DIAGRAMS SHOWING THE INFLUENCE OF VARIABLE LOADS ON THE RIBS OF CENTRAL ARCH (520 FEET SPAN).

WEIGHT OF SUPERSTRUCTURE: 1 TON, MOVABLE LOAD 0.8 TON PER RUNNING FOOT OF ARCH RIBS. AREA OF EACH OF THE TWO MEMBERS OF SPAN IS 100.5 SQ. IN., CENTERPIECE DISTANCE BETWEEN CENTERS OF THE TWO MEMBERS IS 18 FEET.

WEIGHT OF SUPERSTRUCTURE, MOVABLE LOAD = 0.8 TON PER RUNNING FOOT OF ARCH RIBS.

AREA OF EACH OF THE TWO RIBS = 100.5 SQ. IN., CENTERPIECE DISTANCE BETWEEN CENTERS OF THE TWO MEMBERS IS 18 FEET.

The diagrams show the compression on required area in one member for the force in the direction of arch without regarding the moments of flexure.

Julius Bien 1880.
Diagrams showing the influence of temperature on the upper and lower member of a rib of central arch.

Suppositions made for the calculation:
Area of one member in end piece 67 sq. ins. for center piece 67 sq. ins. - distance between the centers of upper and lower members of a rib of ft. modulus of elasticity of cast steel 27,000,000 lbs.)

Additional section of influence of tension against compression. Diagram 1.

Diagram 2.

The light lines show the maximum strain or area without regarding the influence of temperature.
Plate VI.

DIAGRAMS SHOWING THE STRAINS IN THE BRACES OF CENTER SPAN.

Suppositions made for the calculations:
- Weight of superstructure = 1 ton.
- Minimum load = 0.8 ton. Moving load = 1 ton.
- Area of each of the members of the ribs is 100.5 square inches.
- Distance between the centers of the upper and lower members of a rib = 12 feet.
- Modulus of elasticity of cast steel = 27000 lbs. per sq. in.
- Expansion of cast steel for 80°F = 0.000527 of its original length.

Diagram 1.
- Tons. Strains caused by variable loads.

Diagram 2.

Diagram 3.
- Tons. Strains by a change of temperature of 80°F Fahrenheit.

Diagram 4.
- Tons. Maximum total strain by load and temperature.

The light lines show the maximum strain or area without regarding the influence of temperature.

Judd, Wm., U.S. Navy.

W. P. forward date 1880.
CAISSON FOR EAST PIER.

FIG. 1.
SECTION ALONG LINE CD.

FIG. 2.
PLAN.

FIG. 3.
SECTION EF.

A. Air Locks.
B. Air Chamber.
C. Timber Girders.
E. Sand Pumps.
F. Main Entrance Shaft, 10’ diam.
G. Side Shafts, A’ 9’ diam.
H. Iron Sides.
K. Iron Deck.
L. Iron Girders.
O. Strengthening Beams.

S. SCALE S.
CAISSON FOR EAST PIER.

DETAILS OF IRON WORK.

FIG. 1.
SECTION HW.

FIG. 2.
SECTION EX.

SCALES.

100 90 80 70 60 50 40 30 20 10 0

METRES.

1 INCHES. 1 2 3 4 5 6 7 8 9 10 11 INCHES.

CONTRACTIONS 10 20 30 40 50 60 70 80 90 100

METRES.

W.S. Gerard, eng. 1880.
CONSTRUCTION WORKS AND MACHINERY
FOR SINKING CAISSON AND LAYING MASONRY OF THE EAST PIER.

Scales

I - 5 - 10 - 20 - 30 - 40 - 50 - 60 - 80

Plate IX.

A. CAISSON FOR OPERATIONS OF PURCHASES
B. POURTRUS
C. MACHINIST JUNK FOR ROUGHING MATERIALS
D. WIRE CABLES TO SUPPORT TRAVELING PURCHASES
E. WIRE Winching HEADS
F. TRAVELING PURCHASES
G. SPRINGS FOR STIRRING AND SWINGING TRAVELING PURCHASES
H. URETHANE ON HYDRAULIC JACKS FOR PUMPING AND LONGING MATERIALS
I. AIR PUMPS
J. ENGINES TO DRIVE AIR PUMPS

4. HOSE FOR SUPPLYING AIR
5. HORIZONTAL LAY TYPE ON CAISSON
6. PIPE FOR WATER TO SAND PUMP
7. TUBES FOR RIVER PIES
8. MASHING ROOM
9. OFFICE
10. PUMP FOR CEMENT AND STONE CAGG
CONSTRUCTION OF EAST PIER.

PLAN OF
PONTOONS AND DERRICKS.

A. ENTRANCE FOR OPERATORS TO PONTOONS G. SUE HINTS TO MAIN EXHAUSTION
B. PONTOONS H. TRAVELING PONTOONS
C. MAIN ENTRANCE SHAFT I. WIRE CABLE TO TRAVELING PONTOONS
D. MAIN ENTRANCE OF CAISSON J. HOUSE FRAME
E. CABINS FOR OPERATORS OF PURCHASES K. SIDE SHAFTS
F. PONTOONS AND DERRICKS L. MAIN ENTRANCE TO AIR CHAMBER
G. AIR PUMPS AND ENGINES M. GUIDE PILINGS
H. ENGINE TO DRIVE MACHINERY FOR TRAVELERS

Scales:

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 FEET
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 METRES
HYDRAULIC JACKS AND MACHINERY
FOR DERRICKS.

FIG. 1.
SIDE ELEVATION.

VALVE A' FOR HYDRAULIC JACKS.

FIG. 6.
SECTION AB.
LOOKING DOWNWARD.

FIG. 2.
ELEVATION.

FIG. 3.
TOP VIEW OF GEARING.

FIG. 4.
TOP VIEW OF CABIN PLATFORM SHOWING LEVERS TO OPERATE GEARING AND WHEELS FOR VALVES.

FIG. 5.
SECTION CD.
LOOKING DOWNWARD.

SCALE OF FEET.

SCALE OF METRES.
SANDPUMP.

SECTION CD.

FIG. 1.

SIDE ELEVATION.

FIG. 2.

SECTION AB.

FIG. 3.

Julius Bien (eng. XV

W.F. Bodward del. 1880
SECTION OF EAST PIER AND CAISSON

ON LINE AB, PLATE VII.


Scales:

1.0

6 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Feet.

6 0 1 2 3 4 5 6 7 8 9 10

Metres.

A. Air Locks.
B. Air Chamber.
C. Timber Girder.
D. Discharge of Sand Pump.
E. Sand Pumps.

F. Main Entrance Shaft.
G. Side Shafts.
H. Iron Envelope.
I. Drying for Shell.
J. Strengthening Brackets.

Ordinary Water Line.

Extreme Low Water.

Upper Line of Sand Bed.

Julian Scott Lith. N.Y.

W.H. Goodall ed. 1881.
CAISSON FOR EAST ABUTMENT.

FIG. 1.

SECTION OF CAISSON ALONG LINE AB.

1. MAIN SHAFT.
   K. SIDE SHAFTS.
   A. Pipes for air pumps.
   S. Pipes for east pumps.
   W. Pipes for water.
   M. Iron girders.

XX. Iron deck.
   O. Air locks.
   P. Air chamber.
   T. Timber girders.
   Z. Timber deck.
   H. Iron envelope.

TOP VIEW OF CAISSON.

EAST SIDE.

SECTION ALONG LINE GH.

SCALE OF FEET.

18 15 12 9 6 3 .

WEST SIDE.

NORTH FRONT.

SCALE OF METRES.

1 0' 1 2 3 4 5 6 7 8 9 10 11 12 13 14.
CAISSON FOR EAST ABUTMENT.

FIG. 1.
SECTION OF CAISSON
ALONG LINE CD.
(Plate VI.)
LOOKING EASTWARD.

FIG. 2.
ALONG LINE EE.
(Plate VII.)
LOOKING WESTWARD.

CENTRAL AIR LOCKS.

FIG. 3.
ELEVATION.

FIG. 4.
SECTION XX.

FIG. 5.
SECTION YY.

SCALE OF FEET.

SCALE OF METRES.
Plate XX

FIG. 1.

FIG. 2.

VERTICAL SECTIONS AT PIER

NOTE: THE ABOVE ABOVE LENGTHS OF FEET METERS AND TIMES ARE TAKEN FOR CENTER OF PIN-HOI.

Gerhard, del. 1880.
CROSS SECTION AT JOINT NO. 1
OF CENTER SPAN.

FOR DETAILS AND DIMENSIONS
OF JOINT 1 SEE PLATE XX

SCALE OF FEET.

SCALE OF METRES.

W. P. Gerhard del. 1883

Julius Bien, lith. N. Y.
CROSS SECTION AND HORIZONTAL SECTIONS

AT CENTER OF CENTER SPAN

SECTION

FIG. 1.

FOR DETAILS AND DIMENSIONS

OF JOINT 22 SEE PLATE XXXV.

SECTION

FIG. 2.

Scales: Feet

Scales: Meters

Julius Sim 8th, KY.

W.B. Garwood delt 1880.
SUPPORT OF LOWER ROADWAY OF CENTER SPAN.

FIG. 1. ELEVATION.

FIG. 2. SECTION AB.

FIG. 4. ELEVATION.

FIG. 7. SECTION MN.

FIG. 6. SECTION HK.

FIG. 5. SECTION EF.

JOINT №10.

JOINT №11.

INDICATES STEEL.

INCHES |
--- |
1 2 3 4 5 6 7 8 9 10 |
--- |
FREET.

PRINTED BY 
BAILEY & CO. LTD.

279 BROADWAY,
NEW YORK.
SUPPORT OF LOWER ROADWAY OF CENTER SPAN.

JOINT 13.

SCALES

8' 3''

FIG. 1. ELEVATION

FIG. 2. SECTION BB

DOUBLE TRUSS

FOR SIDE OF SHIFTER

STIFFENING CHANNELS

END AT JOINTS 22.6 & 22.0

CENTRE LINE OF TRACK

FIG. 3. SIDE VIEW OF TRACK AND TRACK SUPPORT.

TRACK SUPPORT.

SCALES

0 1 2 3 4 5 6 7 8 9 10 11 12 INCHES

6 12 18 24 30 CENTIMETRES

STEEL PAIL

BEND 47 DEG.

100 PAILS PER CORD.
TABLE OF DIMENSIONS OF BRACE BARS.

<table>
<thead>
<tr>
<th>SIDE SPANS</th>
<th>a</th>
<th>b</th>
<th>CENTER SPAN</th>
<th>a</th>
<th>b</th>
</tr>
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<tbody>
<tr>
<td>BETW. HITS</td>
<td>0-11-1-2-2-2</td>
<td>35-42-40-40-40-40</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>BETW. JOINTS</td>
<td>0-11-1-2-2-2</td>
<td>35-42-40-40-40-40</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2-3, 3-3, 4-4</td>
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<td>11</td>
<td></td>
</tr>
<tr>
<td>3-4, 4-4, 4-4</td>
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<td>35-42-40-40</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>5-5, 5-5</td>
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<td>35-42-40-40</td>
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<td>11</td>
<td></td>
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<tr>
<td>5-5, 7-7, 7-7</td>
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<td>11</td>
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<td>35-42-40-40</td>
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<td>11</td>
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<td>35-42-40-40</td>
<td>11</td>
<td>11</td>
<td></td>
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<td>35-42-40-40</td>
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<td>11</td>
<td></td>
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<tr>
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<td>35-42-40-40</td>
<td>35-42-40-40</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

DETAILS OF VERTICAL STRUTS, BRACES, SUSPENSION BARS AND STAYS.
ANCHORAGE
OF
UPPER WINDTRUSS.

Scales:

1" = 1'-0"

1/16"

Inclined Cincture.

Steel Indicating.

Thread of Smaller (1") Bolt (enlarged)

Thread of Larger (3") Bolt (enlarged)

Julius Bien, NY.

Gerhard del. 1880.
FIG. 1. ELEVATION OF TESTING MACHINE.

FIG. 2. LONGITUDINAL SECTION CB.

FIG. 3. HORIZONTAL SECTION EF.

FIG. 4. CROSS SECTION AB.

ST. LOUIS TESTING MACHINE.

CAPACITY—100 TONS

COLUMNS AND BASES: 200 TON OR 2,000 TON.

FIG. 5.

Diagram showing method of measuring changes in length of specimens.

Plate XXXV
PHILADELPHIA TEST MACHINE.

FIG. 1.
ELEVATION OF TESTING MACHINE.

FIG. 2.
PLAN OF TESTING MACHINE.

FIG. 3.
END VIEW OF TENSION TAILSTOCK

FIG. 4.
END VIEW OF COMPRESSION TAILSTOCK

FIG. 5.
SECTION AB OF STAVE BED PLATE

FIG. 6.
NUT FOR PULLING BOLT

CAPACITY OF MACHINE - 800 TONS

PRESSURE GAUGE

FIG. 7.

FIG. 8.

Scales

1 mm = 0.05 inch

Plate XXXVII

Julius Bien, N.Y.

W. P. Gerhard, delt. 1880
DETAILS OF ERECTION.

PICTURE CLAMP OF MAST, FIG. 6.

Fig. 6.

SECTION CO.

Fig. 7.

LINES OF MAST CABLES.

Fig. 8.

STRIPE CLAMP OF MAST, FIG. 9.

Fig. 9.

Fig. 10.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 1.

NOTE OF BENDING MAIN CABLE AND SECONDARY MAST TO TAKE APRAX AT JOINT NO. 12 ON MAST C. 

Plate XXXIX.
SINKING THE WEST PIER. ICE-BREAKER IN THE FOREGROUND.
SINKING THE EAST ABUTMENT. LAYING MASONRY ON THE FLOATING CAISSON.
ERECITION OF WEST AND CENTER ARCHES. VIEW LOOKING NORTH-EAST.
Erection of West Arch, showing cables to joints 6, 9, and 12.
THE ERECTION. CLOSING THE CENTER AND EAST ARCHES.
THE ERECTION. THE RIBS COMPLETED AND THE ROADWAYS BEGUN.
SOUTH TRACK OF CENTER SPAN, LOOKING EAST.

THE CENTER ARCH SEEN FROM BETWEEN THE RAILROAD TRACKS

VIEW OF WEST ARCH FROM WATER’S EDGE AT WEST ABUTMENT.

THE UPPER ROADWAY LOOKING EAST.