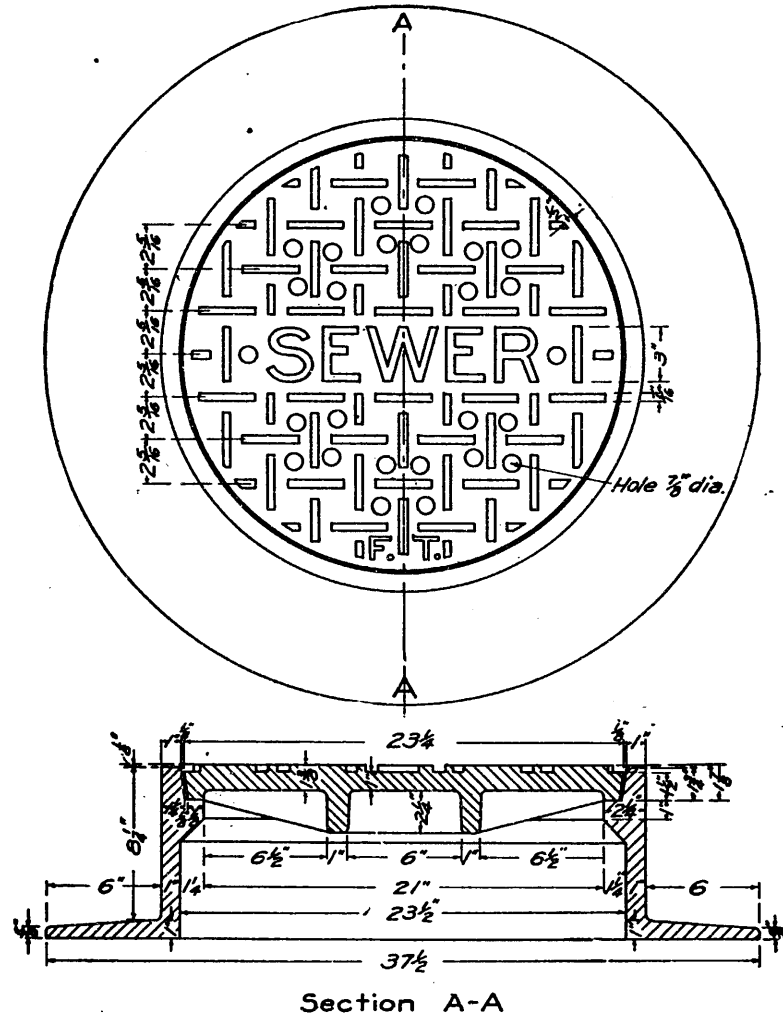
To be used where drop is
10ft or more



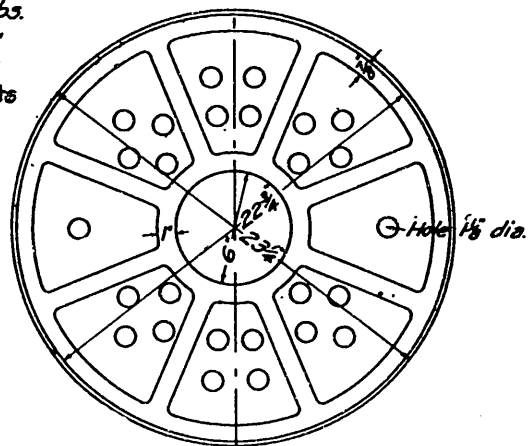


EJECTOR TYPE FLUSH TANK

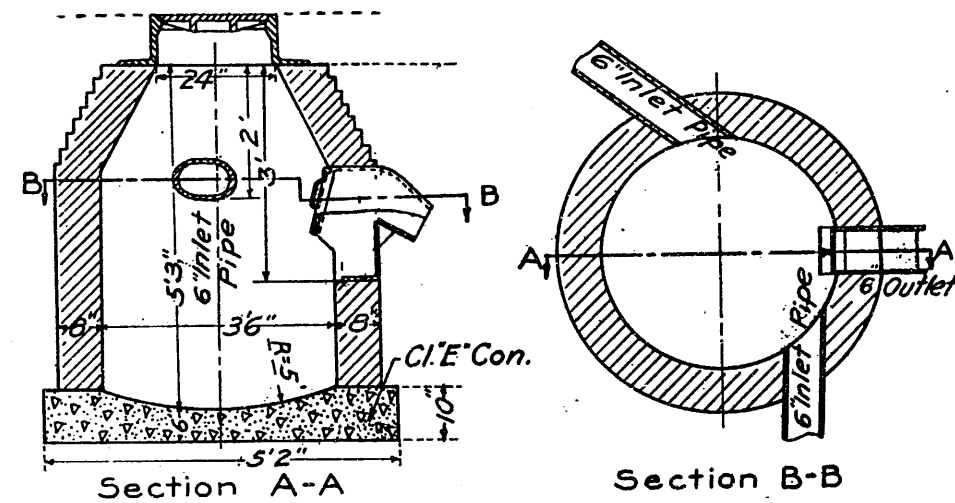




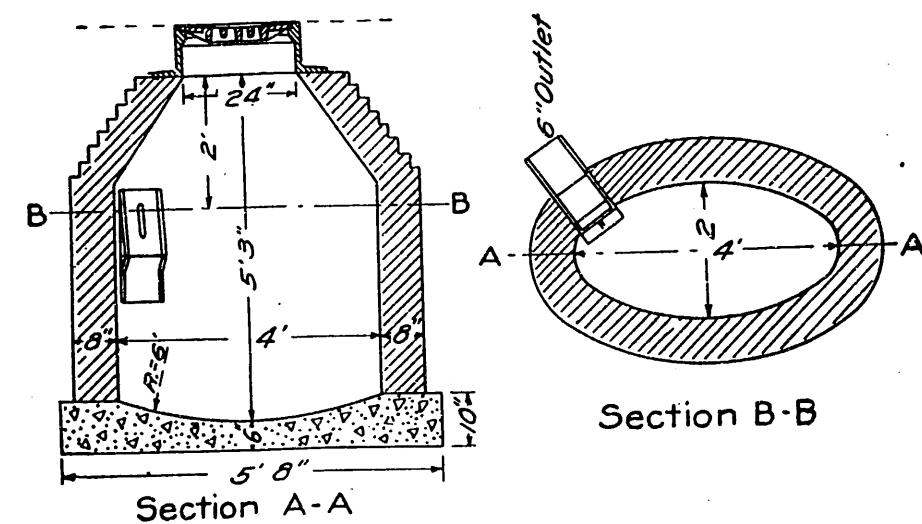
Ring 345 lbs.
Cover 153 "
Total 498 "
Approximate Weights



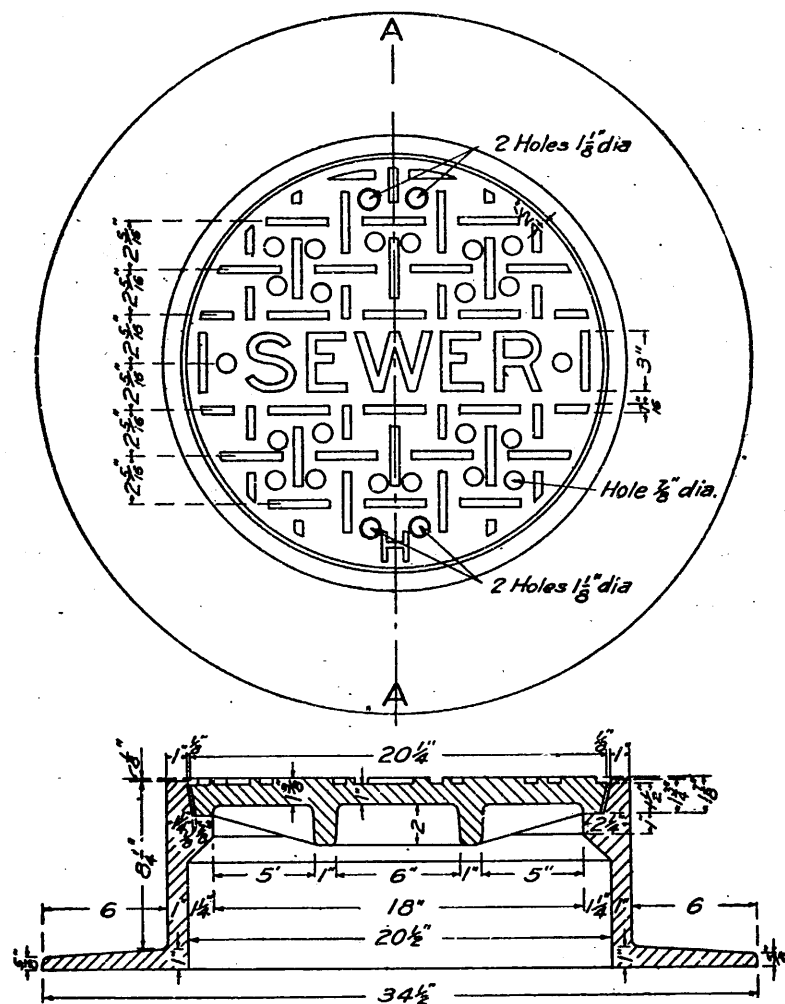
Bottom View of Cover
COVER FOR FLUSH TANK



CATCH BASIN

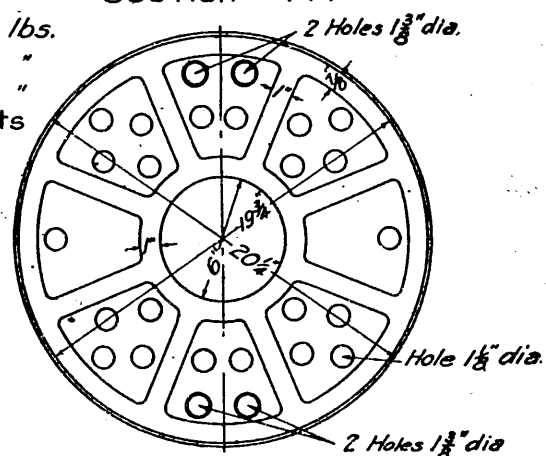


ELLIPITICAL CATCH BASIN



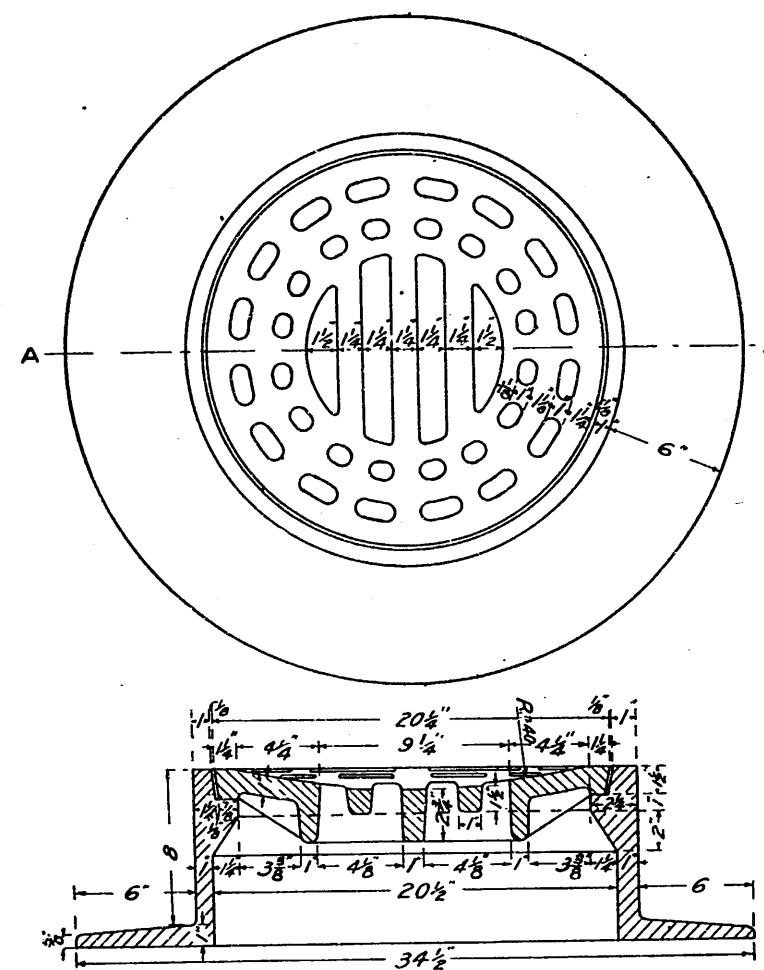
Section A-A

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

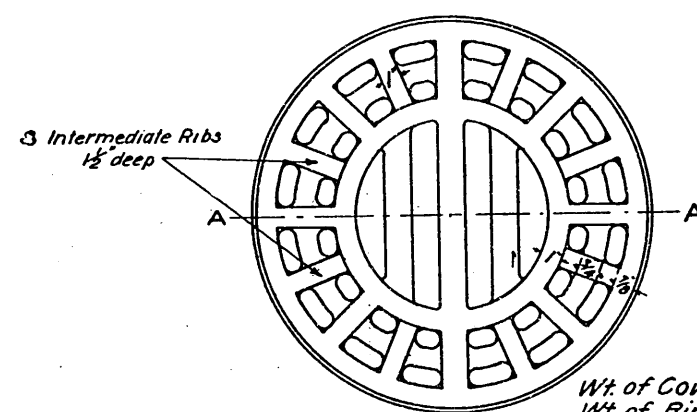


Bottom View of Cover

COVER FOR CATCH BASIN & MANHOLE



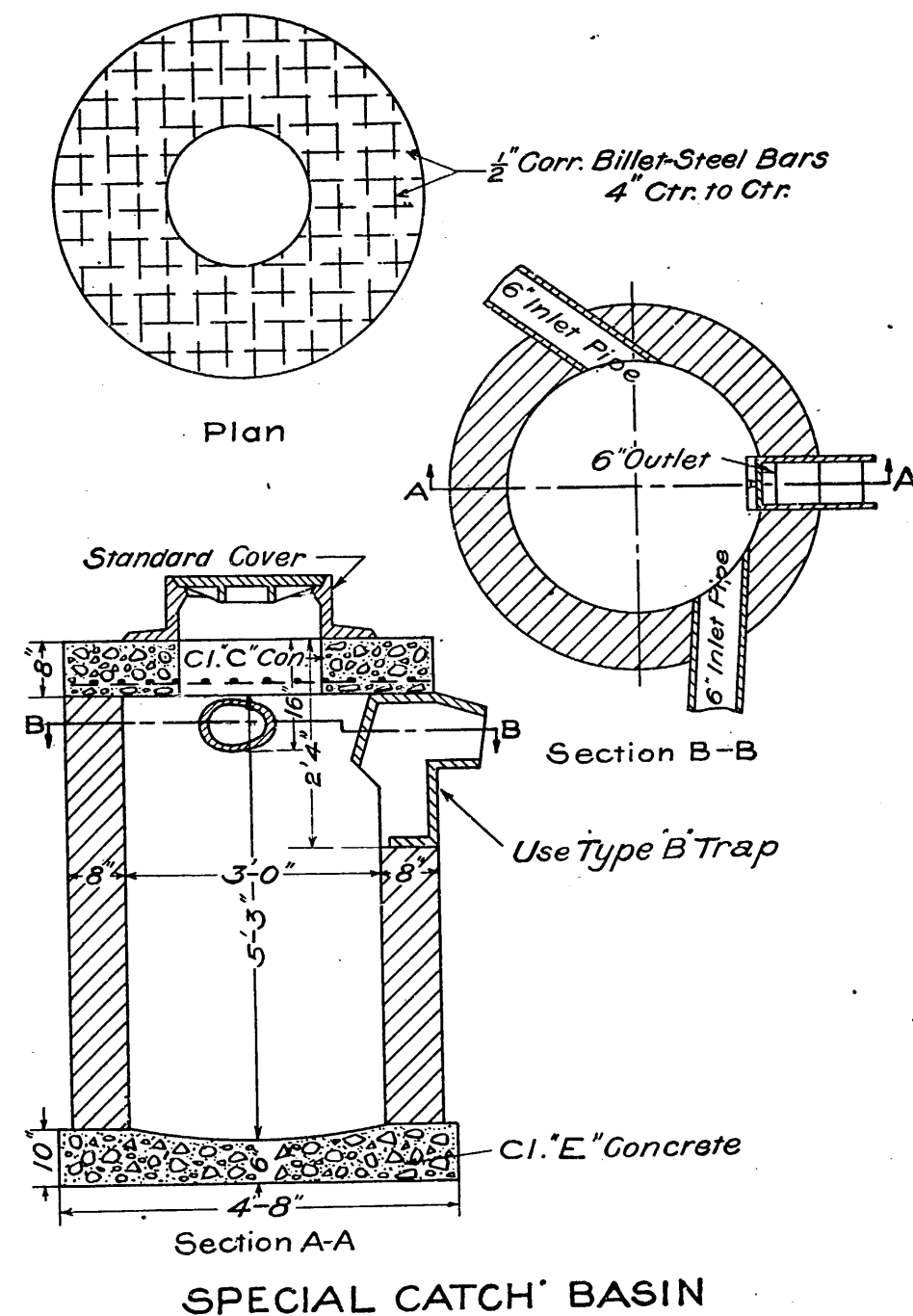
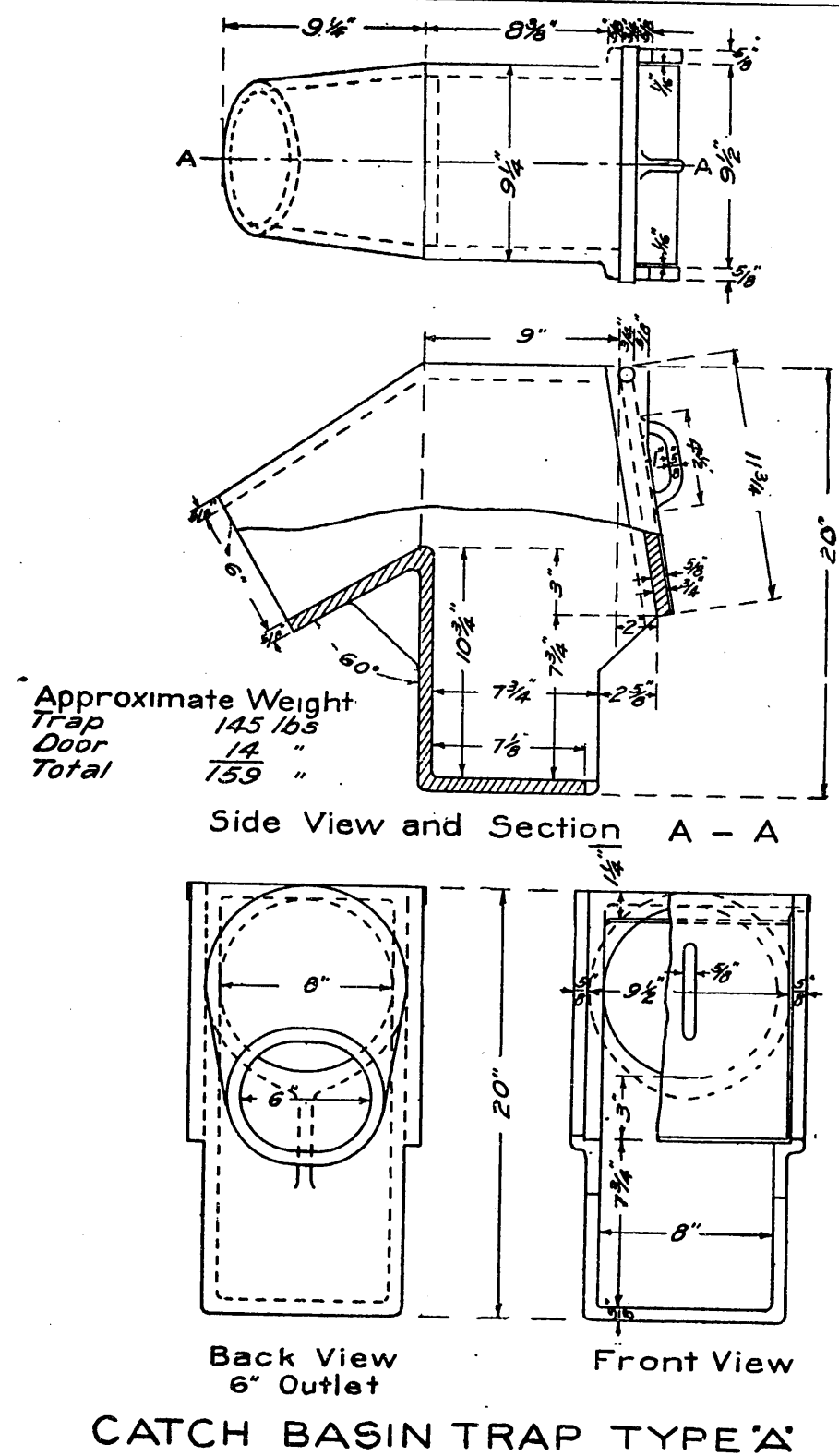
Section A-A

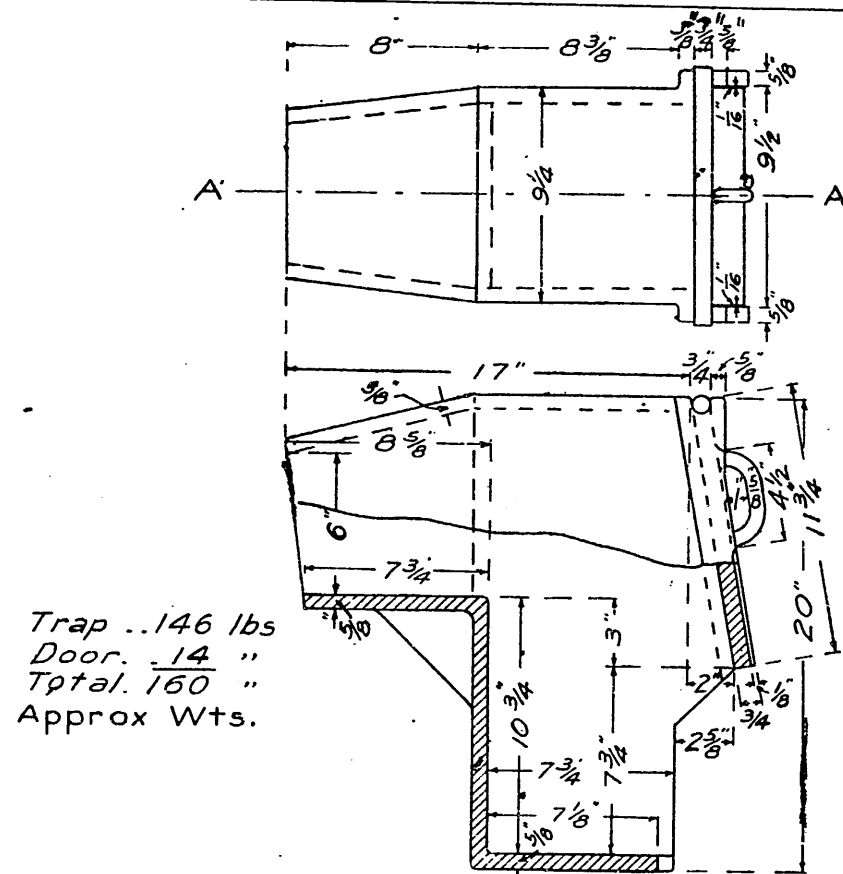


Bottom View of Cover

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

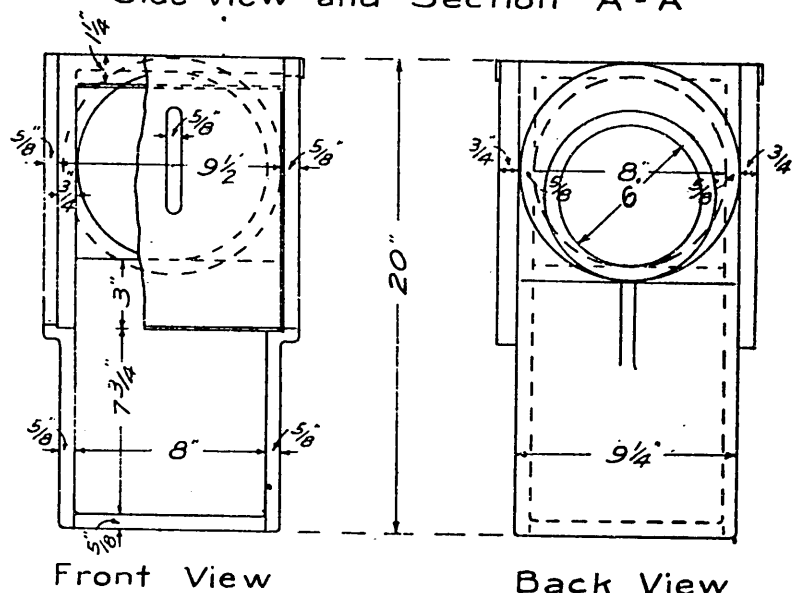
CATCH BASIN COVER - INLET TOP





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

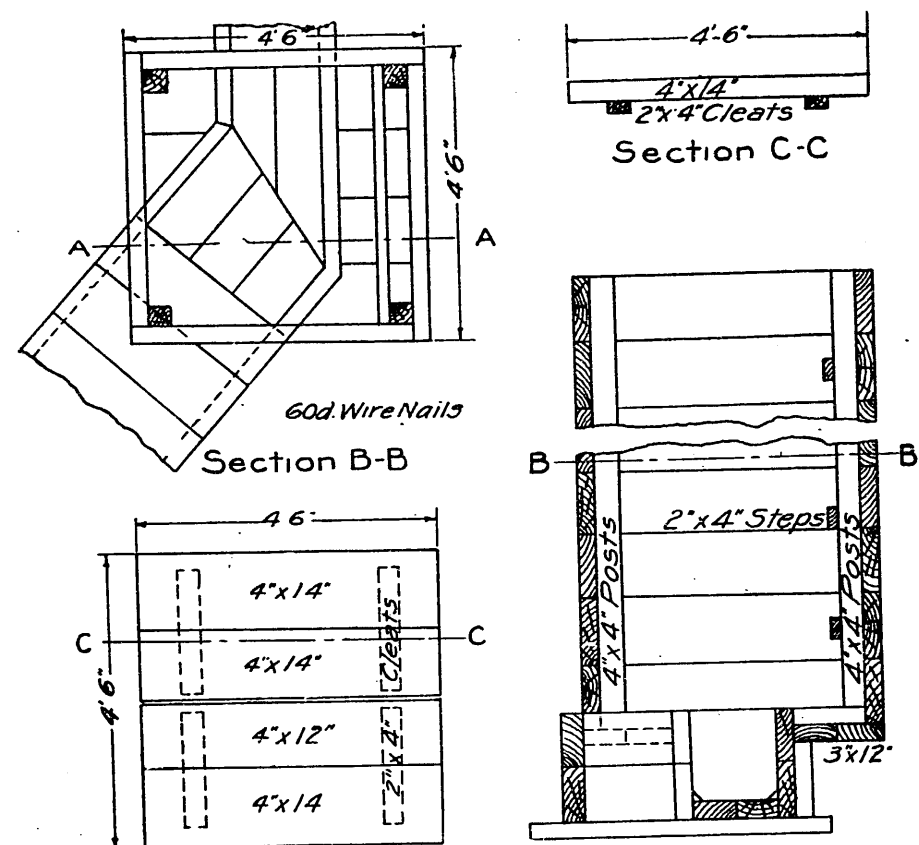
Side View and Section A-A



Front View

Back View

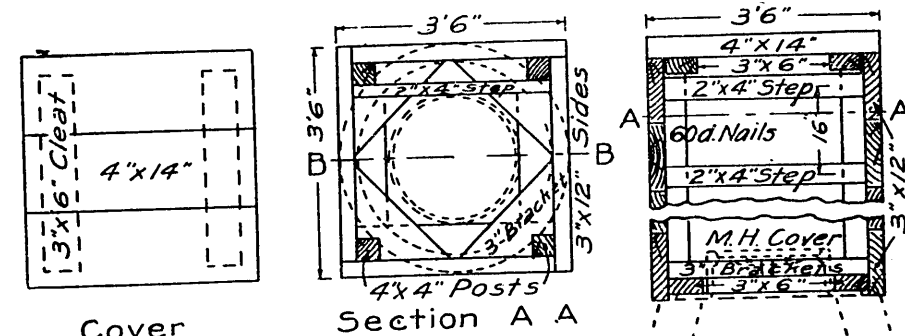
CATCH BASIN TRAP TYPE "B"



Top View of Cover

Section A-A

WOOD MANHOLE



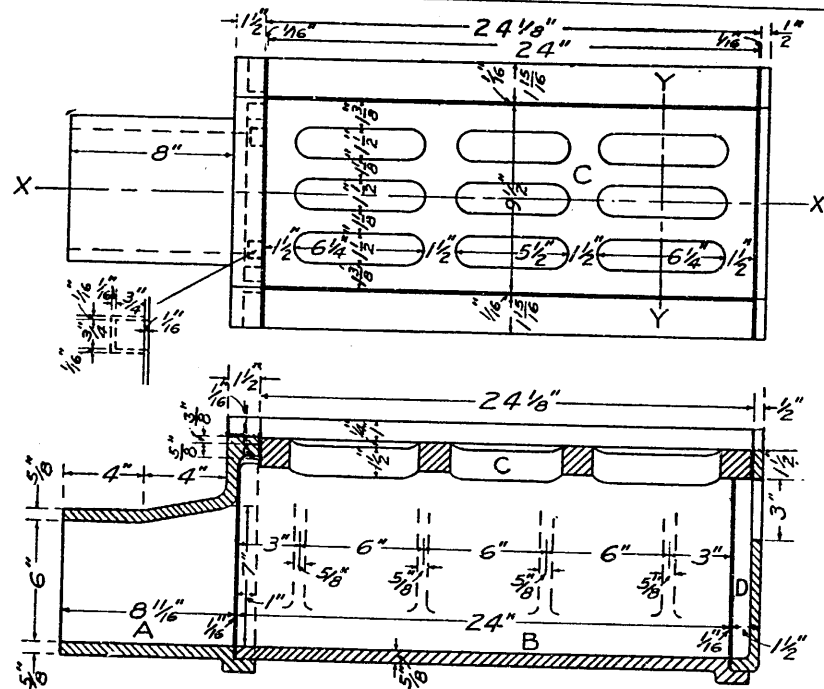
Cover

Section A A

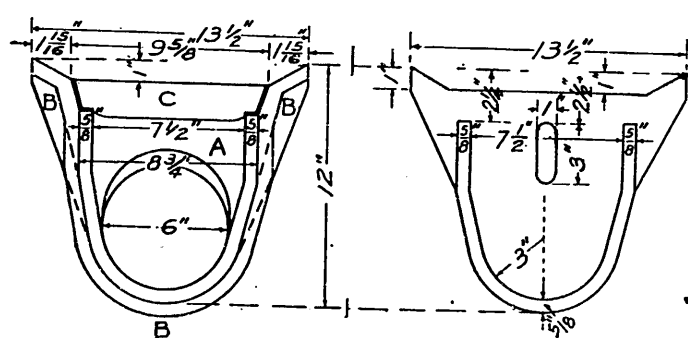
266 ft B.M. for 4 depth
46 " " per foot

Section B-B

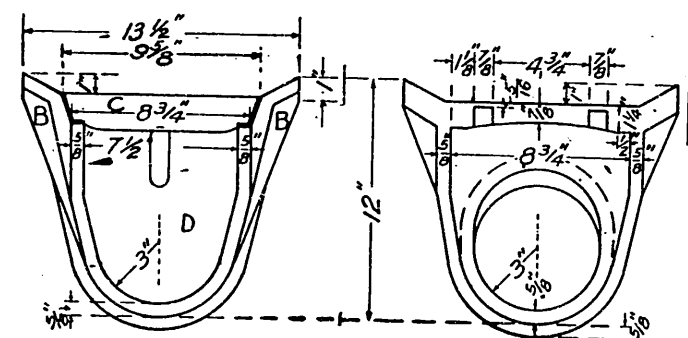
WOOD. EXTENSION TO MANHOLE



Section X-X

End View
Piece D Removed

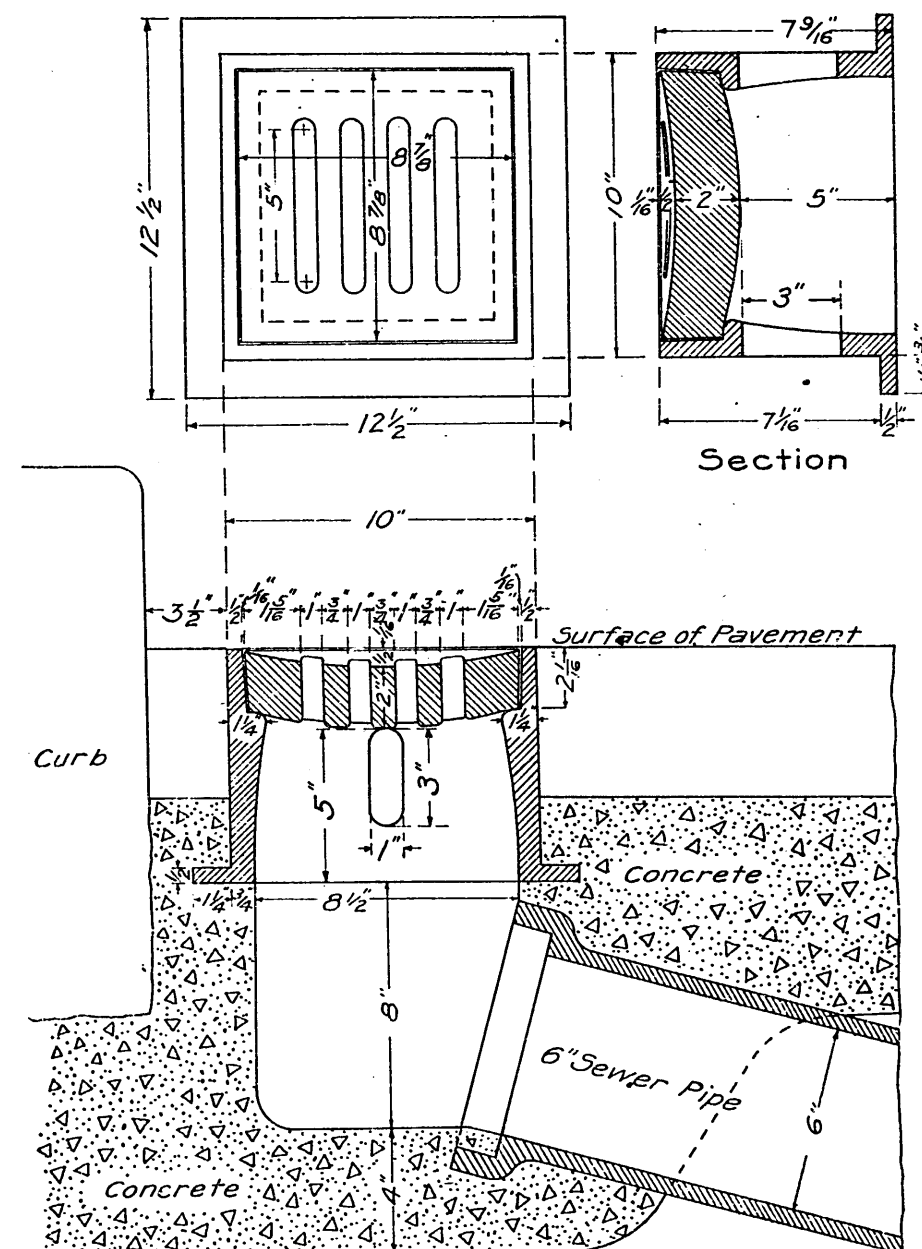
Inner View of Piece D

End View
Piece A Removed

Inner View of Piece A

INLET

Piece A... 49 lbs.
 Piece B... 139 "
 Piece C... 60 "
 Piece D... 14 "
 Total... 262 "
 Approx. Wts.
 Section of Grate at Y-Y

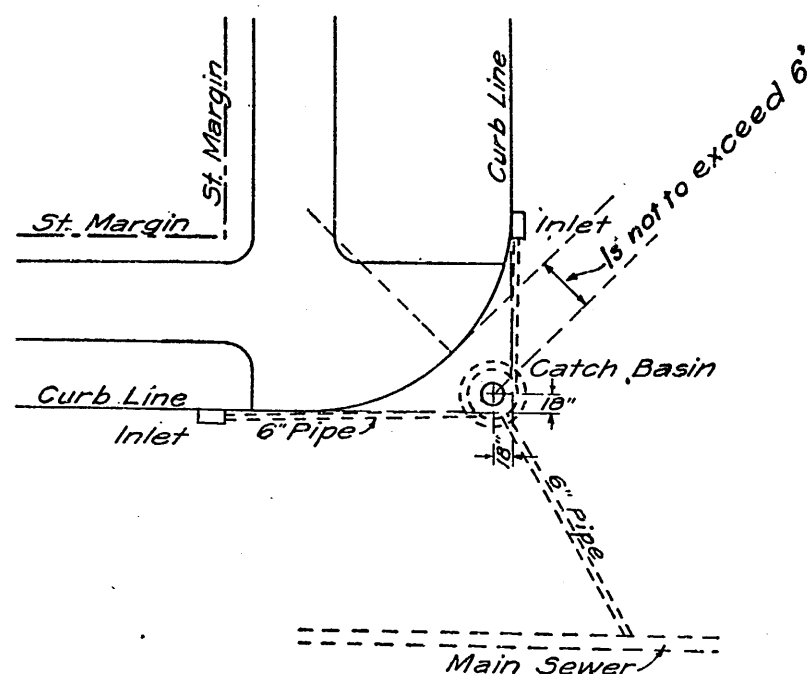


Section

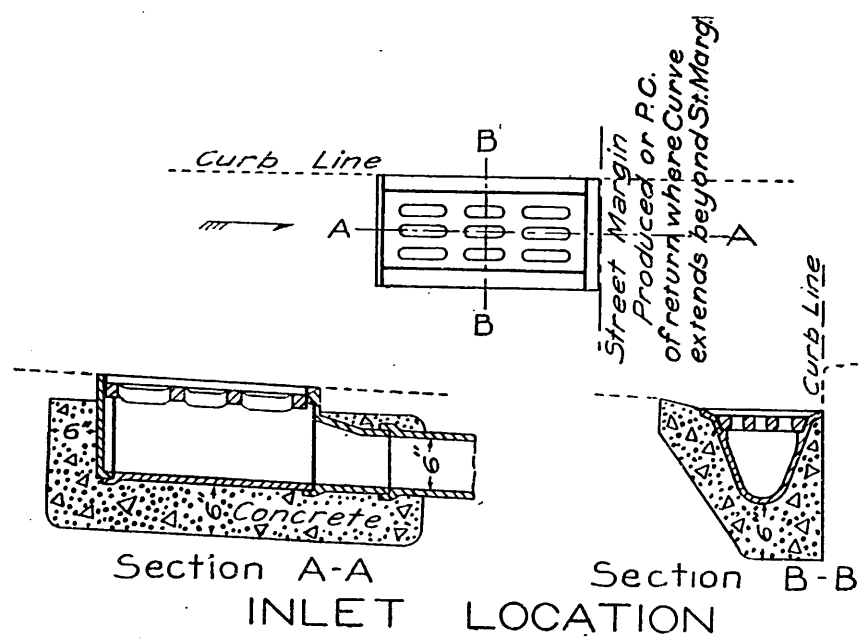
Transverse Section

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

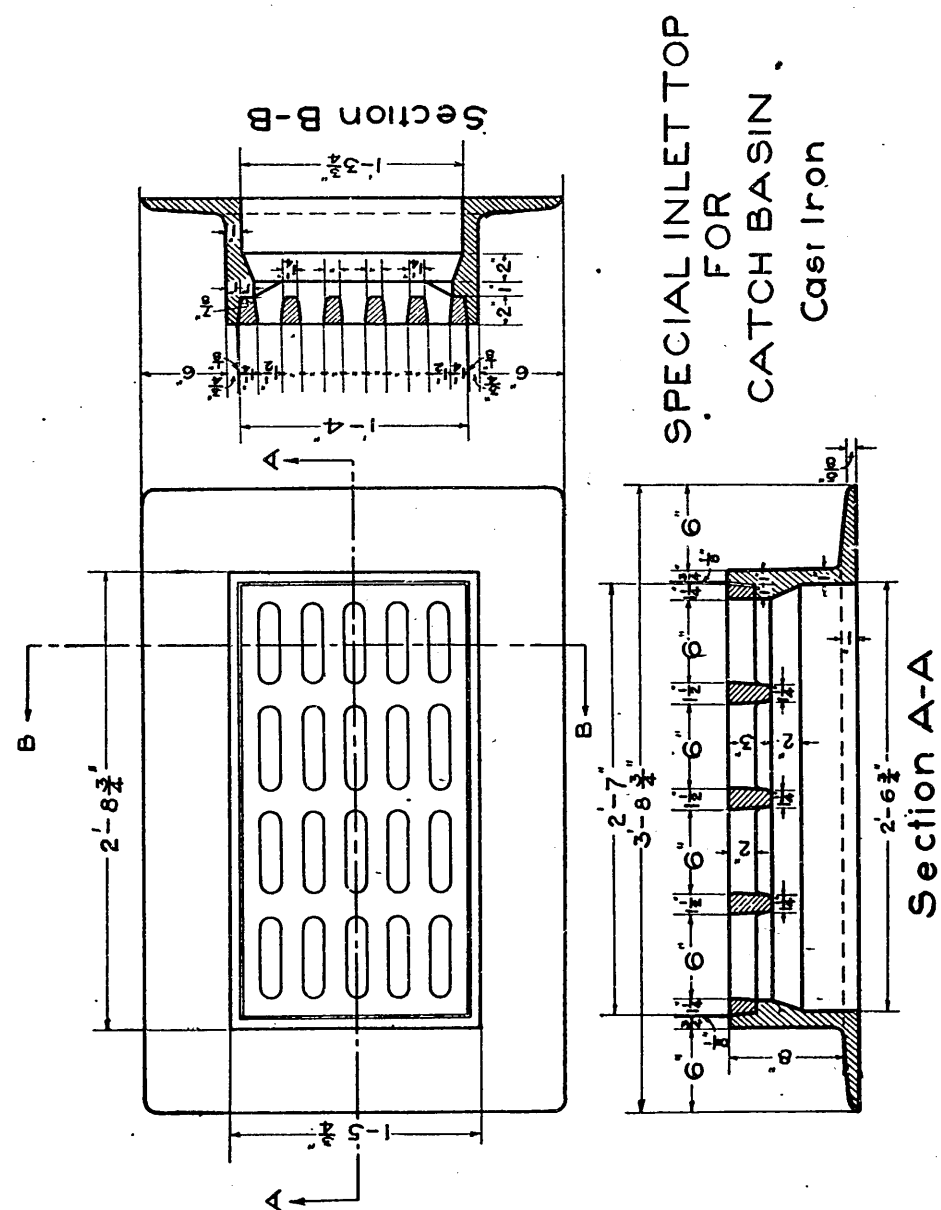
CURB INLET

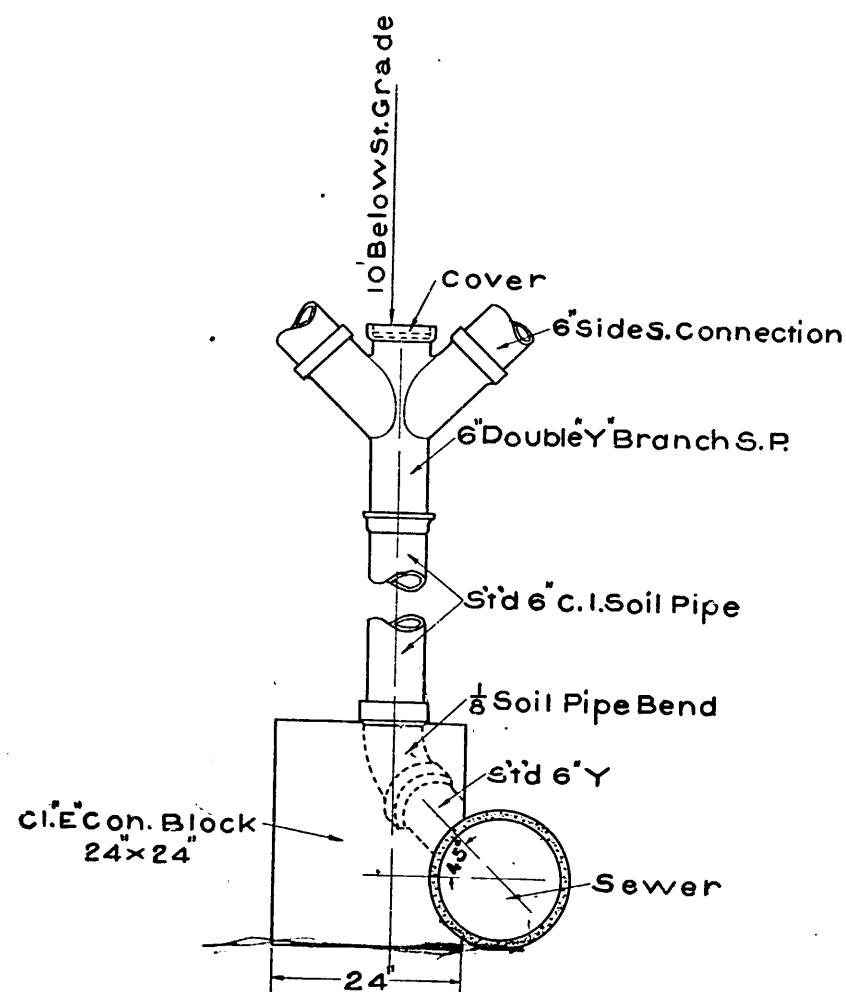


CATCH BASIN LOCATION



Section A-A Section B-B
INLET LOCATION





STANDING CONNECTION

SPECIFICATIONS FOR WATERMAINS AND APPURTENANCES

General Stipulations

140. ALIGNMENT, GRADE AND COVER

Alignment and grade will be given from hubs driven into the ground parallel to the line of pipe. In graded streets grades may be taken, when directed, from the existing curbs. The top of the pipe shall be at the following depths below the mean curb elevations, measured to the barrel of the pipe. These depths shall apply to all pipe laid regardless of the depth of any existing pipe being replaced.

For 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.

141. 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. Earth for such fills may be borrowed from the street area adjacent to the watermain, provided, however, that no existing roadway shall be disturbed or left in a dangerous condition by such borrowing. Before laying the pipe the fills shall be properly compacted by tamping or otherwise, as may be directed by the City Engineer. The cost of such filling shall be included in the price bid per linear foot for the pipe complete. Any culverts or box drains which may be necessary through fills shall be 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, provided, however, that "Rock Excavation" will be measured and paid for as provided in Section 77.

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 116.

142. EXTRA EXCAVATION

For specifications regarding Extra Excavation, see Section 79, under "Grading, Curbing and Appurtenances."

143. BACKFILLING

For refilling the trenches, the earth filled into the bottom of the trench, under, around and to the top of the pipe, and other castings, shall be free from stones. It shall be carefully packed and well rammed with the proper tools. Special care shall be taken in ramming not to injure the coating of the pipe.

The remaining portion of the backfill shall be water settled by casting or sluicing the earth into the trench which has been partially filled with water. Where trenches are less than eighteen (18) inches in depth, measured from the top of the pipe to the surface of the ground, a fill shall be made to provide not less than eighteen (18) inches of cover over the top of the pipe, and the cost of such fill shall be included in the price bid per linear foot for the pipe in place.

144. CONNECTIONS TO EXISTING MAINS

All connections to watermains in use shall be made by the City Water Department. All crosses or other specials required to be inserted in any main already in use shall be furnished by the contractor and set by the City Water Department. The contractor shall furnish the special as shown on the plans, and all other material required. He shall make all necessary excavations and backfilling. The labor of cutting and inserting the special shall be performed by the City Water Department. The contractor shall give at least twenty-four 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 36 of General Stipulations.

145. 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 sec-

tion 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.

146. REMOVAL OF OLD PIPE

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

In removing existing cast iron pipe, the lead joints shall be melted out with an oxyacetylene flame or by some other method which does not overheat or crack the pipe. Burning out with wood fire or similar means shall not be done.

147. 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 36.

WATERMAINS

148. CAST IRON PIPE

(a) SAND CAST PIPE

(1) Description of Pipe:

The pipe shall be made with hub and spigot joints, and shall conform accurately to the dimensions given in the table on Page 121. 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.

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.

TABLE OF WEIGHTS & 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	Wgt. of Pipe in Lbs. per 16 Feet Length	Wgt. of Pipe in Lbs. per 4 Meter Length	Wgt. of Pipe in Lbs. per 5 Meter Length
						Pipe, Inches	Special Castings, Inches	Pipe, Inches	Special Castings, Inches					
4	A	100	.42	2.25	9.00	5.60	5.70	3.50	4.00	4.80	240	315	261	323
4	B	200	.45	2.25		5.80	5.70	3.50	4.00	5.00	260	340	282	348
4	C	300	.48	2.25		5.80	5.70	3.50	4.00	5.00	280	365	304	374
4	D	400	.52	2.25		5.80	5.70	3.50	4.00	5.00	300	390	325	399
6	A	100	.44	2.25	12.00	7.70	7.80	3.50	4.00	6.90	370	485	402	497
6	B	200	.48	2.25		7.90	7.80	3.50	4.00	7.10	400	520	434	532
6	C	300	.51	2.25		7.90	7.80	3.50	4.00	7.10	430	560	466	573
6	D	400	.55	2.25		7.90	7.80	3.50	4.00	7.10	460	600	499	614
8	A	100	.46	2.25	15.00	9.85	10.00	4.00	4.00	9.05	515	675	557	686
8	B	200	.51	2.25		9.85	10.00	4.00	4.00	9.05	570	745	619	758
8	C	300	.56	2.25		10.10	10.00	4.00	4.00	9.30	625	815	678	834
8	D	400	.60	2.25		10.10	10.00	4.00	4.00	9.30	670	875	728	896
10	A	100	.50	2.25	18.00	11.90	12.10	4.00	4.00	11.10	685	895	744	916
10	B	200	.57	2.25		11.90	12.10	4.00	4.00	11.10	765	1000	831	1024
10	C	300	.62	2.25		12.20	12.10	4.00	4.00	11.40	850	1110	923	1136
10	D	400	.60	2.25		12.20	12.10	4.00	4.00	11.40	920	1205	1000	1234
12	A	100	.54	2.25	22.00	14.00	14.20	4.00	4.00	13.20	870	1140	946	1167
12	B	200	.62	2.25		14.00	14.20	4.00	4.00	13.20	985	1290	1071	1321
12	C	300	.68	2.25		14.30	14.20	4.00	4.00	13.50	1100	1440	1195	1474
12	D	400	.75	2.25		14.30	14.20	4.00	4.00	13.50	1200	1575	1304	1613
16	A	100	.60	2.75	42.00	18.40	18.40	4.00	4.00	17.40	1300	1715	1411	
16	B	200	.70	2.75		18.40	18.40	4.00	4.00	17.40	1500	1990	1630	
16	C	300	.80	2.75		18.80	18.80	4.00	4.00	17.80	1725	2255	1876	
16	D	400	.89	2.75		18.80	18.80	4.00	4.00	17.80	1900	2485	2066	
20	A	100	.67	2.75	51.00	22.60	22.60	4.00	4.00	21.60	1800	2385	1954	
20	B	200	.80	2.75		22.60	22.60	4.00	4.00	21.60	2100	2825	2283	
20	C	300	.92	2.75		23.06	23.06	4.00	4.00	22.06	2500	3240	2714	
20	D	400	1.03	2.75		23.06	23.06	4.00	4.00	22.06	2750	3585	2989	
24	A	100	.76	2.75	61.00	26.80	26.80	4.00	4.00	25.80	2450	3230	2660	
24	B	200	.89	2.75		26.80	26.80	4.00	4.00	25.80	2800	3755	3044	
24	C	300	1.04	2.75		27.32	27.32	4.00	4.00	26.32	3350	4340	3639	
24	D	400	1.16	2.75		27.32	27.32	4.00	4.00	26.32	3680	4795	4001	
30	A	100	.88	2.75	75.00	32.74	32.74	4.50	4.50	31.74	3500		3799	
30	B	200	1.03	2.75		33.00	33.00	4.50	4.50	32.00	4000		4351	
30	C	300	1.20	2.75		33.40	33.40	4.50	4.50	32.40	4800		5212	
30	D	400	1.37	2.75		33.74	33.74	4.50	4.50	32.74	5400		5813	
36	A	100	.99	3.00	89.00	38.96	38.96	4.50	4.50	37.96	4700		5103	
36	B	200	1.15	3.00		39.30	39.30	4.50	4.50	38.30	5450		5921	
36	C	300	1.36	3.00		39.70	39.70	4.50	4.50	38.70	6550		7109	
36	D	400	1.58	3.00		40.16	40.16	4.50	4.50	39.16	7500		8154	
42	A	100	1.10	3.00	103.00	45.20	45.20	5.00	5.00	44.20	6150		6672	
42	B	200	1.28	3.00		45.50	45.50	5.00	5.00	44.50	7100		7709	
42	C	300	1.54	3.00		46.10	46.10	5.00	5.00	45.10	8600		9339	
42	D	400	1.78	3.00		46.58	46.58	5.00	5.00	45.58	9900		10759	
48	A	100	1.26	3.00	117.00	51.50	51.50	5.00	5.00	50.50	8000		8683	
48	B	200	1.42	3.00		51.80	51.80	5.00	5.00	50.80	9000		9772	
48	C	300	1.71	3.00		52.40	52.40	5.00	5.00	51.40	10900		11836	
48	D	400	1.96	3.00		52.98	52.98	5.00	5.00	51.98	12600		13680	
54	A	100	1.35	3.00	131.00	57.66	57.66	5.50	5.50	56.66	9600		10422	
54	B	200	1.55	3.00		58.10	58.10	5.50	5.50	57.10	11200		12148	
54	C	300	1.90	3.00		58.80	58.80	5.50	5.50	57.80	13700		14870	
54	D	400	2.23	3.00		59.40	59.40	5.50	5.50	58.40	16100		17480	
60	A	100	1.39	3.00	146.00	63.80	63.80	5.50	5.50	62.80	11000		11940	
60	B	200	1.67	3.00		64.40	64.40	5.50	5.50	63.40	13250		14386	
60	C	300	2.00	3.00		65.20	65.20	5.50	5.50	64.20	16100		17470	
60	D	400	2.38	3.00		65.82	65.82	5.50	5.50	64.82	19000		20367	

(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 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-fitter's cement before being inserted.

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

(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 3/8	29 1/2	20	1 1/4	5 1/2
30	38 3/4	2 1/8	36	28	1 1/4	6 1/4
32	41 3/4	2 1/4	38 1/2	28	1 1/2	6 1/2
36	46	2 3/8	43 1/4	32	1 1/2	6 1/2
42	53	2 5/8	49 1/2	36	1 1/2	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 specifications, they shall be paid for as bid per pound in place for special castings.

(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:

1930 1930 1930
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 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. It shall be of bright texture and free from excessive cold shot or honey comb. 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 Pounds per square inch	Less than 20-inch Diameter Pounds per square inch
Class A Pipe.....	150.....	300
Class B Pipe.....	200.....	300
Class C Pipe.....	250.....	300
Class D Pipe.....	300.....	300

(b) CENTRIFUGALLY CAST PIPE

(1) Description of Pipe:

The pipes 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:

TABLE OF WEIGHTS AND DIMENSIONS OF CENTRIFUGALLY CAST PIPE.

All pipe 12" or less in diameter shall have Class "D" bells.
All pipe over 12" in diameter shall have Class "B" bells.

Nominal Inside Diameter of Pipe In Inches	Head in Feet	Class A. W. W. A.	Thickness of Pipe in Inches	Depth of Lead Joint in Inches	Approx. Weight Lead in Pounds per Joint	Weight per Length in Pounds					
						12'	16'	16'-6"	16' 6 1/2"	16' 7 1/2"	18'-0"
4	100	A	.42	2.25	9.00	240	315		326		346
4	200	A	.42	2.25		240	315		326		346
4	300	A	.42	2.25		240	315		326		346
4	400	B	.45	2.25		260	340		359		383
6	100	A	.44	2.25	12.00	370	485		500		534
6	200	A	.44	2.25		370	485		500		534
6	300	A	.44	2.25		370	485		500		534
6	400	B	.48	2.25		400	520		554		595
8	100	A	.46	2.25	15.00	515	675	700			747
8	200	A	.46	2.25		515	675	700			747
8	300	A	.46	2.25		515	675	700			747
8	400	B	.51	2.25		570	745	765			819
12	100	A	.54	2.25	22.00	870	1140	1197			1283
12	200	A	.54	2.25		870	1140	1197			1283
12	300	A	.54	2.25		870	1140	1197			1283
12	400	B	.62	2.25		985	1290	1353			1454
16	100	A	.60	2.75	42.00	1300	1715	1765			1880
16	200	A	.60	2.75		1300	1715	1765			1880
16	300	A	.60	2.75		1300	1715	1765			1880
16	400	B	.70	2.75		1500	1990	2026			2216
20	100	A	.67	2.75	51.00	1800	2385		2463		2620
20	200	A	.67	2.75		1800	2385		2463		2620
20	300	A	.67	2.75		1800	2385		2463		2620
20	400	B	.80	2.75		2100	2825		2890		3151
24	100	A	.76	2.75	61.00	2450	3230		3306		3552
24	200	A	.76	2.75		2450	3230		3306		3552
24	300	B	.89	2.75		2800	3755		3819		4192
24	400	B	.89	2.75		2800	3755		3819		4192

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 Variations in Diameter of Pipes and Sockets:

The dimensions of sockets and spigots shall be according to the standards of the American Waterworks Association, adopted May 12, 1908. The diameters of the sockets and the outside diameters of the spigot ends of the pipes shall not vary from these standard dimensions by more than .06 of an inch for pipes 12 inches or less in diameter and .08 of an inch for pipes over 12 inches in diameter.

(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

Provided however, that in no case shall the average thickness of any full pipe cross-section be less than the standard thickness.

(4) Allowable Variation in Length:

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

(5) Marking:

Each pipe shall have distinctly cast on the face of the bell, or on the outside surface of the pipe, as the manufacturer may elect, the manufacturer's mark and the year in which the pipe was cast. When specified each pipe may also have cast upon it a symbol such as numbers (serial numbers excepted) or letters not exceeding four or some private mark. The letters and figures shall not be less than 1/2" in height and 1/8" in relief. If serial numbers are required, they may be painted or stamped on the pipe. The weight shall be conspicuously painted on the inside of the bell.

(6) Quality of Iron:

All pipe 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 satisfactorily admit of drilling and cutting.

The melting and pouring temperatures of the iron shall be controlled by suitable pyrometers and a record of the readings shall be open for inspection.

Chemical analysis shall be made for each heat to determine silicon, sulphur, manganese, phosphorus and total carbon, and these results shall be open for inspection.

(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 strength of not less than 25,000 pounds per square inch.

(8) Tests of Pipe:

All pipe after a general inspection shall be subject to a water pressure test of 400 pounds per square inch. While under this 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. If cast in metal contact molds the pipe shall, after being withdrawn, be annealed. On test with a portable Brinnell testing machine the hardness of the outside of the pipe shall not exceed 224.

(10) Coating:

Every pipe shall be cleaned and 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 121.

(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 57

(g) LEAD SUBSTITUTES:

Lead substitutes shall conform to the specifications for "Lead Substitutes", Section 58.

(h) OAKUM

Oakum shall conform to the specifications for "Oakum," Section 63.

(i) LAYING PIPE

After the trenches are complete to the required depth and the bell holes dug, the pipe shall be laid therein. Where pipe is laid on a grade the laying shall be started at the bottom and shall proceed upward with the bell ends of the pipes laid up grade. Spigot ends of pipes shall be entered full depth into the bells and where gate valves are placed in the line the pipes and fittings

shall be jacked tightly together, to prevent any movement of the valves when closed and under pressure, the jacks being maintained in place until the lead joints have been run. The pipe shall be so adjusted as to give uniform space all around, and pipes which do not have sufficient joint space shall be removed and replaced with others of proper dimensions. Gaskets of clean, sound hemp yarn, or oakum, braided or twisted and tightly drawn, shall be used to pack the joints.

(j) JOINTING**(1) With Lead**

Before running the lead, the joints shall be carefully wiped out to make them clean and dry. The joint shall be run full at one pouring, and the melting pot shall be kept within fifty (50) feet of the joint about to be poured. The joint shall be caulked by competent mechanics; the caulking shall be faithfully executed and in such manner as to secure a tight joint without over-straining the iron of the hub. The lead, after being caulked, shall be flush with the face of the socket. The bell hole shall be perfectly free from water while the joint is being prepared.

The pipe and all other castings as they are laid, shall be carefully swept out and cleaned of any earth or rubbish which may have found place inside during or before the operation of laying. Open ends of pipe and fittings which are laid in the trench shall be temporarily plugged before leaving the work for the night.

Whenever it is discovered that a lead joint is less in depth than required by these specifications, the contractor shall at his own expense, drill, cut out, or otherwise remove the lead from any or all joints desired, until the City Engineer is satisfied that all shallow joints have been discovered. All joints deficient in lead shall then be cleared of lead and yarn, re-yarned to the depth required by these specifications, leaded and caulked as required; all at the contractor's expense. Unless otherwise specified, all cast iron pipe shall be jointed with lead.

(2) With Lead Substitutes.

Joints shall be made by men skilled and experienced in their use and in full accord with the instructions furnished by the makers of the compound.

(k) FIELD TESTS

All pipe shall be subjected to a hydrostatic test after being laid.

As soon as any section between gate valves is laid, or when directed by the City Engineer, the same shall be subjected to this hydrostatic test. The pressure shall be brought up to three hundred (300) pounds per square inch for four (4) inch, six (6) and eight (8) inch pipes; two hundred seventy-five (275) pounds per square inch for ten (10) inch pipe; two hundred fifty (250) pounds per square inch for twelve (12) inch pipe; two hundred twenty-five (225) pounds per square inch for sixteen (16) inch pipe; and two hundred (200) pounds per square inch for all larger sizes. The test pressure shall be maintained for not less than fifteen minutes; on stopping the pump the pressure shall not drop abruptly. Any pipe which exhibits any defects shall be taken out and replaced by a sound pipe. All pumps, gauges, plugs and other appliances used in making this test shall be furnished by the contractor, but the City reserves the right to test and approve all

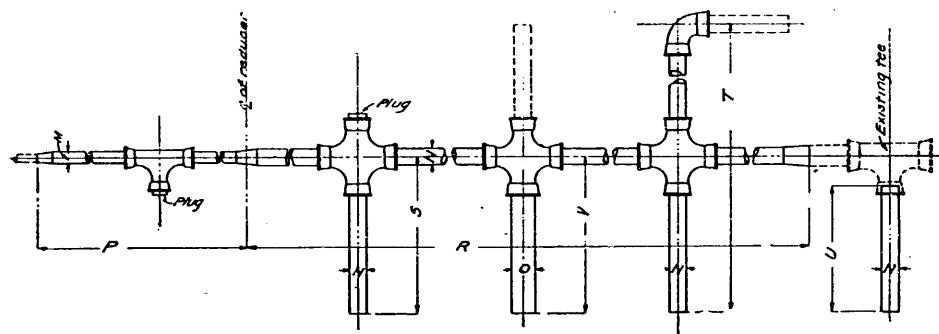
gauges used. If, after any portion of the trench is refilled and before the final release of contract, any defects appear, the contractor shall, at his own expense, correct such defects.

When joints have been made with lead substitutes, the pipe shall be kept at normal pressure for 24 hours before applying test pressure.

(I) MEASUREMENTS

Measurements for the estimate of pipe shall be taken along the top of the pipe in a vertical plane passing through the axis and shall include all gate valves and standard specials, but shall omit all special castings.

The method of making measurements for payment is more clearly shown in the following diagram in which full lines represent new pipe and dotted lines represent existing pipe.



Payment will be made for
P-linear feet of pipe of diameter "M"
R,S,T,U-linear feet of pipe of diameter "N"
V-linear feet of pipe of diameter "O"

(m) PAYMENT

Payment for cast iron pipe shall be made at the price bid per linear foot for "Sand Cast Pipe," or "Centrifugally Cast Pipe," and shall be in full for furnishing and laying the pipe, and all standard fittings shown on the plans, and this shall also include payment for all trenching, jointing, backfilling, restoring the street surface, relaying of pavement or planking (unless the backfilling and restoration of the paving is done by the Street Department as provided in Section 117, and all other material and labor necessary for the complete work. In case any standard fittings shown on the plans are omitted in the work a corresponding reduction will be made from the estimate. Any excavation above that shown on the profiles or specified above, under "Alignment, Grades, and Cover," which may be ordered by the City Engineer, shall be paid for at the rate bid for "Extra Excavation" per cubic yard.

WATERMAIN APPURTENANCES

149. GALVANIZED WROUGHT PIPE

(a) IRON PIPE

Galvanized Wrought Iron Pipe shall conform to the requirements of the specifications of the American Society for Testing Materials for Welded Wrought Iron Pipe, Serial Designation A72-30, and later revisions thereof. It shall be thoroughly galvanized.

(b) STEEL PIPE:

Galvanized Wrought Steel Pipe shall conform to the requirements of the specifications of the American Society for Testing Materials for Welded and Seamless Steel Pipe, Serial Designation A53-30, and later revisions thereof. It shall be thoroughly galvanized.

(c) INSTALLATION

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 pipe when laid shall be subjected to hydrostatic pressure equal to 300 pounds per square inch.

(d) PAYMENT

Payment for galvanized iron pipe and galvanized steel pipe, will 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.

150. GATE VALVES

All gate valves shall be iron bodied, bronze mounted, parallel faced, double disc valve with bronze wedging devices between the discs. Gate valves of thirty inches or less diameter shall be either Iowa, Ludlow, Chapman, Rensselaer or Crane Valves. Smith valves will be accepted in sizes up to and including twelve inches diameter.

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 be provided with a nut for a wrench and 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.

151. 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.

152. VALVE CHAMBERS

(For plan, see pages 138 and 142).

Where shown on the plans, or where directed by the City Engineer, gate valves shall be enclosed in valve chambers provided with a cast iron frame and cover, as shown on the standard detail plans.

Where directed by the City Engineer, valve chambers shall be connected to the sewer, or other suitable outlet, by a four (4) inch sewer pipe drain, the labor and material for which shall conform in all respects to the standard specifications for pipe sewers.

Valve chambers may be constructed of brick, concrete, or concrete blocks at the contractor's option. The specifications for man-holes shall apply to valve chambers in regard to masonry and the general requirements for castings.

The concrete to be used in the reinforced concrete top of large chambers shall be Class "B".

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 Valve Chambers." Other valve chambers will be designated as standard valve chambers, and payment shall be made at the price bid for "Standard 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."

153. WOOD VALVE BOXES

(For plan see page 143).

Where shown on the plans, or where directed by the City Engineer, gate valves, including district gate valves, shall be protected by a wooden box, constructed of three (3) inch lumber and made to conform to the standard drawings, unless otherwise shown on the plans.

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

154. HYDRANTS (For plans, see pages 144 to 151).

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 ($\frac{3}{4}$ ") inside diameter.

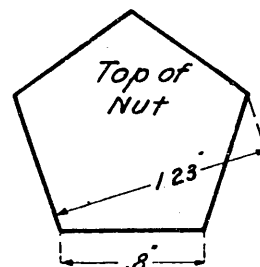
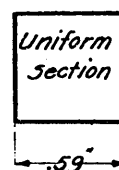
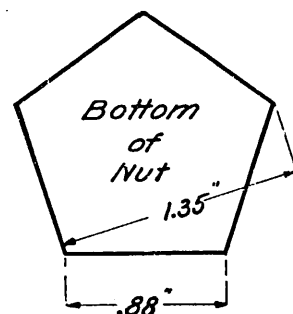
When hydrants cannot be connected to drains at the time of setting, the threaded waste orifice shall be so placed on the hydrant barrel that future connection can be made without disturbing the hydrant. If screw nipples or other fittings are necessary to accomplish this end, no extra payment shall be 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 $\frac{1}{8}$ " 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 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 1/2 feet	3 1/2 feet
10 inches diameter.....	4 feet	4 feet
12 inches diameter.....	4 1/2 feet	4 1/2 feet
16 and 20 inches diameter.....	4 feet	4 feet
24 and 30 inches diameter.....	4 1/2 feet	4 1/2 feet
Valve opening—minimum diameter.....	5 inches	6 1/4 inches
Size of Auxiliary Gate Valve.....	6 inches	8 inches
Hose Nozzle, number and size.....	2-2 1/2 inches	3-2 1/2 in.
Thread (Nat. Board Fire Underwriters).....	7 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 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 1/8 inches	
Operating Nuts, same for both size hydrants		
Dimension in section as shown.		
Minimum height of nuts:		
	Standard size	Large size
Square	5/8 inch	5/8 inch
Pentagon	1 1/8 inch	1 1/8 inch
Diameter of Shackle Rods.....	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.

155. CAST IRON VALVE BOXES

(For plan, see page 147).

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."

156. HYDRANT CONNECTIONS

"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.

157. RESETTING EXISTING HYDRANTS

Where shown on the plans or when directed by the City Engineer, existing hydrants shall be reset. In resetting hydrants the location of the hydrant tee is not changed; the hydrant, however, may be adjusted to conform to a new street grade or to a change in width of roadway. The work shall conform in all respects including painting to the specifications for setting hydrants as mentioned elsewhere in these specifications. Where existing hydrants are blocked to the main line the same method shall be used in resetting unless it is found necessary in the judgment of the City Engineer to shackle them, in which case some approved form of shackling to the main line with steel rods shall be used.

Payment for "Resetting Hydrants" shall include payment for all labor and material necessary to place and connect the hydrant in its new position, but shall not include payment for new shackle rods or new pipe for hydrant connections, which shall be paid for at the rate bid for "Shackle Rods" per pound in place, and "Hydrant Connections," as mentioned in Section 156.

158. MOVING EXISTING HYDRANTS

Where shown on the plans or when directed by the City Engineer existing hydrants shall be moved. In moving hydrants the location of the hydrant tee in the line is changed. The work shall conform in all respects including painting, to the specifications for setting hydrants as mentioned elsewhere herein. Where existing hydrants are blocked to the main line, the same method shall be used in moving unless it is found necessary in the judgment of the City Engineer to shackle them, in which case some approved form of shackling to the main line with steel rods shall be used.

Payment 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 156.

159. 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.

160. HYDRANT DRAINS

When ordered by the City Engineer, waste orifices of hydrants new or existing shall be connected to the nearest sewer or other outlet, by $\frac{3}{4}$ " galvanized wrought iron pipe, which shall conform in all respects to the requirements for "Galvanized Wrought Iron Pipe," as specified in Section No. 149.

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

161. 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."

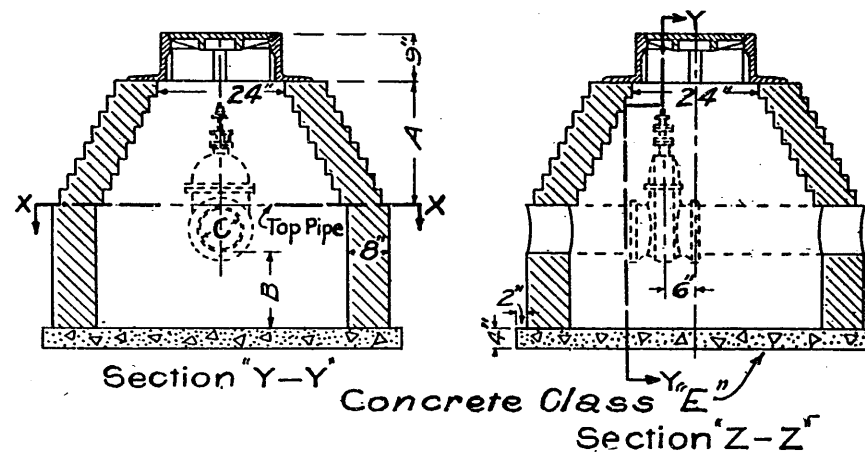
162. SPECIAL CASTINGS

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.

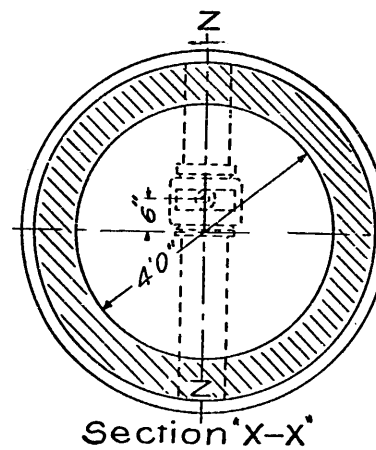
Payment for "Special Castings" shall be made at the price bid per pound in place. In case of flanged special castings, such payments shall include compensation for all necessary gaskets, bolts and machine work. When no bid is taken for special castings the same shall be paid for at the rate of \$0.15 per lb.

163. BLOCKING

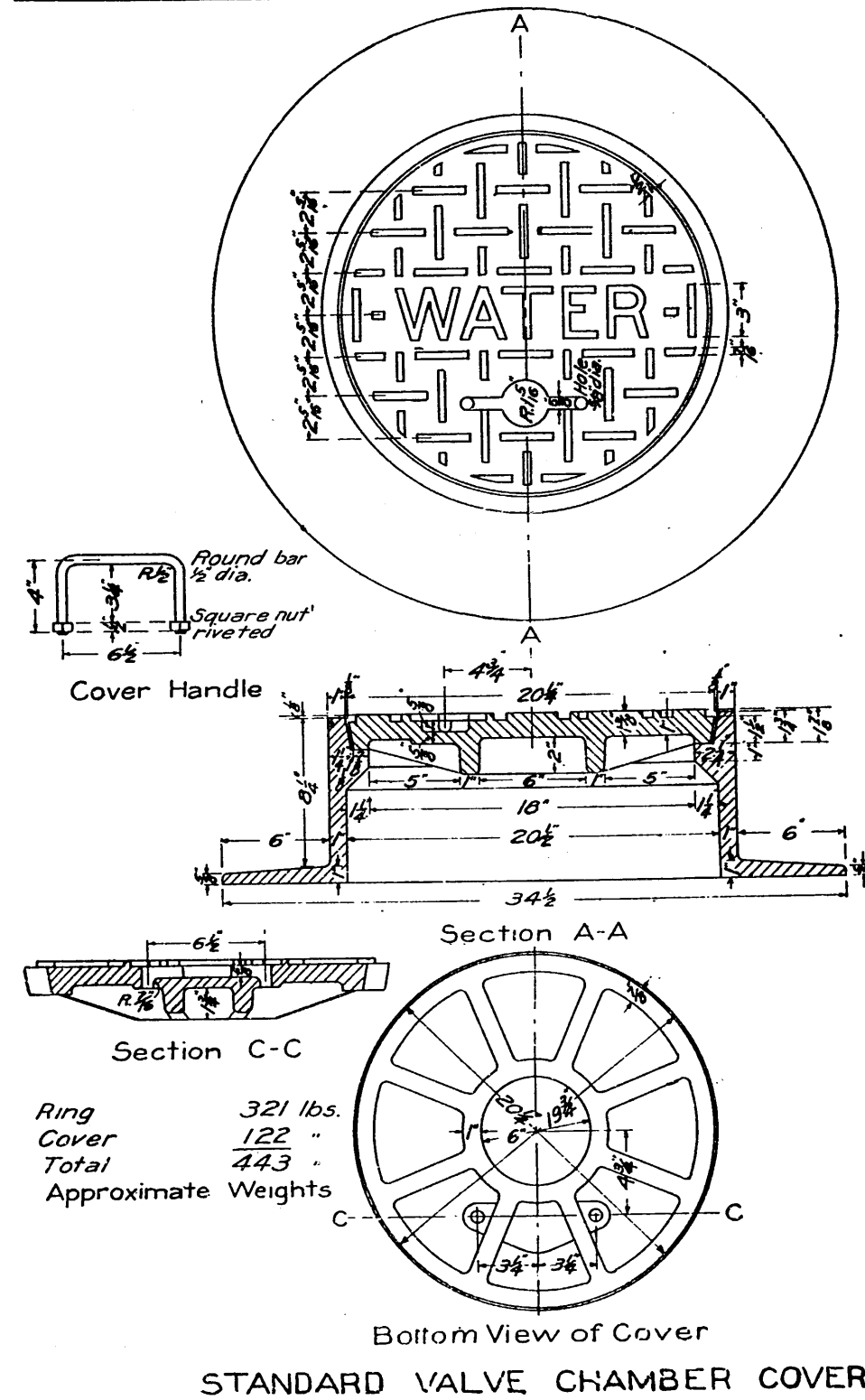
Plugs at the end of lines left for future extension, bends, and other places as ordered by the City Engineer, shall be blocked with concrete or creosoted wood, as directed. Payment shall be made at the price bid for "Concrete Blocking," per cubic yard, or "Creosoted Wood Blocking," per M. Ft. BM. When no bid is taken for blocking the same shall be paid for at the rate of \$10.00 per Cu. Yd. for "Concrete Blocking" and \$40.00 per M. Ft. B. M. for Creosoted Wood Blocking."

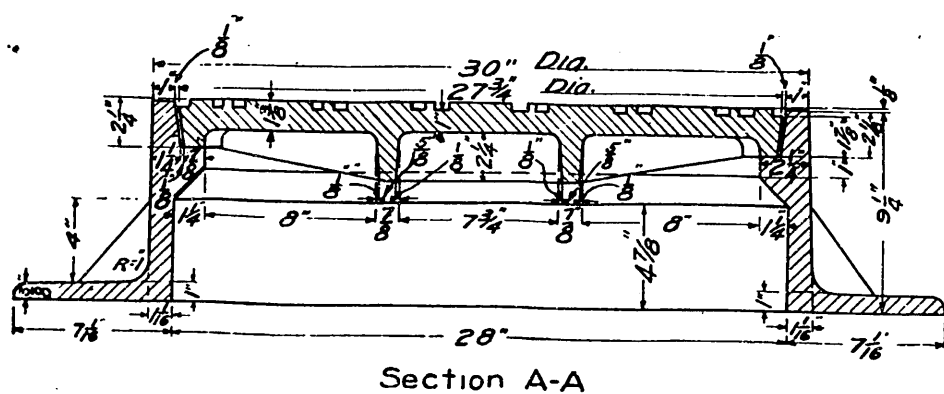
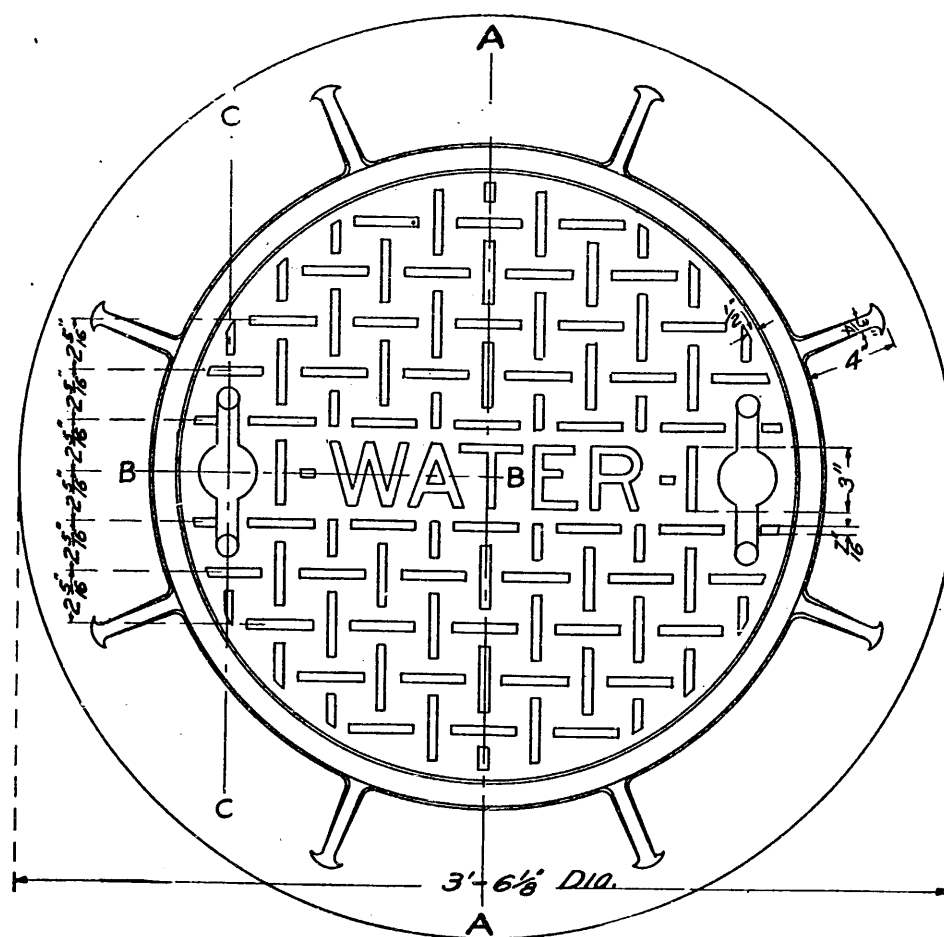


When $C = 8"$ $A = 23\frac{3}{4}"$, not less
 " $C = 10"$ $A = 28\frac{1}{2}"$ " "
 " $C = 12"$ $A = 31"$ " "
 " $C = 8"$ $B = 10"$ " "
 " $C = 10"$ $B = 12"$ " "
 " $C = 12"$ $B = 12"$ " "



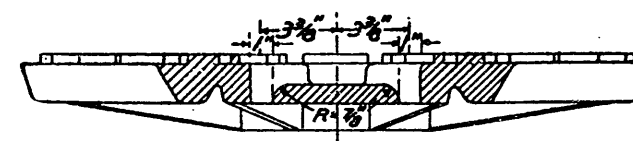
STANDARD VALVE CHAMBER



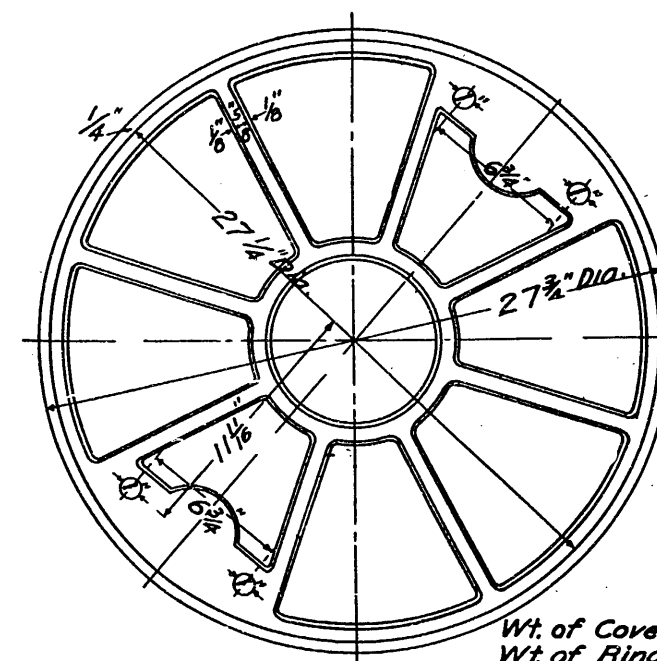


Section A-A

VALVE CHAMBER

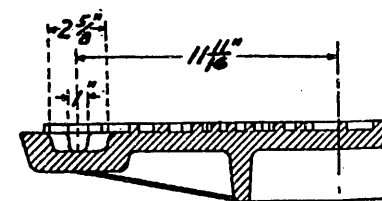


Section C-C

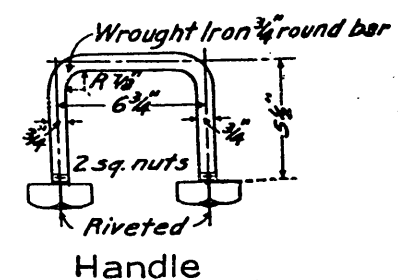


Bottom View

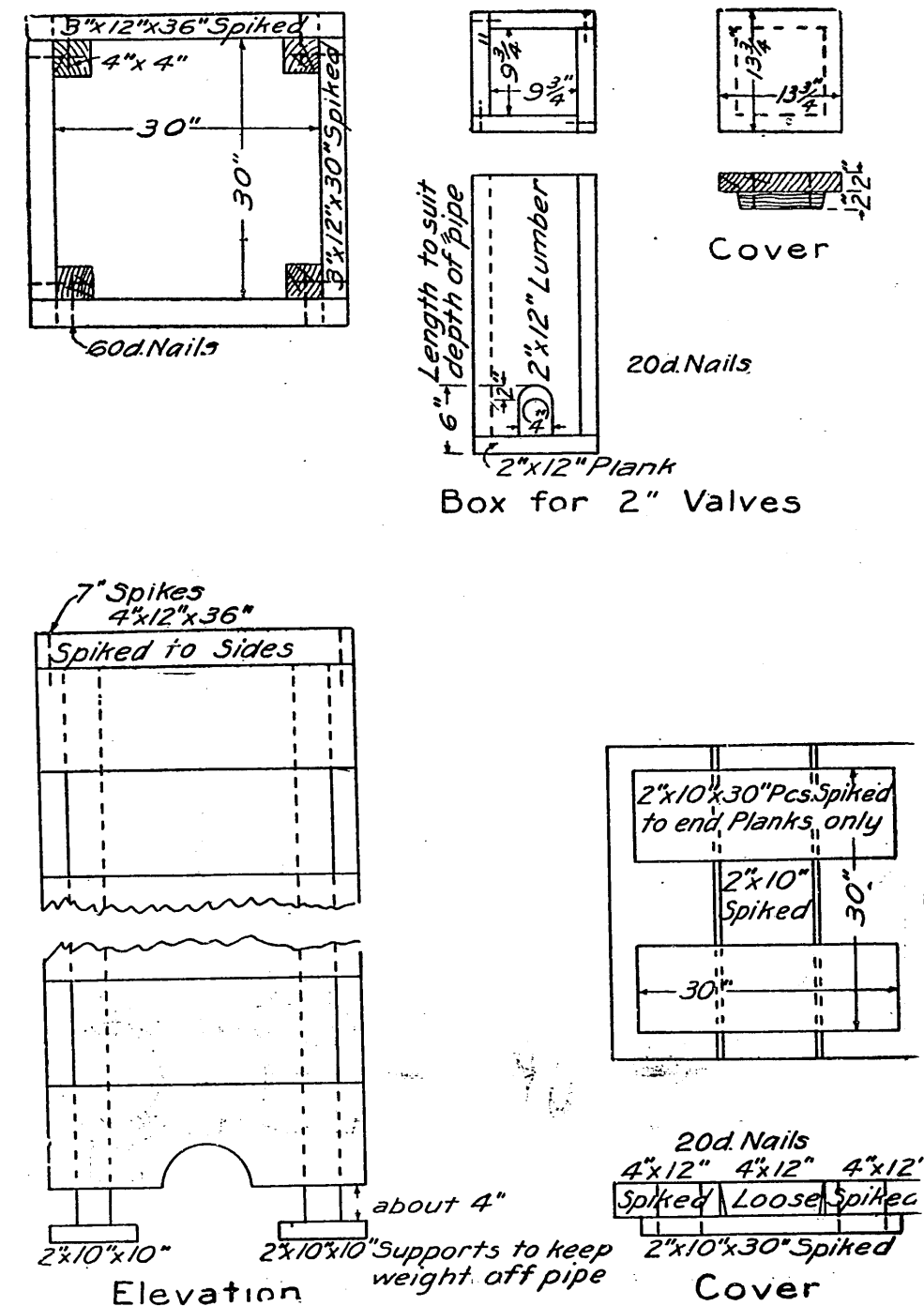
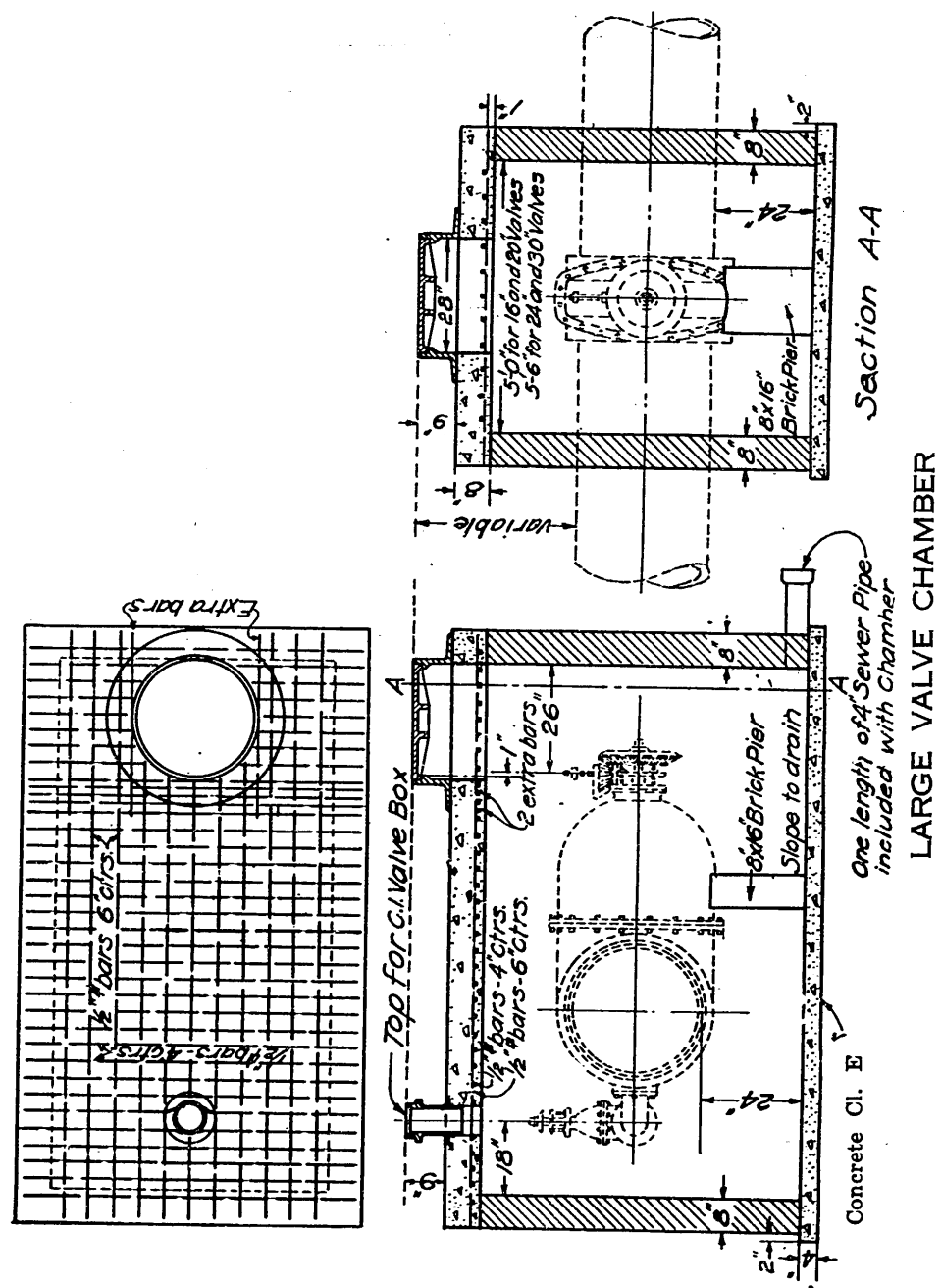
Wt. of Cover...217 lbs
 Wt. of Ring...440 "
 Total.....657 "



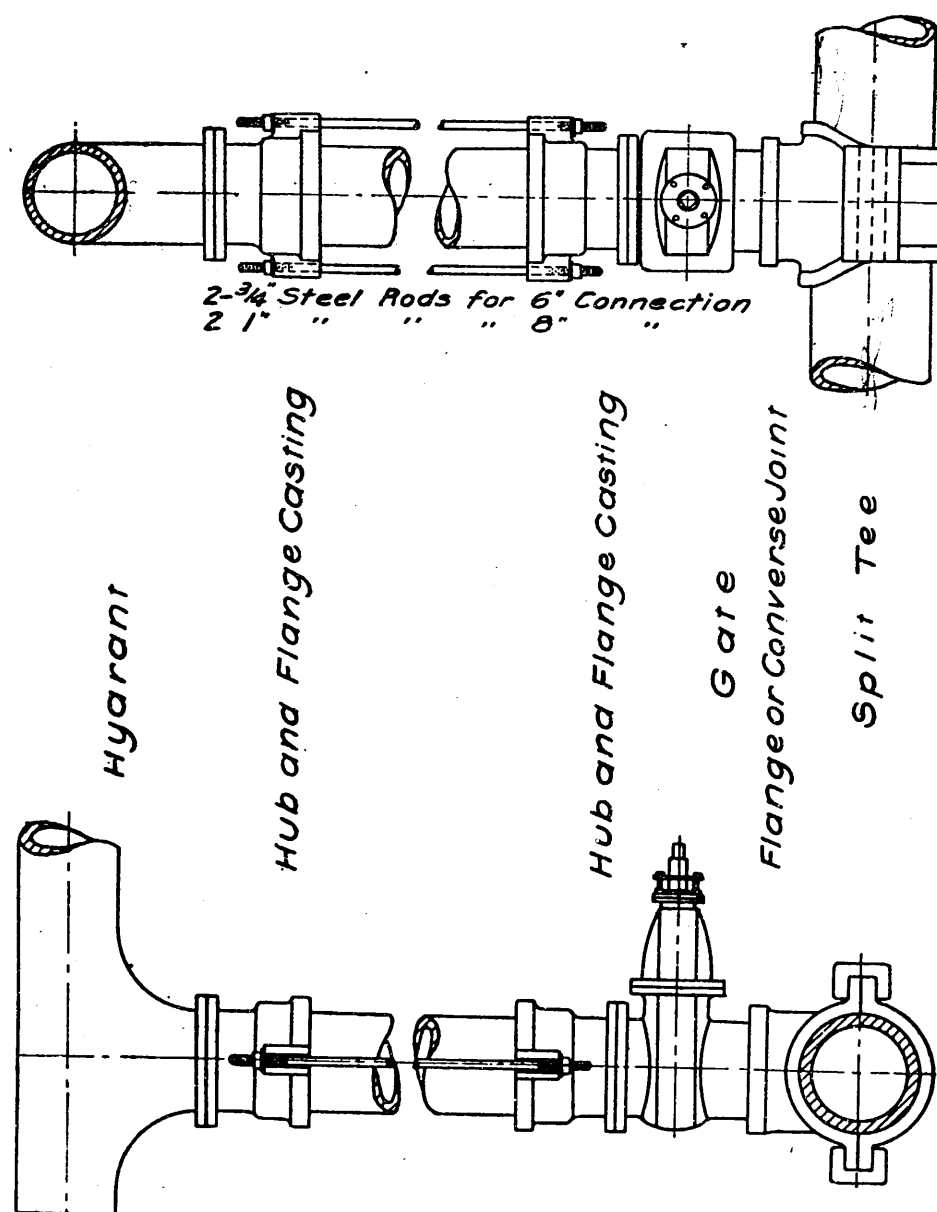
Section B-B



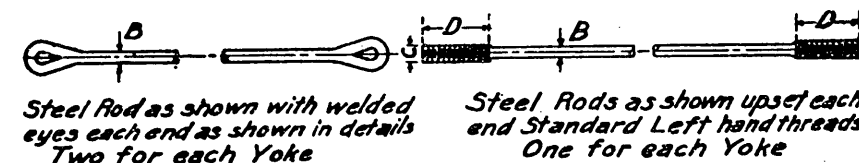
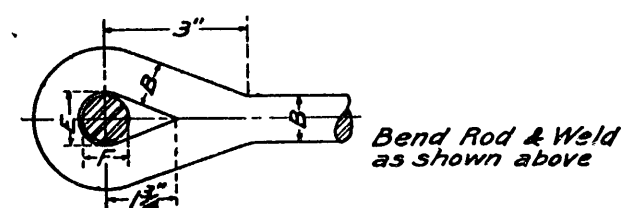
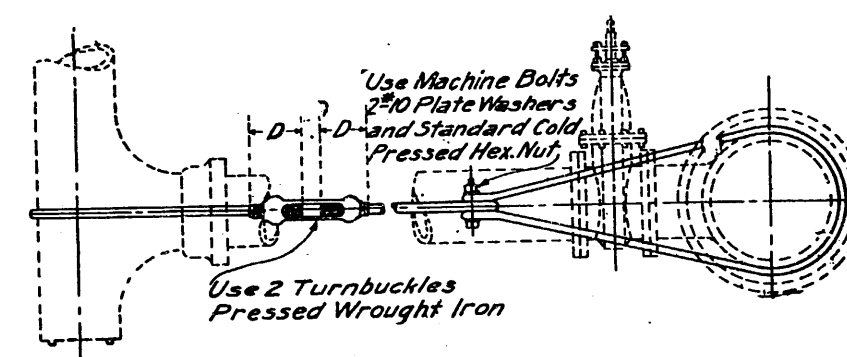
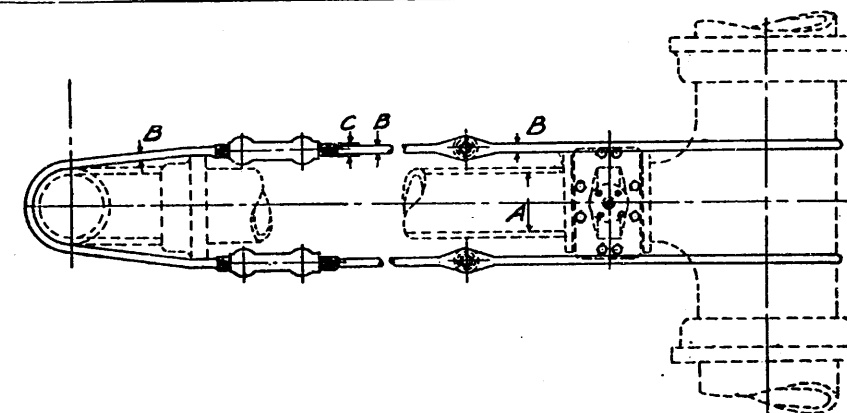
COVER (LARGE)



WOOD VALVE BOX



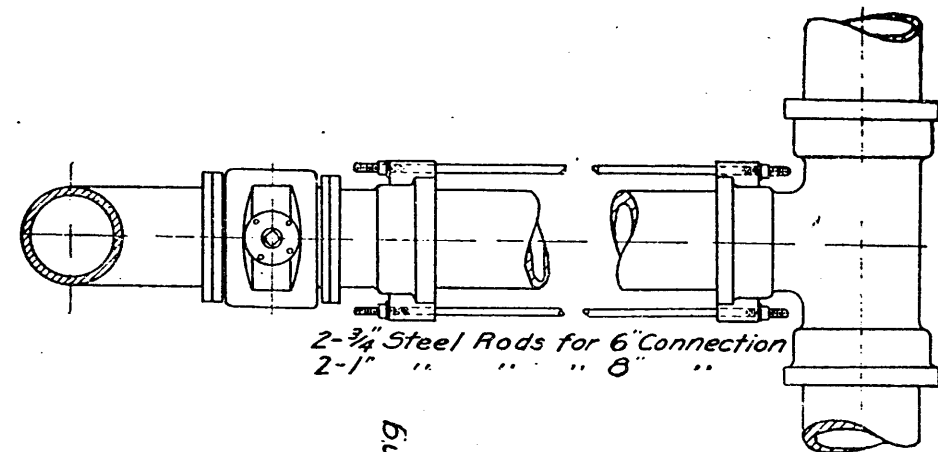
METHOD OF CONNECTING HYDRANT
TO EXISTING MAIN USING SPLIT TEE



A	B	C	D	E	F
6"	3/4"	1"	4 1/2"	7/16"	3/4"
8"	1"	1 3/8"	5"	1 1/8"	1"

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

METHOD OF CONNECTING
HYDRANT TO EXISTING MAIN
WITH FLANGED OUTLET TEE



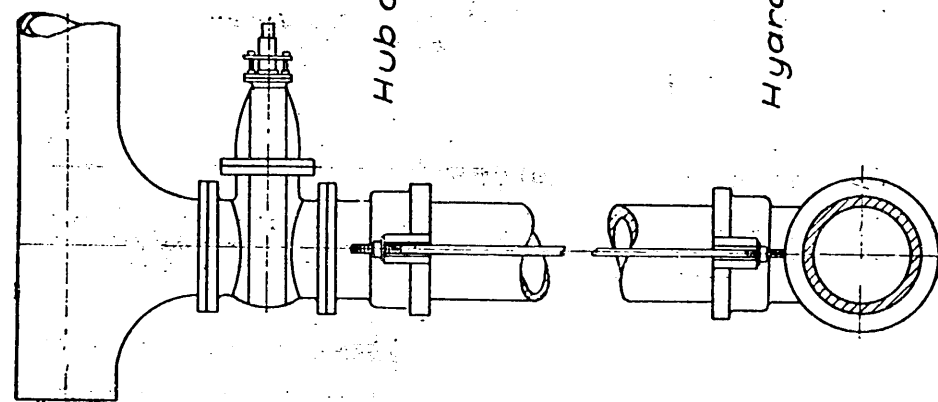
2- $\frac{3}{4}$ " Steel Rods for 6" Connection
2-1" " " " 8" "

Hydrant

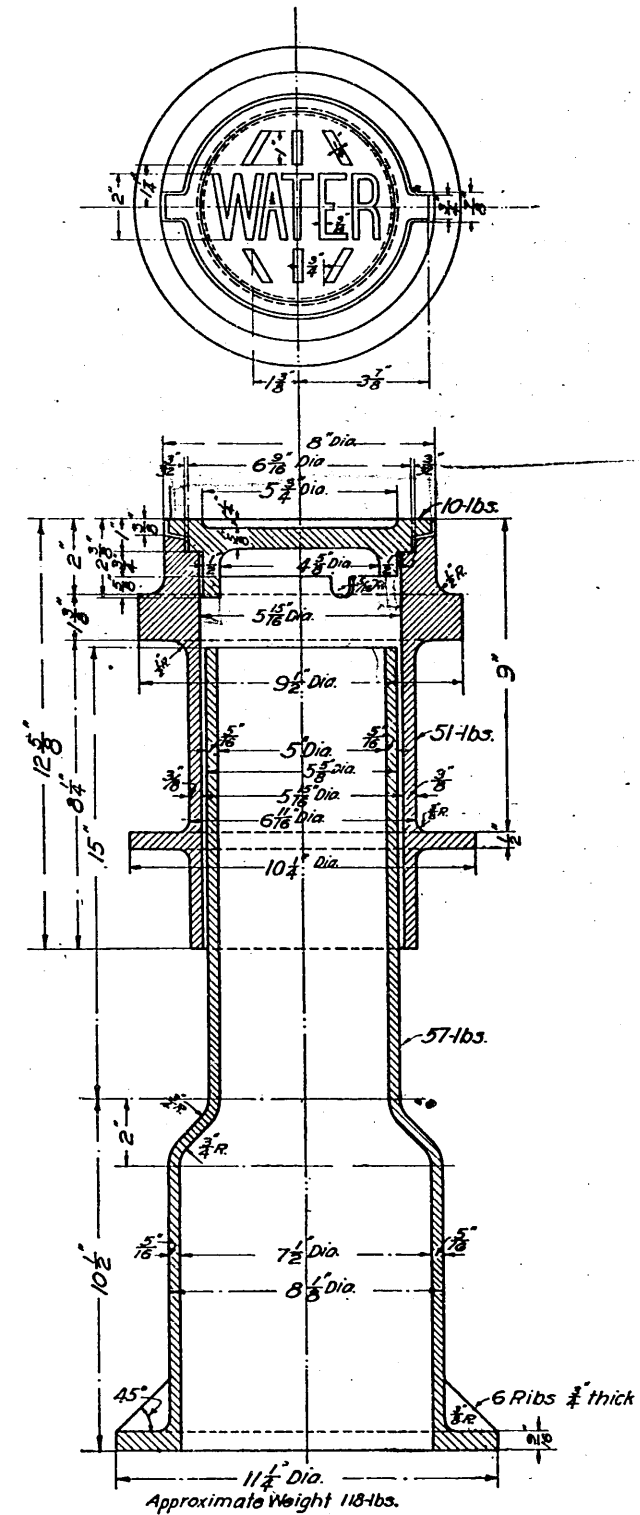
Gare

Hub and Flange Casing

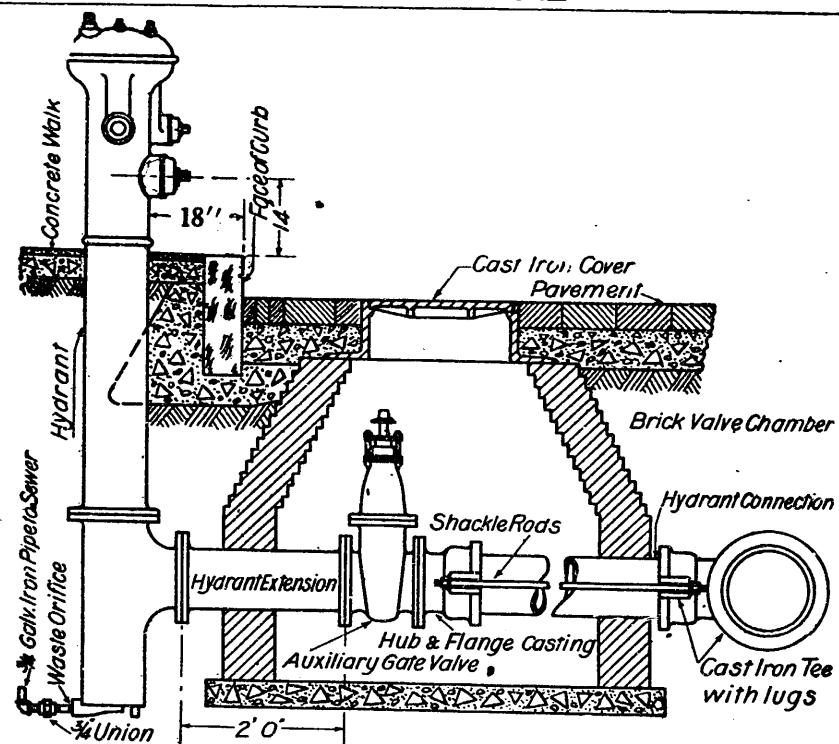
Hydrant Tee with lugs



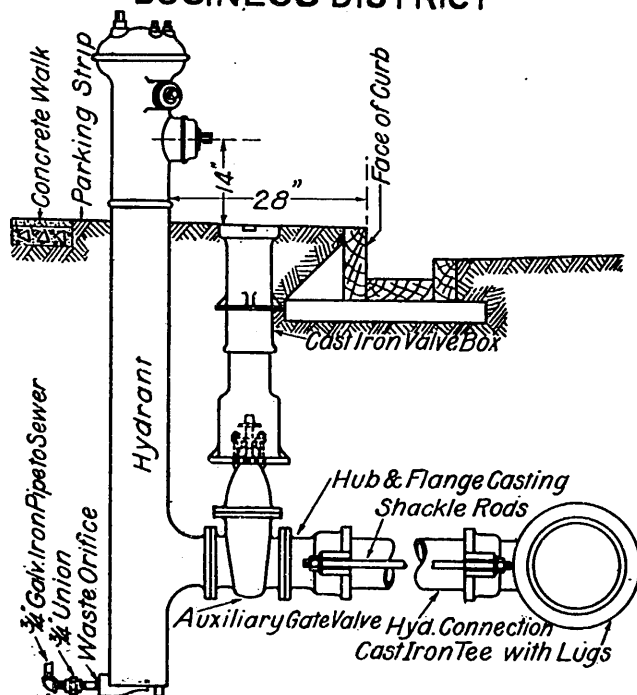
METHOD OF
CONNECTING HYDRANT TO NEW MAIN



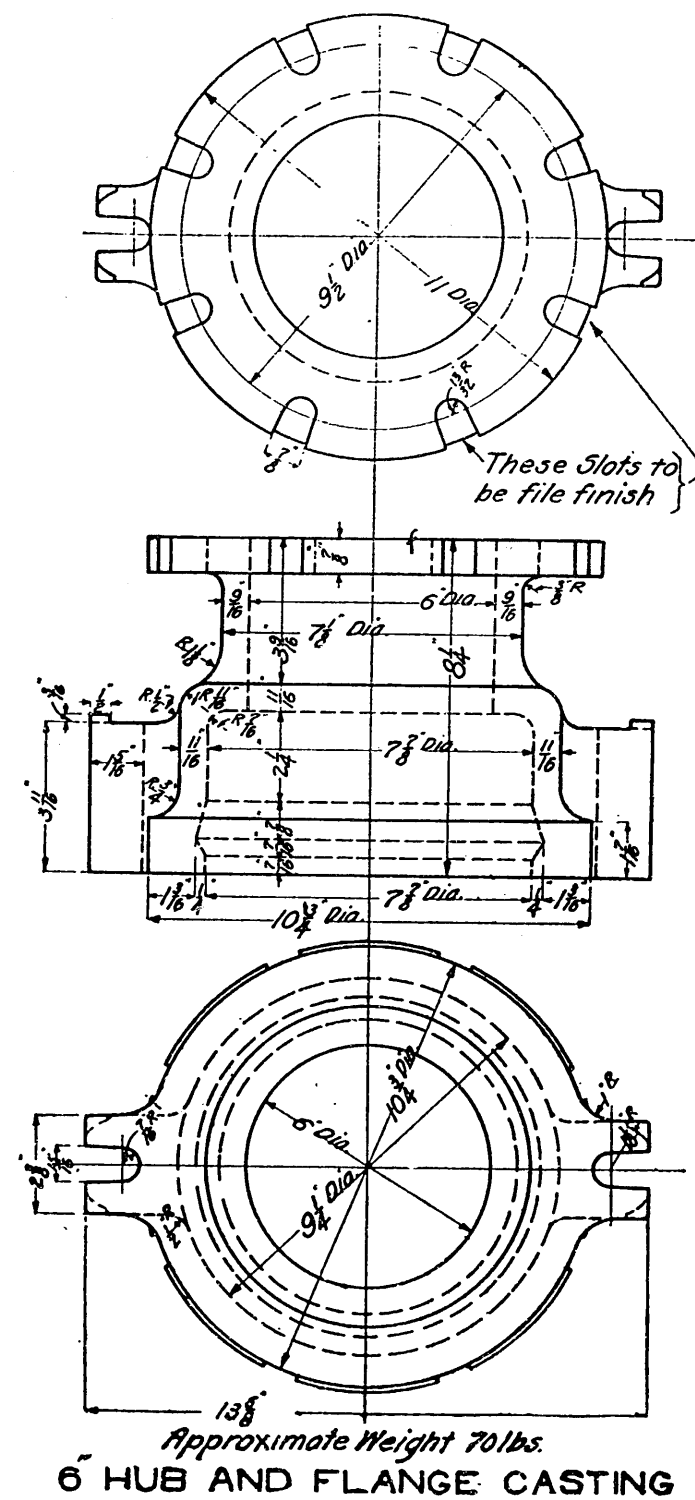
CAST IRON VALVE BOX



**METHOD OF SETTING HYDRANTS
BUSINESS DISTRICT**



**METHOD OF SETTING HYDRANTS
RESIDENCE DISTRICT**



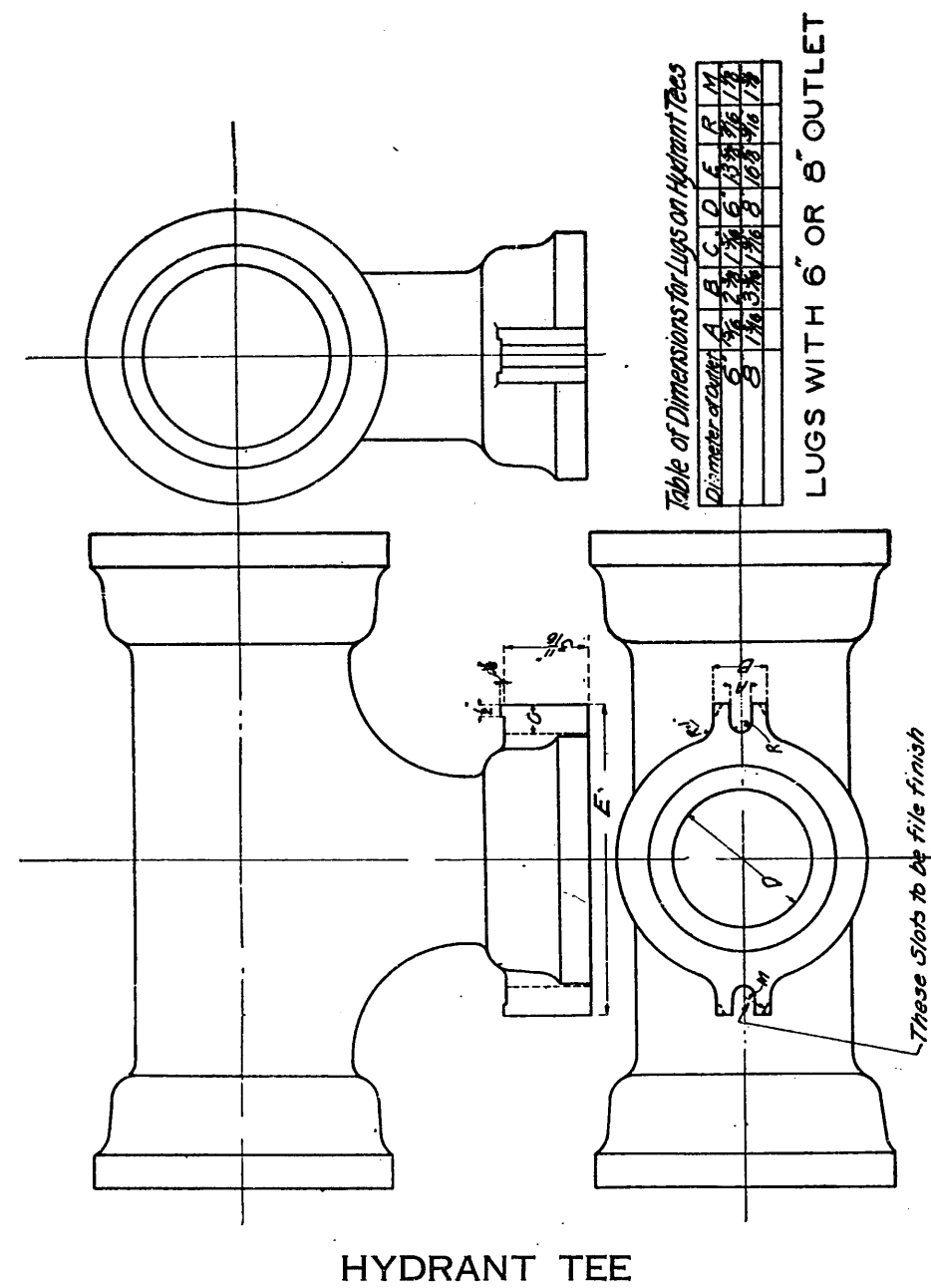
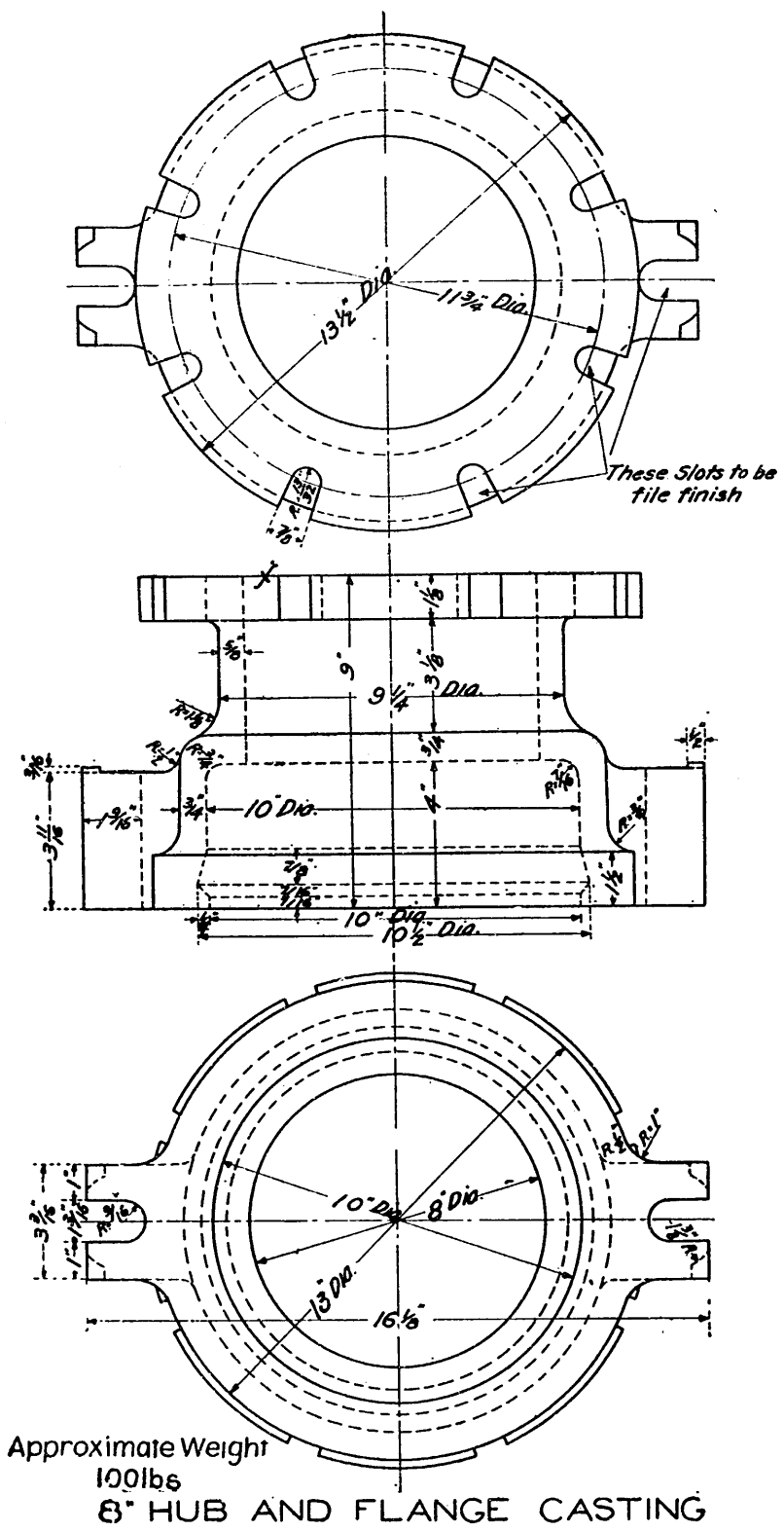
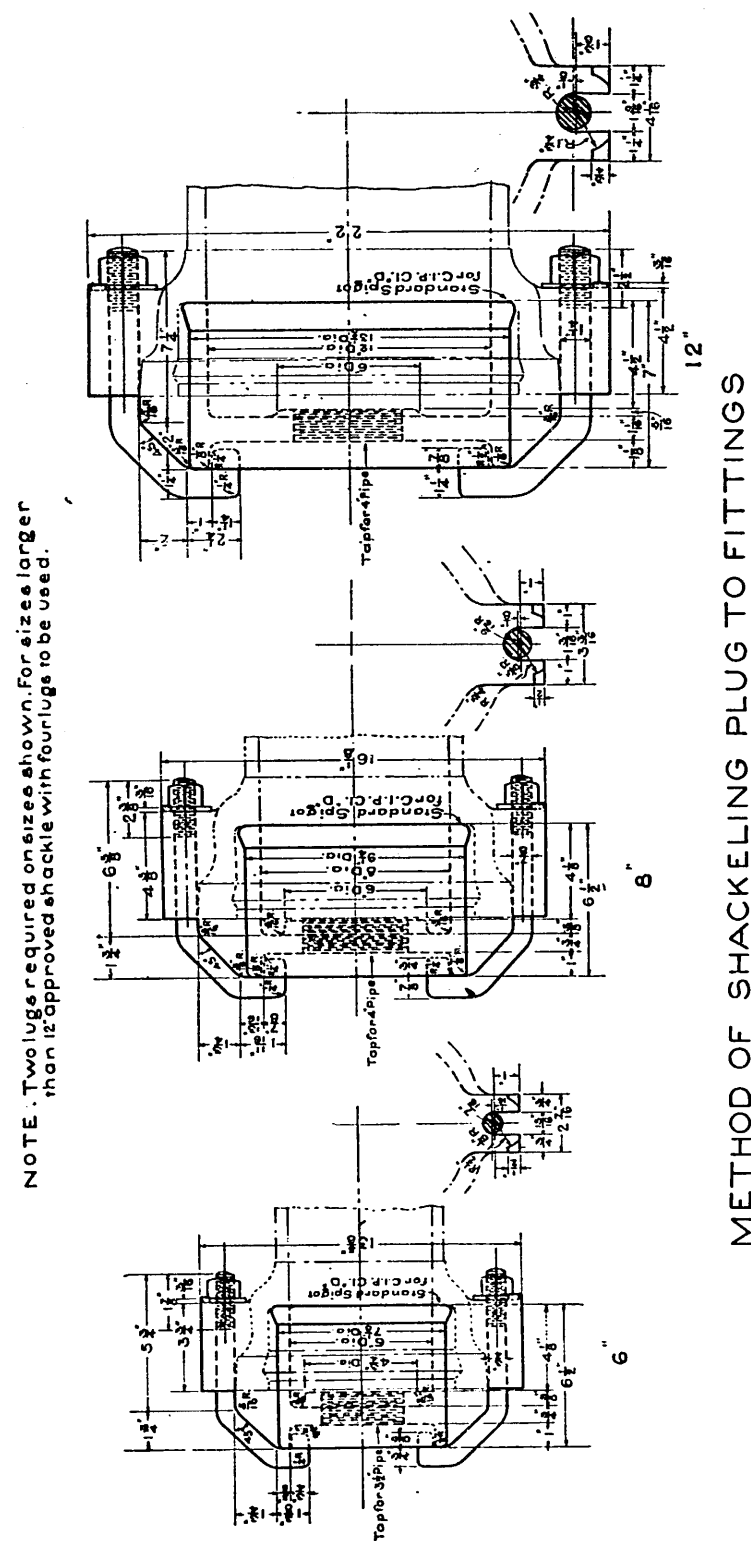


Table of Dimensions for Lugs on Hydrant Tees

Outlet Diameter	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
6"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
8"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"	1 3/4"

LUGS WITH 6" OR 8" OUTLET



SPECIFICATIONS FOR PAVEMENTS AND APPURTENANCES

General Stipulations

164. 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.

165. GRADING PARKING STRIPS

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

All parking strips shall be graded on a true plane from the new curb to the existing concrete sidewalk, or where no walk exists, to the property line whenever so ordered by the City Engineer. Parking strips shall be finally cleaned and raked and roadways cleaned up not later than ten (10) days after street is open to traffic.

Payment shall be made for "Grading Parking Strips" at the price bid per linear foot and measurement shall be taken as the length of curb between street margins and no deduction shall be made for alley crossings or private alley crossings. No payment, however, shall be made for grading parking strips where new concrete sidewalks are constructed as part of this improvement.

166. WASHING PAVEMENT

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

167. SUBGRADING FOR PAVEMENT

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

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 Sec-

tion 79. Such material found within one (1) foot of the subgrade shall be removed by the contractor as part of the clearing.

The City Engineer shall be the sole judge as to what shall constitute unsuitable or improper materials to remain in the subfoundation, and in order to ascertain the presence of unsuitable materials he shall cause holes or trenches to be dug, of such dimensions and lengths and in such directions and to such depths as he deems necessary. If sinking spots develop, the City Engineer shall require the same to be excavated to sufficient depth to investigate and determine the cause of such sinking and the necessary remedy thereof. Such remedy as he may require shall be used. Such excavation, unless otherwise ordered, shall be refilled with suitable earth or material, the refill to be made in layers and thoroughly tamped or water settled. The amount of earth so removed shall be paid for at the rate bid for subgrading, and if the material required is available from waste material within this improvement district, no allowance shall be made for refill. If suitable material cannot be obtained from the streets in this improvement district, payment for refill shall be made at a price per cubic yard agreed upon by the contractor and the City Engineer.

No other payments whatsoever shall be made on the above work.

Unless otherwise specified, all embankments exceeding one (1) foot in height shall be sluiced into place in such a manner that all earth shall have been moved into its place of final deposit by water.

When so specified, embankments shall be built up by rolling, which operation shall consist of spreading the earth in layers not exceeding six inches (6") in thickness, by means of a sheep's foot roller, with spreading scraper attachment, and rolling each layer with a ten-ton road roller. Both the sheep's foot roller and the road roller shall pass over each layer not less than four times. Where necessary, each layer shall be sprinkled with water to secure the proper amount of moisture. Rolling of embankment slopes shall be started by excavating a horizontal bench, wide enough to accommodate the rolling equipment, at the toe of the slope and building up from this point in substantially horizontal layers.

All waste material removed during subgrading operations shall be disposed of as specified for Grading, Section 77, 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; provided, however that where the thickness of the pavement requires form lumber to exceed eight (8) inches in depth, lumber three (3) inches stock width and of a

depth equal to the full depth of the pavement may be used. 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) SCARIFYING AND ROLLING SUBGRADE

Rolling shall be done after the forms have been placed and while the fine grading is being done and immediately thereafter. Just before rolling, the subgrade shall be thoroughly scarified to a uniform depth of two and one-half (2½) inches below the final elevation of the subgrade surface. Subgrade shall be thoroughly wetted the day before rolling. Contractor may, at his option, use a five (5) ton, three-wheeled gas roller, having a minimum pressure of two hundred forty (240) pounds to the inch of tread on the back wheels, or he may use a steam roller having the same or greater pressure per inch of tread. Rolling shall be continued until the subgrade has been brought to the correct elevation, which shall be determined by dragging the subgrade with a template resting on the side forms. Any low spots indicated by dragging with the template shall be filled and rolled until brought to correct elevation. Any soft or muddy spots due to rains, or the water settling of ditches or other excavations, which develop during rolling, or at any time before placing pavement, shall be shoveled out, refilled with suitable material and rolled as specified, at the contractor's expense. Rolling shall be done as close to the side or curb forms as practicable.

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

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

After the rolling has been completed as herein specified, the contractor shall, in the presence of the City Engineer or his representative, check the subgrade by means of a template resting on the side forms. During the hauling of material, should ruts develop, they shall be filled with suitable material and re-rolled.

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

All excavation for side sewers, catch basins, or any other excavation whatsoever which exceeds two (2) feet in depth below the

subgrade shall be completed, backfilled, water settled and rolled at least five (5) days before placing pavement.

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

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

About twelve (12) hours before the concrete is placed, 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. In no case, because of low or sandy subgrade, or for any reason whatsoever, will he be allowed to vary the ratio of cement to aggregate, or to raise the subgrade template. During the subgrading of any street, the contractor shall locate and reference with stakes or painted marks on the concrete walks all drains leading to the curb. When the curb is constructed all such drains shall be connected to two (2) inch galvanized sheet metal weep holes through the curb. The drain connection to the weep holes will be paid for at the price bid for "Sidewalk Drain."

(c) PLANKING SUBGRADE

Whenever the hauling of materials for paving over a finished subgrade causes ruts, depressions or other damage, the City Engineer may order the contractor to lay a loose plank roadway of 4" x 12" plank at least eight (8) feet long laid transversely across the roadway to protect the subgrade from such damage.

All planking used for this purpose shall be furnished by and remain the property of the contractor, and for the use of such planking, including placing, maintenance and removal, the contractor shall be paid at the rate of twenty (20) cents per linear foot of roadway measured along the center line of the roadway between points where such planking is ordered by the City Engineer.

(d) 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."

(e) PAYMENT

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

PAVEMENTS

168. CONCRETE PAVEMENT

Concrete pavement shall be constructed of Class "C" concrete.

(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.

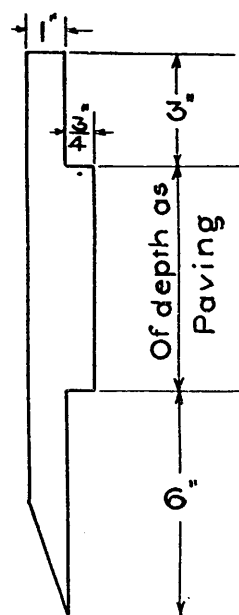
After thoroughly tamping the concrete as specified above, it shall be rolled with a light studded roller ten (10) inches in diameter and five (5) feet long, weighing approximately seventy-five (75) pounds. The roller shall be worked across the pavement as directed by the City Engineer. The rolling shall be continued until mortar has been worked to the entire surface of the panel.

After striking off with the steel shod tamping rod, and rolling, a shaping rod of similar construction to the tamping rod, two and one-half (2½) inches thick shall be worked forward and across the width of the roadway with a sawing motion, keeping a small amount of mortar ahead of it at all times. 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 (⅛) 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



INTERSECTION GRADE STAKE

minimum number of times necessary to leave a uniform finish and shall be followed with a light brushing in a transverse direction. On grades exceeding 7% the brushing shall be done with a heavy brush to give a degree of roughness satisfactory to the City Engineer.

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 having a $\frac{3}{4}$ inch radius and 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. Panels shall be re-edged as a final operation after the concrete has become stiff enough to hold the full radius specified and leave a clean, polished margin. All vertical curves and all intersections, insofar as it is practicable and where directed by the City Engineer, shall be floated and finished as above specified, substituting a flexible one by six (1 x 6) inch finishing board for the stiffened one.

Final brushing shall not be done until the water film has disappeared from the pavement surface. 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 52. Whenever reference is hereinafter made to a "Through Joint," unless otherwise stated, the same shall be construed to mean a joint three-eighths ($\frac{3}{8}$) inch in thickness and one-half ($\frac{1}{2}$) inch deeper than the thickness of the pavement, placed completely through the pavement normal to the pavement surface. Whenever reference is hereinafter made to a "Dummy Joint," unless otherwise stated, the same shall be construed to mean a joint one-fourth ($\frac{1}{4}$) inch in thickness and two (2) inches deep inserted in the fresh concrete during or immediately following the finishing of the pavement.

Expansion joints shall be placed as follows:

Through joints shall be placed transversely across all roadways at intervals of forty-five (45) feet and the 45-foot sections thus formed shall be divided into 15-foot panels with transverse dummy joints.

For alleys and roadways less than sixteen (16) feet in width no longitudinal dummy joint shall be used.

For roadways sixteen (16) feet or more in width, but less than thirty-two (32) feet in width, one dummy joint shall be placed along the center of the roadway.

For roadways thirty-two (32) feet to thirty-four (34) feet wide, inclusive, one dummy joint shall be placed along the center of the roadway and one dummy joint seven (7) feet from each curb.

For roadways over thirty-four (34) feet wide but less than forty (40) feet wide, one dummy joint shall be placed along the center of the roadway and one dummy joint eight (8) feet from each curb, except in the case of an eighteen (18) foot section of roadway adjoining a street railway track, where the dummy joint shall be placed seven (7) feet from the curb.

For roadways forty (40) feet or more in width but less than fifty (50) feet in width, one dummy joint shall be placed along the center of the roadway and one dummy joint in the middle of each half.

For roadways fifty (50) feet to fifty-four (54) feet wide, inclusive, one dummy joint shall be placed along the center of the roadway, one dummy joint seven (7) feet from each curb, and one dummy joint dividing the remainder of each half into two (2) equal lanes.

For roadways over fifty-four (54) feet wide but not exceeding sixty (60) feet wide, one dummy joint shall be placed along the center of the roadway, one dummy joint eight (8) feet from each curb, and one dummy joint dividing the remainder of each half into two equal lanes.

For roadways more than sixty (60) feet in width but less than sixty-eight (68) feet in width, one dummy joint shall be placed along the center of the roadway and two dummy joints shall be so placed as to divide each half into three equal lanes.

For roadways sixty-eight (68) feet or more in width but less than seventy-six (76) feet in width, one dummy joint shall be placed along the center of the roadway, one dummy joint seven (7) feet from each curb, and two additional dummy joints shall be so placed as to divide the remainder of each half into three equal lanes.

For roadways seventy-six (76) feet wide one dummy joint shall be placed along the center of the roadway, one dummy joint eight (8) feet from each curb, and two additional dummy joints shall be so placed as to divide the remainder of each half into three ten (10) foot lanes.

For roadways seventy-eight (78) feet wide one dummy joint shall be placed along the center line of the roadway, one dummy joint nine (9) feet from each curb, and two additional dummy joints shall be so placed as to divide the remainder of each half into three ten (10) foot lanes.

Roadways thirty-two (32) feet or less in width shall be constructed in one operation, roadways over thirty-two (32) feet wide and not over sixty-four (64) feet wide shall be constructed in two operations, and roadways over sixty-four (64) feet wide shall be constructed in three or four operations.

Transverse joints shall not be staggered, but shall extend continuously across the roadway, a through joint in one section being placed opposite a dummy joint in the adjoining section.

No section of the roadway shall be commenced until the adjoining sections have been cured for ten (10) days. The surface of any section shall be thoroughly cleaned immediately after finishing an adjoining strip.

Where specified or where shown on the plans, through doweled joints three-fourths ($\frac{3}{4}$) of an inch thick, constructed according to the detail plan, shall be placed transversely across the pavement at street margins and at intermediate intervals, dividing the block into sections approximately one-hundred-twenty (120) feet in length. The space between such through doweled joints shall be divided transversely and longitudinally by dummy joints to produce the same sized panels as heretofore specified.

All through expansion joints shall be placed against a notched steel plate not less than one-eighth ($\frac{1}{8}$) of an inch in thickness and perpendicular to the grade by driving pointed steel bars five (5) feet apart, firmly into the subgrade. These bars, and the steel plate, shall not be removed until the concrete has been placed and tamped by both tampers for a distance of at least ten (10) feet on both sides of the joint measured along the center line of the roadway. All joints shall be cut off flush with the pavement at the end of the sprinkling period. Where integral curb is specified, joints shall be extended 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 two hundred (200) square feet.

All through joints not placed in one piece shall be securely stapled together by means of clinched staples.

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.

Whenever a pavement adjoins an existing pavement or an existing concrete curb and gutter, a one-quarter ($\frac{1}{4}$) inch dummy joint shall be placed between the new pavement and such existing structure.

At the end of each day's run a wooden header conforming to the width and proper crown of the roadway and four (4) inches thick, 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

The contractor shall use a nozzle which will throw a fog-like spray to keep the pavement moist during finishing and until the same is hard enough to bear the weight of burlap covering. It shall then 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.

As a substitute for the method of curing regularly specified, the use of an automatic or intermittent sprinkling device, of a type approved by the City Engineer, may be used.

Such device shall be so adjusted and timed that the pavement will be kept continuously wet for a period of ten (10) consecutive days.

The pavement edges and backs of curbs shall be banked to the top with earth the day following construction, and care shall be exercised during the sprinkling period to prevent water from collecting along the edges of the pavement. When the pavement adjoins or is near any building, as in the case of alley pavements, the contractor shall protect such buildings from damage by means of canvas, waterproof paper, or other material. 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 72. 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.

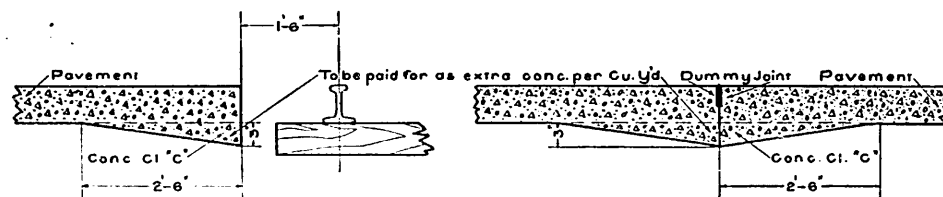
Payment is to include cutting and bending of steel where necessary to length and shape, as directed by the City Engineer, and to be in full for steel in place.

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) EXTRA CONCRETE UNDER PAVEMENT

Extra concrete under pavement placed according to the detail plan shall be used under the edges of all panels adjoining any longitudinal construction joint between sections of roadways constructed in two or more operations, adjacent to existing pavement or concrete curb and gutter, and where ordered by the City Engineer.

Payment for "Extra Concrete under Pavement" shall be made at the price bid per cubic yard and shall include the necessary trenching.



EXTRA CONCRETE UNDER PAVEMENT

(f) MAINTAINING TRAFFIC—PLANK COVERING

When directed by the City Engineer, the contractor shall cover such crossings or portions of pavement as directed with suitable plank three (3) or four (4) inches in thickness, laid upon two (2) inches of sand covering, maintaining the same in proper condition to allow traffic to pass over it.

For so maintaining traffic, the contractor will be paid at the price bid per thousand feet board measure for the use of "plank covering" and at the price bid for the use of "sand covering" per cubic yard, which price includes the final removal of plank and sand from the improvement.

(g) 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."

169. 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 Class "D" Concrete.

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.....	.60 per Sq. Yd.
6 inch Base.....	.70 per Sq. Yd.
7 inch Base.....	.80 per Sq. Yd.
8 inch Base.....	.90 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.

170. 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.

171. CONCRETE WEARING SURFACE FOR TRESTLES

Concrete wearing surface for trestles shall be constructed, finished and cured in all respects as specified for concrete pavement. Payment for such wearing surface shall be made at the price bid per square yard for "Concrete Pavement," or "Reinforced Concrete Pavement."

172. 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 cement, and shall be satisfactory to the City Engineer in all respects.

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

(b) 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%) of calcium carbonate or ninety-five per cent (95%) pure silica.

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

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

(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 (2) inches. The raking shall extend to the full depth of the top to the end that the mixture shall be of uniform density throughout.

The contractor shall furnish a template of a pattern approved by the City Engineer for testing the depth and the surface of the asphalt top after raking. The template shall allow for not less than five-eighths (⅝) inch compression in the final surface. The template shall be used at intervals not greater than four (4) feet. Care shall be taken to set the template at right angles to the curb.

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

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

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

(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 iron.

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 (⅜) inch under a four-foot straight edge. It shall contain no water, no appreciable amount of light oils, or matter volatile at a temperature of three hundred degrees (300°) F.

The mineral matter of the finished pavement, upon analysis, shall be graded within the following limits: One hundred per cent (100%) shall pass a No. 8 mesh screen.

From 0 to 2%	shall be retained on a No. 10 Screen
From 1 to 6%	shall be retained on a No. 20 Screen
From 4 to 8%	shall be retained on a No. 30 Screen
From 8 to 15%	shall be retained on a No. 40 Screen
From 11 to 19%	shall be retained on a No. 50 Screen
From 28 to 40%	shall be retained on a No. 80 Screen
From 14 to 18%	shall be retained on a No. 100 Screen
From 11 to 17%	shall be retained on a No. 200 Screen
From 11 to 15%	shall pass a No. 200 Screen.

The asphaltic cement shall in no case show less than twelve per cent (12%) or more than fourteen per cent (14%) by weight upon analysis. The proportions and physical and chemical properties of the oil and asphalt and the asphaltic cement, sand and filler in the wearing surface, shall be such as to provide the above described results, and shall be satisfactory in all respects to the City Engineer.

(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 from two hundred degrees (200°) to six hundred degrees (600°) F.

Tin Boxes: Five hundred (500) seamless tin boxes of about three (3) ounces 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.

173. 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 "Sheet 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 $1\frac{1}{4}$ -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.

174. 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 43.

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 Class "D" Concrete.

It shall be constructed in all respects as specified for concrete base for pavement, Section 168.

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 ($\frac{3}{4}$) 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 ($\frac{1}{2}$) 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 68.

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 such 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 168.

(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.

175. STREET RAILWAY PAVEMENT

(For plan, see page 190).

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 construct the street railway pavement and cure the same in all respects as specified for pavement of like character.

PAYMENT:

Payment for street railway pavement shall be made at the price bid per square yard for "Brick Street Railway Pavement". The price bid 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 specified.

176. ALLEY PAVEMENTS

(For plan, see page 185).

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**177. 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

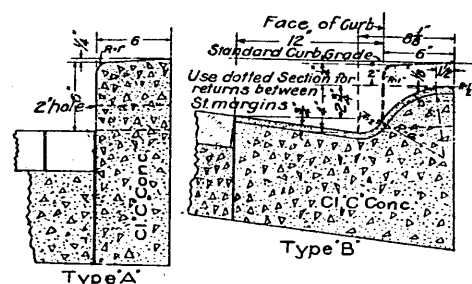
manner so as to insure a neat appearance at the face of the curb.

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.



CONCRETE CURB

Measurement will be made on a line parallel to and six (6) inches from the back of the curb.

178. 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 51 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.

179. 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."

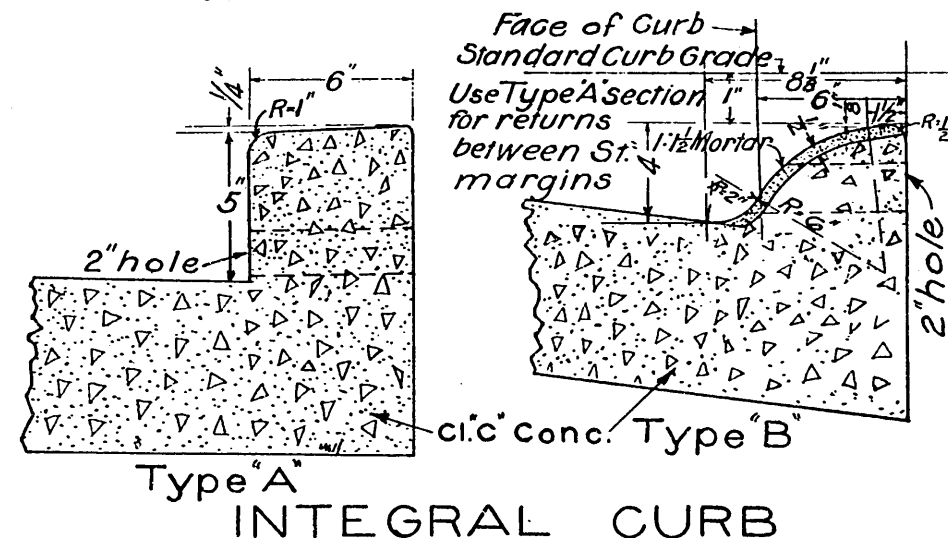
At street intersections, the height of type "B" Integral Curb shall be raised to five (5) inches as specified for type "B" Concrete Curb in Section 177.

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.

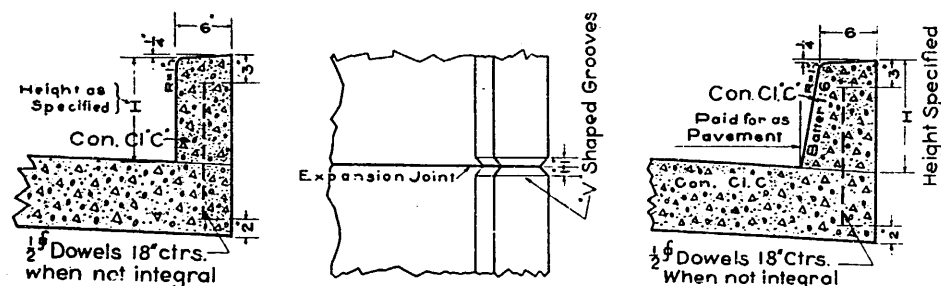
When specified, Type "A" Integral Curb shall be armored as provided for Type "A", Concrete Curb. Payment shall be made at the price bid per linear foot for "Armored Integral Curb," and shall be in full for all labor and material necessary to construct the curb ready for use according to these specifications.



180. HIGH CURB

High curb shall be constructed according to the plan and shall be of the type and face height specified.

It shall be constructed in all respects as to placing of concrete, spading, finishing and placing of expansion joints and weep holes as specified for concrete curb. It shall be constructed either integral with the pavement or after the pavement has been constructed. When the latter method is employed, the contractor shall furnish and set dowels as shown on the plan. When constructed integral with the pavement, forms for curb having a face height exceeding twelve (12) inches shall be set, blocked up, and bolted at four (4) foot intervals prior to placing concrete. When the face height is twelve (12) inches or less the forms may be placed as specified for integral curb. Through and dummy expansion joints shall be placed exactly normal to the pavement and a one (1) inch by one (1) inch triangular fillet nailed to the forms on either side of the joint. After stripping, the expansion joint material shall be cut to the bottom of the groove thus formed.



TYPE A

DETAIL OF EXP JOINT

TYPE B

HIGH CURB

Payment for "High Curb" shall be made at the price bid per lineal foot in place for the type and height specified. Measurement shall be along the face of the curb except in the case of Type "B" High Curb, where measurement will be made on a line parallel to and six (6) inches from the back of the curb.

181. 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.

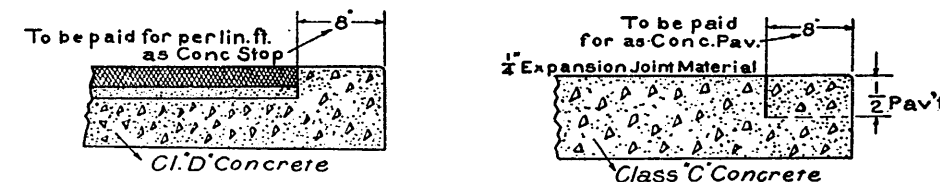
All joints shall be grouted immediately as prescribed for brick pavement.

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

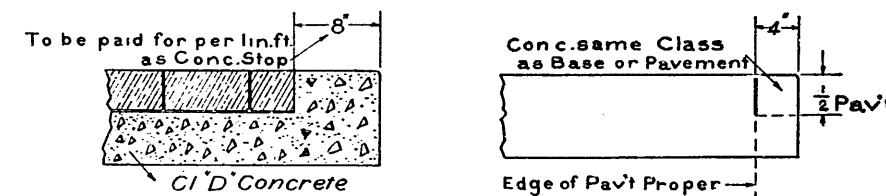
Measurement and payment shall be made for "Brick Gutters" in the same manner as specified for paved areas.

182. 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**183. ALLEY CROSSINGS**

(For plan, see page 188).

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.

184. PRIVATE ALLEY CROSSING

(For plan, see page 189).

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.

185. ALLEY CATCH BASIN

(For plan, see page 191).

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.

186. 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.

187. 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.

188. 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. 98.

189. MONUMENT CASES

(For plan, see page 187).

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.

190. ADJUSTMENT OF CAST IRON VALVE BOXES

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

191. 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. CIVB

Payment shall be made at the price bid for each, or as specified in Section 135.

192. 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.

193. GRAVEL SUB-BASE

Gravel sub-base shall be used in such locations and of such thickness as may be shown on the Plan or as directed by the City Engineer. After excavating for sub-base and before any backfilling is placed, the resulting subgrade shall be brought to a true surface and thoroughly rolled.

The backfilling to normal subgrade shall then be made and may consist of an approved pit run sand and gravel mixture, or washed sand and gravel conforming to the Standard Specifications.

The backfilling shall be rolled in the same manner as specified for the normal subgrade.

Payment for gravel sub-base will be made at the price bid per cubic yard for the same in place. Payment for the extra depth of subgrade will be made at the price bid per cubic yard for subgrading.

194. EXTRA CONCRETE ADJOINING STREET RAILWAY (For plan see page 162).

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" under pavement 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, and one-quarter ($\frac{1}{4}$) inch expansion joint extending to the bottom of the concrete at each expansion joint in the roadway portion.

195. SAFETY ISLANDS

(For plan see page 192).

Safety Islands shall be constructed where shown on the plan and where directed by the City Engineer. They shall be of the dimensions shown on the improvement plan or of such dimensions as may be ordered, and shall be constructed in accordance with the Standard Plan. The white surface course shall be of the same proportions as specified for Traffic Line and shall be placed immediately upon the fresh base, special care being taken to completely cover all curb faces.

Payment for "Safety Islands" shall be made at the price bid per square yard for the same.

196. WARNING BEACONS

(For plan see page 193).

Warning beacons shall be constructed where shown on the plans. They shall conform in all respects to the detail plans. The contractor shall install all conduit and wiring to and including the condulets and the fuses upon the existing service pole as shown on the plans. He shall furnish sufficient $\frac{1}{2}$ " conduit to reach from the condulet to the top of the pole together with a $\frac{1}{2}$ " T. & B. entrance cap. Installation of the conduit beyond the condulet and connection to the feed wires shall be done by the City Light Department and the cost thereof shall be paid for as specified in Section 36.

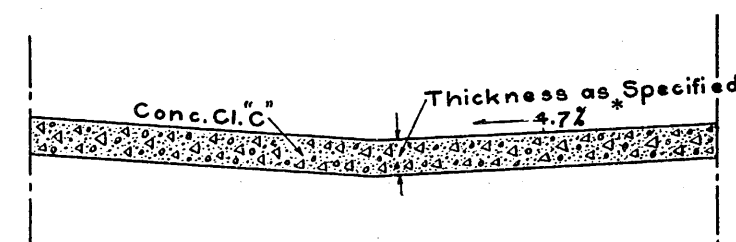
Payment for Warning Beacons shall be made at the price bid each completely installed, except the $1\frac{1}{2}$ " conduit and No. 14 duplex lead covered cable, which items shall be paid for at the price bid per lin. foot in place for the same.

197. TRAFFIC LINES

White traffic lines shall be laid in the pavement where shown on the plan or where directed by the City Engineer. They shall be constructed in the following manner: A 1" x 6" board S. 4 S. shall be floated flush with the pavement. The pavement shall then be edged adjacent to the board. Within one hour after floating

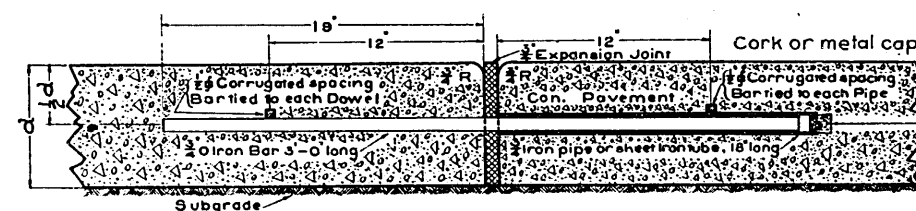
the board shall be removed, and the space filled with a mixture composed of one part white Portland cement and one and one-half parts white marble or white granite chips mixed with white sand. The mixture shall be well troweled into place and edged. The portion across any brick street car right-of-way shall be laid with white face concrete bricks, two bricks wide, at the time of construction of such street railway pavement.

Payment shall be made at price bid per lineal foot for "Traffic Lines" in place, which shall be in full for all labor and material in the completed work.

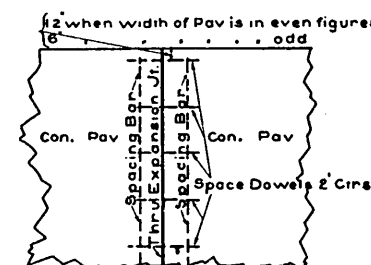


CONC. ALLEY PAVEMENT

*6% When Alley Grade is Less Than 1% For Entire Length of Alley.



SECTION

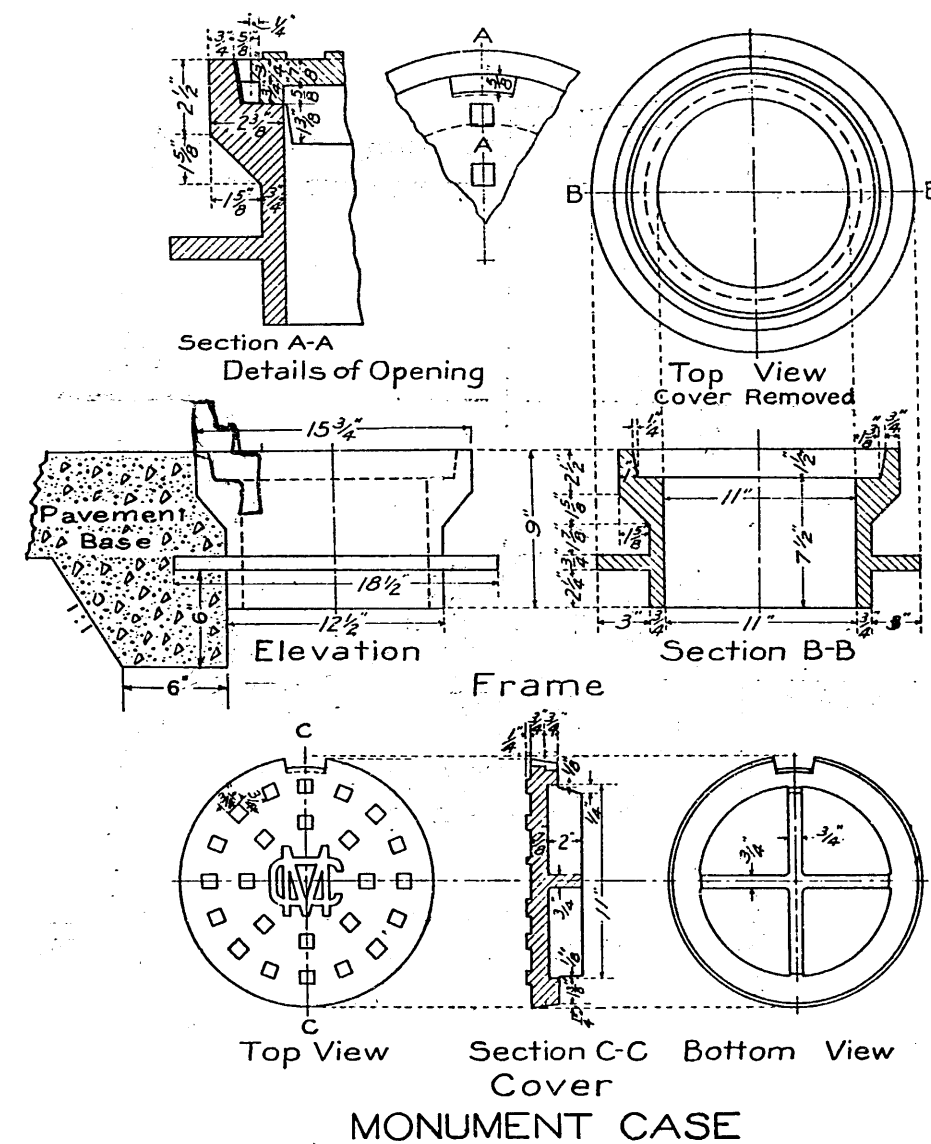


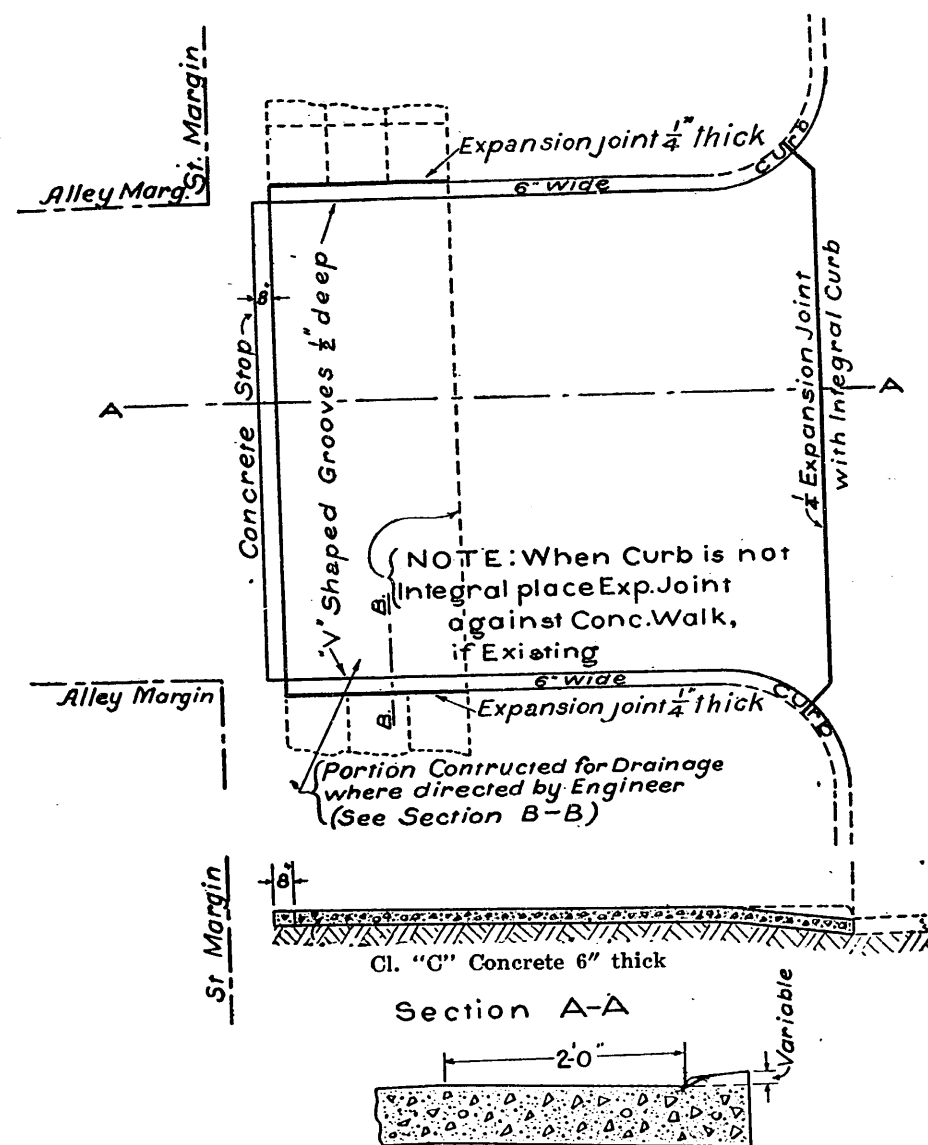
PLAN

DOWEL
EXPANSION JOINT

PLACING OF EXPANSION JOINTS IN ROADWAYS

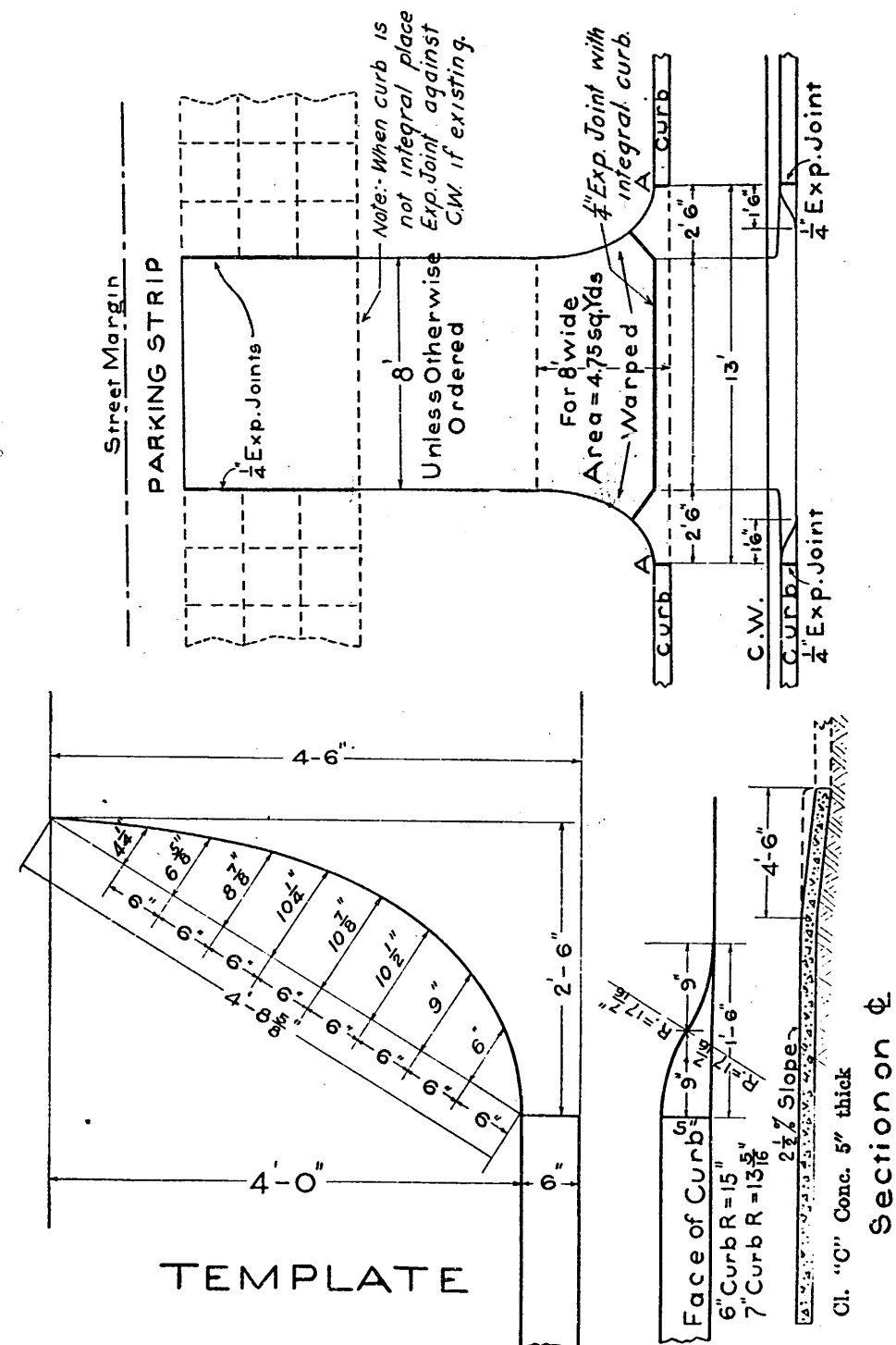
Width of Roadway	$\frac{1}{4}$ " Longitudinal Dummy Joints				Transverse Joints		
					$\frac{3}{8}$ " Through joints in all roadways at 45' intervals. $\frac{1}{4}$ " Dummy joints at 15' in- tervals.		
16	8				8		
25	12.5				12.5		
30	15				15		
32	7	9		9	7	One operation	
34	7	10		10	7		
36	8	10		10	8		
38	8	11		11	8		
40	10	10		10	10		
42	10.5	10.5		10.5	10.5		
44	11	11		11	11		
46	11.5	11.5		11.5	11.5		
48	12	12		12	12		
50	7	9	9	9	9		7
52	7	9.5	9.5	9.5	9.5	7	
54	7	10	10	10	10	7	
56	8	10	10	10	10	8	
58	8	10.5	10.5	10.5	10.5	8	
60	8	11	11	11	11	8	
62	10.3	10.3	10.3	10.3	10.3	10.3	
64	10.6	10.6	10.6	10.6	10.6	10.6	
66	11	11	11	11	11	11	
68	7	9	9	9	9	9	7
70	7	9.3	9.3	9.3	9.3	9.3	7
72	7	9.6	9.6	9.6	9.6	9.6	7
74	7	10	10	10	10	10	7
76	8	10	10	10	10	10	8
78	9	10	10	10	10	10	9
Where specified, $\frac{3}{4}$ " Dowelled joints at street margins and inter- mediate intervals of ap- proximately 120'. Sections between dowel- led joints divided trans- versely and longitudinally by dummy joints to pro- duce standard panels.							
Two operations							
Three or four operations							





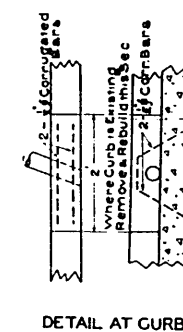
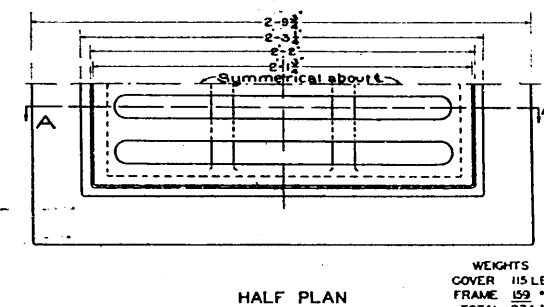
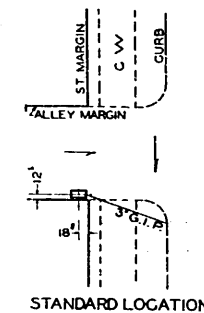
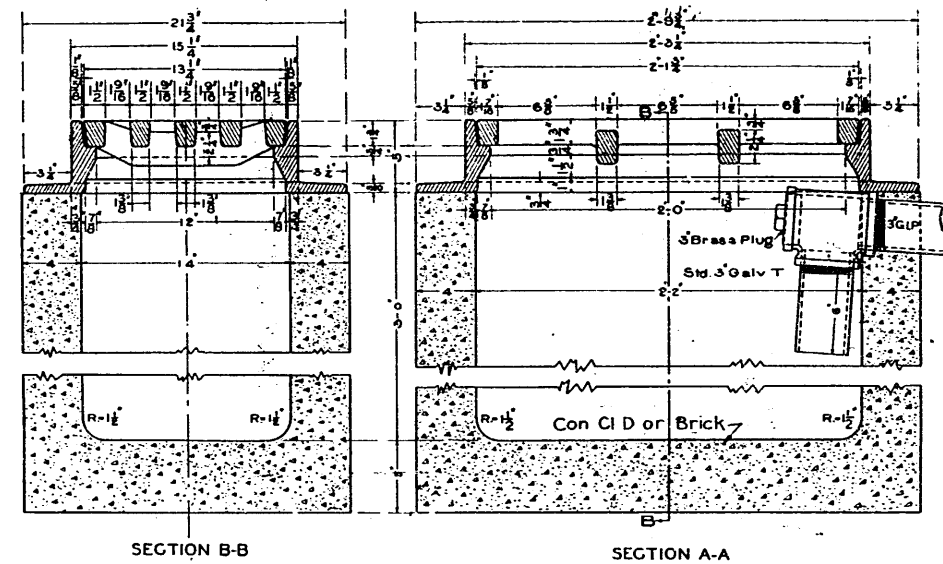
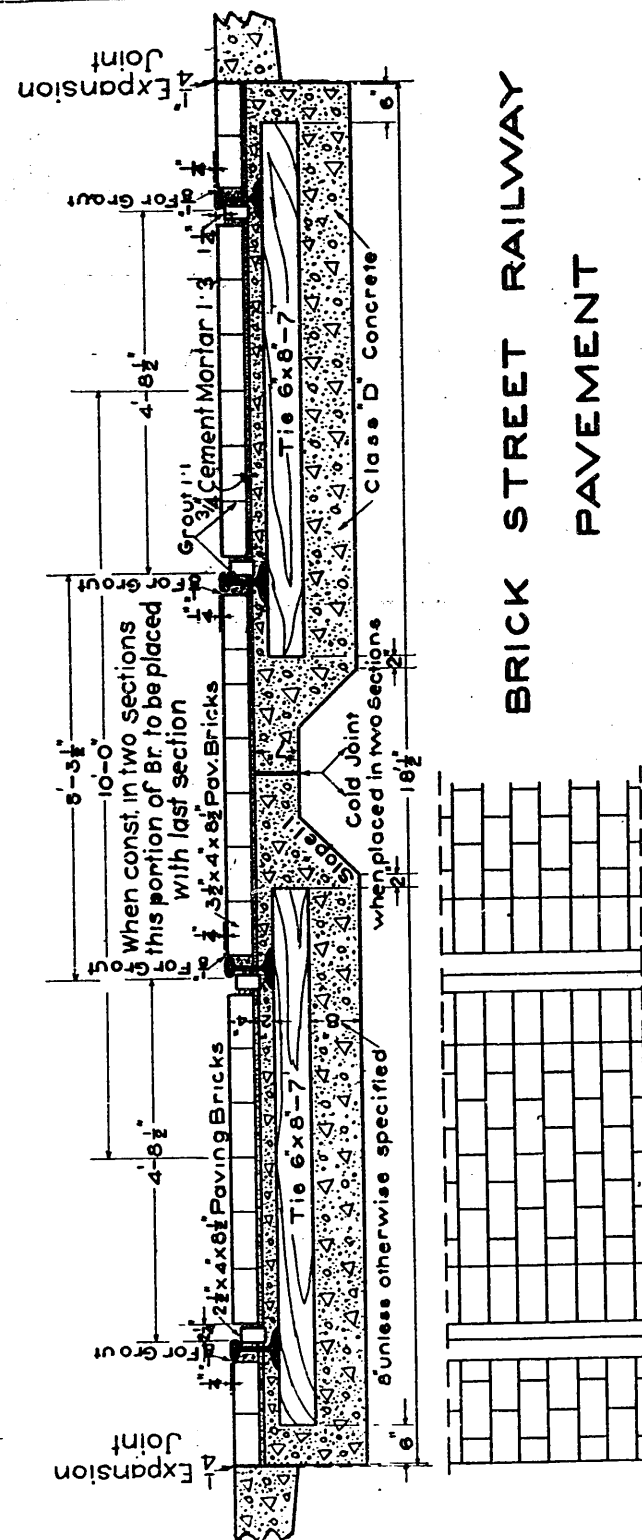
CONCRETE ALLEY CROSSING

For Paved Streets

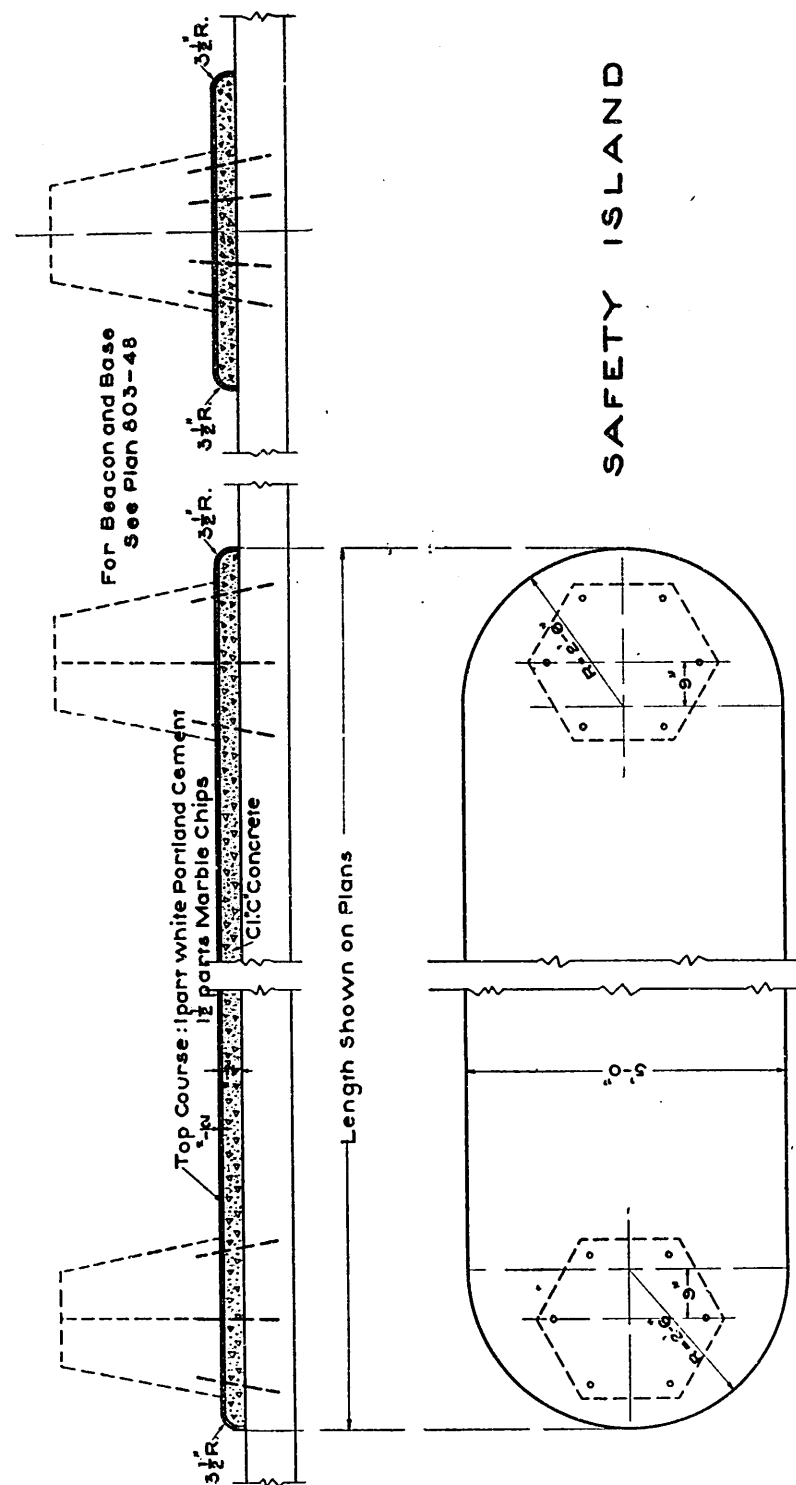
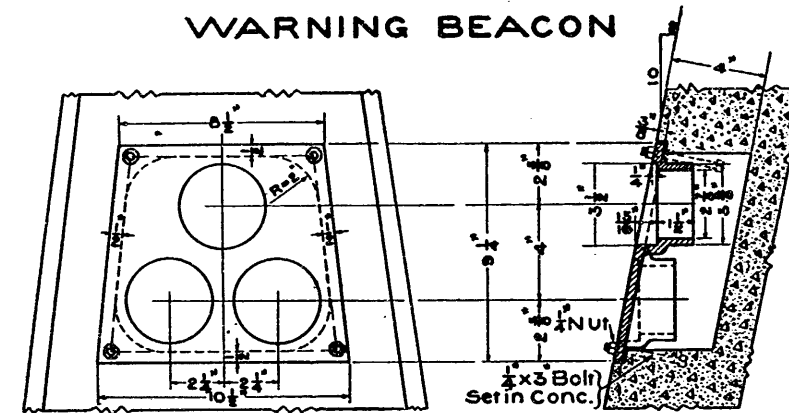
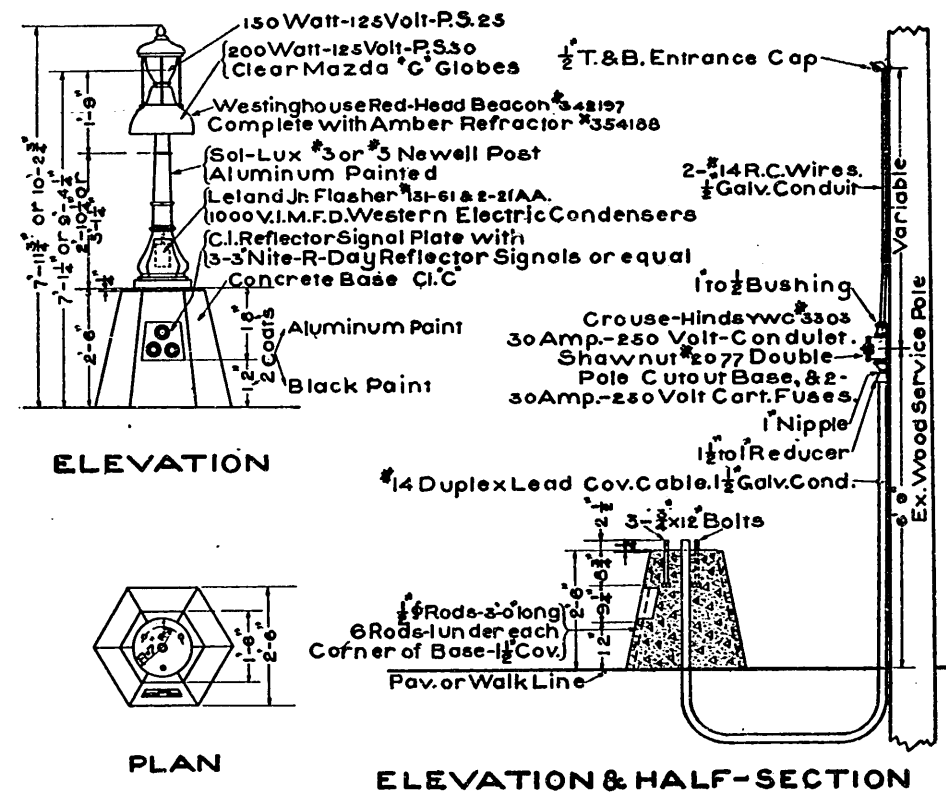


PRIVATE ALLEY CROSSING

For Paved Streets



ALLEY CATCH BASIN

**WARNING BEACON****ELEVATION & HALF-SECTION**

SPECIFICATIONS

For

ORNAMENTAL STREET LIGHTING

General Stipulations

198. 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.

199. 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.

Sizes of all wire and cable mentioned in these specifications or shown on the plans shall be American Standard Brown and Sharpe wire gauge.

200. 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 117 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.

201. MANHOLES

All manholes shall conform in location, arrangement, material and detail to the general plans for the improvement and to detail plan on page 204.

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 ($\frac{3}{4}$ x 4) inch washer or plate bedded in the concrete wall. Eight (8) "Nurdyke" hangers shall be securely fastened in concrete walls where directed.

All conduits entering the manhole shall be fitted with bushings and shall terminate two inches from the inside face of the manhole with the concrete beveled back at an angle of 45 degrees.

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, ground plate as specified under bonding 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.

202. HANDHOLES

Handholes shall be constructed according to detail drawing, page 205. A gravel pocket of one cubic foot shall be placed under the handhole and a three inch hole left in the concrete bottom at the center for drainage.

Payment shall be made at the price bid for each handhole, complete in place, and shall be in full for all necessary labor and material including the gravel pocket.

203. CONDUIT

All conduit shall be of the size specified and shall conform to the requirements for conduit, Section 50.

(a) TRENCHING AND LAYING OF DUCTS

Under pavement or alley crossings, conduit may be laid by driving or jacking, care being taken to secure as nearly as possible a cover of eighteen (18) inches and alignment as shown on plan. Excessive pressure by driving conduit shall be avoided. All conduit laid in open parking area shall be laid in open trench. Under concrete walks conduit may be driven or jacked into place, provided that the lateral deviation from the location shown on the plans or ordered by the City Engineer shall not exceed one (1) foot and that the vertical deviation from the specified cover shall not exceed six inches (6"). Jetting with water will not be permitted. Conduit shall be laid with a cover of eighteen inches (18"). Cost of replacing pavement and concrete walk shall be included in the prices bid for various items of the improvement as specified under "Pavement and Sidewalk Repairing."

Unless otherwise specially shown on the improvement plan, conduits shall be located in parking strip. If no parking strip exists, such fact will be shown on plan.

When possible, conduits shall be located in line with posts. When existing obstructions interfere with such location, conduits shall be laid where directed by the City Engineer. Any such changes as are necessitated by the interference of other systems shall not be considered as extra work.

Whenever ducts are installed in basements under concrete sidewalks 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 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 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 manhole or handhole to a point ten (10) feet above the ground on the existing pole carrying the aerial feed wire. Sufficient conduit, cable, 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 36.

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 36.

(b) BONDING

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

At posts and handholes, the clamp or strap bonding the conduits together shall be entirely embedded in the concrete.

At manholes a copper ground plate not less than two feet square by $\frac{1}{8}$ inch thick shall be entirely buried in coke and not less than one foot below bottom of trap drain.

This plate shall have a No. 0 bare copper wire securely soldered to it and carried through the concrete floor inside the manhole. The bond clamps or straps on each of the conduits entering the manhole shall be bedded in the concrete wall with the end of the strap extending through the wall into the manhole. The ends of these straps, the ground on the secondary fuse box, and the grounding point on the case of the transformer, shall each be connected to the No. 0 ground wire by No. 4 bare copper wires. All connections shall be soldered and shall be electrically and mechanically good.

Payment for the above work shall be included in the unit prices bid for conduits and manholes.

(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 per-

missible, 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 bonding and the replacing of walks and pavement. Measurement of conduit which has been jacked into place shall be taken as the straight line distance between openings.

204. 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 59.

All soldered connections shall be made by pouring molten solder over the heated made-up joint until every portion of the joint has been evenly coated.

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. Care shall be exercised in pulling all lead covered cable in order to avoid damage to lead sheath. Secondary cable shall be pulled from post to post, or from handhole to post. All splices in handholes shall be made in the same manner as specified for primary cable.

In making connections to the post wiring 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.

Primary cable shall not be pulled in long section. In pulling from a manhole to a handhole, the distance pulled shall not exceed 350 feet, and at that handhole cable shall be spliced. In pulling from handhole to handhole, the distance pulled shall not exceed 320 feet and cable shall be spliced at every other handhole.

In the handholes sufficient slack must be left to take cable out of handhole and make a splice, except where size of cable does not permit. If cable is too large to obtain slack in handhole, additional slack shall be left in manhole sufficient to make splice at handhole.

In manholes sufficient slack shall be left to form around side of manhole in a workmanlike manner to a proper connection with the transformer or secondary fuse box.

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

Voltage tests as specified in Section 59 will be made by the Light Department and the cost thereof shall be paid by the local improvement district, as outlined in Section 36. However, should such tests disclose faulty construction or defective material, neces-

sitating subsequent tests, such later tests shall be paid for by the contractor and he shall not be reimbursed therefor.

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.

Measurement shall be taken as the length of conduit through which the cable has been pulled, plus the necessary allowance for connections in post bases, handholes and manholes.

205. RUBBER COVERED WIRE

All rubber covered wire shall be of the size specified, or shown on the plans, and of the quality specified in Section 67.

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. Retesting shall be paid for by contractor as specified for lead covered cable.

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. Measurement shall be made as specified for lead covered cable.

206. OIL FUSE CUT-OUTS

Contractor shall install "Standard Subway Type" D & W Oil Fuse Cutouts on primary side of transformers. For 5000 volt primary cut-out shall be Type D-22 E, No. 4 x 122 and for 3000 volt primary, Type D-10 E, No. 4 x 110, Graybar or General Electric Company's catalog or equal.

Fuses for the cut-outs shall be provided of capacity designated by the City Engineer.

The cut-outs shall be securely fastened to the wall of manhole. They shall be provided with a one-inch galvanized iron breather pipe manifold with a vertical pipe extending two feet below the bottom of cut-out.

Payment for "Oil Fuse Cut-outs" shall be made at the price bid for each in place ready to operate, including fuses, breather pipe and the painting.

207. TRANSFORMERS

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

They shall be single-phase, 60 cycle, subway type, air cooled, oil insulated, with water-tight covers, General Electric Company, Type "H" or Westinghouse Electric & Manufacturing Company, Type "SM" or their equal.

Transformers shall conform in all respects to the latest standards of the A. I. E. E. The covers of the tanks shall consist of a dome with a groove machined in the outer edge, which fits over the top edge of tank and shall be made watertight by the use of an

asbestos gasket fitted into this groove. The cover shall be so reinforced that a tight fit will be assured without springing or cracking the cover of the tank. The cover shall be provided with lifting lugs of sufficient strength so that the transformer may be safely handled with tackle attached to these lugs. There shall be a plugged opening in the cover for filling the transformer with oil without disturbing the joint between the tank and cover.

The tank shall be provided with a locating pin in the top rim and the cover with a corresponding hole to insure that the cover shall invariably be replaced in the same position.

The tank shall be provided with oil level indicators between which the oil level should be maintained.

The extreme bottom of tank shall be provided with a plugged opening for draining the tank and in the plug an auxiliary opening for taking oil samples.

Two Primary and three Secondary outlet bushings shall be provided on the tank so that a wiped joint may be made with the lead cable sheath and the bushings in such manner that they may be easily removed, permitting a change in transformer without destroying the wiped joint.

The transformer shall be capable, when cable joints are properly made, of operating successfully and for considerable periods of time totally submerged in water.

The middle or neutral point of the secondary of all transformers shall be grounded at the secondary fuse box.

The primary shall be wound for a working pressure of 4330 volts, effective alternating current when 5000 volt primary cable is specified, and 2500 volts, effective alternating current when 3000 volt primary cable is specified. The secondary side shall be wound for 250 and 125 volts working pressure.

Before acceptance, the transformers will be inspected at Seattle by the City Engineer or his representatives.

After installation in manhole, each transformer shall be subjected to an air pressure test of six (6) pounds per square inch. If the pressure holds steady for one hour after closing the valve, the tank shall be considered air tight. This test shall be made by the contractor and approved by the City Engineer.

The primary side of the transformer shall be connected to the oil fuse cut-outs with a single conductor lead covered cable of size and insulation equal to that of the primary cable specified. Primary wires connecting to oil fuse cut-outs shall be installed as per instructions that come with cut-outs.

The secondary side of the transformer shall be connected to the secondary fuse box with lead covered cables the insulation of which shall be as specified herein under "Lead Covered Cable."

Three single conductor cables shall be used, No. 0 for transformers up to and including 37.5 K. W. capacity; No. 000 for 50 K. W. transformers, and 250,000 c. m. for 75 K. W. transformers.

The three cables shall be wiped into a single bushing at the secondary fuse box, and shall be formed around the wall from transformer to fuse box with three to four feet of slack left near transformer.

All primary and secondary wires connecting to terminal blocks of transformers shall be taped with empire tape and linen tape, then varnished with air drying insulating varnish. (Shellac is not to be used). Any terminals on transformer not used shall be sealed with lead or copper disks soldered on.

All cables, splices, cut-outs, breather pipes and mountings on primary side of transformers shall be painted red. All other wires, cables, secondary fuse box and fittings in manhole shall be painted with black asphaltum paint.

The secondary fuse box shall be per detail drawings, File No. 723-66 for transformers up to and including 37.5 K. W. capacity; and File No. 829-35 for transformers of 50 K. W., or 75 K. W. capacity, or for smaller transformers having more than six circuits.

Boxes shall be made of a high grade of cast iron, with cast aluminum alloy cover on large size box, and shall have a plugged opening in cover for air pressure test. This air pressure test shall be the same as that required for the transformers.

All cables entering this box shall have wiped joints and all openings into the box made air tight.

The fuse box shall contain double pole, double branch porcelain base fuse blocks or cut-outs complete with enclosed cartridge fuses, one cut-out being provided for each circuit to lamps. 60 ampere cut-outs with ferrule contact fuses shall be provided for the small box and 100 ampere cut-outs with knife blade contact fuses for the large box. Fuses shall be "Economy Renewable" or equal, of a capacity designated by the City Engineer.

The neutral wires from the circuits shall not be fused but shall be securely soldered to the neutral wire from the transformer. This neutral wire from the transformer shall be grounded by means of a copper lug attached to a $\frac{3}{8}$ inch brass stud bolt set through the box terminating on the outside with another copper lug. This outside lug shall be connected to the manhole ground with a bare copper wire, not less than No. 4.

PAYMENT

Payment for transformers shall be made at the price bid for each, for the size specified, and shall be in full for the transformer installed ready to operate, including the secondary fuse box, fuse blocks, fuses and the connections from the oil fuse cut-outs to the transformer, and from the transformer to the secondary fuse box.

200 209. POSTS

All posts shall be of the type specified and shall conform in all respects as to dimensions and other particulars to the detail post drawings, File No. 803-54.

(a) MATERIAL

Concrete posts shall be manufactured from Rymer, B. C., or similar crushed granite acceptable to the City Engineer, and Portland cement in the proportion of one (1) part of cement to two (2) parts of aggregate.

The aggregates shall conform within an allowable variation of five per cent (5%) to the following requirements:

- 100% shall pass a $\frac{3}{8}$ " screen
- 90% shall pass a $\frac{1}{4}$ " screen
- 50% shall pass a No. 6 screen
- 30% shall pass a No. 10 screen

Not more than 10% shall pass a No. 50 screen.

(b) REINFORCEMENT

Reinforcement shall be accurately placed, and all intersections between main bars and spiral wrapping shall be electrically welded.

Reinforcement shall be held rigidly in place during manufacture and spreaders used to position the cages in the form shall be made of brass and sharply pointed where in contact with the forms.

Each assembly shall be fabricated upon a mandrel, which shall not be withdrawn until all intersections have been welded.

(c) MANUFACTURE

Concrete posts shall be manufactured by the centrifugal process. Forms shall be of iron or steel. They shall be perfectly smooth, true to shape and have accurately fitting joints, and shall be so mounted as to revolve in true circles about the axis of rotation. Forms may be filled with concrete either while revolving or before beginning the spinning operation. After being filled they shall be revolved at a rate of not less than 500 revolutions per minute for such a length of time as will produce a post of maximum density. The axis of rotation may be either vertical or horizontal. A hole approximately one inch (1") in diameter shall be left through the center of the post. No metal conduit shall be used.

The resulting post shall show a perfect, smooth, dense surface. No patching will be permitted.

Forms shall be removed the day following casting and the posts kept continuously wet for a period of not less than 18 days. They shall then be immersed in a ten per cent (10%) solution of hydrochloric acid for such time, and in such position or positions as to produce a uniformly etched surface, with all granite surfaces showing but no particles loosened by excess etching.

The posts shall then be thoroughly washed to remove all traces of acid.

The City Engineer will select at random, and at the Contractor's expense, one pole in each lot of posts delivered to the job, or one post in each lot of 25 where the order is in excess of 25 posts, for testing purposes.

The City Engineer will perform all necessary tests to determine the quality and proper fabrication of the posts as contemplated by the Specifications and the results of these tests shall be the basis for the acceptance or rejection of the entire lot of posts. Posts will be rejected for defective concrete, unsatisfactory finish, displacement of the steel reinforcement, checks, cracks or other defects impairing their appearance and usefulness.

The thickness of concrete covering of the steel reinforcement shall not be less than the theoretical thickness, as indicated on the plan, by more than 20 per cent.

The door in the post base shall be made of cast aluminum alloy.

The door casting shall be thoroughly cleaned and then sprayed with three coats of approved brand of lacquer; the first coat a primer, the second coat of a color to match the post as nearly as possible and the final coat of clear lacquer.

(d) **PAYMENT**

Payment for "Posts" shall be at the price bid for each and shall be in full for the post complete in place including the necessary outlets for fire alarm boxes, traffic signals, and street signs when specified, and all material and labor necessary to manufacture and erect the post ready to receive the post furnishings.

209. POST FURNISHINGS

Post furnishings shall include the bracket or capital, the complete light assembly, all as specified or shown on the post drawings, and the post wiring, including cut-out in the post base.

Unless otherwise specified all metal parts shall be cast aluminum alloy, lacquered as specified for the post door.

Posts shall be wired with No. 10 R. C. wire; three wires for the two light post with the neutral wire having a different colored insulation or other distinctive marking, and two wires for the single light post.

A 30 ampere porcelain cut-out shall be furnished and installed inside the post base convenient to the door. The cut-out shall be 2 pole for one light posts, and 3 pole for two light posts, and shall be equipped with enclosed cartridge fuses, "Economy Renewable", or equal, of a capacity of 5 amperes for 200 and 300 watt lamps and 10 amperes for 500 watt lamps.

The glassware for the post tops shall be of the type and density specified on the post drawings. The efficiency of the glassware as compared to a bare lamp shall be not less than 78% for light opalescent nor less than 70% for medium opalescent. The density of the glassware shall be as uniform as possible. In order to secure this uniformity the contractor will be required to submit for approval a sample of the glassware specified. Upon approval by the City Engineer, the sample shall be retained for comparison with the glassware furnished for this improvement. If the glassware furnished varies more than ~~100%~~ lighter or denser than the approved sample the contractor will be required to replace it with glassware which does compare with the approved sample. The City Engineer or his representative shall be the sole and final judge of the density of glassware. The contractor will not be entitled to any additional compensation for above replacement other than his bid price for post furnishings.

PAYMENT:

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

210. CONCRETE POST FOUNDATION

Concrete post foundations shall be of the dimensions shown on the standard plan. The concrete shall be Class "D".

Forms shall be used to keep the foundation true to shape and specified dimensions for a distance of a 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.

211. POST BASE TRANSFORMERS

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

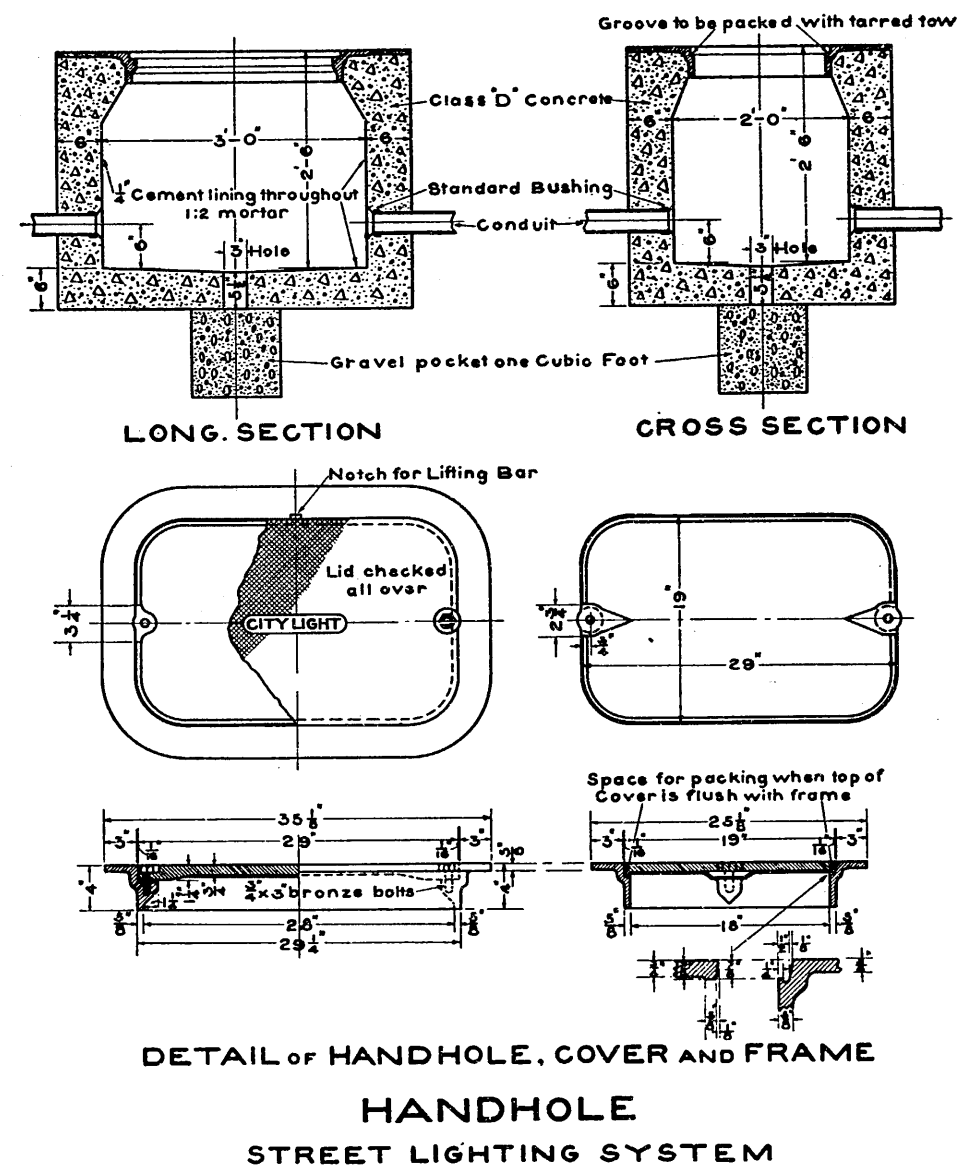
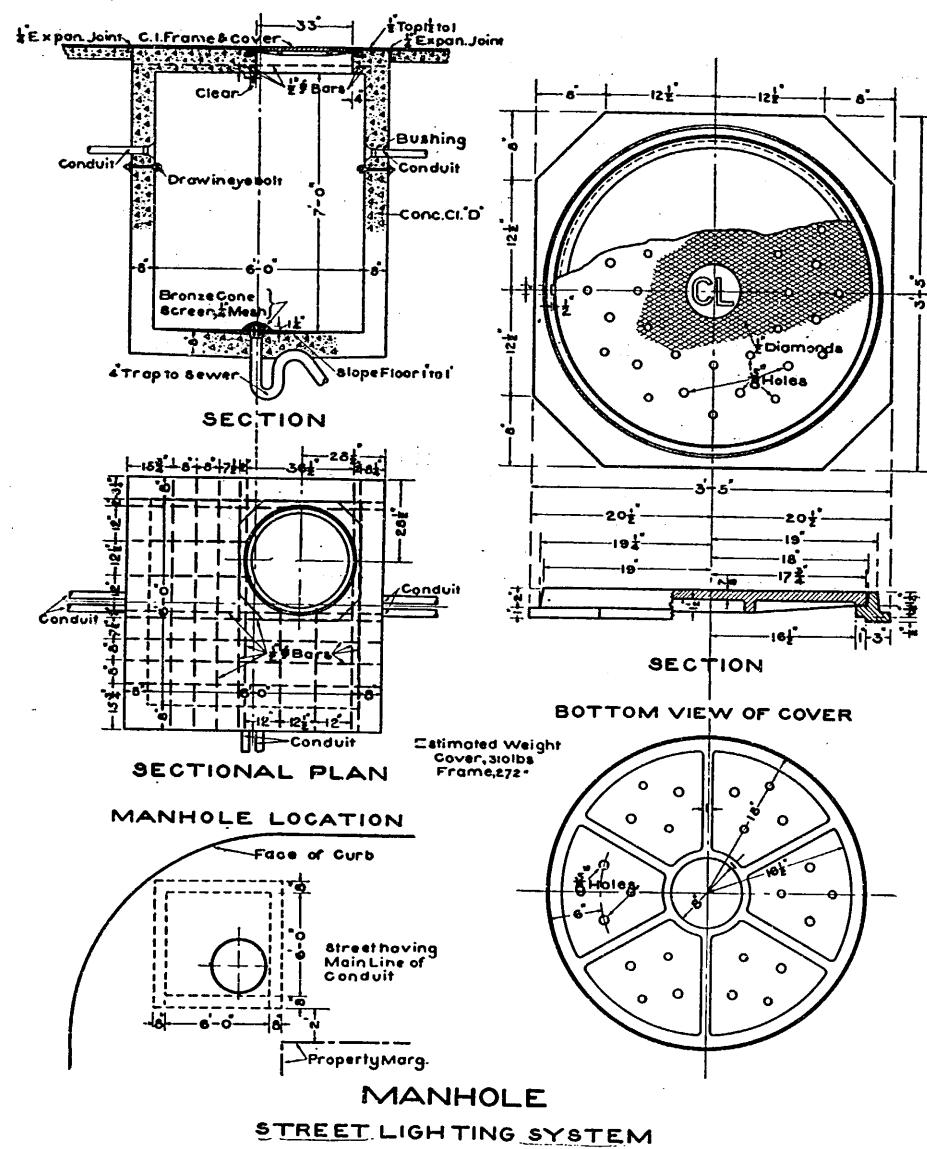
Ratio: 250 to 15 with taps for 15, 16 and 17 volts on the secondary.

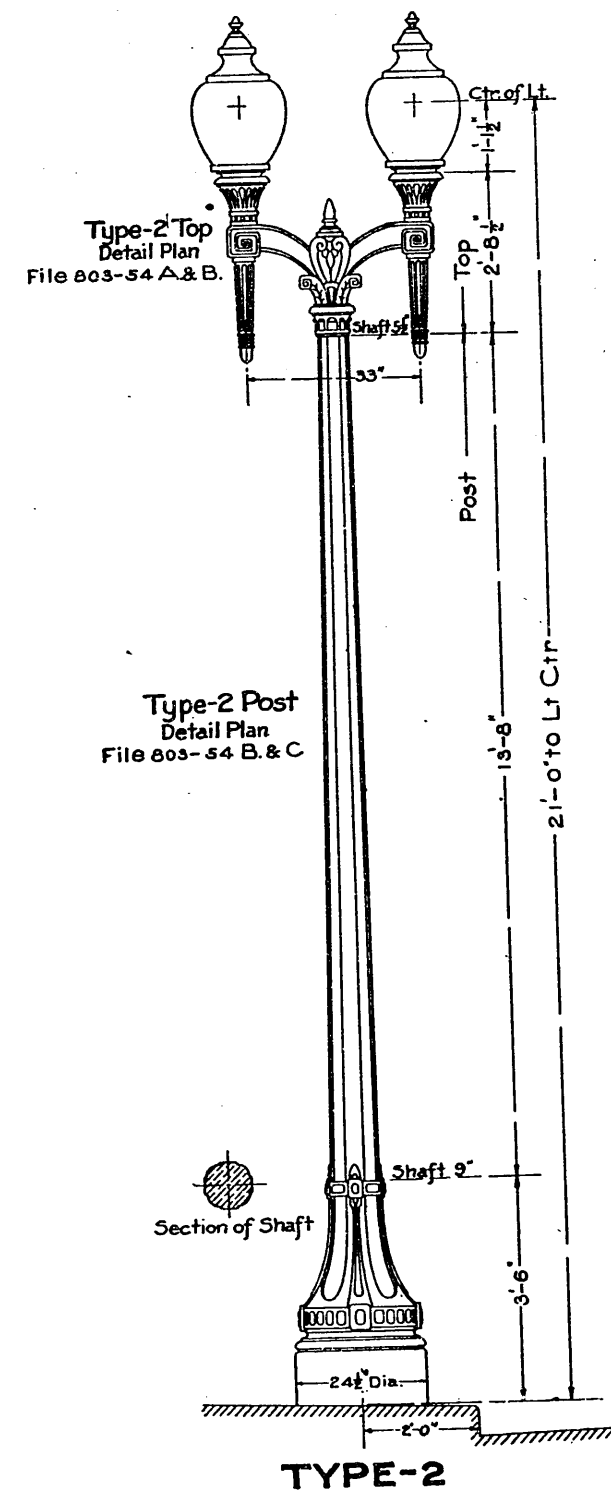
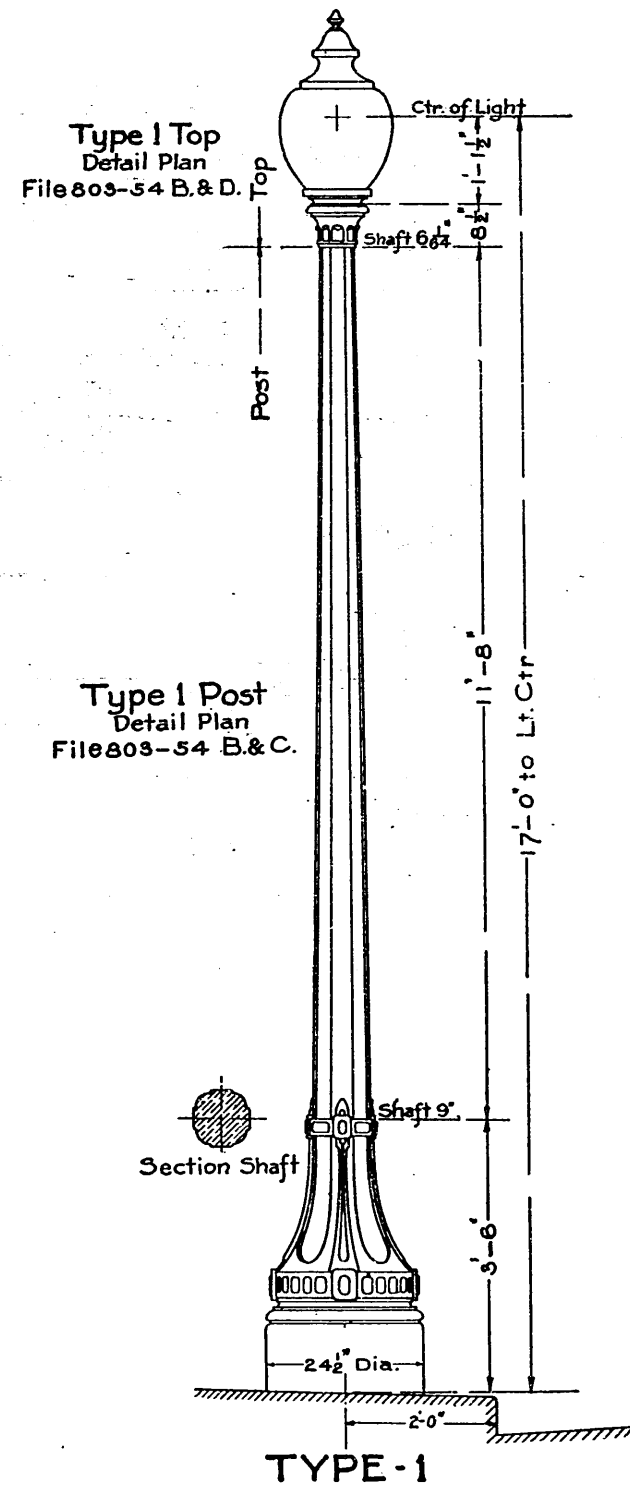
Bidder required to state and guarantee the full load losses.

Temperature rise after 12 hours' operation on full load, 40° Centigrade.

212. STREET SIGNS

Street Signs shall be made of the material specified and in accordance with special plan, File No. 71-62. Payment for street signs shall be made at the price bid each for "Single Street Signs" and "Double Street Signs" and shall include all labor, and material necessary to manufacture and fasten the same in place.





SPECIFICATIONS FOR TIMBER STRUCTURES

213. TIMBER STRUCTURES

(a) MATERIAL

All lumber, timber, hardware and other materials shall conform to the requirements set forth under "Quality of Materials."

(b) CONSTRUCTION DETAILS

(1) Storage of Material

Lumber and timber on the site of the work shall be stored in piles.

Untreated material shall be open stacked at least twelve (12) inches above the ground surface and piled to shed water and prevent warping. When required by the City Engineer it shall be protected from the weather by suitable covering.

The ground underneath and in the vicinity of all material piles shall be cleared of weeds and rubbish.

(2) Workmanship

Workmanship shall be first class throughout. None but competent bridge carpenters shall be employed and all framing shall be true and exact. Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood. Deep hammer marks in wood surfaces shall be considered evidence of poor workmanship and sufficient cause for the removal of the workman causing them. The workmanship on all metal parts shall conform to the requirements as specified for Steel Structures.

(3) Treated Timber

Treated timber shall be carefully handled without sudden dropping, breaking of the outer fibers, bruising or penetrating the surface with tools. It shall be handled with rope slings and no cant dogs, peaveys, hooks or pike poles shall be used.

All cutting, framing and boring of treated timbers shall be done before treatment insofar as is practicable. In waters infested with marine borers, cutting and boring below high water shall be avoided.

All cuts in treated piles or timbers and all abrasions after having been carefully trimmed, shall be coated with two coats of creosote oil and covered with hot roofing pitch.

Before driving bolts, hot creosote oil shall be poured into all bolt holes in such a manner that the entire surface of the hole shall be thoroughly coated with creosote oil. Any unfilled holes, after being treated with creosote oil, shall be plugged with creosoted plugs.

Pile heads after being cut to receive the caps, shall be given three coats of hot creosote oil.

(4) Untreated Timber

In structures of untreated timber, the heads of all piling, ends, tops and all contact surfaces of posts, caps, stringers and bracing shall be thoroughly coated with one brush coat of hot creosote oil. Particular attention is called to the necessity for the avoidance of stains from creosoting on surfaces which are to be painted. Hot creosote shall be poured into all vertical bolt holes exposed to the weather before driving the bolt.

In addition to the above treatment, all depressions or openings around bolt holes, joints or caps which may retain moisture and cause decay, shall be carefully sealed by means of hot asphalt of an approved quality.

(5) Holes for Rods, Bolts, etc.

Holes for drift bolts and boat spikes shall be bored with a bit $\frac{1}{16}$ inch less in diameter than the bolt to be used.

Holes for machine bolts and dowels shall be bored with a bit of the same diameter as the bolt or dowel and holes for truss rods shall be bored with a bit of a diameter $\frac{1}{8}$ inch greater than that of the rod.

(6) Bolts and Washers

Washers of the size and type specified shall be used under all bolt heads and nuts which would otherwise come in contact with wood.

All bolts shall be effectively checked by burring the threads after the nuts have been finally tightened. Vertical bolts shall have the nuts on the lower end.

(7) Countersinking

Countersinking shall be done wherever smooth faces are required.

(8) Framing

All lumber and timber shall be accurately cut and framed to a close fit in such a manner that the joints will have a close fit over the entire contact surfaces. Mortises shall be true to size for their full depth and tenons shall make a snug fit therein. No shimming will be permitted in making joints, nor will open joints be accepted.

(9) Pile Bents

Piles for trestles shall conform to the requirements of Section 65. Driving piles shall conform to the requirements of Section 215.

The location of all piles shall be "spotted" by pegs set to true line and position. The piles shall be driven as accurately as possible in the correct location and to the vertical or batter lines indicated on the plans. In case a pile is driven out of line, it shall be straightened without injury before it is cut off or braced. Piles damaged in driving or straightening, or piles driven below grade, shall be removed and replaced at the contractor's expense. No shimming on top of piles will be permitted.

The piles of any one bent shall be carefully selected as to size, to avoid undue bending or distortion of the sway bracing.

Cut-offs shall be accurately made to insure perfect bearing between the cap and piles of a bent.

(10) Concrete Pedestals:

Concrete pedestals for the support of framed bents shall be carefully finished so that the sills will take even bearing on them. Dowels of not less than three-fourths ($\frac{3}{4}$) inch diameter and projecting at least six (6) inches above the tops of the pedestals, shall be set in them when they are cast for anchoring the sills.

(11) Sills

Sills shall have true and even bearing on piles or pedestals. They shall be drift bolted to piles with bolts of not less than three-fourths ($\frac{3}{4}$) inch diameter and extending into the piles at least six (6) inches. All earth shall be removed from contact with the sills so that there will be free circulation of air around them.

(12) Posts

Posts shall be fastened to sills with dowels of not less than three-fourths ($\frac{3}{4}$) inch diameter extending at least six (6) inches into the posts.

(13) Caps

Timber caps shall be placed to secure an even and uniform bearing over the tops of the supporting posts or piles and to secure an even alignment of their ends. All caps shall be secured by drift bolts not less than three-fourths ($\frac{3}{4}$) inch in diameter extending at least nine (9) inches into the posts or piles. The drift bolt shall be approximately in the center of the pile or post.

(14) Bracing

All pile bents over ten (10) feet high shall be braced transversely at each bent and longitudinally in alternate pairs. Single story bracing shall not exceed twenty (20) feet. The ends of bracing shall be bolted through the pile, post or cap with a bolt not less than five-eighths ($\frac{5}{8}$) inch in diameter. Intermediate intersections shall be bolted or boat spiked, as indicated on the plans. Sway bracing shall extend far enough to lap both upper or lower caps or sills and shall be bolted to the caps or sills at each end.

(15) Stringers

All stringers carrying laminated decking and any stringer varying in depth by more than one-eighth ($\frac{1}{8}$) inch shall be sized to an even depth at bearing points.

Outside stringers shall be butt jointed and spliced, but interior stringers shall be lapped to take bearing over the full width of the cap or floor beam at each end. Joints shall be broken and stringers either toe nailed or drifted, as specified on the plans. Stringers must be of sufficient length to cover two bents, except on sharp horizontal and vertical curves. The ends of lapped stringers shall be separated at least one-half ($\frac{1}{2}$) inch for the circulation of air by means of suitable spacing blocks and shall be securely nailed.

Cross bridging between stringers shall be neatly and accurately framed and securely toe nailed with at least two nails in each end.

(16) 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.

(17) Wheel Guard and Railings

Wheel guards and railing shall be accurately framed in accordance with the plans and erected true to line and grade. Wheel guards shall be laid in sections not less than sixteen (16) feet long. All materials for wheel guards and railings shall be surfaced four sides (s4s).

(18) Trusses

Trusses, when completed, shall show no irregularities of line. Chords shall be straight and true from end to end in horizontal projection and in vertical projection shall show a smooth curve through panel points conforming to the correct camber. All bearing surfaces shall fit accurately. Uneven or rough cuts at the points of bearing shall be cause for rejection of the piece containing the defects. Unless otherwise directed by the City Engineer, all trusses shall be completed, swung free of their falsework and adjusted for line and camber before the handrailing is placed.

(19) Painting

All rails and rail posts shall receive two coats of white paint of the quality specified under Section 64. Metal parts, except hardware, shall be given one coat of shop paint, and after erection, two coats of field paint of the quality specified under Section 64.

(c) MEASUREMENT AND PAYMENT

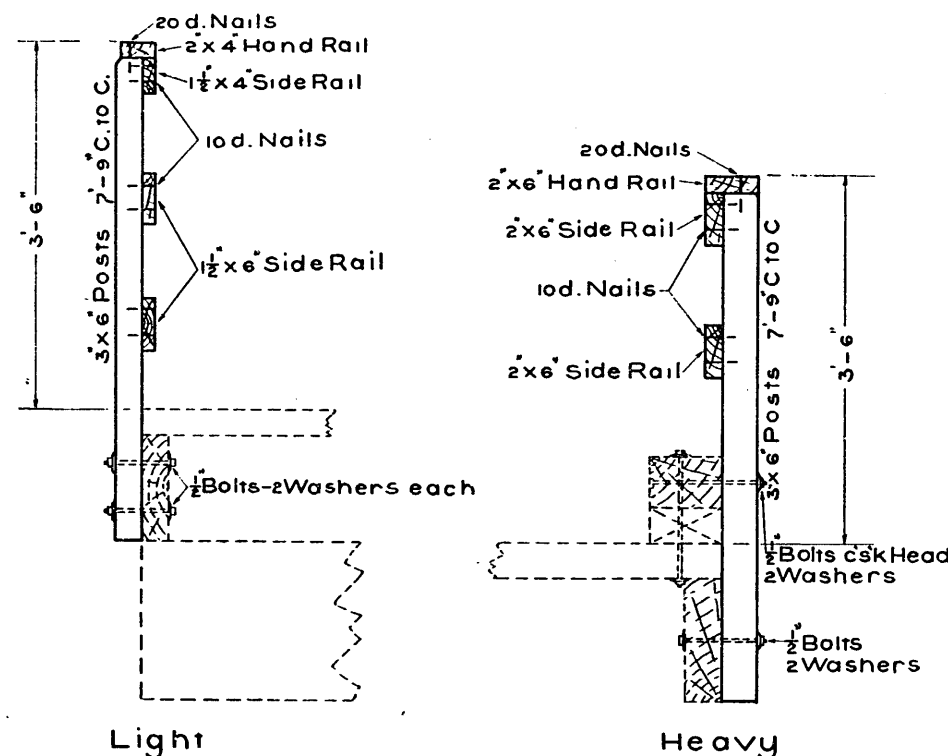
Payment for "Piling" shall be made at the price bid per linear foot of pile in place. Piles shall be measured downward from the "cut-off." Braces shall be measured over all, no reduction being made for diagonal cuts.

Lumber and plank shall be paid for at the price bid per thousand feet board measure (M'BM) for the actual material remaining in the finished structure, which payment shall include the cost of all hardware.

Metal parts, other than hardware, shall be paid for at the price bid per pound in place, the weight being computed in the same manner as specified for Steel Structures.

The contract prices for the pay items of work involved shall be full compensation for the construction of timber structures, which prices shall include the furnishing of materials, preservative treatment, equipment, tools and labor necessary for the erection of the work in a satisfactory manner.

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



WOOD RAILING

SPECIFICATIONS FOR REINFORCED CONCRETE STRUCTURES

General Stipulations

214. WORK INCLUDED

Reinforced concrete structures shall conform to the lines, grades and dimensions shown on the plans. All materials shall conform to the requirements set forth under "Quality of Materials". Construction details, unless otherwise provided for in the plans and special specifications, shall conform to the requirements hereinafter set forth.

Payment will be made for the various items involved, at the prices bid, and such payment shall be in full for the complete structure, including all incidental items shown on the plans or specified in the special specifications, and upon which no bid has been taken.

215. FOUNDATIONS

(a) EXCAVATION

Excavations for all footings, piers, or other structure foundations, shall be made to the lines and grades shown on the plans. Should the character of the foundation material encountered in the opinion of the City Engineer, necessitate a change in foundation dimensions, the City Engineer reserves the right to change the lateral dimensions of foundation pits without limit and to change the depth of such pits up to twenty per cent (20%) of the original depth of the same, without alteration of the unit prices for such items. Any redriving of cribbing, re-bracing or any increase in depth exceeding the above stated 20%, shall be paid for as extra work.

(1) Cofferdams

Cofferdams for foundations below the water line shall be made of tongue and groove material or Wakefield, or steel sheet piling, or other similar tight sheeting, or cribbing driven to sufficient depth below the bottom of the excavation to permit pumping the excavation dry if possible. Where it is impracticable to un-water the foundation pit before placing concrete, lagging shall be driven at least one foot (1') below the bottom of the foundation and the lagging shall be sufficiently tight to permit unwatering of the pit after the tremie seal has been constructed.

Cofferdams shall be braced in such a manner as to maintain their shape and shall be large enough to permit the construction of the forms to the proper lines. No braces or other timbers shall be placed in such a manner as to extend into the concrete. Sufficient clearance between foundation forms and cofferdams shall be allowed to permit of pumping outside of the forms, provided, however, that foundation seals placed by the tremie method shall be poured directly against the cofferdam sides.

After the concrete work has been completed, all cofferdams, lagging, bracing, etc., shall be removed to a point at least one foot (1') below the natural ground line, or to a point at least two feet (2') below extreme low tide; provided, however, that in any navigable channel, such cofferdam material shall be entirely removed above the top of the foundation seal.

(2) Backfilling

All excavations for footings, piers, or other structure foundations, shall be backfilled to the original level of the ground, and the surplus material shall be removed from the site of the structure and disposed of by the contractor; provided however, that the City Engineer may require the surplus material to be evenly spread over the area immediately adjacent to the structure. All backfilling shall be tamped into place in 6 inch layers. Water settling may be used in lieu of tamping where the foundation rests upon piling or where otherwise permitted by the City Engineer.

The cost of backfilling and disposing of surplus material as herein provided shall be included in the price bid for "Foundation Excavation."

(3) Measurement and Payment

Excavations for foundations of any nature shall be paid for at the price bid per cubic yard for "Foundation Excavation," and shall include the removal of all materials encountered of whatever nature, including logs, stumps, boulders, etc.

To determine the amount of material to be paid for as "Foundation Excavation", measurement shall be made of a pit having a bottom area equal to the largest area of the footing and with vertical sides; provided, however, that when any dimension of such bottom area is less than two and one-half feet (2½'), such dimension shall be taken as two and one-half feet (2½').

No allowance shall be made for slope, slides, or swell due to pile driving, or for volume occupied by cofferdams, or for any excess excavation above that herein specified.

(b) PILING

(1) Timber Piling

Timber piling shall conform in all respects to the requirements of Section 65 under "Quality of Materials".

(2) Concrete Piling

Concrete piles shall be precast piles of the dimensions shown on the plans and of such length as shown on the plans or as ordered by the City Engineer.

They shall be cast in a horizontal position of Class "A" concrete. Reinforcement shall be rigidly wired at all intersections, forming one unit, and shall be accurately spaced in the forms. All corners of square piles shall be chamfered. Each pile form shall be completely and immediately filled before pouring the next pile, to insure the absence of horizontal or diagonal cleavage planes. Concrete shall be thoroughly spaded and the forms vibrated by tapping with a wood maul.

Concrete piles shall be kept continuously wet for a period of ten (10) days after casting. They shall not be driven until at least twenty-one (21) days old.

(3) Methods of Driving

All piling shall be accurately spaced and driven vertically or to the batter shown on the plans. A deviation of more than one quarter inch (¼") per foot from specified lines shall not be allowed. No piling shall be driven until the foundation pits in which they are to be driven have been completely excavated.

Unless otherwise specified, piling may be driven either by a drop hammer or a steam hammer. For timber piles, drop hammers shall weigh not less than three thousand pounds (3000 lbs.), and the drop shall be limited to fifteen feet (15'). For concrete piles, drop hammers shall weigh not less than the weight of the pile being driven, and the drop shall be limited to eight feet (8').

For timber piles, steam hammers shall deliver a blow of approximately fifteen thousand (15,000) foot pounds. For concrete piles, steam hammers shall deliver a blow of at least thirty-five hundred (3500) foot pounds per cubic yard of concrete in the pile, but in no case less than ten thousand (10,000) foot pounds per blow.

Jetting, either before driving or during driving of the piles, may be required, when in the judgment of the City Engineer such jetting is necessary. Piles jetted into place shall be driven with the hammer after jetting has been discontinued.

Timber piles shall be fresh headed just before driving and protected from splitting during driving by metal rings. Concrete piles shall be protected during driving by a wood, fiber, or other cushion.

Driving shall be stopped while all piles are far enough above cut-off to insure the removal of all broomed or split material. No timber piling shall be driven to cut-off.

For deep foundations and underwater work, a follower may be used, provided the same be made of seasoned timber, held in place upon the pile head by means of a steel sleeve at least sixteen inches (16") long, into the center of which has been welded a steel diaphragm at least one inch (1") thick, and protected on the top by a metal cap.

Foundation piles shall be driven to refusal if possible, and in no case, unless otherwise specified, shall the safe bearing value of a timber pile be less than twenty tons (20T), computed by the following formulae:

For Drop Hammer, $P = 2 \frac{wh}{s + 1}$

For Single Acting
Steam Hammer $P = 2 \frac{wh}{s + 0.1}$

For Double Acting
Steam Hammer $P = 2h \frac{w+ap}{s + 0.1}$

Where P = bearing value of pile in pounds
w = weight of hammer or moving part in pounds
h = fall or stroke in feet
a = area of piston in square inches
p = steam pressure in pounds per square inch
s = penetration of last blow in inches

After the concrete work has been completed, all cofferdams, lagging, bracing, etc., shall be removed to a point at least one foot (1') below the natural ground line, or to a point at least two feet (2') below extreme low tide; provided, however, that in any navigable channel, such cofferdam material shall be entirely removed above the top of the foundation seal.

(2) Backfilling

All excavations for footings, piers, or other structure foundations, shall be backfilled to the original level of the ground, and the surplus material shall be removed from the site of the structure and disposed of by the contractor; provided however, that the City Engineer may require the surplus material to be evenly spread over the area immediately adjacent to the structure. All backfilling shall be tamped into place in 6 inch layers. Water settling may be used in lieu of tamping where the foundation rests upon piling or where otherwise permitted by the City Engineer.

The cost of backfilling and disposing of surplus material as herein provided shall be included in the price bid for "Foundation Excavation."

(3) Measurement and Payment

Excavations for foundations of any nature shall be paid for at the price bid per cubic yard for "Foundation Excavation," and shall include the removal of all materials encountered of whatever nature, including logs, stumps, boulders, etc.

To determine the amount of material to be paid for as "Foundation Excavation", measurement shall be made of a pit having a bottom area equal to the largest area of the footing and with vertical sides; provided, however, that when any dimension of such bottom area is less than two and one-half feet (2½'), such dimension shall be taken as two and one-half feet (2½').

No allowance shall be made for slope, slides, or swell due to pile driving, or for volume occupied by cofferdams, or for any excess excavation above that herein specified.

(b) PILING

(1) Timber Piling

Timber piling shall conform in all respects to the requirements of Section 65 under "Quality of Materials".

(2) Concrete Piling

Concrete piles shall be precast piles of the dimensions shown on the plans and of such length as shown on the plans or as ordered by the City Engineer.

They shall be cast in a horizontal position of Class "A" concrete. Reinforcement shall be rigidly wired at all intersections, forming one unit, and shall be accurately spaced in the forms. All corners of square piles shall be chamfered. Each pile form shall be completely and immediately filled before pouring the next pile, to insure the absence of horizontal or diagonal cleavage planes. Concrete shall be thoroughly spaded and the forms vibrated by tapping with a wood maul.

Concrete piles shall be kept continuously wet for a period of ten (10) days after casting. They shall not be driven until at least twenty-one (21) days old.

(3) Methods of Driving

All piling shall be accurately spaced and driven vertically or to the batter shown on the plans. A deviation of more than one quarter inch (¼") per foot from specified lines shall not be allowed. No piling shall be driven until the foundation pits in which they are to be driven have been completely excavated.

Unless otherwise specified, piling may be driven either by a drop hammer or a steam hammer. For timber piles, drop hammers shall weigh not less than three thousand pounds (3000 lbs.), and the drop shall be limited to fifteen feet (15'). For concrete piles, drop hammers shall weigh not less than the weight of the pile being driven, and the drop shall be limited to eight feet (8').

For timber piles, steam hammers shall deliver a blow of approximately fifteen thousand (15,000) foot pounds. For concrete piles, steam hammers shall deliver a blow of at least thirty-five hundred (3500) foot pounds per cubic yard of concrete in the pile, but in no case less than ten thousand (10,000) foot pounds per blow.

Jetting, either before driving or during driving of the piles, may be required, when in the judgment of the City Engineer such jetting is necessary. Piles jetted into place shall be driven with the hammer after jetting has been discontinued.

Timber piles shall be fresh headed just before driving and protected from splitting during driving by metal rings. Concrete piles shall be protected during driving by a wood, fiber, or other cushion.

Driving shall be stopped while all piles are far enough above cut-off to insure the removal of all broken or split material. No timber piling shall be driven to cut-off.

For deep foundations and underwater work, a follower may be used, provided the same be made of seasoned timber, held in place upon the pile head by means of a steel sleeve at least sixteen inches (16") long, into the center of which has been welded a steel diaphragm at least one inch (1") thick, and protected on the top by a metal cap.

Foundation piles shall be driven to refusal if possible, and in no case, unless otherwise specified, shall the safe bearing value of a timber pile be less than twenty tons (20T), computed by the following formulae:

For Drop Hammer, $P = 2 \frac{wh}{s + 1}$

For Single Acting
Steam Hammer $P = 2 \frac{wh}{s + 0.1}$

For Double Acting
Steam Hammer $P = 2h \frac{w + ap}{s + 0.1}$

Where P = bearing value of pile in pounds
 w = weight of hammer or moving part in pounds
 h = fall or stroke in feet
 a = area of piston in square inches
 p = steam pressure in pounds per square inch
 s = penetration of last blow in inches

Concrete piles shall show a safe bearing value of at least twenty-five tons (25 T) as determined by loading test in which the safe allowable load shall be taken as one-half of the load which, after forty-eight (48) hours application, causes a permanent settlement of not more than one-quarter inch ($\frac{1}{4}$ ").

(4) **Test Piles**

The contractor shall drive such piles as the City Engineer may direct and load the same in such a manner that the load rests vertically upon the pile and is free to move in a vertical direction. The load shall be applied in such increments as the City Engineer may direct and suitable periods allowed to elapse between the times of applying increments.

After the test has been completed the contractor shall remove the load and all platforms, boxes, etc.

For each pile so tested the contractor shall be paid his bid price per lineal foot for piling in place plus his bid price for "Loading Test Piles." Should no bid be taken on the latter item, the same shall be paid for as provided for extra work.

(5) **Measurement and Payment**

All foundation piling shall be paid for at the price bid per lineal foot for piling in place, and measurement shall be made only of the piling actually left in the completed foundation, except that where concrete piles of certain lengths have been specified or ordered by the City Engineer and cannot be driven to this length, the contractor shall be paid his bid price per lineal foot for the lengths of piles so ordered. All concrete piling not driven to cut-off shall be cut off at the contractor's expense. Concrete piling driven below cut-off shall be built up and the contractor shall be paid therefor at his bid price per lineal foot for concrete piling in place.

The contractor shall be held responsible for determining and ordering the proper length of timber piling.

(c) **CONCRETE**

Concrete shall be of the class specified and shall conform to the requirements set forth in Section 49 under "Quality of Materials."

(1) **Forms**

Forms shall be accurately set to line and grade and adequately braced. Wire ties will be allowed in foundation forms below the ground line where the foundation thickness is twelve (12) inches or less. Form work below the ground line over twelve (12) inches thick and all form work above the ground shall be secured in place by rods or bolts in such a manner that after stripping such bolts may be either entirely removed or removed for a distance of at least one inch (1") below the concrete surface.

Forms for foundations shall conform in quality and workmanship to the specifications for "Forms" for superstructures Section 216.

(2) **Placing Concrete**

Concrete shall be placed by means of a bottom dumping bucket or cart. It shall be brought up in approximately horizontal layers. Mass piers exceeding ten (10) feet in depth and all reinforced walls or other light sections shall be poured through vertical sectional spouts, the end of the spout being not more than six feet

(6') above the concrete at any time. Foundation concrete shall be delivered, placed and otherwise treated as specified for superstructure concrete, Section 216.

Wherever possible foundation excavations shall be pumped dry and kept in this condition during the placing of concrete. Where a foundation seal is provided for on the plans or where, in the judgment of the City Engineer, it is impracticable to un-water the foundation pit, concrete shall be placed by means of a tremie.

The tremie shall consist of a pipe having a diameter of not less than eight inches (8"), equipped with a hopper at the top and suspended by some means giving accurate and immediate control over the raising and lowering of the same. It shall be equipped with a satisfactory device for expelling the water and first filling the tremie.

The tremie pipe shall be kept full to the top at all times, the flow being regulated by raising or lowering the pipe, keeping the lower end continuously buried in the concrete.

Concrete placed by the tremie method shall be placed in still water; only sufficient pumping will be allowed to remove the water raised in the cofferdam by the placing of the concrete. Cofferdam shall be vented at the ground line or low water line to allow the escape of water thus raised without further pumping.

Whenever the area of the foundation requires the concrete to flow more than eight feet (8') from the tremie, additional tremies shall be used.

Concrete poured by the tremie method shall be brought up as evenly as possible and shall be poured continuously until the entire seal is placed. Care shall be taken to cause a minimum disturbance of the fresh concrete. All laitance shall be removed before resuming construction upon any foundation seal.

Foundations sealed by the tremie method and subject to hydrostatic uplift shall not be pumped until the concrete seal has set at least three (3) days.

After the removal of forms all foundation concrete above the ground line, unless otherwise specified, shall be given a Class "C" finish.

Payment for foundation concrete shall be made as specified for superstructure concrete Section 216.

(d) **ANCHOR BOLTS**

All anchor bolts in piers, abutments or other foundations shall be accurately set with a template in pipes at least one inch larger than the bolt, using a washer or steel plate at least four times the diameter of the bolt as an anchorage. The pipes shall be filled with cement grout at the time the bearing plates or other castings are grouted in position.

216. SUPERSTRUCTURES

(a) **ORDER OF CONSTRUCTION**

The component parts of any reinforced concrete structure shall be built in the order shown on the pouring diagram or as directed by the City Engineer. No construction joints other than those provided for will be permitted except as an emergency measure.

When such emergency construction joint is unavoidable, it shall be at right angles to the direction of the main reinforcement at the

point of minimum shear. The contractor will be required to construct such keyways or use such extra reinforcing stubs as the City Engineer may direct. Where an emergency joint is subject to hydrostatic pressure, a sheet copper seal shall be placed in the joint in such a manner as to prevent leakage.

Old concrete at all construction joints other than expansion joints shall be thoroughly cleaned before placing new concrete.

(b) FALSEWORK

Detailed plans for falsework or centering proposed to be used shall be furnished the City Engineer whenever requested, but the approval of such plans or the acquiescence of the City Engineer in the work constructed according thereto, shall not relieve the contractor of the responsibility for satisfactory results.

All falsework shall rest upon a solid footing and the contractor will be required to excavate to such depth as, in the opinion of the City Engineer, is necessary to secure such footing. Where adequate footing cannot, in the opinion of the City Engineer, be secured, all falsework shall be carried on piling.

Falsework shall be erected with as few sub caps as practicable and the workmanship shall be such as to give full bearing at all points of contact between piles, posts, caps and stringers.

No falsework shall be carried upon any bridge, trestle or other structure subject to vibration from passing rail or vehicular traffic.

After completion of the structure, all falsework shall be removed to a point at least one foot (1') below the natural ground line, or two feet below tide; provided, however, that in any navigable channel such falsework shall be entirely removed.

(c) FORMS

Forms shall conform to the shape and dimensions shown on the plans and shall be accurately set to line and grade.

Unless otherwise specified all sheeting in contact with concrete surfaces shall be matched or tongue and groove lumber, sized to uniform thickness and free from wane, warp, splits, loose knots or other defects which will prevent obtaining a smooth tight form.

Posts, stringers, studding and other supporting members shall be of such size and spaced at such intervals as to prevent sagging, bulging or any deviation from the prescribed lines.

All forms shall be thoroughly tied with bolts or rods in such a manner that after stripping such bolts or rods may be either entirely removed or removed for a distance at least one inch (1") below the concrete surface. No wire ties will be permitted.

Columns shall be clamped either with adjustable iron clamps or bolted wooden collars.

To determine the sizes and spacing of form members, ties and clamps, green concrete shall be assumed to weigh one hundred fifty pounds (150 lbs.) per cubic foot.

Form systems for cantilevered copings, curtain beams or other members presenting long, unbroken lines shall be carried on wedges to facilitate bringing the forms to grade just before pouring. Where supports cannot be secured at sufficiently short intervals, such members shall be given the proper camber to absorb deflection. Curb face forms, the bottom of which determines the gutter

line of the roadway, shall on flat grades, be carried in a manner which will permit grade adjustment during pouring.

Forms for columns, wall faces, outside faces of curtain beams, railings, and all similar work shall be thoroughly oiled before placing concrete, using a light colored form oil which will not discolor the concrete.

Forms for concrete copings, handrails and other ornamental members shall either be made of metal or press board or so constructed that each unbroken surface is made of one piece of lumber.

Sheeting for walls, ramps, etc., except where the surface is later to be backfilled, shall be placed horizontally regardless of the grade of the top or bottom of the wall.

All sharp, exposed corners shall be chamfered by means of a triangular strip in the form corners.

Forms for columns, walls, beams, slabs, etc., shall have large cleanout openings at their lowest points, which shall not be closed until just before pouring concrete, and all forms shall be thoroughly cleaned and soaked with water immediately before filling.

Forms may be removed from the various portions of any superstructure at periods after pouring as follows:

Columns and walls not yet supporting loads, three (3) days.

Vertical sides of beams, girders and similar members, five (5) days.

Supporting timbers under any beam, slab, girder or other member subject to bending stress, twenty-one (21) days.

On structures carrying sidewalks or other cantilever sections, posts supporting such sections shall be released in advance of the supports under the main structure.

Form lumber not injured in removal may be re-used, provided that surfaces to be in contact with the concrete shall be thoroughly cleaned.

The foregoing specifications for forms, as regards design, tightness, filleted corners, bracing, alignment removal, re-use and in all other particulars, shall apply to metal forms. The metal shall be of such thickness that the forms shall remain true to shape. All bolts, rivets, etc., shall be countersunk. Clamps, pins and other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injuring the concrete. Special care shall be exercised to keep metal forms free from rust, heavy grease or other foreign matter.

(d) REINFORCING STEEL:

Reinforcing steel shall conform in quality to the requirements set forth in Section 72 under "Quality of Materials". It shall be free from loose scale, excessive rust, or coatings of any character which will reduce the bond between steel and concrete.

(1) Placing Reinforcement:

Reinforcement lists upon or accompanying the plans may be used by the contractor only at his risk. In all cases the location, size, shape and number of bars shall be as shown on the plans which shall take precedence over the tabulated list.

Bars shall be bent cold and shall conform accurately to the shape and dimensions shown on the bending diagram. Bent up bars unless otherwise specified shall be bent up at an angle of

forty five degrees ((45°) and in no case shall the radius of any bend be less than four times the diameter of the bars.

Reinforcement shall be positioned as indicated on the plans or as hereinafter specified, and shall be rigidly blocked and wired in place, using metal supports or concrete blocks and securely tied at each intersection with annealed iron wire of at least twelve gage.

Splicing bars at points not indicated on the plans will not be permitted except as an emergency measure and with the consent of the City Engineer. Such splices shall be at the points of minimum tensile stress and the lap shall be not less than forty (40) diameters of the bar.

Unless otherwise specified the minimum clear space between reinforcing bars and the cover shall be as follows:

Minimum distance between adjacent bars in a layer.....	2½"
Minimum distance between adjacent layers.....	2"
Cover on main bars (except slabs).....	2"
Cover on bottom slab bars.....	1"
Cover on top slab bars (not used as roadway surface).....	1"
Cover on top slab bars (roadway surface over 10" slab).....	1½"
Cover on top slab bars (" " less than 10" slab).....	1"
Cover on main bars in piers and mass footings.....	3"

(2) Payment for Reinforcing Steel

Reinforcing steel shall be paid for at the price bid per pound, computed weight, in place in the completed structure. Measurement will be of the steel in place and no allowance will be made for laps or stubs not shown on the plans. To facilitate computation of weights, the contractor shall furnish the City Engineer with two copies of his shop lists.

For the purpose of computing weights, the following table shall be used:

Size.....	¼"	⅜"	½"	⅝"	¾"	⅞"	1"	1⅛"	1¼"	1½"
Wts. lbs.										
Round.....	167	.38	.67	1.05	1.52	2.06	2.69	3.41	4.21	6.07
Wts. lbs.										
Square.....	22	.49	.86	1.35	1.94	2.64	3.43	4.34	5.35	7.69

(e) CONCRETE

Concrete used in the various parts of the structure shall be of the class specified and shall conform in all respects to the requirements of Section 49 under "Quality of Materials". It shall be mixed with the minimum amount of water which can be used and still give sufficient workability to place properly in the various parts of the structure.

(1) Placing

Columns, walls, and similar high structures of relatively small cross section shall be filled from the top through vertical sectional spouts, the bottom of the spout being kept not more than six feet (6') above the concrete and so arranged that the concrete falls vertically into place without coming into contact with reinforcing steel or other obstructions.

Beams, slabs, floors and similar open sections shall be filled by means of carts or bottom dumping buckets. The concrete shall be placed continuously from one side or end of the section to the

other, using precaution to put the full load upon any given area of form as rapidly as possible. The rate of delivery of concrete to the work shall be such as to insure continuity of placement. No partially completed surface shall be allowed to stand more than forty-five (45) minutes before continuing the placing of concrete thereon. To insure compliance with this provision the City Engineer reserves the right to pass upon the sufficiency of the mixing plant and delivery system before the placing of any section of the work.

No spouting of concrete into place will be permitted.

All concrete shall be thoroughly puddled into place, using all of the following methods:

Spading along the forms with a thin metal perforated spade or fork.

Tapping the forms on the outside with a wooden maul or air hammer.

Vibrating the steel reinforcement by means of an iron bar with a suitable head.

(2) Finish

Roadway surfaces shall be finished as specified for concrete pavement except that the tamping rod and roller may be omitted.

Reinforced concrete sidewalks shall be finished as specified for one course concrete walks, except that the tamping rod and roller may be omitted.

Unless otherwise specified, other parts of any reinforced concrete structure shall be given the following class of finish.

Concrete handrails	Class A
Copings, columns, exposed surfaces of beams, walls, piers, etc.	Class B
All other concrete.....	Class D

(3) Curing:

Roadway surfaces, sidewalks, floors, curbs and similar parts of the structure shall be cured as specified for concrete pavement.

Walls, railings and similar units shall be covered with burlap curtains and kept continuously wet for three (3) days.

(4) Measurement and Payment

Concrete in any superstructure or part thereof shall be paid for at the price bid per cubic yard in place for the class of concrete specified, and measurement shall be taken as the computed volume of the structure as shown on the plans.

SPECIFICATIONS FOR STEEL STRUCTURES

217. MATERIALS

Except where otherwise provided, all members and rivets shall be of structural steel.

Forgings shall be of carbon steel and shall be thoroughly annealed before machine finishing.

Castings shall be of cast steel or cast iron, as specified.

(a) STORAGE OF MATERIALS

All materials stored at the fabricating plant prior to the fabrication of the material shall be properly protected from rust and an accumulation of dirt, oil or other foreign matter. Material which shows any sign of pitting due to rust will not be accepted.

All fabricated material stored prior to shipment shall be subject to the same requirements of storage as the unfabricated material.

(b) STRAIGHTENING MATERIAL

All deformed structural material shall be properly straightened by methods which are non-injurious prior to being laid off, punched or otherwise worked in the shop. Sharp kinks and bends shall be cause for rejection.

(c) WORKMANSHIP AND FINISH

The workmanship and finish shall be first class and equal to the best practice in modern bridge shops. Welding, shearing and chipping shall be neatly and accurately done and all portions of the work exposed to view shall be neatly finished.

218. MILL AND SHOP INSPECTION

(a) NOTICE OF ROLLING AND FABRICATION:

The contractor shall give ample notice to the City Engineer of the beginning of work at the mill and shop, so that inspection may be provided. No material shall be rolled or fabricated before the City Engineer has been notified where the orders have been placed.

(b) FACILITIES FOR INSPECTION

The contractor shall furnish all facilities for the inspection of material and workmanship in the mill and shop and inspectors shall be allowed free access to the necessary parts of the premises.

(c) REJECTIONS

The acceptance of any material or finished members by the inspector shall not be a bar to their subsequent rejection, if found defective. Rejected materials and workmanship shall be replaced promptly or be made good by the contractor.

(d) MEASURING CAMBER

A camber diagram shall be furnished the City Engineer showing the camber at each panel point for each truss, taken from actual measurements while the truss is assembled.

(e) MILL ORDERS AND SHIPPING STATEMENTS

The contractor shall furnish the City Engineer with as many copies of mill orders and shipping statements as the City Engineer may direct. The weights of the individual members shall be shown.

(f) WEIGHING

All structural steel shall be weighed in the presence of and certified to by the inspector. The contractor shall supply satisfactory scales and shall perform all the work involved in handling and weighing the various members. Car weights will not be accepted. Rivets, pins and other small parts shall be shipped in boxes and kegs and a list and description of the contained material and its weights shall be marked on the outside of the container.

The weight of all tools and erection material shall be kept separate.

(g) LOADING AND UNLOADING

The loading, transportation, unloading and piling of the structural material shall be so conducted that the metal will be kept clean and free from injury from rough handling.

219. WORKMANSHIP

(a) SHOP WORK

(1) Shop Plans

The contractor will be required to furnish the City Engineer with all shop detail plans required for fabrication of the steel. The original drawings may be made either on paper or cloth but the details must be drawn in ink so that the prints will be clear and legible. Only complete sets of drawings, which have been checked, will be accepted for approval. Casting details, however, may be submitted for approval previous to the other details. Shop plans shall follow the design plans and the required strength shall be developed as shown in the plans and specifications. When submitting shop plans for approval, two sets of shop plans shall be furnished the City Engineer, who will retain one set and return the other either approved or with corrections marked thereon. After the plans have been approved, four sets of shop plans shall be furnished the City Engineer. All shop plans shall be submitted for approval at least fifteen days before fabrication is started and no material shall be fabricated until the plans have been finally approved by the City Engineer.

The City Engineer's approval of any shop plan is understood to be an acceptance of the character and sufficiency of the details and not a check on any dimensions.

(2) Changes and Substitutions

No changes shall be made in any drawing after it has been approved except by the consent or direction of the City Engineer in writing.

Substitutions of sections having different dimensions than those shown on the plans shall be made only when approved in writing by the City Engineer. Should the substitution of heavier members be allowed upon the contractor's request, no extra weight will be allowed over the original design section.

(3) Rivet Holes

When reaming is not required, holes in material three-fourths ($\frac{3}{4}$) inch or less in thickness may be punched full size. Holes in material more than three-fourths ($\frac{3}{4}$) inch in thickness shall be sub-punched and reamed, or drilled from the solid.

(4) Punched Holes

Full size punched holes shall be one-sixteenth inch ($\frac{1}{16}$ ") larger than the nominal diameter of the rivet. The diameter of the die shall not exceed the diameter of the punch by more than three thirty-seconds inch ($\frac{3}{32}$ "). Holes must be clean cut, without torn or ragged edges. If any holes must be enlarged to admit the rivets, they shall be reamed.

(5) Accuracy of Punched Holes

The punching of holes shall be so accurately done that, after assembling the component parts of a member, cylindrical pins one-eighth ($\frac{1}{8}$) inch smaller than the nominal diameter of the punched hole may be passed through at least seventy-five of any group of one hundred (100) contiguous holes in the same surface or in like proportion for any group of holes. If this requirement is not fulfilled, the badly punched pieces shall be rejected. If any holes will not pass a pin three-sixteenths ($\frac{3}{16}$) inch smaller than the nominal diameter of the punched holes, this shall be cause for rejection.

(6) Drilled Holes

Drilled holes shall be one-sixteenth ($\frac{1}{16}$) inch larger than the nominal diameter of the rivet. Burrs on the outside surfaces shall be removed with a tool producing a one-sixteenth ($\frac{1}{16}$) inch fillet around the edge of the hole.

(7) Sub-Punched and Reamed Holes

Sub-punched and reamed holes for rivets having diameters greater than three-fourths ($\frac{3}{4}$) inch shall be punched three-sixteenths ($\frac{3}{16}$) inch smaller than the nominal diameter of the rivet, and for rivets having diameters three-fourths ($\frac{3}{4}$) inch or less the holes shall be punched one-sixteenth ($\frac{1}{16}$) inch less than the nominal diameter of the rivet. The punch and die shall have the same relative sizes as specified for full size punched holes. After punching, the holes shall be reamed to a diameter one-sixteenth ($\frac{1}{16}$) inch larger than the nominal diameter of the rivet. Burrs resulting from reaming shall be removed with a tool producing a one-sixteenth ($\frac{1}{16}$) inch fillet around the edge of the hole.

Reaming of rivet holes shall be done with twist drills or with short taper reamers. Reamers preferably shall not be directed by hand. No oil or grease shall be used as a lubricant.

(8) Accuracy of Reamed and Drilled Holes

Reamed or drilled holes shall be cylindrical and perpendicular to the member and their accuracy shall be the same as specified for punched holes except that, after reaming or drilling, eighty-five (85) of any group of one hundred (100) contiguous holes in the same surface, or in like proportion for any group of holes, shall not show an offset greater than one thirty-second ($\frac{1}{32}$) inch between adjacent thicknesses of metal.

(9) Drifting of Holes

The drifting done during assembling shall be only such as to

bring the parts into position, and not sufficient to enlarge the holes or distort the metal.

(10) Reaming

All stringer and floor beam connections, all main members and their connections and such other rivet holes as are indicated on the plans shall have sub-punched and reamed rivet holes or shall be drilled from the solid. This requirement shall not apply to rivet holes in top and bottom chord lateral members, lateral hangers, truss and girder sway bracing and to the lateral plates, connection angles, etc., connecting these members to the main members of the structure. Reaming shall be done after the pieces forming a built member are assembled and firmly bolted together. No interchange of reamed parts will be permitted.

Holes for field connections in main truss members shall be reamed with the entire truss assembled. All stringer and floor beam connections shall be reamed to a steel template not less than one inch thick.

(11) Shop Assembling

All surfaces of metal to be in contact when assembled shall be carefully painted one coat of the paint specified for the shop coat. The paint shall be applied on surfaces free from dirt, loose mill scale or other foreign matter and the parts shall be assembled while the paint is plastic.

The component parts of the built member shall be assembled, drift pinned to prevent lateral movement, and firmly bolted to draw the parts into close contact before reaming, drilling or riveting is begun. At least twenty-five (25) per cent of the holes should be bolted up and the City Engineer may require fifty (50) per cent. Assembled parts shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation.

The member shall be free from twists, bends or other deformations.

Preparatory to shop riveting where the rivet holes are punched full size, they shall be cleared for the admission of the rivets by reaming.

End connection angles, stiffeners, angles, etc., shall be carefully adjusted to correct locations and rigidly bolted, clamped or otherwise firmly held in place until riveted.

(12) Match-Marking

Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections, shall be match-marked, and diagram showing such marks shall be furnished to the City Engineer.

(13) Rivets

The diameter of rivets indicated upon the plans shall be understood to mean their diameter before heating.

Heads of driven rivets shall be of approved shape, concentric with the shanks, true to size, full neatly formed, free from fins and in full contact with the surface of the member.

(14) Field Rivets

Field rivets, for each size and length, shall be supplied in excess of the actual number to be driven to provide for losses due to

misuse, improper driving or other contingencies. Rivets shall be free from furnace scale on their shanks and from fins on the under side of the machine formed heads.

(15) Bolts and Bolted Connections

Bolted connections shall not be used unless specifically authorized. Where bolted connections are permitted the bolts furnished shall be unfinished bolts, (ordinary machine bolts) or turned bolts as specified or directed by the City Engineer.

(16) Unfinished Bolts

Unfinished bolts shall be standard bolts with hexagonal heads and nuts. The use of "button head" bolts will not be permitted. Bolts transmitting shear shall be threaded to such a length that not more than one thread will be within the grip of the metal. The bolts shall be of lengths which will extend entirely through their nuts but not more than one-fourth ($\frac{1}{4}$) inch beyond them. The diameter of the bolt holes shall be one-sixteenth ($\frac{1}{16}$) inch greater than the diameter of the bolts used.

(17) Turned Bolts

Holes for turned bolts shall be carefully reamed or drilled and the bolts turned to a driving fit by being given a finishing cut. The threads shall be entirely outside of the holes and the heads and nuts shall be hexagonal. Approved nutlocks shall be used on all bolts unless permission to the contrary is secured from the City Engineer. When nutlocks are not used, round washers having a thickness of one-eighth ($\frac{1}{8}$) inch shall be placed under the nuts.

(18) Riveting:

Rivets shall be heated uniformly to a light cherry red color and shall be driven while hot. The heating of the points of rivets more than the remainder will not be permitted. When ready they shall be free from slag, scale and other adhering matter and when driven they shall completely fill the hole. Burned, burred or otherwise defective rivets, or rivets which throw off sparks when taken from the furnace or forge shall not be driven.

Loose, burned, badly formed or otherwise defective rivets shall be cut out. Caulking and recupping of rivet heads will not be allowed. In cutting out defective rivets care shall be taken not to injure the adjacent metal and if necessary, the rivet shanks shall be removed by drilling.

Countersinking shall be neatly done and countersunk rivets shall completely fill the holes.

Shop rivets shall be driven by direct-acting riveters where practicable. The riveting machine shall retain the pressure for a short time after the upsetting is complete.

Pneumatic hammers shall be used for field riveting except when the use of other hand tools for riveting is permitted by the City Engineer.

(19) Edge Planing

Sheared edges of material more than five-eighths ($\frac{5}{8}$) inch in thickness shall, when required by the City Engineer, be planed to a depth of not less than one-eighth ($\frac{1}{8}$) inch. Re-entrant cuts shall be filleted before cutting.

(20) Planing of Bearing Surface:

Ends of columns taking bearing upon base and cap plates shall be milled to true surfaces and correct bevels after the main section of these members and the end connection angles have been fully riveted.

Caps and base plates of columns and the sole plates of girders and trusses shall have full contact when assembled. The plates, if warped or deformed, shall be hot-straightened, planed or otherwise treated to secure an accurate, uniform contact. After being riveted in place, the excess metal of countersunk rivet heads shall be chipped smooth and flush with the surrounding metal and the surfaces which are to come in contact with other metal surfaces shall be planed or milled, if necessary to secure proper contact. Correspondingly, the surfaces of base and sole plates which are to come in contact with masonry shall be rough finished, if not free from warps or other deformations.

Surfaces of cast pedestals and shoes which are to come in contact with metal surfaces shall be planed and those which are to take bearing upon the masonry shall be rough finished.

In planing the surfaces of expansion bearings the cut of the tool shall be in the direction of expansion.

Surfaces of bronze bearing plates intended for sliding contact shall be carefully milled and polish finished.

(21) Abutting Joints

Abutting ends of compression members shall, after the members have been riveted, be accurately faced to secure an even bearing when assembled in the structure.

Ends of tension members at splices shall be rough finished to secure close and neat but not necessarily contact fitting joints.

(22) End Connection Angles

End connecting angles of floor beams and stringers shall be flush with each other and accurately set as to position and length of member. In general, end connection angles shall not be finished unless required by the City Engineer. However, faulty assembling and riveting may be cause for requiring them to be milled, in which case their thickness shall be reduced not to exceed one-sixteenth ($\frac{1}{16}$) inch, nor shall their rivet bearing value be reduced below design requirements.

(23) Built Members

The several pieces forming one built member shall be straight and close fitting. Such members shall be true to detailed dimensions and free from twists, bends, open joints or other defects resulting from faulty fabrication and workmanship.

(24) Lacing Bars

The ends of lacing bars shall be neatly rounded unless otherwise indicated.

(25) Web Plates

Web plates of girders having no cover plates may be detailed with the top edge of the web flush with the backs of the flange angles. Any portion of the plate projecting beyond the angles shall be chipped flush with the backs of the angles. Web plates of girders having cover plates may be one-half ($\frac{1}{2}$) inch less in width than the distance back to back of flange angles.

When web plates are spliced, not more than three-eighths ($\frac{3}{8}$) inch clearance between ends of plates will be allowed.

(26) Web Stiffeners

End stiffener angles of girders and stiffener angles intended as supports for concentrated loads shall be milled or ground to secure a uniform, even bearing against the flange angles. Intermediate stiffener angles shall fit sufficiently tightly to exclude water after being painted.

(27) Web Splices and Fillers

Web splice plates and fillers under stiffeners shall fit within one-eighth ($\frac{1}{8}$) inch at each end.

(28) Eye-Bars

Eye-bars shall be straight and true to size and shall be free from twists, folds in the neck and head, or any other defect affecting their service strength. Heads shall be made by upsetting, rolling or forging. Welds in the body portions or in the head of bars will not be permitted. The form of the heads may be determined by the dies in use at the works where the eye-bars are to be made, if satisfactory to the City Engineer. The thickness of head and neck shall not overrun more than one-sixteenth ($\frac{1}{16}$) inch.

(29) Boring

Before boring, each eye-bar shall be properly annealed and carefully straightened. Pinholes shall be located on the center line of the bar and in the centers of the heads. The holes in the ends of the bars shall be bored simultaneously and be so accurately located that when the bars of the same truss panels are placed in a pile the pins may be completely inserted in the pinholes without driving. All eye-bars intended for the same locations in the trusses shall be interchangeable.

(30) Annealing

All eye-bars shall be annealed by heating uniformly to the proper temperature followed by slow and uniform cooling in the furnace. The temperature of the bars shall be under full control at all stages.

Forged pins, and other steel parts requiring their full strength, which have been partially heated shall be subsequently annealed. Slight bends in pieces of secondary importance may be made without heating the metal. Crimped web stiffeners need not be annealed.

(31) Pins and Rollers

Pins and rollers shall be accurately turned to detailed dimensions and shall be smooth, straight and free from flaws. The final surface shall be produced by a finishing cut.

(32) Forged Pins

Pins having a diameter greater than six (6) inches shall be forged and annealed.

(33) Bored Pins

Pins larger than eight (8) inches in diameter shall have a hole not less than two (2) inches in diameter bored longitudinally through their centers. Pins showing defective interior conditions shall be rejected.

(34) Boring Pin Holes

Pin holes shall be bored true to detailed dimensions, smooth and straight, at right angles with the axis of the member and parallel with each other unless otherwise required. A finishing cut shall always be made.

The length outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from detailed dimensions more than one-thirty-second ($\frac{1}{32}$) inch. Boring of holes in built up members shall be done after the riveting is completed.

(35) Pin Clearances

The difference in diameter between the pin and the pin hole shall be not more than one-thirty-second ($\frac{1}{32}$) inch. All pins shall be fitted to their respective pin holes in the assembled member and numbered.

(36) Welds

Welding of steel shall not be permitted except to remedy minor defects and then only with the approval of the City Engineer.

(37) Screw Threads

Screw Threads shall make close fits in the nuts and shall be U. S. Standard, except that for diameters greater than one and one-half ($1\frac{1}{2}$) inches, they shall be made with six (6) threads to the inch.

(38) Pilot and Driving Nuts:

Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

(b) ERECTION

(1) Field Inspection

All work of erection shall be subject to the inspection of the City Engineer who shall be given all facilities required for a thorough inspection of workmanship.

Material and workmanship not previously inspected will be inspected after its delivery to the site of the work.

(2) Storage

All material shall be stored in such manner as to prevent deterioration by rust or loss of minor parts. No material shall be piled so as to rest upon the ground or in water, but must be placed on suitable skids or platforms.

(3) Falsework

All falsework shall conform to the specifications for falsework as specified under "Reinforced Concrete Structures".

(4) Handling Members

The field assembling of the component parts of a structure shall involve the use of methods and appliances not likely to produce injury by twisting, bending or otherwise deforming the metal. No member slightly bent or twisted shall be put in place until its defects are corrected and members seriously damaged in handling shall be rejected.

(5) Alignment

Before beginning the field riveting the structure shall be adjusted to correct grade and alignment and the elevations of panel

points (ends of floor beams) properly regulated. For truss spans a slight excess camber will be permitted while the bottom chords are being riveted, but the correct camber and relative elevations of panel points shall be secured before riveting the top chord joints, top lateral system and sway bracing.

(6) Straightening Bent Material

The straightening of bent edges of plates, angles and other shapes shall be done by methods not likely to produce fracture or other injury. The metal shall not be heated unless permitted by the City Engineer, in which case the heating shall not be to a higher temperature than that producing a dark cherry red color. After heating the metal shall be cooled as slowly as possible.

Following the completion of the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of incipient or other fractures.

(7) Assembling and Riveting

All field connections and splices shall be securely drift pinned and bolted before riveting. Important connections in trusses, girders, floor system, etc., shall have at least fifty (50) per cent of the holes filled. An ample number of drift pins shall be used to prevent slipping at joints and splices. Structures erected by the cantilever method shall be field bolted to seventy-five (75) per cent full strength unless otherwise permitted by the City Engineer.

The results obtained in the field assembling and riveting of the members of a structure shall conform to the requirements for shop assembling and riveting. Field driven rivets shall be inspected and accepted before being painted.

Field riveting shall be done before the false work is removed, unless special permission to the contrary is given by the City Engineer.

No riveting shall be done at compression joints until the blocking has been adjusted so that there will be full and even bearing over the entire joint.

Railings shall not be riveted until the falsework has been released and the deck placed. Sidewalk railings on concrete walks shall be bolted instead of riveted.

(8) Adjustment of Pin Nuts

All nuts on pins shall be thoroughly tightened and the pins so located in the holes that the members shall take full and even bearing upon them. All pins shall have sufficient thread to allow "burring" after the nuts are tightened.

(9) Setting Anchor Bolts

Anchor bolts shall be set in accordance with the requirements specified under Foundations, Section 215.

(10) Setting Rocker Bearings

Rocker bearings at the expansion end of spans shall be adjusted to the proper position for the prevailing temperature at the time of erection.

(c) PAINTING

Unless otherwise provided by the special specifications, all steel structures shall be given one shop and two field coats of paint as specified under "Quality of Materials," and as follows:

(1) Shop Painting

All structural steel shall be thoroughly cleaned of all mill scale, dirt, rust, chips, oil, grease or other deleterious material which will in any way affect the bond between the paint and the steel. The cleaning shall be done by thorough scraping and wire brushing. Grease and oil shall be removed by a cloth wet with benzine. No painting shall be started until the inspector has examined the surfaces to be painted and accepted the same as suitable for painting. All surfaces shall be thoroughly dry and free from moisture.

Shop painting shall be done immediately after fabrication.

Surfaces in contact riveted in the shop shall not be painted.

Surfaces inaccessible after assembling, but not in contact, shall be given a shop coat of paint before assembling.

The steel shall not be handled until thoroughly dry.

(2) Field Painting

When the erection work is complete, including all riveting, straightening of bent metal, etc., all adhering rust, scale, dirt, grease or other foreign matter shall be removed as specified under shop painting.

As soon as the field cleaning is done to the satisfaction of the City Engineer, the heads of field rivets, bolts and any surfaces from which the shop coat has become worn or has otherwise become defective, and all shipping and erection marks, shall be thoroughly covered with one coat of the same paint as used in the shop and permitted to become thoroughly dry before the first field coat is applied.

The field coats shall then be applied, the second coat being thoroughly dry before the final coat is applied. At least five (5) days shall be allowed between successive coats.

(3) Application of Paint

All paint shall be of the mixtures specified and shall be applied in a thorough and workmanlike manner.

In general, brush application is required on all outside or easily accessible surfaces. However, if experienced operators are employed, permission may be given by the City Engineer to use air brushes, subject to his direction.

All brush coats shall be applied by means of round or oval brushes, except in places where it is impossible to use them. Particular care must be exercised to brush out thoroughly the paint film and to obtain in all cases a heavy, even coat on all surfaces. In no case will dipping be allowed as a means of applying the shop coat. All shop marks shall be painted on surfaces which have been previously given a coat of shop paint.

Great care must be exercised in thoroughly covering all inside surfaces of members and places of difficult accessibility, as shoes, panel points, etc.

On surfaces which are inaccessible for paint brushes, the paint shall be applied with sheep skin daubers specially constructed for the purpose.

Paint shall not be applied when the atmospheric temperature is below 40 degrees or above 100 degrees Fahrenheit, nor in wet, damp or foggy weather.

All work, including manufacture and mixing of paints, shall be subject to the direction and rejection of the City Engineer, and he or his authorized representative shall have full access at all times to all places where paints are being mixed or manufactured and shall be given reasonable assistance by the contractor in sampling or testing the proposed paints.

All metal coated with impure or unauthorized paint shall be thoroughly cleaned and repainted to the satisfaction of the City Engineer at the expense of the contractor.

If it is necessary in cool weather to thin paint in order that it shall spread more freely, this shall be done only by heating in hot water.

(4) Machine Finished Surfaces

With the exception of abutting chord and column splices, column and truss shoe bases, machine finished surfaces shall be coated, as soon as practicable after being accepted, with a hot mixture of white lead and tallow before removal from the shop. Surfaces of iron or steel castings milled for the purpose of removing scales, scabs, fins, blisters or other surface deformations shall generally be given a coat of shop paint.

The composition used for coating machine finished surfaces shall be mixed in the following proportions:

- 4 pounds pure tallow
- 2 pounds white lead
- 1 quart pure linseed oil

(d) MEASUREMENT AND PAYMENT

(1) Basis of Payment

The contract price for structural steel shall include all material, labor, supplies and equipment used in the manufacture, fabrication, transportation, erection and painting of all structural steel necessary for the proper completion of the work.

Payment will be made at the price bid per pound in place, unless otherwise provided in the special provisions. For the purpose of payment, such minor items as bearing plates, pedestals, anchor bolts, etc., shall unless otherwise provided, be considered as structural steel, even though made of other materials.

(2) Weight Paid For

Payment for Structural Steel shall be based on the weight of metal in the fabricated structure, including field rivets shipped, providing such rivets do not exceed by ten (10) per cent the weight of the rivets required. The weight of erection bolts, pilot and driving nuts, field paint and all boxes, crates or other containers used for packing, together with sills, struts and rods used for supporting members during transportation, shall be excluded.

Weights paid for shall be shop-scale weights providing such weights are within the allowable variation of the computed weights as hereinafter specified.

(3) Variation in Weight

The allowable variation of the total scale weight of any structure above the weight as computed from the approved shop plans, shall not exceed two (2) per cent. Payment shall not be made for any greater excess in weight but an additional allowance of

five-tenths (0.5) of one per cent of the total computed weight may be made for shop paint.

If there is a deficiency in scale weight of any member of more than two (2) per cent of the computed weight, it may be cause for rejections.

(4) Computed Weight

The weight of steel shall be assumed at four hundred ninety (490) pounds per cubic foot. The weight of cast iron shall be assumed at four hundred fifty (450) pounds per cubic foot.

The weight of rolled shapes and of plates up to and including thirty-six (36) inches in width, shall be computed on the basis of the nominal weights and dimensions as shown on the approved shop drawings, deducted for copes, cuts, etc.

The weights of plates wider than thirty-six (36) inches shall be computed on the basis of their dimensions, as shown on the approved shop drawings, deducting for cuts, etc. To this shall be added one-half of the allowable percentage of overrun in weight given in the Standard Specifications for Structural Steel for Bridges, Serial Designation A7-24, of the American Society for Testing Materials.

The weight of heads of shop driven rivets shall be included in the computed weight, assuming the weights to be as follows.

Diameter of Rivet	Weight for 100 Heads
1/2"	4.5
5/8"	8.6
3/4"	14.3
7/8"	21.3
1"	31.0

The weight of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of ten (10) per cent for fillets and overrun.

Examined and approved by the

BOARD OF PUBLIC WORKS, January 4, 1932.

G. W. ROBERGE,
Secretary.

J. D. ROSS,
Chairman.

INDEX

	Page
Abbreviations	1-3
Abutting Joints in Structural Steel.....	227
Additional Concrete Base	163
Adjustment of Cast Iron Valve Boxes.....	183
Inlets	183
Manholes, Catch Basins, etc., Covers.....	183
Wood Curb and Gutter.....	50
Alignment for Sewers	84
Watermains	117
Alleys, Asphalt	170
Alley Catch Basins	182
Alley Crossings	181
Alley Crossing, Concrete	66
Alley Crossing, Private	66, 181
Alley Pavement	177
Allowable Variations in Dimensions of Pipes and Sockets, Sand	
Cast	122
Allowable Variations in Dimensions of Centrifugally Cast Pipe.....	127
Alloys	17
Aluminum Alloy	17
Anchor Bolts	217
Annealing	228
Applications for Waste Earth.....	46
Approaches	156
Approaches Paid as Earthwork.....	46
Armor, Curb	26
Armored Concrete Curb	178
Asphalt Alleys	170
Filler Mixture	165
Gutters	170
Pavement, General Requirements.....	163
Pavement, Payment for	172
Pavement, Paint Coat	167
Pavement Requirements for Finished Pavement.....	169
Plant Operation	170
Refined	164
Asphaltic Cement	165
Asphaltic Concrete Pavement.....	173
Asphaltic Concrete Pavement, Payment for.....	174
Assignment of Contract.....	4
Backfilling behind Concrete Retaining Wall.....	79
Backfilling by Street Department.....	86
Backfilling Sewer Trenches.....	86
Sewer Tunnels	86
Street Lighting Trench.....	196
Watermain Trenches	118

	Page
Banding Cut Cast Iron Pipe.....	122
Barricades, Contractor to Provide.....	11, 16
Base, Additional for Pavement.....	163
Base for Brick Pavement.....	175
Base, Concrete for Pavement.....	163
Beacons, Warning.....	184
Bearing Surface, Planing in Structural Steel.....	227
Bidder, Errors and Omissions.....	3
Bidders to Examine Location of Work.....	3
Bills of City Departments Against L. I. D.....	12
Binder for Asphalt.....	166
Bituminous Filler.....	27
Bituminous Joints in Pipe Sewers.....	88
Block, Concrete Manholes.....	92
Blocking for Watermain.....	137
Bolted Connection of Structural Steel.....	226
Bonding of Conduits.....	196
Boring.....	228
Boulders—Disposal of, in Watermain Trench.....	118
Box Drains.....	51
Box Sewers, Wooden.....	90
Boxes, Wood Valve.....	132
Bracing in Timber Structures.....	210
Brick Gutters.....	180
Laying in Sewers.....	89
Manholes.....	92
Pavement.....	174
Pavement, Filler for.....	27
Pavement, Payment for.....	176
Sewers, Payment for.....	90
Bricks.....	17
Bridges, Asphalt, Wearing Surface.....	168
Bridge Hardware.....	18
Bronze Alloy.....	17
Bulkhead, Concrete Crib.....	80
Cable, Lead Covered.....	29, 197
Camber, in Steel Structures.....	222
Caps for Trestles.....	210
Castings, Steel.....	41
Cast Iron, General Specification.....	18
Cast Iron Pipe, Conditions for Delivery.....	128
Table of Weights.....	121, 126
Cast Iron Valve Boxes.....	135
Cast Iron Valve Boxes, Adjusting.....	183
Catch Basins.....	94
Alley.....	182
Cover, Adjusting.....	183
Moving.....	95
Rebuilding.....	95
Caulking Watermain Joints.....	129
Cement, Asphaltic.....	165
Cement, High Early Strength.....	19

	Page
Cement Joints in Pipe Sewers.....	88
Cement, Portland.....	19
Centrifugally Cast Iron Pipe.....	125
Centrifugal Concrete Pipe.....	20
Changes in Plans and Quantities.....	7
City Engineer, Meaning of.....	1
Claims, for Extras.....	7
Clay Sewer Pipe.....	39
Clearing and Grubbing for Grading.....	45
Clearing and Grubbing for Sidewalk.....	60
Coal Tar Creosote Oil.....	22
Coating for Cast Iron Pipe.....	124
Cofferdams.....	213
Computed Weight of Structural Steel.....	233
Concrete, General Specification.....	22
Alley Crossings.....	66
Base Additional.....	163
Base for Pavement.....	163
Block Manholes.....	92
Block Valve Chamber.....	132
Bricks.....	18
Crib Bulkhead.....	80
Cross Walk.....	61
Curb.....	177
Curb and Gutter.....	49
Curb, Armored.....	178
Curb, Integral.....	179
Gutters for Stairway.....	65
In Cold Weather.....	25
In Reinforced Concrete Structures.....	216, 220
Manholes.....	93
Mixing.....	25
Pavement.....	157
Pavement, Curing of.....	161
Paving, Expansion Joints for.....	159
Pavement, Payment for.....	163
Pedestals.....	210
Piling.....	36, 214
Pipe, Centrifugal.....	20
Post Foundations.....	202
Post Fence.....	51
Retaining Walls.....	76
Sewer Pipe.....	41
Sewers.....	90
Sidewalks.....	61
Sidewalk, Corrugated.....	64
Sidewalks, General Requirements.....	63
Sidewalks, One Course.....	63
Sidewalk, Payment for.....	64
Sidewalk Replaced.....	64
Sidewalk, Replacing.....	183
Sidewalks, Two Course.....	61
Stairway.....	65

	Page
Stop and Side Stop.....	181
Underpinning	52
Walls, Reinforced	80
Wearing Surface	163
Condition of Delivery of Cast Iron Pipe.....	128
Conduit	26, 195
Conduit, Payment for	197
Connections, Hydrant	135
Standing for Sewer	91
to Existing Watermains.....	118
Watermain Service	118
Consent of Property Owners to Deposit Waste Material.....	46
Contract, Assignment of.....	4
Forfeiture of	15
Plans and Specifications Part of	1
Subletting of	4
When to Take Effect	4
Contracts, Interference with Other Contracts.....	12
Contracts, to Whom Forbidden.....	16
Contractor, Meaning of	1
Responsible for Work Done.....	6
to Maintain Guards	11
Corrugated Concrete Sidewalk	64
Cover for Watermains.....	117
Coping, Concrete Stairways.....	65
Creosoted Lumber	30
Creosote Oil	22
Creosoted Piling	37
Creosoted Pipe Staves	32
Crib Bulkhead, Concrete	80
Crossings, Alley	181
Crossings, Concrete Alley	66
Crossings, Private Alley	181
Cross Walks, Concrete	61
Cross Walks, Temporary Wood.....	60
Culvert Pipe	52
Curb and Gutter, Concrete.....	49
Curb and Gutter, Wood.....	49
Curb Armor	26
Curb, Concrete	177
Curb, High	180
Curb Inlets	96
Curb, Integral	179
Curing Brick Pavement	176
Curing Concrete in Reinforced Concrete Structures.....	221
Curing of Concrete Pavement.....	161
Curing Concrete Sidewalk	63
Cushion for Brick Pavement	175
Cut-Out, Oil Fuse	198
Damage Suits	11
Damage to Existing Improvements.....	9

	Page
Debris on Private Property.....	47
Decision of Questions.....	15
Decking on Timber Structures.....	210
Defective Spigots on Watermain.....	122
Depths for Watermain	117
Dimensions	1
Dimensions of Cast Iron Pipe.....	121, 126
Disputes	15
District Gate Valves	132
Dowelled Expansion Joints.....	160, 185, 186
Drains, Box	51
Drains for Concrete Retaining Walls.....	79
Drains, Hydrant	136
Drains, Sewer Pipe	50
Drains, Sidewalk	66
Driving Piles	215
Drop Manholes	93
Ducts, Trenching for and Laying of.....	195
Earthwork, General	46
Earthwork, Payment for	47
Edge Planing of Structural Steel.....	226
Elliptical Catch Basins	94
Embankment, Grading	47
End Connection Angles	227
Erection of Steel, Structural	229
Errors and Omissions by Bidder.....	3
Estimates and Payments.....	13
Examination of Proposed Work by Bidders.....	3
Excavating in Rock.....	48, 84, 118
Excavation, Extra	48, 118
Excavation, Grading	46
Existing Hydrants, Moving	135
Hydrants, Resetting	135
Improvements, Damage to	9
Utilities, Interference with.....	8
Watermains, Connections to	118
Expansion Joint Materials	27
Expansion Joints, Dowelled.....	160, 185, 186
in Concrete Walk	63
Placing	159, 186
Extension of Time	12
Extensions to Hydrants	136
to Side Sewers	91
Wood Manhole	95
Extras, Claims for	7
Extra Concrete Adjoining Street Railway.....	162
Extra Concrete under Pavement.....	162
Extra Excavation	48, 118
Extra Wyes in Sewer	90
Eye-Bars	228

	Page
Falsework for Concrete Superstructure.....	218
Fees and Royalties	4
Felt for Waterproofing	79
Fence, Concrete Post.....	51
Fence, Wood	51
Field Painting of Steel.....	231
Field Test of Watermains.....	129
Filler used in Asphalt Mixture.....	165
Filler for Brick Pavement.....	27
Fills Under Sidewalk	60
Finish for Concrete Retaining Wall	78
Finish for Concrete Sidewalk	62
Finish for Concrete Structures.....	221
First Aid, Contractor to Provide.....	5
Fittings for Cast Iron Pipe.....	122
Flange Drillings, Table	123
Flush Tanks	93
Flush Tanks Rebuilding	95
Force Account	7
Forfeiture of Contract	15
Forgings, Steel	42
Forms for Concrete Retaining Walls.....	76
Forms for Concrete Structures.....	216
Forms for Concrete Superstructure.....	218
Forms for Pavement	154
Foundations for Concrete Retaining Wall.....	76
Foundations for Reinforced Concrete Structures.....	213
Framing of Timber Structures.....	209
Galvanized Materials	27
Galvanized Iron Railing	65
Galvanized Wrought Pipe	131
Gas Connection, Provision for.....	10
Gaskets for Watermains.....	123
Gate Chambers, Rebuilding	95
Gate Valves	131
Gate Valves, District	132
General Stipulations	1
Grade for Sewers	84
Grade for Watermains	117
Grading for Sidewalks	60
Grading Parking Strips	153
Grading Specification	45
Gravel, General Specifications	28
Gravel Sub-base	183
Gravity Retaining Walls	76
Grubbing and Clearing for Grading.....	45
Grubbing and Clearing for Sidewalks.....	60
Grouting Brick Pavement	176
Guards, Contractor to Maintain.....	11
Gutters, Asphalt	170
Gutters, Brick	180

	Page
Gutter and Curb, Concrete	49
Gutter and Curb, Wood.....	49
Gutters, for Concrete Stairway.....	65
Handholes, Street Lighting	195
Hardware, Bridge	18
High Curb	180
High Early Strength Cement	19
Holes for Rivets in Structural Steel.....	224
Hours of Labor	6
Hydrant Connection	135
Hydrant Drains	136
Hydrant Extensions	136
Hydrants	133
Hydrants, Moving Existing	135
Hydrants, Reconnecting Existing	136
Hydrants, Resetting Existing	135
Hydrostatic Test of Cast Iron Pipe.....	125
Improvements, Damage to Existing.....	9
Industrial Insurance	13
Injunctions	11
Inlet Top for Catch Basin	94
Inlets	96
Inlets, Adjusting	183
Inlets, Curb	96
Inlets, Moving	96
Inspection of Fabricating Steel	222
Inspection of Materials	7
Insurance, Industrial	13
Integral Concrete Curb	179
Interference with Existing Utilities.....	8
Interference with Other Contracts.....	12
Intersections, Placing Pavement in.....	158
Iron, Cast	18
Islands, Safety	184
Joint, Expansion	27
Joints in Concrete Retaining Walls.....	77
Jointing in Sewer Pipe	88
Jointing in Watermains	129
Labor, Hours of.....	6
Lacing Bars	227
Lamp Black	28
Lamp Black in Concrete Walks	63
Lamp Posts	200
Lawns, Protection to.....	9
Laying Asphalt Binder	166
Brick for Pavement	175
Cast Iron Pipe Watermain.....	128
Ducts	195
Laying Out of Work.....	8

	Page
Laying Sewer Pipe	87
Lead	28
Lead Covered Cable	29, 197
Lead Substitutes	28
Level Boards for Sewers	84
Light, Use of	8
Lights, Ornamental Street	194
Lines, Traffic	184
Lumber, General Stipulations	30
Lumber, Creosoted	30
Lumber Left in Sewer Trench	85
Machine Finished Surfaces of Steel	232
Maintaining Traffic	11, 162, 176
Manhole, Catch Basins Adjustment	183
Manhole, Wooden Extension	95
Manholes	92
Drop	93
Payment for	93
Rebuilding	95
Street Lighting	194
Wooden	95
Manufacture of Light Posts	201
Markers for Side Sewer	90
Marking Centrifugally Cast Pipe	127
Marking Sand Cast Pipe	123
Materials for Light Posts	200
Materials, Inspection and Testing of	7
Materials, Quality of	17
Meaning of Terms	1
Measurement of Earth	47
Pavements	163
Structural Steel	232
Timber Structures	211
Watermains	130
Mixing of Concrete	25
Monthly Estimates and Payments	13
Monument Cases	183
Monuments, Preservation of	9
Mortar for Brick Sewers	89
Mortar for Manholes	92
Mortar for Pipe Sewer	88
Moving Catch Basins	95
Moving Existing Hydrants	135
Moving Inlets	96
Nails and Spikes	33
Oakum	33
Oil Fuse Cut Outs	198
Old Watermain Pipe, Removal of	119
Omissions and Errors by Bidder	3
One Course Concrete Sidewalks	63

	Page
Order of Construction for Reinforced Concrete Structures	217
Orders to Begin Work	5
Orders to be Obeyed	7
Ornamental Street Lighting	194
Paint, General Requirements	33
Paint Coat for Asphalt Pavement	167
Painting Steel Structures	230
Parking Strip, Dressing of	48
Resurfacing of	67
Grading of	153
Pavement and Appurtenances	153
Pavement Appurtenances	177
Alley	177
Asphalt	163
Asphaltic Concrete	173
Brick	174
Concrete	157
Concrete Base for	163
Curing	161
Extra Concrete Under	162
Measurement of	153
Reinforcement	162
Relaid	182
Replaced	182
Repair due to Street Lights	194
Sheet Asphalt	163
Street Railway	177
Sub Grading for	153
Washing of	153
Payment and Monthly Estimates	13
Payment for Asphalt Paving	172
Asphaltic Concrete	174
Brick Pavement	176
Catch Basins	94
Conduit	197
Concrete Retaining Wall	79
Concrete Pavement	163
Concrete Sidewalk	64
Concrete Crib Bulkhead	80
Earthwork	47
Foundations	214
Light Posts	202
Manholes	93
Sewers	89
Structural Steel	232
Subgrading	157
Transformers	200
Timber Structures	211
Watermains	130
Payment of Wages	5
Payment of City Department Bills Against L. I. D.	12
Persons to Whom Contracts are Forbidden	16

	Page
Pile Driving	215
Piling, Creosoted	37
Piling, General Stipulations	37
Pins in Steel Structures	228
Pipe, Centrifugally Cast Iron	125
Pipe, Centrifugally Cast Concrete	20
Pipe Culvert	52
Pipe for Watermains	119
Pipe, Galvanized	131
Pipe Sewers	87
Pipe Sewer Jointing	88
Pipe Sewer Laying	87
Pipe Sewer, Payment for	89
Pipe Staves, Creosoted	32
Placing Concrete in Pavement	157
Placing Concrete in Retaining Walls	76
Placing Concrete in Reinforced Concrete Structures	216
Placing of Expansion Joints	159, 186
Placing of Bearing Surface in Structural Steel	227
Plank Covering over Pavement	162
Planking Subgrade	156
Plans and Specifications, Part of Contract	1
Plans, Change in	7
Post Base Transformers	203
Post, Concrete Fence	51
Post Foundations for Street Lights	202
Post Foundations for Street Lights	202
Posts for Trestles	210
Posts, Ornamental Lights	200
Power, Use of	8
Preservation of Monuments	9
Primary Lead Covered Cable	29
Private Alley Crossings	181
Private Concrete Alley Crossing	66
Property, Protection to	9, 161
Proportions of Aggregate in Concrete	24
Protection to Utilities	10
Protection to Work and Property	9, 161
Provision for Sewer, Water and Gas Connections	10
Provision for Water Courses	10
Quality of Iron for Watermain	124
Quality of Materials	17
Questions, Decision of	15
Quantities, Change in	7
Quantities, List of Furnished to Bidders	4
Railing	211
Railing, Galvanized Iron	65
Railway Pavement	177
Rates of Wages	5
Reaming Holes in Structural Steel	225

	Page
Rebuilding Catch Basins	95
Flush Tanks	95
Gate Chambers	95
Manholes	95
Reconnecting Existing Hydrants	136
Refined Asphalt	164
Reinforced Concrete Sewers	90
Reinforced Concrete Structures	213
Reinforcement in Light Posts	201
Reinforcement Steel Bars	42
Reinforcing Steel in Retaining Walls	77
Reinforcing Steel for Concrete Structures	219
Relaid Pavement	182
Removal of Trees and Shrubs	9
Removal of Old Watermain Pipe	119
Removing Unsuitable Material	47
Replaced Pavement	182
Replaced Concrete Sidewalks	64
Replacing Concrete Sidewalks	183
Resetting Existing Hydrants	135
Responsibility for Shop Tests of Cast Iron Pipe	128
Responsibility for Work Done	6
Requirements for Finished Asphalt Pavement	169
Restoring Roadways	87, 119
Resurfacing of Slopes and Parking Strips	67
Retaining Walls, Backfilling	79
Concrete Crib	80
Finishing	78
Gravity	76
Joints in	77
Payment for	79
Placing Concrete in	76
Reinforced Concrete	80
Reinforcing Steel in	77
Sewer Pipe Drains for	79
Waterproofing	78
Rivet Holes	224
Rivets	225
Riveting	226
Roadways, Surfacing of	48
Rock Excavation	48, 84, 118
Rock Pockets	51
Rolling Brick Pavement	176
Rolling Subgrade	155
Royalties and Fees	4
Rubber Covered Wire	38, 198
Safety Islands	184
Sand, General Specifications	38
Sand Boxes	50
Sand Cast Pipe	119
Sand Used for Asphalt Mixture	165

	Page
Scarifying Subgrade	155
Secondary Lead Covered Cable	29
Service Connections to Watermains	118
Sewer, General Stipulations	84
Sewer Appurtenances	90
Brick	89
Brick Laying in	89
Connections, Provision for	10
Payment for Pipe	89
Sewer in Fill	85
Trench	84
Tunnel	85
Sewer Pipes, General Specifications	39
Sewer Pipe Drains	50
Drains for Concrete Retaining Walls	79
Jointing	88
Laying	87
Sewers, Side	90
Sewers, Standing Connections to	91
Sewer Trenches, Backfilling of	86
Sewer Tunnels, Backfilling of	86
Sewer Subdrain	91
Sewers, Wooden Box	90
Shear Boards	50
Sheet Asphalt Pavement	163
Shop Assembly of Structural Steel	225
Shop Painting of Steel	231
Shop Plans of Structural Steel	223
Shop Work on Structural Steel	223
Shrubs, Removal of	9
Side Sewers	90
Side Sewer Extension	91
Side Stop, Concrete	181
Sidewalks and Appurtenances	60
Sidewalk, Concrete	61
Concrete Replaced	64
Corrugated Concrete	64
Drains	66
Repair due to Street Lights	194
Replacing Concrete	183
Signals, Contractor to Provide Warning	11
Signs, Contractor to Provide Warning	11
Signs, Street	203
Sills for Trestles	210
Slopes, Resurfacing of	67
Slope Stakes	46
Special Catch Basins	94
Special Inlet Top, Catch Basins	94
Special Watermain Castings	122, 137
Specifications, Part of Contract	1
Spikes and Nails	33

	Page
Stairways, Concrete	65
Stairways, Wood	61
Stakes, Slope	46
Standing Connections to Sewers	90
Steel Castings	41
Steel Forgings	42
Steel Reinforcement Bars	42
Steel Reinforcing in Concrete Retaining Wall	77
Steel, Structural	44
Steel Structures	222
Stop and Side Stop, Concrete	181
Storage of Fabricated Steel	222
Storage of Timber	208
Straightening of Structural Steel	222
Street Barricade	11
Street Lighting Conduit	195
Handholes	195
Manholes	194
Street Lights, Ornamental	194
Street Railway Pavement	177
Street Signs	203
Streets, Use of	5
Stringers in Timber Structures	210
Stripping of Top Soil	46
Structural Steel	44
Sub-Base, Concrete	183
Subdrain for Sewer	91
Subgrade, Planking	156
Subgrade, Rolling	155
Subgrading for Pavement	153
Subletting of Contract	4
Suits, Damage	11
Superstructures, Concrete	217
Surfacing Roadways and Parking Strips	48
Tanks, Flush	93
Testing of Materials	7
Test of Watermain in Field	129
Test Piles	216
Temporary Wood Walks and Cross Walks	60
Terms, Meaning of	1
Timber Piling	36
Timber Structures	208
Timber Underpinning	52
Time, Extension of	12
Traffic, Maintaining of	11
Traffic Lines	184
Transformers	198
Transformers, Post Base	203
Transportation of Asphalt Binder	166
Transportation of Wearing Surface	167
Treated Timber Structures	208

	Page
Trees, Removal of	9
Trenching and Laying of Ducts	195
Trenching Machine, Care of Utilities while using	10
Trenching for Watermains	117
Trenching for Pipe Sewer	84
Trestles, Concrete Surface on	163
Trusses, Timber	211
Tunneling for Sewers	85
Two Course Concrete Sidewalk	61
Underpinning	52
Unsuitable Material, Removal of	47
Untreated Timber Structures	209
Use of Streets	5
Use Water, Light and Power	8
Utilities, Interference with Existing	8
Utilities, Protection of	10
Valve Boxes, Cast Iron	135
Valve Boxes, Wood	132
Valve Chambers	132
Valves, Gate	132
Variation in Weight of Watermain	123
Vitrified Clay, Sewer Pipe	39
Wages, Payment of	5
Wages, Rates of	5
Walls, Retaining	76-83
Waste Earth, Applications for	46
Warning Beacons	184
Washing Pavement	153
Water	44
Water Connection, Provision for	10
Water Courses, Provisions for	10
Water for Backfilling	8
Watermains and Appurtenances	117
Watermain Alignment Grade and Cover	117
Watermain Appurtenances	131
Watermain, Connection to Existing	118
Field Tests	129
Flange Drillings	123
Gaskets	123
Markings	123
Measurements	130
Trenching	117
Trench Backfill	118
Payment for	130
Waterproofing Concrete Retaining Walls	78
Waterproofing Materials for Walls	79
Water, Use of	8
Wearing Surface for Asphalt	166
Wearing Surface for Bridges	168
Wearing Surface for Trestles	163

	Page
Web Plates	227
Web Splices and Fillers	228
Web Stiffeners	228
Weighing of Cast Iron Pipe	128
Weighing of Steel	223
Weights of Centrifugally Cast Pipe	126
Weight of Structural Steel	233
Wheel Guards	211
Wire, Rubber Covered	38, 198
Wood Curb and Gutter	49
Wood Curb and Gutter Adjusted	50
Fence	51
Stairways	61
Valve Boxes	132
Walks and Cross Walks, Temporary	60
Wooden Box Sewers	90
Wooden Manholes	95
Wooden Manhole Extension	95
Work Done, Contractor Responsible for	6
Work, Layout of	7
Work, Orders to Begin	5
Work, Protection to	9
Workmen	5
Workmens Compensation Act	13
Wyres, Extra in Sewers	90

Page 188 spelling.

✓ " 42 Serial Designation A-15-30

P 2 Break in.

P 202 10%

✓ P 41 Resolution 15 min. absorption^{3%}

✓ P 126 Pipe over 12" - CD Bells

P 200 Poots. See 203

P 156 ~~at least~~ Pyl fu

P 194 q 209 should be q 200

350 Conduit "wrought iron"?

Class	Cement Bbls per Cu Yd	W/C Ratio	Slump in	Approx Vol. Prop.
A	1.95	.6	2	
94-152-252	1.90	.7	4	
	1.84✓	.8	6	
B	1.81	.6	2	
94-170-284	1.76	.7	4	1:1.6:2.7
	1.71✓	.8	6	
C	1.62✓	.6	2	
94-216-200	1.58	.7	4	1:2:3
	1.54	.8	6	
D	1.42✓	.6	2	
94-240-246	1.39	.7	4	1:2:4
	1.36	.8	6	
E	1.21✓	.6	2	
94-300-303	1.19	.7	4	1:3:5
	1.16	.8	6	