THE CITY OF NEW YORK

BOARD OF ESTIMATE AND APPORTIONMENT

THE HARBOR TUNNEL

New York Bay Section - Trench Method

CONTRACT No. 1A

Contract Drawings

1 to 21

1966

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THE CITY OF NEW YORK

BOARD OF ESTIMATE AND APPORTIONMENT

THE NARROWS TUNNEL

New York Bay Section—Trench Method

CONTRACT No. 4A

Contract Drawings

1 to 58

1925

H 48-3000-25-31

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JESSE B. SNOW,
Tunnel Engineer.

LIST OF CONTRACT DRAWINGS

CONTRACT NO. 4A.

Dwg.
No.

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2. Detail Plan and Profile, Station 119+92 to Station 136.
3. Detail Plan and Profile, Station 136 to Station 166.
4. Detail Plan and Profile, Station 166 to Station 196.
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Dwg.
No.

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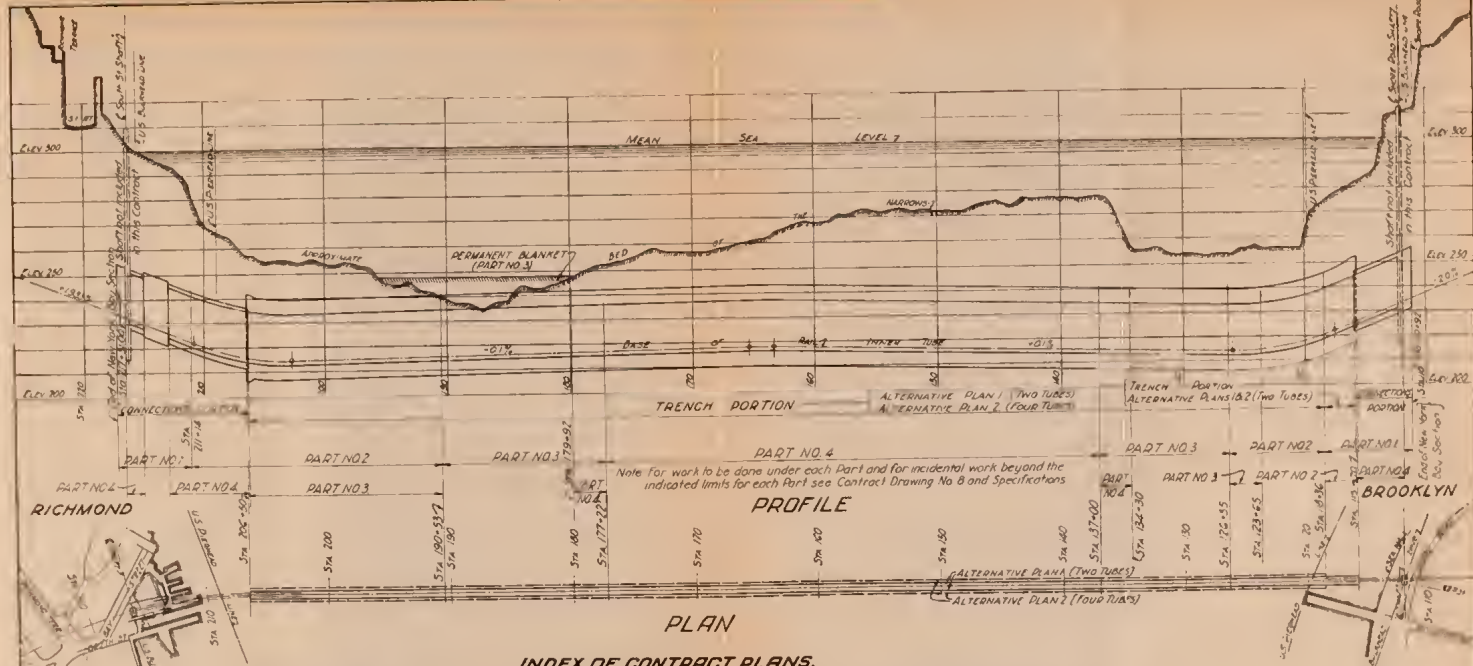

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56. Wharf Changes
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58. Areas Available for Contractors Use in Richmond

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

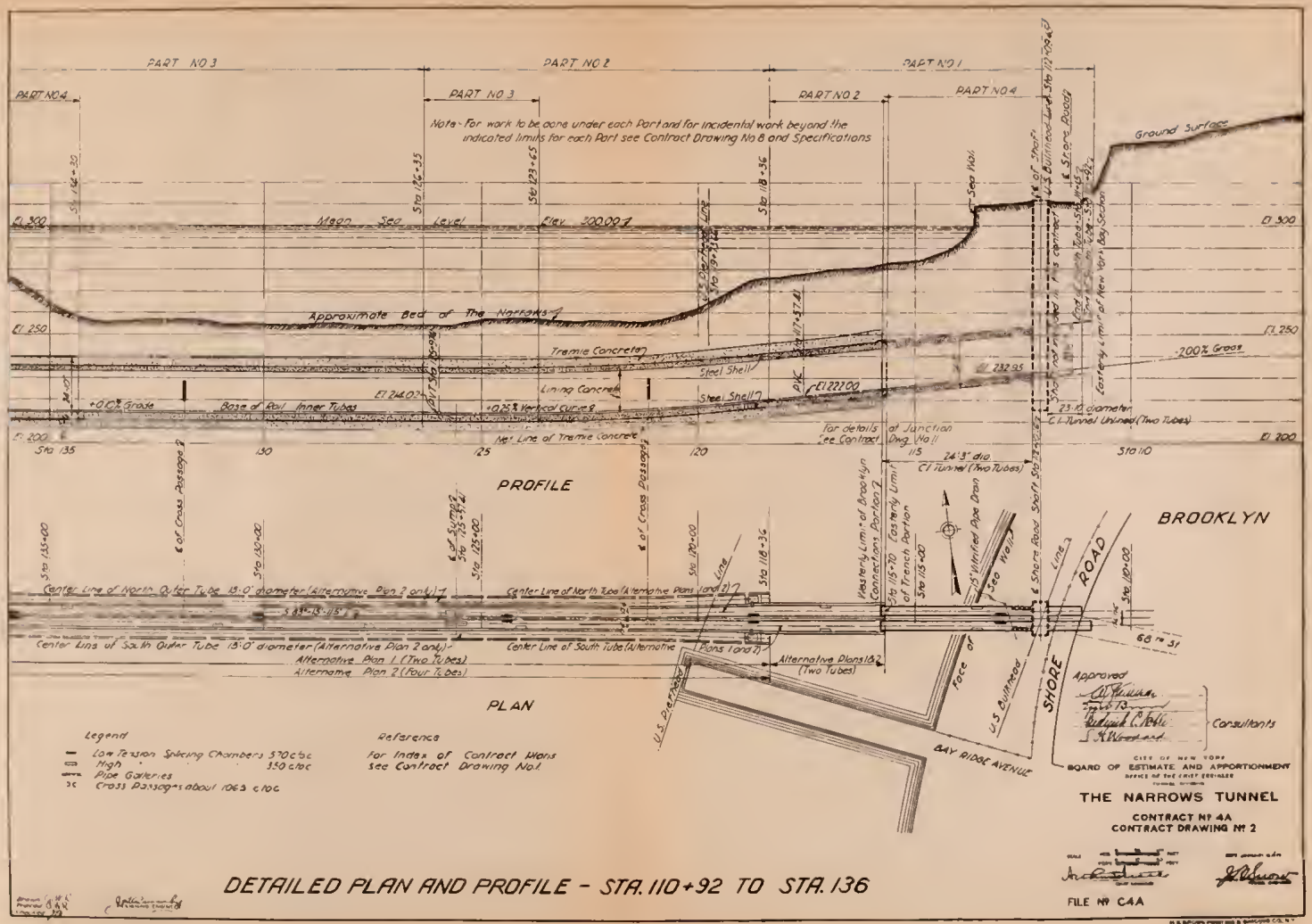
THE NARROWS TUNNEL

CONTRACT Nº 4A
CONTRACT DRAWING Nº 1

FILE Nº C4A

Drawn D.N.E.
Traced D.N.E.
Checked

LOCATION PLAN AND PROFILE


PART NO 3
PART NO 2
PART NO 1
PART NO 4
Note - For work to be done under each Part and for incidental work beyond the indicated limits for each Part see Contract Drawing No 8 and Specifications
Ground Surface
Mean Sea Level
Elev. 300.00
Approximate Bed of The Narrows
Tremie Concrete
Steel Shell
Lining Concrete
Base of Rail Inner Tubes
+0.0% Grade
+0.2% Vertical curve
Elev. 244.07
Elev. 222.00
Elev. 232.95
-2.00% Grade
23'-10" diameter C.L. Tunnel Unlined (Two Tubes)
24'-3" dia. C.L. Tunnel (Two Tubes)
for details of Junction see Contract Dwg. No 11
Net Line of Tremie Concrete
Sta 135
130
125
120
115
Sta 110
PROFILE
BROOKLYN
Center Line of North Outer Tube 15'-0" diameter (Alternative Plan 2 only)
Center Line of North Tube (Alternative Plans 1 and 2)
Center Line of South Outer Tube 15'-0" diameter (Alternative Plan 2 only)
Center Line of South Tube (Alternative Plans 1 and 2)
Alternative Plan 1 (Two Tubes)
Alternative Plan 2 (Four Tubes)
Alternative Plans 1 & 2 (Two Tubes)
Westerly Limit of Brooklyn Connections Portion 2
Easterly Limit of Trench Portion
15" Vitrified Pipe Drain
Sea Wall
Shore Road Shaft
SHORE ROAD
BAY RIDGE AVENUE
U.S. Bulkhead
U.S. Pierhead
PLAN
Legend
Low Tension Splicing Chambers 370 c to c
High " 350 c to c
Pipe Galleries
Cross Passages about 1063 c to c
Reference
for Index of Contract Plans see Contract Drawing No 1
Approved
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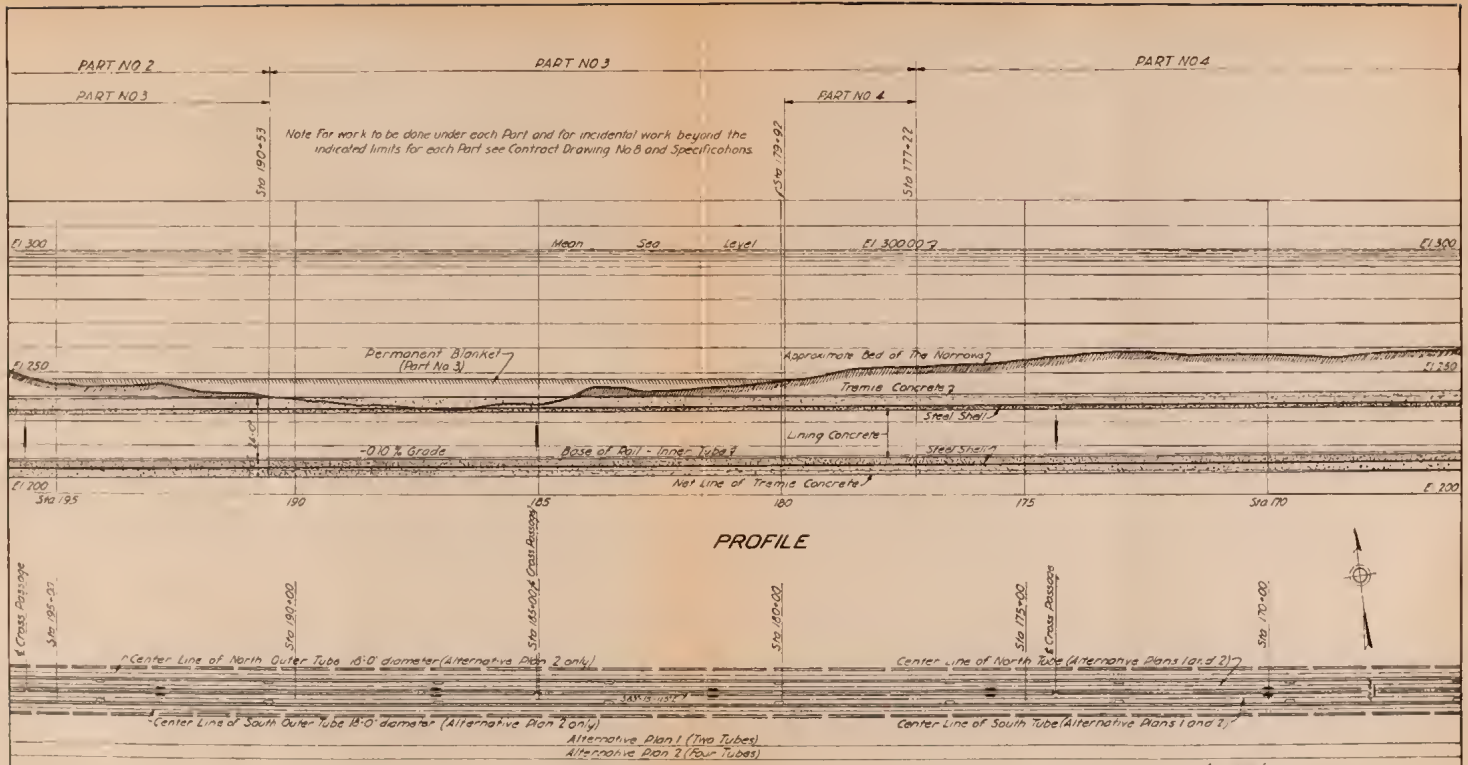
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
THE NARROWS TUNNEL
CONTRACT Nº 4A
CONTRACT DRAWING Nº 2
FILE Nº C4A
DETAILED PLAN AND PROFILE - STA. 110+92 TO STA. 136



Legend

- Low Tension Splicing Chambers 510 c to c
- High " " 350 c to c
- 2c Cross Passages about 1065' c to c

Reference

For Index of Contract Plans see Contract Drawing No 1

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CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

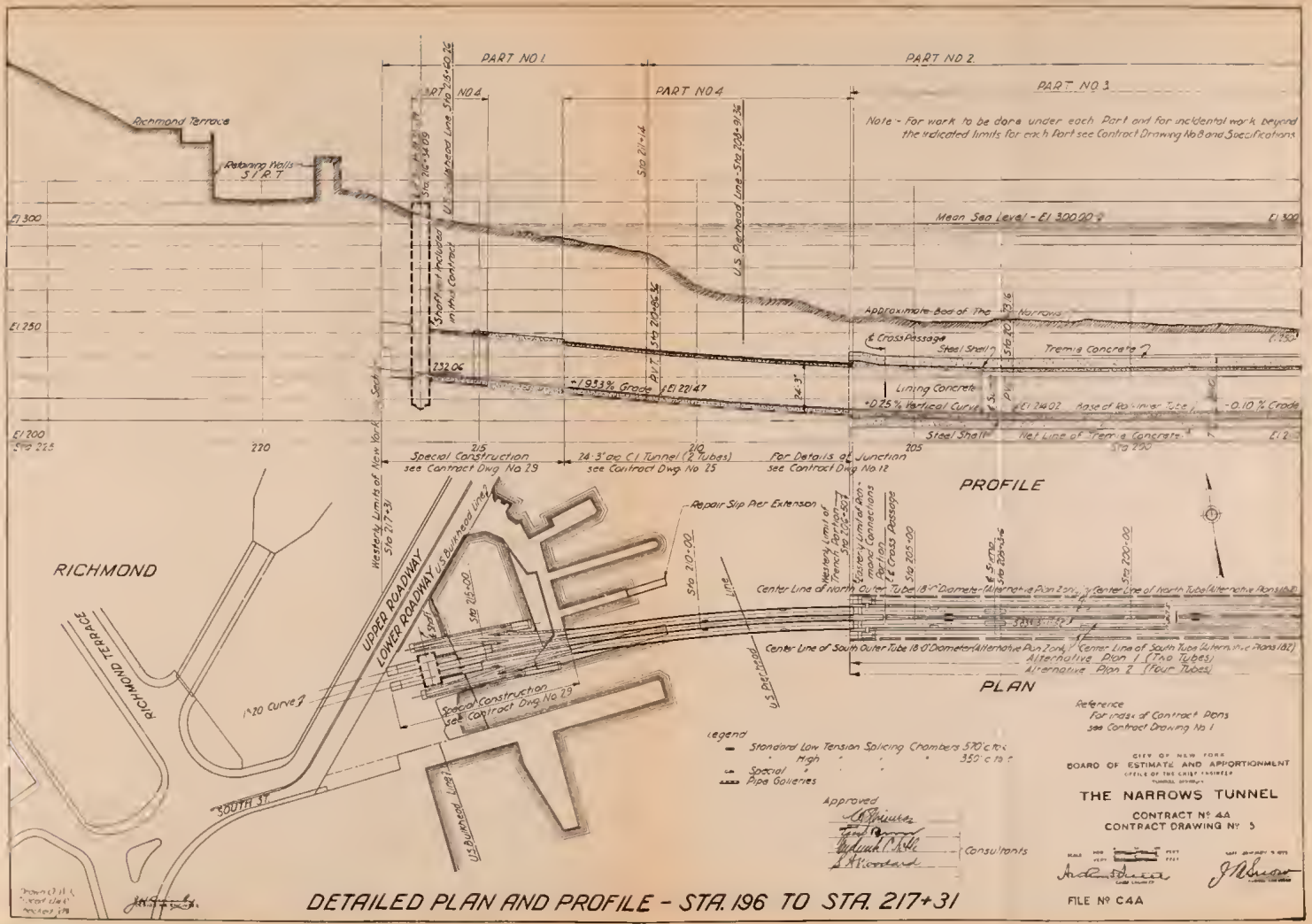
THE NARROWS TUNNEL

CONTRACT Nº 4A
CONTRACT DRAWING Nº 4

DETAILED PLAN AND PROFILE - STA. 166 TO STA. 196

FILE Nº C4A

Drawn L.H.S.
Traced O.W.
Checked


PART NO 1
PART NO 2
PART NO 3
PART NO 4
PART NO 4
Note - For work to be done under each Part and for incidental work beyond the indicated limits for each Part see Contract Drawing No 8 and Specifications
Richmond Terrace
Retaining Walls S/R T
Sta 216+50.26
U.S. Pierhead Line - Sta 216+50.09
Shaft - not included in this Contract
Sta 217+14
Sta 216+06.36
U.S. Pierhead Line - Sta 216+91.36
El 300
El 250
El 200
Sta 225
220
215
210
205
Sta 200
Mean Sea Level - El 300.00
Approximate Bed of The Narrows
Cross Passage
Steel Shell
Tremie Concrete
Lining Concrete
+1.933% Grade
El 22.47
232.06
+0.75% Vertical Curve
El 24.02
Base of Roof Liner Plate
-0.10% Grade
Steel Shell
Net Line of Tremie Concrete
Special Construction see Contract Dwg No 29
24'-3" dia C I Tunnel (2 Tubes) see Contract Dwg No 25
For Details of Junction see Contract Dwg No 12
PROFILE
Repair Slip Per Extension
Sta 210+00
Sta 206+00
Sta 205+00
Sta 200+00
Center Line of North Outer Tube 18'-0" Diameter (Alternative Plan 2 only)
Center Line of South Outer Tube 18'-0" Diameter (Alternative Plan 2 only)
Center Line of South Tube (Alternative Plans 1 & 2)
Alternative Plan 1 (Two Tubes)
Alternative Plan 2 (Four Tubes)
PLAN
RICHMOND
RICHMOND TERRACE
UPPER ROADWAY
LOWER ROADWAY
U.S. Bulkhead Line
Westerly Limits of New York Sta 217+31
Special Construction see Contract Dwg No 29
SOUTH ST
U.S. Pierhead Line
Reference For index of Contract Plans see Contract Drawing No 1
Legend
Standard Low Tension Splicing Chambers 570' c to c
High " " " 350' c to c
Special
Pipe Galleries
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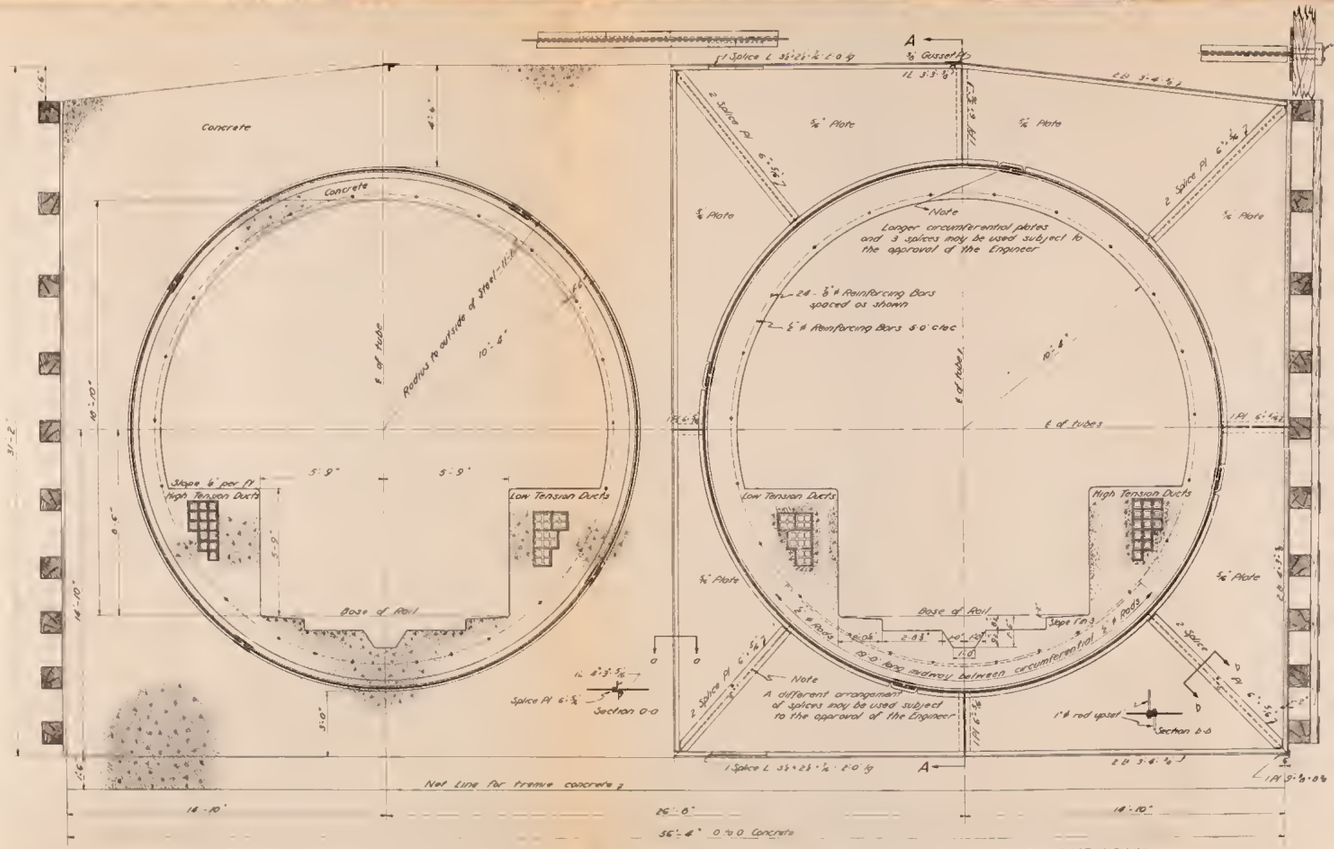
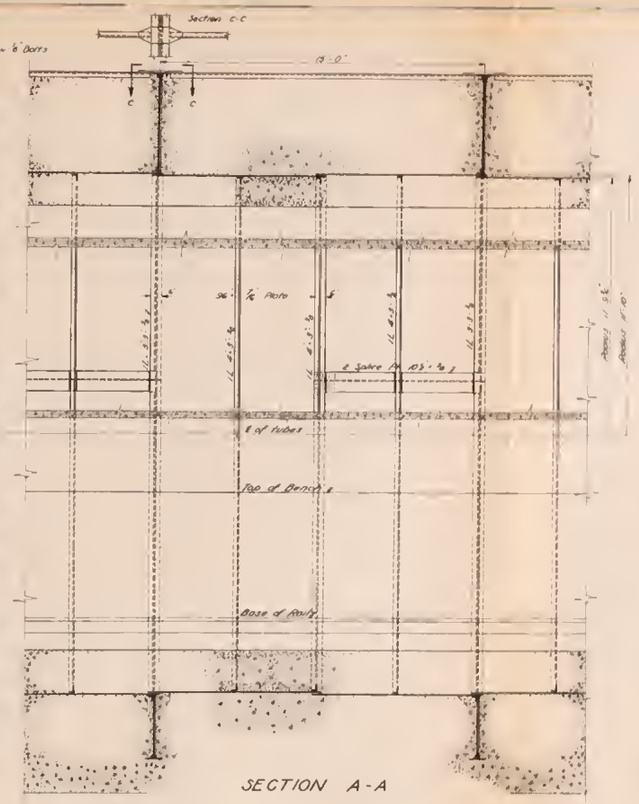
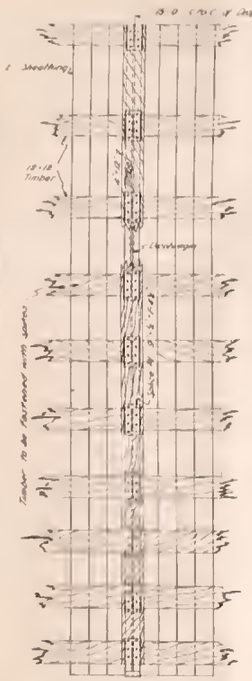
OFFICE OF THE CHIEF ENGINEER
THE NARROWS TUNNEL
CONTRACT Nº 4A
CONTRACT DRAWING Nº 5
FILE Nº C4A
DETAILED PLAN AND PROFILE - STA. 196 TO STA. 217+31







NOTES

Temporary bracing will be required in the interior of the tubes during sinking and concreting operations.
All shell riveting to be made water tight.
Caulking edges to be planed or bevel sheared.
Rivets ⅞" diameter.

REFERENCE:

For Index of Contract Plans, see Contract Drawing No. 1.

Approved:
Consultants

HALF SECTION BETWEEN DIAPHRAGMS
HALF SECTION AT DIAPHRAGMS

TYPICAL CONSTRUCTION - TRENCH PORTION

ALTERNATIVE PLAN 1

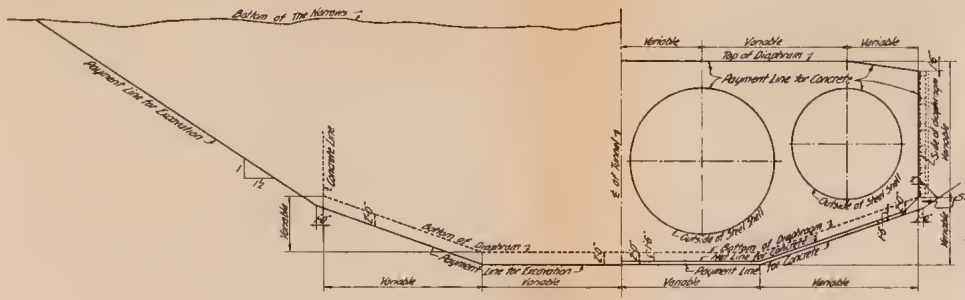
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT Nº 4A
CONTRACT DRAWING, Nº 6

SCALE FEET DATE JAN. 15, 1919

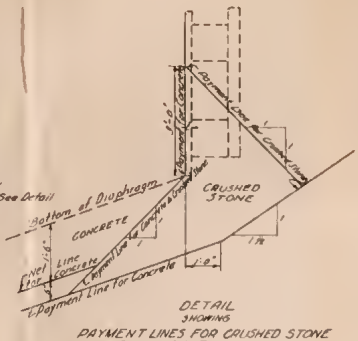
FILE Nº C4A



HALF-SECTION FOR EXCAVATION HALF-SECTION FOR EXTERIOR CONCRETE AND CRUSHED STONE

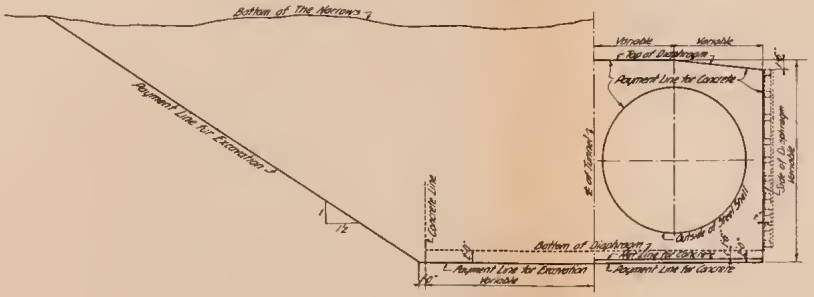
ALTERNATIVE PLAN 2

EXCEPT EASTERLY SECTION



DETAIL SHOWING PAYMENT LINES FOR CRUSHED STONE AND CONCRETE, AT CORNER

SCALE 1/4" = 1 INCHES



HALF-SECTION FOR EXCAVATION HALF-SECTION FOR EXTERIOR CONCRETE

ALTERNATIVE PLAN 1

AND EASTERLY SECTION OF ALTERNATIVE PLAN 2

NOTES:
Net payment quantities of exterior concrete not to include embedded steel
Net payment quantities of crushed stone not to include embedded timber
REFERENCE
For Index of Contract Plans, see Contract Drawing No 1.

Approved:
W. Hinnicks
Chas B.
Richard C. Wolle
S. A. Woodard
Consultants.

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 7

SCALE 1/4" = 1 FOOT DATE: JAN 6 1914

A. Rudolphus
CHIEF ENGINEER
J. H. Brown
TUNNEL ENGINEER

FILE No C4A

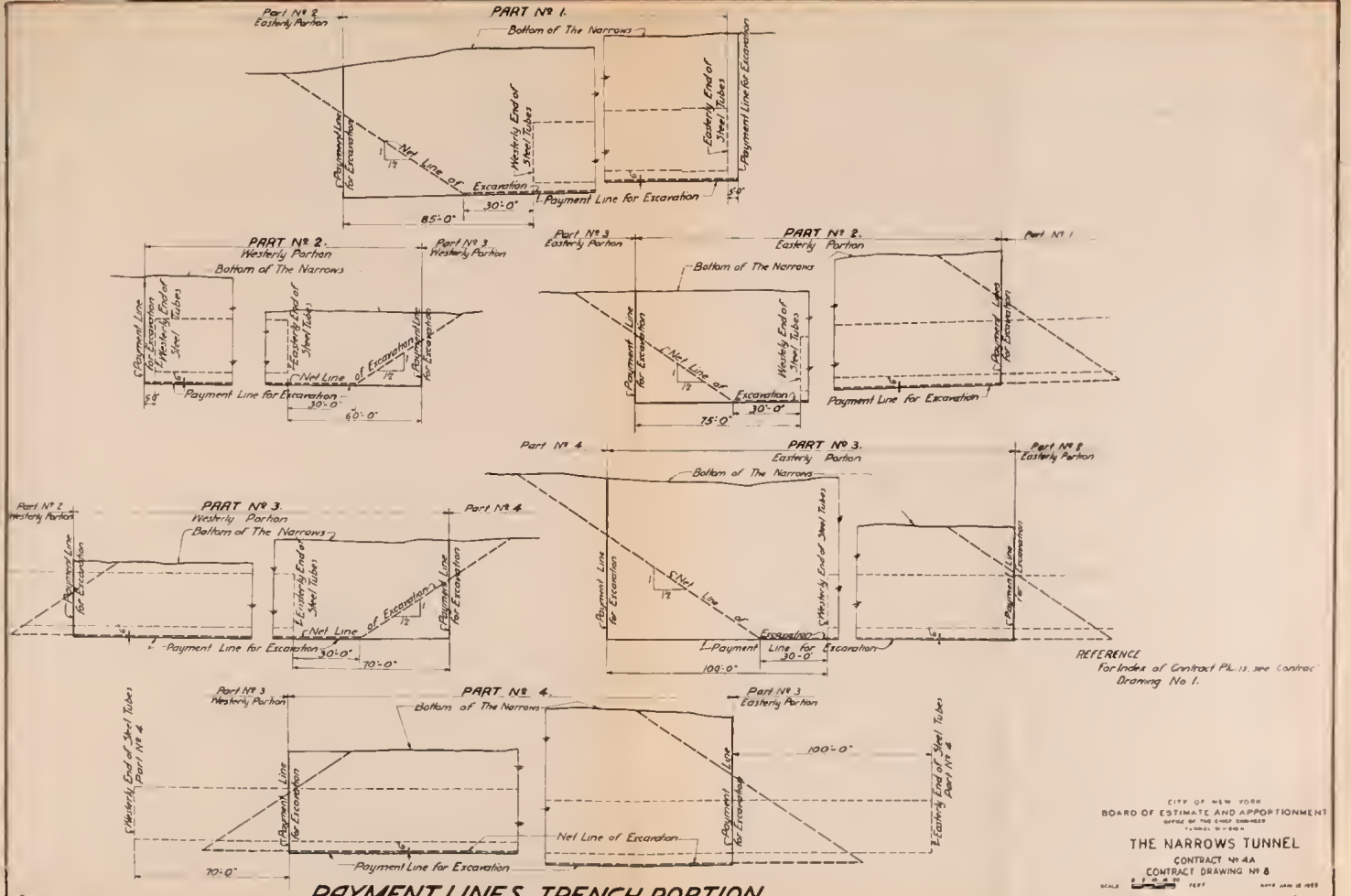
PAYMENT LINES, TRENCH PORTION

See Also Dwg No 8.

Drawn by
Traced
Checked

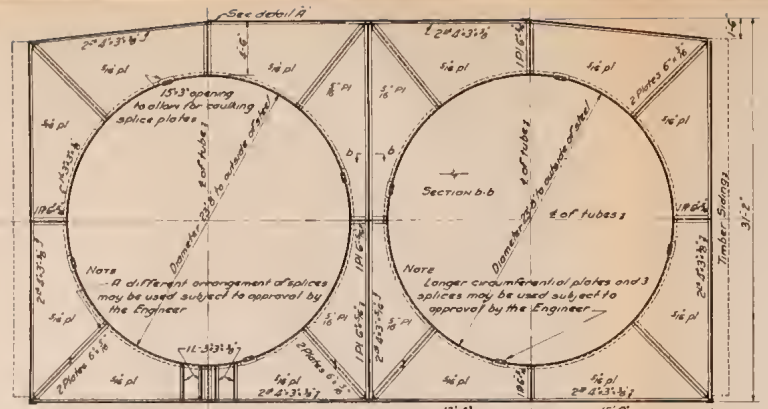
J. H. Brown
LICENSED ENGINEER

H. D. BERGEN PRINTING & SUPPLY CO. N.Y.



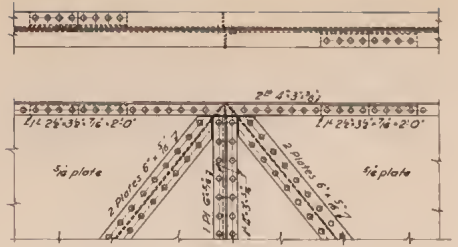
PAYMENT LINES, TRENCH PORTION

AT ENDS OF PARTS.
See Also Drawing Nº 7.

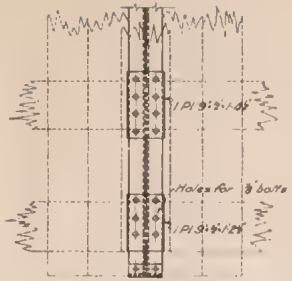


Section A-A - End Diaphragm

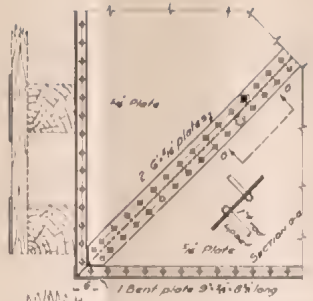
Section B-B - Typical

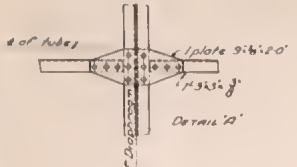


Detail of Splice at Top Center of Diaphragm



Detail of Splice Plates





Steel Sections Required

1 Junction Section-East End	266'-2"
2 Intermediate Section with distance c to c varying	532'-4"
30 Typical Sections as shown @ 266'-2"	7985'-0"
1 Junction Section-West End	266'-2"
1 Closing Section (about)	30'-8"
Total from Sta 115+70 to Sta 206+50	9080'-0"

Notes

Details shown are for Alternative Plan 1 (two tubes) for Alternative Plan 2 (four tube) construction, see Contract Drawing No. 19

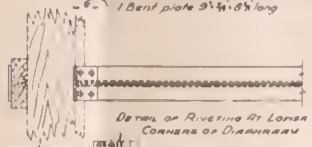
All shell riveting to be made watertight

Coulking edges to be planed or bevel sheared

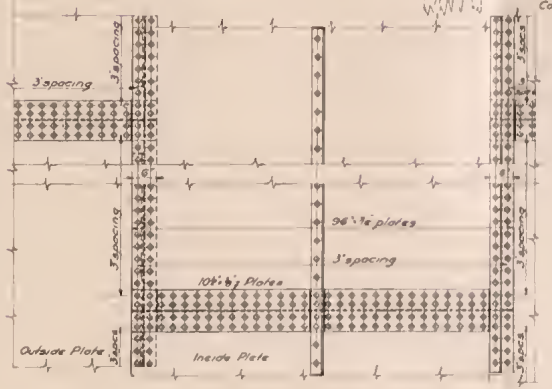
Rivets 3/4" diameter

Reference

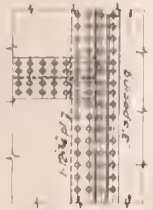
For Index of Contract Plans, see Contract Drawing No. 1



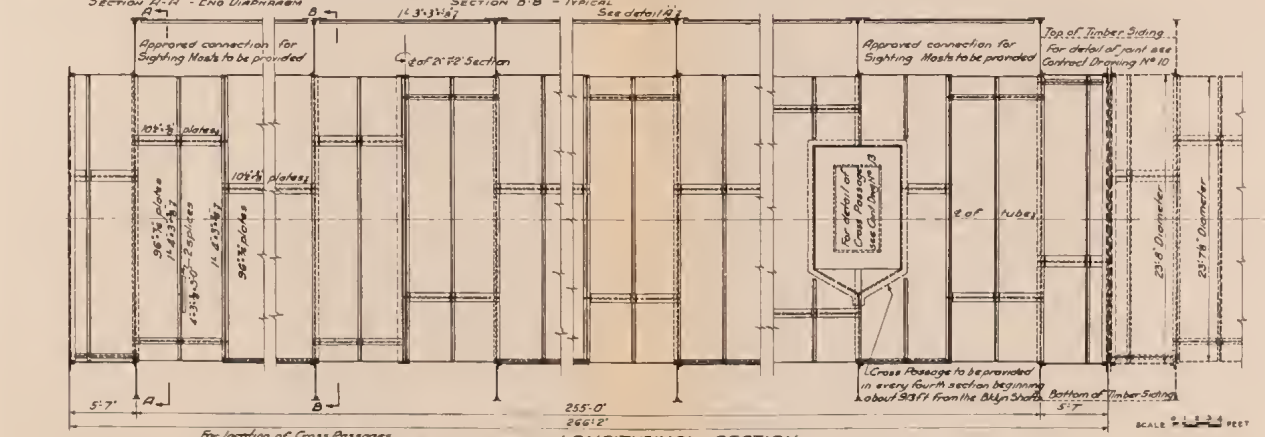
Detail of Riveting at Lower Corners of Diaphragm



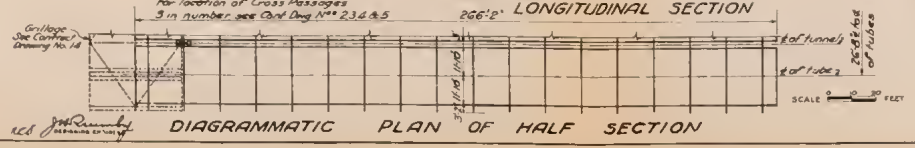
Detail of Shell Riveting



Detail of Splice at ℄ of Section



Longitudinal Section



Diagrammatic Plan of Half Section

Drawn RJS
Traced RJS
Checked R.T.H.

TYPICAL STEEL SECTION TRENCH PORTION
ALTERNATIVE PLAN 1

Approved

Consultants

City of New York
Board of Estimate and Apportionment
Office of the Chief Engineer
Tunnel Division

THE NARROWS TUNNEL

Contract No. 4A
Contract Drawing No. 9

Scale 1/8" = 1 foot

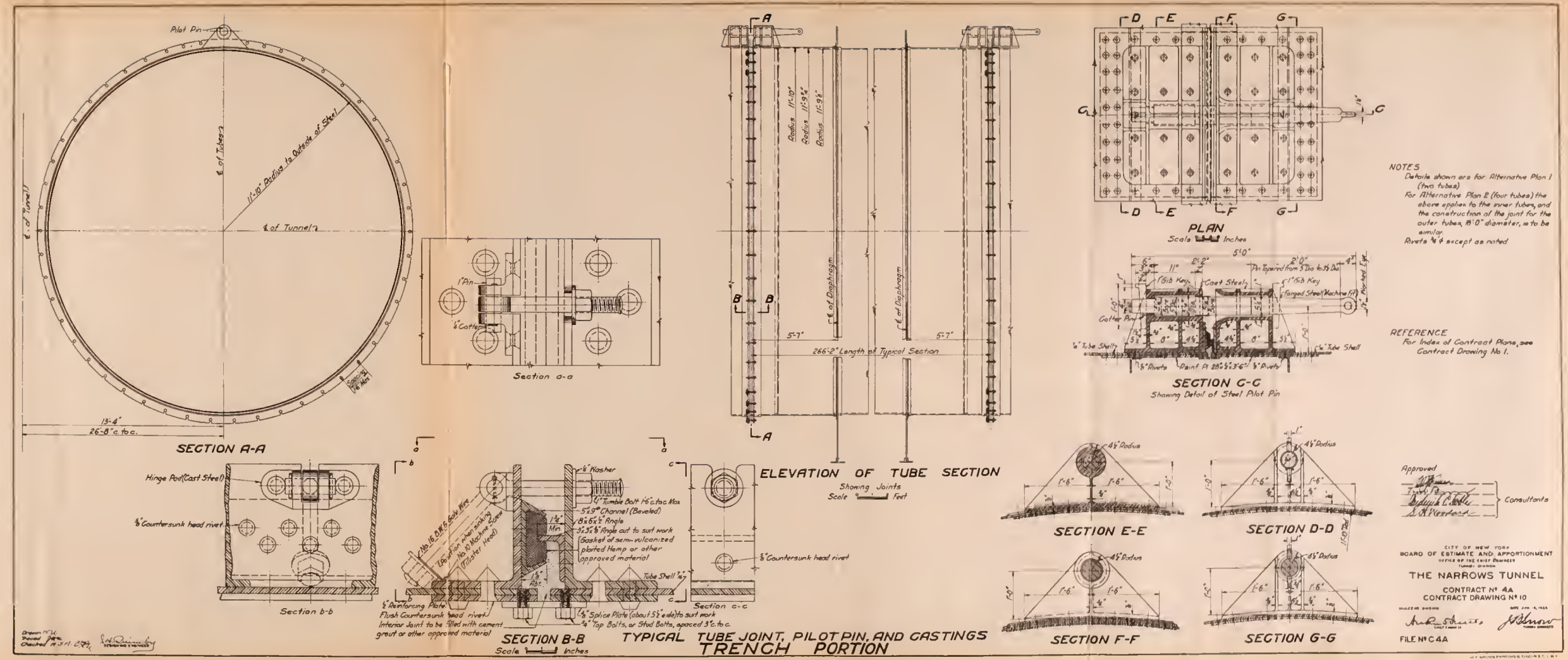
Date Jan. 6, 1925

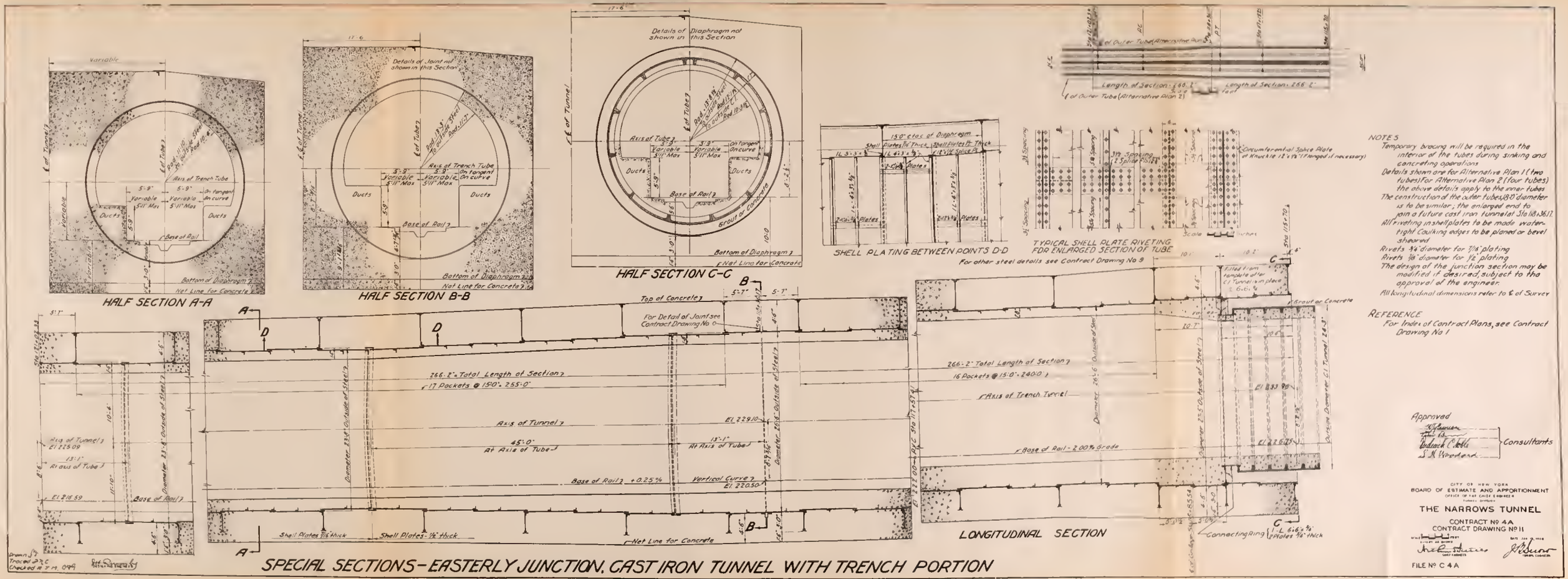
Chief Engineer

Tunnel Engineer

File No. C4A

H. D. Brown Pencils & Engineering Co. N.Y.


Pilot Pin
℄ of Tubes
11'-10" Radius to Outside of Steel
℄ of Tunnel
13'-4"
26'-8" c. to c.
SECTION A-A
1" Pin
½" Cotter
Section a-a
Radius 11'-10"
Radius 11'-9¾"
Radius 11'-9½"
℄ of Diaphragm
5'-7"
266'-2" Length of Typical Section
ELEVATION OF TUBE SECTION
Showing Joints
Scale Feet
PLAN
Scale Inches
Gib Key
Cast Steel
Forged Steel (Machine Fit)
Gotter Pin
½" Tube Shell
½" Rivets
SECTION G-G
Showing Detail of Steel Pilot Pin
NOTES
Details shown are for Alternative Plan 1 (two tubes)
For Alternative Plan 2 (four tubes) the above applies to the inner tubes, and the construction of the joint for the outer tubes, 18'-0" diameter, is to be similar.
Rivets ¾" ϕ except as noted
REFERENCE
For Index of Contract Plans, see Contract Drawing No 1.
Hinge Pad (Cast Steel)
⅝" Countersunk head rivet
Section b-b
½" Washer
¼" Tumble Bolt 1'-6" c. to c. Max
5"x9" Channel (Beveled)
8"x6"x½" Angle
3"x3"x⅜" Angle cut to suit work
Gasket of semi-vulcanized plaited hemp or other approved material
Tube Shell ½"
½" Reinforcing Plate
Flush Countersunk head rivet
Interior Joint to be filled with cement grout or other approved material
½" Splice Plate (about 5½" wide) to suit work
¾" Tap Bolts, or Stud Bolts, spaced 3" c. to c.
SECTION B-B
Scale Inches
Section c-c
TYPICAL TUBE JOINT, PILOT PIN, AND CASTINGS
TRENCH PORTION
SECTION E-E
SECTION D-D
SECTION F-F
SECTION G-G
Approved
Consultants
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 10
FILE No C4A



NOTES

Temporary bracing will be required in the interior of the tubes during sinking and concreting operations

Details shown are for Alternative Plan 1 (two tubes) for Alternative Plan 2 (four tubes) the above details apply to the inner tubes

The construction of the outer tubes, 80' diameter is to be similar, the enlarged end to join a future cast iron tunnel at Sta 118+36.17

All riveting in shell plates to be made water-tight Caulking edges to be planed or bevel sheared

Rivets ¾" diameter for 7/16" plating

Rivets ⅞" diameter for ½" plating

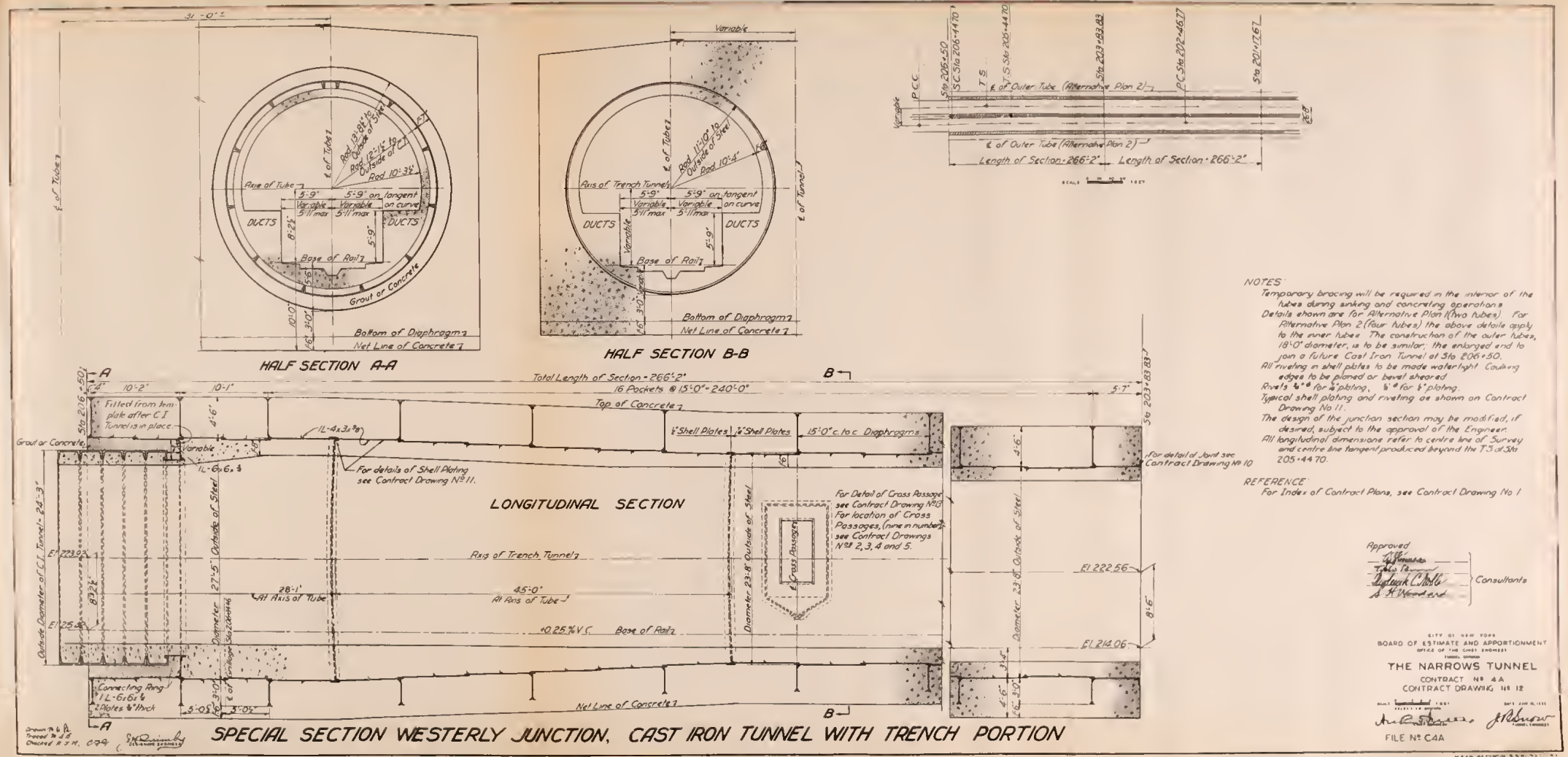
The design of the junction section may be modified if desired, subject to the approval of the engineer.

All longitudinal dimensions refer to ℄ of Survey

REFERENCE

For Index of Contract Plans, see Contract Drawing No 1

SPECIAL SECTIONS - EASTERLY JUNCTION, CAST IRON TUNNEL WITH TRENCH PORTION


HALF SECTION A-A
HALF SECTION B-B
LONGITUDINAL SECTION
SPECIAL SECTION WESTERLY JUNCTION, CAST IRON TUNNEL WITH TRENCH PORTION
Axis of Tube
Axis of Trench Tunnel
DUCTS
Base of Rail
Grout or Concrete
Bottom of Diaphragm
Net Line of Concrete
Total Length of Section - 266'-2"
16 Pockets @ 15'-0" = 240'-0"
Top of Concrete
Length of Section - 266'-2"
Diameter 23'-8" Outside of Steel
Cross Passage
Connecting Ring
NOTES
Temporary bracing will be required in the interior of the tubes during sinking and concreting operations.
Details shown are for Alternative Plan 1 (two tubes). For Alternative Plan 2 (four tubes) the above details apply to the inner tubes. The construction of the outer tubes, 18'-0" diameter, is to be similar; the enlarged end to join a future Cast Iron Tunnel at Sta 206+50.
All riveting in shell plates to be made watertight. Caulking edges to be planed or bevel sheared.
Rivets 5/8" ϕ for 1/2" plating, 3/4" ϕ for 5/8" plating.
Typical shell plating and riveting as shown on Contract Drawing No 11.
The design of the junction section may be modified, if desired, subject to the approval of the Engineer.
All longitudinal dimensions refer to centre line of Survey and centre line tangent produced beyond the T.S. at Sta 205+44.70.
REFERENCE
For Index of Contract Plans, see Contract Drawing No 1
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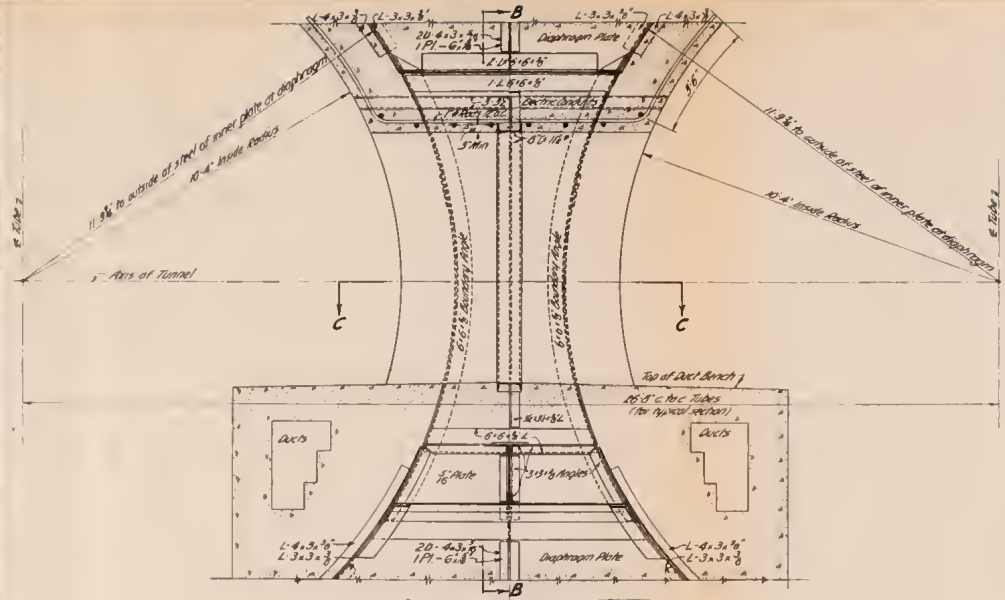
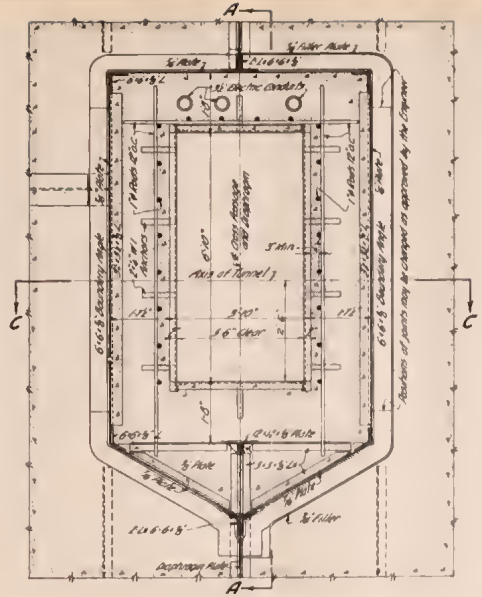
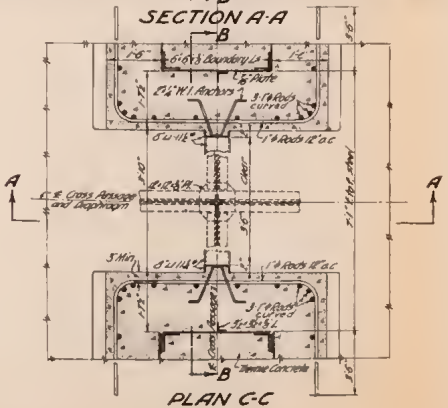
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 12
FILE No C4A



SECTION A-A



SECTION B-B



PLAN C-C

NOTES.
All rivets 5/8"
Caulking rubber to be placed as shown. Ground
All metal to be made water tight
Details shown are for alternative plan 1 (two ducts). For Alternative Plan 2 (four ducts) the above details apply to the inner ducts.
Approved 3 Cross Passages (except as shown on Dwgs Nos 2, 3, 4, 5, 9, and 12)

REFERENCE:
For index of Contract Plans see Contract Drawing No 1

Approved
Consultants

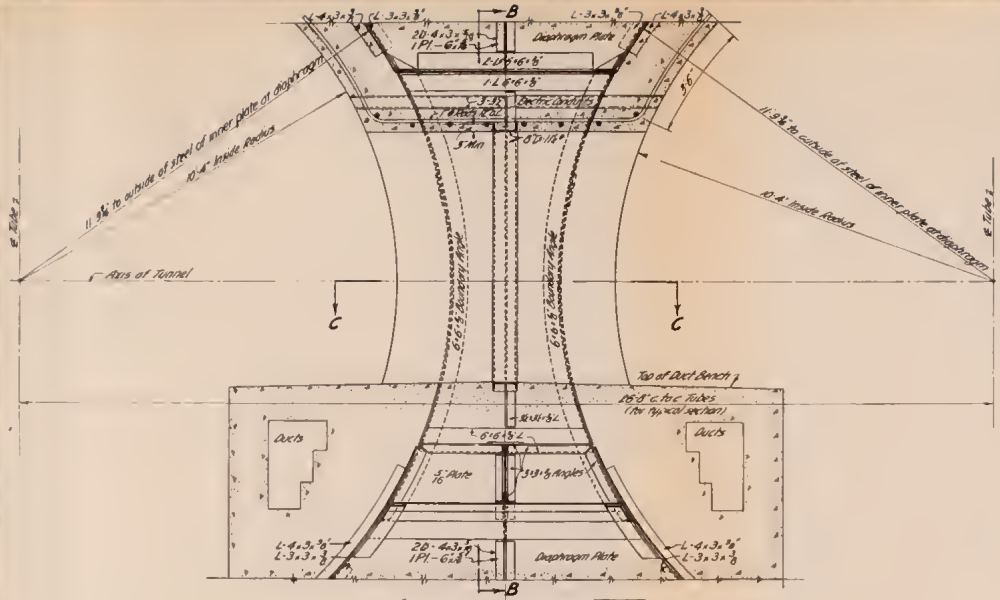
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

THE NARROWS TUNNEL

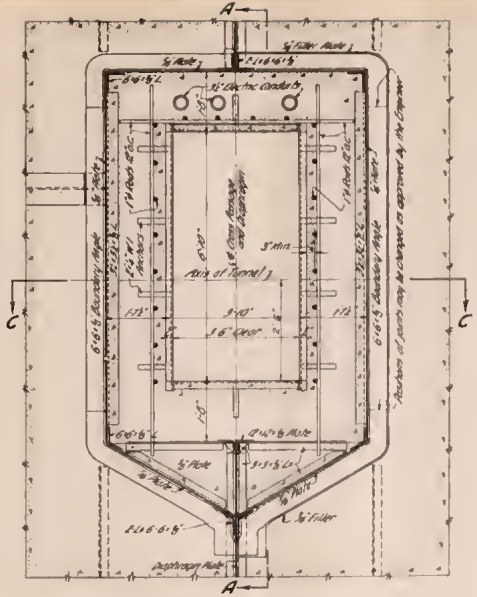
CONTRACT Nº 4A
CONTRACT DRAWING Nº 13

FILE Nº C4A

CROSS PASSAGE - TRENCH PORTION



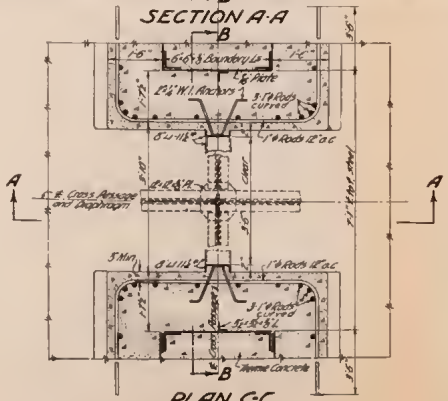
SECTION A-A



SECTION B-B

NOTES.
All Rivets ⅝ ø
Coaling holes to be placed as shown
All rivetting to be made water tight
Details shown are for Alternative Plan 1 (two holes). For Alternative Plan 2 (four holes) the above details apply to the inner L's.
Required - 3 Cross Passages (as built as shown on Dwgs. Nos 2, 3, 4, 5, 9, and 12)

REFERENCE:
For notes of Contract Plans see Contract Drawing No. 1



PLAN C-C

CROSS PASSAGE - TRENCH PORTION

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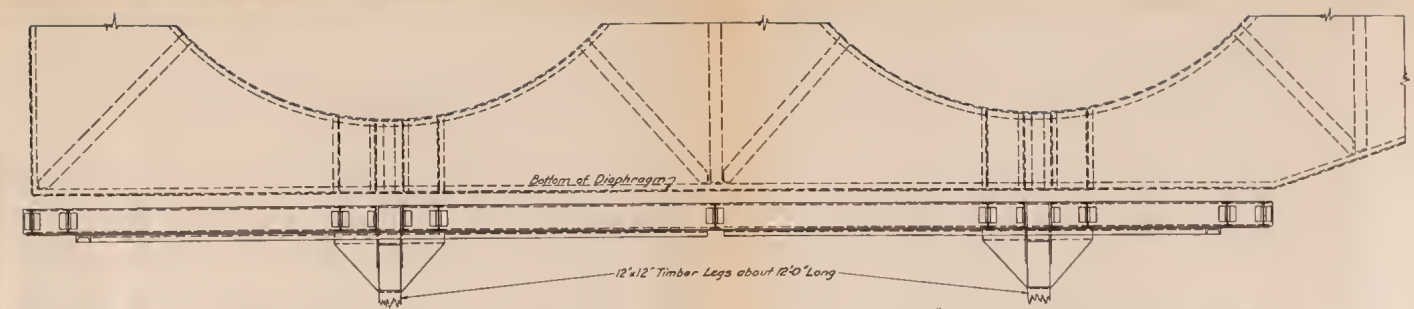
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

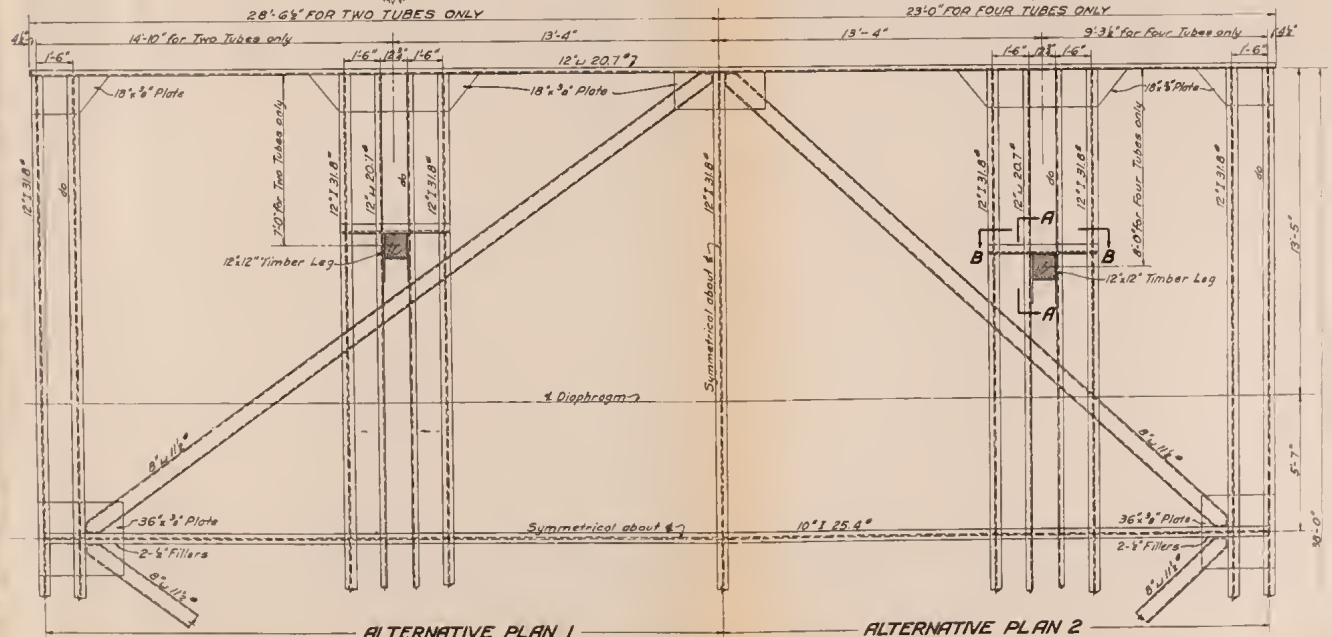
THE NARROWS TUNNEL

CONTRACT No 4A
CONTRACT DRAWING No 13

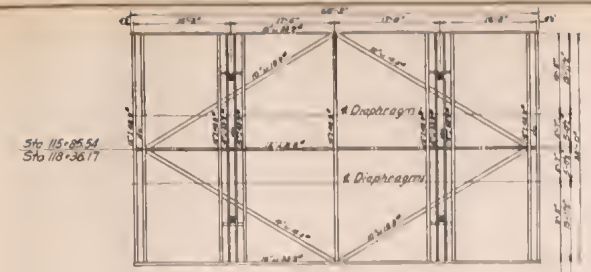
FILE No C4A

Drawn by
Traced by
Checked by





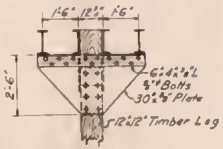
TYPICAL GRILLAGE OR LANDING PLATFORM TRENCH PORTION



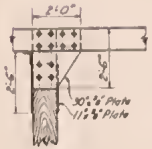
SPECIAL GRILLAGE
AT STA. 115+85.54 AND STA. 118+36.17

NOTE
The Contractor may substitute other forms of grillage or landing platform, subject to approval of the Engineer, and provided that the Contractor shall bear any additional cost involved thereby.

REFERENCE:
For Index of Contract Plans, see Contract Drawing No. 1.



SECTION B-B



SECTION A-A

Approved:
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

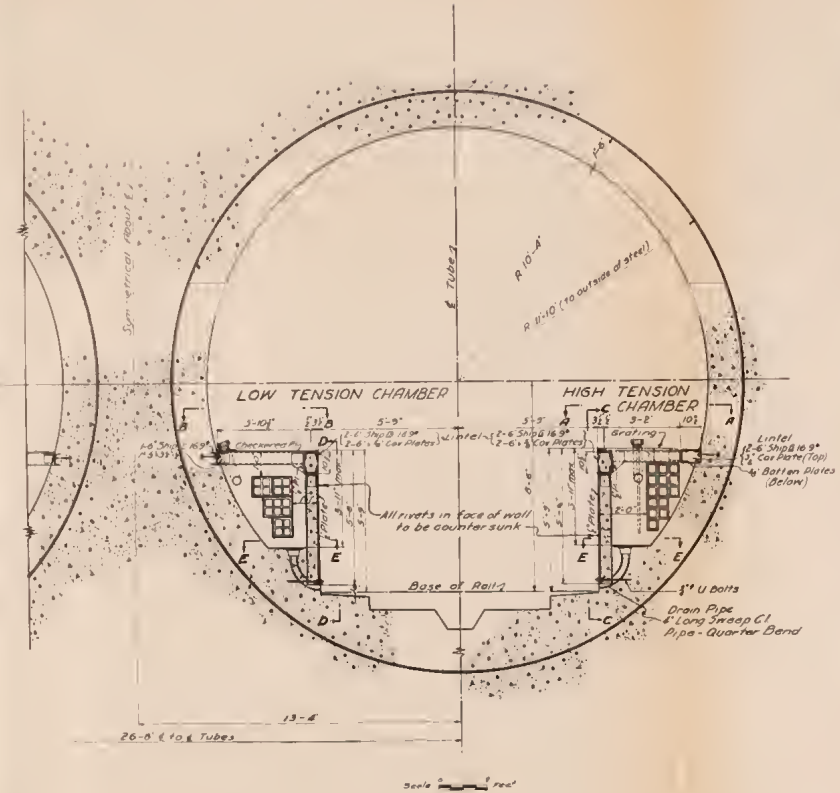
THE NARROWS TUNNEL

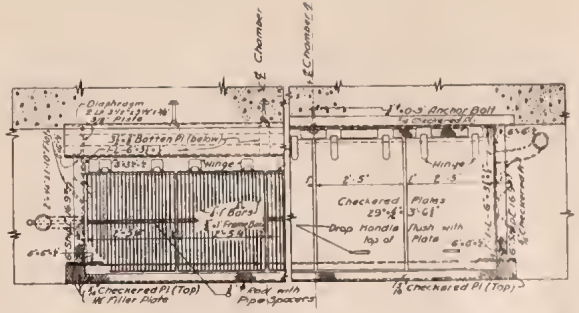
CONTRACT No 4A
CONTRACT DRAWING No 14

SCALE 1/4" = 1 FOOT DATE JAN. 15, 1929

FILE No C4A

Drawn M.A.B.
Traced
Checked

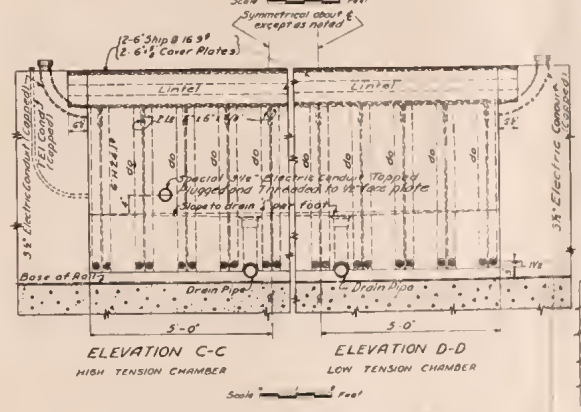




PLAN A-A
HIGH TENSION CHAMBER

PLAN B-B
LOW TENSION CHAMBER

Scale 1" = 1 foot

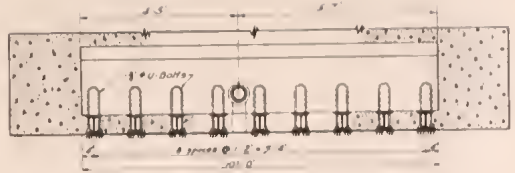


ELEVATION C-C
HIGH TENSION CHAMBER

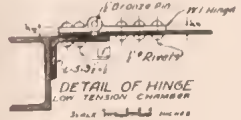
ELEVATION D-D
LOW TENSION CHAMBER

Scale 1" = 1 foot

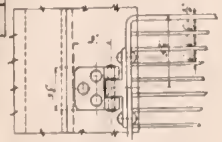
NOTE: 1" Electric Conduit to be provided at every third High Tension Chamber and at one end of Chamber only
One Drain per Chamber located off center as shown

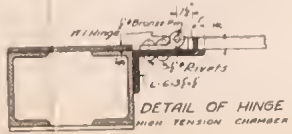


SECTION E-E
Scale 1" = 1 foot



DETAIL OF HINGE
LOW TENSION CHAMBER
Scale 1" = 1 inches





DETAIL OF HINGE
HIGH TENSION CHAMBER

NOTES

HIGH TENSION SPLICING CHAMBER -

Chambers spaced 330 feet apart in each tube
One chamber required in each shaft opposite to low tension splicing chamber. See Drawings Nos 43, 45, 49 & 50.
Chambers spaced 175 feet each side of center line of special splicing chamber at station 164+32

LOW TENSION SPLICING CHAMBER

Chambers spaced 370 feet apart in each tube
One chamber to be located on inside of each shaft, one on west end of Brooklyn Shaft and one on east end of Richmond Shaft. See Drawings Nos 43, 44, 49 & 50.
One chamber to be spaced 370 feet each side of special splicing chamber at station 164+32
All work called for is to be the same for Alternative Plan 1 (two tubes) and Alternative Plan 2 (four tubes).

REFERENCE
For Index of Contract Plans, see Contract Drawing No 1

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
BUREAU OF THE DIRECTOR OF WORKS
TUNNEL DIVISION

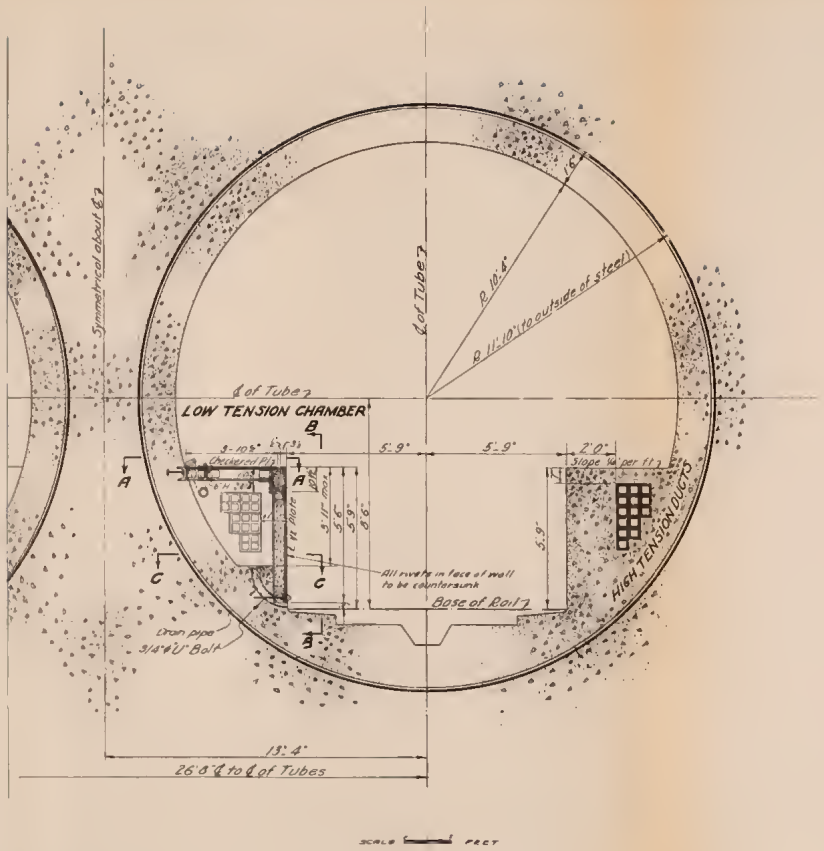
THE NARROWS TUNNEL
CONTRACT Nº 4A
CONTRACT DRAWING Nº 15

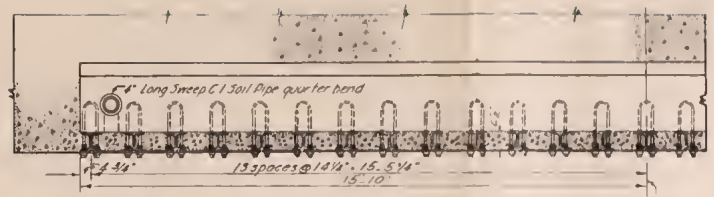
DATE JAN 6, 1930

FILE Nº C4A

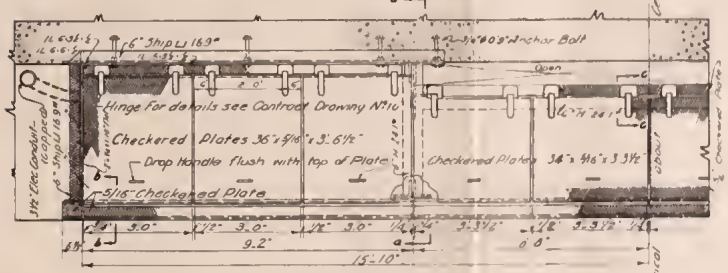
STANDARD SPLICING CHAMBERS - TRENCH PORTION

Drawn S.G.
Traced
Checked R.C.S.



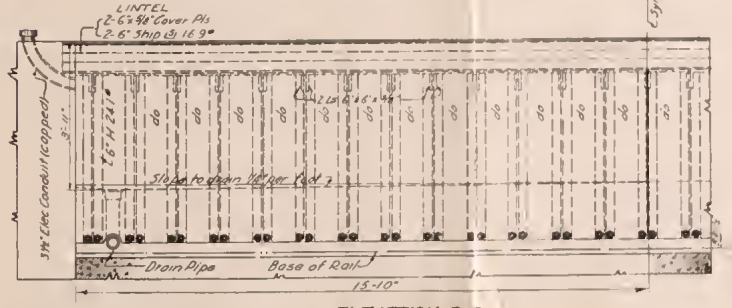


SECTION C-C

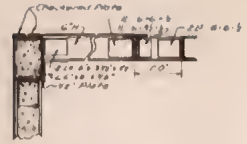


PLAN A-A

SCALE FEET



ELEVATION B-B



SECTION a-a

SCALE FEET

SECTION b-b

SCALE FEET

SECTION c-c

SCALE INCHES

For Details of Hinge see Contract Drawing No 15

NOTES

One Special Splicing Chamber at Station 18+88 in each Tube. This chamber is for bending pots for telephone cables which will be placed on Dwg Plan A

All work called is to be the same for Alternative Plan (Two tubes) and Alternative Plan B (four tubes)

REFERENCE

For Index of Contract Plans see Contract Drawing No 1

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
PUBLIC WORKS

THE NARROWS TUNNEL

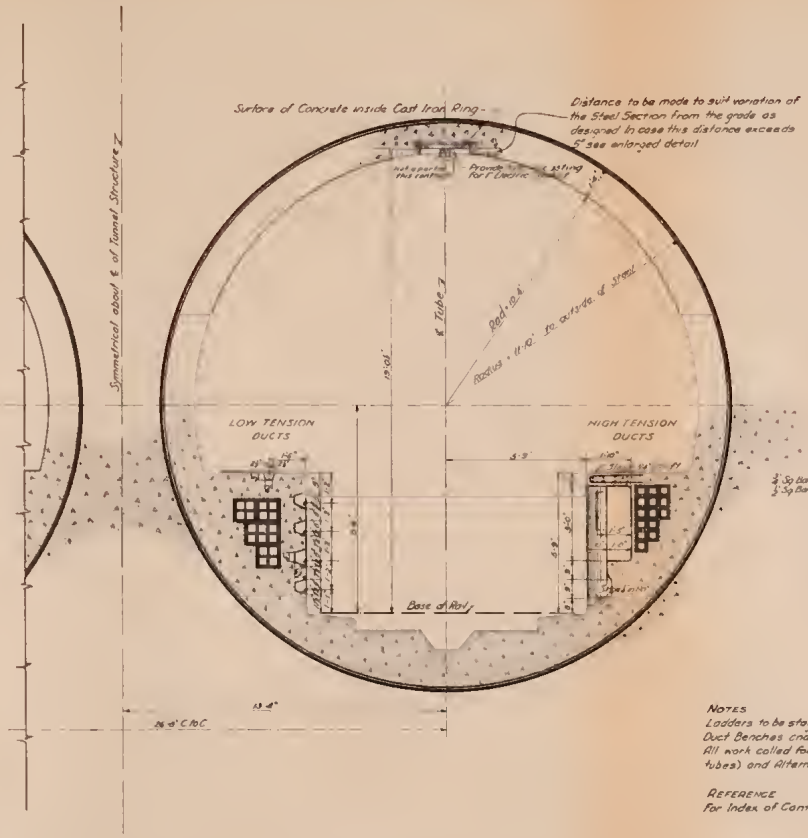
CONTRACT Nº 4A
CONTRACT DRAWING Nº 16

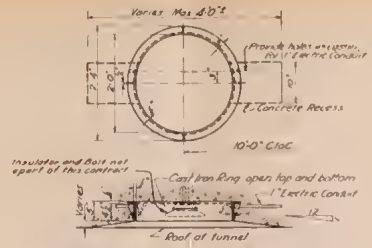
SIGNATURE OF ENGINEER — SIGNATURE OF ENGINEER

FILE Nº C4A

SPECIAL SPLICING CHAMBER-TRENCH PORTION

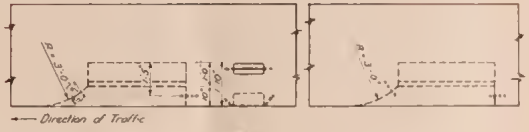
Drawn J.E.C.
Traced J.E.C.
Checked 7/1/24 RCS



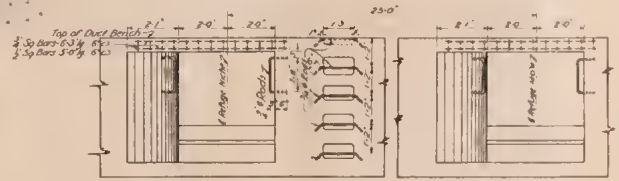


ENLARGED DETAIL OF ROOF POCKET

SCALE 0 1 FOOT



PLAN



ELEVATION OF HIGH TENSION DUCT BENCH

NOTES
Ladders to be staggered along High and Low Tension Duct Benches and to be spaced 100 feet apart on each Bench
All work called for to be the same for Alternative Plan 1 (Two tubes) and Alternative Plan 2 (Four tubes)

REFERENCE
For Index of Contract Plans, see Contract Drawing No 1

REFUGE NICHES, LADDERS AND ROOF POCKETS - TRENCH PORTION

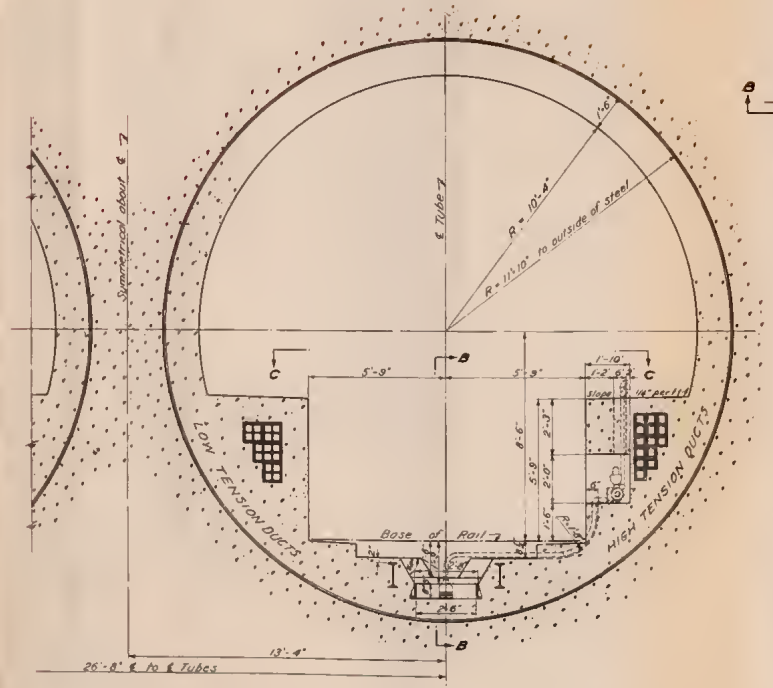
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

THE NARROWS TUNNEL

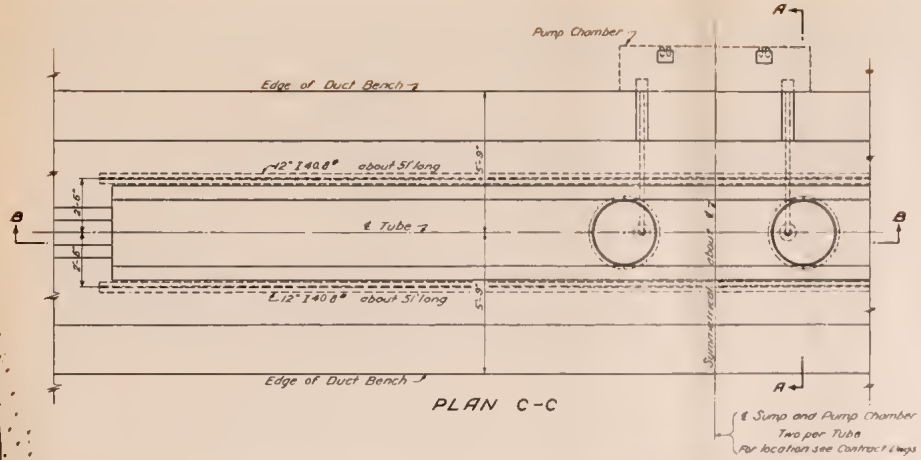
CONTRACT No 4A
CONTRACT DRAWING No 17

FILE No C4A

Drawn F.J.R.
Traced F.J.R.
Checked W.H.R. R.C.A.



SECTION A-A

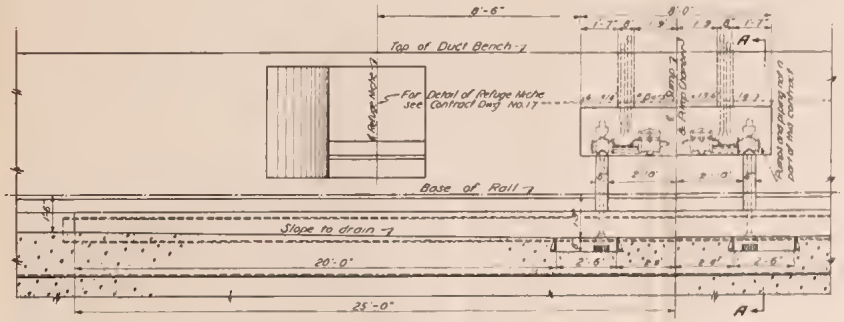


PLAN C-C

DETAIL OF CAST IRON SUMP BOX

NOTE
All work called for is to be the same for Alternative Plan I (Two tubes) and Alternative Plan II (Four tubes)

REFERENCE
For Index of Contract Plans, see Contract Drawing No 1



SECTION B-B

Approved
Consultants

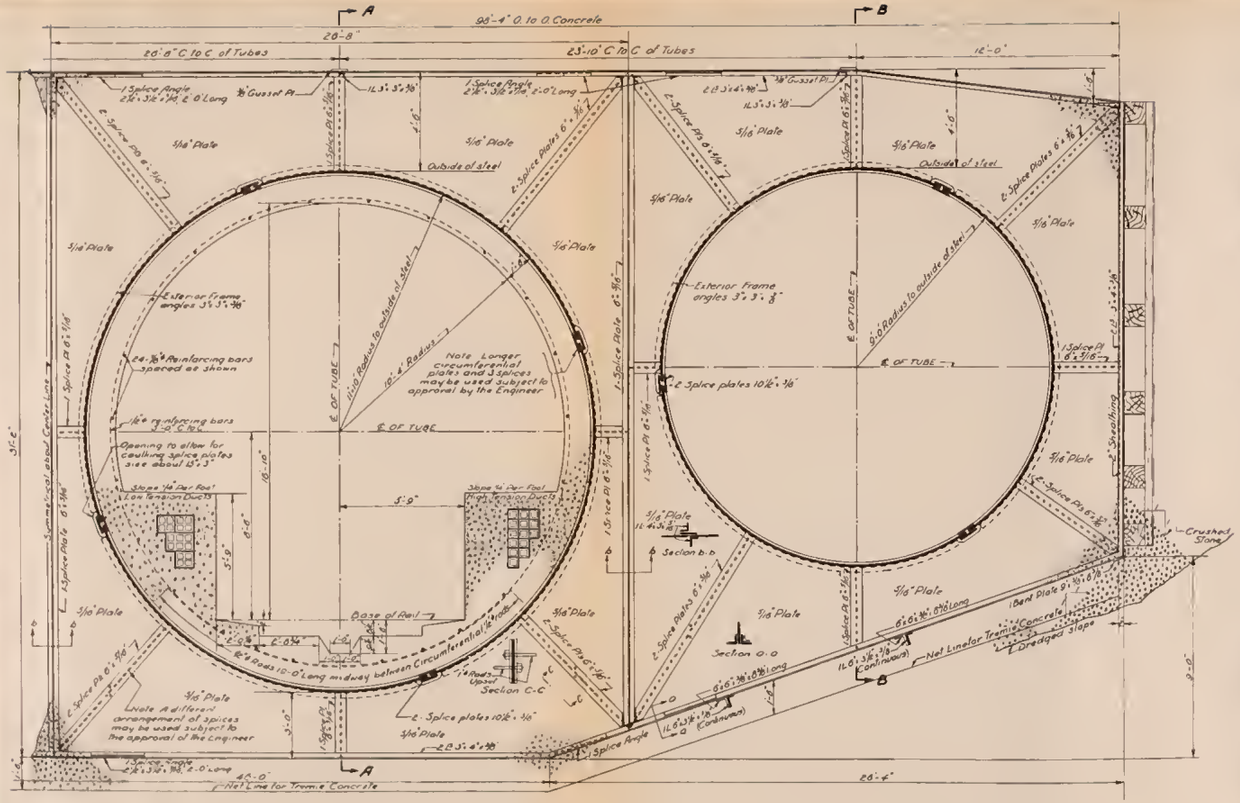
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT

THE NARROWS TUNNEL
CONTRACT No 4 A
CONTRACT DRAWING No 18

FILE No C4A

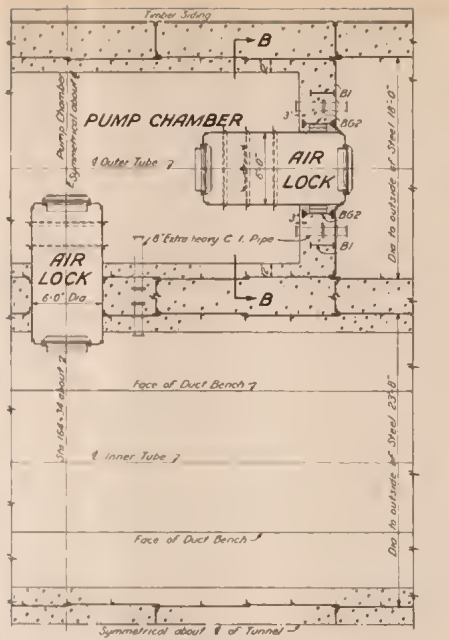
SUMPS AND PUMP CHAMBERS-TRENCH PORTION

Drawn S.G.
Traced S.G.
Checked H.R. R.C.S.

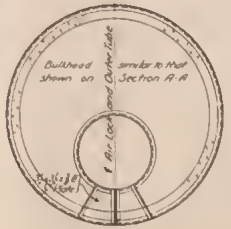


TYPICAL CONSTRUCTION - TRENCH PORTION

ALTERNATIVE PLAN 2

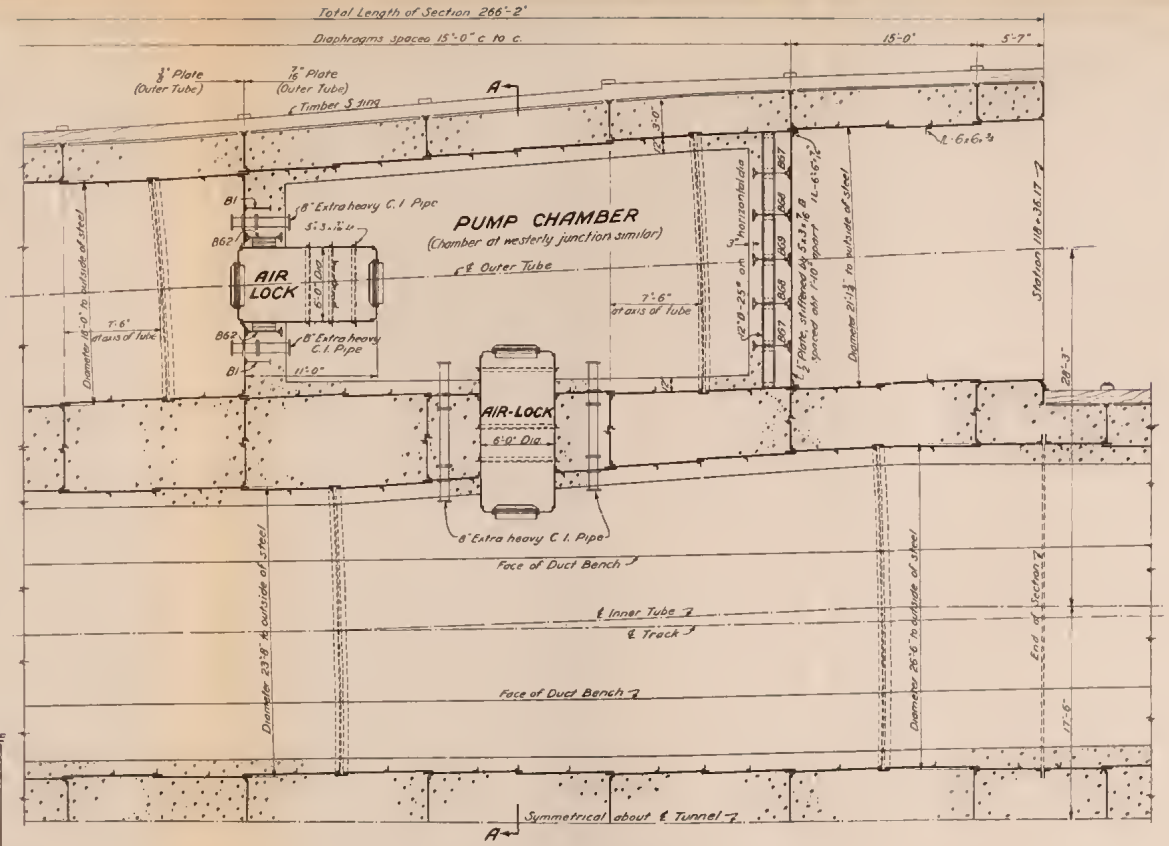


SECTIONAL PLAN
PUMP CHAMBER AT SUMMIT

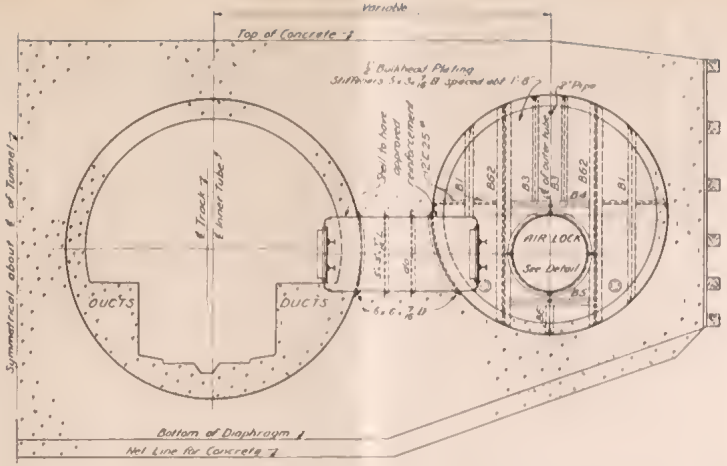


SECTION B-B

BEAM AND GIRDER SCHEDULE		
MARK	WEB	FL. ANGLES
B1	24" I	73.9#
B62	PL 33 x 3/16	2D 6x6x 3/8 (PL 14 x 1/2)
B3	15" I	42.9#
B4	24" I	73.9#
B5	do-	
B6	do-	
B67	PL 36 x 1/2	2D 4x3x 1/2 (PL 10 x 1/2)
B68	PL 36 x 1/2	2D 6x6x 1/2 (PL 14 x 1/2)
B69	PL 36 x 1/2	do-



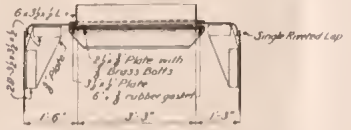
SECTIONAL PLAN
PUMP CHAMBER AT EASTERLY JUNCTION

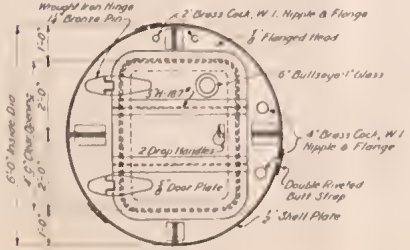


SECTION A-A

NOTES
Pump Chambers required in both north and south outer tubes, at east and west junctions and at summit.
All shell riveting to be made water tight.
Caulking edges to be planed or bevel sheared.

REFERENCE
For Index to Contract Plans, see Contract Drawing No. 1





DETAIL OF AIR-LOCK

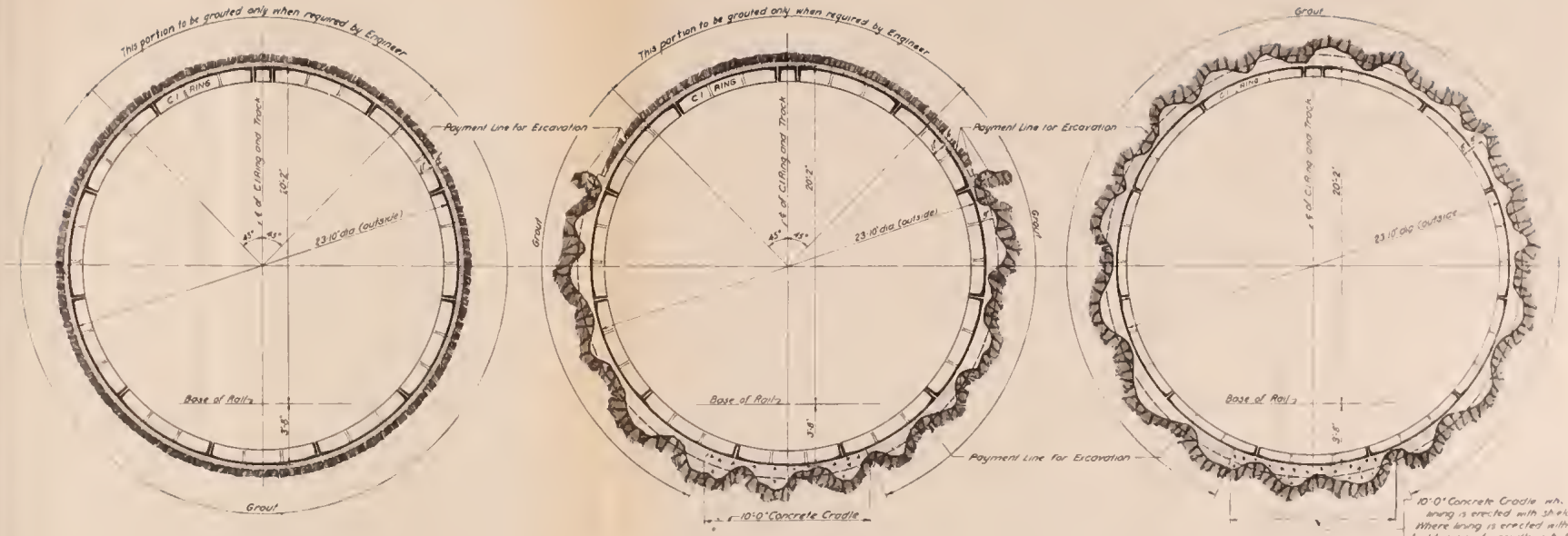
Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT

THE NARROWS TUNNEL
CONTRACT Nº 4A
CONTRACT DRAWING Nº 20

FILE Nº C4A

PUMP CHAMBERS IN OUTER TUBES, TRENCH PORTION
ALTERNATIVE PLAN 2



SECTION IN EARTH

SECTION IN EARTH AND ROCK

SECTION IN ROCK

10'-0" Concrete Cradle where lining is erected with shield. Where lining is erected without shield, concrete cradle is to be carried up to horizontal diameter of tube, above which stone packing and grout are to be placed outside of C.I. Ring

23'-10" DIA. CAST IRON TUNNEL

(UNLINED)

CONNECTIONS PORTION

REFERENCE
For Index of Contract Plans, see Contract Drawing No 1

Approved
Consultants

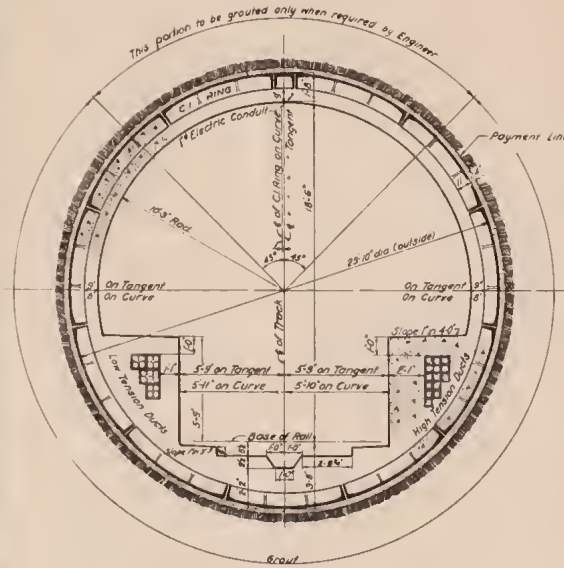
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

THE NARROWS TUNNEL

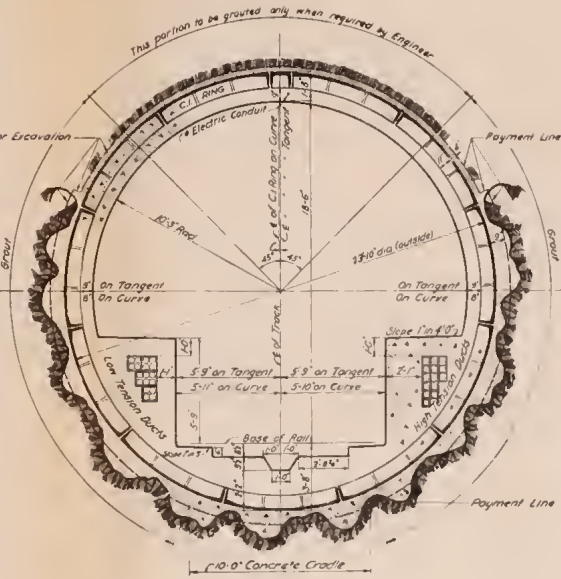
CONTRACT No 4A
CONTRACT DRAWING No 21

FILE No C4A

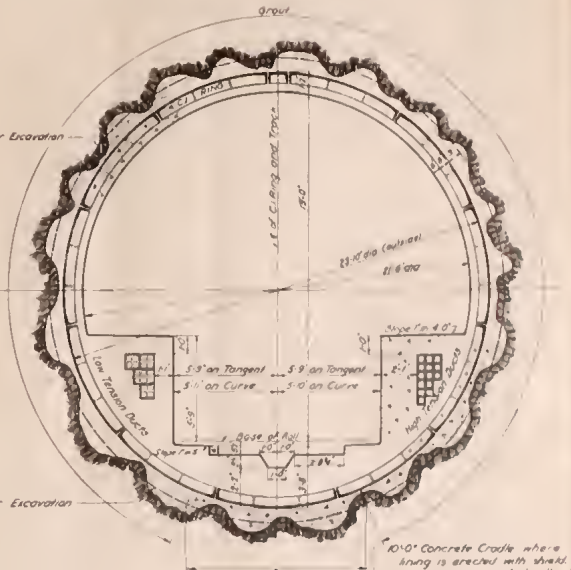
Drawn H.S.
Traced H.S.
Checked



SECTION IN EARTH



SECTION IN EARTH AND ROCK



SECTION IN ROCK

10'-0" Concrete Cradle where lining is erected with shield. Where lining is erected without shield, concrete cradle is to be carried up to horizontal diameter of tube, above which stone packing and grout are to be placed outside of C.I. Ring

NOTES

Sections are drawn looking Westward and apply to either Tube excepting Duct arrangement
Ducts shown in position for North Tube (Westbound).
Duct arrangement for South Tube (Eastbound) opposite hand

REFERENCES

For Index of Contract Plans, see Contract Drawing No. 1.

23'-10" DIA. CAST IRON TUNNEL
(LINED)
CONNECTIONS PORTION

Approved
Consultants

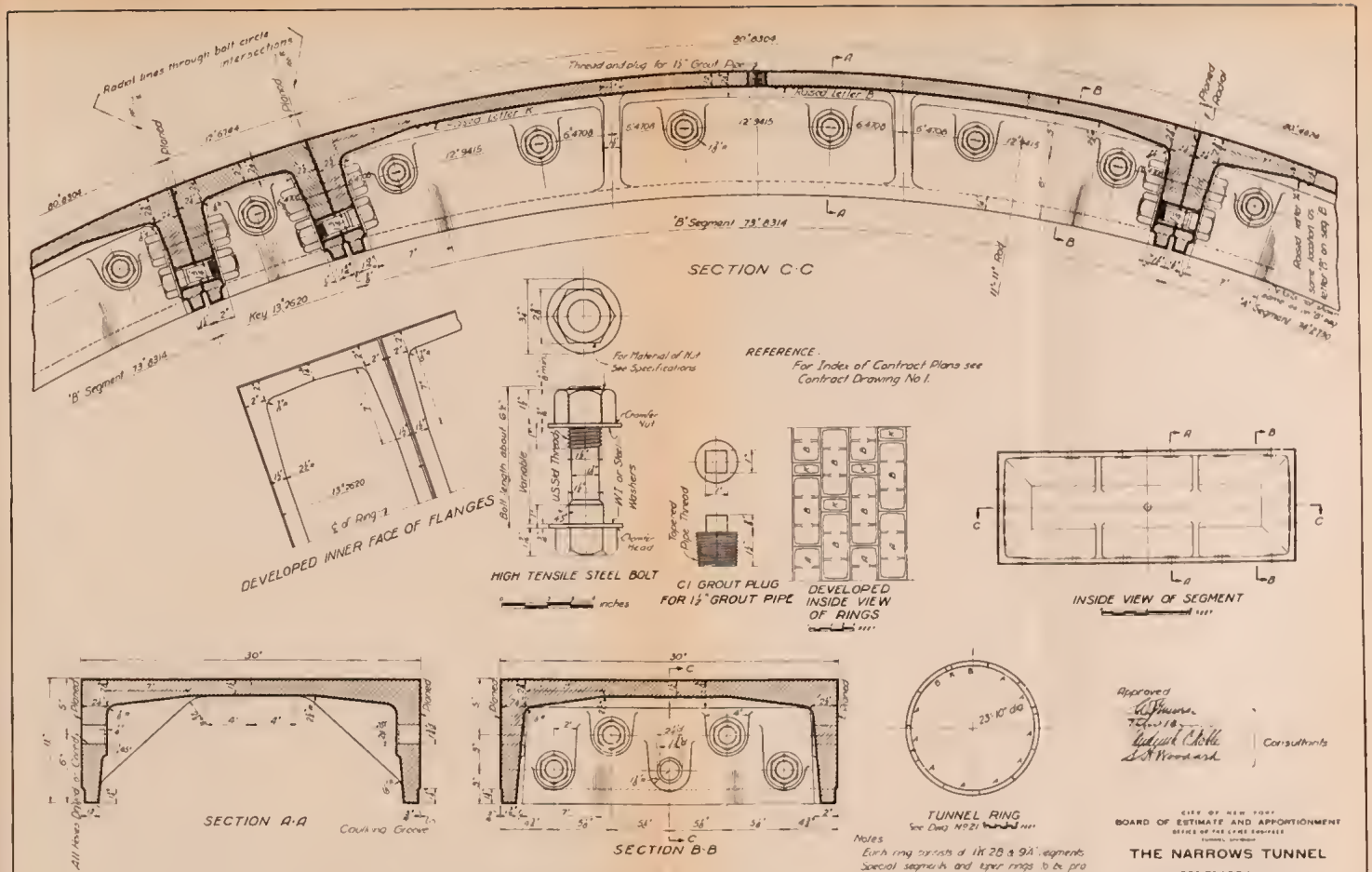
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

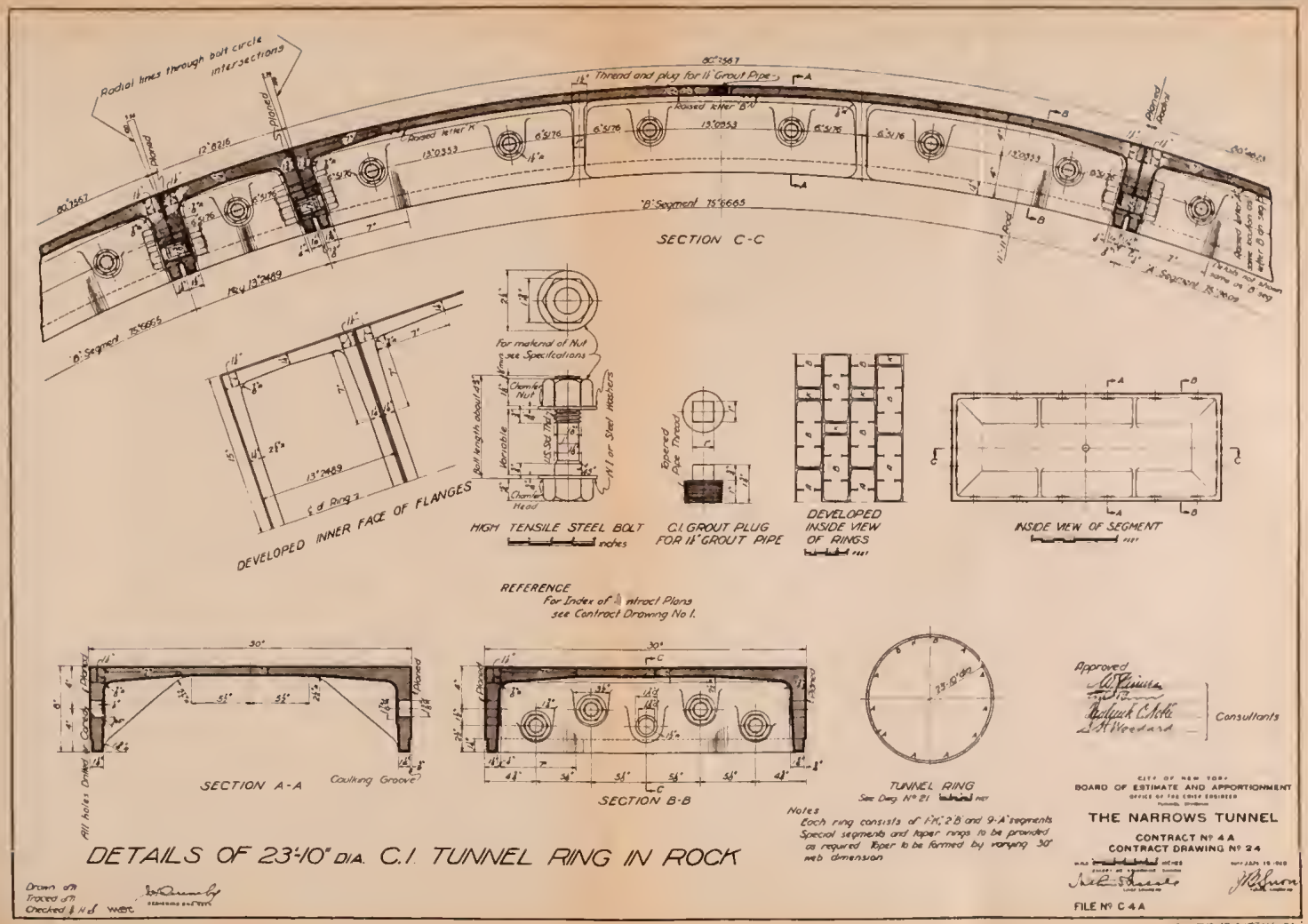
THE NARROWS TUNNEL

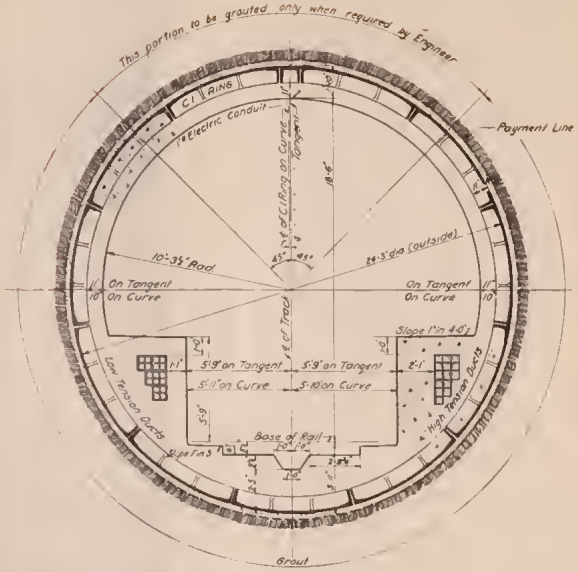
CONTRACT No 4 A
CONTRACT DRAWING No 22

FILE No C 4A

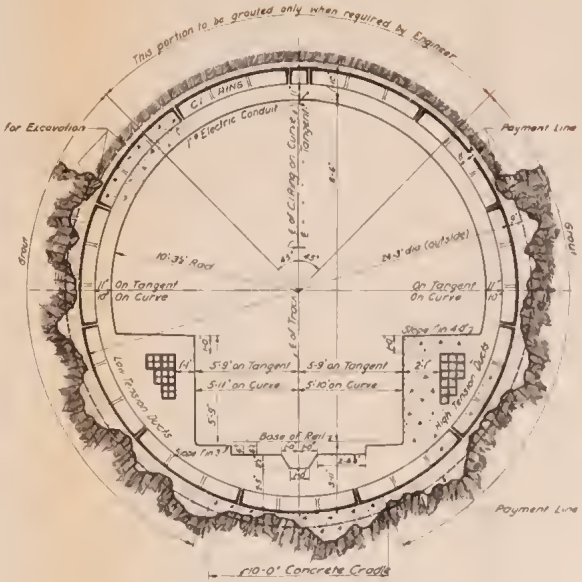
Drawn KS
Traced KS
Checked


Radial lines through bolt circle intersections
Thread and plug for 1½" Grout Pipe
Raised letter B
Raised letter K
'B' Segment 73°.8314
SECTION C-C
Key 13°.2620
'B' Segment 73°.8314
For Material of Bolt See Specifications
REFERENCE: For Index of Contract Plans see Contract Drawing No 1.
DEVELOPED INNER FACE OF FLANGES
HIGH TENSILE STEEL BOLT
C1 GROUT PLUG FOR 1½" GROUT PIPE
DEVELOPED INSIDE VIEW OF RINGS
INSIDE VIEW OF SEGMENT
SECTION A-A
Coaling Groove
SECTION B-B
TUNNEL RING
23'-10" dia
Notes
Each ring consists of 1 K 28 & 9 A segments. Special segments and taper rings to be provided as required. Taper to be formed by varying the 10" web dimension. Cast steel tunnel rings, if required by the Engineer, shall conform to the details on this sheet.
Approved
Consultants
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
THE NARROWS TUNNEL
CONTRACT No 4 A
CONTRACT DRAWING No 23
FILE No C 4 A
DETAILS OF 23'-10" DIA. C.I. TUNNEL RING IN EARTH AND IN EARTH & ROCK
Drawn
Traced
Checked

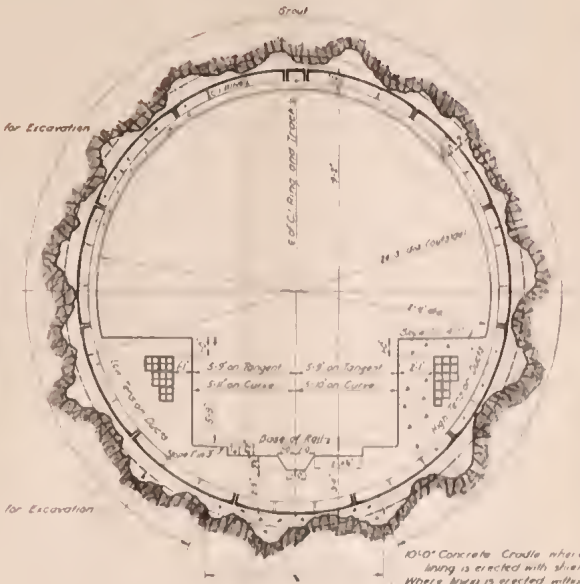

Radial lines through bolt circle intersections
Thread and plug for 11" Grout Pipe
Raised letter B-0
Raised letter H
'B' Segment 75°6665
SECTION C-C
'A' Segment 75°3409
For material of Nut see Specifications
Chamfer Nut
Bolt length about 4½"
Variable
Chamfer Head
Steel Washers
Tapered Pipe Thread
DEVELOPED INNER FACE OF FLANGES
HIGH TENSILE STEEL BOLT
C.I. GROUT PLUG FOR 11" GROUT PIPE
DEVELOPED INSIDE VIEW OF RINGS
INSIDE VIEW OF SEGMENT
REFERENCE
For Index of Contract Plans see Contract Drawing No 1.
SECTION A-A
Caulking Groove
All holes Drilled & Candy Planed
SECTION B-B
TUNNEL RING
See Dwg. No 21
Notes
Each ring consists of 1-'H', 2-'B' and 9-'A' segments
Special segments and taper rings to be provided as required. Taper to be formed by varying 30" web dimension
Approved
Consultants
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 24
FILE No C 4A
DETAILS OF 23'-10" DIA. C.I. TUNNEL RING IN ROCK
Drawn off
Traced off
Checked
WBC



SECTION IN EARTH



SECTION IN EARTH AND ROCK



SECTION IN ROCK

10'-0" Concrete Cradle where lining is erected with shield. Where lining is erected without shield, concrete cradle is to be carried up to horizontal diameter of tube, above which stone packing and grout are to be placed outside of C.I. Ring

NOTES

Sections are drawn looking Westward and apply

Ducts shown in position for North Tube (Westbound).
Duct arrangement for South Tube (Eastbound) opposite hand.

REFERENCE

For Index of Contract Plans
see Contract Drawing No 1.

24-3 DIA. CAST IRON TUNNEL

CONNECTIONS PORTION

Approved

Consultants

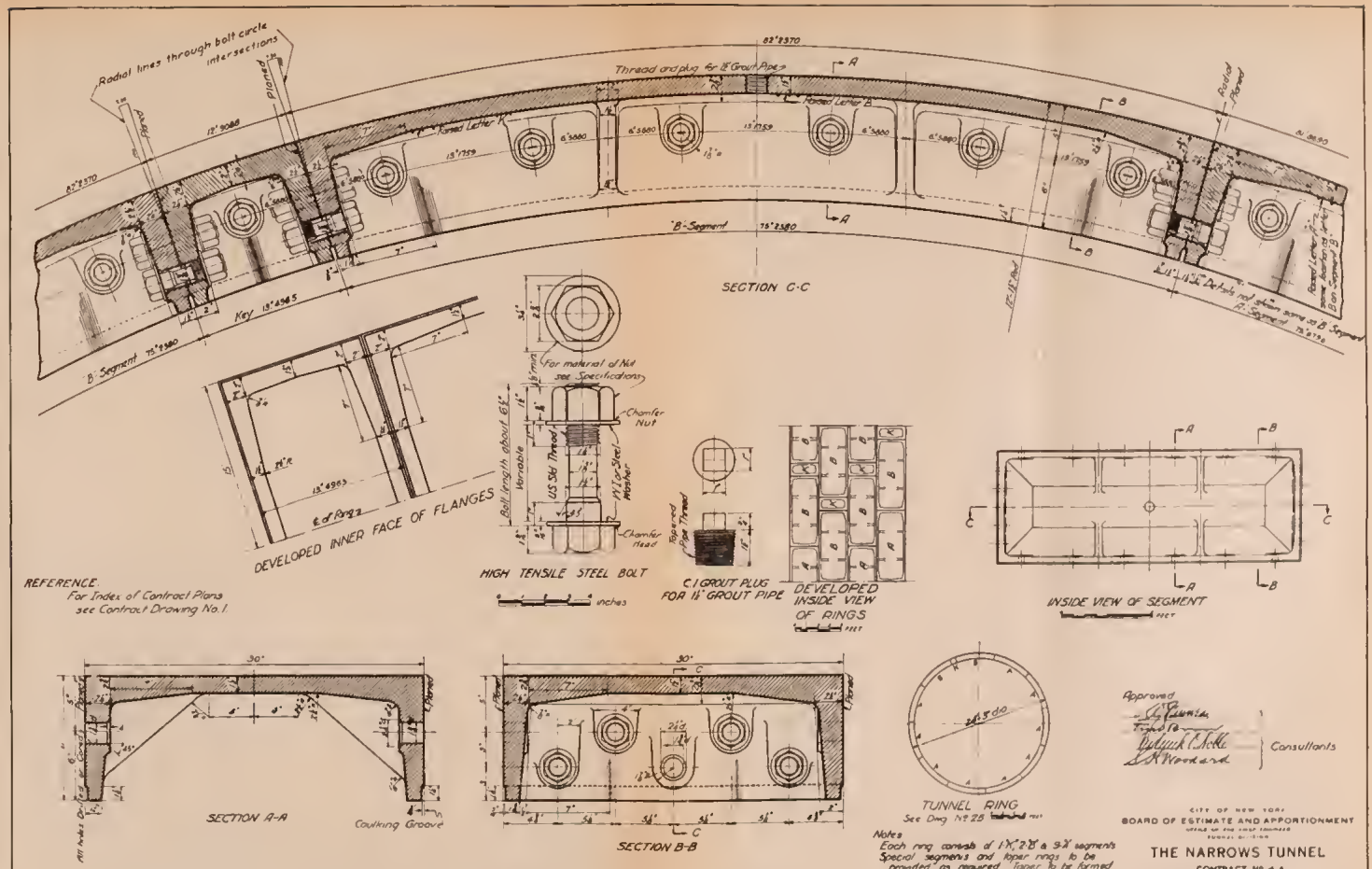
STATE OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT

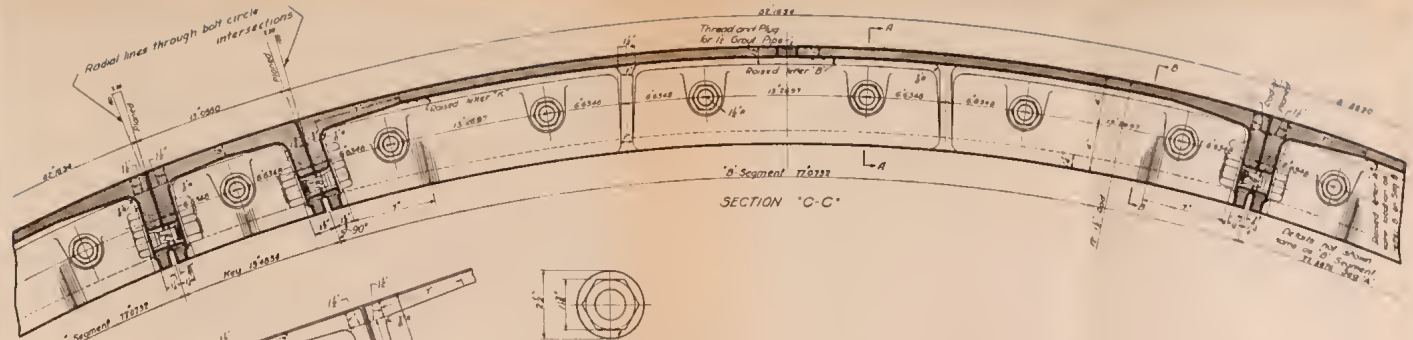
THE NARROWS TUNNEL

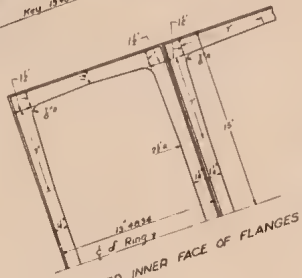
CONTRACT Nº 4 A
CONTRACT DRAWING Nº 25

FILE Nº C 4 A

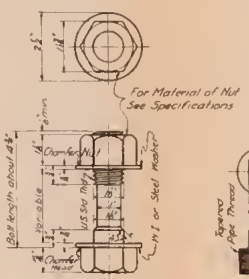
Drawn A. Trosse Jr


Radial lines through bolt circle intersections
Planed
Thread and plug for 1½" Grout Pipe
Tooled Letter
SECTION C-C
'B' Segment
Key
DEVELOPED INNER FACE OF FLANGES
For material of Nut see Specifications
Chamfer Nut
Variable
U.S. Std Thread
Chamfer Head
HIGH TENSILE STEEL BOLT
inches
Tapered Pipe Thread
C.I. GROUT PLUG FOR 1½" GROUT PIPE
DEVELOPED INSIDE VIEW OF RINGS
feet
INSIDE VIEW OF SEGMENT
feet
REFERENCE:
For Index of Contract Plans see Contract Drawing No. 1.
SECTION A-A
Caulking Groove
SECTION B-B
TUNNEL RING
See Dwg No. 28
Notes
Each ring consists of 1½"x2½" & 3½" segments
Special segments and taper rings to be provided as required. Taper to be formed by varying the 30" web dimension
Cast steel tunnel rings, if required by the Engineer, shall conform to the details on this sheet
Approved
Consultants
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
THE NARROWS TUNNEL
CONTRACT No 4 A
CONTRACT DRAWING No 28
FILE No C4A
DETAILS OF 24' 3" DIA C.I. TUNNEL RING IN EARTH AND IN EARTH & ROCK
Drawn
Traced
Checked

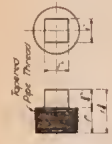




DEVELOPED INNER FACE OF FLANGES

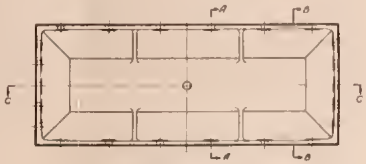


HIGH TENSILE STEEL BOLT



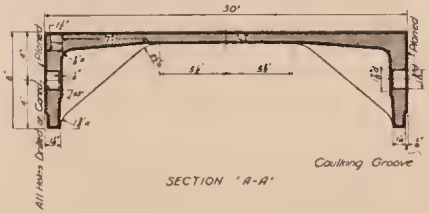
C1 GROUT PLUG FOR 1½" GROUT PIPE

DEVELOPED INSIDE VIEW OF RINGS

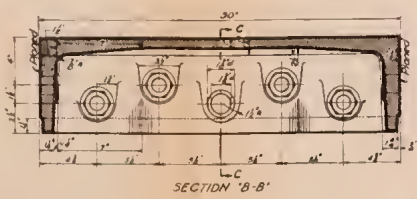


INSIDE VIEW OF SEGMENT

REFERENCE
For Index of Contract Plans see Contract Drawing No. 1.



SECTION 'A-A'



SECTION 'B-B'

TUNNEL RING
See Dwg No. 25

Notes
Each ring consists of 1 'M', 2 'B' & 9 'A' segments
Special segments and taper rings to be provided as required. Taper to be formed by varying the 30" web dimension

Approved
Consultants

STATE OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

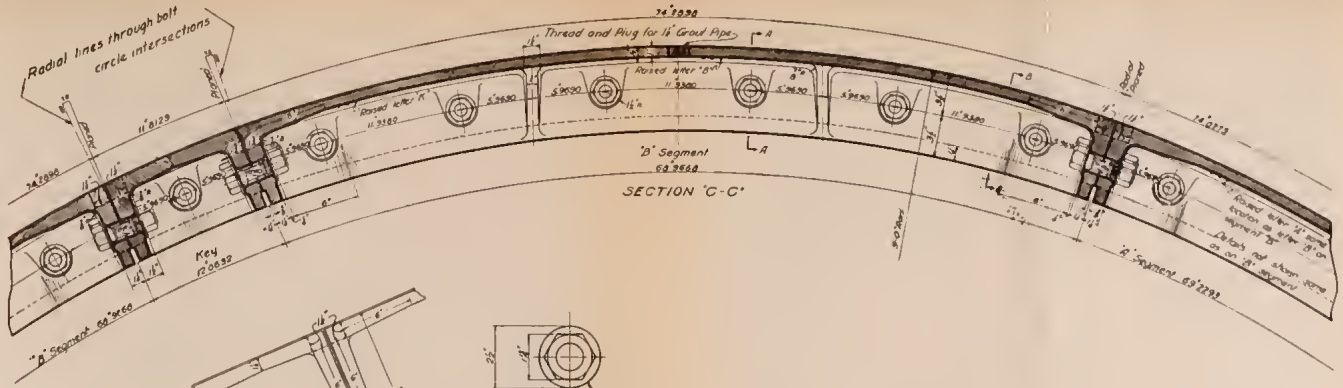
THE NARROWS TUNNEL

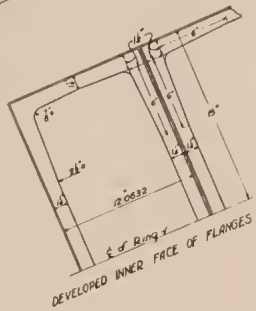
CONTRACT No. 4 A
CONTRACT DRAWING No. 27

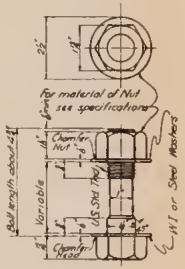
FILE No. C 4 A

DETAILS OF 24'-3" DIA. C.I. TUNNEL RING IN ROCK

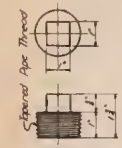
Drawn
Traced
Checked





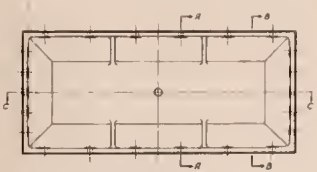


HIGH TENSILE STEEL BOLT



C.I. GROUT PLUG FOR 1½" GROUT PIPE

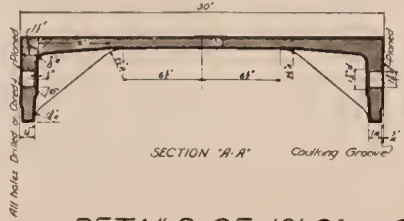
DEVELOPED INSIDE VIEW OF RINGS

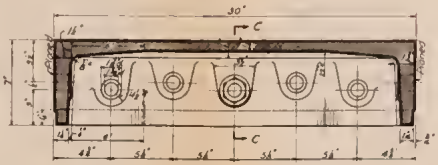


INSIDE VIEW OF SEGMENT

inches

REFERENCE:
For Index of Contract Plans see Contract Drawing No. 1.





TUNNEL RING
See Dwg. No. 32

Notes
Each ring consists of 1 "A", 2 "B" and 7 "A" segments
Special segments and taper rings to be provided as required. Taper to be formed by varying the 30" web dimension.
Cast steel tunnel rings, if required by the Eng. Engr. shall conform to the details on this sheet

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER

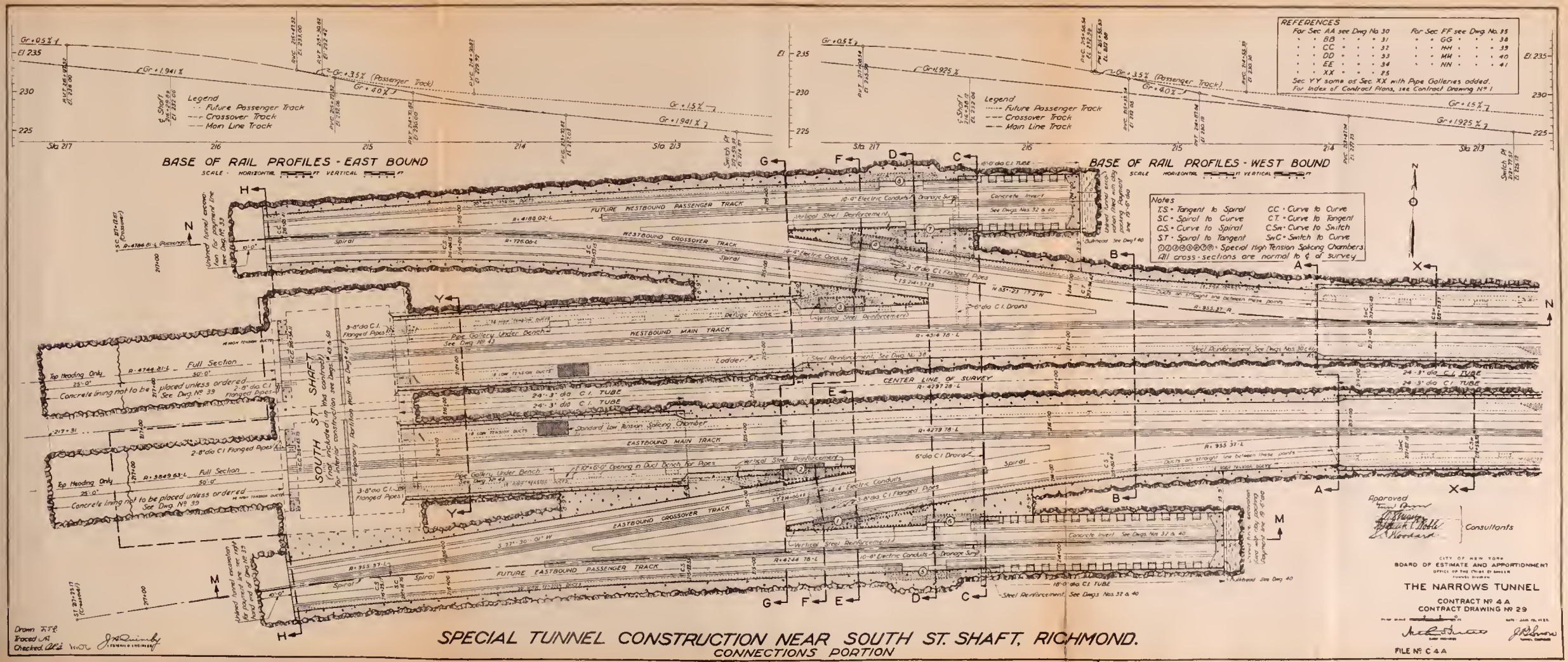
THE NARROWS TUNNEL

CONTRACT No. 4 A
CONTRACT DRAWING No. 28

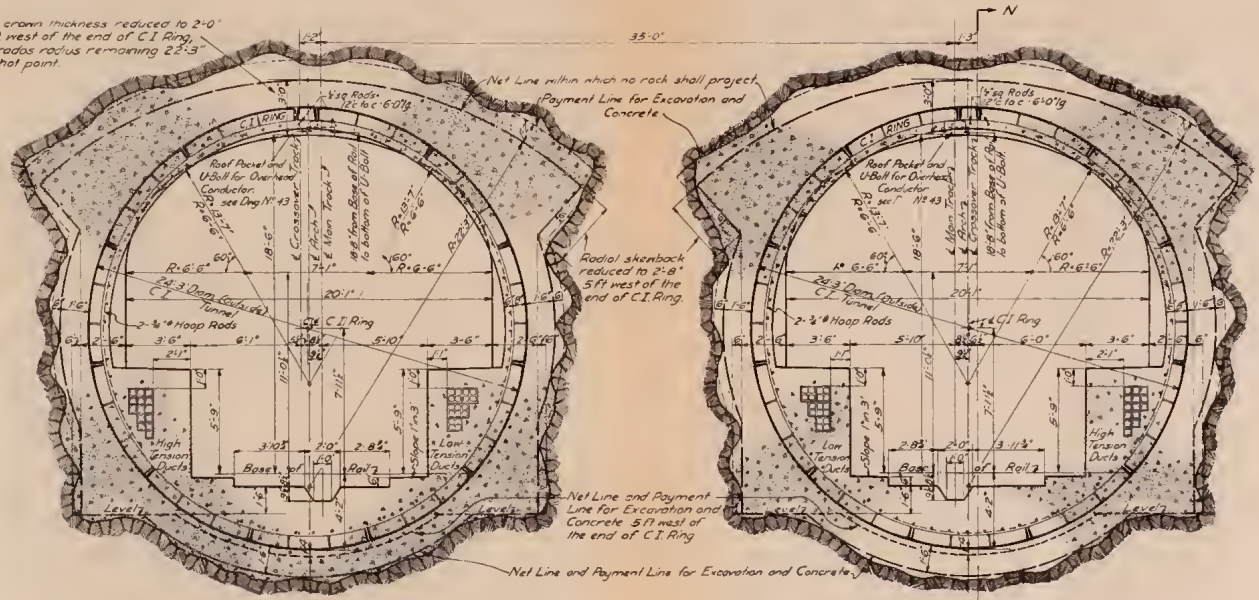
DETAILS OF 18'-0" DIA. C.I. TUNNEL RING

Drawn
Traced
Checked

FILE No. C 4 A



SPECIAL TUNNEL CONSTRUCTION NEAR SOUTH ST. SHAFT, RICHMOND.
CONNECTIONS PORTION



SECTION A-A

(STATION 213+11±)

NOTES:

Payment Lines and Excavation Lines of Section A-A apply for a distance of 5 ft each side of the end of the C.I. Ring. (see Drg. No. 41)

At Switch Points C.I. Rings are in their normal position with relation to Base of Rail and ℄ Main Track (see Drg. No. 25)

REFERENCES

For Index of Contract Plans, see Contract Drawing No.

" Section "N-N" see Contract Drawing No. 41 "

Approved

Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No. 4 A
CONTRACT DRAWING No. 30

SCALE 1/8" = 1 FOOT

DATE - JAN. 18, 1928

CHIEF ENGINEER

TUNNEL ENGINEER

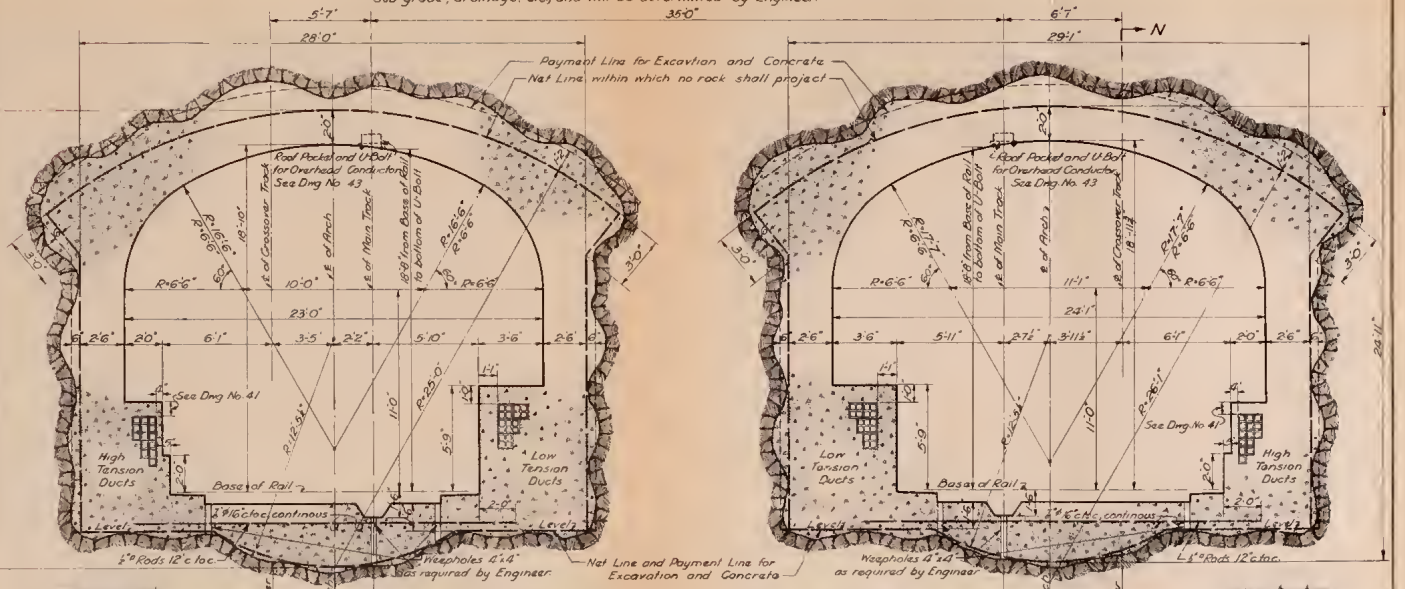
FILE No. C 4 A

Drawn by
Checked by
Checked by

DIS. DRAWING ENGINEER

NOTES

Tunnel Invert will be built to lines indicated as Alternative No.1 unless otherwise directed.
The use of Tunnel Invert as shown on Alternative No.2 will depend upon conditions of sub-grade, drainage, etc, and will be determined by Engineer.



REFERENCES
For Index of Contract Plans, see Contract Drawing Nº 1.
Section 'N-N' see Contract Drawing Nº 41.

SECTION B-B
(STATION 213+75 ±)

Approved:
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

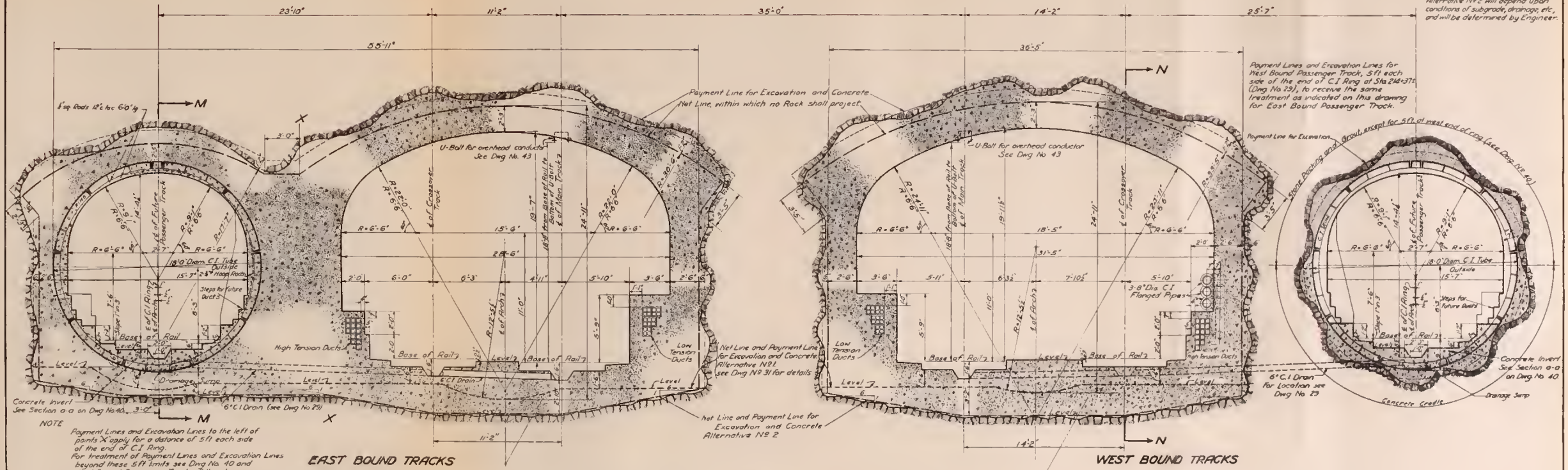
THE NARROWS TUNNEL

CONTRACT Nº 4A
CONTRACT DRAWING Nº 31

FILE Nº C4A

Drawn F.J.R.
Traced F.J.R.
Checked C.R.B. W.S.C.

NOTES: Tunnel invert will be built to lines indicated as Alternative Nº 1 unless otherwise directed.
The use of tunnel invert as shown on Alternative Nº 2 will depend upon conditions of subgrade, drainage, etc., and will be determined by Engineer.



NOTE

Payment Lines and Excavation Lines to the left of points X apply for a distance of 5 ft each side of the end of C.I. Ring.
For treatment of Payment Lines and Excavation Lines beyond these 5 ft limits see Dwg No. 40 and West Bound Passenger Track of this drawing.

REFERENCES

For Index of Contract Plans, see Contract Drawing Nº 1.
" Section "M-M" see Contract Drawing Nº 40
" " "N-N" " " " 41

SECTION C-C

(STATION 214 + 25 ±)

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT Nº 4 A
CONTRACT DRAWING Nº 32

SCALE 1 FOOT — DATE JAN 18 1923

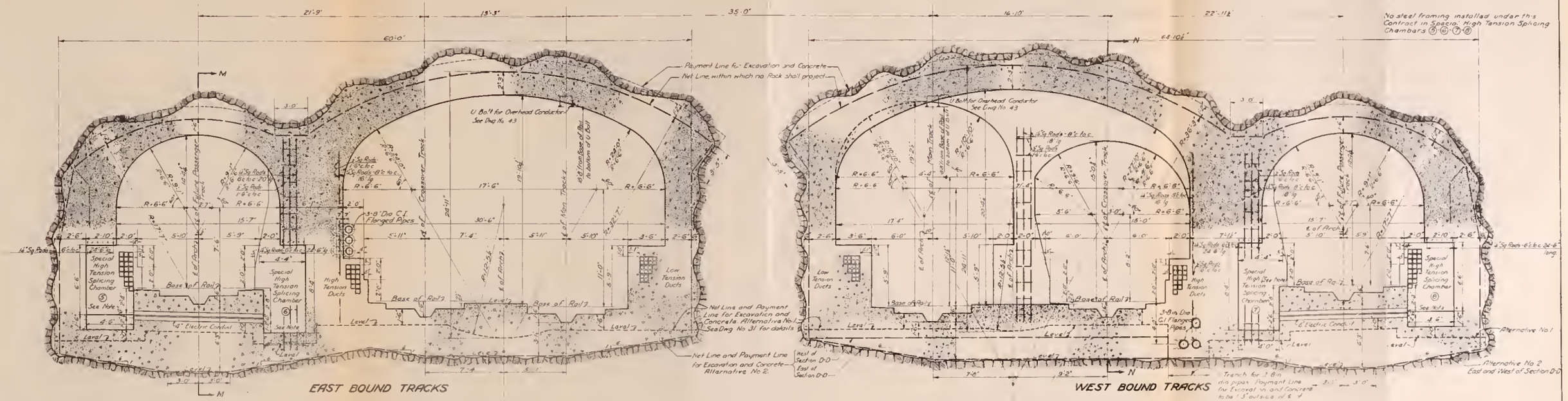
Chief Engineer — Tunnel Engineer

FILE Nº C 4 A

Drawn F.H.G.
Traced T.H.P.
Checked W.E.S.
Assistant Engineer

NOTES
Tunnel Invert will be built to lines indicated as Alternative No 1 unless otherwise directed.
The use of Tunnel Invert as shown on Alternative No 2 will depend upon conditions of sub-grade, drainage etc, and will be determined by Engineer

No steel framing installed under this Contract in Special High Tension Splicing Chambers ⑤ ⑥ ⑦ ⑧



REFERENCES
For Index of Contract Plans, see Contract Drawing No 1
" Section "M-M" see Contract Drawing No 40
" " "N-N" " " " 41

SECTION D-D
(STATION 214+42±)

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

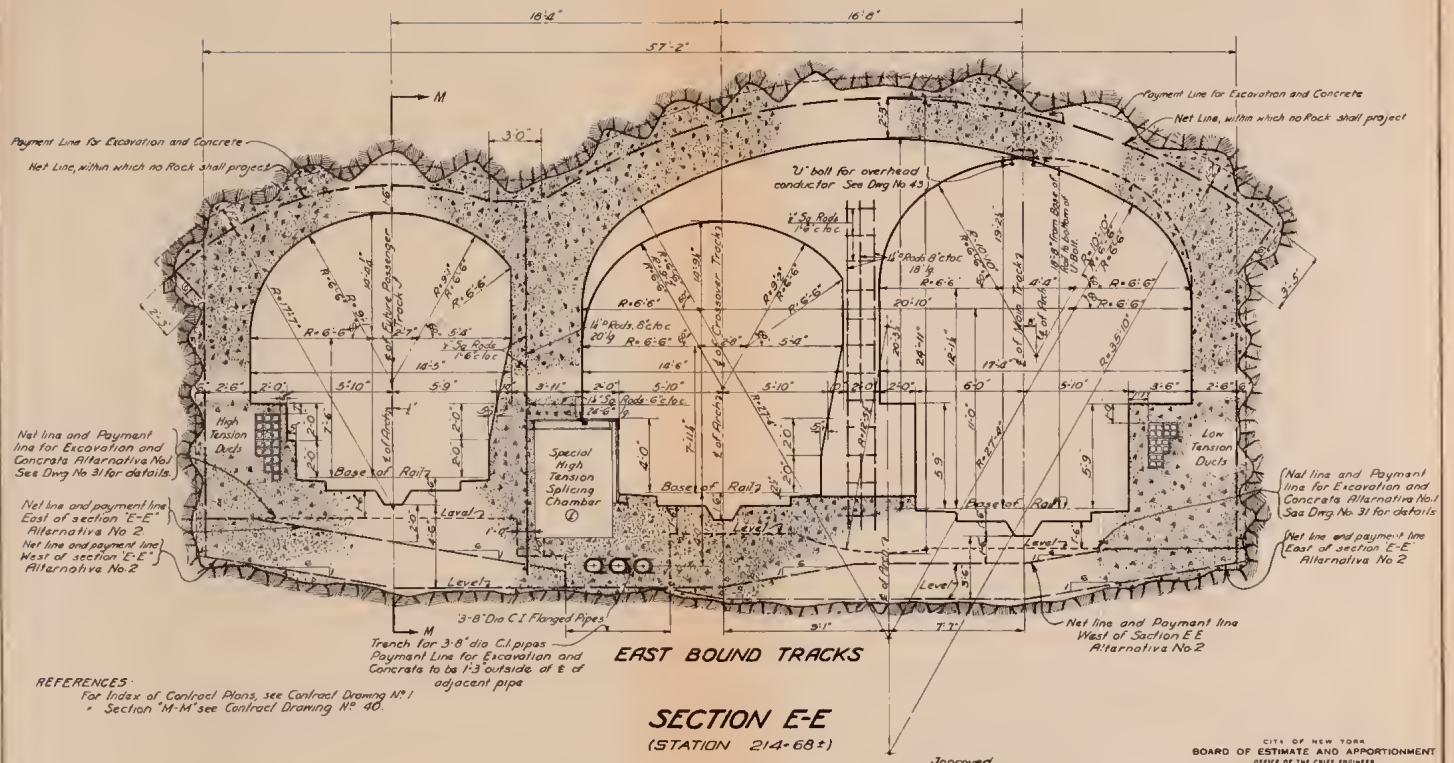
CONTRACT No 4A
CONTRACT DRAWING No 33

SCALE 1/4" = 1 FOOT DATE JUNE 10 1925

CHIEF ENGINEER TUNNEL ENGINEER

FILE No C4A

NOTES:
Tunnel Invert will be built to lines indicated as Alternative No.1 unless otherwise directed
The use of Tunnel Invert as shown on Alternative No 2 will depend upon conditions of sub-grade, drainage, etc., and will be determined by Engineer.



REFERENCES:
For Index of Contract Plans, see Contract Drawing No 1
" Section "M-M" see Contract Drawing No. 40.

SECTION E-E
(STATION 214+68±)

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
SUBWAY DIVISION

THE NARROWS TUNNEL

CONTRACT No 4A
CONTRACT DRAWING No 34

SCALE 1/4" = 1'-0" DATE: JAN 18 1926

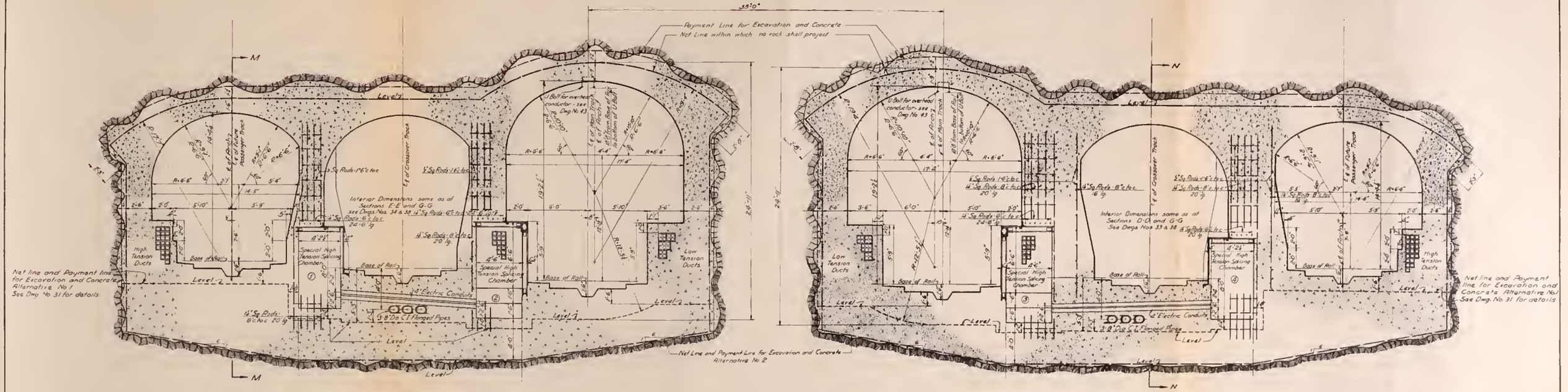
CHIEF ENGINEER — CHIEF ENGINEER

FILE No C 4A

Drawn A.R.G.
Traced No G.G.
Checked G.R.S. WASC
DESIGNING ENGINEER

M. S. BURCH & PRINTING & FINDING CO. N.Y.

NOTES:
Tunnel Invert will be built to lines indicated as Alternative No 1 unless otherwise directed. The use of Tunnel Invert as shown on Alternative No 2 will depend upon conditions of subgrade, drainage, etc, and will be determined by Engineer



EAST BOUND TRACKS

SECTION F-F
(STATION 214+74±)

WEST BOUND TRACKS

REFERENCES:
For Index of Contract Plans, see Contract Drawing No 1
" Section 'M-M' see Contract Drawing No 40
" " 'N-N' " " " 41

Approved:
Consultants

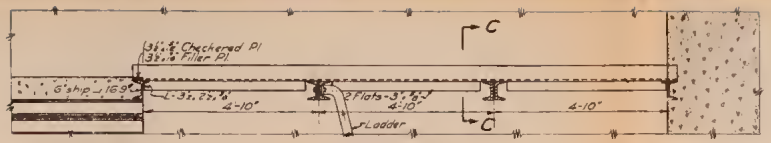
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL BUREAU

THE NARROWS TUNNEL

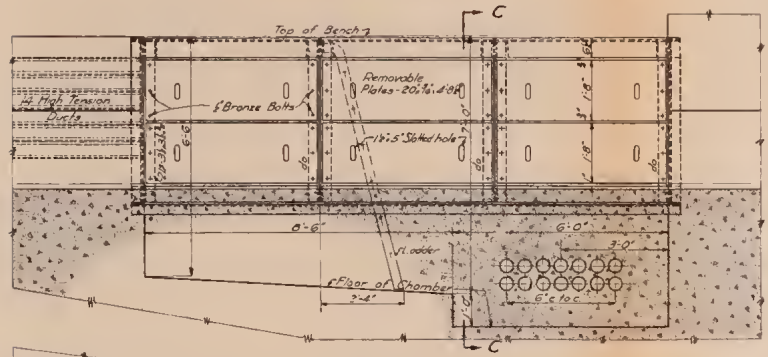
CONTRACT No 4 A
CONTRACT DRAWING No 35

FILE No C 4 A

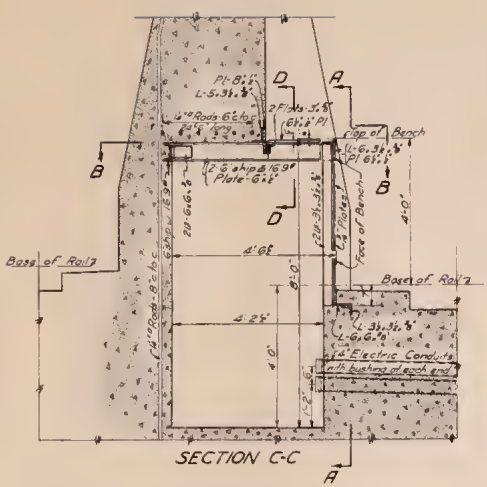
Drawn A.G.
Traced H.S. & F.J.R.
Checked J.L. & J.W.E.



SECTION D D

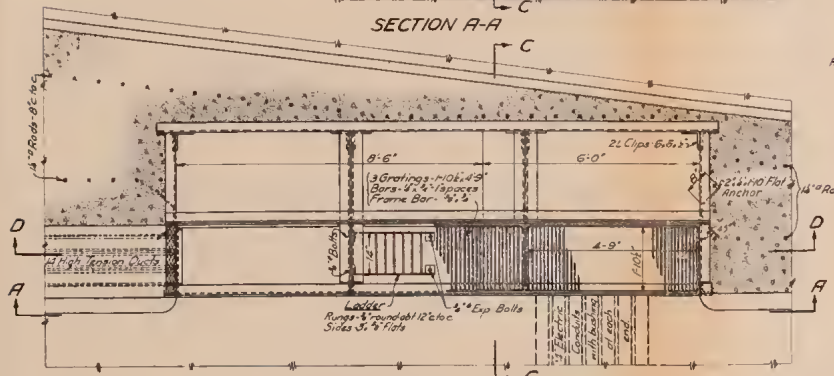


SECTION A-A



SECTION C-C

REFERENCE
For Index of Contract Plans, see Contract Drawing No. 1.



HORIZONTAL SECTION B-B

SPECIAL HIGH TENSION SPLICING CHAMBERS (1) AND (4)

DETAILS HERE SHOWN APPLY TO CHAMBER (1). CHAMBER (4) OPPOSITE HAND BUT OTHERWISE IDENTICAL WITH CHAMBER (1) EXCEPTING OUTLINE OF PIER AND VERTICAL REINFORCEMENT AS PER DWG No 29

Drawn B.W.
Traced B.W.
Checked W.E.K.

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

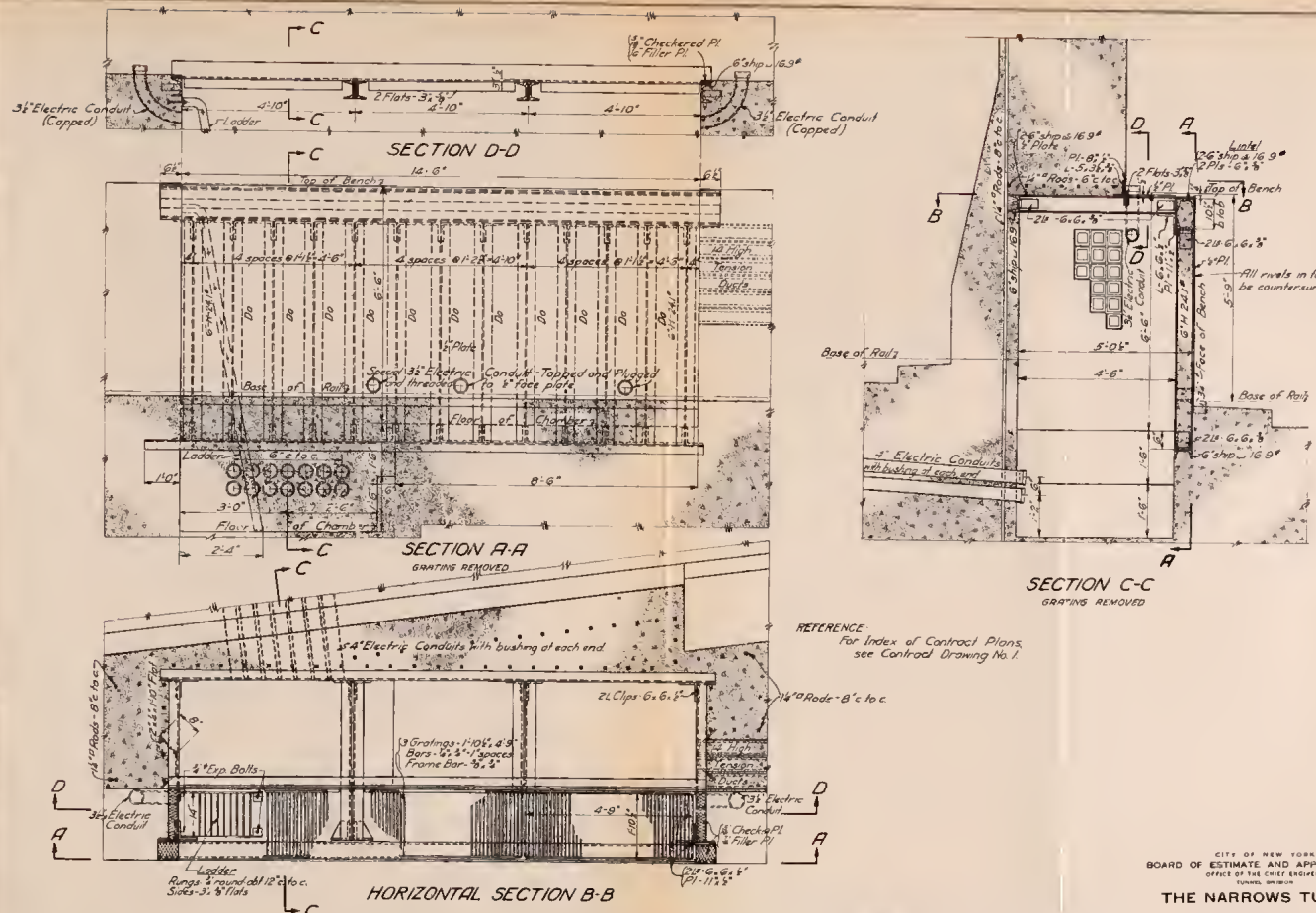
THE NARROWS TUNNEL

CONTRACT No 4 A
CONTRACT DRAWING No 36

SCALE 1 FEET
DATE JAN 10 1927

FILE No C4A

H.S. GRUBER PRINTING & BINDING CO. N.Y.



SPECIAL HIGH TENSION SPLICING CHAMBERS ② AND ③

DETAILS HERE SHOWN APPLY TO CHAMBER ②. CHAMBER ③ OPPOSITE HAND BUT OTHERWISE IDENTICAL WITH CHAMBER ② EXCEPTING OUTLINE OF PIER AND VERTICAL REINFORCEMENT AS PER DWG No 29.

Drawn A.W.
Traced A.W.
Checked 7/12-K. W.E.C.
J. H. Quinlan DESIGNING ENGINEER

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No 4 A
CONTRACT DRAWING No 37

SCALE 1" = 1 FOOT — DATE JAN. 29, 1925

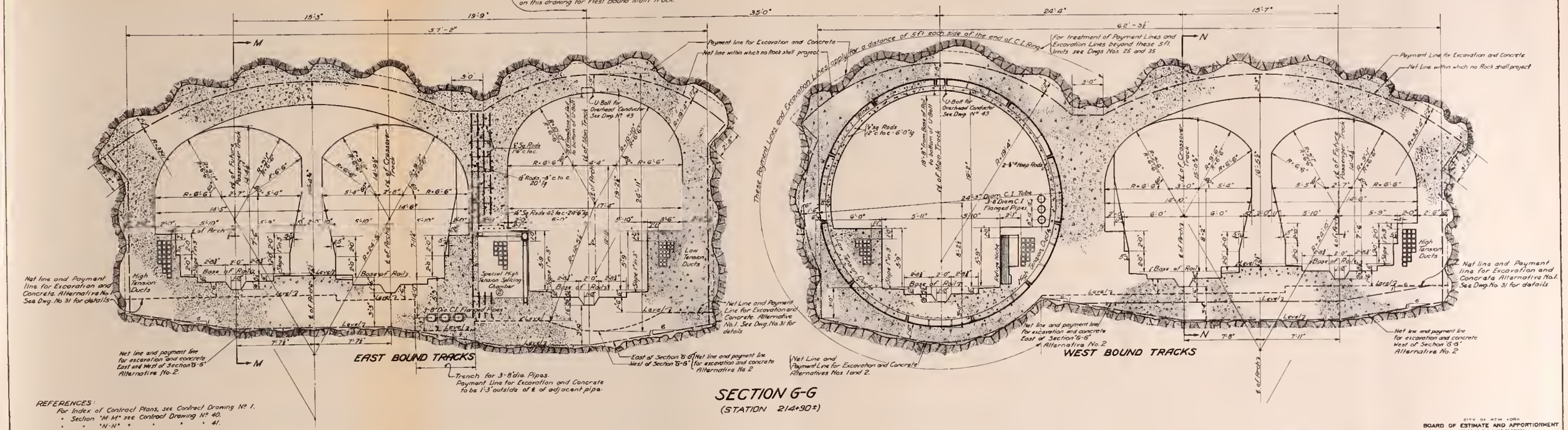
J. H. Quinlan CHIEF ENGINEER — J. H. Quinlan TUNNEL ENGINEER

FILE No C 4 A

M. B. BROWN PRINTING & BINDING CO., N.Y.

NOTE:
Payment Lines and Excavation Lines for East Bound Main Track, 5 ft each side of the end of C.I. Ring at Sta 215+19± (Dwg No. 29), to receive the same treatment as indicated on this drawing for West Bound Main Track.

NOTES:
Tunnel Invert will be built to lines indicated as Alternative No. 1 unless otherwise directed. The use of Tunnel Invert as shown on Alternative No. 2 will depend upon conditions of subgrade, drainage etc, and will be determined by Engineer.



REFERENCES:
For Index of Contract Plans, see Contract Drawing No. 1.
" Section 'M-M' see Contract Drawing No. 40.
" " 'N-N' " " " " 41.

SECTION G-G
(STATION 214+90±)

Approved
Consultants

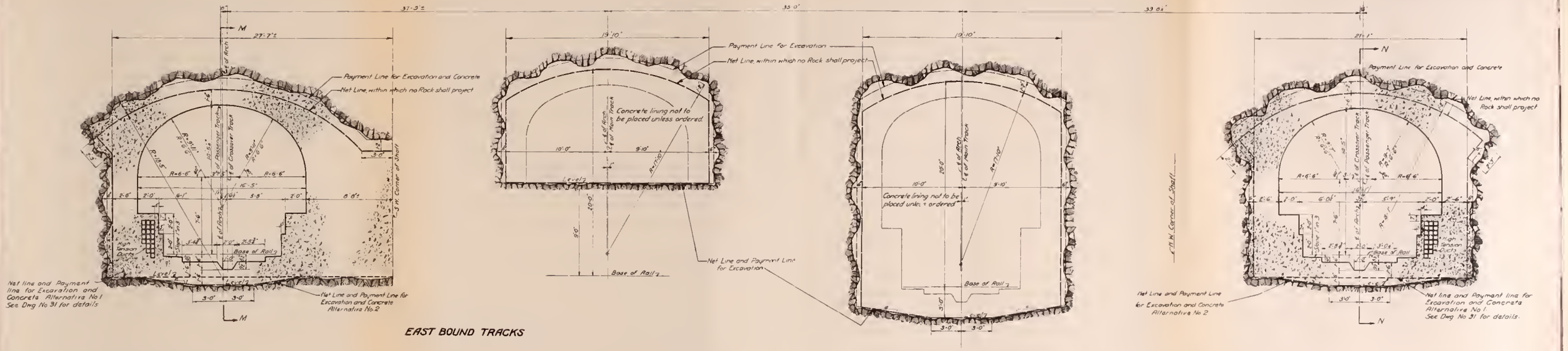
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 38

FILE No C4A

Drawn A.R.G.
Traced W.D.G. & P.J.R.
Checked W.E.R.

NOTES
Tunnel Invert will be built to lines indicated as Alternative No.1 unless otherwise directed.
The use of Tunnel Invert as shown on Alternative No.2 will depend upon conditions of sub-grade, drainage, etc., and will be determined by Engineer



REFERENCES
For Index of Contract Plans see Contract Drawing No. 1.
" Section M-M see Contract Drawing No 40
" " N-N " " " 41.

SECTION H-H
(WEST OF SOUTH ST SHAFT.)

Drawn HS
Traced HS
Checked AHL WSC

ENGINEERING ENGINEER

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT Nº 4 A
CONTRACT DRAWING Nº 39

SCALE 1/4" = 1'-0"
DATE JAN. 16, 1913

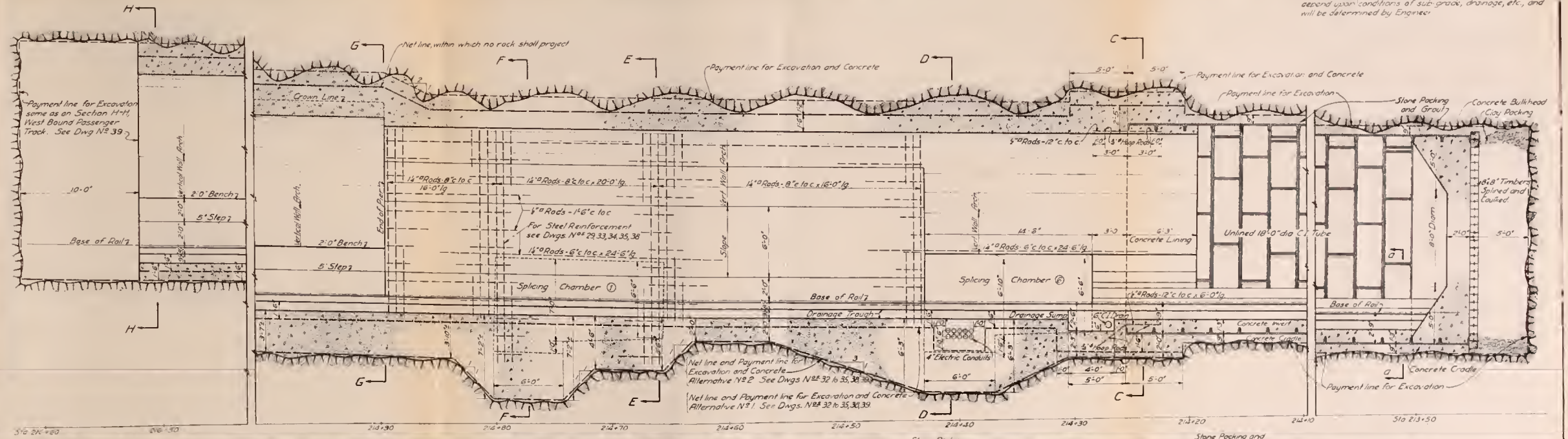
CHIEF ENGINEER
TUNNEL ENGINEER

FILE Nº C4A

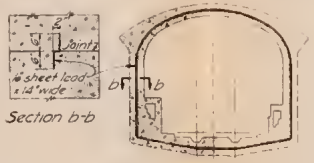
M. O'BRIEN PRINTING & PHOTO CO. N.Y.

NOTES

Tunnel Invert will be built to lines indicated as Alternative No 2, unless otherwise directed.
The use of Tunnel Invert as shown on Alternative No 2 will depend upon conditions of sub-grade, drainage, etc., and will be determined by Engineer



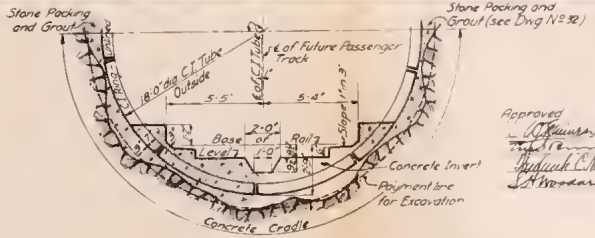
REFERENCES
For Index of Contract Plans, see Contract Drawing No 1
Section "C-C" see Contract Drawing No 32
" D-D " " " 33
" E-E " " " 34
" F-F " " " 35
" G-G " " " 38
" H-H " " " 39



Section b-b

LEAD WATER STOP
AT VERTICAL CONSTRUCTION JOINTS SPACED ABOUT 25 FEET APART
NO SCALE

SPECIAL CONSTRUCTION
LONGITUDINAL SECTION M-M



Section a-a

Approved
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No 4 A
CONTRACT DRAWING No 40

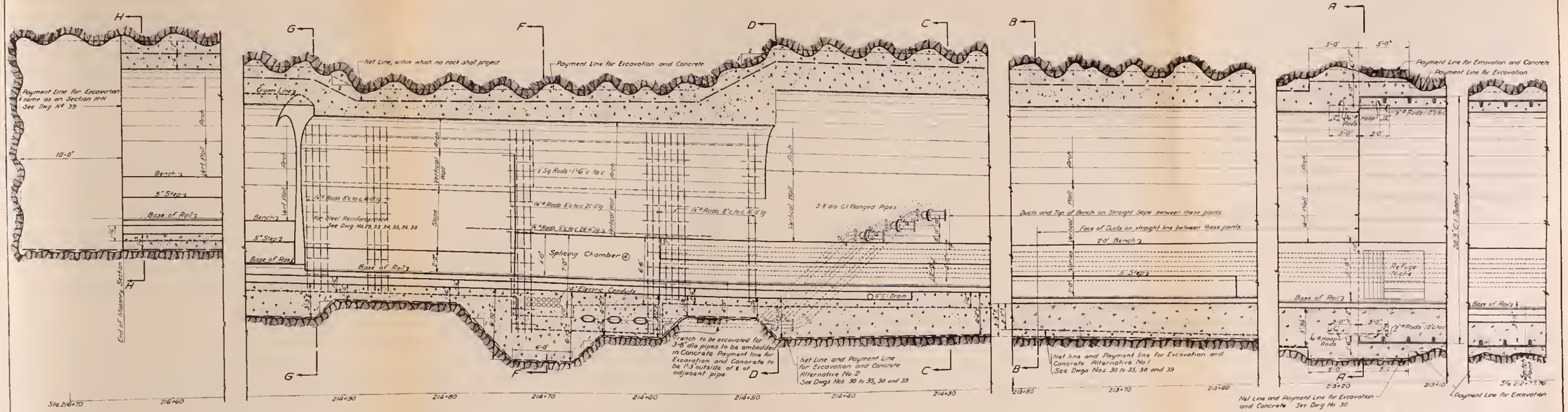
DATE JAN 10 1928

FILE No C4 A

Drawn by
Traced by
Checked by

NOTES

Tunnel Invert will be built to lines indicated as Alternative No 1 unless otherwise directed. The use of Tunnel Invert as shown on Alternative No 2 will depend upon conditions of sub-grade, drainage etc, and will be determined by Engineer.



REFERENCES

For Index of Contract Plans, see Contract Drawing No 1

Section	"A-A"	see Contract Drawing No	30.	
"	"B-B"	" "	"	31.
"	"C-C"	" "	"	32.
"	"D-D"	" "	"	33
"	"F-F"	" "	"	35
"	"G-G"	" "	"	38
"	"H-H"	" "	"	39

SPECIAL CONSTRUCTION
LONGITUDINAL SECTION N-N

Drawn F.H.V.
Traced Th. & B.
Checked W.E.B. WEST.
J. A. Ruiz
Assistant Engineer

Approved
Tom Brown
Chairman
Rudolph C. Rolle
S. K. Woodard
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CITY ENGINEER
TUNNEL BUREAU

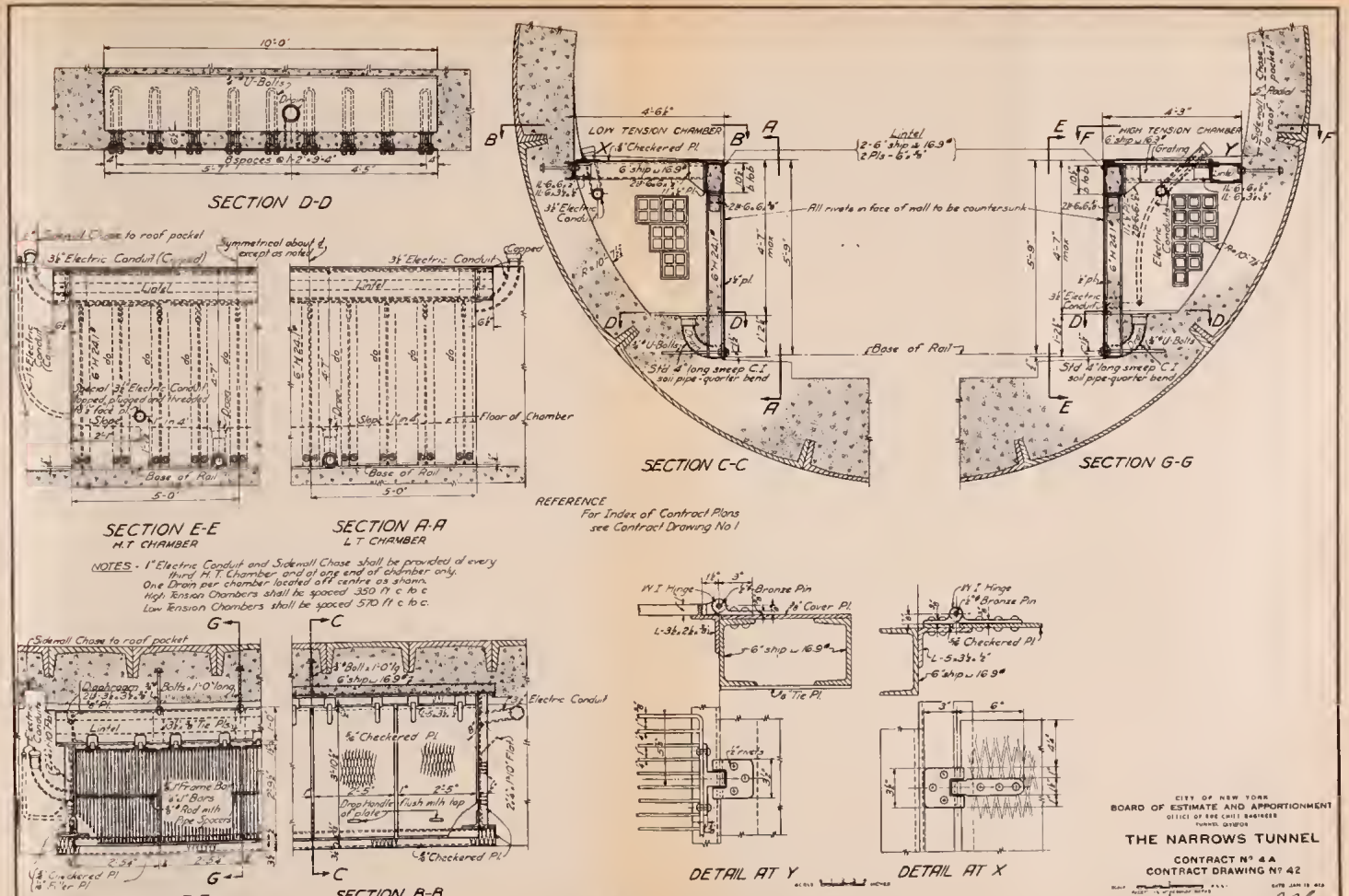
THE NARROWS TUNNEL

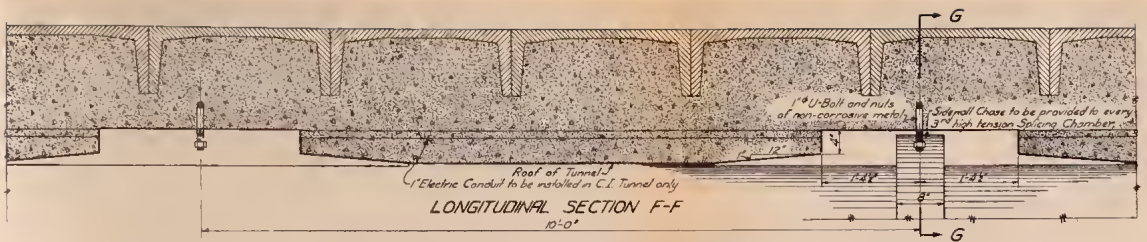
CONTRACT No 4 A
CONTRACT DRAWING No 41

SCALE — DATE JAN 13 1950

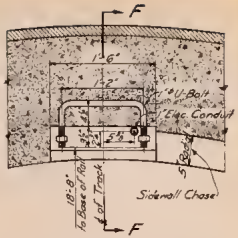
Chief Engineer — Tunnel Engineer

FILE No C 4 A


SECTION D-D
SECTION E-E
H.T CHAMBER
SECTION A-A
L.T CHAMBER
SECTION C-C
SECTION G-G
REFERENCE
For Index of Contract Plans
see Contract Drawing No 1
NOTES - 1" Electric Conduit and Sidewall Chase shall be provided at every third H.T. Chamber, and at one end of chamber only.
One Drain per chamber located off centre as shown.
High Tension Chambers shall be spaced 350 ft c to c
Low Tension Chambers shall be spaced 570 ft c to c.
SECTION F-F
H.T. CHAMBER
SECTION B-B
L.T. CHAMBER
DETAIL AT Y
DETAIL AT X
STANDARD SPLICING CHAMBERS
(CAST IRON TUNNEL)
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION
THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 42
FILE No C 4A



LONGITUDINAL SECTION F-F

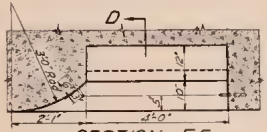


CROSS SECTION G-G

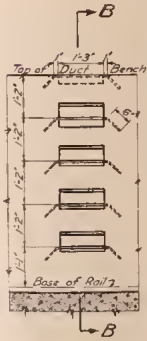
ROOF POCKET FOR OVERHEAD CONDUCTOR - IN EARTH TUNNEL

In Rock Tunnel, Roof Pockets and Electric Conduit may be omitted and U-Bolts made longer.

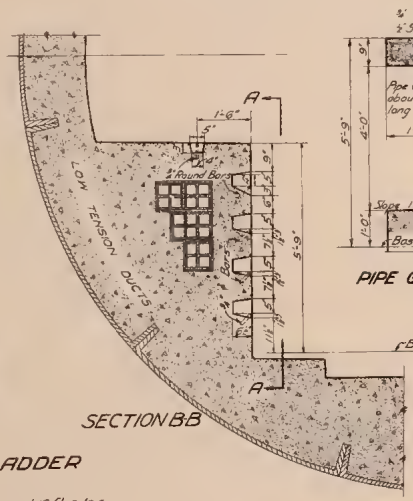
SCALE 1 0 1 2 3 4 INCHES



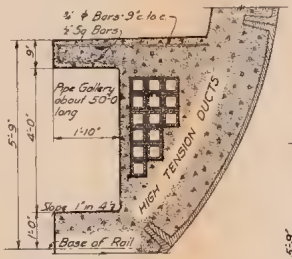
SECTION E-E



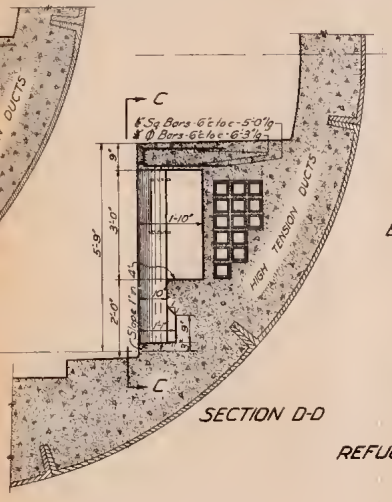
SECTION A-A



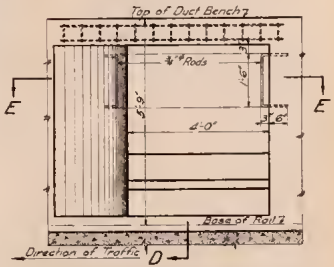
SECTION B-B



PIPE GALLERY



SECTION D-D



SECTION C-C

LADDER

REFUGE NICHE

NOTES

Roof Pockets shall be spaced 10 ft. c. to c.
Refuge Niches shall be spaced 25 ft. c. to c. in High Tension duct bench only
Ladders shall be spaced 100 ft. c. to c. in both duct benches (staggered)

REFERENCE:

For Index of Contract Plans, see Contract Drawing No. 1.

PIPE GALLERIES, REFUGE NICHES, LADDERS AND ROOF POCKETS

(CAST IRON TUNNEL)

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No 4A
CONTRACT DRAWING No 43

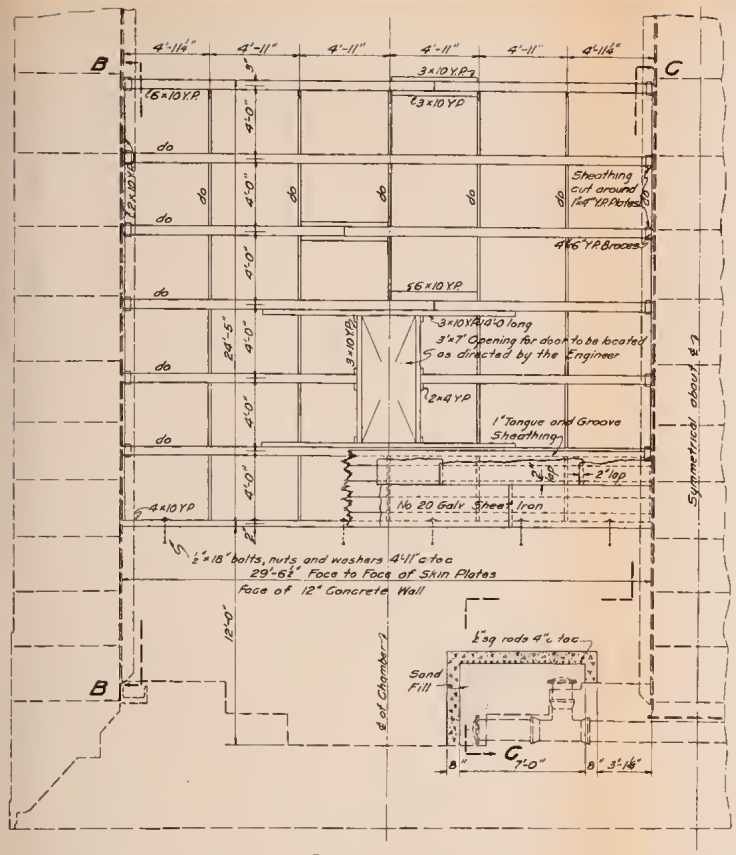
SCALE 1" = 5 FEET EXCEPT AS OTHERWISE NOTED
DATE JAN. 13, 1925

Chief Engineer
Tunnel Engineer

FILE No C 4 A

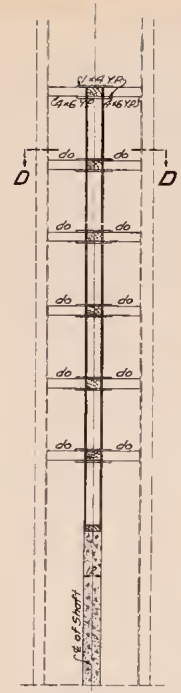
Drawn A.W.
Traced A.W.
Checked H.J.R. YNGC.
Designing Engineer

W. C. BROWN, PRINTING, BROOKLYN, N.Y.

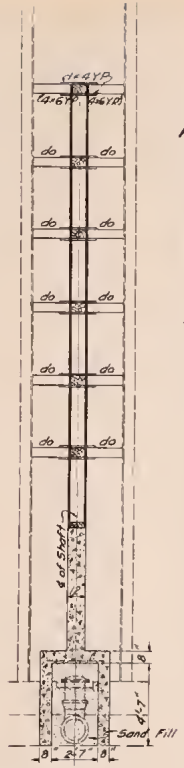


SECTION A-A

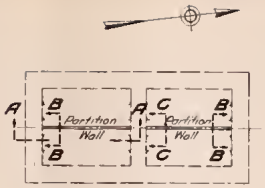
REFERENCE:
For Index of Contract Plans
see Contract Drawing No. 1



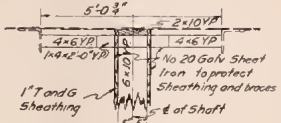
SECTION B-B
North and South Walls



SECTION C-C
Middle Wall



PLAN OF SHAFT
Showing location of Partition Wall
Scale Feet



SECTION D-D
Scale Feet

Shaft construction indicated thus - - - - not included in this contract

TEMPORARY
PARTITION WALL
IN
SHORE ROAD SHAFT, BROOKLYN

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

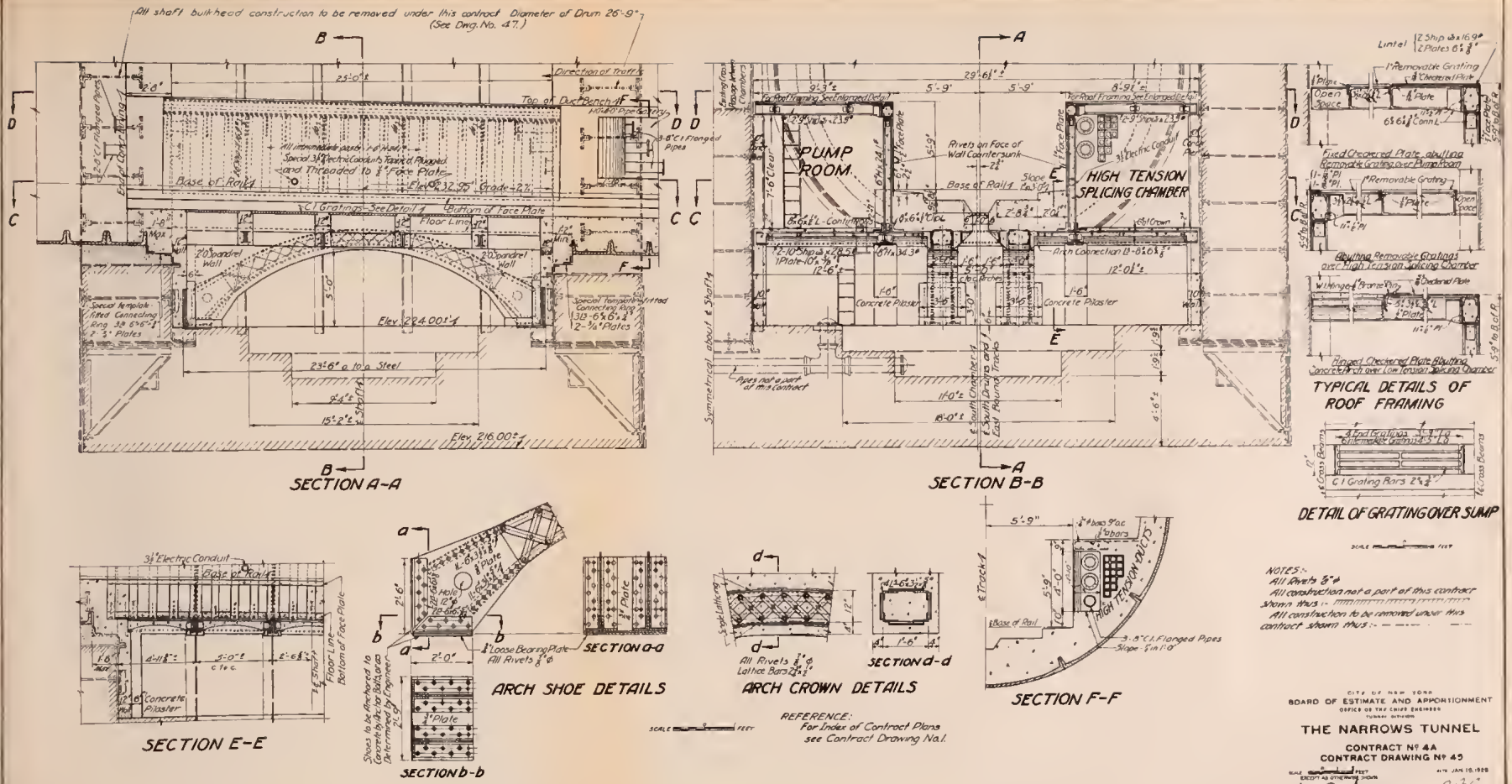
THE NARROWS TUNNEL

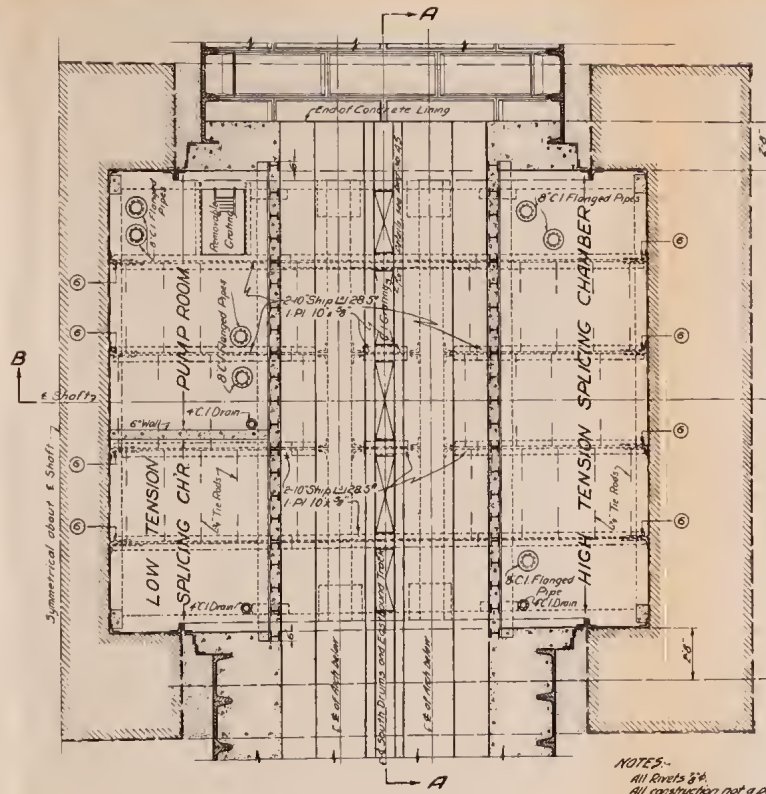
CONTRACT No 4A
CONTRACT DRAWING No 44

SCALE FEET
DATE JAN 15, 1926

FILE No C 4A

Drawn
Traced
Checked
TESTING ENGINEER

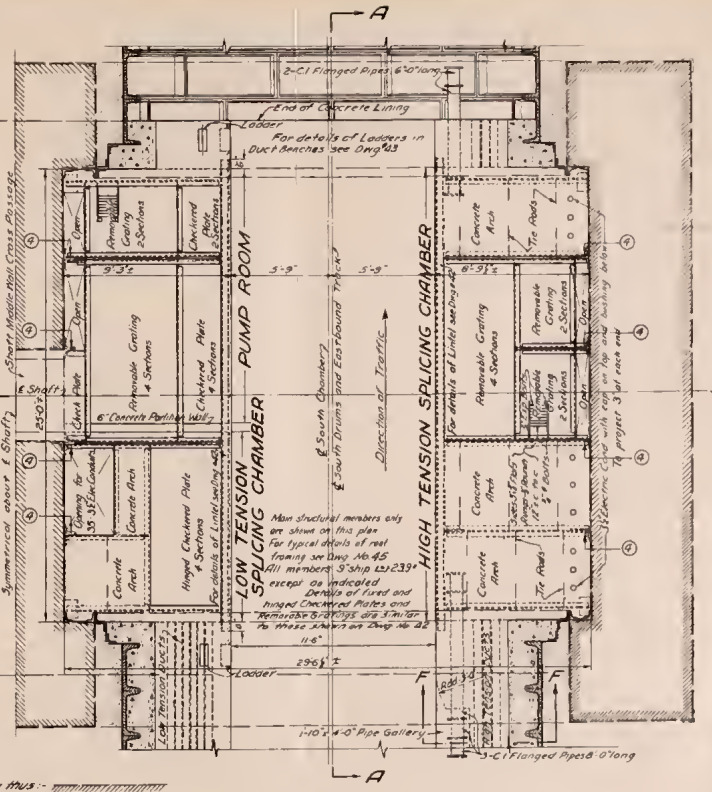

All shaft bulkhead construction to be removed under this contract Diameter of Drum 26'-9" (See Dwg. No. 47.)
SECTION A-A
SECTION B-B
PUMP ROOM
HIGH TENSION SPLICING CHAMBER
TYPICAL DETAILS OF ROOF FRAMING
DETAIL OF GRATING OVER SUMP
SECTION E-E
ARCH SHOE DETAILS
SECTION a-a
SECTION b-b
ARCH CROWN DETAILS
SECTION d-d
SECTION F-F
NOTES:-
All Rivets 5/8" ϕ
All construction not a part of this contract shown thus:-
All construction to be removed under this contract shown thus:-
REFERENCE:
For Index of Contract Plans see Contract Drawing No. 1.
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 45
FILE No. C4A
INTERIOR CONSTRUCTION AT SHORE ROAD SHAFT. BROOKLYN.



SECTIONAL PLAN C-C

NOTES:-
All Rivets ⅞".
All construction not a part of this contract shown thus:-
(4) or (6) indicates number of holes to be drilled for rivets in outstanding legs of existing vertical angles.

REFERENCE
For Index of Contract Plans see Contract Drawing No. 1.



SECTIONAL PLAN D-D

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
PUBLIC WORKS

THE NARROWS TUNNEL

CONTRACT No 4A
CONTRACT DRAWING No 46

SCALE 1/4" = 1 FOOT DATE JAN 16 1929

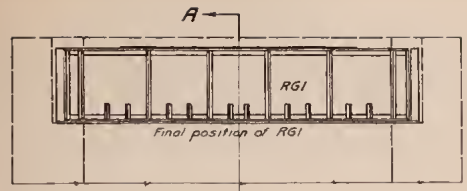
Chief Engineer Public Works

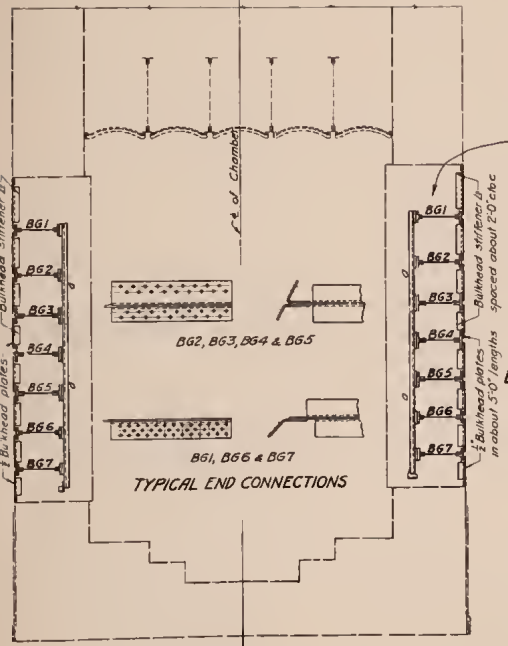
FILE No C4A

INTERIOR CONSTRUCTION AT SHORE ROAD SHAFT, BROOKLYN.

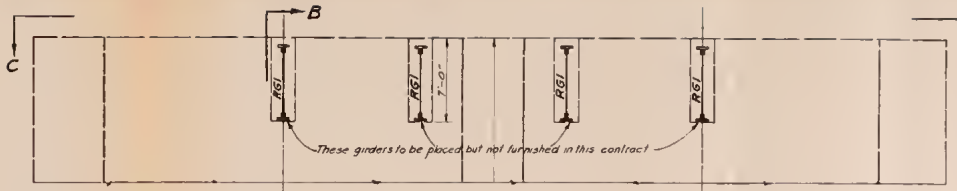
Drawn E.J.H.
Traced G.C.
Checked M.F.K.
Approved J.H. Quinby, Designing Engineer

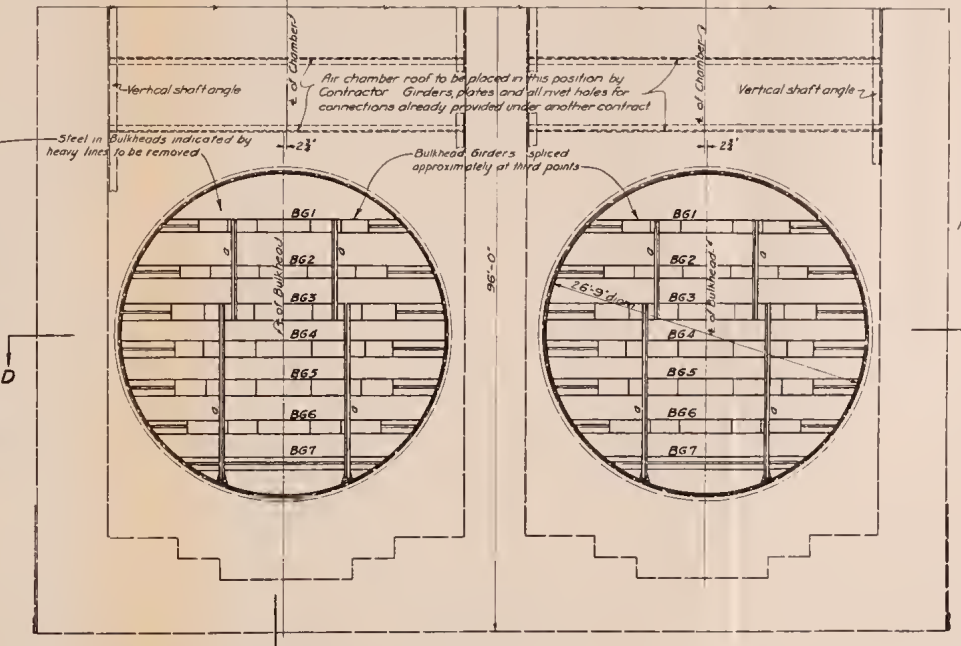
H. GREENWOOD PRINTING & BINDING CO. N.Y.





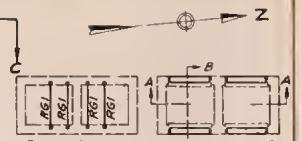
SECTION B-B





SECTION A-A

BULKHEADS & ROOF GIRDERS



GIRDER SCHEDULE				
MARK	LENGTH	DEPTH	FLANGE WIDTH	APPROX WT TONS
BG1	19'-9 3/8"	3'-10 1/8"	13"	2.3
BG2	24'-7 1/8"	3'-10 3/8"	13"	3.7
BG3	26'-6"	3'-10 3/8"	17"	4.9
BG4	26'-8 3/8"	3'-10 3/8"	17"	4.3
BG5	25'-3 1/8"	3'-10 3/8"	17"	4.3
BG6	22'-1 3/8"	3'-10 3/8"	13"	3.0
BG7	16'-3 1/8"	3'-10"	13"	1.9
RG1	29'-5 1/8"	6'-2 1/4"	13"	7.0

REFERENCE
For Index of Contract Plans see Contract Drawing No. 1

Shaft construction shown thus — — — not included in this contract

SHORE ROAD SHAFT, BROOKLYN.

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No. 4-A
CONTRACT DRAWING No. 47

SCALE 1/4" = 1 FOOT
DATE JAN. 18, 1926

Except as shown
Chief Engineer

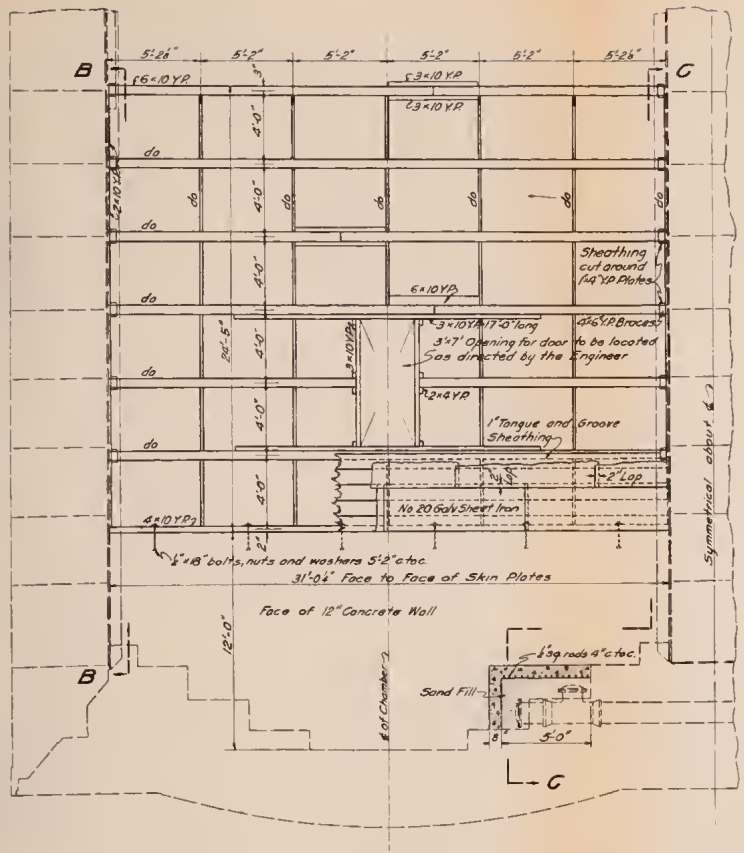
J. H. Brown
Tunnel Engineer

FILE No. C-4-A

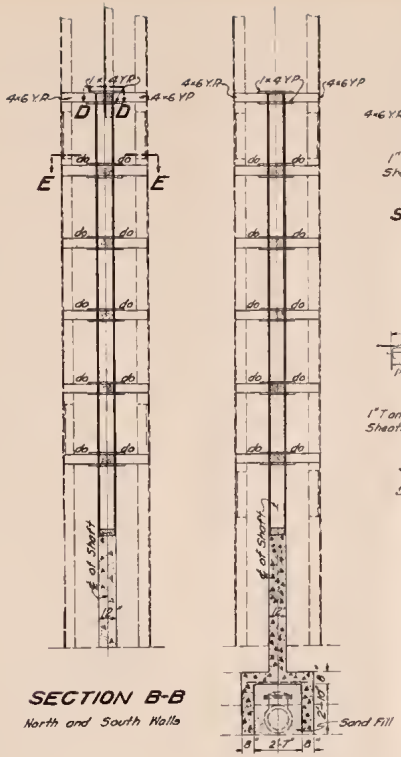
Drawn LC
Traced LC
Checked

J. H. Brown
Designing Engineer

M. B. BRICKER PRINTING & BINDING CO. N.Y.



SECTION A-A

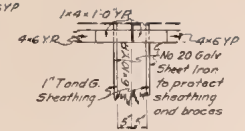


SECTION B-B

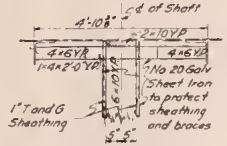
North and South Walls

SECTION C-C

Middle Wall

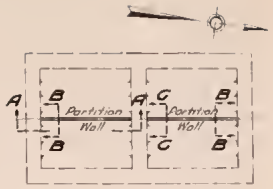


SECTION D-D



SECTION E-E

Scale Feet



PLAN OF SHAFT

Showing location of Partition Wall

Scale Feet

Shaft construction indicated thus — - - - not included in this contract

REFERENCE
For Index of Contract Plans see Contract Drawing No. 1.

TEMPORARY PARTITION WALL IN SOUTH ST. SHAFT, RICHMOND

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
LAUREL SYMONS

THE NARROWS TUNNEL

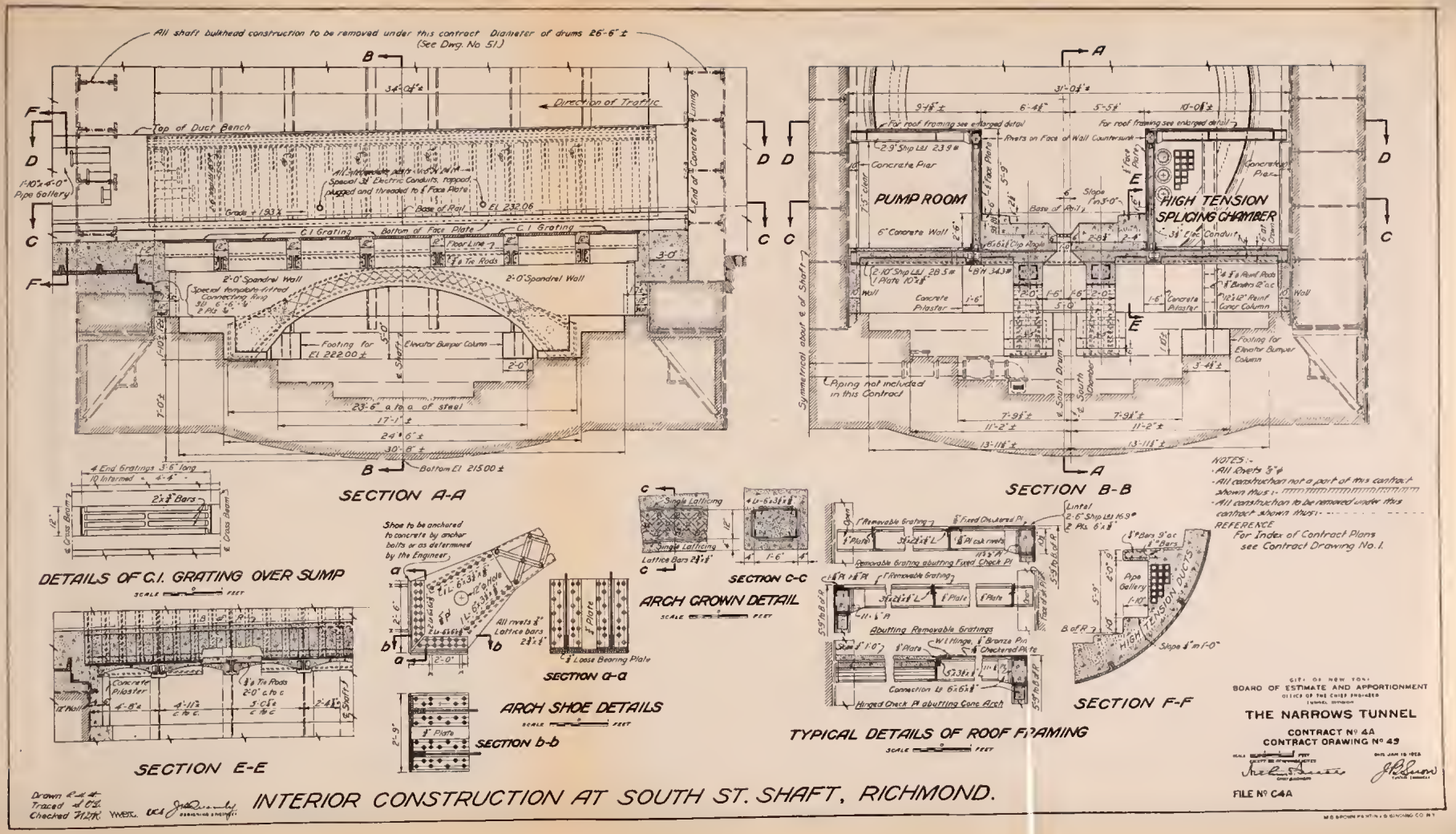
CONTRACT No. 4A
CONTRACT DRAWING No. 48

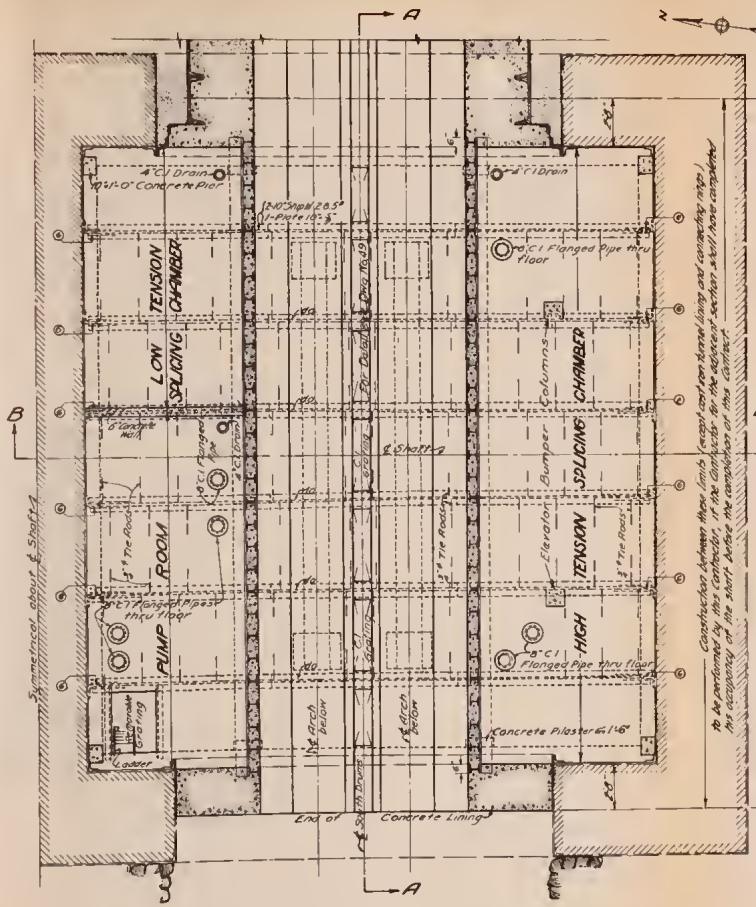
SCALE 1/4" = 1 FOOT — DATE JAN. 15, 1923

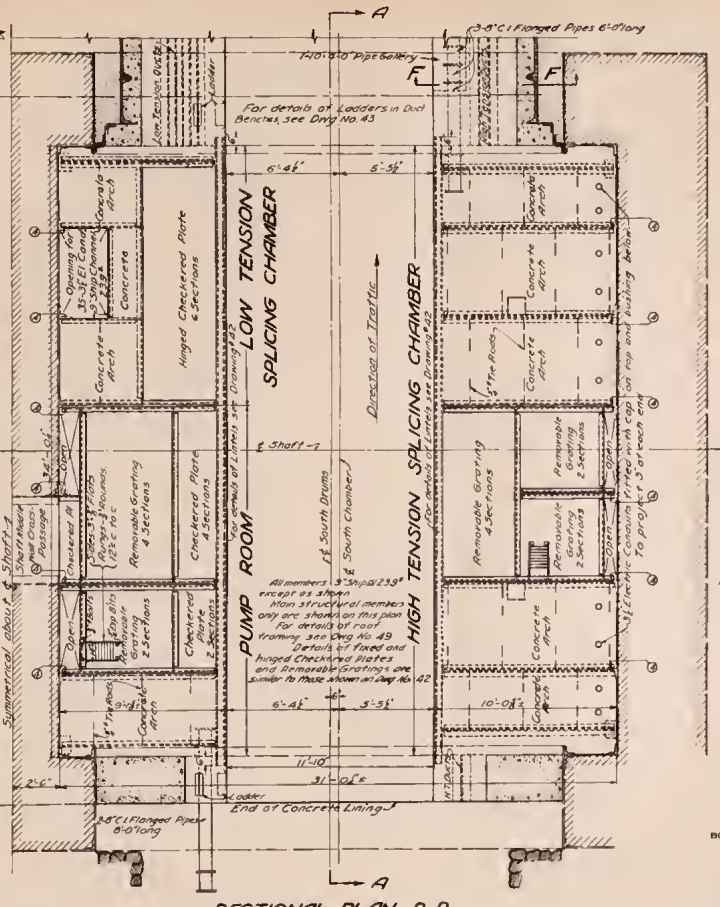
CHIEF ENGINEER — PUBLIC WORKS

FILE No. C 4A

Drawn A.C.S.
Traced J.H.H.
Checked C.W.P.A.
J. W. Quinty
DESIGNING ENGINEER


All shaft bulkhead construction to be removed under this contract. Diameter of drums 26'-6" ± (See Drwg. No 51.)
Direction of Traffic
Top of Duct Bench
Pipe Gallery
Grade = 1.93%
Base of Rail
EL 232.06
C.I. Grating
Bottom of Face Plate
Floor Line
Tie Rods
2'-0" Spandrel Wall
Special template-fitted Connecting Ring
Footing for EL 222.00 ±
Elevator Bumper Column
23'-6" a to a of steel
17'-1" ±
24'-6" ±
30'-8" ±
Bottom EL 215.00 ±
SECTION A-A
PUMP ROOM
HIGH TENSION SPLICING CHAMBER
For roof framing see enlarged detail
Rivets on Face of Wall Countersunk
Concrete Pier
6" Concrete Wall
Base of Rail
Slope 1" in 3'-0"
3½" Elec Conduit
Concrete Pilaster
Footing for Elevator Bumper Column
Piping not included in this Contract
Symmetrical about ℄ of Shaft
SECTION B-B
NOTES:-
All Rivets ⅝" ϕ
All construction not a part of this contract shown thus:
All construction to be removed under this contract shown thus:
REFERENCE
For Index of Contract Plans see Contract Drawing No. 1.
DETAILS OF C.I. GRATING OVER SUMP
SCALE FEET
Shoe to be anchored to concrete by anchor bolts or as determined by the Engineer
All rivets ⅝" Lattice bars 2½"x⅜"
⅝" Loose Bearing Plate
SECTION a-a
ARCH SHOE DETAILS
SECTION b-b
Single Lattice
Lattice Bars 2½"x⅜"
SECTION C-C
ARCH CROWN DETAIL
Removable Grating
Fixed Channel Pl.
Removable Grating abutting Fixed Check Pl.
Abutting Removable Gratings
Hinges, ⅝" Bronze Pin
Checked Plate
Connection Lt 6x6x⅜
Hinged Check Pl. abutting Cone Arch
TYPICAL DETAILS OF ROOF FRAMING
Lintel
Pipe Gallery
HIGH TENSION DUCTS
Slope ⅛" in 1'-0"
SECTION F-F
SECTION E-E
Drawn
Traced
Checked
INTERIOR CONSTRUCTION AT SOUTH ST. SHAFT, RICHMOND.
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION
THE NARROWS TUNNEL
CONTRACT No 4A
CONTRACT DRAWING No 49
FILE No C4A





NOTES:-
All Rivets ⅝" ⌀
All Construction not a part of this contract shown thus:-
(4) or (6) indicates number of holes to be drilled for rivets in outstanding legs of existing vertical angles

REFERENCE
For Index of Contract Plans see Contract Drawing No 1.

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
PUBLIC BUILDING

THE NARROWS TUNNEL

CONTRACT Nº 4A
CONTRACT DRAWING Nº 50

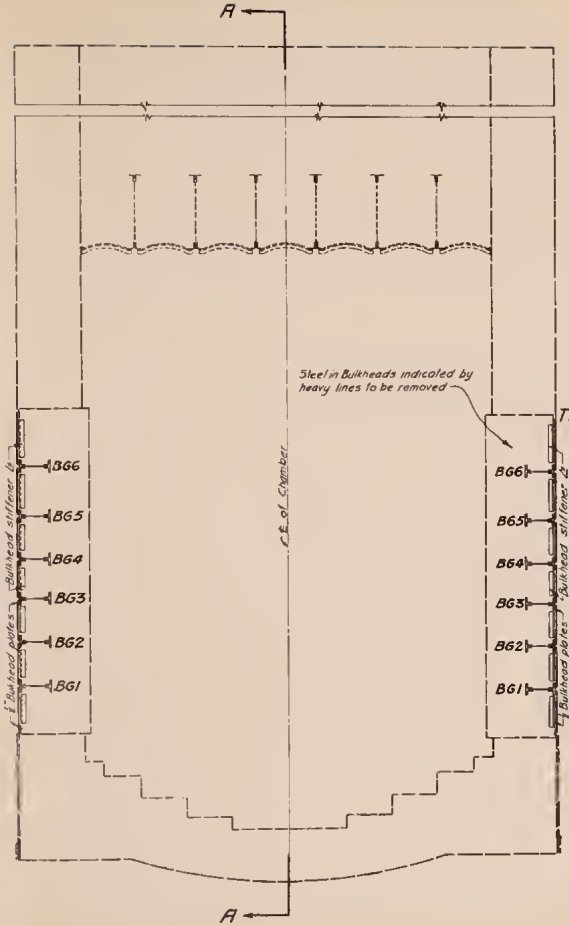
SCALE 1/4" = 1 FT. DATE JAN. 18 1928

CHIEF ENGINEER

FILE Nº C4A

INTERIOR CONSTRUCTION AT SOUTH ST. SHAFT, RICHMOND.

Drawn R.W.S.
Traced A.F.
Checked M.B.R. W.B.R. Rec'd

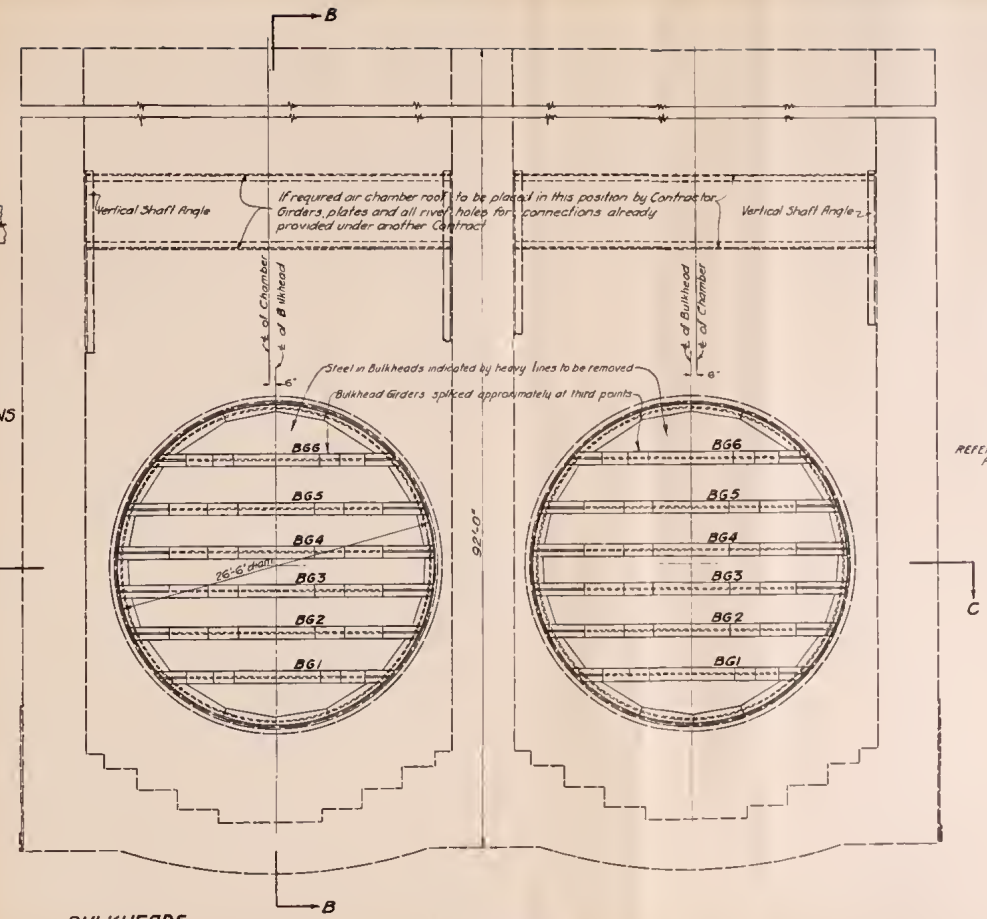


SECTION B-B

BG1 & BG6

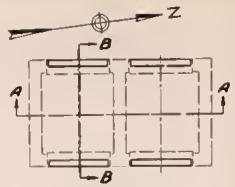
BG2, BG3, BG4 & BG5

TYPICAL END CONNECTIONS



BULKHEADS

SECTION A-A



SECTION C-C

Scale 0 10 20 FEET

GIRDER SCHEDULE				
MARK	LENGTH	DEPTH	WIDTH OF FLANGE	APPROX. WT. TONS
BG6	19'-10½"	2'-7⅞"	13"	1.6
BG5	24'-9½"	2'-7⅞"	13"	2.6
BG4	26'-5"	2'-7⅞"	13"	2.9
BG3	26'-1⅞"	2'-7⅞"	13"	2.9
BG2	23'-11⅞"	2'-7⅞"	13"	2.6
BG1	18'-11⅞"	2'-7⅞"	13"	1.6

REFERENCE
For Index of Contract Plans
see Contract Drawing No. 1.

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT Nº 4A
CONTRACT DRAWING Nº 51

SCALE 1" = 10 FEET
EXCEPT AS SHOWN
SHOP DRAWING

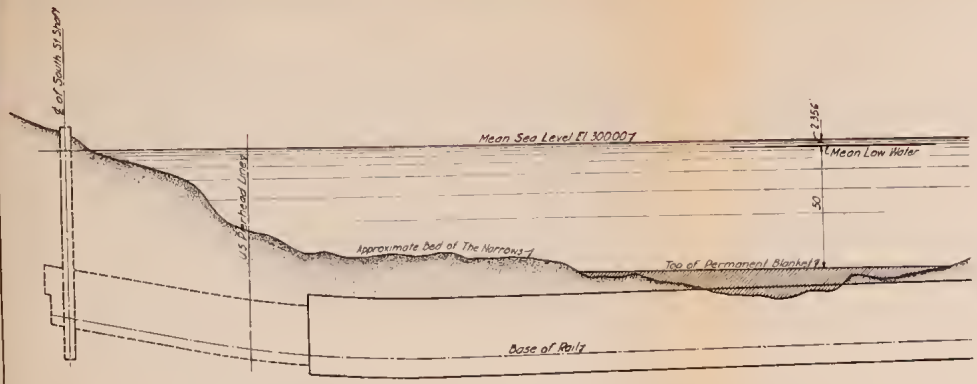
DATE JAN 19, 1925

TUNNEL ENGINEER

FILE Nº C4A

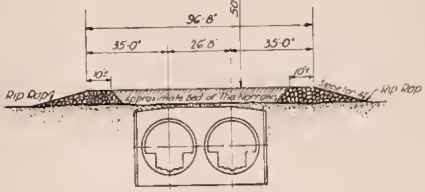
SOUTH ST. SHAFT, RICHMOND.

Drawn JJK
Traced EC
Checked
DESIGNING ENGINEER



PROFILE

Scales Hor 0 60 120 180 FEET
Vert 0 18 36 54 FEET

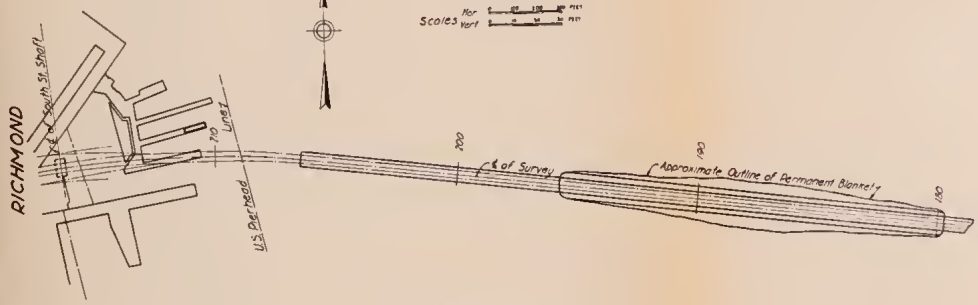


TYPICAL CROSS SECTION

Scale 0 10 20 30 FEET

NOTE:
No stone of the rip-rap shall be larger than two (2) feet in any direction

Reference
For Index of Contract Plans, see Contract Drawing No 1.



PLAN

Scale 0 100 200 300 FEET

Approved
G. Bruce
Thos. Brown
Rudolph C. Wolle
S. H. Woodard
Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT Nº 4 A
CONTRACT DRAWING Nº 52

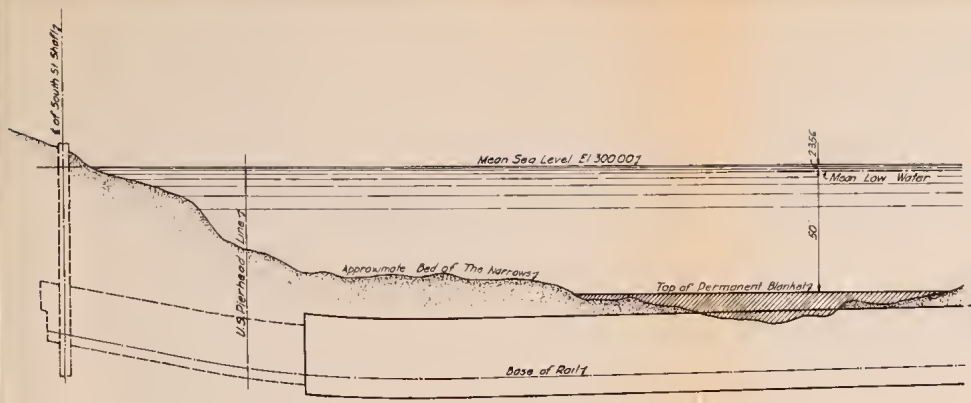
SCALE AS INDICATED
DATE JANUARY 15 1929

PERMANENT BLANKET
ALTERNATIVE PLAN I

Drawn A.W.R.
Traced A.W.R.
Checked J.B.

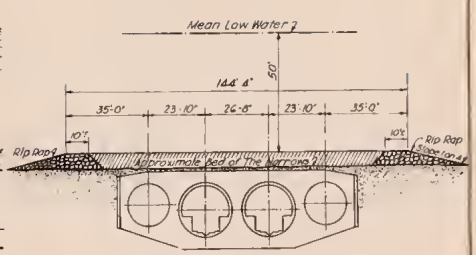
FILE Nº C4A

H. B. BROWN PRINTING & BINDING CO., N.Y.



PROFILE

Scales Hor 0 100 200 300 FEET
Vert 0 10 20 30 FEET

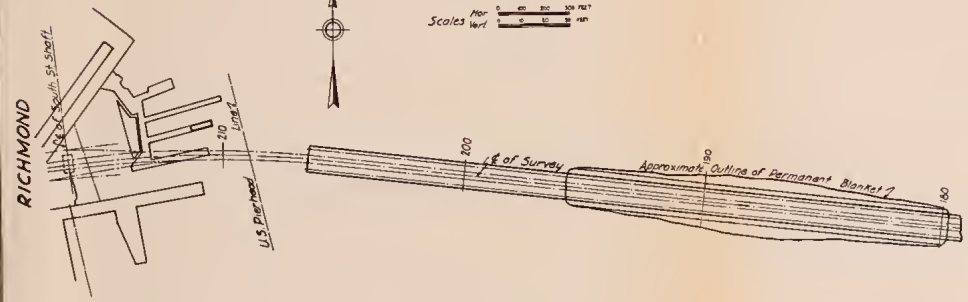


TYPICAL CROSS SECTION

Scale 0 10 20 30 FEET

NOTE:
No stone of the rip-rap shall be larger than two (2) feet in any direction

Reference:
For Index of Contract Plans, see Contract Drawing No. 1.



PLAN

Scale 0 100 200 300 FEET

Approved
W. Hewitt
Fred'k Penn
Frederick C. Noble
S. K. Woodard
} Consultants

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT Nº 4 A
CONTRACT DRAWING Nº 53

SCALE AS INDICATED
Arthur Ross
CHIEF ENGINEER

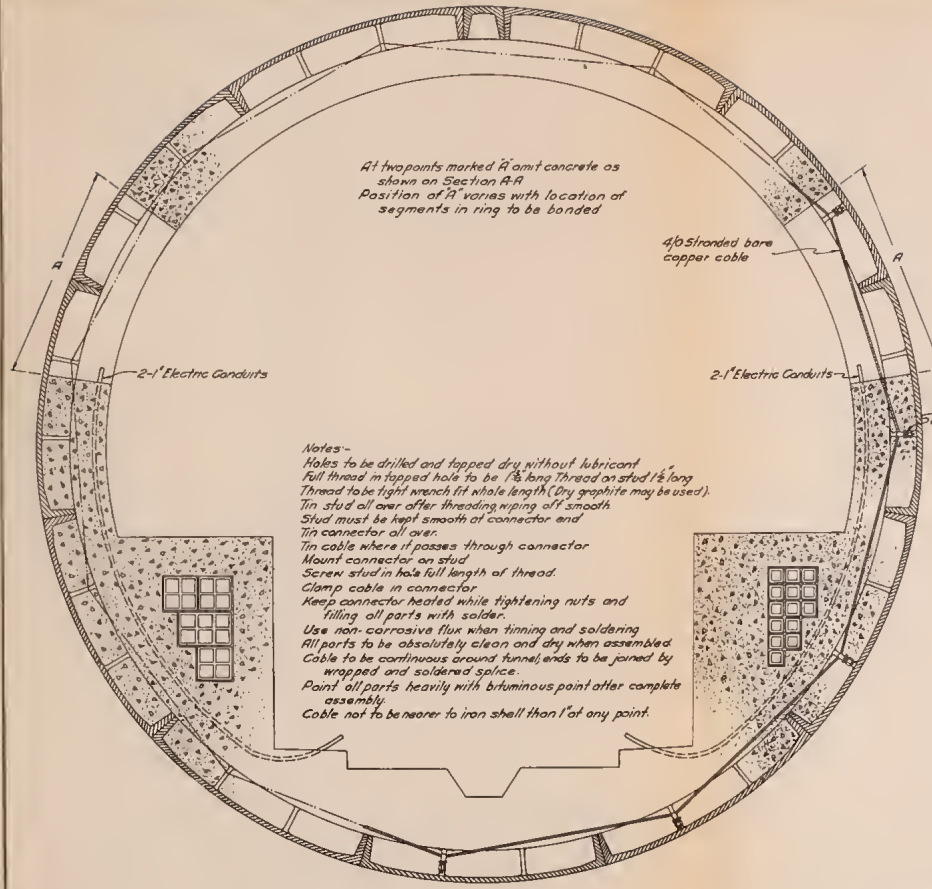
DATE JANUARY 15, 1925
J. H. Brown
ASSISTANT ENGINEER

PERMANENT BLANKET
ALTERNATIVE PLAN 2

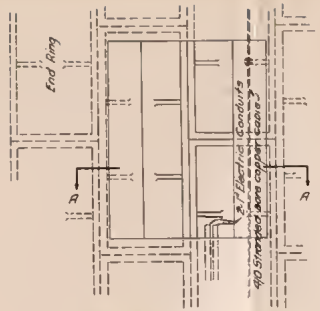
FILE Nº C 4 A

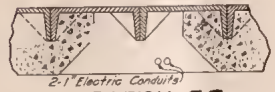
Drawn C.W.R.
Traced with
Ozalid Pa
J. H. Brown
ASSISTANT ENGINEER

H. G. BROWN PRINTING & BIND. NO. C.U. N.Y.



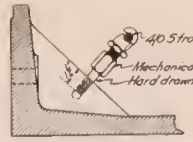
TYPICAL BOND





SECTION A-A

Type "A" to be used where Cast Iron Tunnel construction is interrupted



DETAIL OF BOND

Scale 0 1 2 3 4 5 Inches

Reference
For Index of Contract Plans, see Contract Drawing No. 1.

ELECTROLYSIS BOND

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

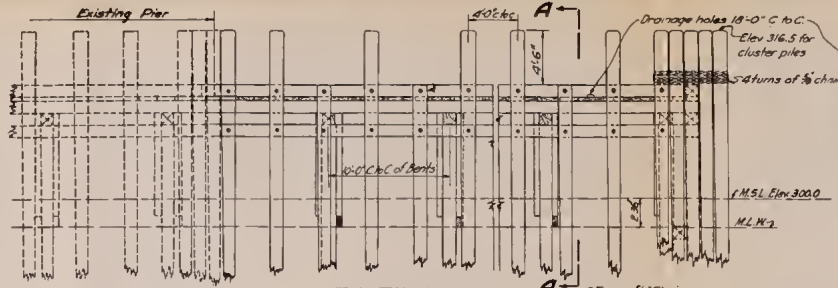
CONTRACT No. 4 A
CONTRACT DRAWING No. 54

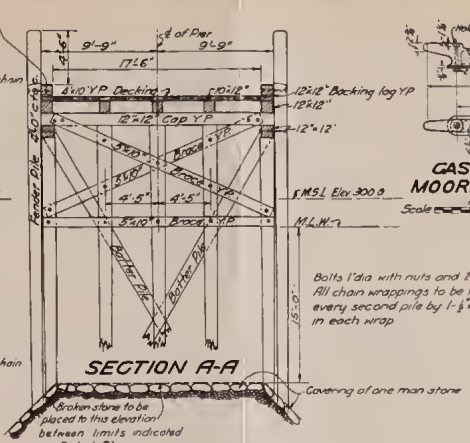
SCALE: 1/4" = 1 FOOT

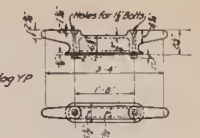
FILE No. C 4A

Drawn J.H.L.
Traced J.H.L.
Checked J.H.B.
DESIGNING ENGINEER

M. B. GROSS PRINTING & PHOTO CO. N.Y.

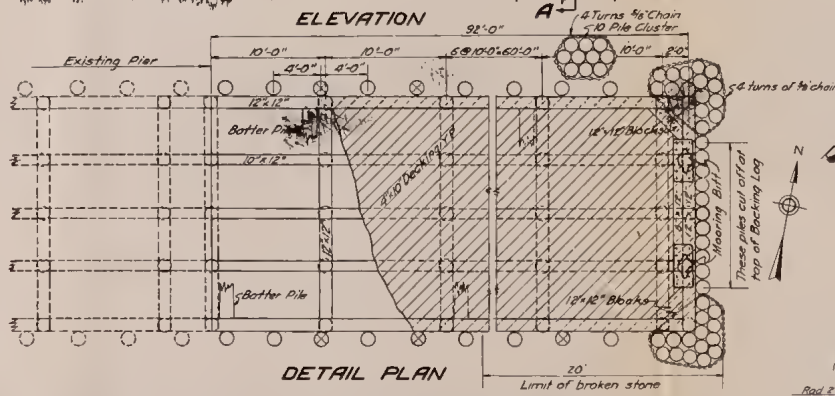


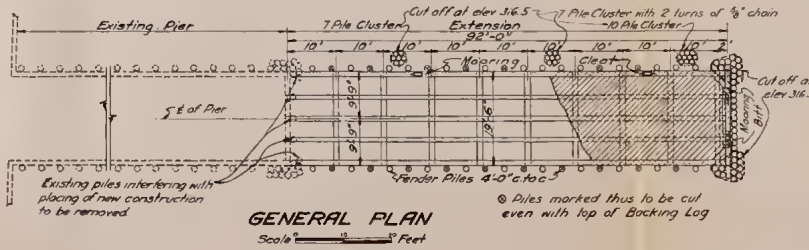


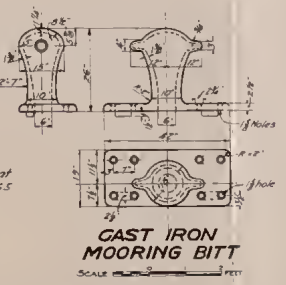


Bolts 1" dia with nuts and 2 washers
All chain wrappings to be fastened to every second pile by 1-1/2" x 4" galv. staple in each wrap

REFERENCES:
For Location see Dwg No 5.
" Index of Contract Plans, see Contract Dwg No 1.







CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No 4 A
CONTRACT DRAWING No 55

SCALE 1/4" = 1 FOOT EXCEPT AS SHOWN
DATE - JANUARY 15, 1930

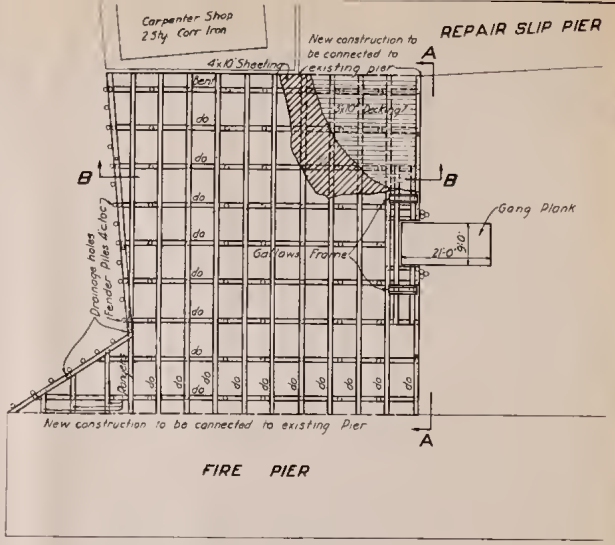
CHIEF ENGINEER
TUNNEL ENGINEER

FILE No C 4 A

Drawn 4-7-31
Traced 4-7-31
Checked 2-13-31

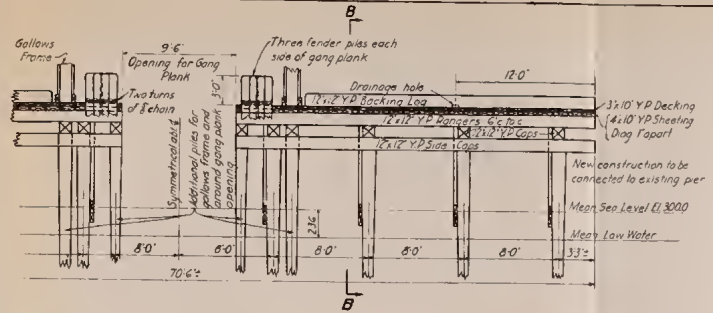
REPAIR SLIP PIER EXTENSION

H. D. BRUNNER - THOS. D. WARDEN & CO., N.Y.

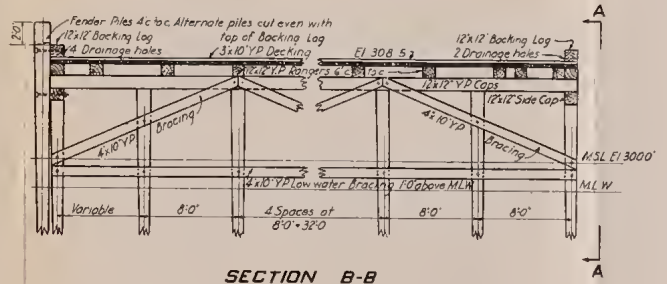


FIRE PIER

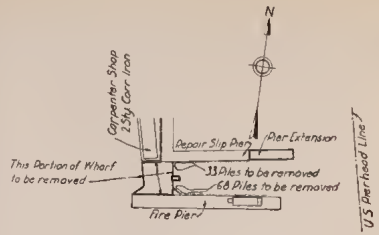
GENERAL PLAN
WHARF RECONSTRUCTION



SECTION A-A



SECTION B-B



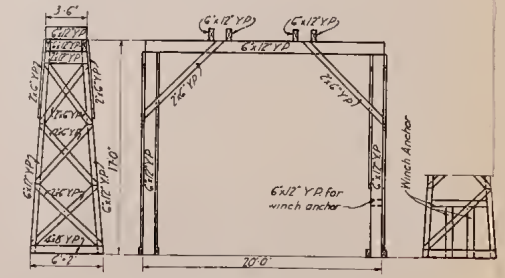
STRUCTURES TO BE REMOVED

NOTES:-

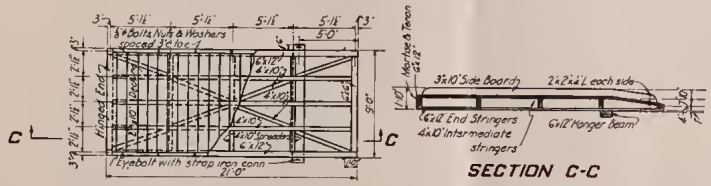
For additional details of materials and workmanship see Contract Specifications. Gallows Frame and Gang Plank bolts 8" dia. sq. heads with nuts and two washers. Elsewhere, bolts 1" dia. sq. heads with nuts and two washers.

REFERENCES:

For Location see Dwg. No. 5.
" Index of "Contract Plans, see Contract Dwg. No. 1.



GALLOWS FRAME



PLAN

SECTION C-C

GANG PLANK
Y.P. Timber. Stringers one piece

WHARF CHANGES

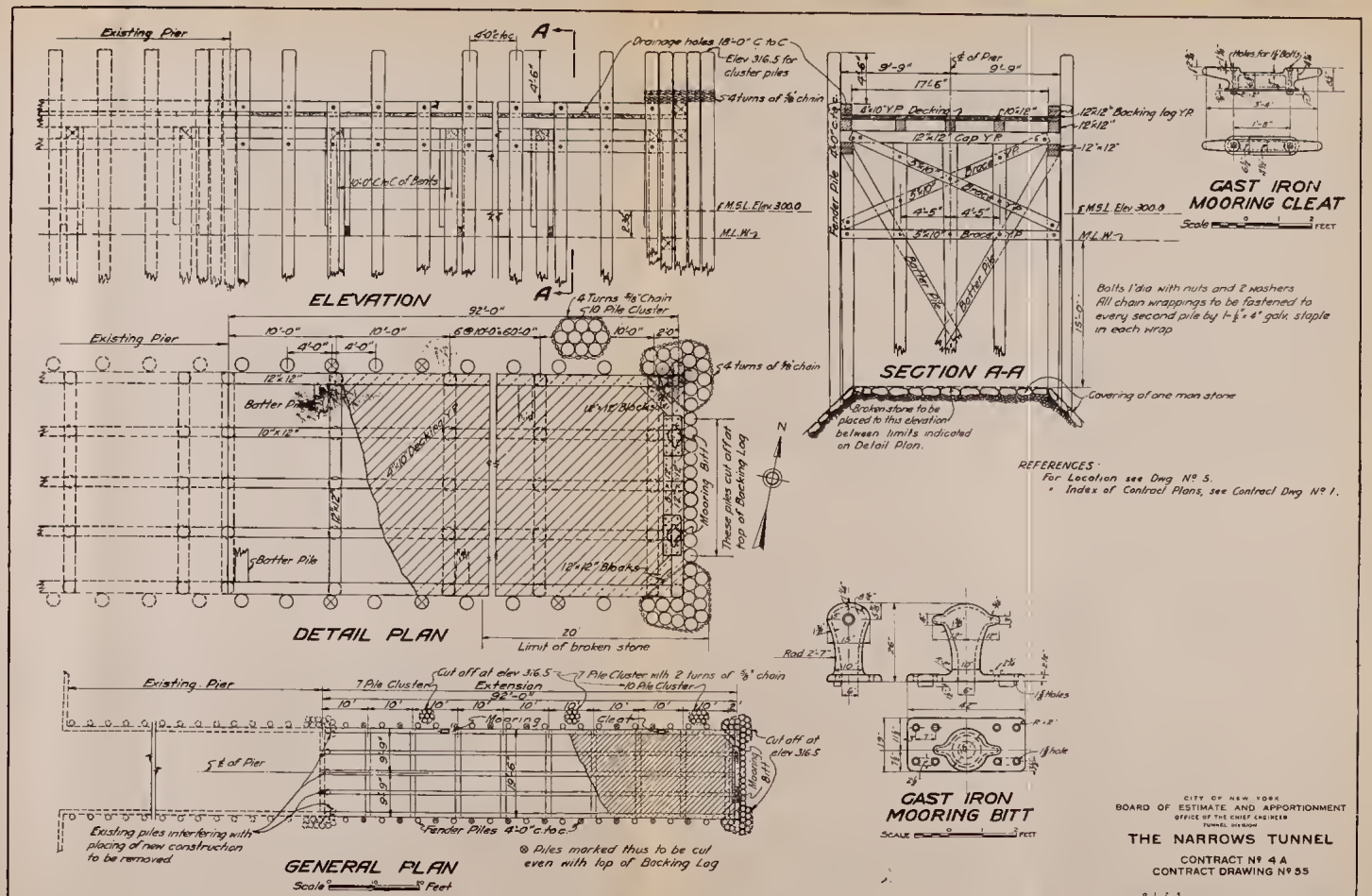
(Contractor's Area A.A., Richmond)

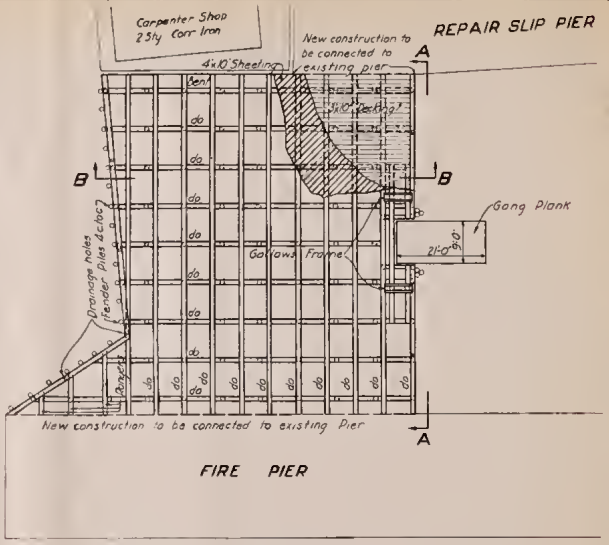
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No. 4 A
CONTRACT DRAWING No. 56

FILE No. C4 A

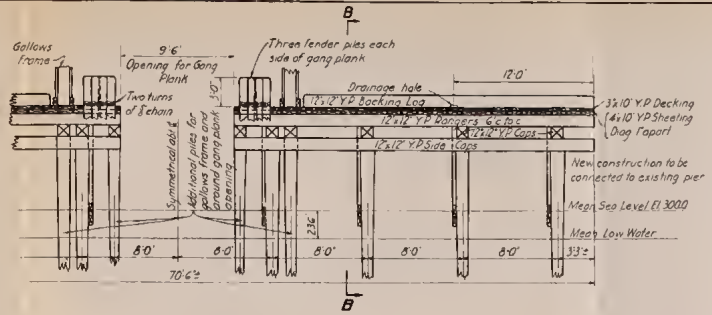

Existing Pier
4'-0" to c
A
Drainage holes 18'-0" C to C
Elev 316.5 for cluster piles
5-4 turns of 5/8" chain
4'-6"
10'-0" C to C of Bents
2'-6"
2'-6"
M.S.L. Elev 300.0
M.L.W.
ELEVATION
A
4 Turns 5/8" Chain
5-10 Pile Cluster
92'-0"
Existing Pier
10'-0"
10'-0"
6@10'-0"=60'-0"
10'-0"
2'-0"
4'-0"
4'-0"
12"x12"
Batter Pile
10"x12"
4"x10" Decking
12"x12" Blocks
5-4 turns of 5/8" chain
These piles cut off at top of Backing Log
Mooring Bitt
12"x12"
Batter Pile
12"x12" Blocks
20'
Limit of broken stone
DETAIL PLAN
N
℄ of Pier
9'-9"
9'-9"
17'-6"
4"x10" Y.P. Decking
10"x12"
12"x12" Backing log Y.P.
12"x12"
12"x12" Cap Y.P.
12"x12"
Fender Pile
4"x10" Brace
4"x10" Brace
4'-5"
4'-5"
4"x10" Brace
M.S.L. Elev 300.0
M.L.W.
Batter Pile
Batter Pile
15'-0"
Bolts 1" dia with nuts and 2 washers
All chain wrappings to be fastened to every second pile by 1-1/2"x4" galv. staple in each wrap
SECTION A-A
Covering of one man stone
Broken stone to be placed to this elevation between limits indicated on Detail Plan.
(Holes for 1 1/2" Bolts)
GAST IRON MOORING CLEAT
Scale 0 1 2 FEET
REFERENCES:
For Location see Dwg No 5.
" Index of Contract Plans, see Contract Dwg No 1.
Existing Pier
7 Pile Cluster
Cut off at elev 316.5
Extension
92'-0"
7 Pile Cluster with 2 turns of 5/8" chain
10 Pile Cluster
10'
10'
10'
10'
10'
10'
10'
10'
Mooring
Cleat
Cut off at elev 316.5
Mooring Bitt
℄ of Pier
9'-9"
9'-9"
19'-6"
Existing piles interfering with placing of new construction to be removed
Fender Piles 4'-0" c. to c.
⊗ Piles marked thus to be cut even with top of Backing Log
GENERAL PLAN
Scale 0 10 20 Feet
Rad 2'-7"
1 1/8" Holes
R 1'-8"
1 1/8" hole
GAST IRON MOORING BITT
Scale 0 1 3 FEET
Drawn
Traced
Checked
DESIGNING ENGINEER
REPAIR SLIP PIER EXTENSION
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION
THE NARROWS TUNNEL
CONTRACT No 4 A
CONTRACT DRAWING No 55
SCALE 1 0 1 2 FEET EXCEPT AS SHOWN
DATE JANUARY 15, 1915
CHIEF ENGINEER
TUNNEL ENGINEER
FILE No C 4 A



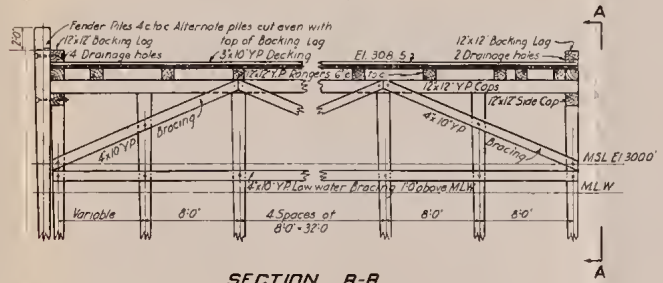
FIRE PIER

GENERAL PLAN

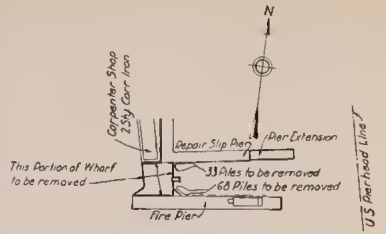
WHARF RECONSTRUCTION



SECTION A-A



SECTION B-B



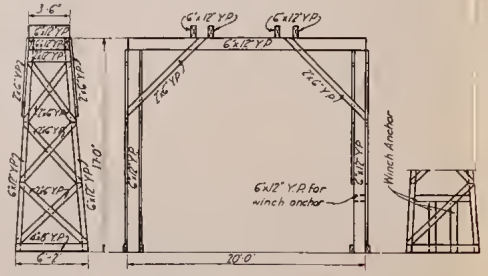
STRUCTURES TO BE REMOVED

NOTES:-

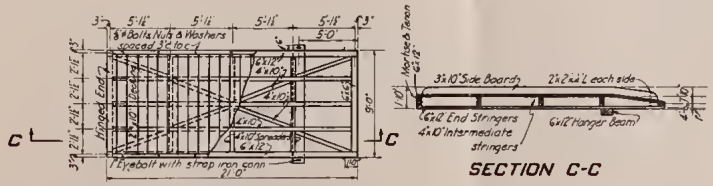
For additional details of materials and workmanship see Contract Specifications
Gallows Frame and Gang Plank bolts 8" dia. sq heads with nuts and two washers
Elsewhere, bolts 1" dia sq heads with nuts and two washers

REFERENCES.

For Location see Dwg No. 5
" Index of Contract Plans, see Contract Dwg No. 1



GALLOWS FRAME



PLAN

SECTION C-C

GANG PLANK

Y.P. Timber Stringers one piece

WHARF CHANGES

(Contractor's Area A-A, Richmond)

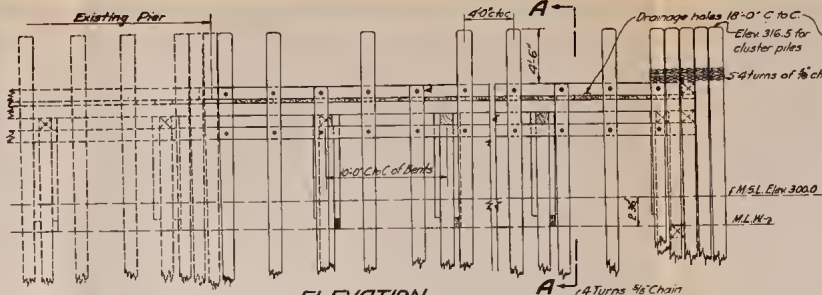
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

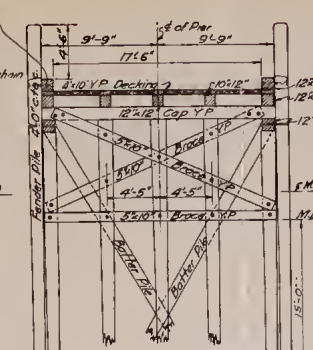
CONTRACT Nº 4 A
CONTRACT DRAWING Nº 56

FILE Nº C-4 A

Traced O.K.R.
Checked



ELEVATION

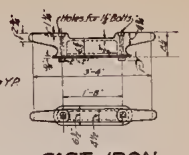


SECTION A-A

Bolts 1" dia with nuts and 2 washers
All chain wrappings to be fastened to every second pile by 1-5/8" x 4" galv. staple in each wrap

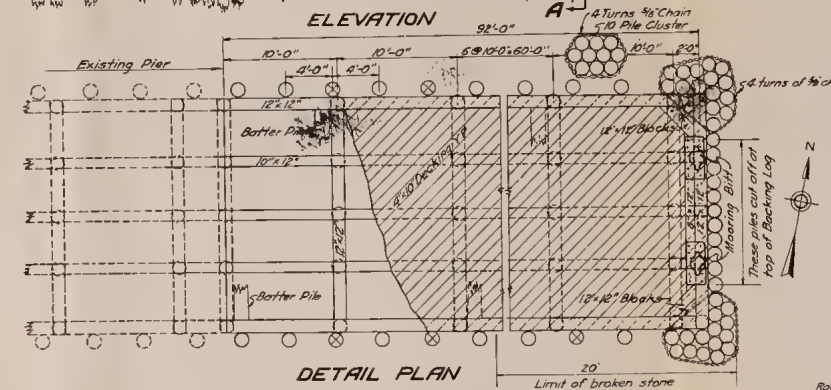
Covering of one man stone.

Broken stone to be placed to this elevation between limits indicated on Detail Plan.

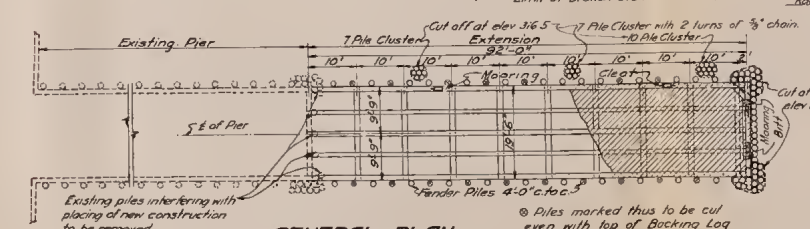


CAST IRON MOORING CLEAT

Scale 0 1' 2 FEET

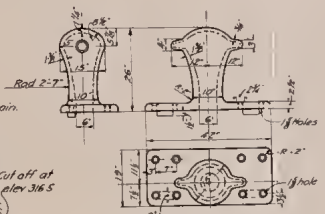


DETAIL PLAN



GENERAL PLAN

Scale 0 10 20 Feet



CAST IRON MOORING BITT

Scale 0 1 2 FEET

REFERENCES:
For Location see Dwg. No. 5.
" Index of Contract Plans, see Contract Dwg. No. 1.

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

THE NARROWS TUNNEL

CONTRACT No. 4 A
CONTRACT DRAWING No. 55

SCALE 1/8" = 1 FOOT EXCEPT AS SHOWN
DATE - JANUARY 13, 1910

Arthur S. Hill
CHIEF ENGINEER

J. J. Brown
TUNNEL ENGINEER

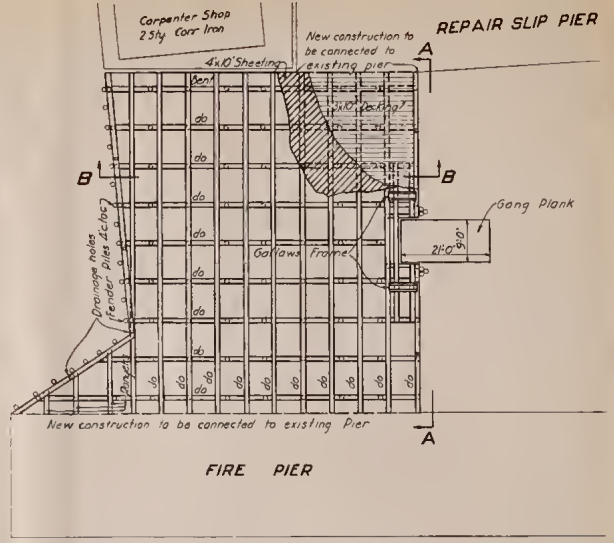
FILE No. C 4 A

Drawn J. K.
Traced J. M.
Checked J. W.

J. J. Brown
TUNNEL ENGINEER

REPAIR SLIP PIER EXTENSION

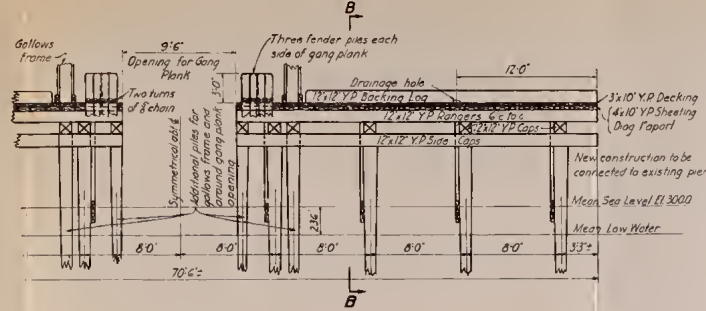
M. B. GROWNEY LITHO. & BINDING CO. N.Y.



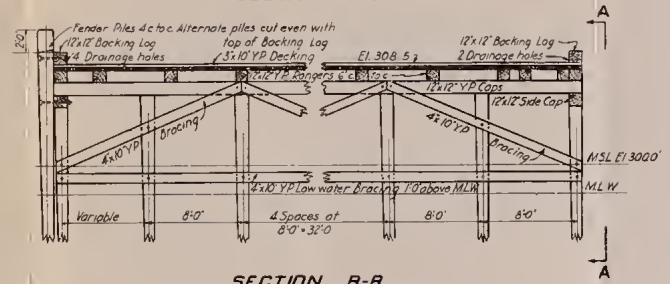
FIRE PIER

GENERAL PLAN

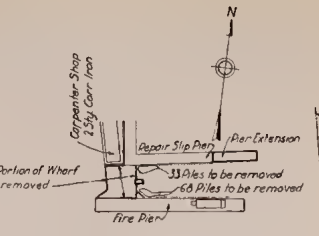
WHARF RECONSTRUCTION



SECTION A-A



SECTION B-B



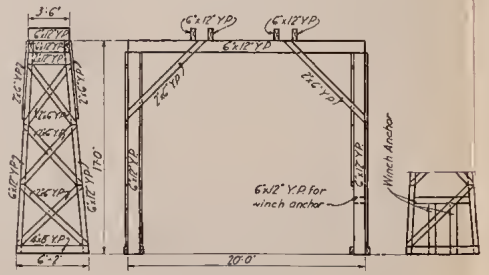
STRUCTURES TO BE REMOVED

NOTES:-

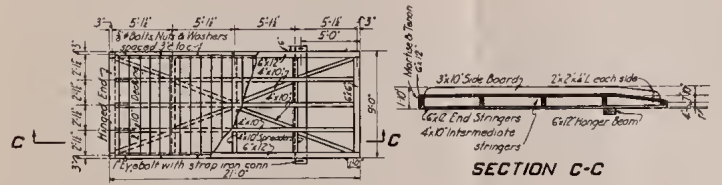
For additional details of materials and workmanship see Contract Specifications
Gallows Frame and Gang Plank bolts 8" dia sq heads with nuts and two washers
Elsewhere, bolts 1" dia sq heads with nuts and two washers

REFERENCES:

For Location see Dwg No 5.
" Index of Contract Plans, see Contract Dwg No 1.



GALLOWS FRAME



PLAN

SECTION C-C

GANG PLANK

Y.P. Timber Stringers one piece

WHARF CHANGES

(Contractor's Area A-A, Richmond)

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION

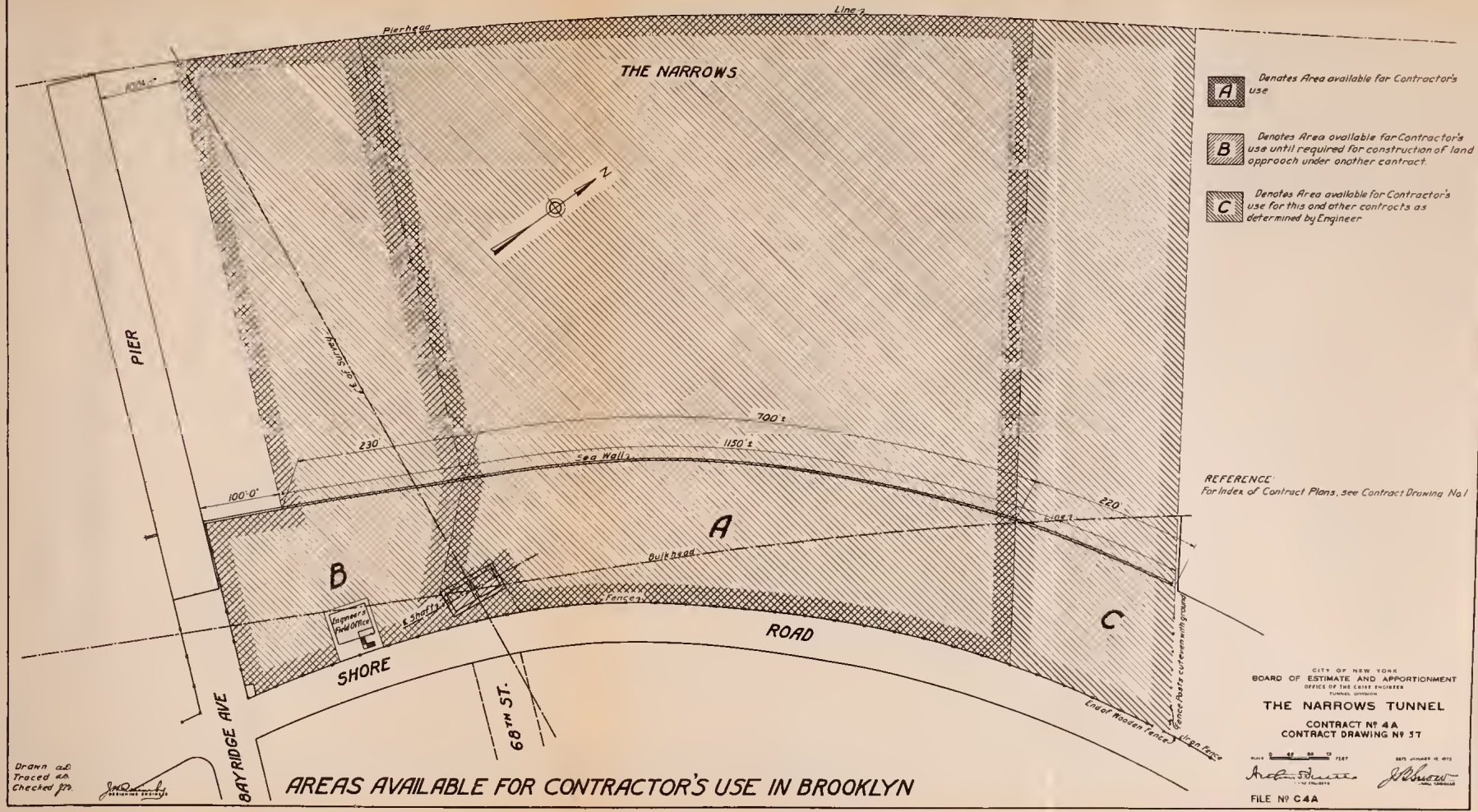
THE NARROWS TUNNEL

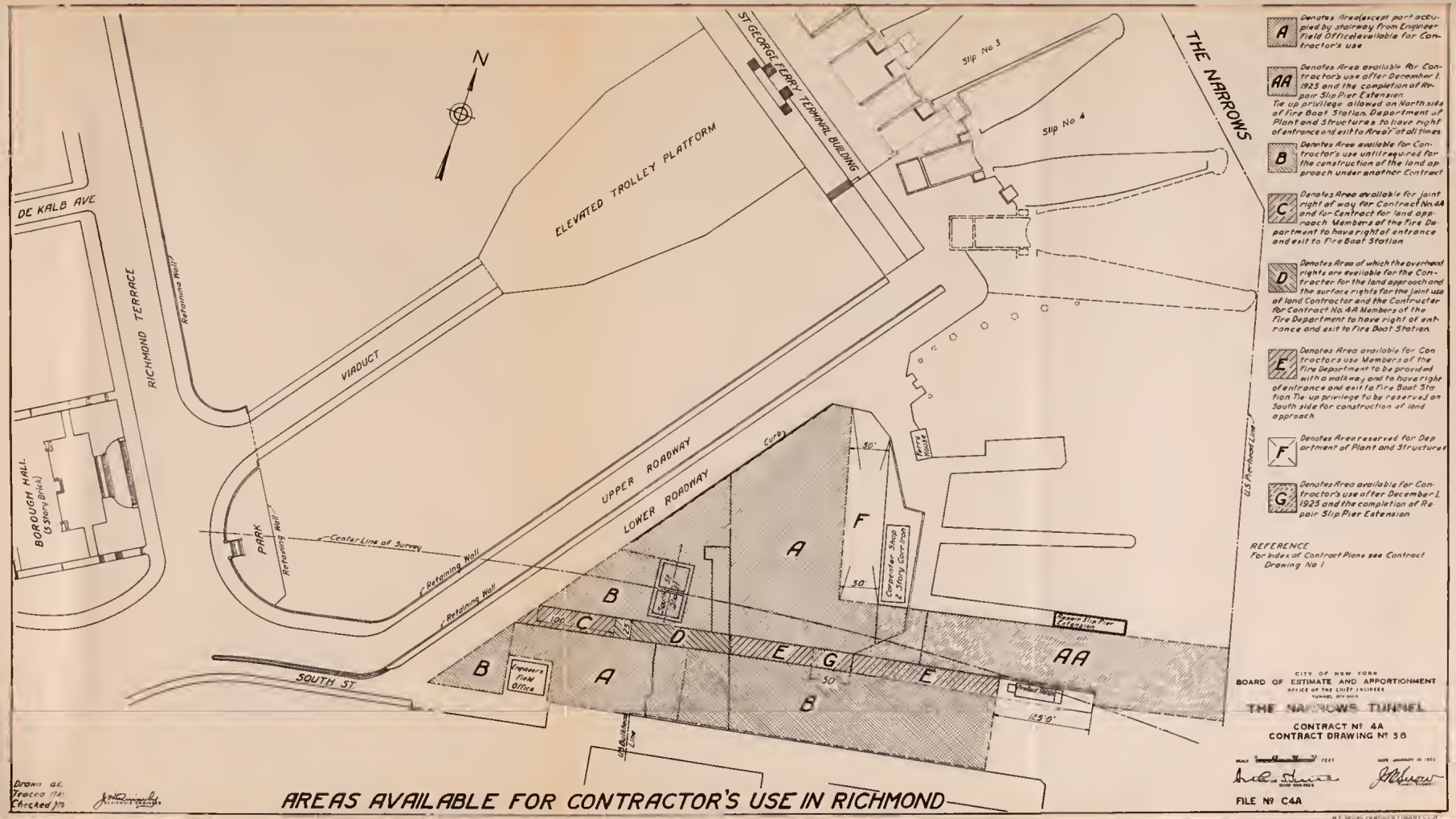
CONTRACT Nº 4 A
CONTRACT DRAWING Nº 56

FILE Nº C4A

Drawn J.A.S.
Traced G.W.P.
Checked J.C.S.

M.E. BROWN PRINTING & ENGRAVING CO. N.Y.


Line 2
Pierhead
THE NARROWS
N
PIER
Axis of Survey
700 ±
230
1150 ±
Sea Wall
100'-0"
220
Line 1
A
Bulkhead
B
Fences
Engineer's Field Office
℄ Shaft
C
ROAD
SHORE
BAY RIDGE AVE
68TH ST.
End of Wooden Fence
Fence Posts cut even with ground
Iron Fence
Denotes Area available for Contractor's use
Denotes Area available for Contractor's use until required for construction of land approach under another contract.
Denotes Area available for Contractor's use for this and other contracts as determined by Engineer
REFERENCE
For Index of Contract Plans, see Contract Drawing No. 1
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION
THE NARROWS TUNNEL
CONTRACT Nº 4A
CONTRACT DRAWING Nº 57
FILE Nº C4A
Drawn
Traced
Checked
AREAS AVAILABLE FOR CONTRACTOR'S USE IN BROOKLYN


N
DE KALB AVE
RICHMOND TERRACE
Retaining Wall
BOROUGH HALL (3 Story Brick)
PARK
Retaining Wall
VIADUCT
ELEVATED TROLLEY PLATFORM
ST GEORGE FERRY TERMINAL BUILDING
Slip No 3
Slip No 4
THE NARROWS
Center Line of Survey
Retaining Wall
Retaining Wall
UPPER ROADWAY
LOWER ROADWAY
Curbs
SOUTH ST
Ferry House
Carpenter Shop & Spring Garrison
Repair Slip Pier Extension
Engineer's Field Office
U.S. Pierhead Line
A
B
C
D
E
F
G
AA
50'
50'
100'
125'0"
A Denotes Area (except part occupied by stairway from Engineer Field Office) available for Contractor's use
AA Denotes Area available for Contractor's use after December 1, 1925 and the completion of Repair Slip Pier Extension. Tie up privilege allowed on North side of Fire Boat Station. Department of Plant and Structures to have right of entrance and exit to Area F at all times
B Denotes Area available for Contractor's use until required for the construction of the land approach under another Contract
C Denotes Area available for joint right of way for Contract No 4A and for Contract for land approach. Members of the Fire Department to have right of entrance and exit to Fire Boat Station
D Denotes Area of which the overhead rights are available for the Contractor for the land approach and the surface rights for the joint use of land Contractor and the Contractor for Contract No 4A. Members of the Fire Department to have right of entrance and exit to Fire Boat Station
E Denotes Area available for Contractors use. Members of the Fire Department to be provided with a walkway and to have right of entrance and exit to Fire Boat Station. Tie-up privilege to be reserved on South side for construction of land approach
F Denotes Area reserved for Department of Plant and Structures
G Denotes Area available for Contractor's use after December 1, 1925 and the completion of Repair Slip Pier Extension
REFERENCE
For Index of Contract Plans see Contract Drawing No 1
CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
OFFICE OF THE CHIEF ENGINEER
TUNNEL DIVISION
THE NARROWS TUNNEL
CONTRACT Nº 4A
CONTRACT DRAWING Nº 56
SCALE 0 10 20 30 FEET
DATE JANUARY 15 1923
FILE Nº C4A
Drawn a.e.
Traced
Checked
AREAS AVAILABLE FOR CONTRACTOR'S USE IN RICHMOND

AVERY
CLASSICS