Grade Separation Systems

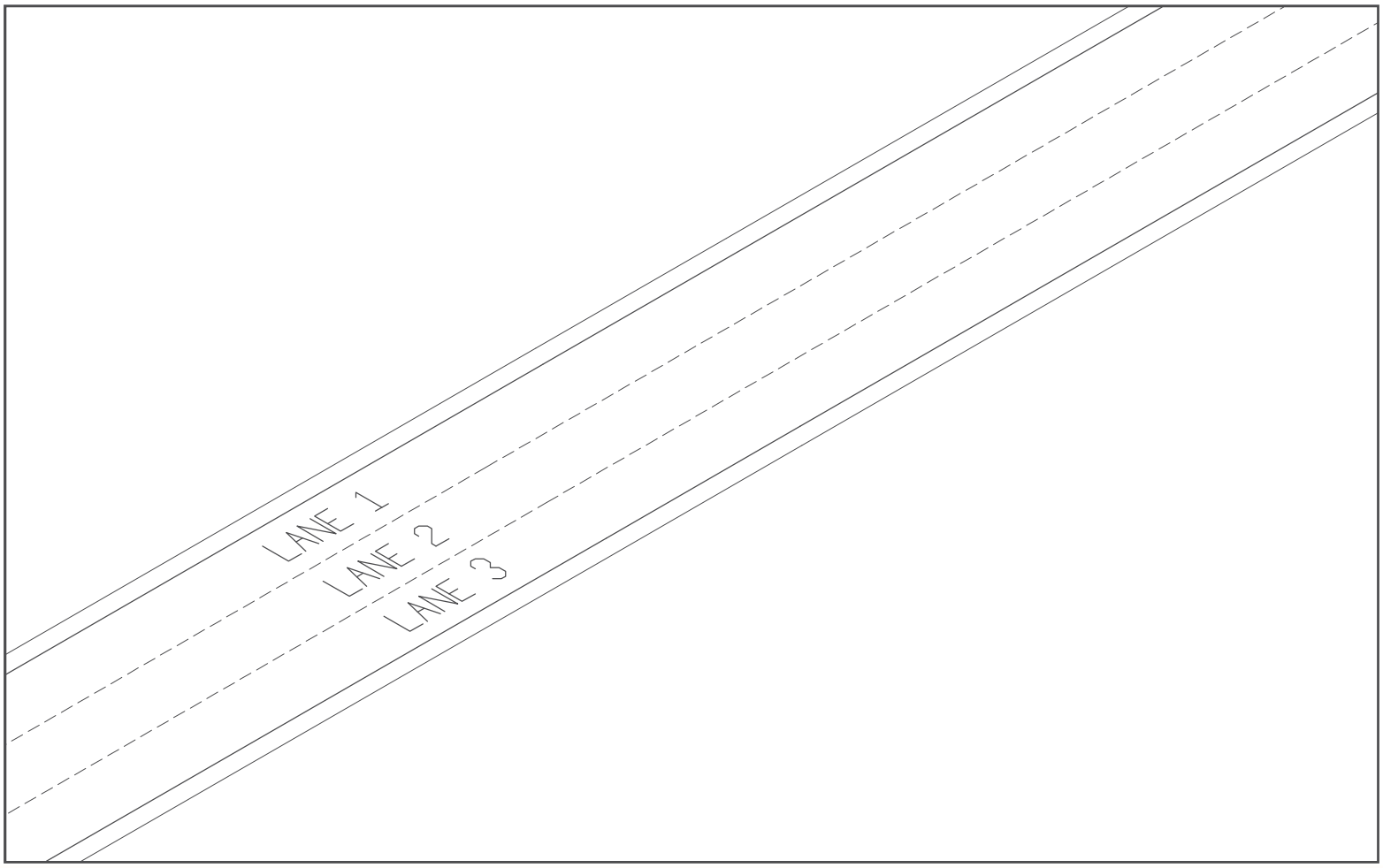
Multilane Highway Bridge Construction Procedure

An innovation from

art engineering inc.

GSS Highway Example

Shown: An existing multilane highway.



Goal: To construct a rigid frame highway bridge with an under-passing roadway while leaving two lanes open at all times.

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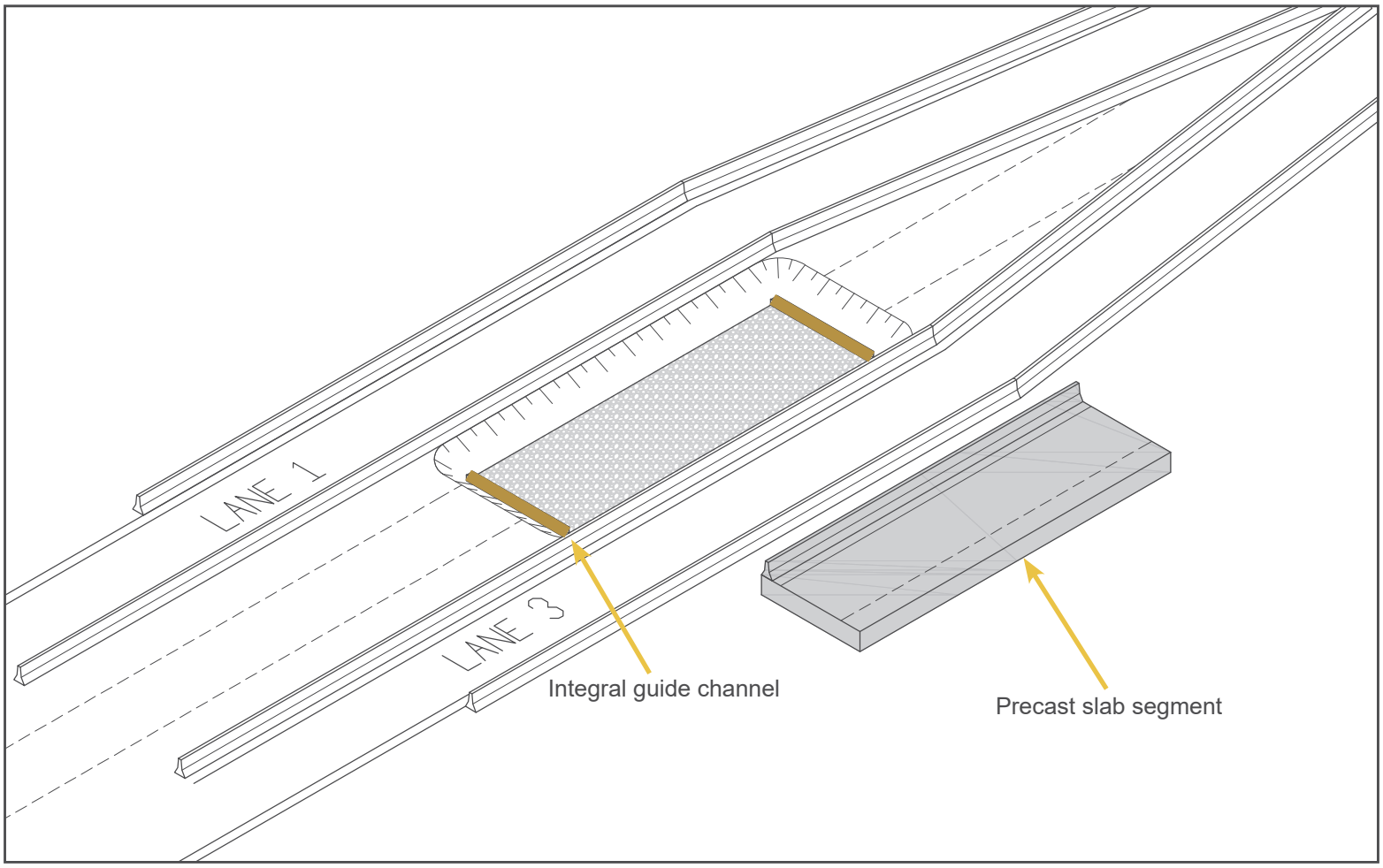
Lane 2 Slab Installation

- Precast slab
- Shift lanes overnight
- Dig trench
- Place guide channel



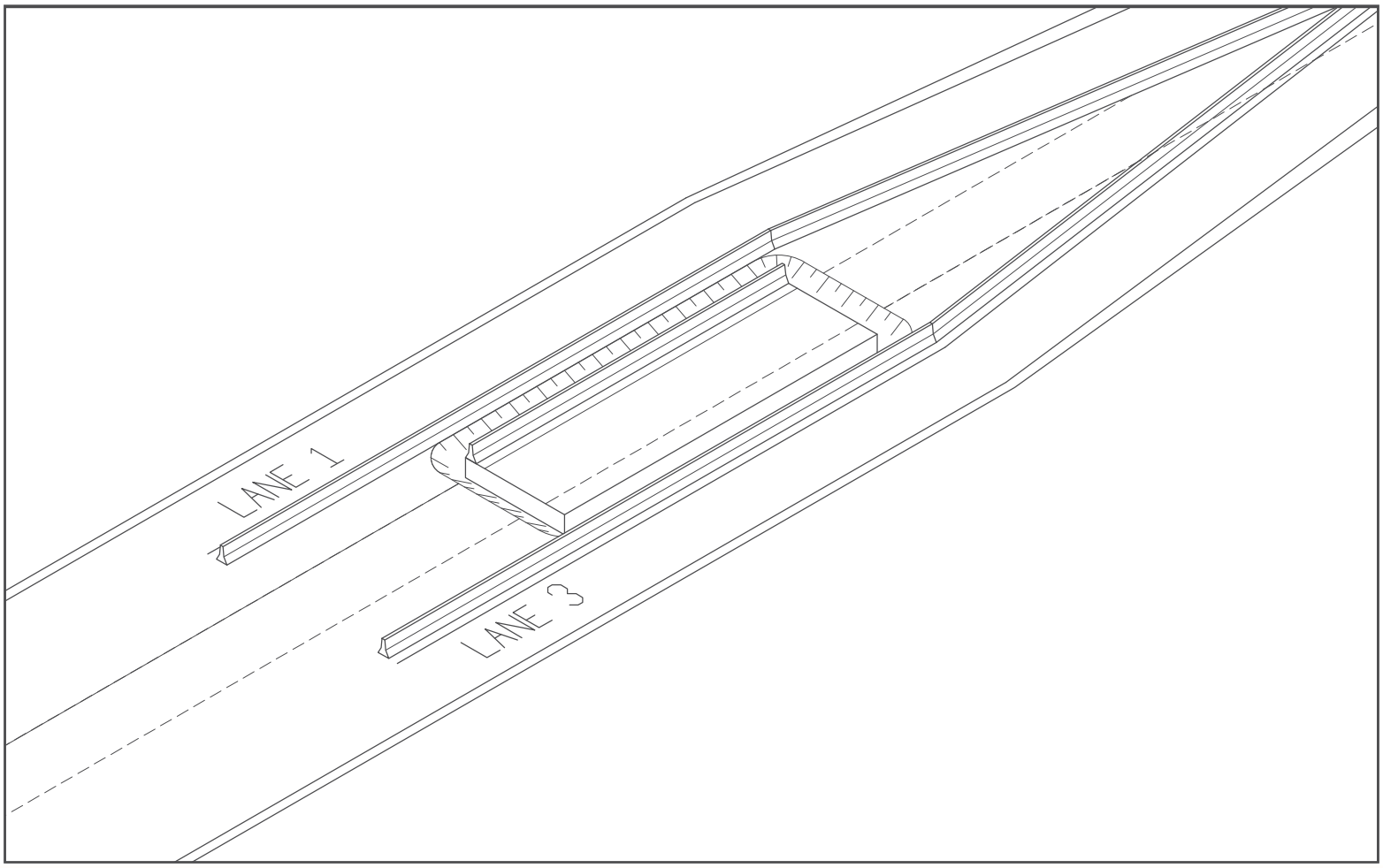
A precast slab segment is prepared on site, to the side of the roadway. The segment is the width of one lane and two TCB's, and is thicker than traditional slabs (approximately 100 mm) due to temporary conditions.

This completed slab segment (including mechanical couplers or post-tensioning ducts, waterproofing, and asphalt) weighs approximately 100 tons.

Lanes are shifted overnight and the middle lane is closed. A trench is dug and guide channels are placed. These guide channels will simplify the vertical excavation process

Lane 2 Slab Installation

- Place precast slab
- Backfill edges
- Shift lanes overnight

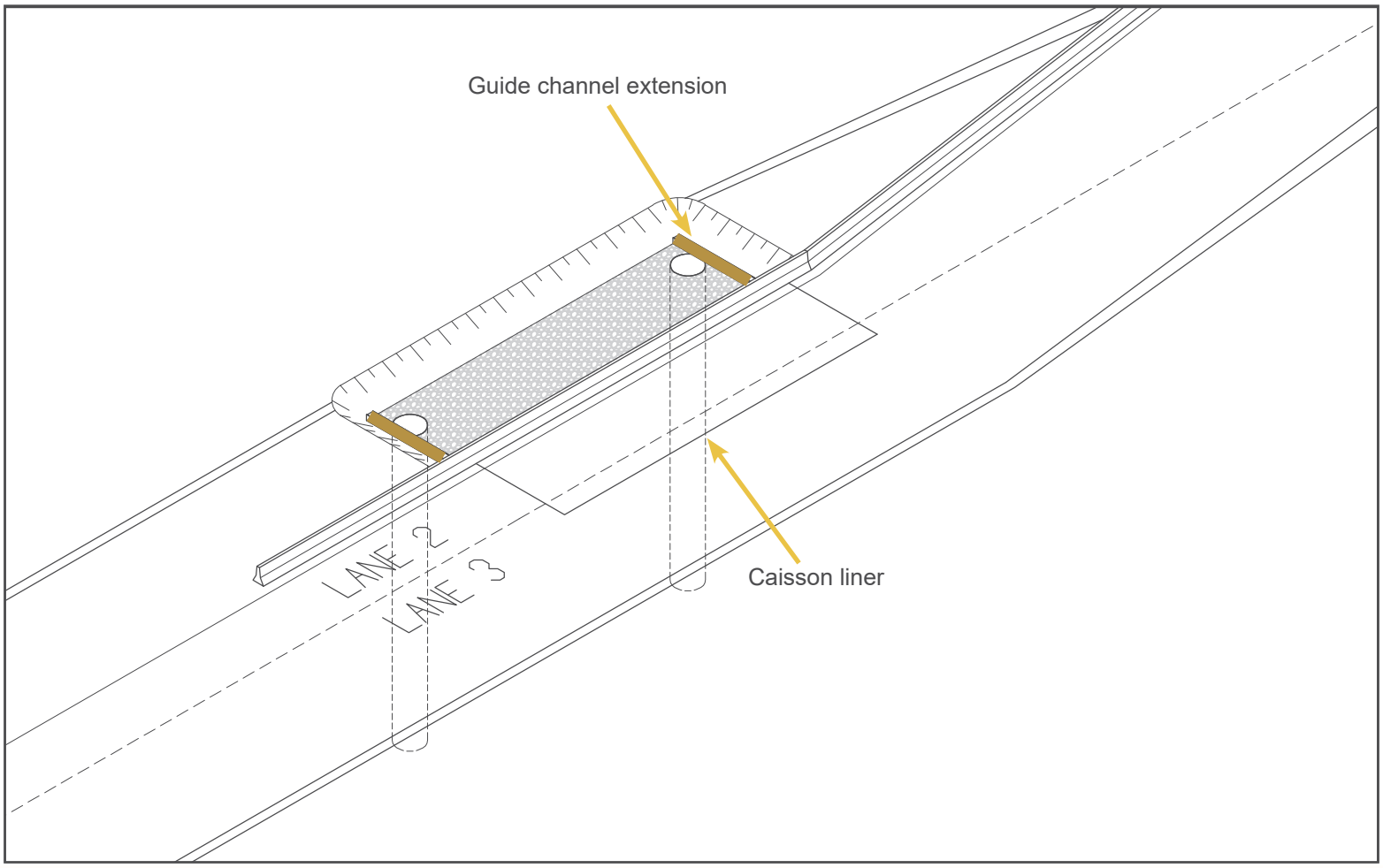


The precast slab segment is lifted into place using two 300 ton cranes. The trench is then backfilled around the edges of the slab.

Lanes are shifted overnights; Lane 2 is permanently opened and Lane 1 temporarily closed.

Lane 1 Slab Installation

- Dig trench
- Install caisson liners
- Extend guide channel

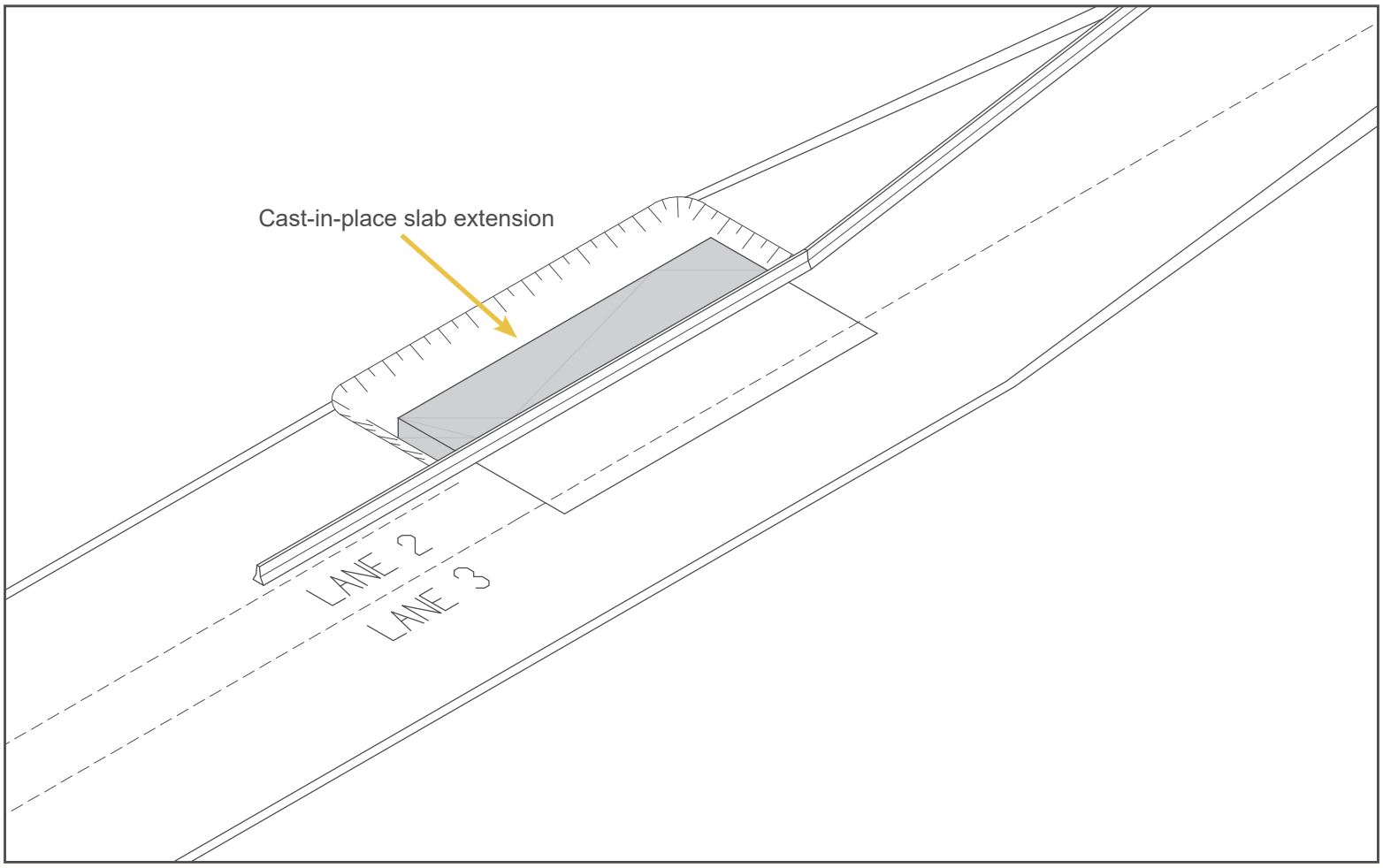


A trench is dug in preparation for the slab placement and caisson liners are drilled.

The guide channels are extended beneath the location of the future slab; they are then welded to the caisson liners.

Lane 1 Slab Installation

- Pour slab extenstion
- Backfill edges
- Shift lanes overnight



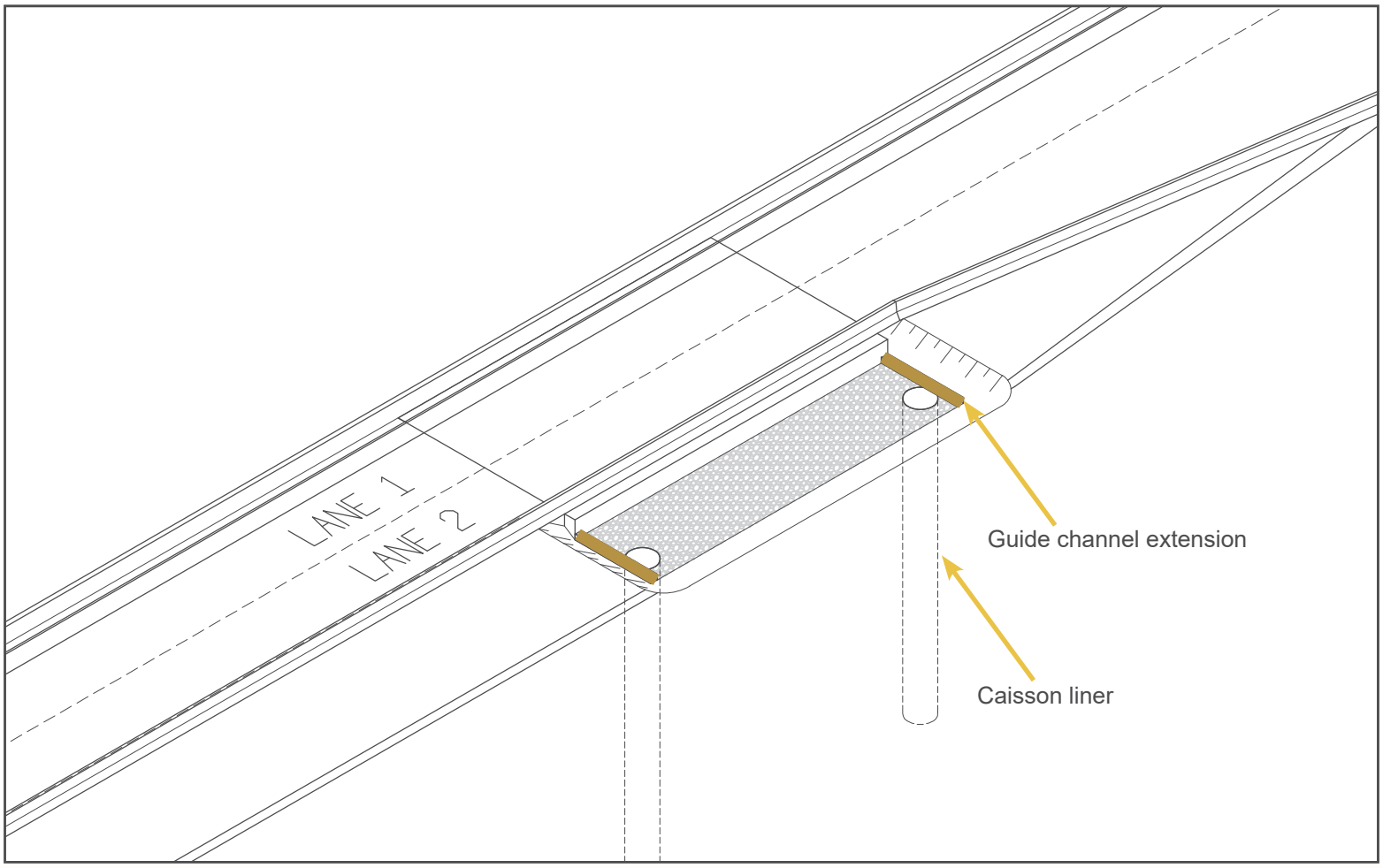
Structural steel is mechanically coupled to the segment underneath lane 2 and the slab extension is cast-in-place at its permanent location. Post tensioning can alternatively be used if preferred.

Waterproofing asphalt is installed and the trench is backfilled around the edges of the slab.

Lanes are shifted overnight; Lane 1 is permanently opened and Lane 3 is temporarily closed.

Lane 3 Slab Installation

- Dig trench
- Install caisson liners
- Extend guide channel

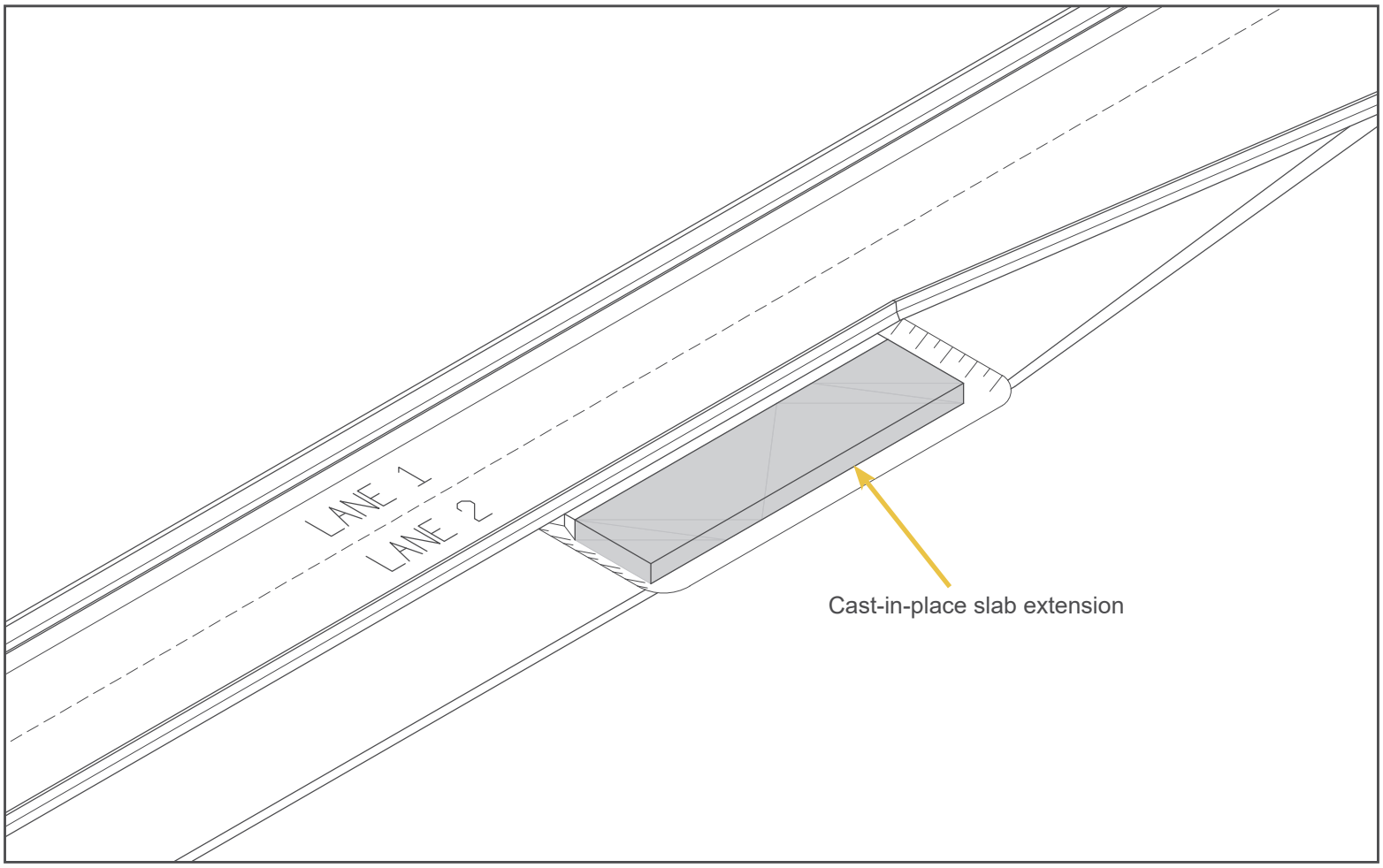


The same process used for Lane 1 is repeated. A trench is dug in preparation for the slab placement and caisson liners are drilled.

The guide channels are again extended and welded to the caisson liners.

Lane 3 Slab Installation

- Pour slab extension
- Backfill edges
- Open lane

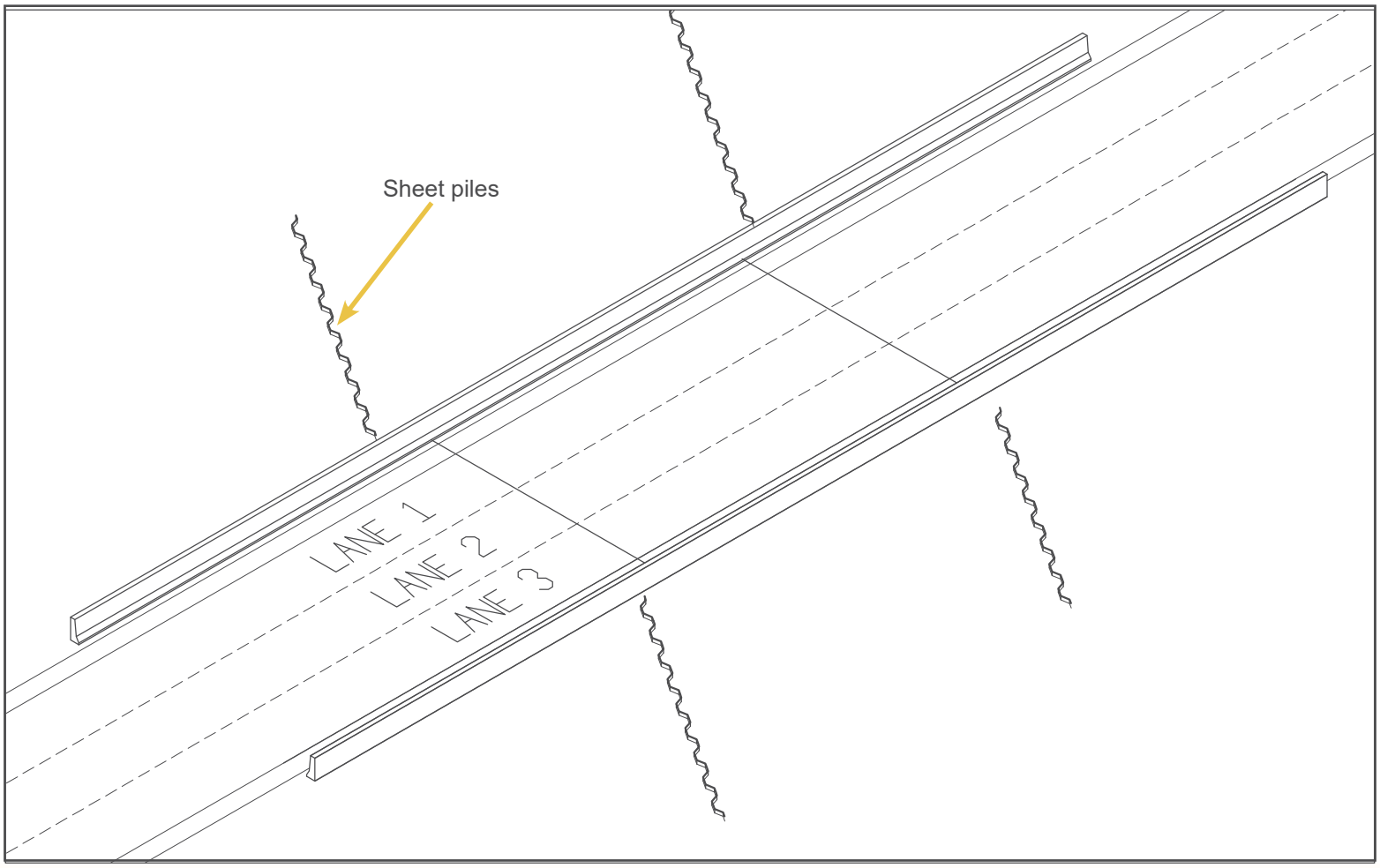


Structural steel is mechanically coupled to the segment underneath lane 2 and the slab extension is cast-in-place at its permanent location. Post tensioning can alternatively be used if preferred.

Waterproofing asphalt is installed and the trench is backfilled. All three lanes are now permanently opened.

Excavation Preparation

- Drive sheet piles
- Excavate to guide channel depth

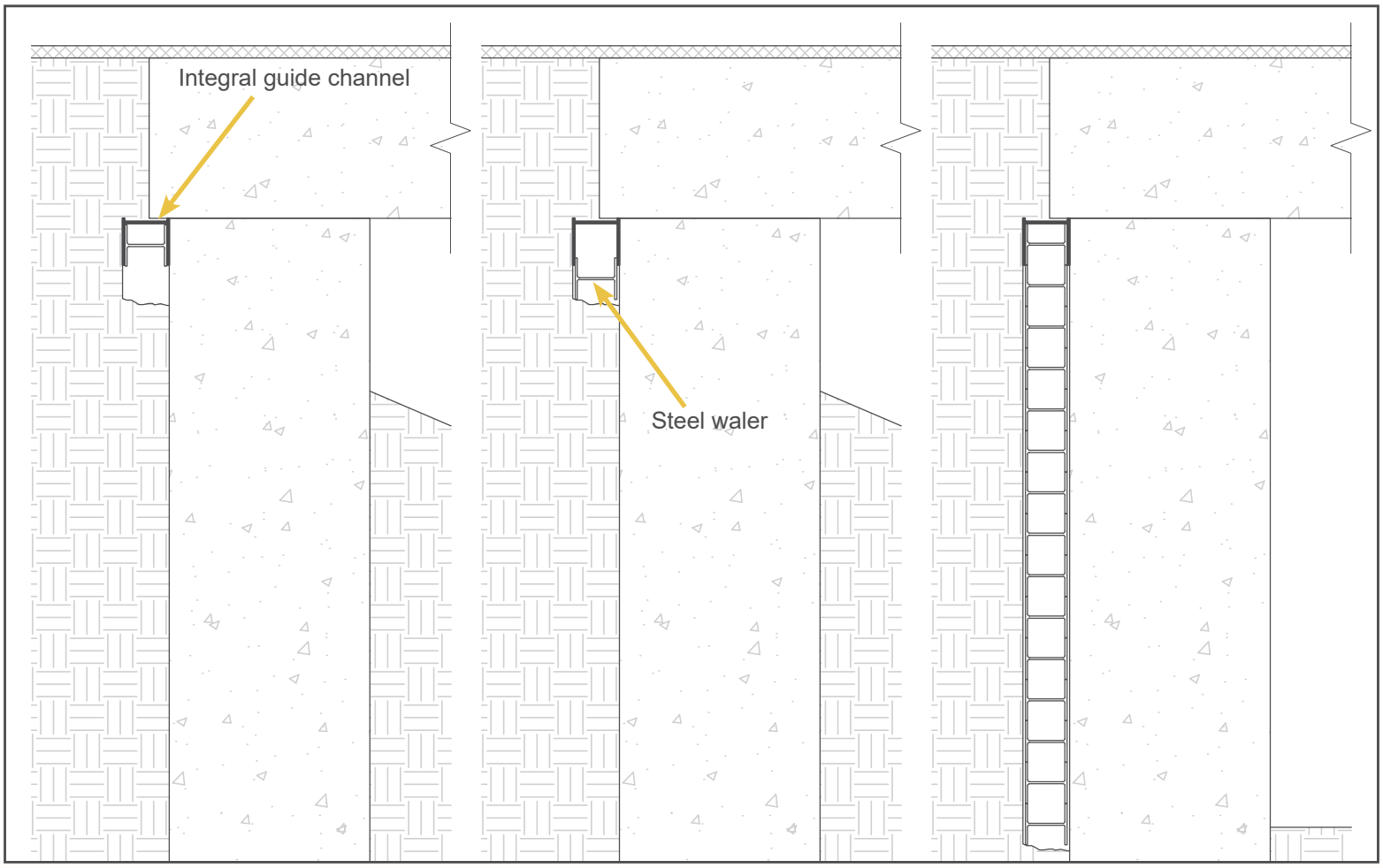


Sheet piles are driven at the corners of the slabs before excavation. This ensures a safe working area throughout the construction of the underpass.

Excavation then begins beneath the bridge span to the depth of the guide channel. A steel waler is housed within this guide channel to serve as soil protection behind the substructure.

Vertical Excavation

- Excavate locally
- Drop waler
- Insert next waler
- Repeat process

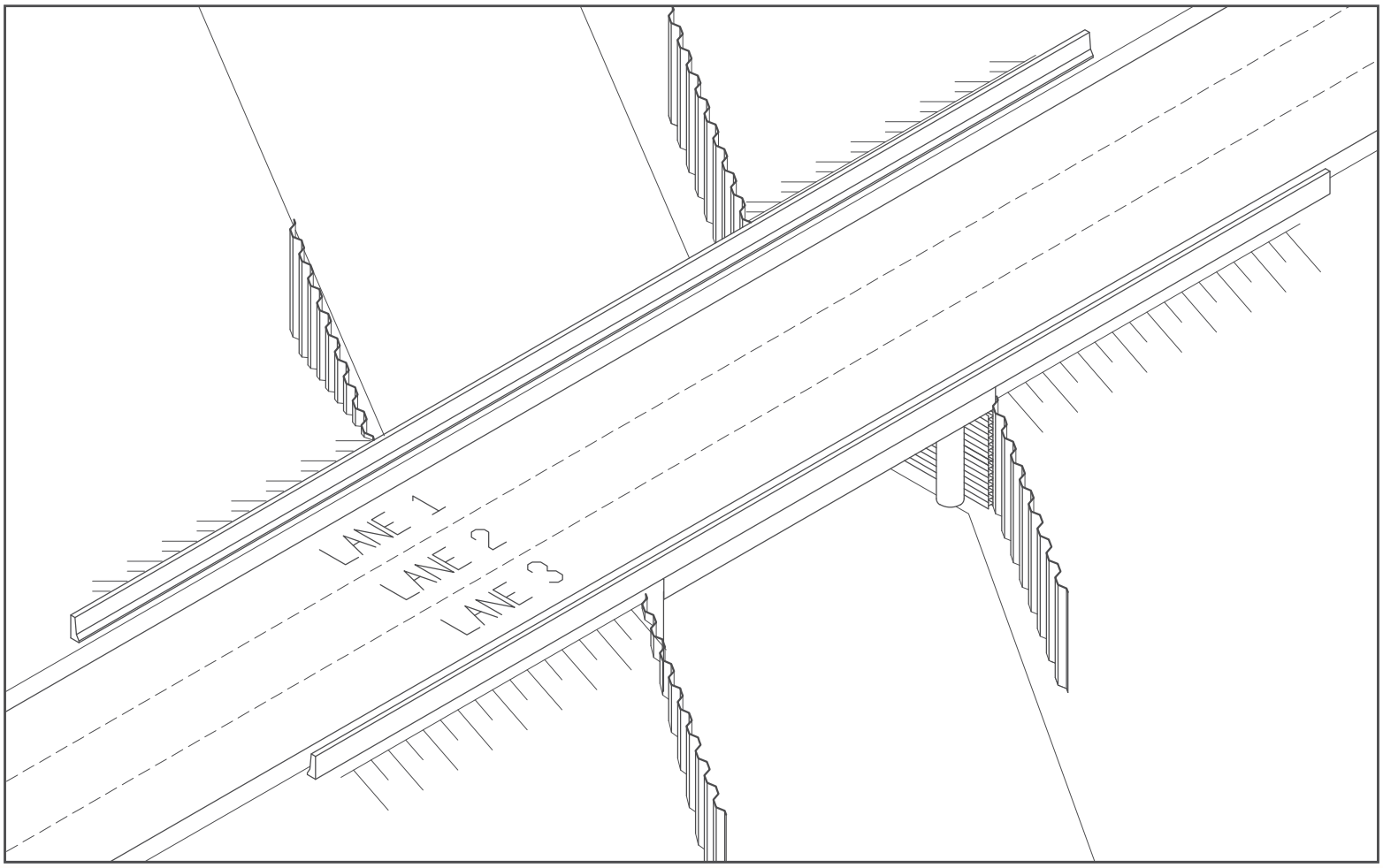


One foot below the waler is locally excavated so that it drops directly below its former position. A second waler replaces the first within the guide channel. Another foot is then excavated so that both walers drop together. This process is repeated until designed excavation depth is reached.

This “foot-at-a-time” approach allows for constant soil protection throughout excavation. To facilitate integration and sliding, guide plates can be welded onto the walers prior to their placement within the guide channel. The walers will drop due to their self weight or can be lowered with a hydraulic jack if required.

Underpass Construction

- Construct walls
- Construct road

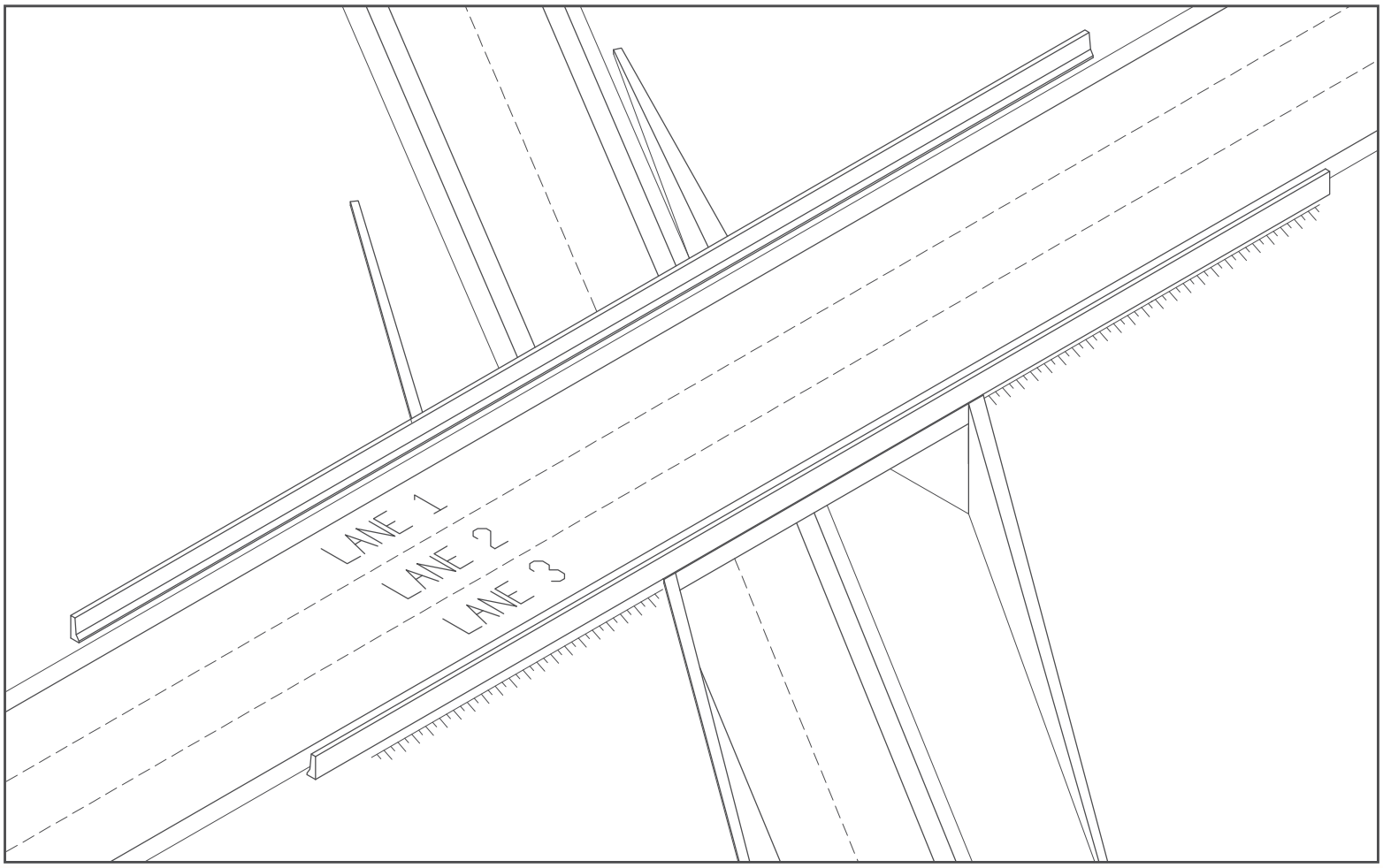


Once excavation is complete, the abutment walls are poured. The steel walers can serve as the back formwork for the abutment walls. The retaining walls are then formed.

Now that the permanent retaining system is in place, the under-passing roadway is constructed.

Completion

- Backfill structure
- Open roadway



The sheet piles and walers are removed, voids are grouted, and the structure is back-filled. The roadway can now be permanently opened.

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