Fraser River Bridge. Canadian Pacific Railway.

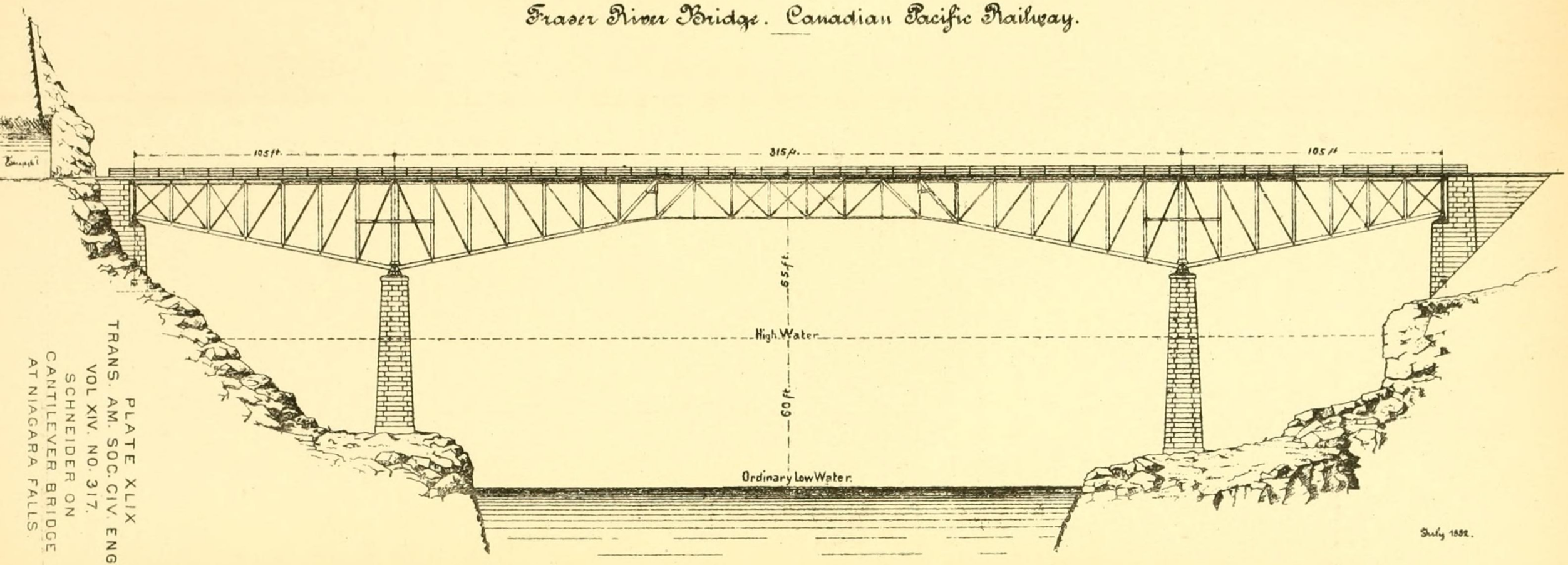
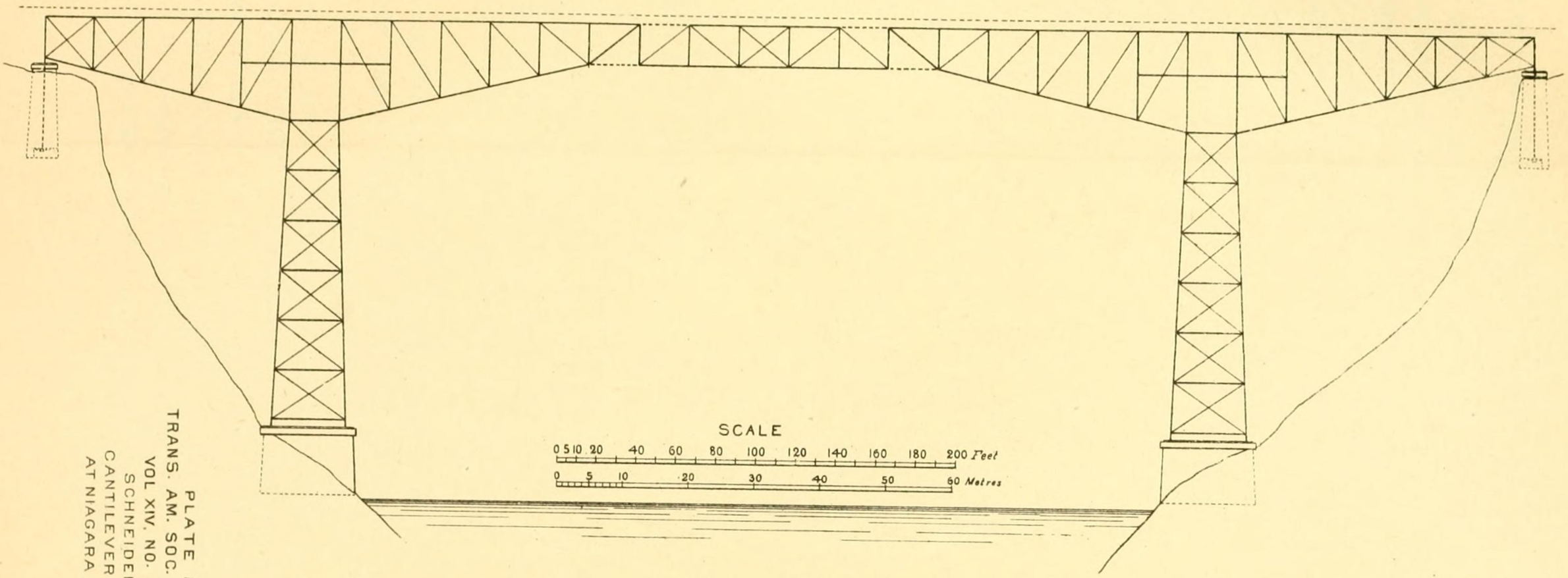


PLATE XLIX
TRANS. AM. SOC. CIV. ENG'RS
VOL XIV. NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.



PRELIMINARY DESIGN.

PLATE L
TRANS. AM. SOC. CIV. ENG'RS
VOL XIV, NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

CANTILEVER BRIDGE AT NIAGARA FALLS

GENERAL PLAN.

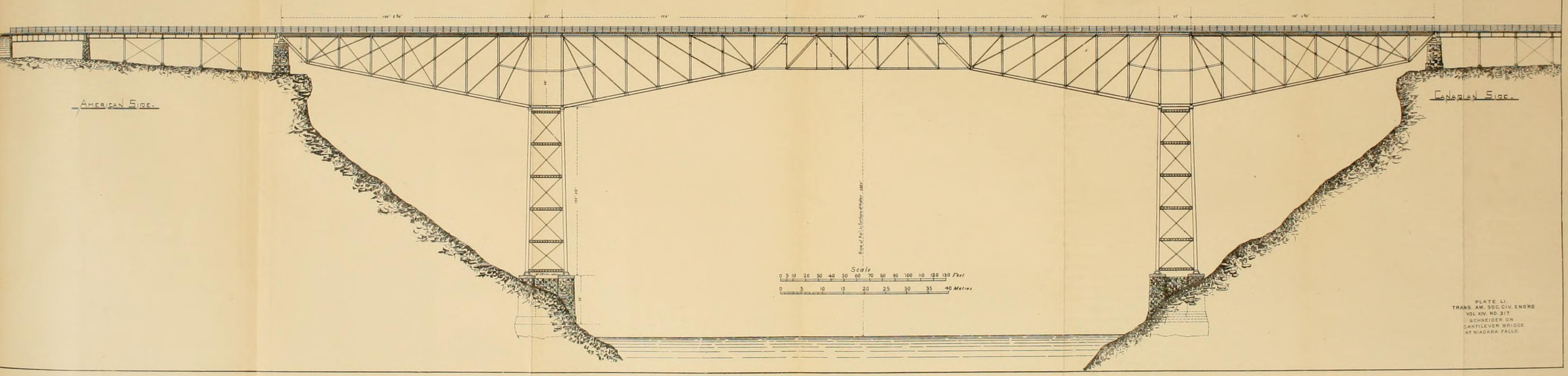


PLATE LI.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

MASONRY PIERS.

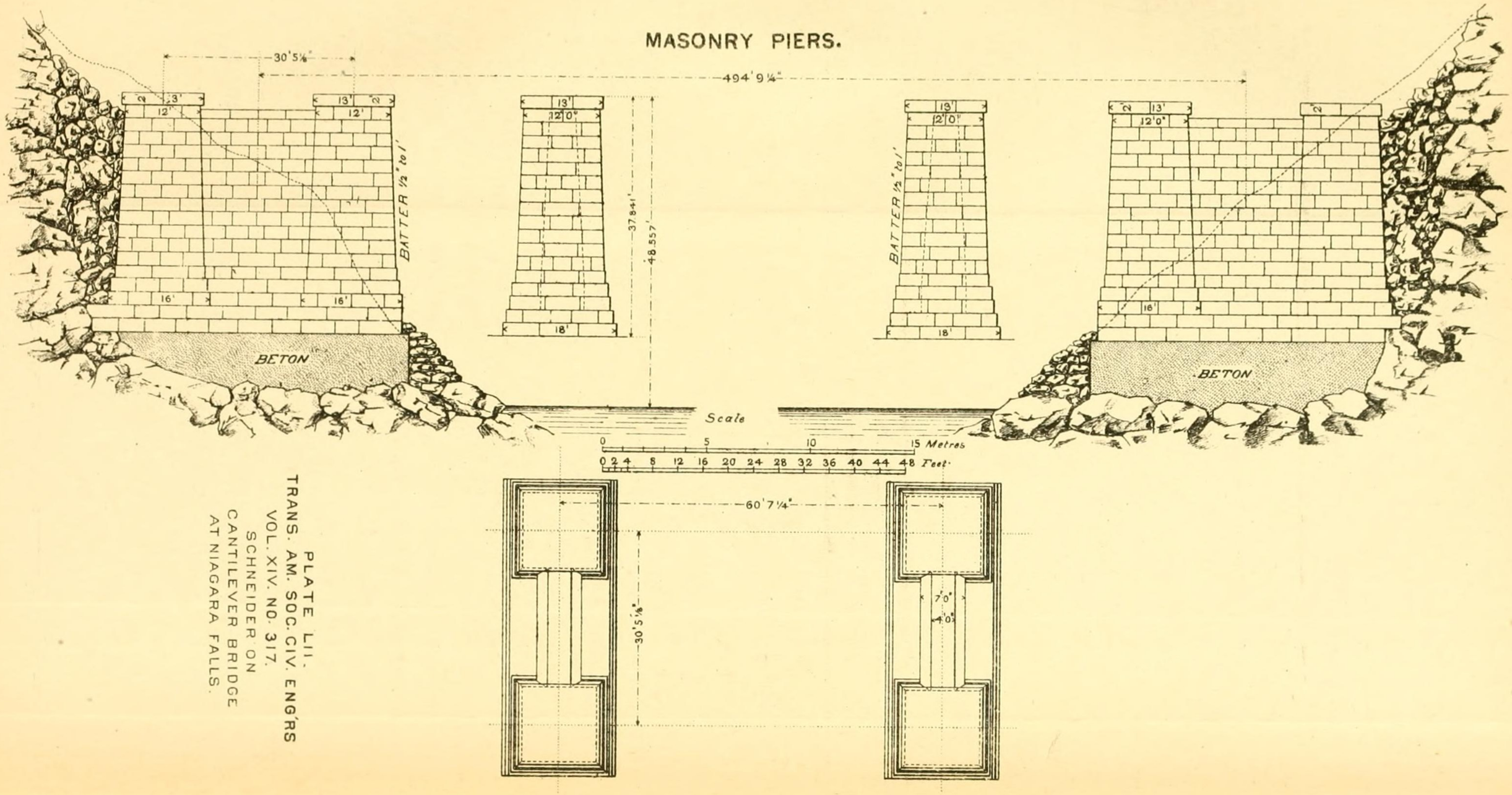


PLATE LII.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

ANCHORAGE PIER.

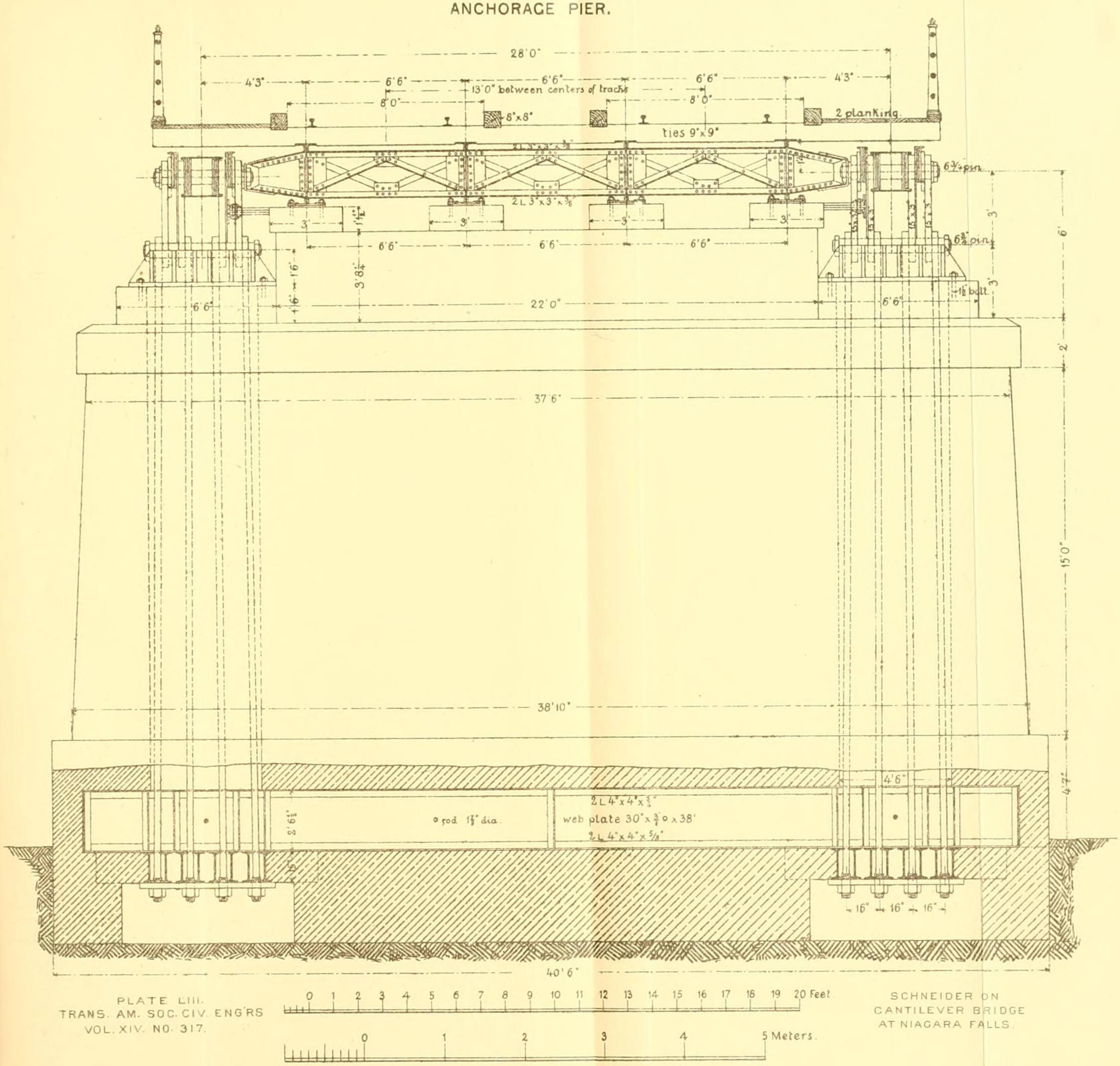


PLATE LIII.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. NO. 317.

SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

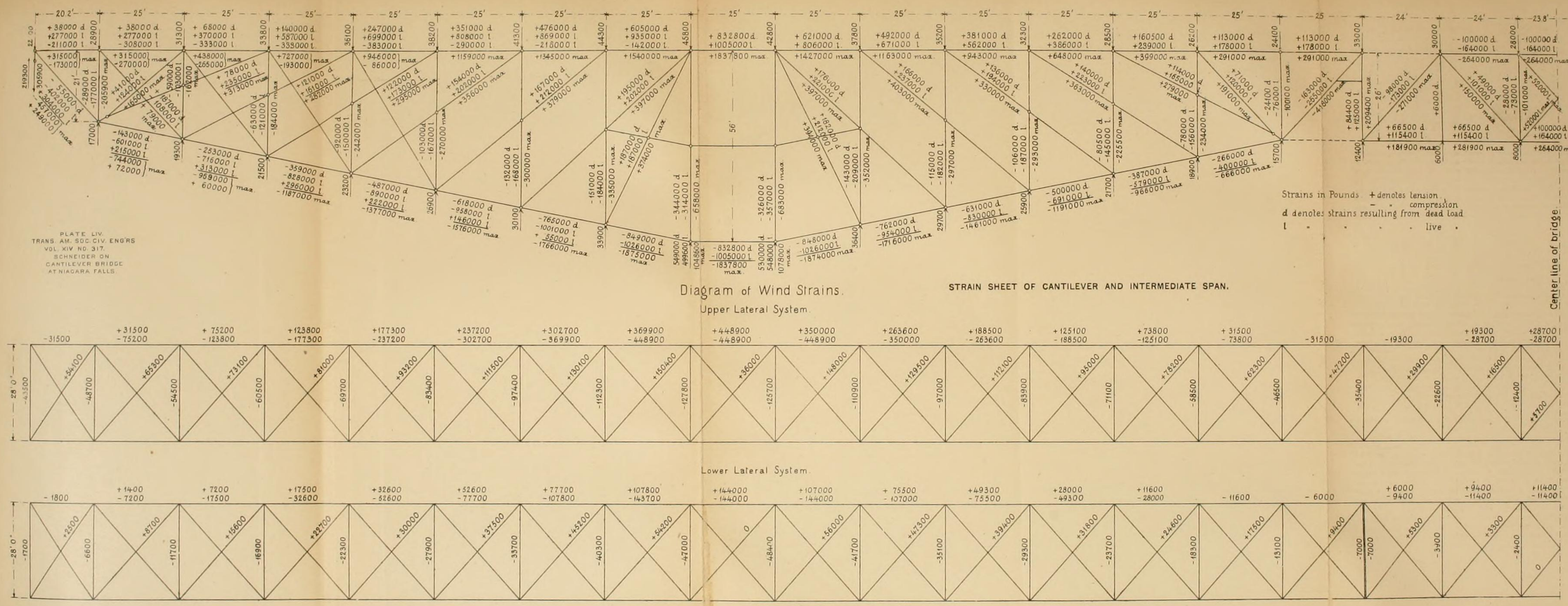
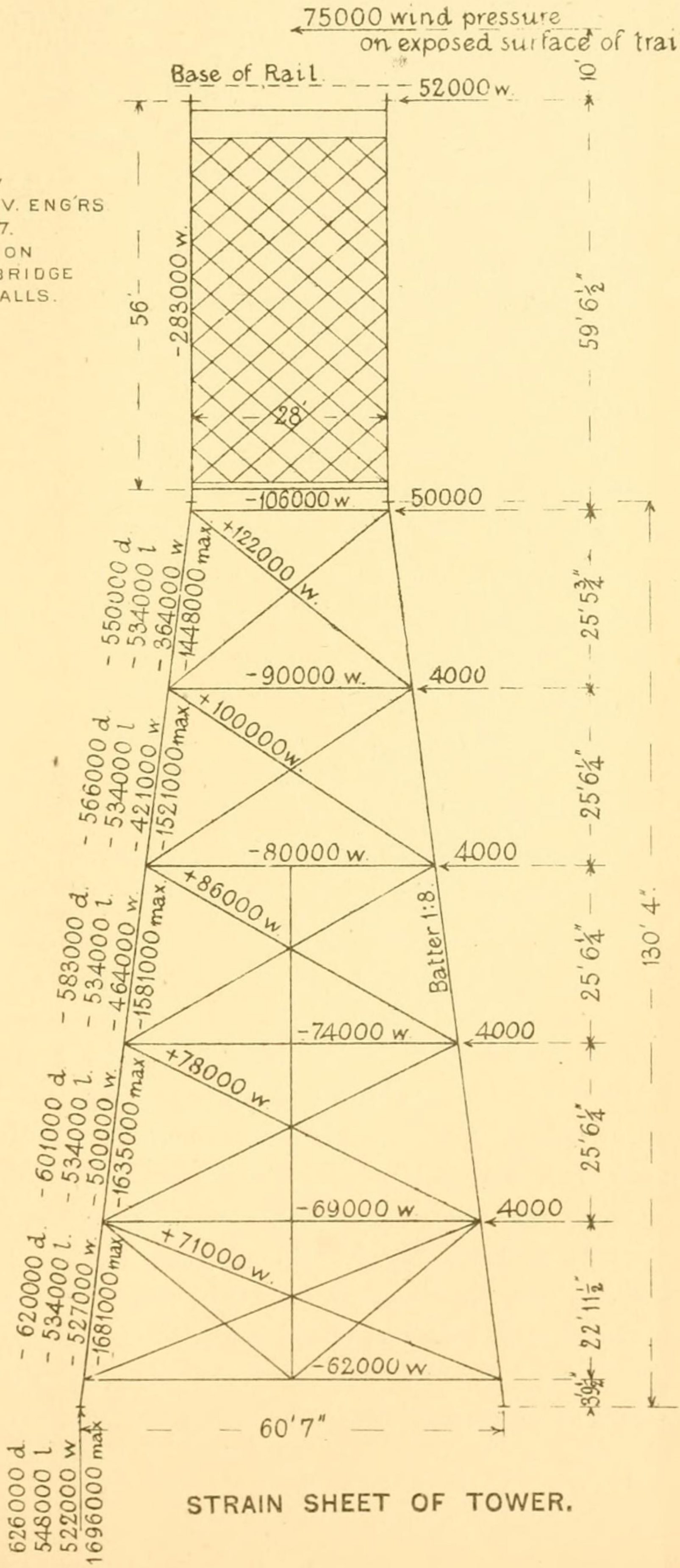


PLATE LIV.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.
Diagram of Wind Strains.
STRAIN SHEET OF CANTILEVER AND INTERMEDIATE SPAN.
Strains in Pounds + denotes tension
− " compression
d denotes strains resulting from dead load
l " " " " live "
Center line of bridge
Upper Lateral System
Lower Lateral System

Strains in pounds.
+ denotes tension.
− " compression.
d - Strains resulting from dead load.
l = " " " live "
w = " " " wind pressure.

PLATE LV
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.



STRAIN SHEET OF TOWER.

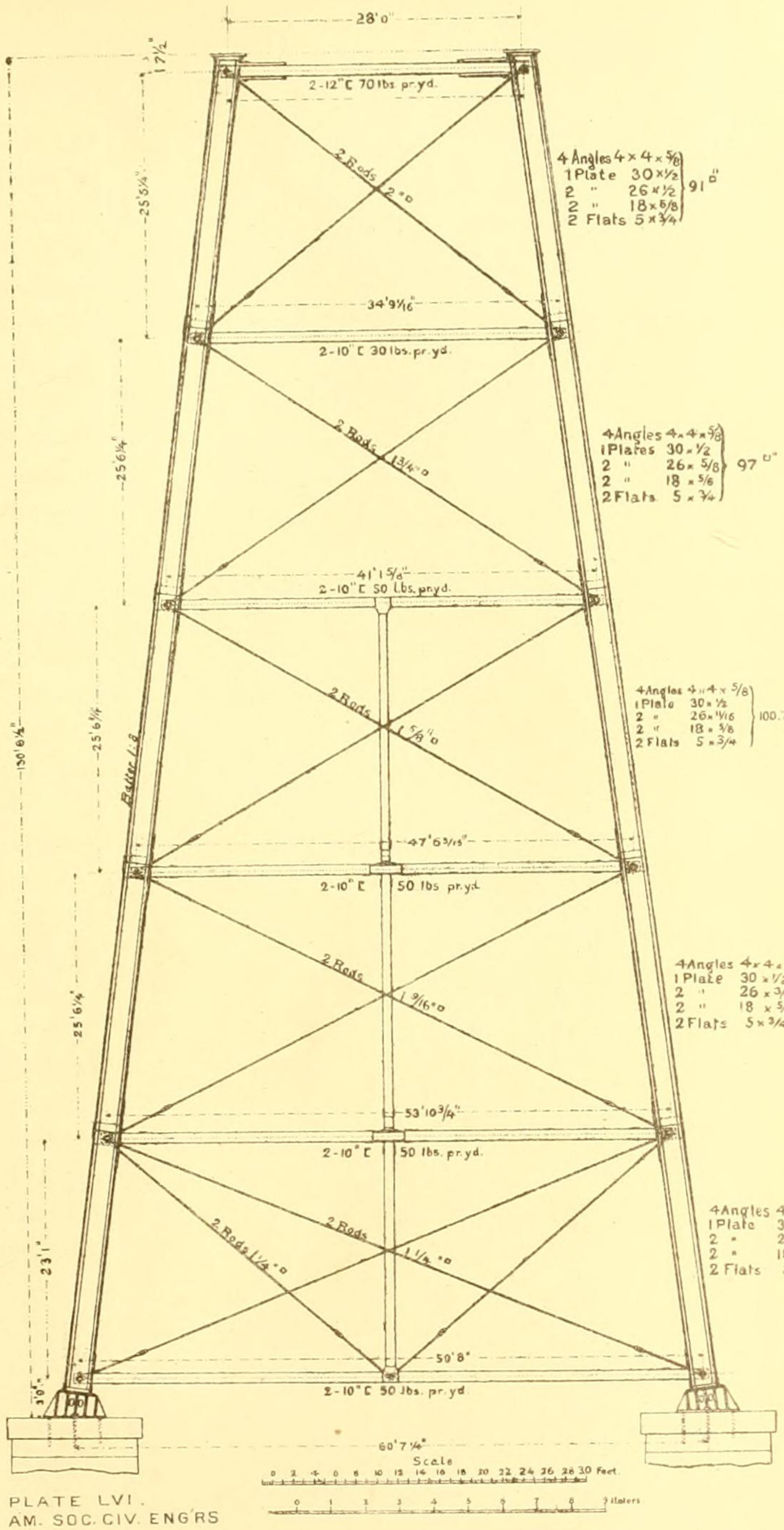
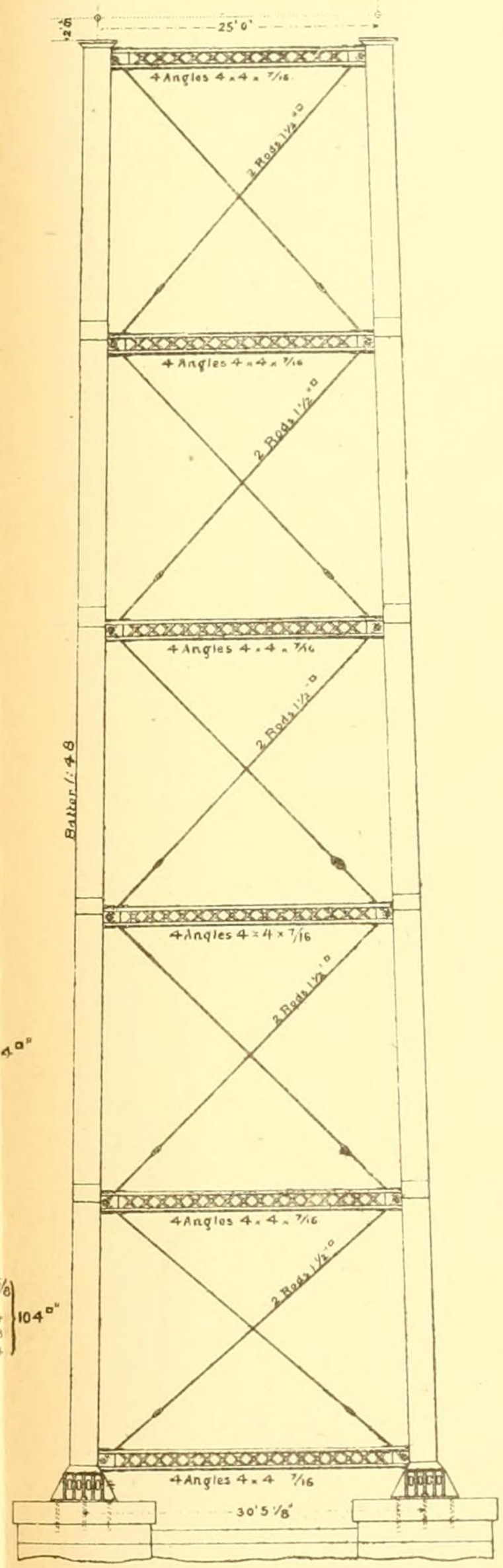


PLATE LVI.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. NO. 317.

GENERAL PLAN OF TOWER.



SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

DETAILS OF TOWER.

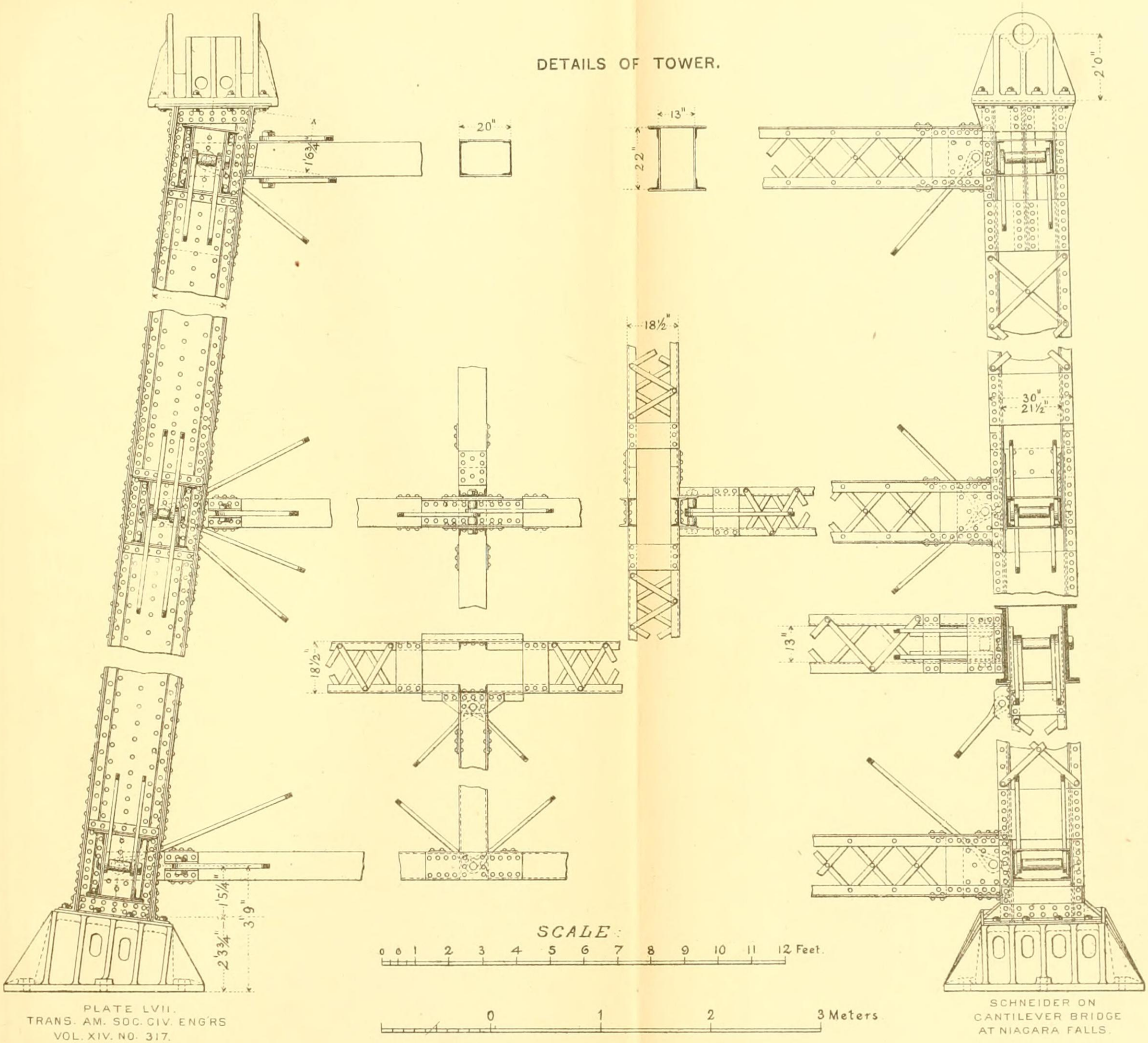
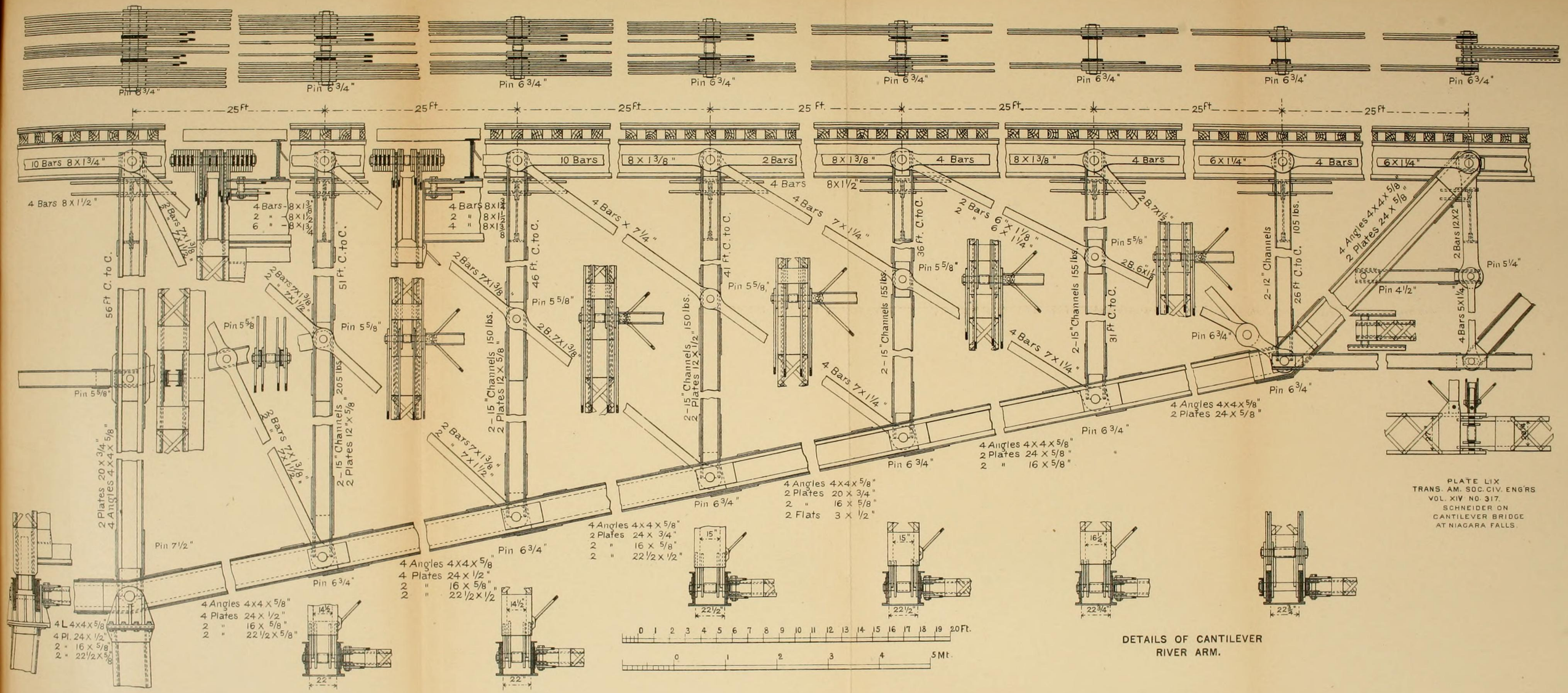


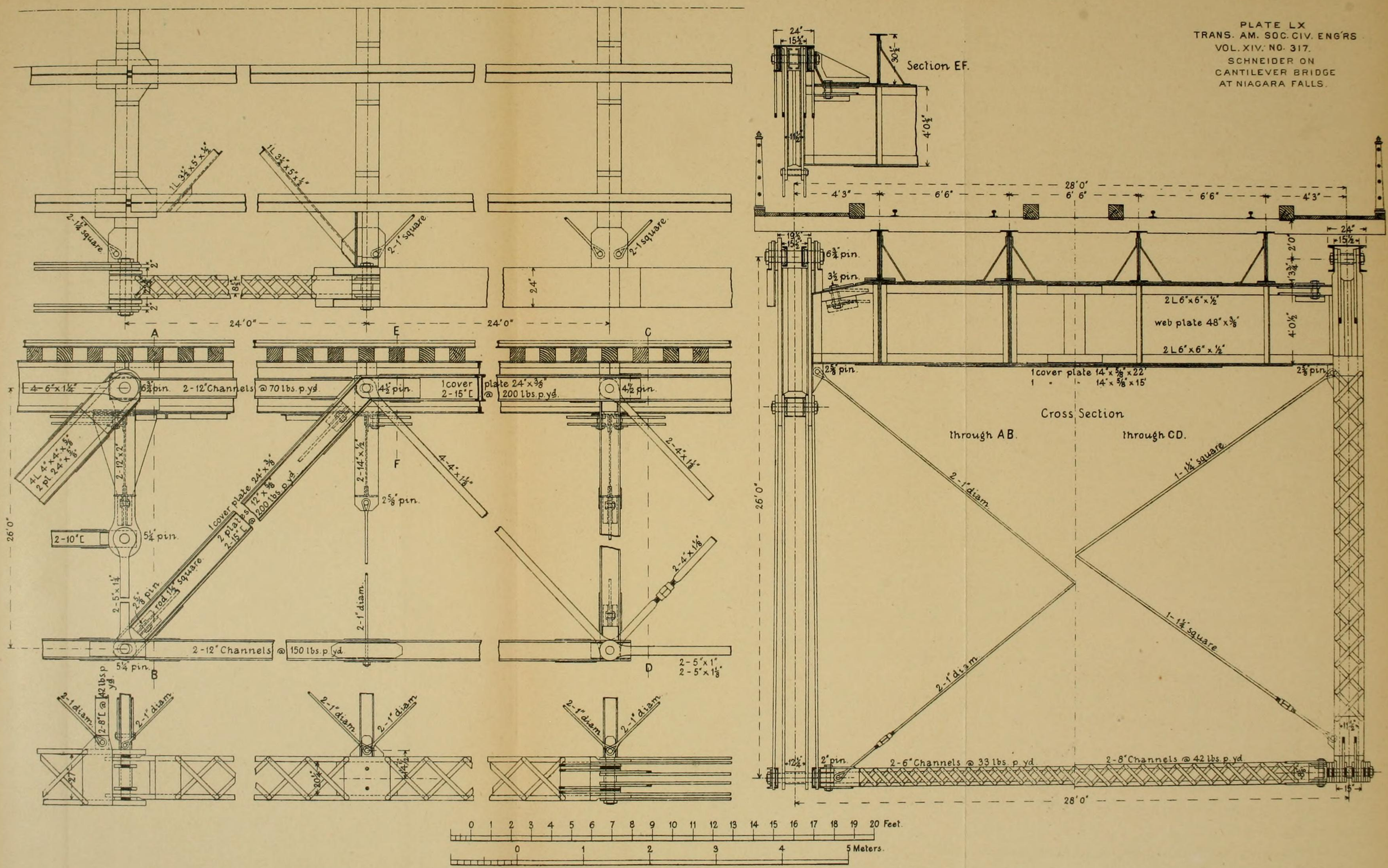
PLATE LVII.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. NO. 317.

SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.



DETAILS OF CANTILEVER RIVER ARM.

PLATE LIX
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.



DETAILS OF INTERMEDIATE SPAN.

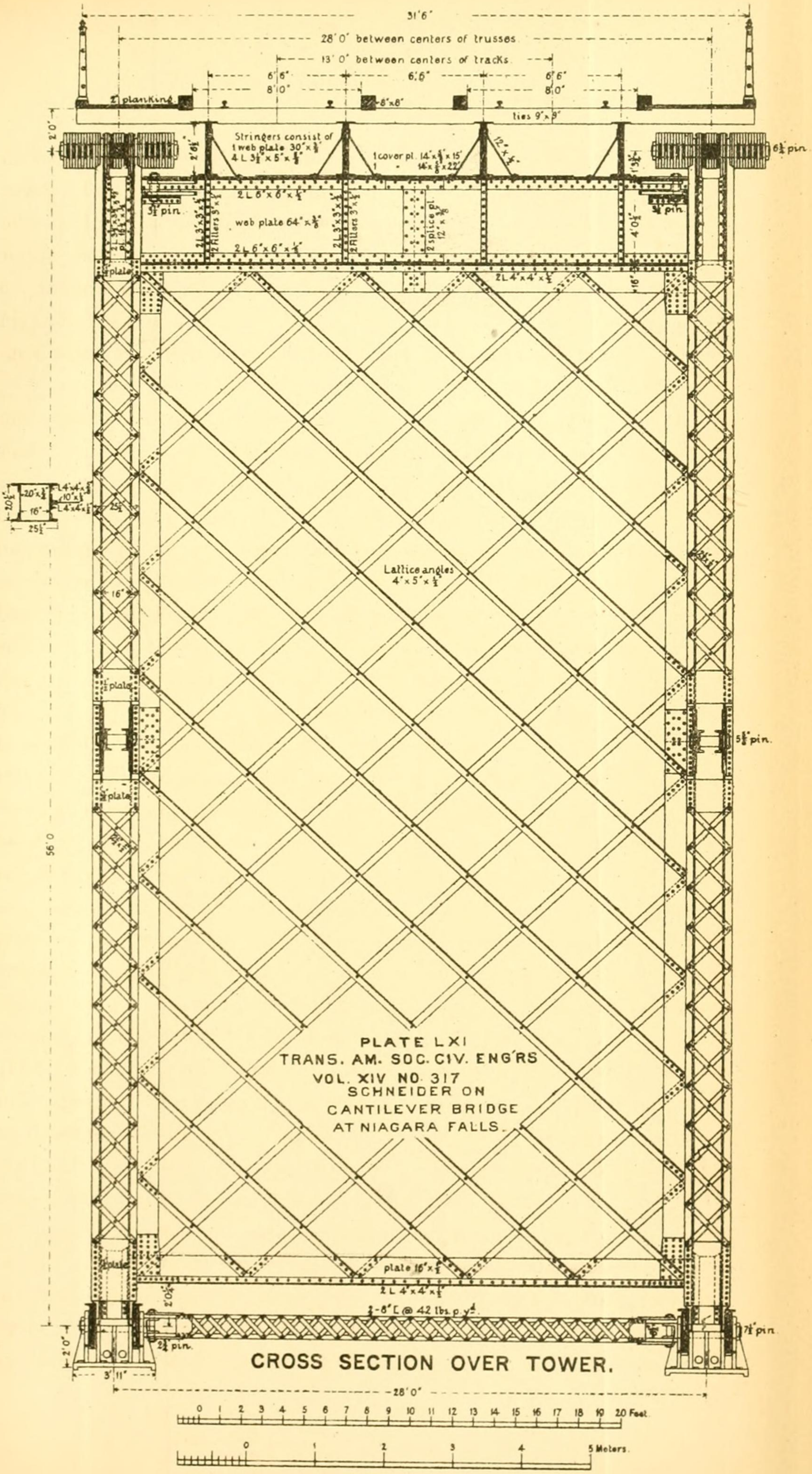
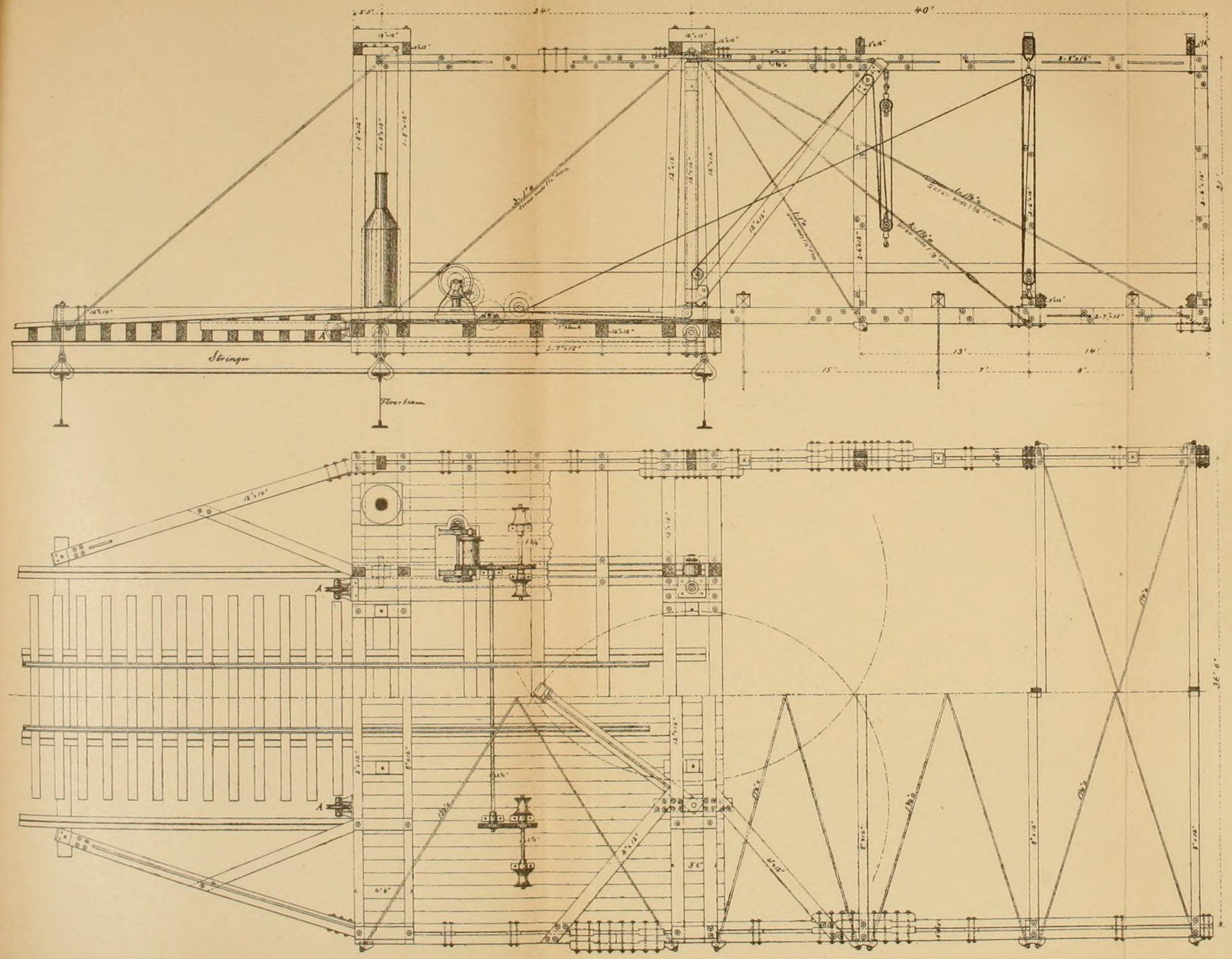


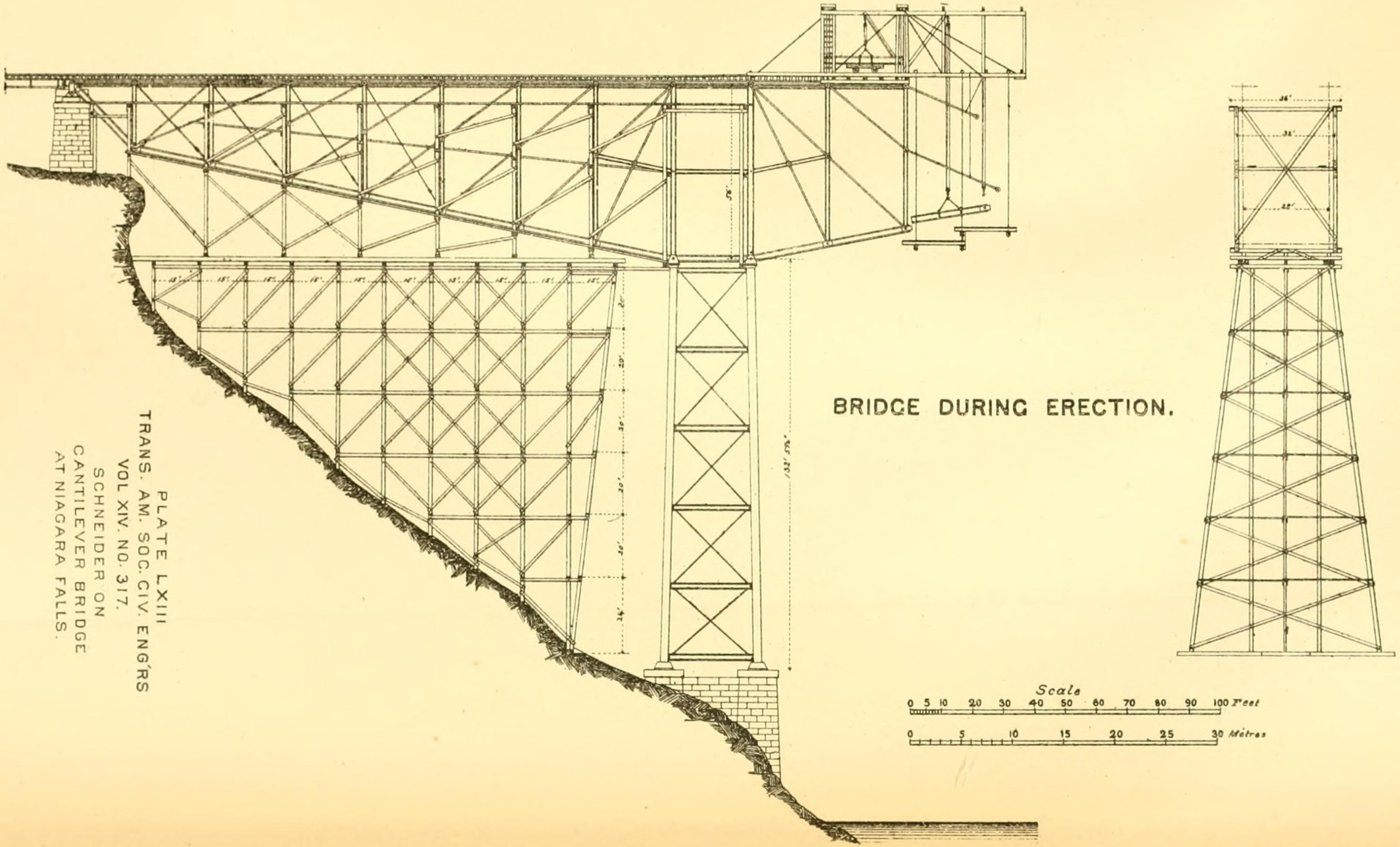
PLATE LXI
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV NO. 317
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

CROSS SECTION OVER TOWER.



DETAILS OF TRAVELER.

PLATE LXII
TRANS. AM. SOC. CIV. ENG'RS
VOL XIV. NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.



BRIDGE DURING ERECTION.

PLATE LXIII
TRANS. AM. SOC. CIV. ENG'RS
VOL XIV. NO. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

Arrangement of Targets.

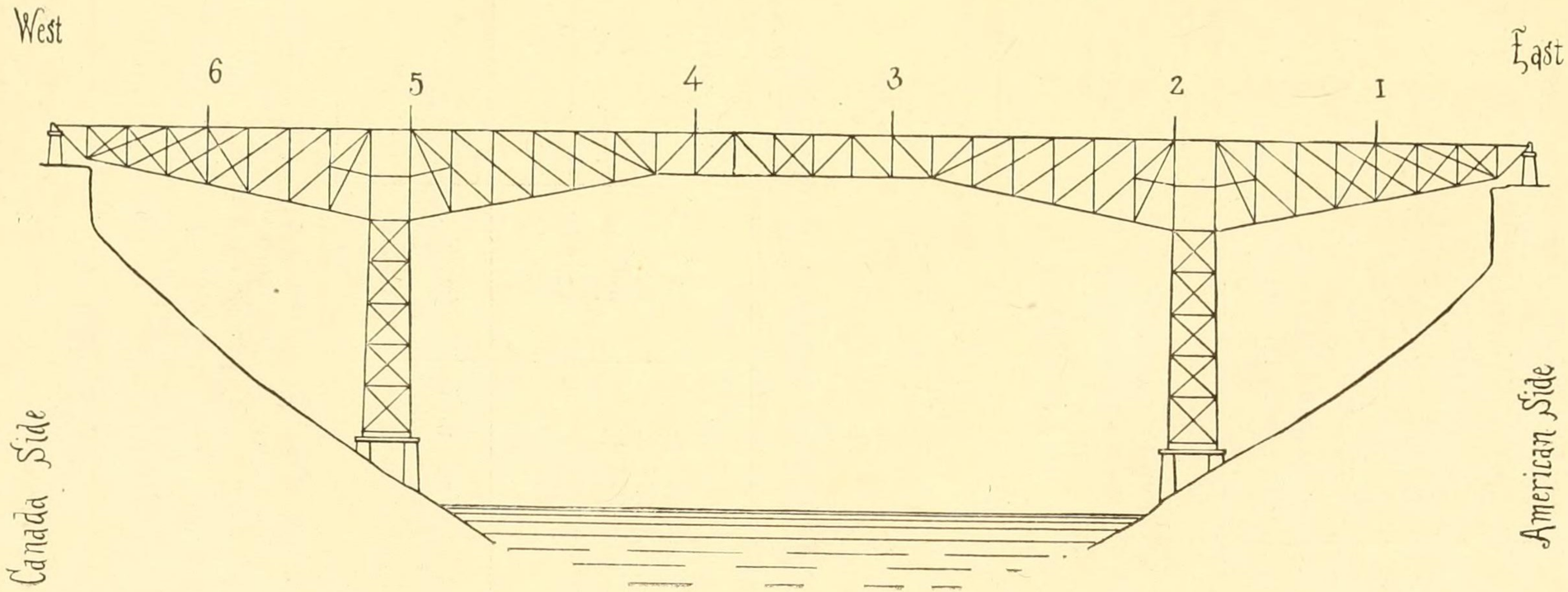
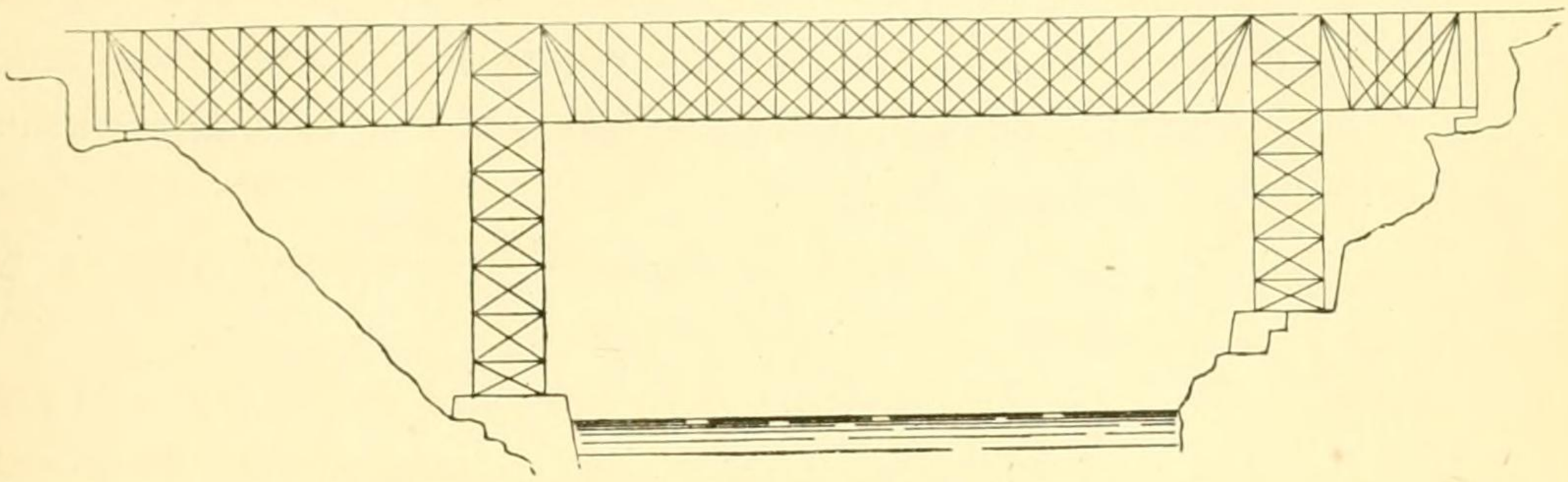
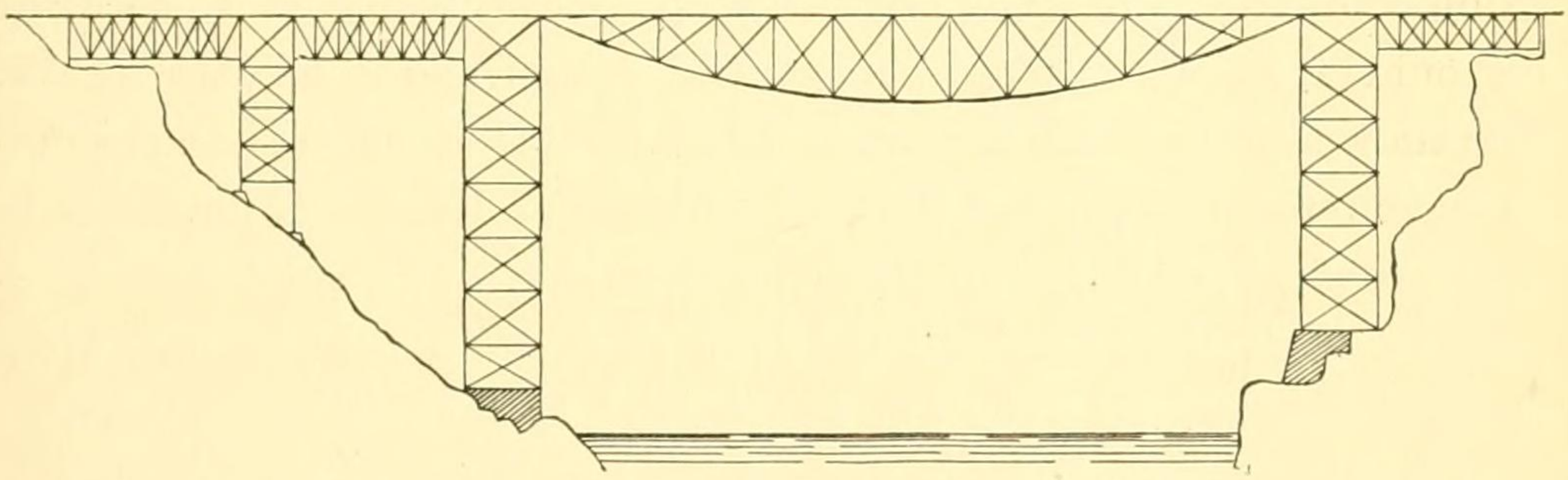


PLATE LXIV.
TRANS. AM. SOC. CIV. ENG'RS.
VOL. XIV. No. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.

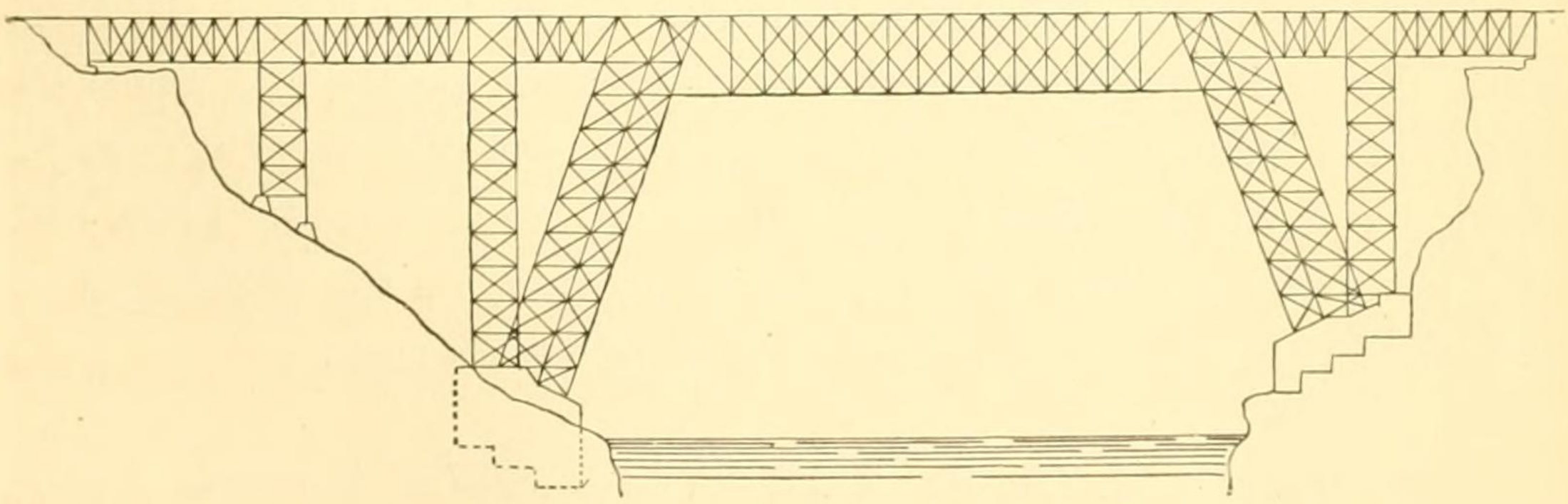
1. The first plan discussed was a continuous girder, to be built by corbelling out from each end, until the parts met in the center, with rollers on each pier. The estimated weight of this was 3 200 tons.



2. The second plan was three discontinuous girders. The loose central span was to have been erected on temporary cables. Reducing the weight of these cables to their equivalent value in tons—the weight of this design was 2 840 tons.

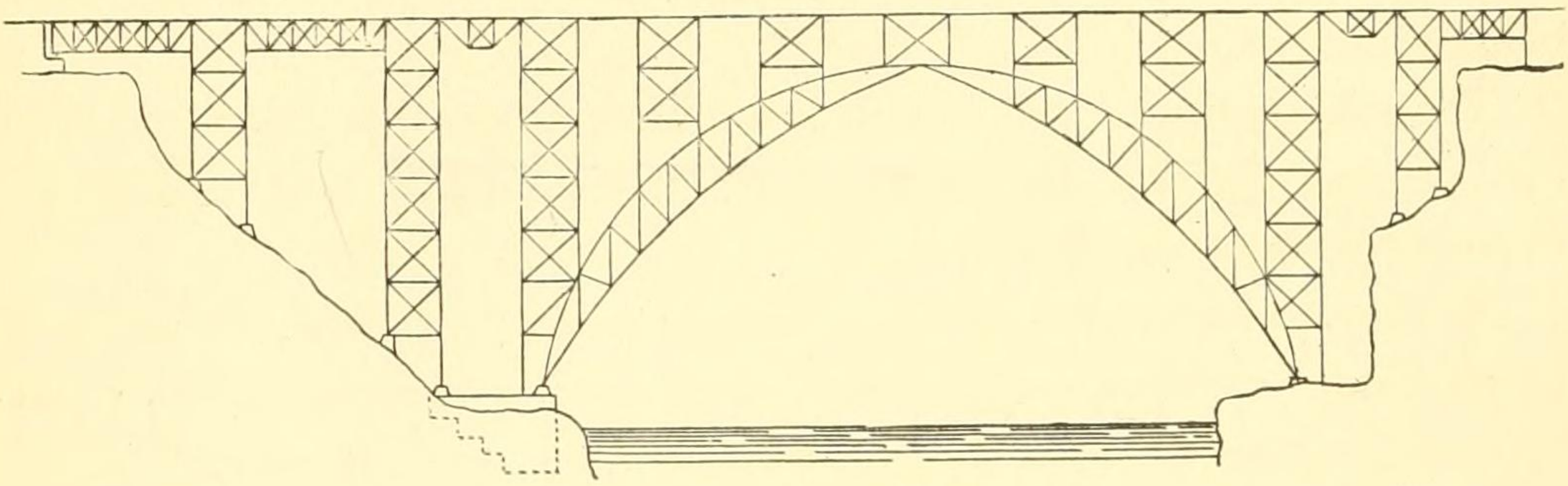


3. The third design was similar to No. 2, except that the length of the central span was reduced from 430 feet to 300 feet by leaning towers, somewhat like the false works of the Attock Bridge, in India, lately illustrated in London *Engineering*. The estimated weight of this design was 2 590 tons. This design is only eclipsed in ugliness by Max Am Endes' bridge in South Africa.



4. The recommended design was a braced arch, hinged in the center

and at the springing. The clear span was 430 feet, and the height of versed sine 175 feet. The arches were to have been erected by corbelling out as was done at St. Louis. The whole design was very similar to that since erected over the Tagus, in Portugal. The estimated weight of this design was 2 320 tons, and the time required fifteen months. All these designs were intended to carry two trains of coal cars, headed by one locomotive of the heaviest type.



In comparing this design with the bridge as actually built, it will be seen that the latter is simpler in general design and in its details; that this allowed of its being constructed and erected in half of the time estimated for the arch; and that the changes of lengths of parts due to changes of temperature are better provided for. The weights of material are about the same, but the arch piers are 430 feet apart, while those of the cantilever are 480 feet apart. In short, the cantilever design is better in every respect than the arch as designed by me.

Without entering into the delicate question of priority of design, I will say that the first bridge involving the cantilever principle (in its erection, certainly) was built by C. Shaler Smith, M. Am. Soc. C. E., over the Kentucky River in 1876–77, and that its successful erection without scaffolding solved all the difficulties which were subsequently met and overcome at the Niagara River.

The Niagara River Bridge is of better design than that at the Kentucky River, inasmuch as it makes its piers fixed points, and allows its trusses to expand and contract in each direction from them as centers, while the Kentucky River Bridge requires a movement of its piers, and the necessity of rollers under them, to provide for the differences of lengths due to changes of temperature of its central span.

Carl Gayler, M. Am. Soc. C. E.—The results of the tests of the Niagara Cantilever Bridge, observed June 9th, 1884, and published as

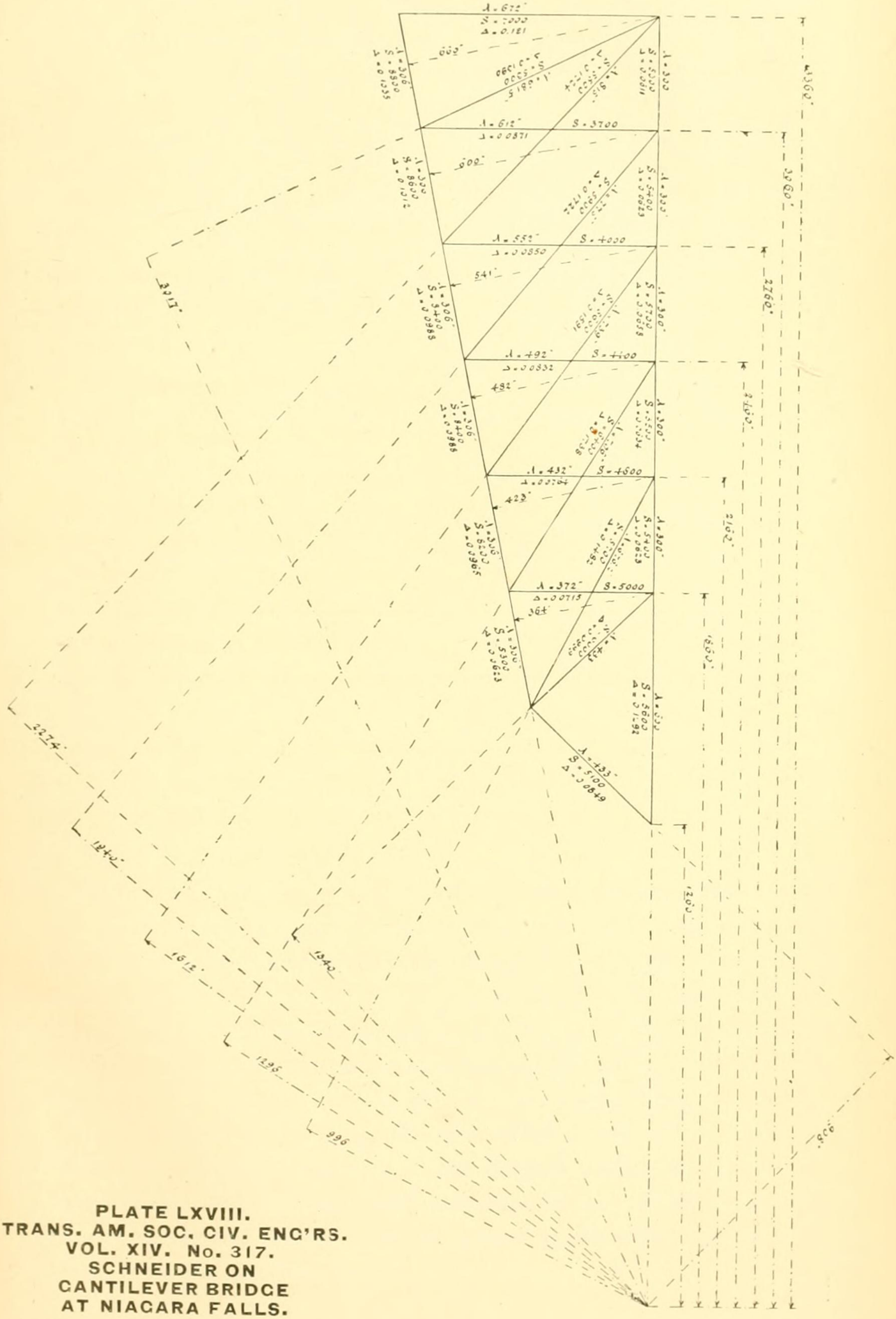


PLATE LXVIII.
TRANS. AM. SOC. CIV. ENG'RS.
VOL. XIV. No. 317.
SCHNEIDER ON
CANTILEVER BRIDGE
AT NIAGARA FALLS.