



Grade Separation Systems

Multi-Span Rail Bridge Construction Procedure

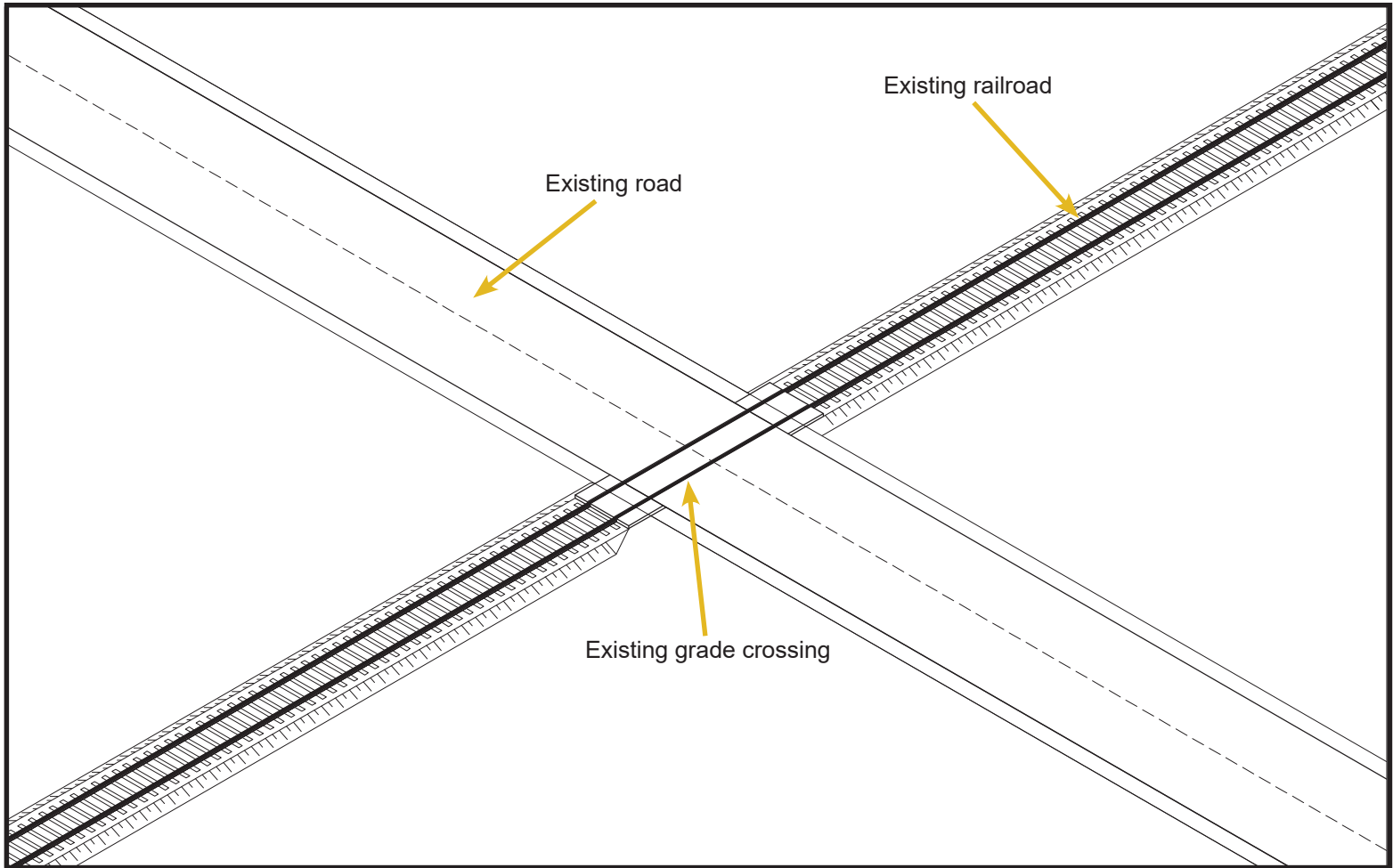


An innovation from

art engineering inc.

GSS Multi-Span Example

Shown: An existing railroad grade crossing.

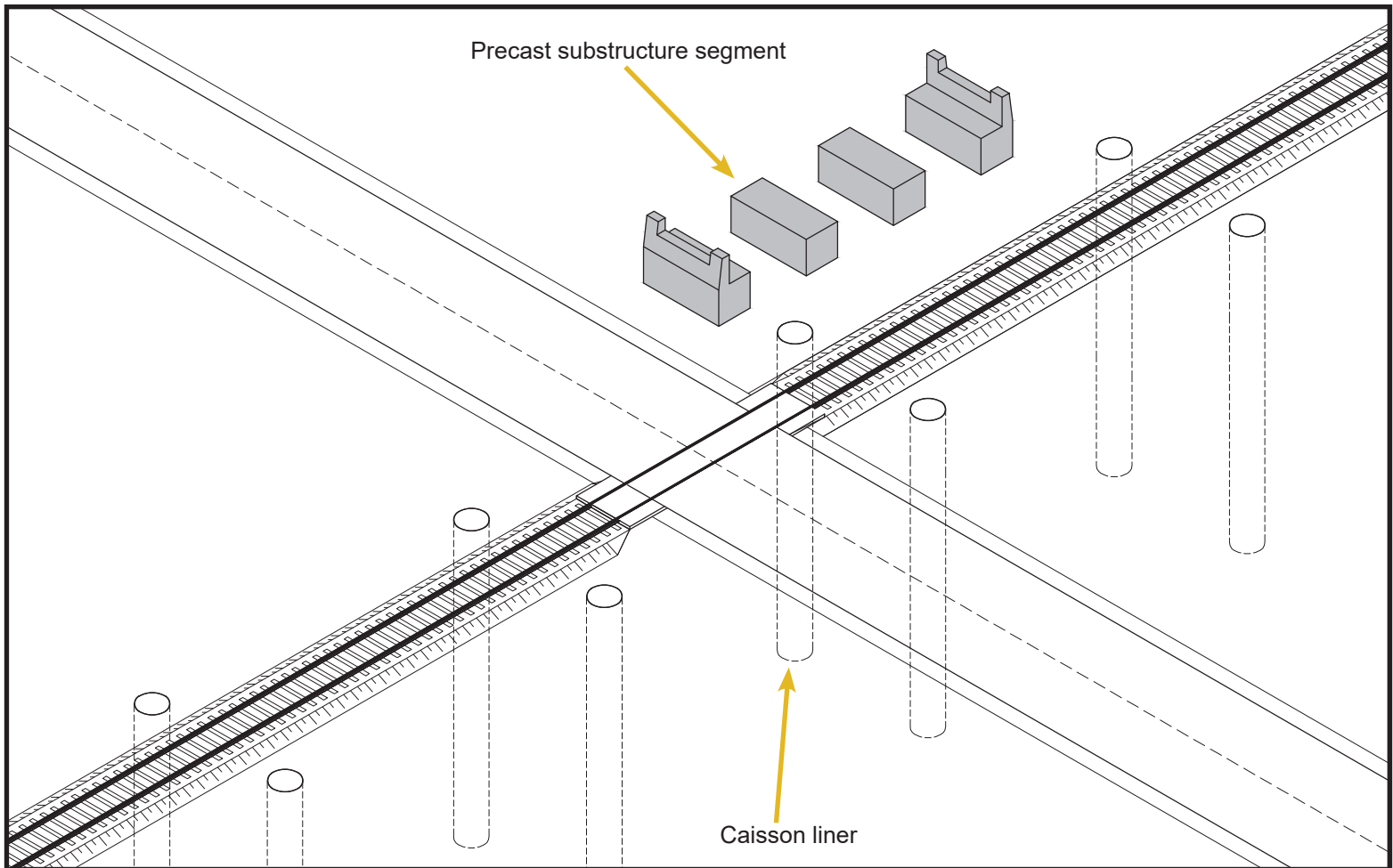


Goal: To separate the grades by constructing a multi-span rail bridge and an under-passing roadway.



Preliminary Work

- Install caisson liners
- Precast substructure segments
- Detour road (optional)



Caisson liners are installed outside of the rail clearance envelope, a minimum of 9 ft away from the centre line of the track.

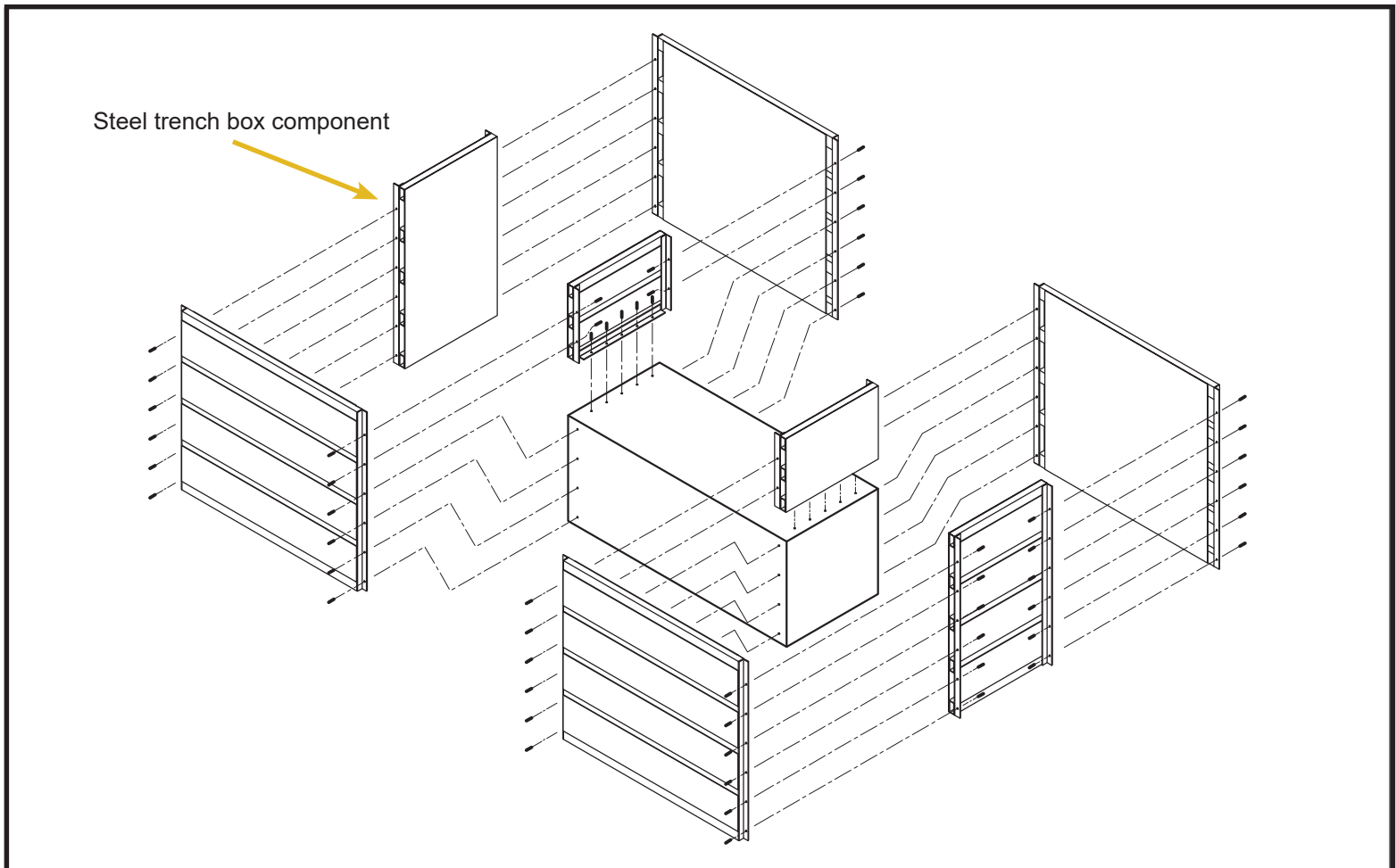
Substructure segments are precast in shop or on site. These segments are components of the permanent bridge structure and will be built up into piers and abutments. They weigh approximately 35 tons.

The roadway is detoured, closed, or otherwise dealt with, but rail traffic is unaffected.



Assembly Preparation

- Join trench boxes to precast



Steel GSS trench boxes are bolted directly to the precast substructure segments with threaded rods or bolts.

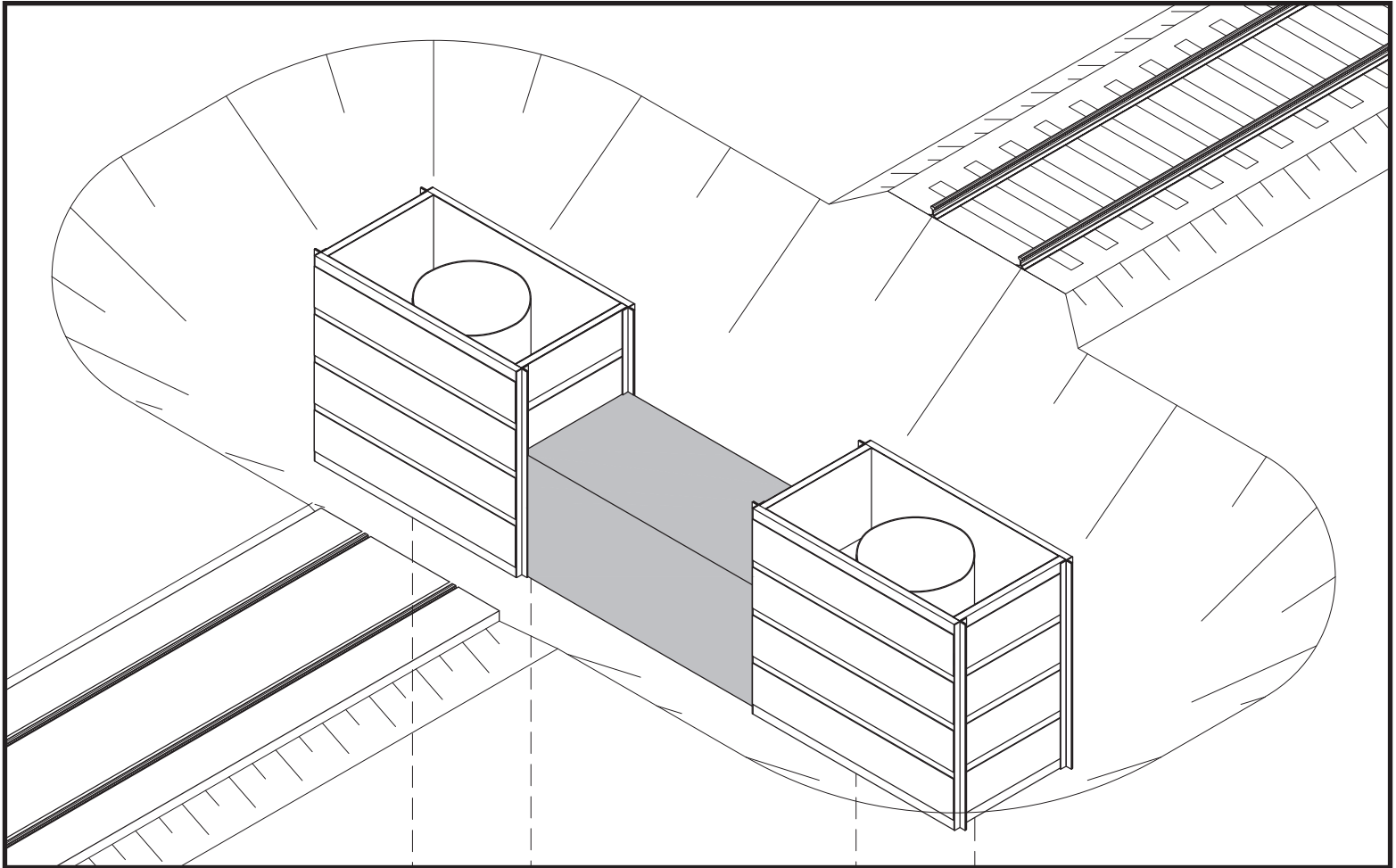
These trench boxes are designed to match the given precast substructure segment and to withstand train and soil loads.

GSS trench boxes will provide a safe working area for construction so that the railway can continue to remain in operation. They also will serve as formwork.



First Rail Closure

- Close track for 4 hours
- Dig trench
- Place assembly
- Open track



The track is closed for a four hour period and a trench is dug across the tracks. Most rail companies can easily accommodate overnight for this closure period.

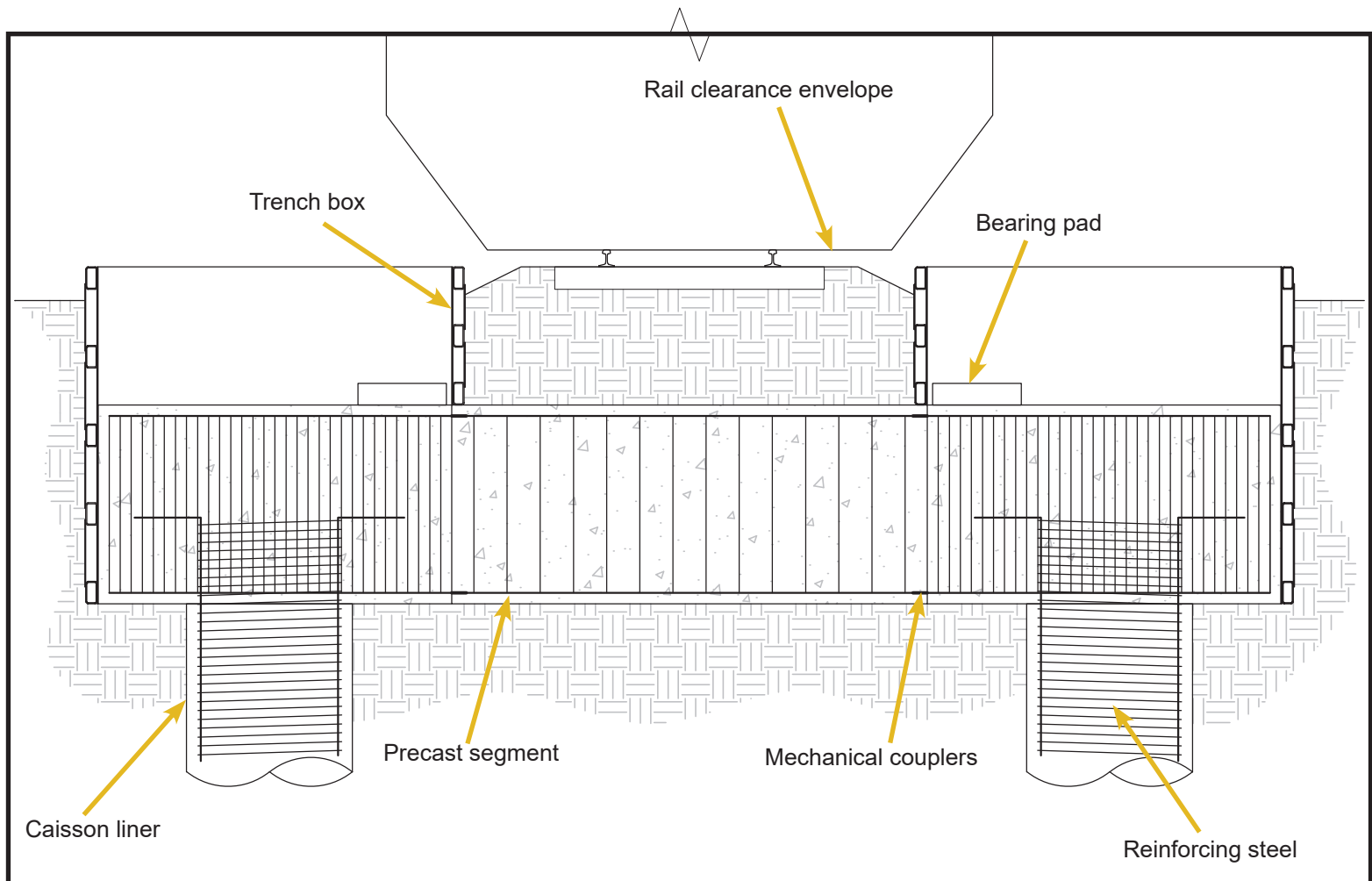
The precast assembly is then lifted into place where the piers and abutments will sit permanently. The completed assembly weighs approximately 35 tons and can be lifted with a 100 ton crane.

The ground is then ballasted and the track can be re-opened. This process is repeated for each precast assembly.



Trench Boxes

- Cut off caisson liners
- Install reinforcing steel
- Pour caissons
- Extend pier caps/abutments
- Place bearing pads



The caisson liners are cut off at the designed elevation and work continues within the trench boxes. The railroad can continue to operate at full capacity as work is performed outside of the rail clearance envelope.

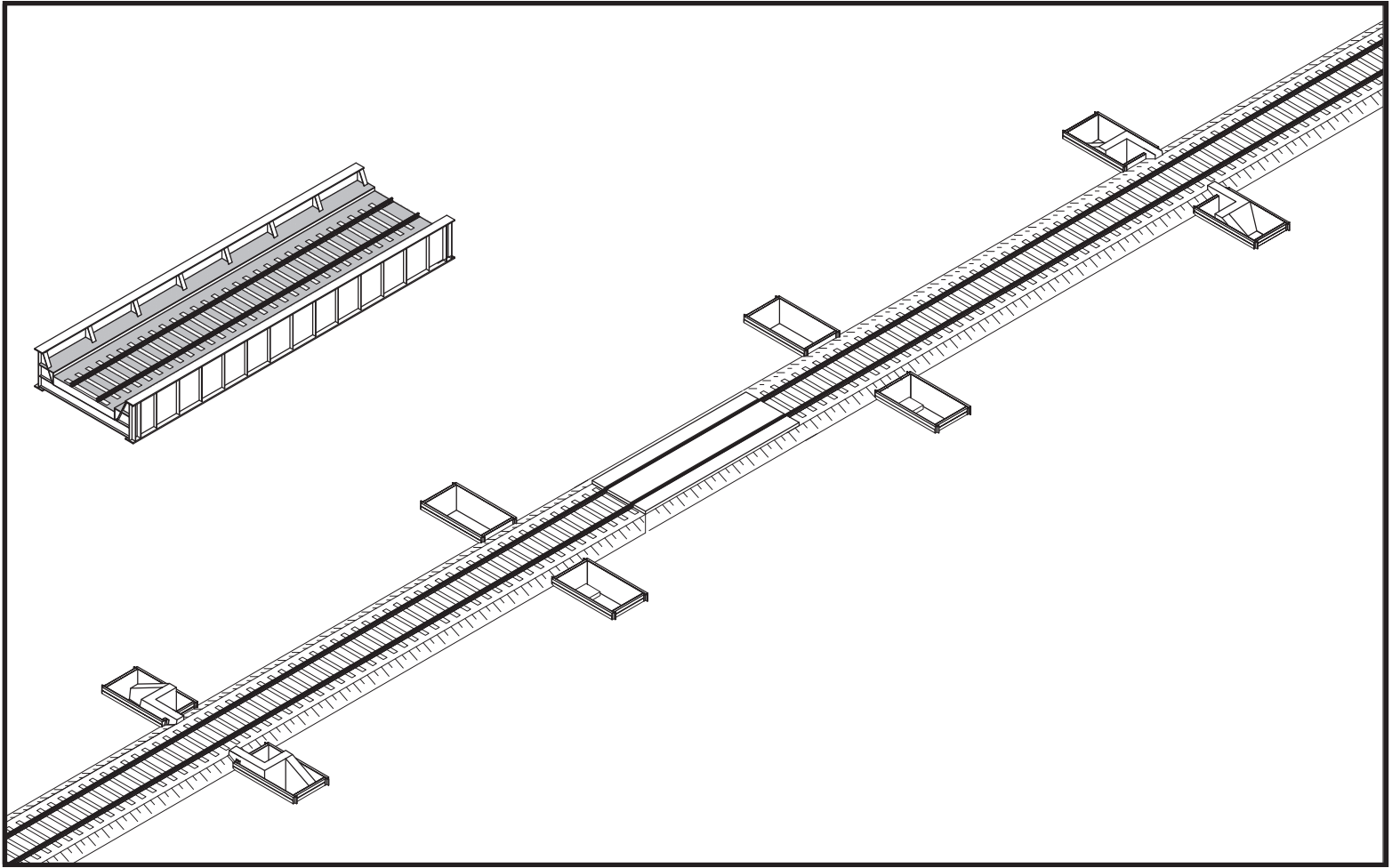
Reinforcing steel is placed throughout the liners and integrated with the segment through mechanical couplers or post tensioning. The caissons are then poured.

The pier caps/abutments are extended and the bearing pads are installed outside of the cold joint. This placement eliminates a significant amount of steel from the design.



Bridge Span Assembly

- Assemble bridge span



While work continues within the trench boxes, the bridge span(s) are assembled to the side of the track.

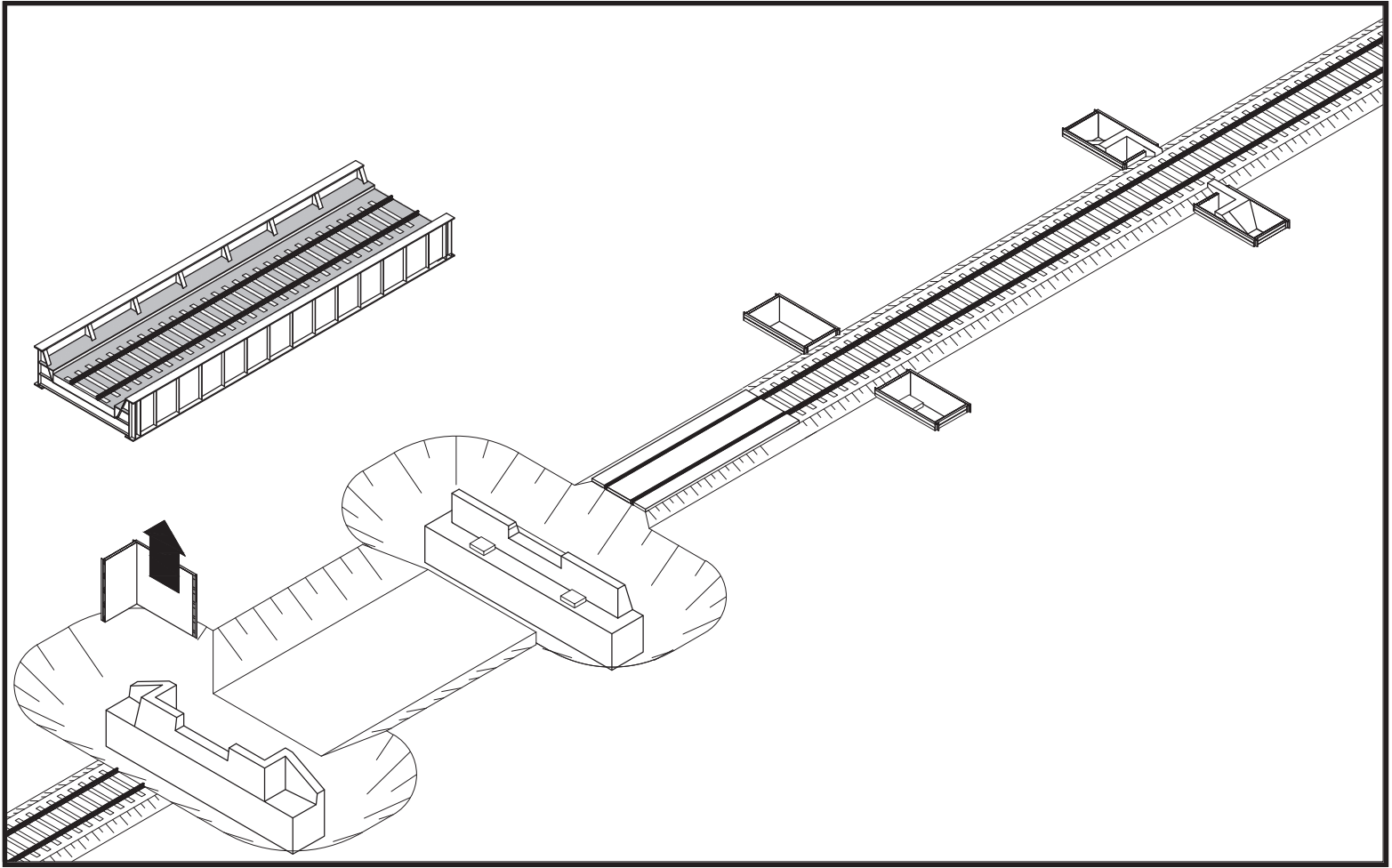
A 19 m long bridge span complete with ballast and rails weighs approximately 100 tons.

Although a steel girder bridge with steel plate decking is shown, the GSS method can accommodate any bridge span design.



Second Rail Closure

- Close track for 4 hours
- Dig trench
- Remove trench boxes

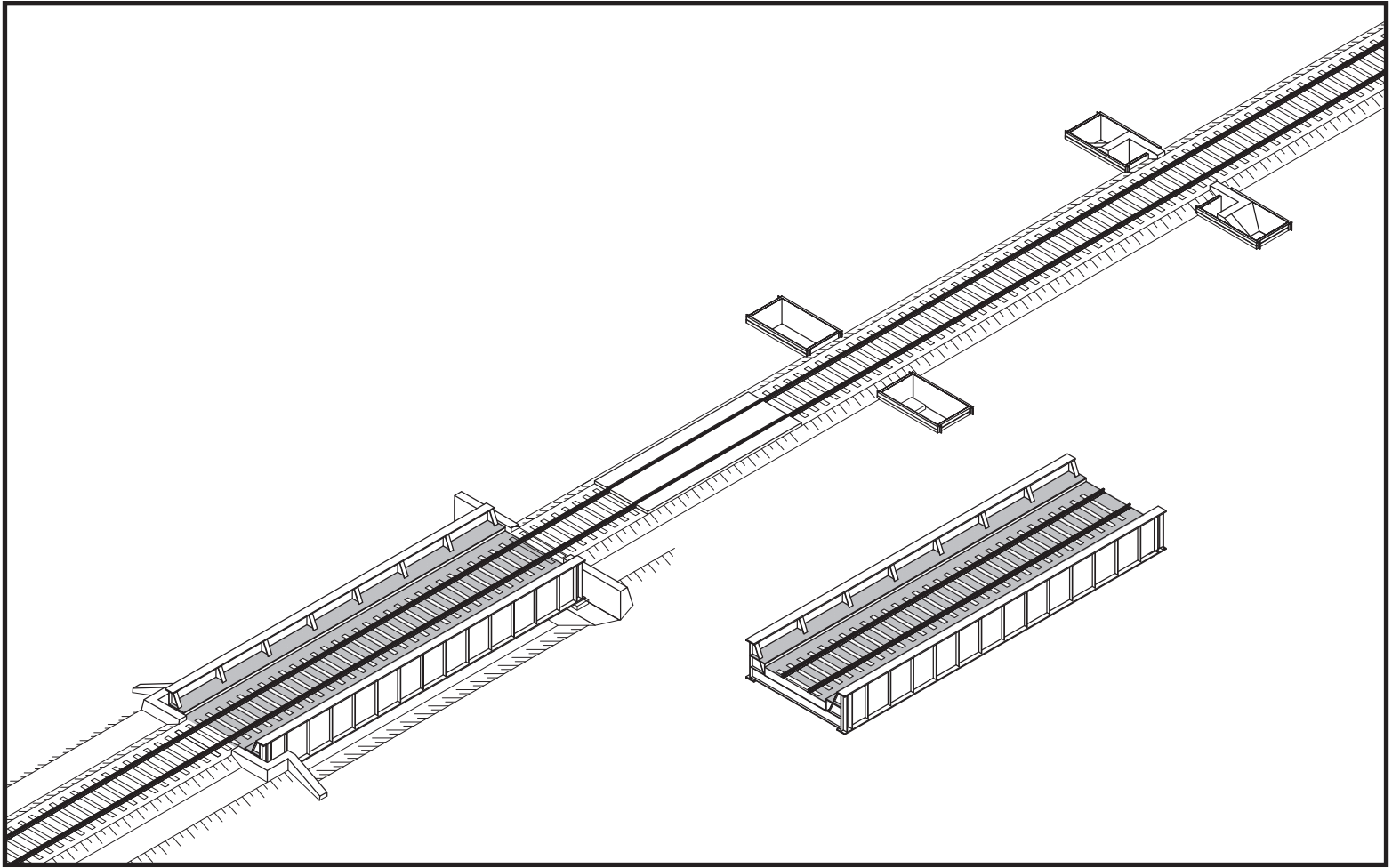


The track is closed for a second four hour period and a trench is dug between the first abutment and pier cap. The trench boxes are then removed. These trench boxes are reusable to help cut down on wasted material.



Second Rail Closure

- Place span
- Open track
- Assemble second bridge span



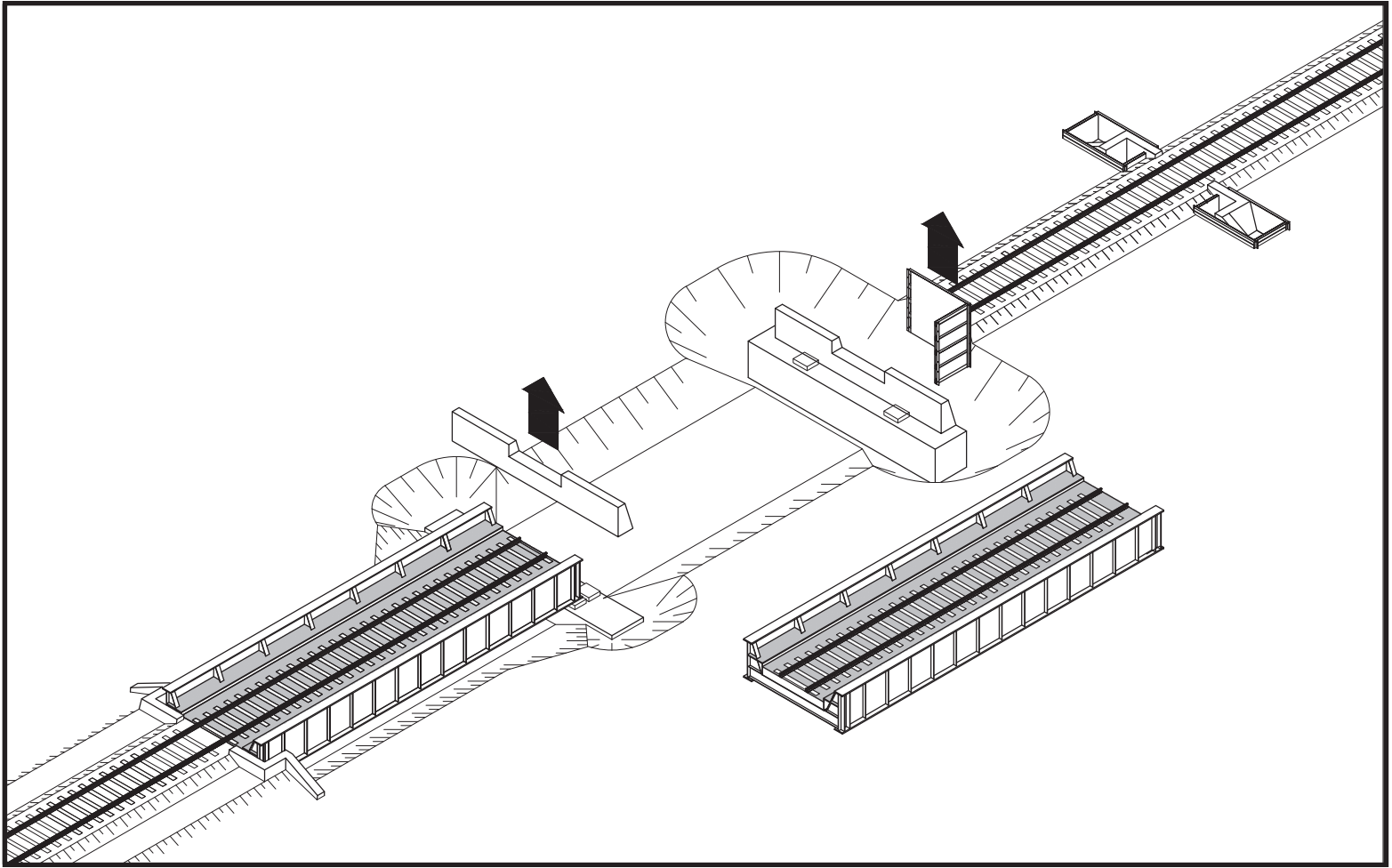
The completed bridge span is then lifted into place to sit on the bearing pads. The span can be lifted with two 300 ton cranes or a lateral slide. A temporary ballast wall can be used at the pier cap if required. The tracks are then connected and the railway can be re-opened.

The second bridge span is assembled to the side of the track (if not already done).



Third Rail Closure

- Close track for 4 hours
- Dig trench
- Remove trench boxes



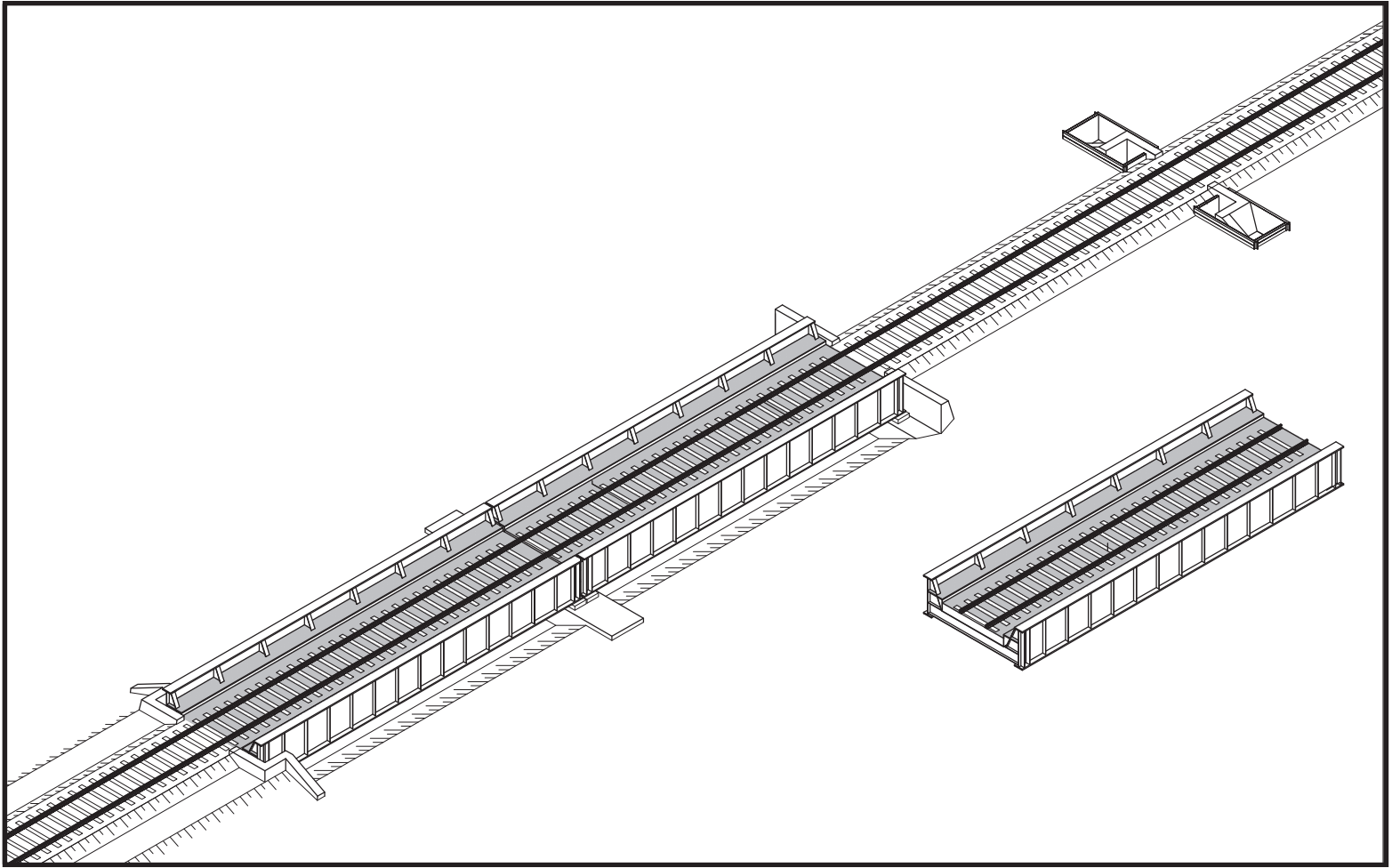
The track is closed for another four hour period to allow for the installation of the second bridge span. A trench is dug between the two pier caps and the trench boxes are again removed.

The temporary ballast wall (if required) is moved from the first pier cap to the second.



Third Rail Closure

- Place bridge span
- Open track
- Assemble third bridge span



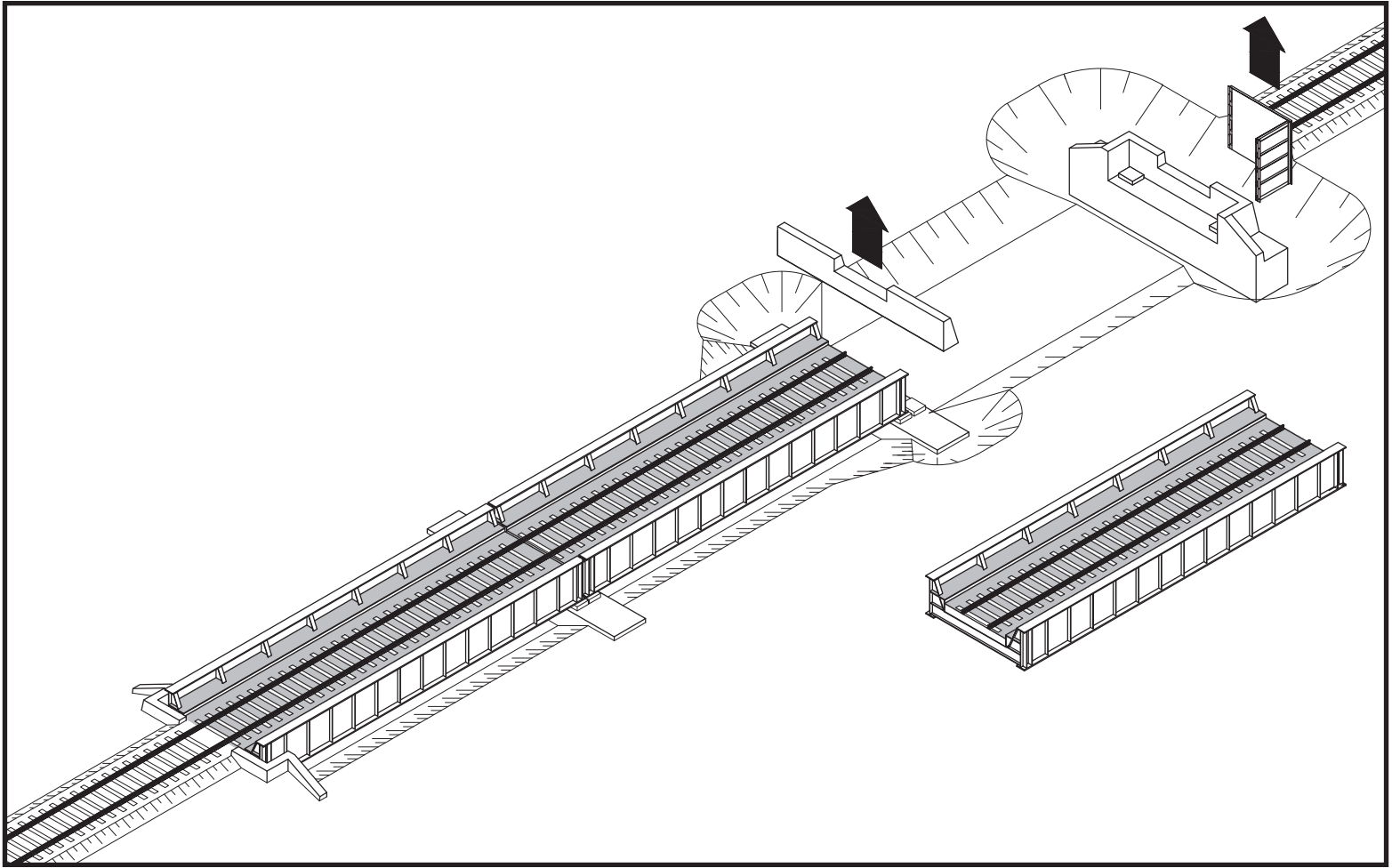
The second bridge span is then lifted into place in the same way as the first to sit on the bearing pads. The tracks are then connected and the railway can be re-opened.

The third and final bridge span is assembled to the side of the track (if not already done).



Final Rail Closure

- Close track for 4 hours
- Dig trench
- Remove trench boxes



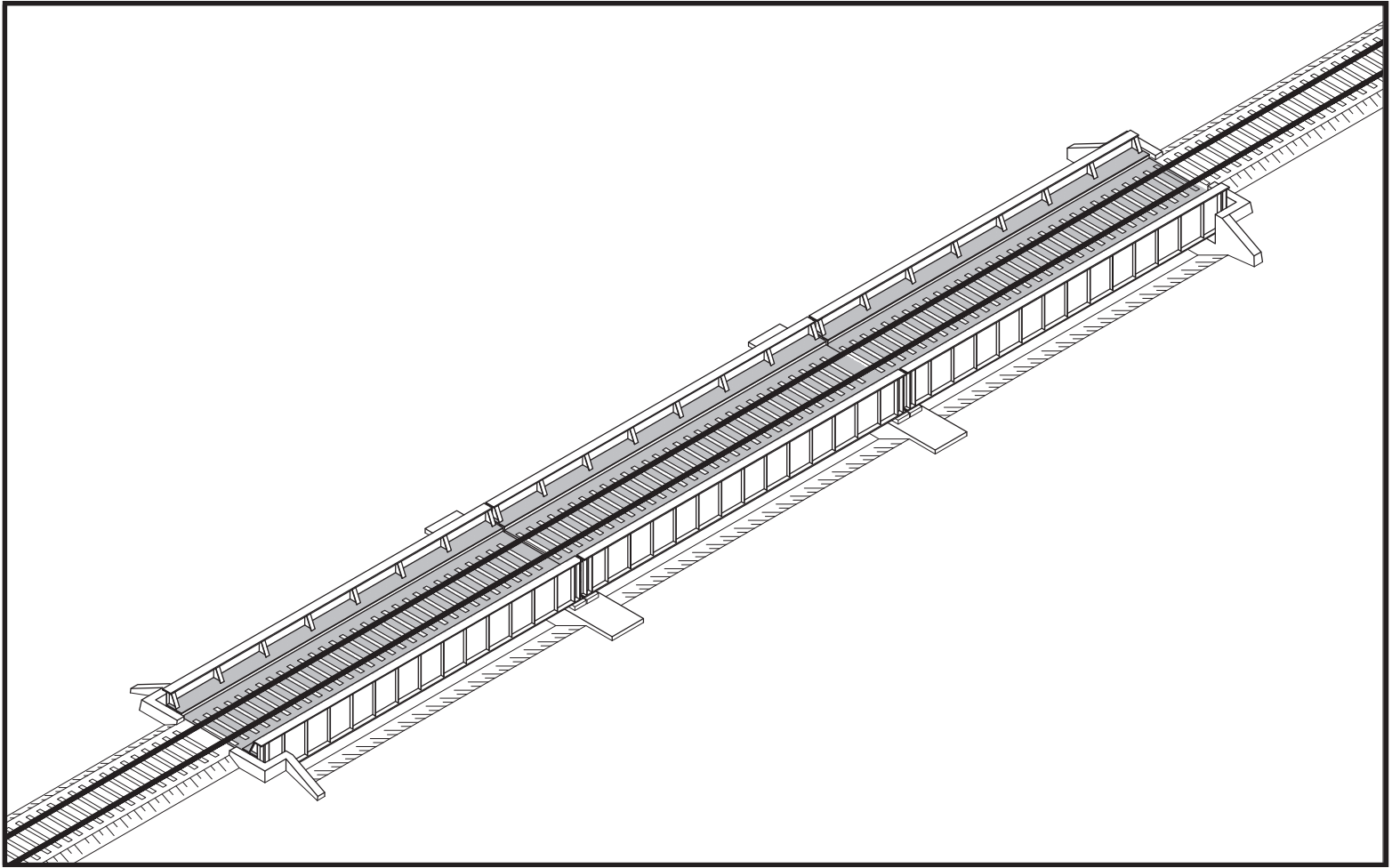
The track is closed for a final four hour period to allow for the placement of the final bridge span.

A trench is dug between the second pier cap and abutment. The final trench boxes are removed along with the temporary ballast wall (if required).



Final Rail Closure

- Place bridge span
- Permanently open rail bridge



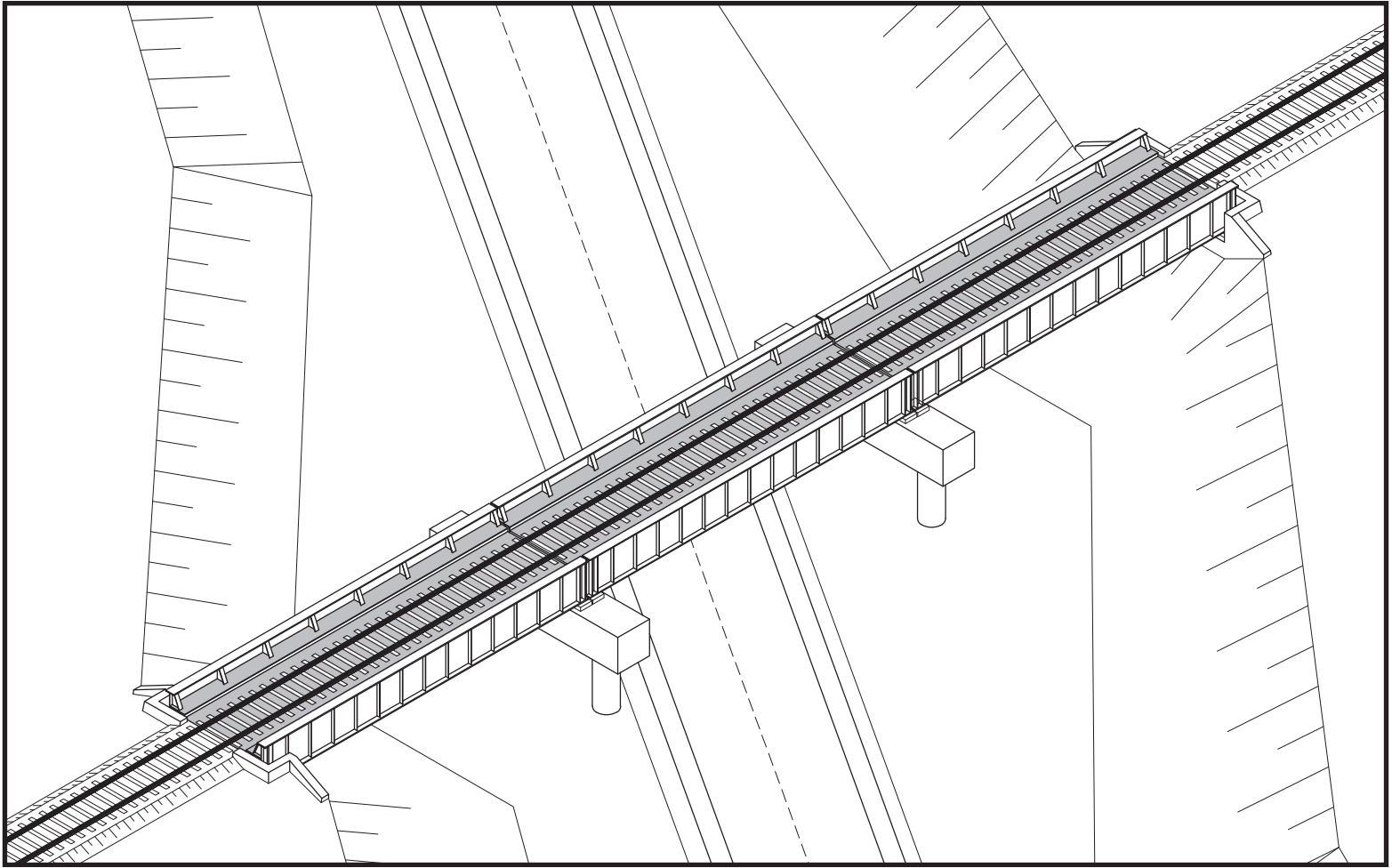
The final bridge span is lifted into place in the same way as the first two. The tracks are connected and the rail bridge is now permanently opened.

It is important to note that these steps can be modified. Longer rail closure periods, more equipment, and more man power are all factors that can reduce the number of required closures. The bridge spans can also be assembled all at once or before each relevant closure.



Completion

- Excavate
- Install slope paving
- Construct and open road



All that is left to do is excavate beneath the track to reveal the completed multi-span rail bridge, install slope paving, and construct the under-passing roadway.





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