DATA SHEET

Return to index

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Title:	MOVABLE BRIDGES: BASCULES
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Page:	1 of 6

DEFINITIONS

Bascule bridges rotate vertically around one or more horizontal axes, fixed or moving. As shown in Data Sheet D6e.1, the pivoting axis takes many forms as do the counterweights. The moving bridge portion of a bascule is called a leaf. Most railroad bascules consist of a single leaf, although double-leaf bascules do exist, particularly for highways.

TYPES

Bascule bridges are of numerous types. In appearance the most important differences are noticeable in the bridge (whether plate girder or truss, deck or through), the axis of rotation (whether fixed or rolling) and the method of counterweighting. In 1960 the longest singleleaf bascule spanned 260 feet, the longest double leaf 336 feet.

Bascule bridges for railroad use were built primarily during the period from 1900 to 1930. Most were of double-track capacity, although single track bascules were likewise common. Triple-track bascules were known, and there is evidence that at least one four-track bascule was erected. In general practice, however, multi-track railroad lines used two (or more) parallel double-track bascules. Occasional forms of double-decked, highway-railroad bascules also exist. Since the great majority of railroad bascules built in the U. S. were of either Strauss Heel Trunnion or Scherzer Rolling Lift types, this Data Sheet will consider them in detail.

STRAUSS HEEL TRUNNION

The success of this type is due to the division of the weight of the leaf and that of the counterweight between two sets of trunnions, the exact balance between the leaf and the counterweight, and the absence of any shifting weight on the foundations. All bridges of this type, as far as is known, are of the through-truss type, usually Warren with or without posts. The basic information contained in Data Sheets D6c.6 thru D6c.10 is applicable to this type of bascule with the exception that a bascule is somewhat heavier and more strongly braced than a fixed bridge of the same span.

The bridge shown in Figure 1 is an example of a large Strauss Heel Trunnion, although the details of the trunnion and other operating parts (except for size) are similar for bridges of any span or number of tracks. Most have parallel upper and lower chords, but bridges with curved upper chords were also built. One example, the Rock Island's bridge over the Chicago River (Figure 2A), featured curved upper chords with a subdivided-panel truss.

Among all bridges of the Strauss Heel Trunnion type there are many distinctive differences in the counterweights and mountings. Figure 1 shows split counterweights that swing down outside of the A-frames supporting the counterweight trusses. To permit the counterweight trusses to be located outside of the A-frames, outboard trunnions are supported on brackets on this particular bridge. Other bridges may have split counterweights which swing inside of the A-frames, in which instance the counterweight trusses are located directly above the A-frames as illustrated in Figure 2B. A single counterweight (Figure 2C) is another common method of mounting. Note that the height of the A-frames will vary from bridge to bridge. There are two parallel, double-

STRAUSS HEEL TRUNION - continued

track Strauss Heel Trunnion bridges (B&O and CRI&P) across the Chicago River, each of apparently identical span, yet one has a straight upper chord, the other curved; the heights of the A-frames are distinctly different; and one has split counterweights, the other a single.

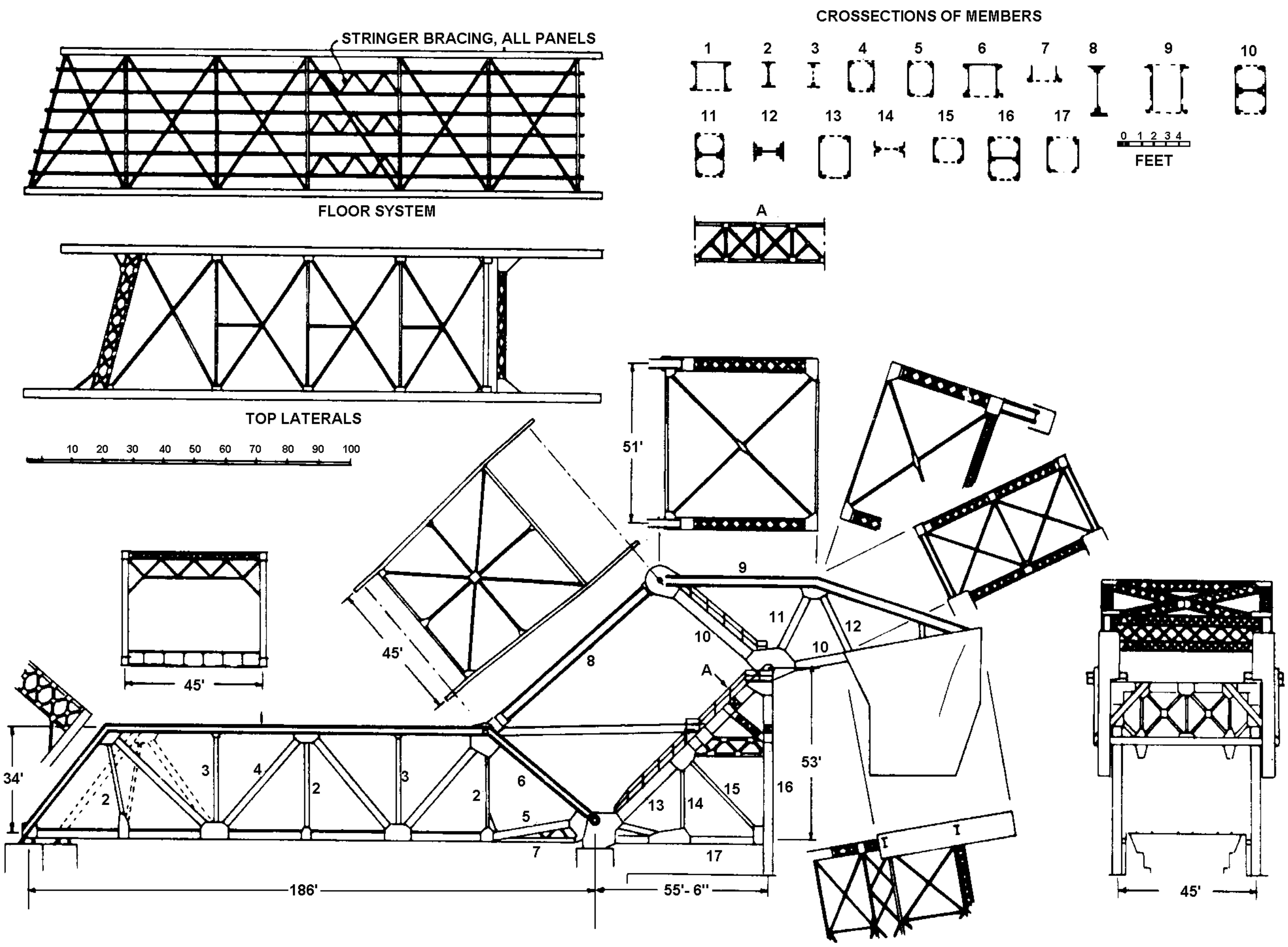


Fig 1: Chicago & Northwestern Railroad Bridge over Chicago River

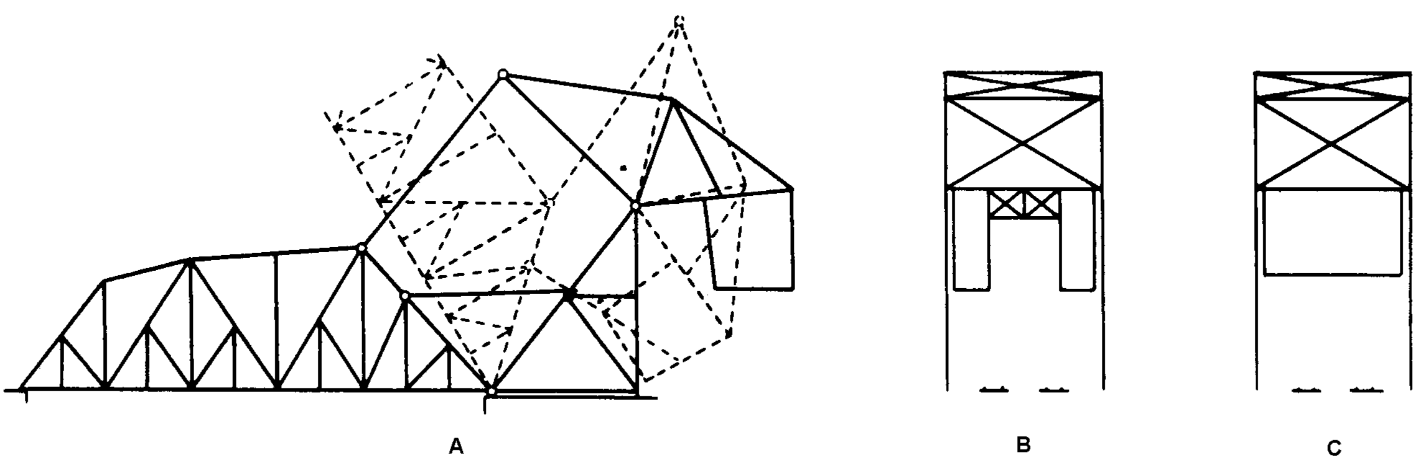


Fig 2: Some Variations in Strauss Heel Trunnion Bascules

MACHINERY

Strauss Heel Trunnions are operated through pinions on the A-frame engaging racks on the lower surfaces of the operating struts. These struts normally connect to the leaf truss at the junction of the top chord and the end post as in Figure 1. The connection shown in Figure 2 is rare. On railroad bridges, the most common location for the operator is in a machinery house between the A-frames and over the track. Figure 3 shows the machinery house for the draw bridge of Figure 1. In addition to the electric motors normally used to drive the operating struts through reduction gearing, the house also contains a 35 hp gasoline engine for emergency operation plus an interlocking machine. For highway bridges, on the other hand, the motors and gearings are often housed under simple covers, and an operator's booth is provided at street level.

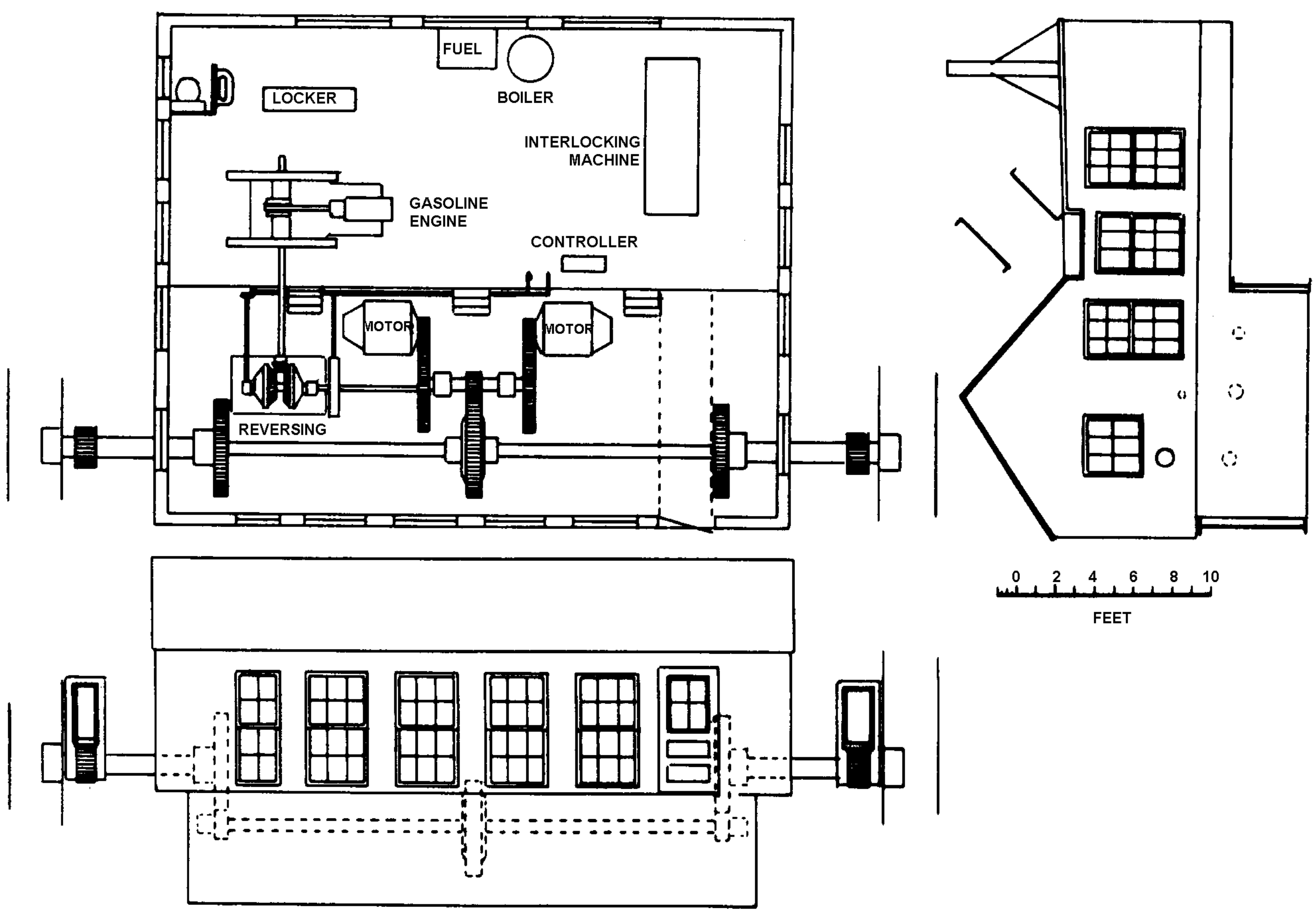


Fig 3: Machinery House for C&NW Strauss Heel Trunnion Bascule

SCHERZER ROLLING LIFTS

The chief advantages of this type of bascule are (1) no trunnion is required and (2) the bridge rolls back out of the way when open. Scherzers were built in a great variety of types and spans there being at least one example on a narrow gauge line, the Boston, Revere Beach & Lynn. Information contained in Data Sheet D6c.5 is applicable to plate girder Scherzer Rolling Lifts while that in Data Sheet D6c.6 applies to truss Scherzers. Both truss and plate-girder Scherzers are common in highway and in railway usage, but the plate-girder types are the more numerous. Many examples of both through and deck plate-girder Scherzers were still extant in 1968. Truss Scherzers almost invariably are of the Warren type with or without posts although the first Scherzer, the Van Buren Street bridge in Chicago (1893) used the Pratt truss. For railroad use, truss Scherzers are of the through type.

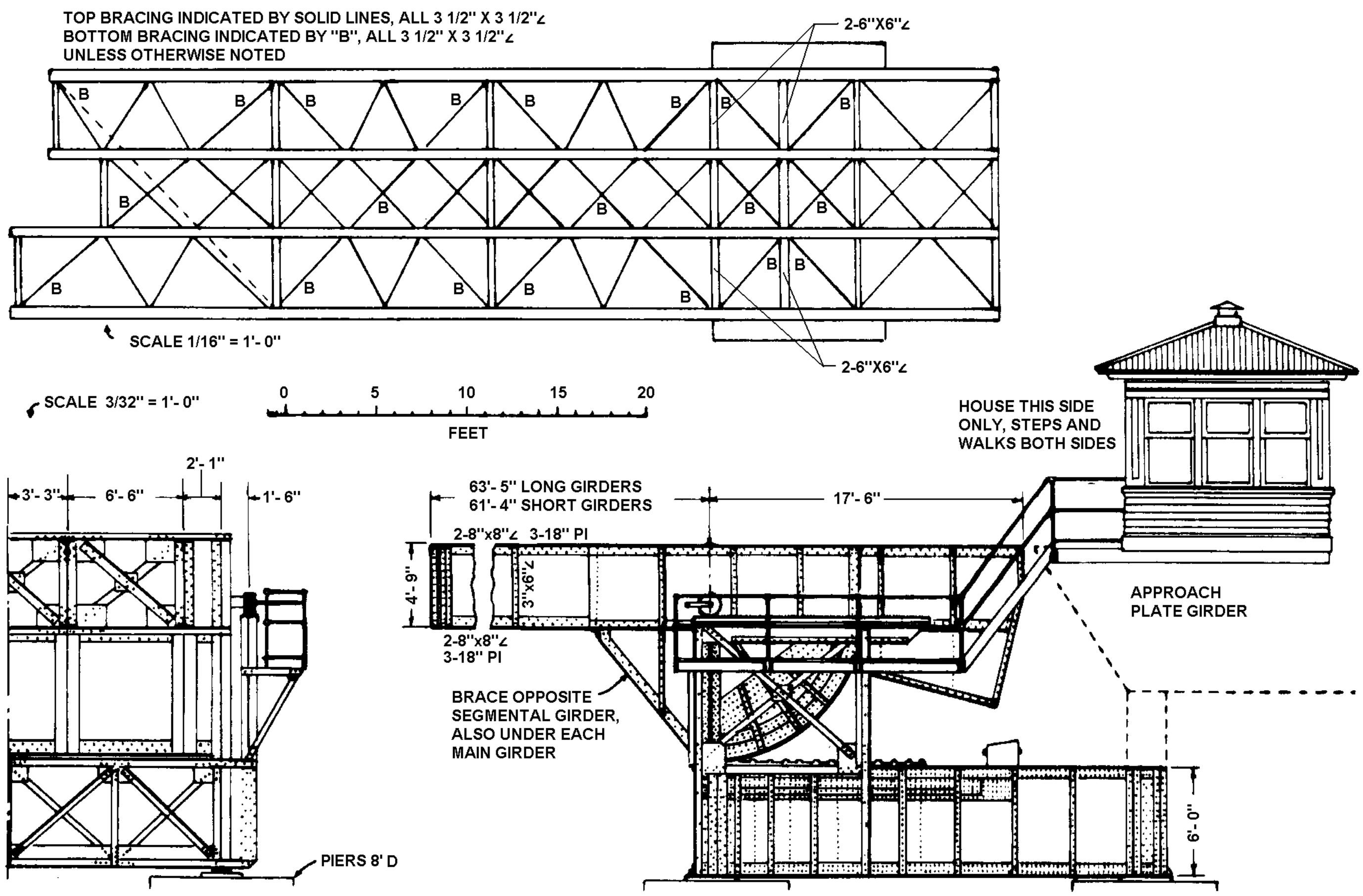
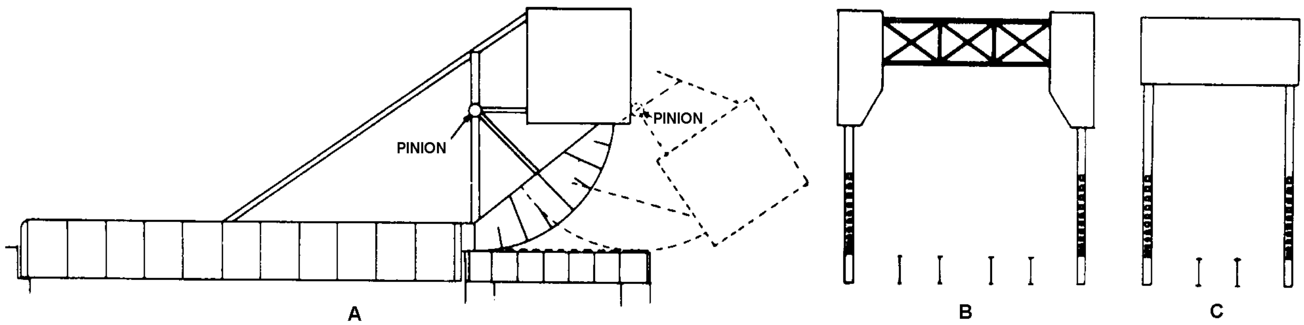


Fig 4: Deck Scherzer Rolling Lift, Dutch Hills Creek, Long Island Railroad. Built 1909

The distinguishing feature of a Scherzer Rolling Lift, both in appearance and in operation, is the wheel segment called a segmental girder on which the bridge rolls back along a cogged track. These segmental girders vary in size depending upon the bridge, but they always follow the same general form of construction. Figure 4 shows the segmental girders on a double-track deck, plate-girder draw on the Long Island Railroad. In this particular bridge, the segmental girders are set out from the plate girders of the leaf to permit the counterweight to pass between the cogged tracks on which the segmental girders roll.



On through Scherzers, the segmental girder is placed directly behind the girder or truss of the leaf. This construction is illustrated in Figure 5A. Normally the cogged track is carried on a plate girder as shown in this Figure and in Figure 4, but it may be supported by the masonry of the abutment as was the method used on the first Scherzer. There are great variations among the counterweights used on the various Scherzer Rolling Lifts. The only requirement of a counterweight is that the line between its center of gravity and the center of gravity of the leaf must pass through the center of the roll. Split counterweights are common on double-track bridges as in Figure 5B, while single-track bridges often have a single counterweight as shown in Figure 5C.

MACHINERY

Operation of a Scherzer is accomplished by applying horizontal force to the center of roll. Two methods are used. The more common is to provide a pinion at the center of roll as shown in Figures 4 and 6. These pinions on powered bridges are operated by electric motors and reduction gearing mounted on the bridge. Suitable protection against the weather is provided, although it is not uncommon to see the gearing exposed. There is no machinery house as such. The pinions drive against fixed horizontal racks on each side of the bridge. These racks are shown In Figure 4. Catwalks are provided alongside one ok both pinions so they may be hand cranked if necessary.

Hand operated Scherzer Rolling Lifts exist. On such bridges some means, such as an endless chain, is provided to permit a. man standing on the track to operate the bridge through reduction gearing. There is at least one example of a Scherzer Rolling Lift erected without its segmental girders, counterweight, or machinery; it was built to serve as a fixed bridge until such time as the waterway it spanned was made navigable.

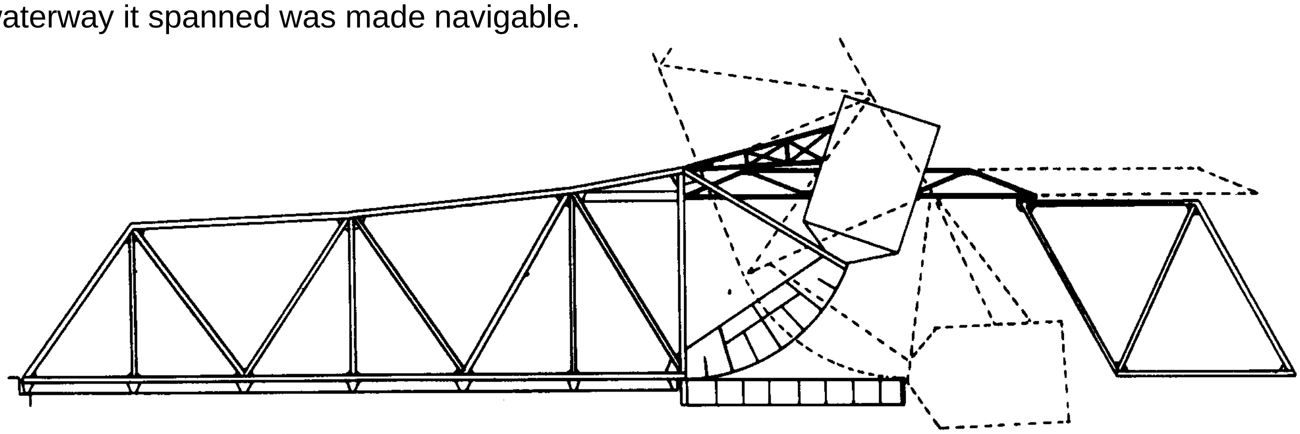


Fig 6: Hinged-Rack Drive for Scherzer Rolling Lifts

MACHINERY - continued

A second form of power operation (illustrated in Figure 6) was obtained by attaching a hinged rack to the center of roll in the horizontal plane and driving it by means of a pinion mounted on a fixed frame separate from that of the bridge proper. By this method, the thrust of the rack was applied to the centerline of the bridge and was carried to the first panel point of the truss by the heavy diagonals in the horizontal plane. There are three, parallel, double-track, through-truss bridges of this type at South Station, Boston, which are controlled from a point remote from the bridges. At North Station, Boston, there were four, parallel, double-track, through-truss Scherzers of the fixed rack type all controlled from a single tower set well back from the river. On the Dutch Kills bridge of the Long Island Railroad (Figure 4) the operator in the house also controls a nearby, electrically operated swing span.

MODELING BASCULE BRIDGES

Bascule bridges, because of their additional detail, make more effective models than those of fixed bridges of the same span. If they are not constructed as operating models, no special techniques are needed, and no train operating difficulties will be introduced. Of the operating models, operating bascules are more feasible than operating swing spans as no end lift is required. Many have been built and operated successfully. Particularly in O gauge, bascules have been used to span passageways. Two Scherzer Rolling Lifts, once used for this purpose by the NYSME were, in 1967, awaiting reinstallation to bridge passageways at the Newark, NJ, club. Most bascules for passageways have been of the Scherzer type, but there is a Strauss Heel Trunnion bridge, based on the prototype of Figure 1, on the Alturas & Lone Pine Railroad of Whit Towers. This bridge is equipped with a manual lock-down, an arrangement to be recommended for HO use due to the lightness of the structure. Since a bascule is very vulnerable if hit, strong construction is indicated. Moreover, a long span is advisable so that the axis of the bridge can be set well back from the edge of the opening. In HO this takes a large prototype, for the record-holding, single leaf bascule is only 260 feet, or a little over three feet (in HO). Double-leaf bascules are not recommended for working models for the same reason they are seldom used in prototype -- it is difficult to interlock the leaves together.

For one level of track, very satisfactory bascules can be made of the benchwork for adequate strength is easy to obtain. Usually such bascules are simple trunnion (large hinges) without counterweights. On the Summit-New Providence HO Railroad Club a cable-lift bascule has been installed for the passage not of trains but of people.

The Columbia Gorge MRC in Portland Oregon has a working model of the double lift "Steel Bridge" of that city (see page D6e.1 for diagram). It works as the prototype, with the railroad span lifting first and then the highway portion.