Humes

Strength. Performance. Passion.

HumeDeck® bridge system Installation guide

Purpose of this guide

This guide outlines the construction procedures and requirements for the installation of the HumeDeck® bridge system. This document should be reviewed by supervisory personnel prior to commencing any HumeDeck® system installation.

This guide is of a general nature only and should be read in conjunction with project-specific documents including the contract, project specifications and project drawings. This guide is not a substitute for the project documentation.

For typical installation requirements please refer to the Humes general assembly standard drawings or Humes project-specific drawings. The Humes drawings contained in this document are system assembly drawings only and do not constitute a site layout; the site layout should be specified in project documents provided by the consulting engineer who has been engaged by the asset owner.

Where the contents of this guide differ from project specifications and drawings, supervisory personnel should consult with a Humes engineer. In the event of any conflict between the information in this guide and local legislative requirements, the legislative requirements will take precedence.

It is the responsibility of the site owner and its contractors and consulting engineers to determine the site's suitability for construction, including access for plant and other issues.

No statement in this guide is to be construed as a guarantee or warranty.

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HumeDeck® modular bridge system

The HumeDeck® bridge system is a modular precast solution for bridges spanning 6 m to 12 m. It is suitable for installation onto an existing or new substructure, or can be combined with precast concrete piles, abutments and headstocks to achieve a total precast solution.

Bottom: HumeDeck® modular bridge system installation including deck units, precast piles, abutments and headstocks

The HumeDeck® bridge system is a cost effective decking system with fast and simple installation and requires minimal maintenance:

- The deck and girders are combined into one unit to enable efficient design and fast and simple installation. The combined deck and girder unit provides a span from 6 m to 12 m.
- Headstocks and abutments are either fixed to piles or bolted to existing piers for faster installation.
- Minimal longitudinal joints reduce installation time and maintenance requirements.
- It is efficient to transport and handle.
- Site work is reduced as post tensioning of units is not necessary.
- The top surface of the HumeDeck® units have a coarse broom finish which can be used as the road surface without the need for additional concrete topping or asphalt surfacing.

The standard HumeDeck® bridge system has a design life of 100 years, in accordance with the Australian Standard – Bridge Design (AS 5100 – 2004).

Bridge units can be designed to meet site-specific parameters and tolerances and can also incorporate cast-in fittings for the connection of different types and classes of barriers. Kerbs can be precast integrally with the HumeDeck® units or manufactured as separate precast units and bolted to the deck units on site.

Other bridge systems

Humes provide a wide range of bridging and platform solutions including precast arches, large box culverts, precast modular beams, planks and decking units, and prestressed concrete bridge components.

The flexibility of Humes' bridge solutions allows for the easy adaptation of standard unit sections, providing a choice of geometric envelopes to meet access and waterway requirements from 2 m to 38 m span.

We pride ourselves on delivering customised solutions to maximize installation, performance, and budgetary outcomes for our clients.

Specifications

HumeDeck® system components

Figure 1 –A complete HumeDeck® system assembly

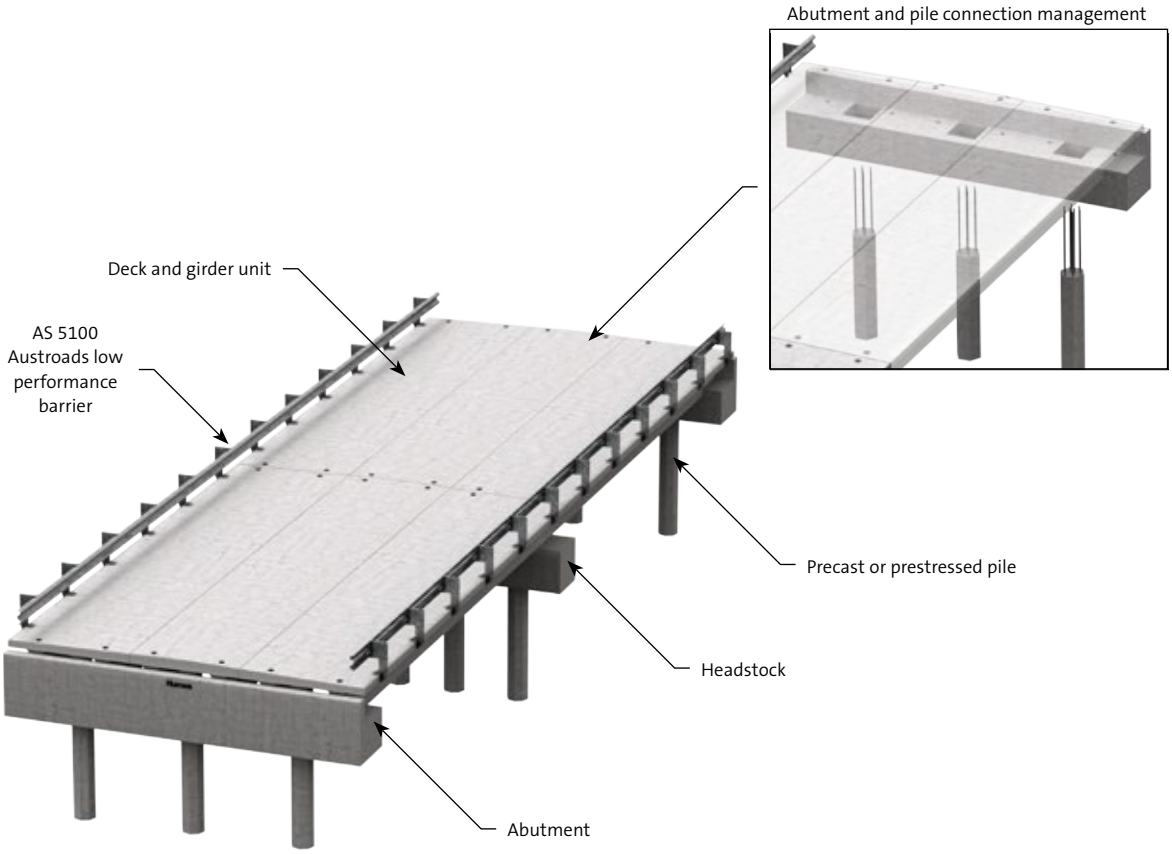


Table 1 – Superstructure components

Deck and girder unit*	• Deck and girders are combined into one unit. • Can be produced in spans ranging from 6 m to 12 m. • Cross-sectional dimensions are dependent upon the span and applied design load. • Maximum unit width is 2,700 mm although additional width can be achieved by using an in-situ joint. • Available with and without kerbing.
Precast kerbs	• The deck and girder units can be manufactured with integral or bolt-on kerbs. While continuous kerbing is applicable to some bridges, standard Humes practice is to have non-continuous, slotted kerbing for ease of drainage. • Kerb segments are typically 1,800 mm in length with a 200 mm block-out between each segment.
Barriers†	• Designed to accommodate a variety of barriers that comply with Austroads and AS 5100 standards including AS 5100 low and regular performance barriers, and jersey kerbs.

Notes:
* Refer to Figures 2 and 3 on page 4 and Table 1.
† Refer to Figure 4 on page 4.

Figure 2 – Typical deck and girder unit cross section

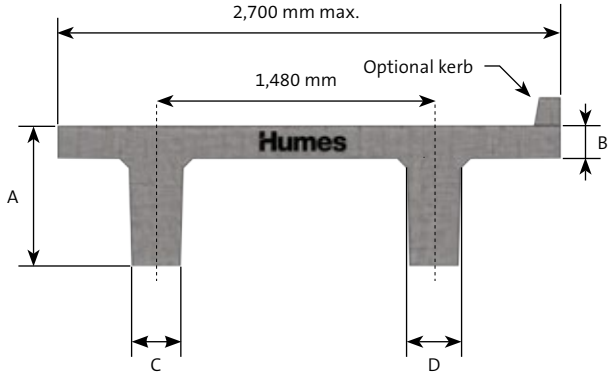


Figure 3 – Cross section detail of a complete HumeDeck® bridge system

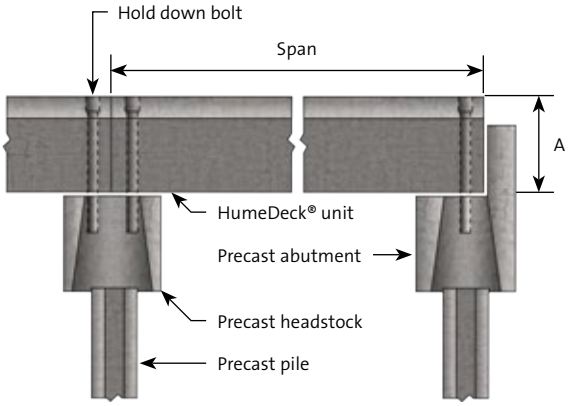


Table 2 – Indicative decks cross-sectional dimensions and masses

Span (m)	A (mm)	B† (mm)	C (mm)	D (mm)	Mass for 2.7 m wide deck* (t)
8	550	150 - 180	280	300	15.41
9	650	150 - 180	274	300	18.60
10	725	150 - 180	270	300	21.74
11	825	150 - 180	264	300	25.40
12	900	150 - 180	260	300	29.03

Notes:
1. Refer to Humes Technical Services for decks spanning more than 12 m.
2. *Mass does not include kerb.
3. †Typical thickness between 150 mm - 180 mm.

Figure 4 – AS 5100 low performance barrier

Table 3 – Substructure components

Piles*	Two types: • Rectangular reinforced concrete piles - measure up to 550 mm x 550 mm wide. Piles can be potted or driven. • Prestressed octagonal piles - measure from 400 mm to 550 mm diameter. Both types are designed to be mechanically joined to meet designated length.
Headstock and abutments†	• Can be installed on newly erected piles or existing piers. • Custom made to fit a variety of traffic profiles and to suit a specific bridge width. • A crossfall can be maintained in one or two directions.

Notes:
* Refer to Figure 5.
† Refer to Figure 6.

Figure 5 – Piles

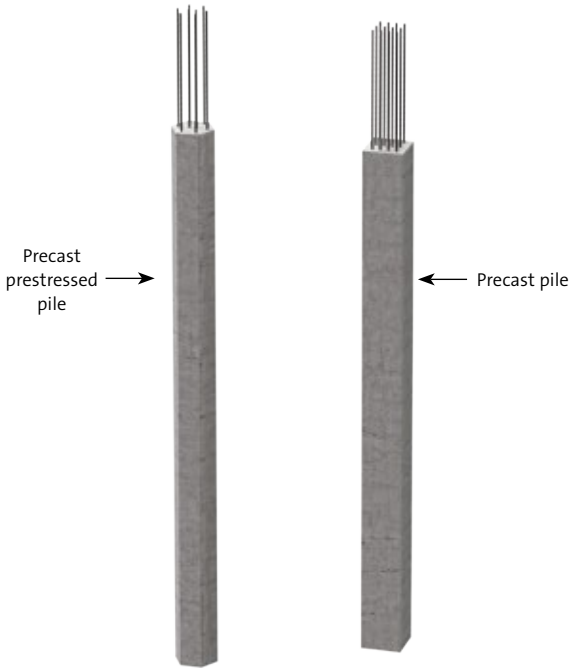


Figure 6 – Abutment

Handling and installation

Safety recommendation

The precast concrete component should only be lifted using the appropriate lifting clutches and from the designated lifting points which are shown in the project-specific drawings. Each deck is fitted with at least four Swiftlift® foot anchors. All lifting equipment must be certified to lift the specific mass and approved for lifting heavy componentry.

The mass of the HumeDeck® units vary depending on its geometry; weights will be clearly marked on the precast units and in the relevant project drawings.

All lifting and placement must proceed with caution and strictly in accordance with all relevant occupational health and safety standards. Bumping or impact with abutments and piers can cause damage and should be avoided.

The advice in this publication is of a general nature only. Where any doubt exists as to the safety of a particular lift or installation procedure, seek the guidance of a professional engineer or contact Humes for general advice. Humes supply a lifting diagram as part of our standard drawings.

Safety requirements and regulations must be observed during transportation, handling, storage and installation of HumeDeck® units. It is the responsibility of the contractor installing HumeDeck® units to produce a Safe Work Method Statement that complies with relevant law, codes of practice, standards and safety regulations.

Pre-delivery

To ensure the safe and efficient installation of the HumeDeck® bridge system it is important to undertake sufficient planning prior to its arrival on site.

Specific tasks, responsibilities and equipment requirements are outlined in Appendix 1, Installation check list. These items should be addressed prior to delivery of the HumeDeck® units.

Site meeting

A site meeting can be arranged one to two weeks prior to delivery and installation to delegate responsibilities and discuss constraints and special considerations. It is suggested that representatives from the main contractor or installation contractor, the crane company, and Humes should attend a site meeting.

Delivery

The rate of delivery should be decided by the main contractor or installation contractor in consultation with Humes; this will be dependent on issues including:

- on-site access
- crane size and reach
- transport availability
- site traffic control
- nominated project time.

Humes recommend the development of a shipping plan to document the sequence, date and delivery time of each HumeDeck® unit. This will provide better management of transport access, carriage, and on-site materials.

Top:
Placing a deck and girder unit onto an abutment

Middle:
HumeDeck® unit lifting process

Opposite page:
Installed HumeDeck® system

Lifting

All the precast units are supplied with Swiftlift® cast-in lifting anchors to enable safe handling. To prevent stress and possible concrete cracking, all units must be handled using the cast-in lifting anchors and appropriately sized lifting clutches. If the contractor does not have his own lifting clutches they can be obtained from the crane contractor or hired from an approved supplier. It is the installation contractor's responsibility to ensure the correct sized lifting clutches are available on site.

The lifting points and size of lifting anchors are clearly shown on Humes drawings. A minimum four point lift is required at all times with a minimum sling angle of 60° to the horizontal (refer to Figure 8). Use a proper link connection to ensure a four point lift.

The precast deck will be transported in a horizontal position (refer to Figure 7). Wherever possible, all modular components should be lifted from the delivery truck and set directly onto the prepared substructure. However, if temporary site storage is necessary, the deck units can be stored on firm leveled ground on hardwood timber bearers. A minimum number of two bearers should be used underneath the location of the lifting anchors (refer to Figure 9). If the ground is suitable, a maximum of two decks may be stacked with hardwood timber bearers in between.

Figure 7 – Deck transport

Figure 8 – Deck lifting

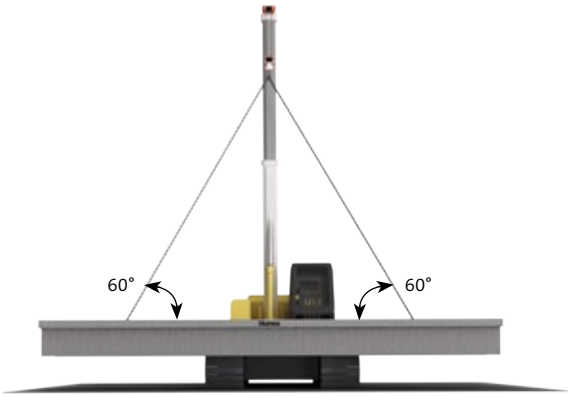
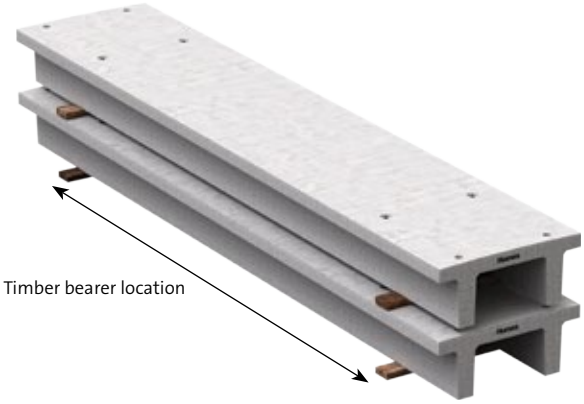


Figure 9 – Deck stacking



Bridge installation

The HumeDeck® system is typically installed as follows:

1. Install and position piles.
2. Place headstocks and abutments.
3. Install hold down bolts.
4. Attach elastomeric pads.
5. Place and secure deck to the headstock and abutments.
6. Complete deck jointing (if required).
7. Place and fix barriers, rails and kerbs.

Critical dimensions

As a modular bridge system, the efficiency of installing the superstructure components will depend on the accuracy of the substructure installation.

It is important to understand the critical dimensions that need to be observed during installation of the bridge components (refer to Figure 10).

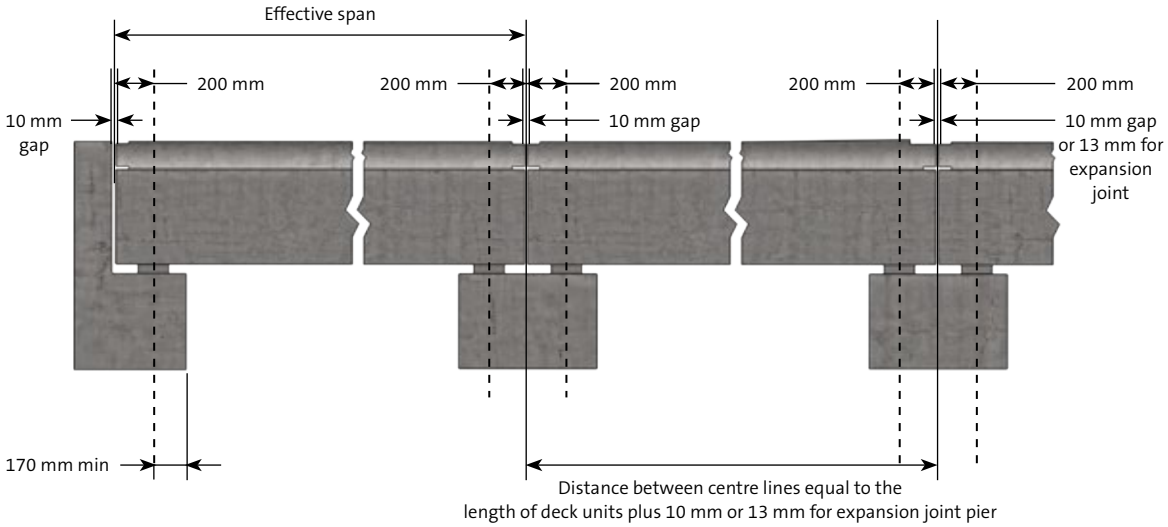
- **Pile location**
  The distance between the centre lines of the head of the piles should be equal to the length of the deck units plus 10 mm (or 13 mm for expansion joint pier). A tolerance of +-75 mm (unless noted otherwise) in any direction for the head of each individual pile, has been built into the geometry of the Humes precast headstock/abutment.
- **Headstock and abutment**
  The superstructure is fixed to the abutment and headstock using hold down bolts. Their positions, the void former in the deck units and the recess in the headstock and abutment, are predetermined and set as part of the design and prefabrication process and specification.

Critical dimensions are defined as follows although always refer to project-specific drawings for exact dimensions:

- The recess location in existing headstocks/abutments:
  – The following critical dimension to receive hold down bolts must be observed: the recess in the headstock abutment should not be less than 170 mm away from the front edge (unless otherwise shown on the drawings).
- The location of precast headstocks/abutments:
  – The distance between the centre lines of the headstock should be equal to the length of the deck units plus 10 mm (or 13 mm for expansion joint pier).

In addition, the flatness and squareness of the headstock and abutment are important to maintain during the installation process.

Figure 10 – Longitudinal cross section showing critical dimensions



Install and position piles

Top:
Temporary steel support brackets attached to piles

Bottom:
Formply placed over steel bracket

Pile installation is not managed by Humes. Humes is not responsible for any cost or possible construction delay if the head of any pile is not within tolerance. Drive or pot the piles to the required set.

Piles are installed in the following procedure:

1. Check and approve the location of the piles by survey prior to installing the headstock or abutment. A tolerance of +-75 mm (unless noted otherwise) in any direction for the head of each individual pile, has been built into the geometry of the headstock/abutment (refer to pile location on page 8).
2. Expose the pile head reinforcement.
3. Cut back the concrete at the pile head to a level 75 mm above the soffit of the headstock/abutment.
4. Trim the pile longitudinal reinforcement to the projection bar length nominated on the project drawing.
5. Fix the support steel brackets around the piles; these brackets are temporary and are designed to support the headstock/abutment during installation, and should be retained in position until penetrations in headstock/abutment have been concreted, and concrete reaches at least two thirds of its specified strength (refer to bracket fixing procedure, Appendix 2).
6. Fully fasten the brackets to the specified torque, and check the position and level of each bracket as it will affect the level of headstocks/abutments.
7. Place formply over the steel bracket and around the pile in order to contain the grout; this will be held in position when placing the headstock/abutment. The thickness of the timber former should be considered when determining the bracket level.
8. Seal the gap between the bracket and the pile to prevent grout leaking out during headstock/abutment void filling.

Place headstocks and abutments

1. Lift the headstock/abutment into place on top of the piles using its designated lifting points.
   a) The headstock/abutments are designed to suit the specific size and number of piles required for the project. Penetrations through the headstock/abutments are of a number and size to receive the relevant pile head +-75 mm. The penetration is smaller at the top of the headstock/abutment.
   b) Reinforcement bars act as a potential safety barrier, running the length of the headstock/abutment, past the penetration and over the piles. These reinforcement bars should not be trimmed or bent.
   c) In the event of any clash between headstock/abutment bars and pile bars, please contact Humes Technical Services to review the products integrity.
2. Check location and levels and use steel shims to adjust if required.
3. Check the location, alignment and level of the headstock/abutment before placing concrete.
4. Fix/adjust reinforcement within penetrations.
5. Place and vibrate concrete/grout in penetrations. Refer to project specific drawings for the concrete/grout properties.
6. After concrete has reached two thirds of its nominated 28 day strength, remove the bracket and temporary former (refer to project specific drawings for concrete specifications).
7. After installation, mark the headstock and abutments with the centre of each deck. Also mark the ends of each deck unit to assist in aligning the decks during installation.

Top and bottom: Placement of headstock/ abutments onto piles

Install hold down bolts

Top:
Fixing the hold down bolts prior to installing the deck

Bottom:
Greased polyethylene sleeve slid over hold down bolt

Hold down bolts can be installed in headstock/abutments either before or after installing the deck. Humes recommended installing the hold down bolts before installing the deck.

The hold down bolts are fixed into the abutments/headstock using a grout (refer to project specific drawing for grout details):

1. Ensure all loose debris is removed from formed holes and recesses. For existing abutment/headstock, locate the position of hold down bolts and core/form to the diameter and depth specified in Humes drawings.
2. Mark the bottom of the hold down bolts indicating the depth of the bolts that required to be inserted into formed holes. Refer to Humes drawings for the mark position.
3. Unclamp the hold down bolt and partially lower the bolt into the formed hole to the marked level until the bolt is accurately located in the recess.
4. Fill the formed hole in the headstock/abutment with the specified grout and move the bolt up and down to eliminate air pockets in the grout. Ensure that the grout is well compacted and the final position of the down bolt is perpendicular to the abutment/headstock.
5. Attach elastomeric pads (refer to instructions on page 13).
6. Grease and slide the polyethylene sleeve conduit over the hold down bolt.
7. Place and secure the deck to the headstock and abutment.
8. Fill the formed hole in the deck unit with the specified grout.
9. Leave the grout to cure (undisturbed and with no vehicle loadings on the deck) until it reaches the specified compressive strength which is usually a minimum of 50 MPa.
10. Fit plate washer and nut and fill the recess at the top of the bolt with the specified grout. Alternatively, this recess can be filled with an elastic filling material.

Attach elastomeric pads

Two different types of elastomeric pads are used:

- Regular - 230 mm x 150 mm x 35 mm for standard joints; and thicker pads.
- 230 mm x 200 mm x 57 mm or 230 mm x 200 mm x 79 mm for use at the expansion joint.

The pad size will be determined by the size of the deck.

The pads will have a DN35 mm hole centrally located. The pads will be placed on the hold down bolts and fixed in position. As the pads may dislodge during transport, it is a requirement that they are attached on site.

To fix the elastomeric pads:

1. Glue the bearing pads centrally over the voids (100 mm diameter recess) through the hold down bolts in the headstocks and abutments. Glue must not react with the elastomeric material.
2. If necessary, place a small area of grout, the size of elastomeric bearing pads, at the marked locations. This grout will be set to an accurate level related to the underside of the bearing pad.

Place and secure deck to the headstock and abutments

Read these instructions in conjunction with the project's general assembly drawing.

An edge deck should be installed first, followed by the mid unit(s) (depending on the configuration), then the far edge unit. For multi-span bridges, installation should continue from one side to the other. Avoid starting from mid-spans:

1. Install safety rails after installing the first span. Cast-in ferrules can be used for the temporary installation of the safety rail.
2. Backfill the abutments prior to grouting the hold down bolts.

Top:
Placement of elastomeric pads

Bottom:
Ready to install decks

Complete deck jointing (if required)

Top:
Longtiudunal joint being formed

A longitudinal joint is formed where multiple units are placed adjacent to each other to provide the required carriageway width. The longitudinal joint may be a butt joint or an in-situ joint.

- **Butt joint:**
  This is the most common deck joint due to its ease of installation. This joint type has a nominal 10 mm gap between units which may be either sealed with a flexible sealant, or left open. Humes recommend sealing the joints to keep out solid objects like stone. The sealing process will prevent spalling of the concrete surface.
- **In-situ joint:**
  The in-situ joint is a reinforced concrete joint poured on site, after deck units have been placed. The joint provides a continuous concrete running surface across the width of the bridge and may be constructed using various methods.

Figure 11 – In-situ joint detail

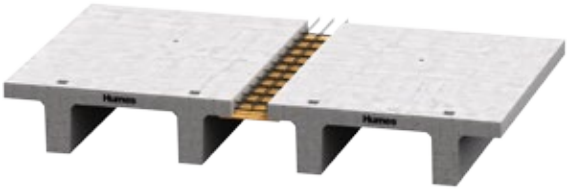
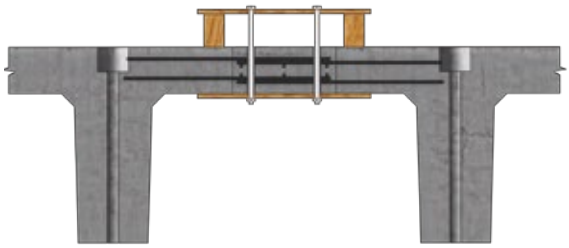


Figure 12 – Plywood formwork for in-situ jointing



The following method is recommended by Humes however specific work instructions remain the client's and/or contractor's responsibility:

1. Place 20 mm thick plywood formwork to the underside of the joint location (refer to Figure 11). Plywood formwork can be avoided for webs 180 mm or thicker. A recess in the deck flange can be designed to form the in-situ joint.
2. Place timber or steel beams laterally across the joint.
3. Bolt the timber through the joint to the underside of the formwork beams (refer to Figure 12).
4. Fit the supplied longitudinal steel reinforcement as shown on the project drawings.
5. Clean all surfaces within the joint.
6. Prime the edge of the HumeDeck® units with a suitable bonding agent (AV 600M or equivalent).
7. Cast with 50 MPa concrete (or as specified on the project drawings) with a maximum aggregate size of 14 mm. The concrete must be well compacted (vibrated) and cured in an appropriate manner to achieve the specified strength. No traffic should traverse the completed bridge until the in-situ concrete has reached the specified strength.

Place and fix barriers, rails and kerbs

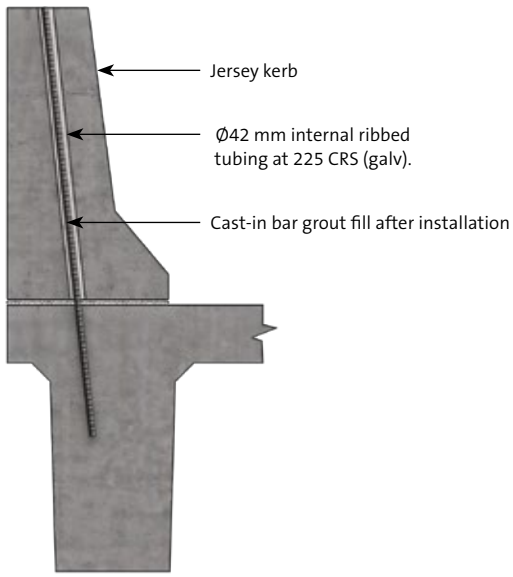
Concrete barrier fixing

1. Align the ribbed tubing with the cast-in starter bars and slowly drop the barrier over the starter bars (if required use a 10-20 mm thick mortar bed to ensure barriers are level), refer to Figure 13 and 14.
2. Once barriers have been located into place fill the ribbed tubing (from the top of the barrier) with 50 MPa grout.
3. Recheck the level of the grout and refill if required.

Top and bottom: Fixing concrete barrier onto deck

Figure 13 – Concrete barrier fixing

Figure 14 – Concrete barrier fixing cross section



Rail barrier fixing

If ordered, HumeDeck® units are supplied with the appropriate steel brackets, ferrules and holes for hold down bolts required for fixing non-concrete barriers. Cross section details of these fixing arrangements are shown in Figures 15-19. Refer to barrier supplier and the road authority standards for fixing details.

Figure 15 – Austroads level 3 barrier fixing

Figure 16 – Low and regular performance barrier fixing

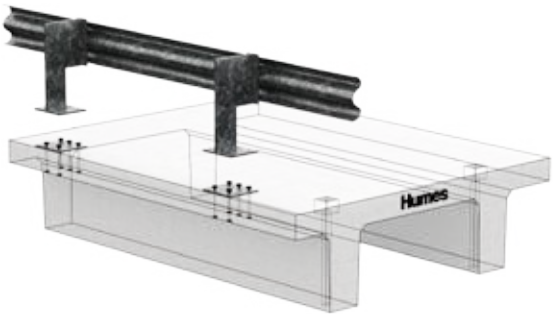


Figure 17 – Low performance barrier fixing cross section

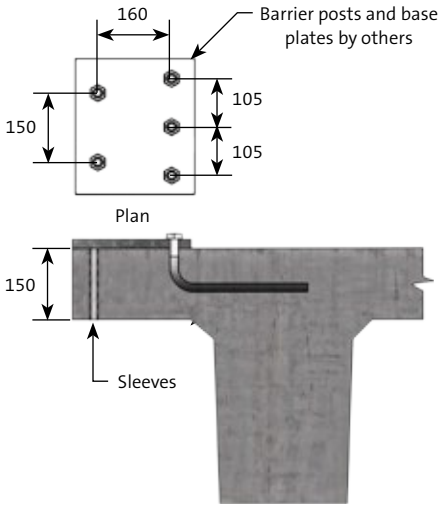


Figure 18 – Regular performance barrier fixing cross section

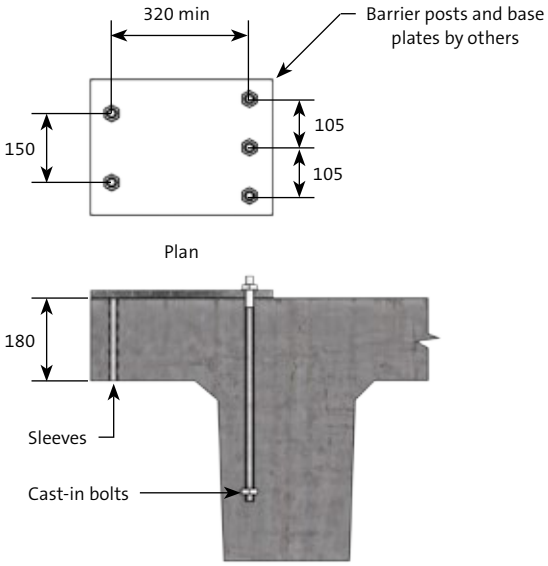
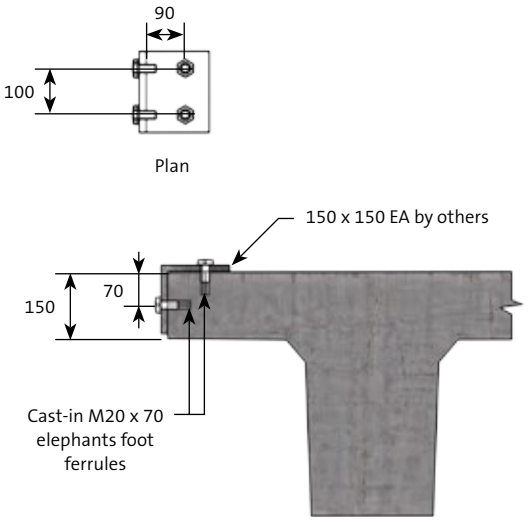


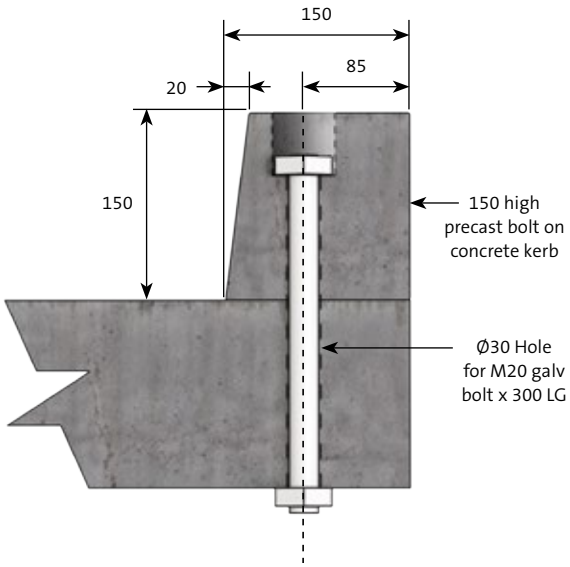
Figure 19 – Austroads level 3 barrier fixing cross section



Kerb fixing

Wide kerbs (150 mm) can be cast integrally with the deck units or as separate precast units and bolted to the deck units on site (refer to Figure 20 below).

Figure 20 – Kerb fixing into deck



Appendix 1 – HumeDeck® bridge system installation check list

Project.....

Client.....

Location.....

	Modular components	Number of units	Approximate mass
Super structure	Deck units with kerb		
	Deck units without kerb		
	Traffic barriers		
	Precast kerbs		
Sub structure	Abutment		
	Headstock		
	Rectangular piles		
	Hexagonal piles		

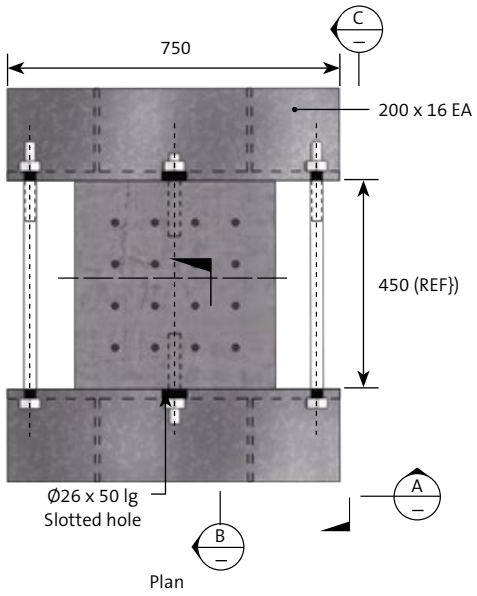
	Requirement	Action
Site preparation and delivery	Ensure site access is suitable for trucks and cranes.	Customer
	Organise HumeDeck® units to be delivered to site in sequence and quantities to suit erection.	Customer/Humes
	Have hardwood timber bearers available for stacking of precast units.	Customer/Crane company
Lifting equipment	Organise Swiftlift® lifting knuckles and appropriate lifting equipment including running snatch blocks for:	Crane company
	Approved lifting knuckles required:	
	Check all component unit lifting points with lifting knuckles before units leave factory.	Humes

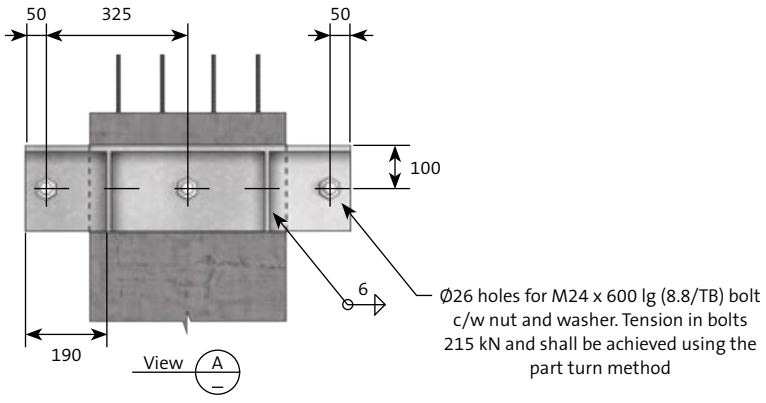
Product	Length (m)
Unloading and installing the decks.	
Unloading and installing the abutment and headstock.	
Unloading and installing the precast piles.	

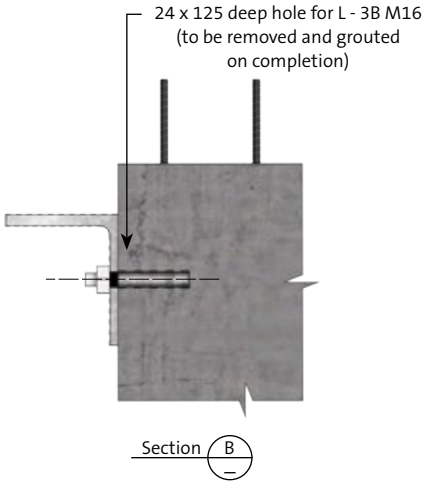
Size (capacity)	Number required
10 tonne	
20 tonne	

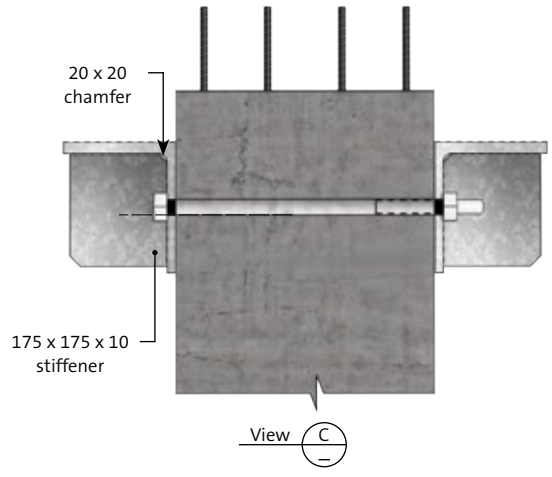
<table>
<tr><td rowspan="10">Installation requirements</td><td>Elastomeric pads:
<table><tr><th>Size</th><th>Per deck</th><th>Total</th></tr><tr><td>230 x 150 x 35</td><td></td><td></td></tr><tr><td>230 x 200 x 79</td><td></td><td></td></tr><tr><td>230 x 200 x 79</td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></td><td>Customer</td></tr>
<tr><td>Hold down bolts and polyethylene sleeve:
<table><tr><th rowspan="2">Grade
(4.6 X/S)
(8.8 X/S)</th><th colspan="2">Size</th><th rowspan="2">Per deck</th><th rowspan="2">Total</th></tr><tr><th>ø</th><th>Length</th></tr><tr><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table></td><td>Humes</td></tr>
<tr><td>Provide abutment/headstock support steel brackets and fixing bolts</td><td>Customer</td></tr>
<tr><td>Provide a 3 mm plywood sheet for placement around the piles to avoid direct contact between the concrete elements and the steel bracket.</td><td>Customer</td></tr>
<tr><td>Provide birk bars for holding pads in position and adjusting a guiding units installation.</td><td>Customer</td></tr>
<tr><td>Provide miscellaneous levelling PVC or steel packers for levelling. Size to suit pads, of varying thickness 1 mm, 2 mm, 5 mm, 10 mm.</td><td>Customer</td></tr>
<tr><td>Provide stepladders on site to access lifting knuckles when unloading and unhooking arches, and extension ladder access top of arches during erection.</td><td>Crane company</td></tr>
<tr><td>Provide two chain blocks (2-3 tonne) complete with 4-6 metre soft slings normally carried by cranes. These are for pulling top arch joints together and/or to level and adjust units as required.</td><td>Crane company</td></tr>
<tr><td></td><td>Provide theodolite, stringline or plumb bob for the alignment of abutments, headstock and decks.</td><td>Customer</td></tr>
<tr><td rowspan="6">In-situ longitudinal joint</td><td>Grout and seal joints.</td><td>Customer</td></tr>
<tr><td>Provide material for sealing of joints.</td><td>Customer</td></tr>
<tr><td>Provide longitudinal bars for cast in-situ joints.</td><td>Humes</td></tr>
<tr><td>Form and place in-situ joint (usually 20 mm thick plywood formwork to the underside of the joint location).</td><td>Customer</td></tr>
<tr><td>Provide supporting timber or steel beams for lateral placement across the joint.</td><td>Customer</td></tr>
<tr><td>Provide bolts and nuts for fixing timber through the deck to the underside of the formwork beams.</td><td>Customer</td></tr>
</table>

Appendix 2 – Bracket fixing procedure









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