INQUIK® BRIDGE

Reinforced Concrete Structure | Cast-In-Place

Installation Guide

- AASHTO Bridge Design Compliant
- Pre-engineered Modular System
- Prefabricated for Rapid Installation

CMC

it's what's **inside** that counts

Disclaimer

This installation guide is intended as a general overview of the installation method for the InQuik bridge solution, and it does not remove the need for professional confirmation to ensure that the installation is undertaken correctly. Each bridge is different, and there are many design variables which must be taken into consideration for the bridge installation. While InQuik does provide an on-site representative and support throughout the entire process, InQuik recommends that the bridge project's designer/engineer is consulted where appropriate. It is the responsibility of the installer to ensure that the installation is undertaken properly, and safe working practices are enforced. InQuik accepts no liability for anything that might occur due to improper or unsafe installation of the InQuik system, whether or not this installation guide is consulted, and all such liability is to be held solely by the party installing the system. By reading this installation guide, you accept and agree to be bound by these terms.

InQuik®
accelerated construction

INQUIK® BRIDGE INSTALLATION GUIDE

The InQuik Bridge is a reinforced concrete structure that consists of several modular parts: deck panels, abutments, wing walls, headstocks, and pier caps. Once the foundations are established on-site, the substructure (abutments, wing walls, headstocks and/or pier caps) are placed and filled with concrete. Then, after the substructure concrete is sufficiently cured, the decks are then placed and also filled with concrete.

A Abutment & Wing Wall Install

B Abutment/ Headstock Concrete

C Deck Install

D Deck Concrete

E Tie-downs & Barriers

F Concrete

A) ABUTMENT INSTALLATION

+ WING WALLS

01 The abutments and wing walls for each end of the bridge typically arrive as one component (pre-assembled), but they can be delivered separately for on-site assembly (delivery format to be arranged upon order). Whenever possible, the whole bridge will arrive on one truck. If the abutments are laying on their backs, you will need to lift as per the supplied document and rotate to upright.

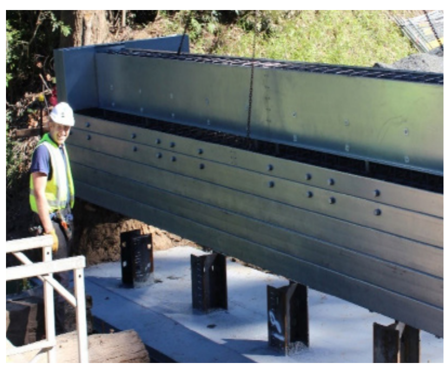
02 When lifting the components, each component has a safety sticker affixed to the unit which gives the weight of the component, and lifting points are marked on the top of each component. It is the installer's responsibility to lift each component correctly.

03 Mark the centerline of the abutment on both the leveling pad/abutment foundation slab and the abutment module.

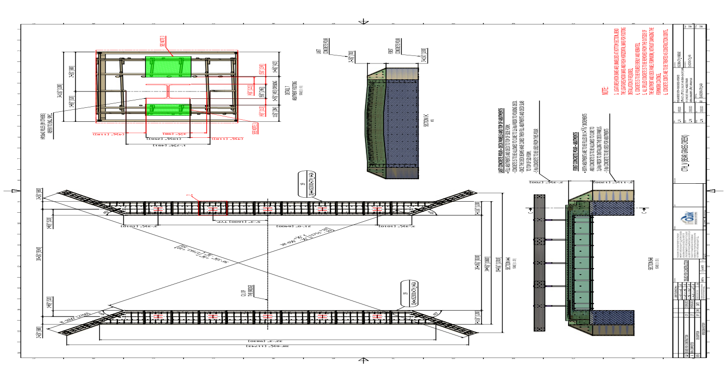
04 Align the centerline mark on the front face of the abutment as it is lowered into position with the mark on the leveling pad.

05 The abutment will fit over the piles or starter bars, and sit on top of the leveling pad.

The abutment reinforcing cage is designed with appropriate tolerance for most pile designs. However, there is a risk of clashing with large piles when the pile position is outside the allowed tolerance. Pile starter bars can usually be joggled to fit within the abutment cage, and certain bars inside the abutment cage can be moved out of the way. If absolutely necessary, some abutment rebar may be cut with an overlap bar placed, but this must only be done with the consultation and approval of InQuik.



Note: The InQuik system is compatible with nearly all foundation types.
Consult an InQuik representative or your engineer for questions on site specifics.



06 Each bridge is supplied from InQuik with a full set of drawings. These should be followed closely as it is critical that the positioning for the bridge is correct for the components.

07

Ensure that the abutment is exact and the deck bearing shelf measurement is correct between abutment modules. Ensure that you check diagonals on the bearing shelf to confirm that the units are square and parallel.

08

90° angle brackets can be installed on the bottom of the abutment and wing wall sections to secure to the leveling pad. These are fixed with a hex head screw and a masonry fastener. Once this has been completed, expandable foam can be installed from the outside to fill up the 0.47" gap under the bottom of the module. Care must be taken to ensure that not too much foam enters the cavity near the reinforcing, as it could obstruct the reinforcing itself and affect the concrete cover.

09

Alternatively, the abutments can be held down with threaded bar, fixed to the pile and then have some timber formwork fixed to the leveling pad to stop concrete coming out, or a combination of the timber and 90° brackets. These timbers are removed once the concrete has set.

10

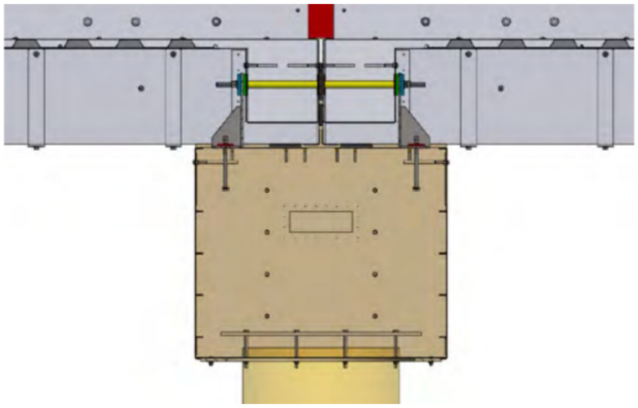
We also recommend bracing the top of the wing walls and the top of the abutment if they are likely to move significantly when in position. This will assist in holding the parts in position whilst the concrete is being poured and vibration is taking place.

HEADSTOCK INSTALL

+ MULTI-SPAN BRIDGE

01 **Please refer to the *"InQuik Multi-Span Installation Guide"* for more information.**

If a headstock is required, follow the guidelines noted on the drawings for your specific project and pile type.



02 The headstock needs to be properly supported on top of the piles. Usually, the headstock sits directly on top of the piles, but pile collars can be affixed to the piles if necessary. Scaffolding/falsework can also be used to support the headstock during construction.

03 Once the headstock is placed, the base will then be fixed to the pile support (refer to detail in the construction drawings).

B) ABUTMENT CONCRETE

+ HEADSTOCK CONCRETE

01 **It is the installers responsibility to comply with any applicable standards that relate to concrete installation.**

The standard InQuik system is designed for 5,000 PSI concrete and is compliant with the AASHTO LRFD 9th Edition standards. Under certain circumstances, higher PSI concrete may be specified by the site engineer.

02 The abutments are filled in roughly 20" increments.

03 Each incremental pour is then vibrated adequately to ensure there are no air voids (refer to detail in the construction drawings).

04 This practice ensures that the loads and pressures on the components are not too large, and the components do not shift due to lack of care.

05 We suggest that after an incremental pour on one abutment and while the concrete is being vibrated, an incremental pour on the other abutment is done.

06 The abutments and wing walls are filled to the top of the deck shelf with concrete and finished off with a steel trowel.

07 InQuik suggests that throughout the concrete pour, the structure is monitored to ensure nothing has moved, and to clean off any excess concrete that may have splashed onto the external face of the abutments and wing walls prior to the concrete setting. This will prevent the concrete from staining the finished face.

08 Where an abutment has an approach slab shelf, ensure the dowels/tie-bars are embedded into the shelf concrete in the correct locations before the concrete sets.

C) DECK INSTALL

01 The abutment concrete needs to cure to a minimum of 3,600 PSI, which typically takes 3-4 days for a 5,000 PSI concrete mix design. Then the deck panels can be installed and filled with concrete. *Following this process is necessary for the structure to retain its engineering certification.*

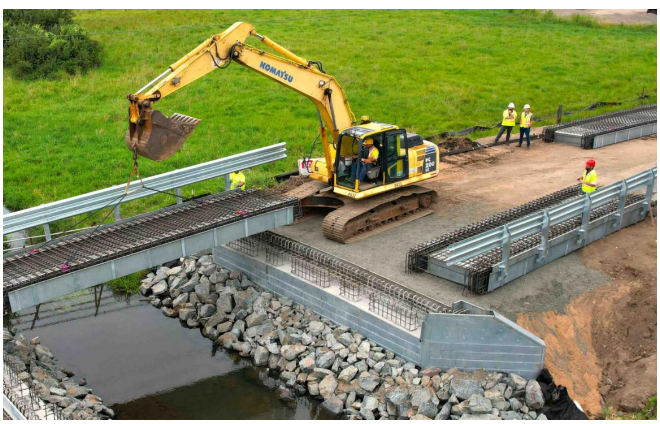
02 For a fully integral bridge, it is important to ensure a good bond between the deck and the abutment. Preparing the construction joint involves removing any loose aggregate/material from the top of the exposed reinforcing on the abutment concrete with either high-pressure water, wire brush, or chipping hammer.

03 If bearings are required, set out the bearing centerlines and secure the restraint plates with 0.4" masonry fasteners. After the first restraint plate is installed, the bearing is placed against the restraint. The other restraint plate can then be placed against the bearing, which will act as a guide and give you the correct spacing apart.

04 Install the bearing between the restraints if it is not already in place.

05 Prior to lifting, ensure any on-site additions like barrier posts have been fitted to the bridge deck panel. When lifting, each component has a safety sticker affixed to the back which gives the weight of the component, and lifting points are marked on the top of each component. It is the installer's responsibility to correctly and safely lift, move and position each component.

06 Place the first deck panel facing the correct way as per the supplied layout drawings. Ensure that when placed, the deck panels are even on each abutment and that the loose reinforcing will not clash with the deck and the abutment. These measurements will be given on the detailed general assembly drawings.



07 When constructing an integral bridge, the supplied drawings will include a numerical step-by-step "tie-bar" reinforcing install guide that is to be followed in sequential order to avoid bar conflicts and for better ease of installation.

08 Before the next panel is placed against the previous one, lay loose reinforcing tie-bars into the first deck panel as indicated on the supplied plans. Note that the transverse loose reinforcing for the deck can be done on the ground, before the first panel is lifted into place.

09

Place the next panel, with the 1.57" side lip on top of the lip of the previous panel.

10

If more than two panels are laid side-by-side, repeat steps 4 and 5 until all panels have been laid out.

11

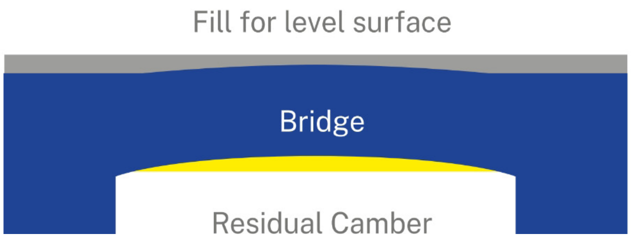
If the deck is to be made wider using extension spacers, then the deck units are spaced apart and spacer plates are then installed.

12

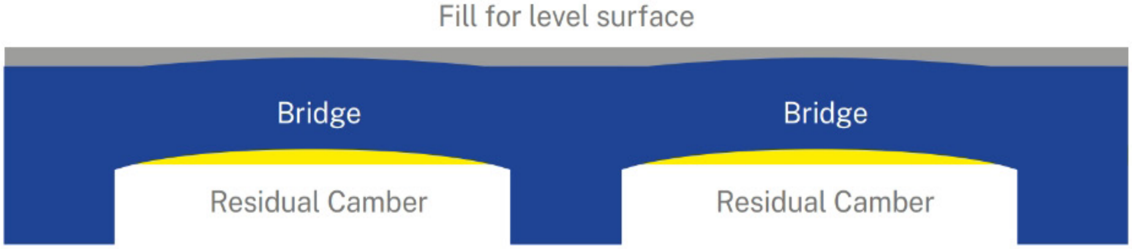
Secure the two laps together with screws at 19.7" centers and place silver tape over any gaps. Check the whole panel to ensure there are no gaps. If there are, tape over them or seal them with silicone.

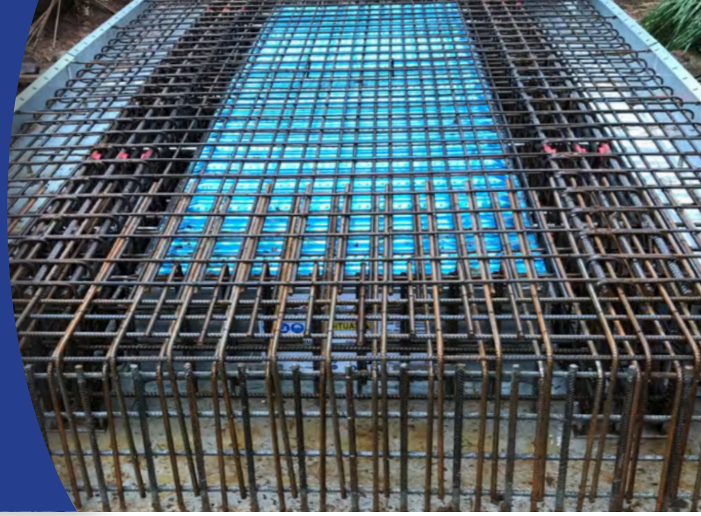
CAMBER IN BRIDGES

All InQuik bridge decks are designed with a pre-camber. Compliant with AASHTO LFRD 9th edition standards, the deck maintains a positive hog under dead load for the 75+ year design life of the structure. So, after the concrete, barriers, asphalt, and other dead loads are applied, there must be sufficient pre-camber left to allow for long-term creep effects as well. Since sag curves on the structure should be avoided, positive hog must be maintained through the life of the structure.



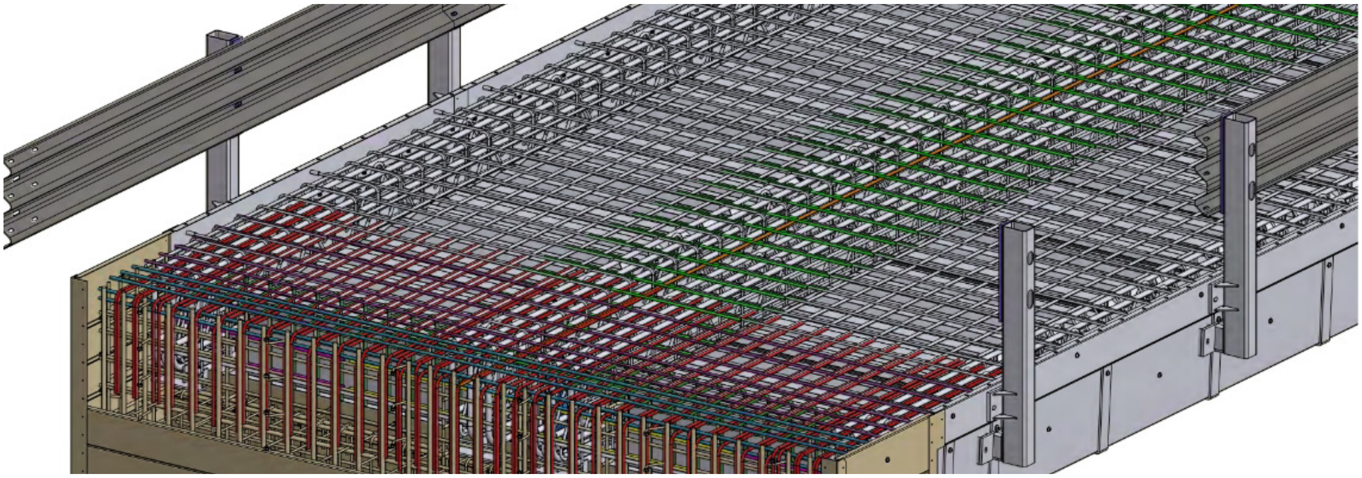
As a result, after construction is completed each InQuik deck span will have a positive hog, which may need to accounted for in the site design depending on the bridge and road geometry and traffic speed. If a totally level surface above the bridge deck is required, the site engineer must allow for some extra fill at each end of the span, which can be concrete or asphalt.



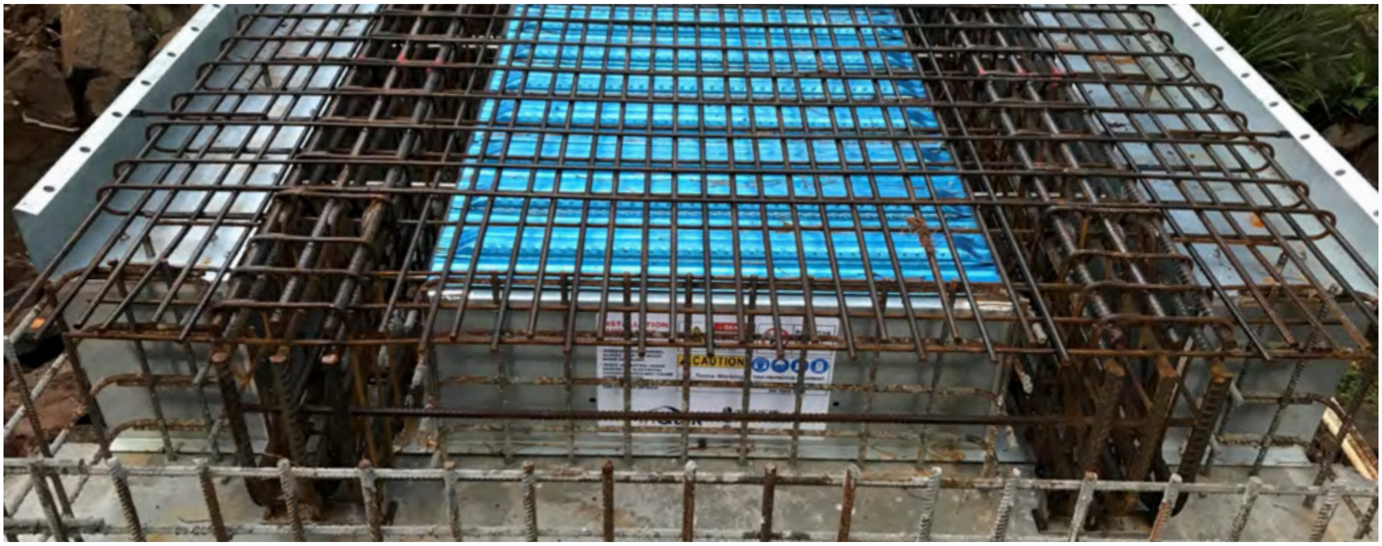


INTEGRAL BRIDGES

13 For integral bridges, follow the steps shown on the layout drawings supplied by InQuik for your specific bridge. The drawing below shows an example of an integral connection detail. All of the bars are color coded and dimensioned, to help with the installation.



14 For an integral bridge, the integration bars protrude out of the abutment, and the reinforcing from the deck needs to be connected into the abutment (so the deck load is transferred), which gives the integral connection.



15

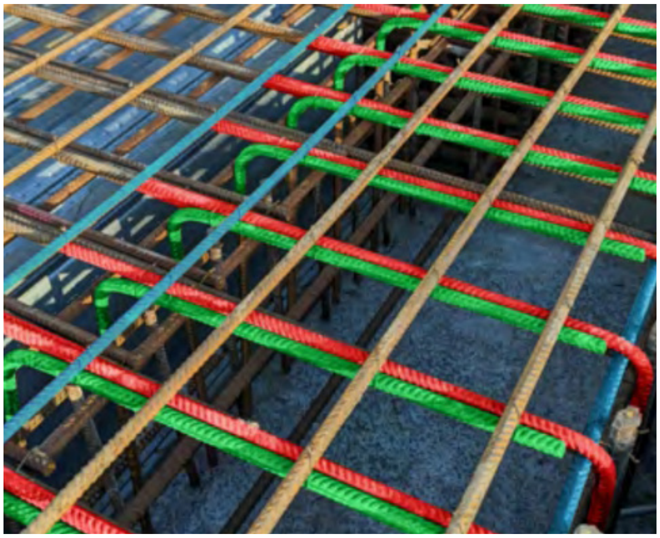
Before the deck sections are placed onto the abutment, some loose reinforcing bars will need to be placed into the abutments in preparation (Please reference the tie bar installation process in the construction drawings). Once all decks are placed, pull back the pre-placed reinforcing bars to connect the horizontal bars on the front wall of the abutment, through the deck girder. Then fix the bars into position with tie wire.

16

Install the 90° green bars into the front wall, to align with the top reinforcing mesh. Once these are placed, install the blue bars, and fix into position. Lift the green bars up and fix to the underside of the blue bars, so the green bars are in line with the top mesh.

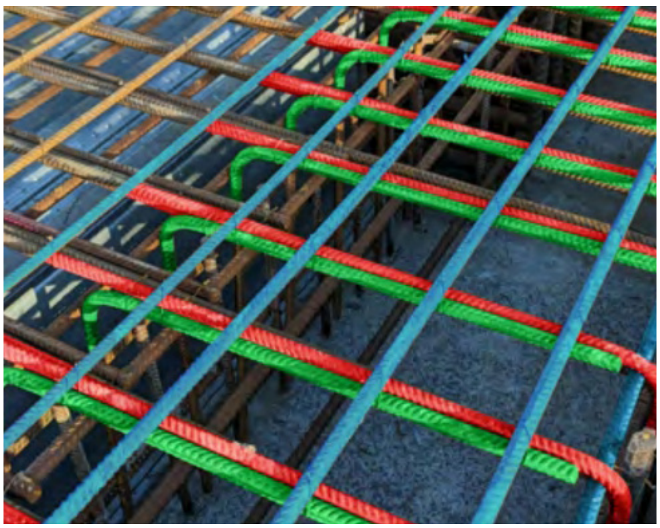
17

Insert the 90° red bars for the bottom mesh into the deck, and affix to the bottom reinforcing mesh and the back wall reinforcing on the abutment.



18

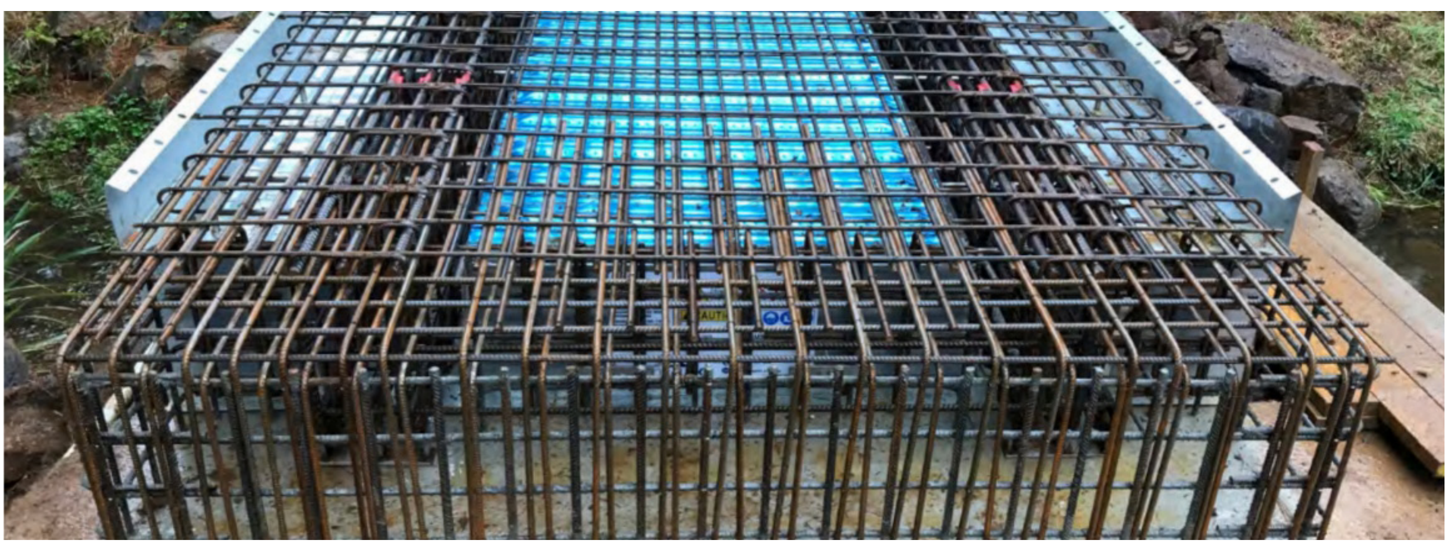
Insert the dark blue bars on the top of the bottom red cog bars and ensure that they are between the top mesh and the bottom mesh. The bar at the rear of the abutment will not be covered by the top mesh bars (see far left in photo below).



19

Insert the top cog bars in the same manner as the bottom bars, and tie into position.

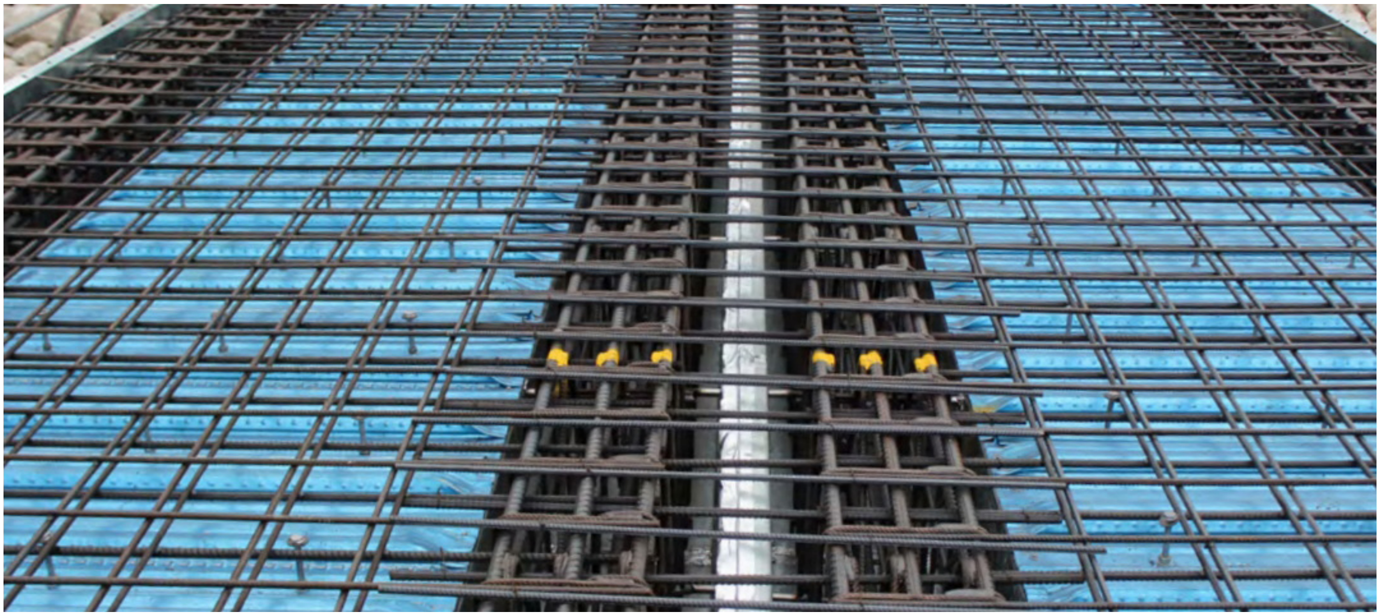
Once this is completed, lift the dark blue bars up to the top red cog bars and tie evenly as indicated on the plans.



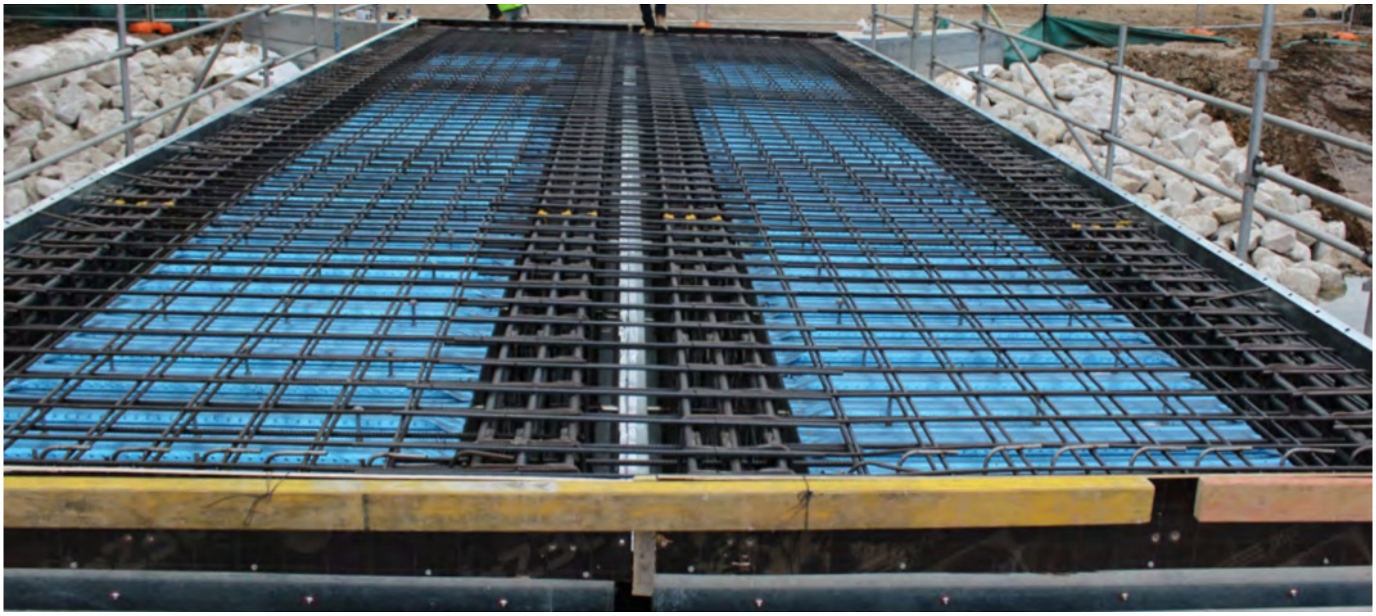
This is the completed integral connection, which transfers the deck load into the abutment.

20 Between the decks, pull back the bottom reinforcing bars across the join, then place and secure the tie bars overlapping the top layer of mesh. Position the reinforcing bars evenly on both sides of the join to ensure the correct lap length is achieved and fix off with tie wire.

Note: The bottom reinforcing bars will need to be installed in the correct sequence with the integral reinforcing installation. Refer to relevant bridge drawings.



21 Install timber formwork on the back wall of the abutment or deck if required for your type of bridge and ensure that it is high enough for the finished height of the concrete.



D) DECK CONCRETE

01 The standard InQuik system is designed for 5,000 PSI concrete and complies with AASHTO LFRD 9th edition guidelines, but the 45' deck panels will typically require 7,500 PSI concrete.

Note: Allow deck beams to cure to 3,600 PSI.

02 For the 53' and 61' deck spans, the concrete must be poured and set in 2 separate stages:

1. Pour the deck beams then allow them to cure to 3,600 PSI.
2. Then complete the rest of the deck (with the abutment concrete to the same level for the integral bridges). See Appendix E.

This detail will be noted in the plans supplied by InQuik.

03 Concrete is first placed at the two end beams of the panels (over the abutments), to load up mass on the ends.

04 Continue the pour by progressively loading up the girders and vibrating as you go. When you are filling the two girders side by side, ensure that you fill both at the same time, so the load is evenly distributed.

05 Fill the girders and vibrate them in two stages, 10" at a time. Vibrate the concrete correctly to ensure there are no air voids.

06

For a single stage pour, once the girders are filled up to the underside of the decking sheet, start filling up the top deck slab by working from one end to the other, vibrating concrete while progressively screeding the top surface from one end to the other, and avoiding excessive mounding of the concrete in one place.

For a two stage pour, once the girders are filled up to the underside of the deck slab, the concrete must be allowed to cure to 3,600 PSI, and a construction joint will need to be prepared before the second stage pour can commence.

07

We suggest that if a vibrating screed is not used, you float the surface as you go, in three or four stages.

08

Once the decks are filled, vibrated, and screeded, the concrete will need to set adequately before it is finished.

09

When the decks have been finished, it is advised that any excess concrete is removed from the edges and an overall check is made on the decks, on top and underneath, to clean off any excess concrete.

E) TIE-DOWNS + BARRIERS

01 Once the concrete has set, any tie-downs required to secure the deck to the abutment or headstock are then installed.

Note: The site designer is responsible for ensuring the tie-down detail is appropriate for site conditions.

02 If required, install barriers onto the barrier posts which have been installed prior to concrete being poured. Certain bridge designs have non-standard spacings of side-mounted barrier posts, due to the placement of supporting straps on the girders. The barrier guardrail for these bridges will need to have holes drilled on-site by the installer to accommodate these spacings. Affected bridge designs include multi-span bridges, and 53' and 61' deck spans.

F) CONCRETE

01

Concrete testing needs to be done to ensure that the required strength is achieved, as per the requirements for the InQuik system and to comply with AASHTO. This is the responsibility of the contractor.

Samples of concrete must be collected on the day of the pour. The samples are allowed to cure, and they are crush tested after different time periods to give the compressive strength over time. Slump tests also need to be conducted.

EXAMPLE BRIDGES

APPENDIX

Tools & Materials

The following checklists serve as a guide to the tools and materials that are required for a typical bridge installation. Be advised that this list does not replace expert advice, and the installer should consult the bridge construction designs for any additional materials and tools that might be necessary.

Also note that the installer may wish to have multiple of the same type of tool available, so that more than one person can work on the same job.

On-Site Storage

If stored on-site before installation, panels should be placed level on blocks of wood, whether stored separately or stacked on one another. They should be placed somewhere with minimal risk of damage.

For longer-term storage, care must be taken to protect the panels from the weather and environment. Tarpaulins or plastic sheeting can be used to keep out dust, leaves, and debris. The rebar structure should be kept reasonably dry to avoid rust build-up. Water should not be allowed to pool inside the formwork.

General Safety

Proper safety equipment and procedures must be used at all times. This includes ensuring all people on the construction site are wearing the necessary Personal Protective Equipment (e.g., high-visibility vest, safety helmet, boots, glasses, gloves, etc).

APPENDIX - ABUTMENT INSTALL

+ MULTI-SPAN BRIDGE

Tools

• String line, chalk line
• Pencil/crayon
• 100' tape measure
• Levels, 48" and 78"
• Screw Gun
• Drill
• Hex head bits for 12G and 14G (5/16 and 3/8 size bits).
• Assortment of steel drill bits if required for pilot holes, mainly 0.12" - 0.24"
• Hammer drill with 0.39" and 0.47" bits to drill holes in the blinding layer for masonry fixings to affix anchor brackets to the abutment
• Hammer for installing masonry fixings
• Socket set to suit the masonry fixings
• Nips or wire twisters for tying the steel tie bars for the on-site wing wall to abutment assembly
• Grinder with cutting discs if minor adjustments are required on site
• Long crowbar for shifting placed abutment
• Sledgehammer in case it is needed to shift anything
• Handsaw or electric saw for installing timber form for the back wall of the abutment
• Adjustable spanners for any ancillary tie-down bolts

Materials

• 7.5" x 1.8" timber formwork: enough lengths for the front and back faces of both abutment main walls.
• Steel drill point screws: for fixing the timber formwork to the abutment back wall. Fixings are needed every 20", using 2.5" long screws.
The screws are installed next to each internal cross tie within the abutment back wall.
• 2.75" x 1.4" timber: for bracing the wing wall to the ground with a star picket or similar. Screws are needed to fix this to the wing wall. Enough timber for each wing wall for both abutment sets.
• 90° steel brackets, 2" x 2": placed at 40" centers on the front and back of the abutment and wing wall, enough for each abutment (to immobilize the abutments).
• Masonry fixings to suit the brackets, along with steel drill point screws to fix into the formwork.
• Roll of tie wire or steel ties.
• Plywood for the front shelf of the abutment, if required.
• Expandable foam, for filling under the abutment, if required

APPENDIX - ABUTMENT CONCRETE

+ DECK INSTALL

Abutment Concrete Tools

• Steel trowel
• Timber float
• Steel edger
• Broom to finish the back wall of the abutment if the deck is broom finished
• Concrete vibrator
• Sponge and bucket to clean any spilled concrete off the face of the abutments

Abutment Concrete Materials

• Concrete as required for the project

Deck Install Materials

• Bridge bearings, steel strips and fixings for placement on abutments (unless supplied by InQuik).
• Tie wire or steel ties, for fixing of loose bars.
• Silver foil tape, to seal off the joint between panels.
• Silicone for filling any holes.

Deck Install Tools

• Hammer drill with 0.39" and 0.47" drill bits for the bearing restraints
• Hammer to knock in masonry fixings for bearing restraints
• Chalk line for bearing set out
• 100' tape measure to set out the bearing centerline
• Long crowbar for shifting the decks to ensure correct position
• Screw gun for installing the spacer trays between the panels or fixing the panels together
• Drill
• Hex head bits for 12G and 14G (5/16 and 3/8 size bits)
• Assortment of drill bits if required for pilot holes, mainly 0.2" - 0.24"
• Nips or wire twisters for tying the steel tie bars between the panels
• Fall protection/safety measures as required for working on the deck
• Calking gun to seal the joint between panels

APPENDIX - DECK CONCRETE

Tools

- Concrete screed
- Shovel or steel concrete rake
- Concrete vibrator
- Bull float
- String line for checking levels across the bridge deck
- Vibrating screed if available
- Petrol concrete helicopter
- Edging tool
- Steel trowel
- Concrete broom
- Fall protection as required
- Stanley knife

Materials

- Concrete as required.
- Foam expansion joint as detailed by engineer

APPENDIX - CONSTRUCTION JOINTS

Recommended practice for construction joints:

Where multiple concrete pour stages are required, a construction joint must be properly prepared to ensure a secure concrete bond. Construction joints are needed for all integral bridges (between the abutment shelf and the deck), and where the deck panels require multiple pours, in particular for the 53' and 61' spans.

All the surfaces of the construction joints must be prepared properly to ensure proper performance of the joint. This can be achieved using the following methods, as outlined in the TMR's Technical Specification for Concrete, MRTS70.

The surface of the joint shall be prepared by removing all laitance and sufficient surface mortar in order to expose the coarse aggregate, but leaving the coarse aggregate firmly embedded in the mortar matrix, without undercutting. This may be achieved by using:

- Sand-blasting techniques.
- Wire brushes, hand tools and pneumatic tools.
- A 'green cutting' technique whereby the surface laitance and mortar are removed from partially hardened concrete by means of a high-pressure combined air/water jet directed through a single nozzle onto the concrete, or
- Proprietary surface retarding agents followed by any of the above (sugar solutions are not to be used)

Construction joints should be dampened prior to the placement of the adjoining concrete. Membrane curing agents should not be applied to the surface of any construction joint.

The joint should be cleaned of any foreign contaminants prior to concreting the next lift, and the fit of forms along the construction joint should be checked to ensure a mortar-tight joint.

It is critical to follow the recommended methods above, as it will ensure that a secure concrete bond will be formed between the layers and a proper construction joint can be achieved.

APPENDIX - GALVANIZED PARTS

Recommended handling and storage for galvanized parts.

Whenever galvanized parts are packed closely together for storage or transport, precautions should be taken against white rust. White rust is a white chemical called zinc hydroxide that can be formed on galvanized products if the zinc reacts with water under certain conditions. It's not detrimental to the product, but it is a visual issue.

1. Galvanized steel should be stored under cover in dry, well-ventilated conditions away from open doorways.

2. If outdoor stacking is unavoidable, the galvanized steel pieces should be raised from the ground and separated with wooden spacers to provide free access of air to all parts of the surface. They should also be inclined in a manner to promote drainage. Do not store galvanized steel on wet soil or rotting vegetation.

3. Small items stored in containers should be thoroughly dried before packing. Desiccant should be added.

4. Uncovered material should not be left standing at in-transit loading points where it may be exposed to rain, mist, condensation, or snow.

5. When shipping overseas, galvanized steel should not be consigned as deck cargo or stowed beneath deck where contact with bilge water is likely. The high humidity at sea, particularly in the tropics, makes the provision of dry, well-ventilated facilities important.

In the event of white rust forming, separate the parts and arranged them so the coating can dry rapidly. Remove any free water with a clean dry cloth prior to air drying. Light stains can be easily removed by brushing with a stiff nylon brush. If the white rust remains after this, wipe the surface down with white vinegar.

InQuik®

InQuik bridges have exceptional resilience to impacts caused by severe weather events, and require minimum to no structural maintenance over its 75+ year design life. We provide environmentally friendly, long-lasting solutions for communities, and enable the use of local labor, equipment, and materials.

For more information, contact CMC Bridge Systems,
the authorized provider of InQuik® Bridges in the United States.

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it's what's **inside** that counts

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