Humes

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3-PIN ARCHES INSTALLATION GUIDE

TECHNICAL REFERENCE FOR 3-PIN ARCHES

ISSUED BY HUMES

National Sales
1300 361 601
humes.com.au

A MEMBER OF HOLCIM GROUP

Contents

Introduction

This guide outlines the construction procedures and specifications required for installation of Humes 3-pin (two-piece) concrete arch systems.

Humes 3-pin concrete arch systems have no in-situ top joint. The 3-pin arch profiles are shown in Appendix 1.

This guide is not relevant to the installation of one-piece and classic two-piece arch systems. A separate installation guide should be referred to for these types of systems and Humes can supply copies of these documents on request.

Prior to commencement of any project, all supervisory personnel should carefully review this guide.

Reference should be also made to Humes 3-pin arch system General Assembly Standard drawings for typical installation requirements or project specific drawings for General Assembly prepared by Humes engineers. Note that Humes drawings are system assembly drawings and do not constitute a site general layout which is provided for and specified in the owners consulting engineers project documents.

This guide should be read in conjunction with the specific project contract documents. Where the contents of this guide differ from the contract documents, the requirements of the contract documents will govern. Supervisory personnel should however consult with Humes engineers where differences between the project contract documents and this guide are identified.

The information presented in this guide is for general construction purposes only. Applications of the 3-pin concrete arch systems and the specific data for each installation must be evaluated by the owner or their consulting engineer to determine site suitability, possible site access problems for plant, and other constructability issues.

In the event of any conflict between information in the guide and local legislative requirements, that legislative requirements shall take precedence.

Statements in this guide are not to be construed as either guarantees or implied warranties. Satisfactory adherence to this guide will not discharge the contractor from the contractual requirements of the project.

Recommendation

The main contractor/erection contractor should also produce a safe work method statement specifically for the erection of the arch structure.

In the planning stages for the footings and erection a shopping list (See Appendix 2 for a sample) should be prepared and then amended to be project specific at a pre-erection meeting held on site one to two weeks prior to erection.

This meeting should be attended by the main contractor/erection contractor, crane company and Humes to discuss the shopping list, safe work method statement and carry out a site inspection.

Humes Site Representative

Right:
Humes site representative observing installation

A Humes representative can be made available to assist with planning the erection processes and at the construction site during the installation.

The responsibilities of this representative are to provide advice on the installation of the 3-pin arch systems and to act as an observer on site. If he/she observes any incorrect or unsafe practices, these will be immediately drawn to the attention of the installation contractor's site supervisor for his/her action.

The Humes representative is not responsible for enforcement of the contract document requirements, or for the quality of the work performed by the installation contractor.

In-Situ Footings

Reinforcement and Concrete

1. Reinforcement should conform to AS 4671.
2. Concrete should be a minimum Grade N40 to AS 1379.
3. Cover to reinforcement for all in-situ work shall be in accordance with AS3 600 Concrete Structures or AS 5100 Bridge Design as appropriate.
4. All grout for arch keyway and wing wall dowel holes shall be 50 MPa.

- Minimum cement content – 500 kg/m^3.
- Maximum aggregate size – 7 mm.
- Alternatively use bagged proprietary grout.

General Construction Procedure

Excavation

Prior to any excavation work, all underground service conduits must be located and precautions taken to protect them.

The systems in-situ footings are typically shallow strip footings with supporting piers or piles spaced along its length. Deep excavations for in-situ footings are not common however where these occur care should be taken.

It is recommended that a suitably qualified geotechnical engineer inspects the open excavation and that any discrepancies between soil properties and those assumed in the design are reported to the superintendent for evaluation.

Construction

Construction of the in-situ footings for arch, spandrel and wing walls is in accordance with the owner's consultant engineer's contract documents.

Where light duty wing walls are specified, a supporting in-situ concrete footing with provision for cast-in galvanised dowels is required. As a minimum 4No. N20 bars protruding vertically out 250 mm above the in-situ concrete footing is recommended. The light duty wing wall footing must be cast integral with the arch strip footing to eliminate the possibility of differential movement between the first adjacent wing wall and the supported spandrel wall.

Left:
Footings and shim blocks in place

Levelling Pads Shims and Shim Blocks

To ensure that arch units are laid on a level foundation and uniformly supported along the unit length, a 50 mm nominal allowance is provided between the underside of arch base and the level of the base of the footing keyway for a 400 mm long 50 MPa grout pad or placing of compressed sheeting packers 400 mm x 300 mm supplied by the installation contractor. Width and depth of keyway also provides an allowance for precast shim blocks (supplied by Humes) and are placed at the same RL as that of the 400 mm x 300 mm leveling pads (paving bricks or hard PVC plastic shims are good to sit the shim blocks on).

Tolerances and Critical Dimensions

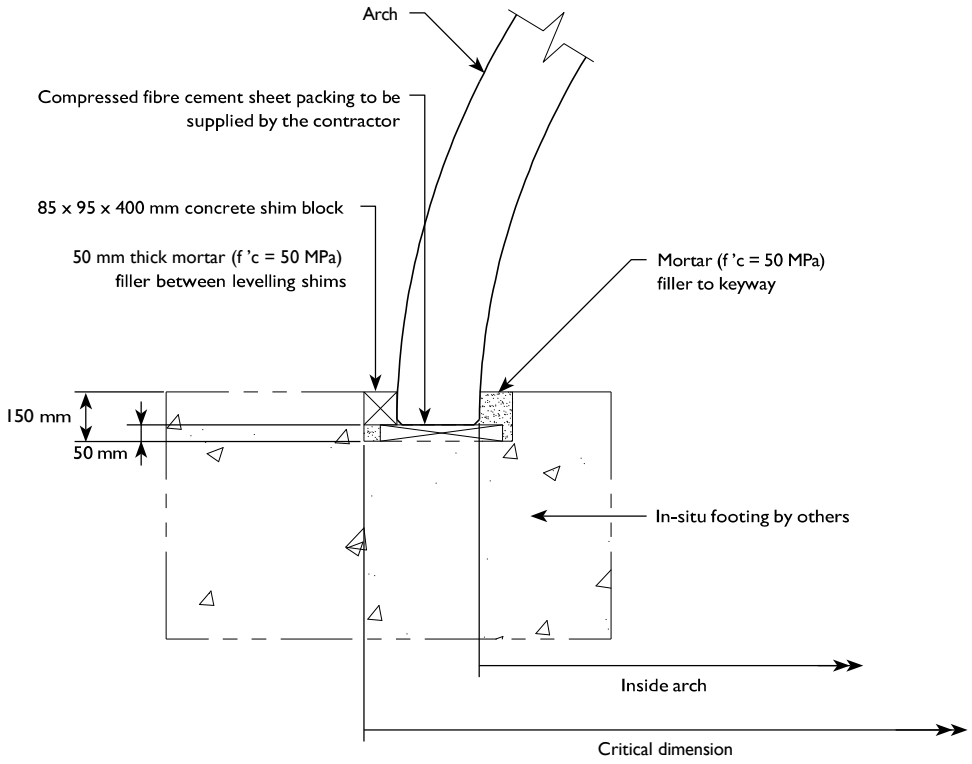
All in-situ work should generally be in accordance with the requirements of AS 3600 Concrete Structures or AS 5100 Bridge Design as appropriate for quality of workmanship and materials and for tolerances on design dimensions and reinforcement placement. In addition to these general requirements special care should be taken in forming three critical areas in the arch foundation.

These areas are:

- the horizontal alignment of the arch keyway,
- the level of the arch keyway,
- the critical dimension to the span control points.

Figure 1 shows the critical dimension location and the actual dimensions for each size arch are shown on the Humes General Assembly drawings.

Figure 1 – Critical dimensions and control points



Scour Protection

In most instances where the arch structure is exposed to scouring either during the construction period or in finished operation it is essential that the works be protected.

In particular where in-situ footings are designed and specified as strip footings without supporting piers or piles, it is critical for the systems structural stability that the integrity of the footing foundation be protected against degradation from the effects of surface
water flows.

The final surface treatments for scour protection to in-situ footings and bed of stream are specified by the site layout design in the owner's consultant engineer's contract documents.

Drainage

The design of the 3-pin arch system makes no allowance for hydrostatic pressure due to entrapped ground water. It is therefore an essential part of the design that the structure be adequately drained.

Since all element joints within the systems are unsealed butt joints, the free release of ground water occurs at the structure/soil interface. In instances where it is necessary to prevent ingress of water into the arch structure the joints between elements will need to be sealed to prevent water flows and for these cases it is essential that the design include soil drains in the backfill.

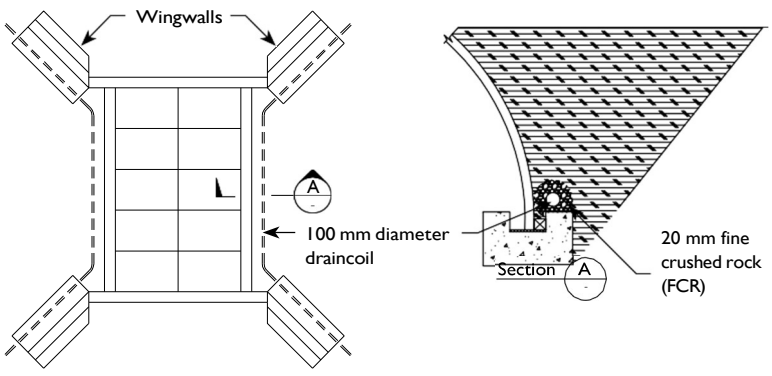
Where the arch structure is located within a tidal zone or within a frequently rising and falling water table, the Zone B backfill material must be enclosed within a suitable filter fabric to eliminate the movement of fines either into or from the placed and compacted Zone B material. Consideration should also be given to the provision of weep holes in the arch units which should also be covered with fabric to prevent loss of fines material.

Left:
Arch structure spanning a waterway

When the 3-pin concrete arch system is used as a tunnel on an incline it is suggested that floor sumps be incorporated into the tunnel to catch any water and then have it pumped away.

Note that the arch structure is designed to act as a soil/ structure model. The specified quality and compaction of the backfill surrounding the arch can be adversely affected by groundwater flows and with some materials their supporting strength can be lost in the presence of excess soil water. As a minimum requirement, the suggested drainage lines are shown in Figure 2 below.

Figure 2 – Suggested drainage lines



Handling of Precast Arch System Elements

General

Top:
Arch units stacked in “as delivered” position

Bottom:
Unloading a multiple unit delivery

Wherever possible, all system elements should be lifted from the delivery truck and set directly onto the prepared footings. However, if circumstances are such that temporary site (or near site) storage of arch units is necessary, ensure that arch units are stored in the “as delivered” position on hardwood timber pads and on level firm ground. The location and number of these pads around the arch perimeter must be the same as those positioned on the delivery truck and illustrated on next page.

All precast units are supplied with cast-in lifting anchors for handling. To ensure that the units are not over-stressed which could result in possible concrete cracking, all units must be handled using the cast-in lifting anchors fitted with lifting clutches. These lifting clutches can be arranged through the crane contractor or the supplier and it is the installation contractor’s responsibility to ensure that they are available on site.

It is possible to transport more than one unit per truck if unit weight and shape permits.

Storage and Transportation

Arch Elements

Store and transport only in the vertical position, i.e., perpendicular to the final position, as shown in Figure 3 below.

Figure 3 – Arch unit transportation

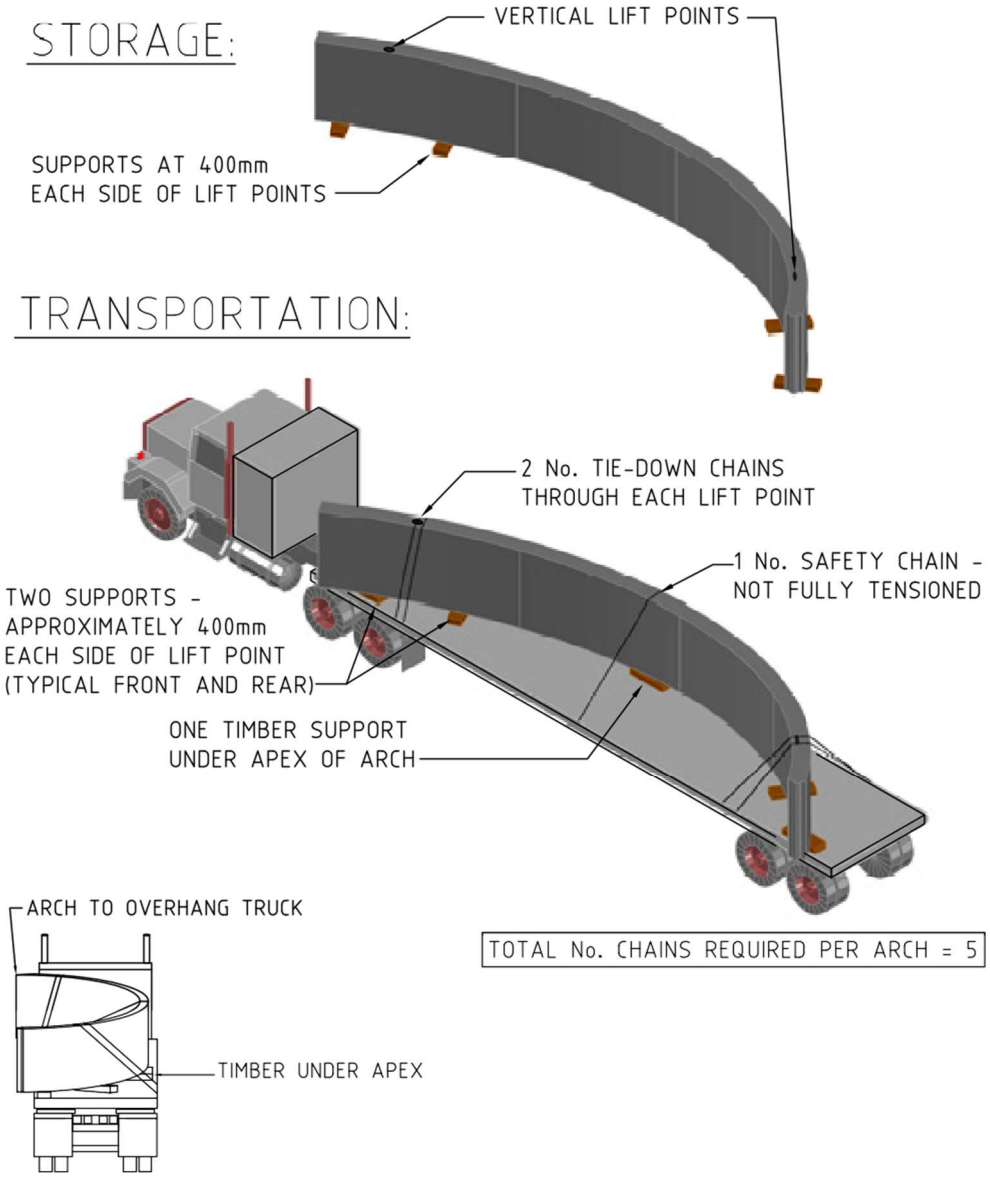
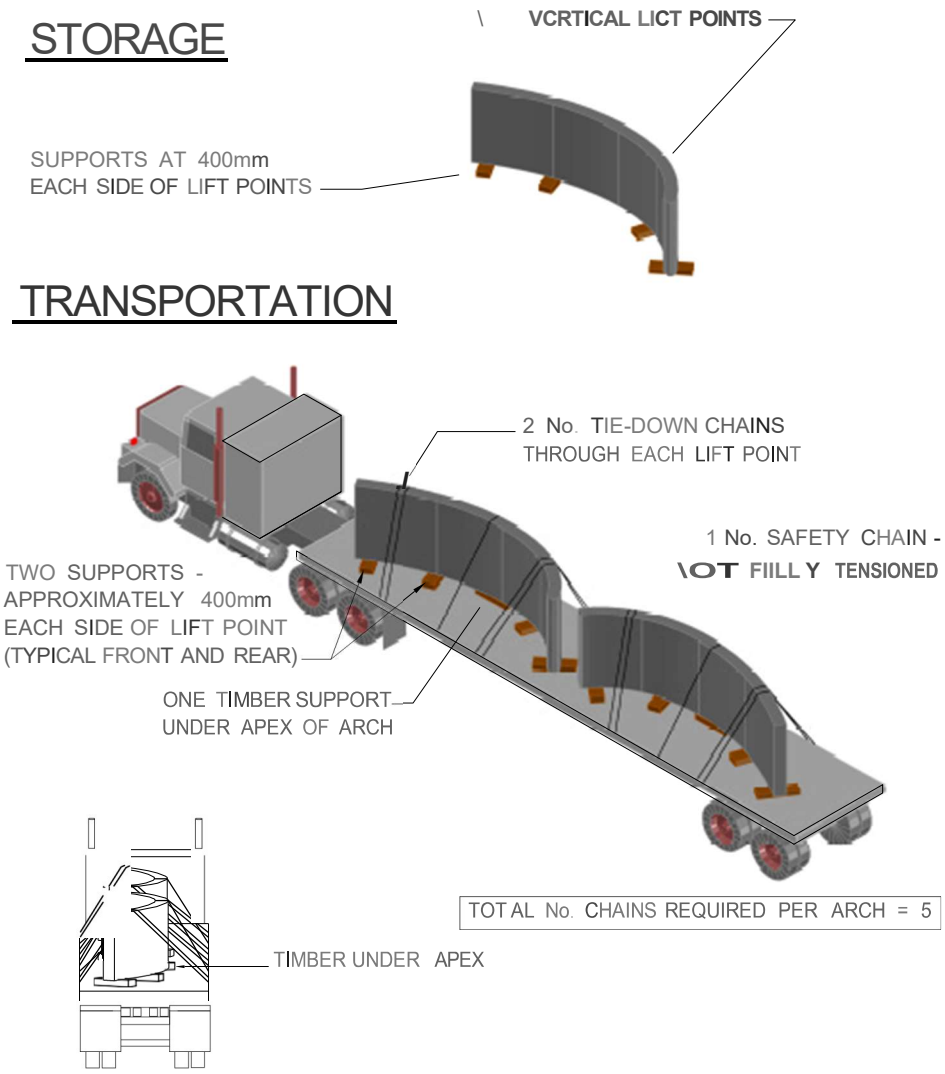


Figure 4 – Arch unit transportation (multiple units)



Spandrel and wing walls

Both spandrels and wing walls are transported horizontally except for small wing walls which may travel upright as shown in Figures 5 and 6 respectively.

Figure 5 – Spandrel transportation (multiple units)

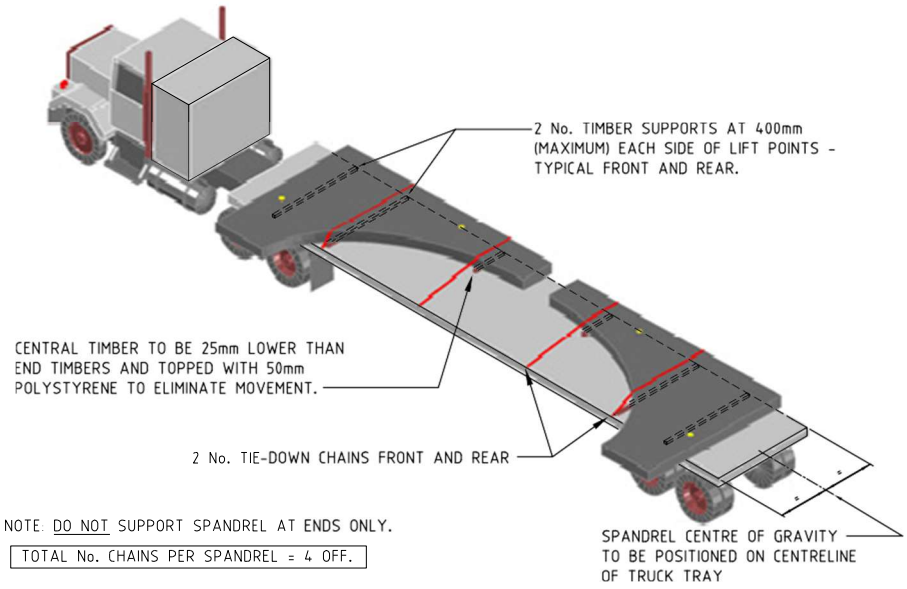
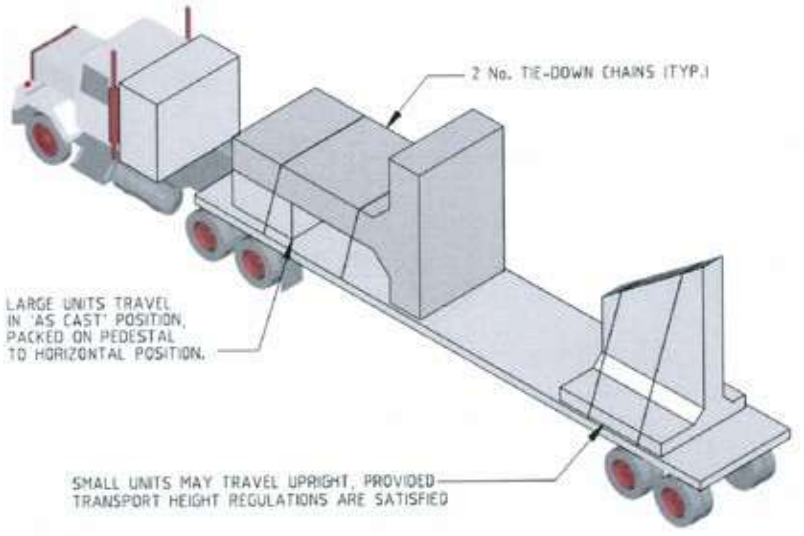


Figure 6 – Wing wall transportation (multiple units)



Erection of Precast Elements

Arches

Lifting Equipment – Cranes

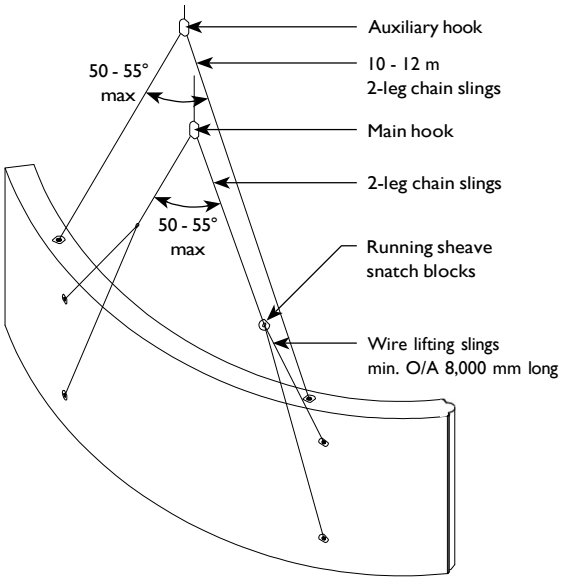
The crane contractor is to supply all erection tackle and cables as outlined in the sample shopping list (Appendix 2) necessary to install the 3-pin concrete arch structure. It is necessary when erecting 3-pin concrete arch structures that two cranes capable of individually lifting each unit and turning them into the erecting position are used.

It is the responsibility of the contractor to ensure that cranes with the correct lifting capacity to handle each unit are available. Field conditions should be checked and overhead power lines located well in advance to ensure proper crane location and to avoid any lifting restrictions.

Erection

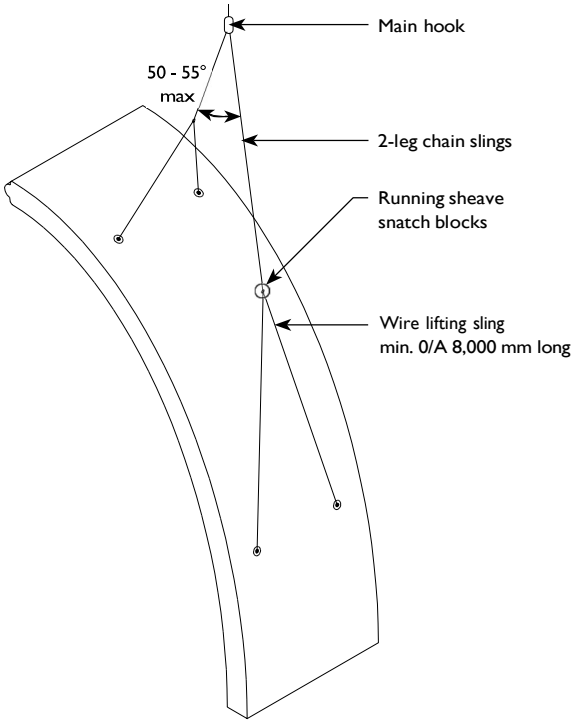
Initially the arch units are lifted vertically using the edge lifters and sling assemblies as shown in Figure 7. The rigging is attached to the arch units using anchors and lifting clutches. To rotate the arch unit, the rigging shown in Figure 8 is used.

Figure 7 – Arch element lifting sling connection



Top:
Arch units being lifted from truck

Figure 8 – Rotated arch unit



Notes:
- Sling lengths calculated at 50 - 55 degrees + 1,500 mm.
- Snatch block slings to be min. O/A 8,000 mm in length.

Top:
Shim block and leveling pads in place (positions marked with paint)

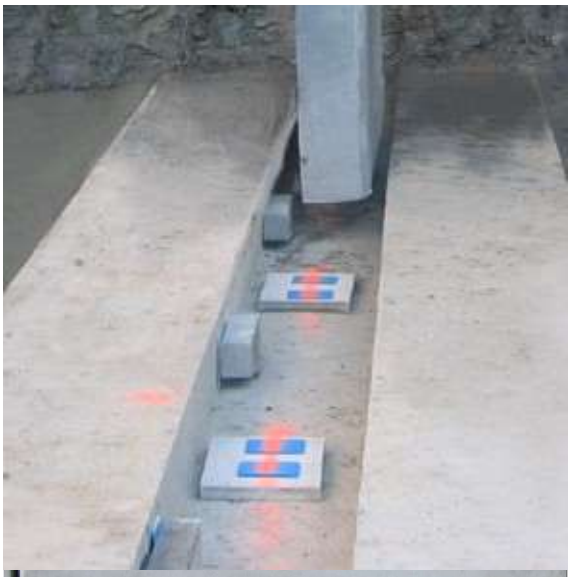
Bottom:
Use of packers to accurately space arches

Next the bridge setout is done and it is strongly recommended that all survey, the setout and placement of leveling pads for arches, spandrels and wingwalls and placement of shim blocks be carried out prior to erection day.

Concrete shim blocks are 85 mm wide x 95 mm thick x 400 mm long and are supplied with all Humes arc systems and are used to prevent lateral spreading of the arches at the base supports after being placed. (For a diagram showing shim block installation, see Appendix 4) First place a shim block 95 mm away from the outside vertical face of the keyway at each end of the footing on the already leveled PVC packers. For the 3-pin concrete arch system the concrete shim blocks are positioned on the hard PVC packers (100 mm x 150 mm) and on the same RL as the leveling packers and equally spaced (eg. on the centre of "arch" between the arch leveling packers (400 mm x 300 mm) that the arches actually sit on.

Then stretch a string line the length of the footing across the vertical face of the shim blocks in the arch keyway and align all the internal shim blocks in their respective positions and on the hard PVC shim packers to the string line, fine tuning once again with the hard PVC shim packers if required. This line will mark the arch outside span for one side of the footing. Carry out the same procedure on the opposite side footing but first set the two end shim blocks at the specified arch outside span shown on the drawings before string lining along the footing.

If necessary the shim blocks can be rotated and again shimmed with additional hard PVC packers to align the face of the block with the outside span of the arch shown on the contract drawings.



The first arch sits on one set of leveling packers (400 mm x 300 mm) at the start end and thereafter each arch shares approximately 200 mm each of all the intermediate arch leveling packers set at the required RL and at the centerline between two arches along the length of the footing.

Each crane then places its arch onto the leveling packers, hard up against the vertical face of the shim block and then positioned relative to the joint centerline marked on the back face of the keyway. Before lowering the arches to the jointing position, softwood timber wedges are placed by hand opposite the shim block against the inner arch face and inner face of the keyway and lightly secured to hold the arches against the shim block and in position during the jointing procedure.

Lower the arches until the gap between the arches at the top is approximately 250 mm. The operator on top of the arches wearing a safety harness places a tee wedge (listed in the sample shopping list in Appendix 2) in one arch to hold the required joint gap and then gently guides, with a birk bar, the other half arch down so that they come together aligned over the full length of the joint.

Top:
A tee wedge (used to maintain joint gaps)

Bottom:
Typical joint showing uniform alignment over the full length of the joint

Top:
Checking joint alignment before unhooking crane

Bottom:
Checking plumb before unhooking crane

Before dropping off the full weight of the arches check the joint alignment. When alignment has taken place lose weight equally from both cranes down to zero tonnes and before unhooking the units check the units for plumb.

Initial spacing between the arch units should be approximately 15 mm (10 mm min, 20 mm max) for arch spans up to 10 m, but before installing the elements, measure the length of the arch footing and calculate the exact spacing needed between the arch units and progressively check the measurement with opposite end of footing so as to achieve even joints.

Measure from the end of the footing to the first joint centerline, allowing for the arch to hang over the end of the footing by 10 to 15 mm. Then mark the centerline of joints along the top outer rear face of arch footing, once again allowing for the last arch to hang over the footing by 10 to 15 mm. Arch units should be placed such that a concrete off form end is adjacent to a hand finished concrete end with edge lifters, except for end arch units where the orientation of ends is controlled by cast-in items for the arch to spandrel tie-back assemblies. It is helpful to have 5 mm and 10 mm thick PVC packers available to assist in spacing the arch units as they are being set.

Note: The final end arch units may differ from the internal units if end treatments are used in the project. The arches typically have cast-in ferrules for the arch to spandrel tie-back assembly connection.

Spandrel Walls

The lifting process for the spandrel wall is similar to the arch element, and in some cases the same lifting cables can be used. The lifting sling configuration depends on the spandrel geometery and whether it is one or more pieces, see Figure 9 below.

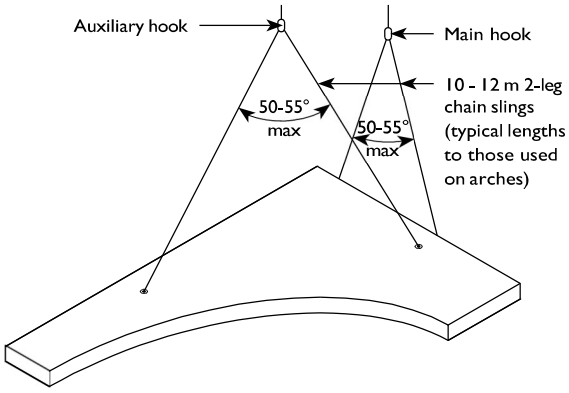
After the spandrel wall has been lifted from the truck and rotated into the vertical position, place it on the footing so that the spandrel wall turnbuckle assemblies are aligned with their connections on the arch.

It is necessary to have personnel in position at the top of the arch to align, and adjust the spandrel perpendicular and tension the turnbuckle assemblies whilst the spandrel is still safely held by the crane. The spandrel turnbuckle assemblies are supplied by Humes and are detailed on the Humes General Assembly Drawings.

Tie-back bars and turnbuckle assemblies which are attached to the spandrels and anchored back to the footings are tightened to support the spandrels.

Spandrel tie-back assemblies are supplied galvanised and require wrapping on site with corrosion protection tape supplied by the installation contractor. Care should be taken to ensure that the tape is not damaged during backfill placement and compaction.

Figure 9 – Rigging arrangement for lifting and erecting spandrel with two top lifters (unit mass not exceeding 20 t)



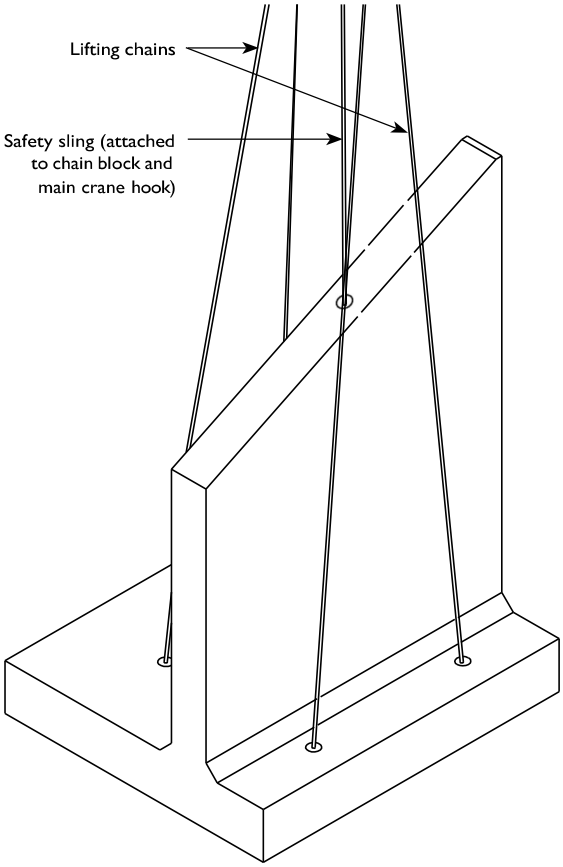
Wing Walls

The type of wing walls generally used with 3-pin precast arches and normally requires no in-situ footing and can be placed on excavated natural ground, compacted granular material or preferably on a low strength blinding layer approximately 100 mm thick.

Prior to placement of the wing walls, the allowable bearing capacity of the exposed foundation needs to be checked by a suitably qualified geotechnical engineer. A foundation with minimum bearing capacity of 200 KPa (working) is required. Where the natural material is not a suitable foundation, it should be excavated and replaced with compacted granular material. Once this has been confirmed place the concrete blinding layer prior to placement of the wing walls. In-situ strip footings might be necessary to prevent overturning and sliding of wing walls.

Top and bottom: Fully installed wing walls

Figure 10 – Lifting of wing walls



The use of a suitable geofabric material may assist in stabilizing the existing foundation and may be of some benefit in many situations. The depth of material and its compaction should be determined by site investigations and recommendations of a suitably qualified geotechnical engineer.

Using both main and auxiliary crane hooks attached to the cast-in lifting anchors, the wing walls can be lifted and rotated in the air and placed onto flat ground for re-rigging. With the wing wall in the correct orientation it can be lifted onto the prepared foundation. In the interest of safety it is recommended, as shown in Figure 10, that a safety sling and chain block attached to the top of the wing wall blade and back to the main hook of the crane be used for all wing walls.

If the wing wall does not hang level, place a sling with a chain block attached off the main hook of the crane, hook onto the out of level corner lifting knuckle and adjust the wing wall to sit down flat onto the packers.

For assemblies with wing walls arranged from 90° and up to 120° where the spandrel is supported by the first adjacent wing wall, the joint between the spandrel wall and the first wing wall element should be clean, smooth and uniform so as to provide an even bearing support for the spandrel wall. No mastic jointing material is required to cover this joint, however it is recommended that a 600 mm wide vertical strip of no-fines geotextile is glued to the rear of the wing wall joints to prevent loss of fines.

Left:
Lifting of wing wall using lifting chains and safety sling

Grouting and Sealing

Grouting

Top:
Grouting of the keyway

Top:
Joints sealed with mastic tape

After the arches have been erected in the keyway they should be grouted as soon as possible whilst the keyway is clean and dry. The grout should be vibrated to ensure that the entire keyway around and beneath the arch unit is completely filled with grout. The underside of light duty wing walls and dowel holes must also be grouted.

Sealing of Joints

After priming the area either side of the arch joint and the arch spandrel joint to manufacturer's specifications, a 250 mm wide strip of adhesive mastic tape, backed on one side with a durable synthetic laminate, should be placed over the joint between each arch unit and the joint between end arch and spandrel wall.

Note: Sealing of joints can be carried out progressively as the backfill comes up. This then allows people to be working from the ground level.

It is recommended that the vertical joints between spandrel and wing wall and wing wall to wing wall should be covered with a suitable geotextile to prevent the loss of backfill fines. The use of an adhesive material on the concrete helps hold the geotextile in position whilst backfilling occurs.

Backfilling

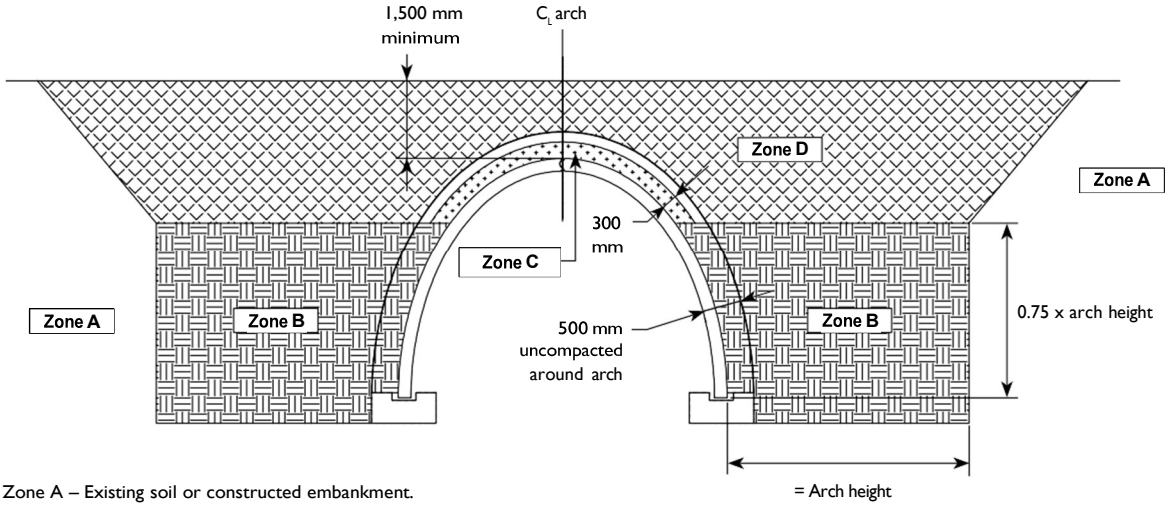
General

Backfilling operations can commence once the footing keyway grouting has reached half its characteristic strength.

This stage of construction represents one of the most important series of load cases experienced by the structure. Damage to the structure can result if the correct procedures are not followed. The zones of backfilling are as indicated in Figure 11 below.

Left:
Observe the no go zone for heavy equipment

Figure 11 – Backfill zones for specification



Zone A – Existing soil or constructed embankment.
Zone B – Sidefill necessary for effective arch support.
Zone C – Overfill providing uniform loading.
Zone D – Road subgrade or embankment.

Backfill material specification

Zone A

Natural ground or compacted embankment fill material.

Zone B

This is the critical zone for the soil/structure model and careful consideration of the material specification for quality and placement is absolutely essential.

The material specification extends vertically up from the in-situ footings to 75% of the arch height and extends laterally for a distance equal to the arch height beyond the surface of the arch at the level of the in-situ footing and must consist of material from one of the following soil groups:

- GW – Gravel or sandy gravel, well graded
- SW – Sand or gravelly sand, well graded
- GC – Clayey gravel or clayey sandy gravel
- SC – Clayey sand or clayey gravelly sand

Soils within the soil groups and which fall within the grading limits and with a liquid limit equal to or less than 30% and a plasticity index equal to or less than 10 are required provided that these materials, in their compacted state, exhibit an angle of internal friction of not less than 30 degrees.

Apparent gravely materials, which become unstable and break down to become primarily silts and clays when wetted such as shalestone or naturally cemented conglomerates, are not suitable materials and must not be used.

Unsuitable natural materials may become satisfactory when blended with cement or imported materials. Where on site material outside of the above specification for either grading, liquid limit or plasticity index is to be considered for use as Zone B material, Humes engineers must be consulted.

Table 1 – Zone B material grading limits

Sieve size (mm)	Passing (%)
75.00	100
9.50	80 - 50
2.36	70 - 30
0.60	50 - 15
0.075	25 - 10

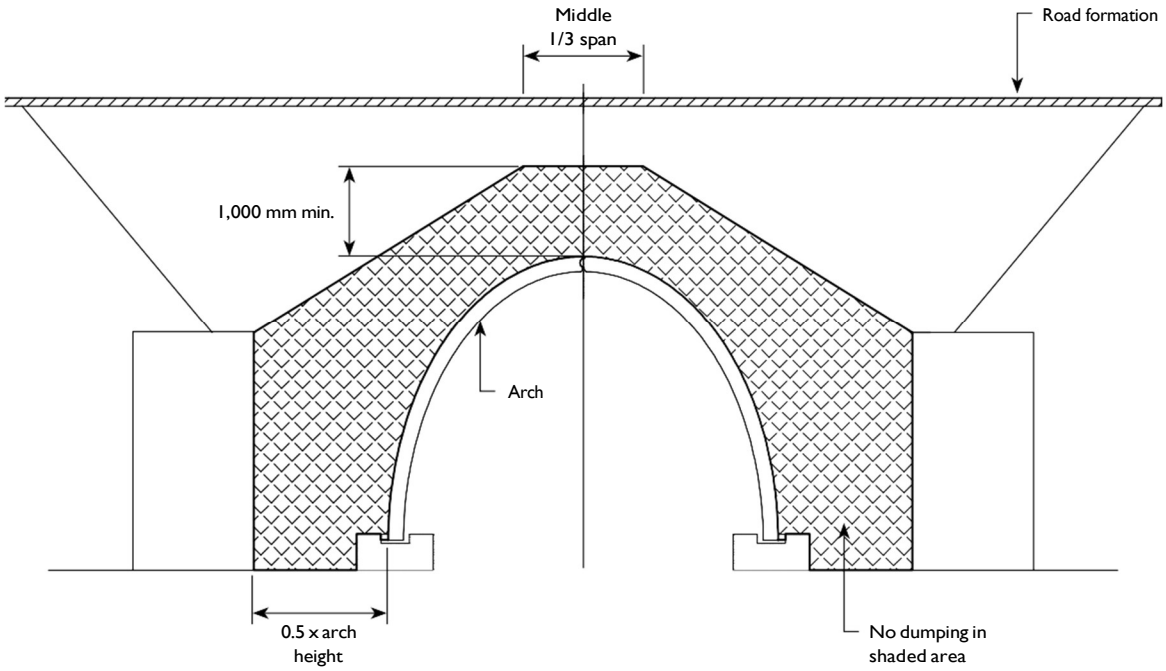
Zone C

This is the overlay material, which extends outwards 300 mm from the arch outside surface, and should be substantially free of organic matter and include no stones larger than 150 mm. The material should also have good compaction properties and be easily compacted and stable in place.

Zone D

The road subgrade or embankment according to the owners consulting engineer's project documents. Where the road pavement (gravel, asphalt or concrete) falls within the Zone C material, then the road pavement sub-base material must extend to the arch surface and Zone C material is not used.

Figure 12 – Dumping of backfill



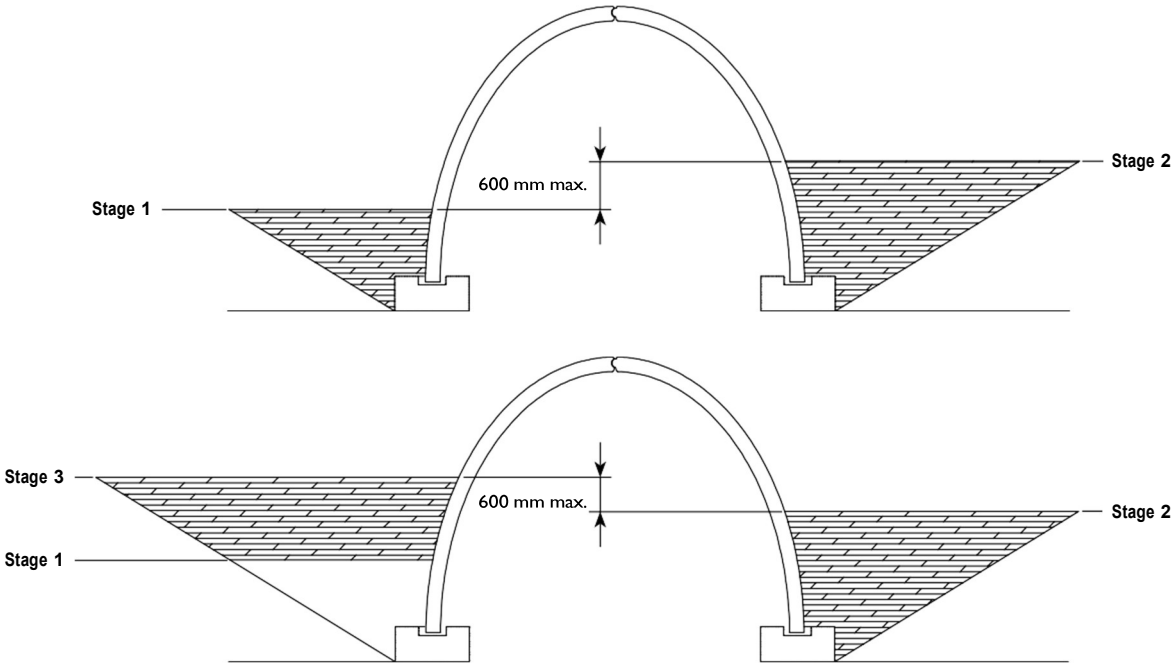
Embedment Materials Placement

The sidefill and overlay material should be placed in layers not exceeding 300 mm so as to achieve the required compaction. Dumping of backfill material is not allowed adjacent to and within the middle third of the arch span until the height of fill over the arch exceeds 1.0 m (see Figure 12 on the previous page).

The most critical factor during backfilling is that the maximum difference in the levels of fill on opposite sides must not exceed 600 mm as shown in Figure 13. This difference must alternate from side to side as the fill rises up the arch so that the backfill operation induces no permanent sideways movement in the structure.

Lines may be marked on arch units indicating each fill level as a guide to the equipment operators and to help ensure that the maximum difference is not exceeded.

Figure 13 – Zone B backfill stages

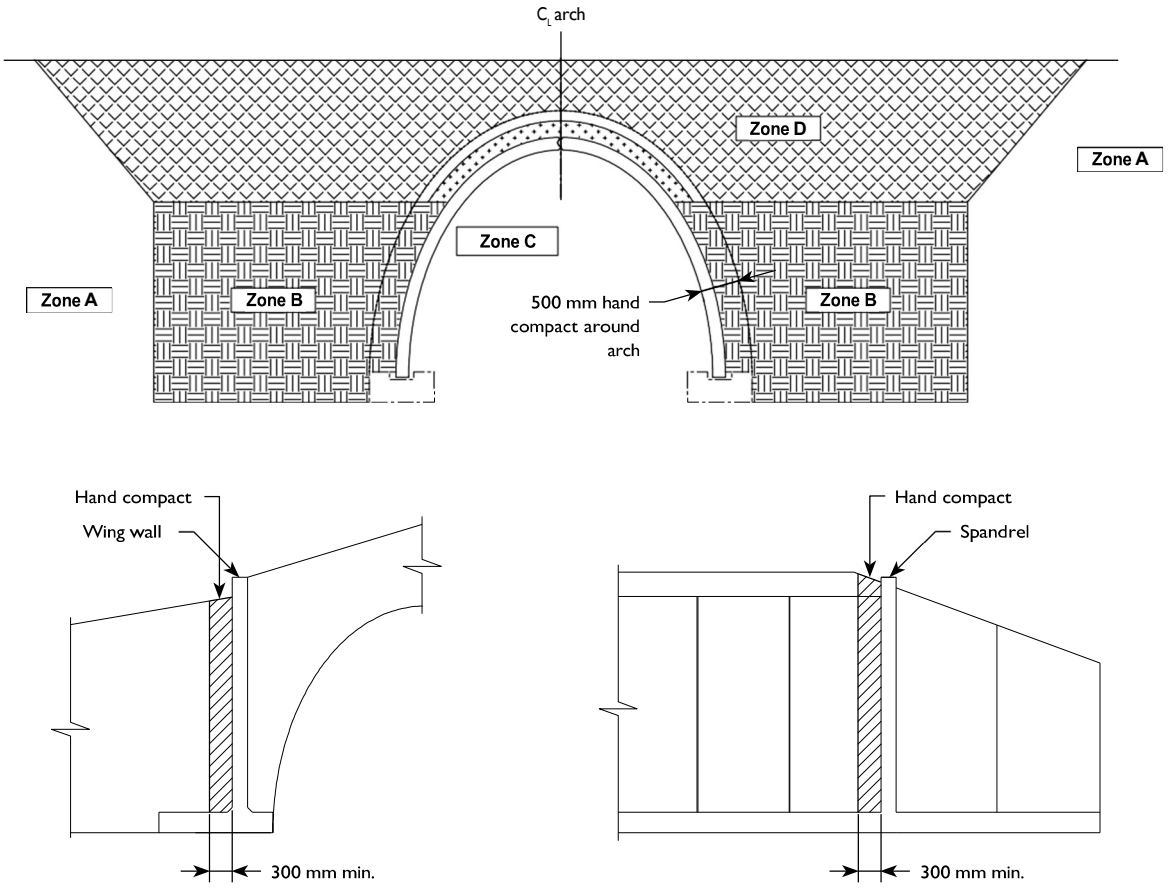


Backfill Compaction

Zone B (sidefill) backfill material must be compacted to not less than 95% of the maximum dry density at optimum moisture content for standard compaction.

To avoid damaging or causing instability of the structure, the backfill material adjacent to the arch is not compacted and behind the wing walls and spandrels is hand compacted as shown in Figure 14 below.

Figure 14 – Hand compaction zones

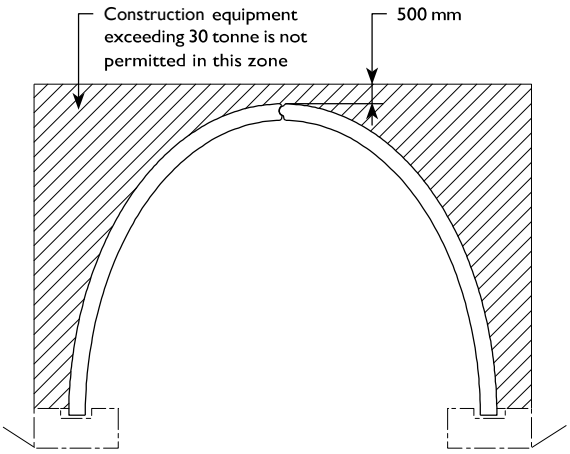


Restrictions for Construction Machinery

The restrictions for construction machinery in the immediate area of the arch are as follows:

- The bare arch may not be crossed over by any heavy construction equipment.
- After compacted fill has been placed to a height of 500 mm over the crown, construction equipment with a maximum gross vehicle weight of 30 tonnes may cross the arch.
- Construction equipment heavier than 30 tonnes is not allowed in the backfill zone indicated in Figure 15.
- To avoid excessive vibration in the arch, heavy vibrating compaction equipment (greater than 5 tonne) should be started and switched off outside the limits as shown for dumping in Figure 12 on page 20.

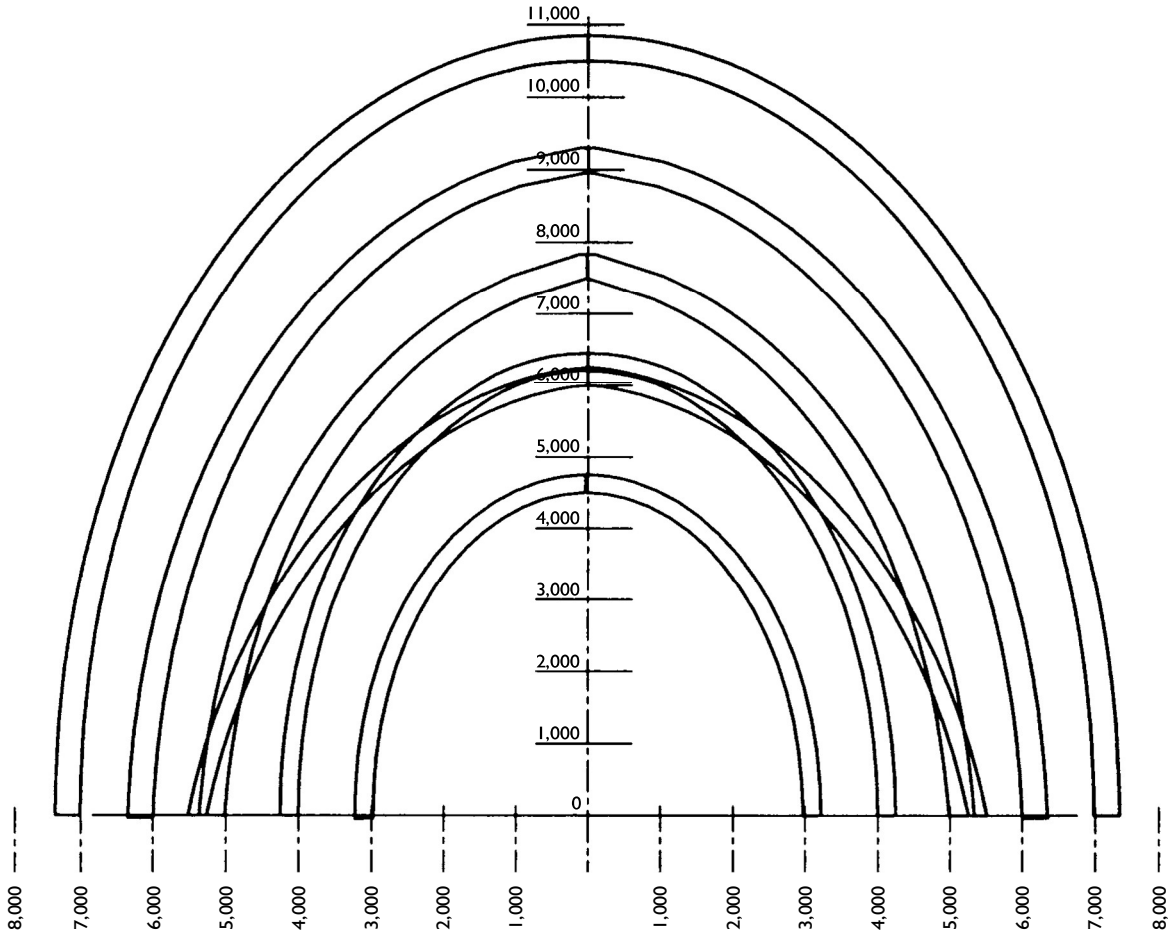
Figure 15 – Construction equipment limits



Appendices

1. 3-pin arch profiles
2. Sample 3-pin arch installation shopping list
3. Pre-erection check sheet
4. Shim block configuration and installation process

Appendix 1 – 3-pin arch profiles



Appendix 2 – Sample 3-pin arch installation shopping list

Project: ..... **Date:**.....

3-pin arch structure comprising of:

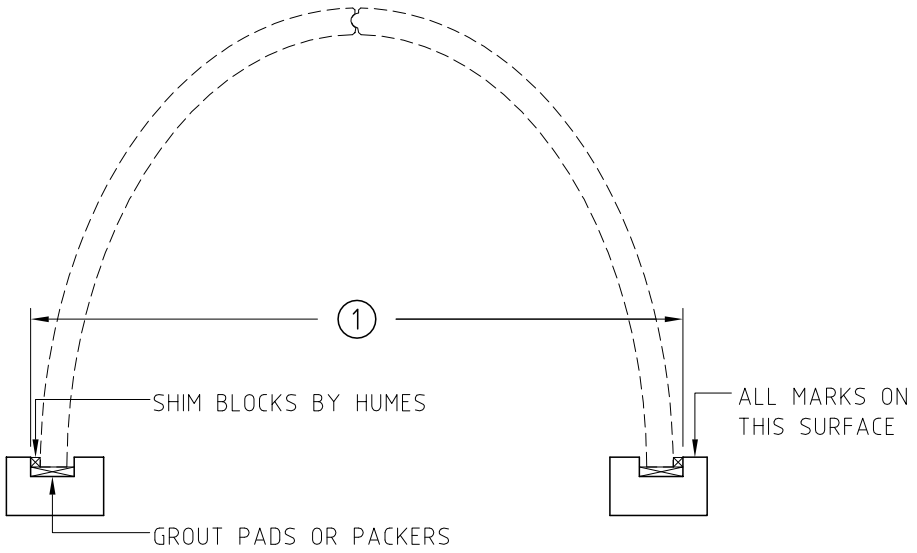
Half arch units (including specials) ..... off, weighing approximately.....tonnes per half span.

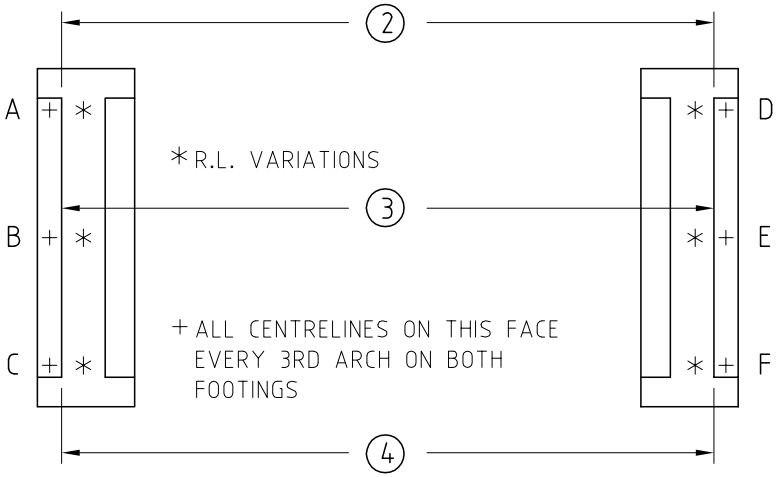
Spandrel wall units ..... off, weighing approximately..... tonnes each.

Wing walls (heavy duty or light duty) ..... off, weighing approximately .....tonnes each.

Requirement	Actioned by
Site access is suitable for trucks and cranes.	Customer
All arch units are to be delivered on site in a sequence to suit erection.	Customer/Humes
Specials – sequence and quantities to be programmed into deliveries to suit erection.	Customer/Humes
Spandrel walls to be delivered and erected directly off the trucks.	Customer/Humes
Arch shim blocks ..... off	Humes
Swiftlift® type lifting knuckles ..... off 5 tonne, ... off 10 tonne ,..... off..... tonne Long slings ..... mm, short slings.....mm (including snatch blocks).	Crane company
Safety harnesses to access the top of the arch structure.	Crane company
Arch leveling packers 400 mm x 300 mm to make up packer height of 50 mm using 19 mm and 12 mm compressed sheeting cut to the nominated sizes - a total of..... off sets x 50 mm high.	Customer
Miscellaneous plastic packers 150 mm x 100 mm of varying thickness 2 mm, 5 mm, 10 mm and 20 mm. Initial requirement: ..... off packs 2 mm, ... off packs 5 mm,..... off packs 10 mm and .....off packs 20 mm (1 pack = 100 off). Actual numbers required depends on accuracy of footings.	Customer
Timber tee wedges 150 mm x 50 mm x 20 mm on top and the leg tapering 20 mm thick to 15 mm at bottom 200 mm deep x 50 mm width. .....off (Used to maintain the joint width at the top of the arch)	Customer
Softwood wedges 200 mm long x 75 mm wide x 50 mm thick..... off (Used to hold arch bases back against shim blocks during final positioning)	Customer
Arch joint centre lines to be marked on top of rear face on both sides of footings.	Customer
Stepladders to access lifting knuckles when unloading and unhooking arches and extension ladder to access top of arches during erection.	Customer
5 x birk bars for adjusting units during erection. 2 for each side and 1 for on top of arches.	Crane company
Levelling of packers and set out of job prior to erection.	Customer
2 x chain blocks and 2 x come-alongs (approx. 2 tonne capacity) complete with 2 -3 m soft slings normally carried by cranes. (To pull top arch joints together and/or to level and adjust units as required).	Crane company
Sealing of joints and required materials (see page 17).	Customer
Alignment of arches carried out by theodolite, stringline and plumb bob.	Customer
Checking of footings for both parallel and critical width.	Customer
Hand tools to adjust and tighten arch to spandrel tie-back assembly brackets.	Customer
Fitting of spandrel and arch tie-back fittings (carried out prior to delivery).	Humes
Tail ropes for all units during erection.	Humes
All lifting points to be checked with lifting knuckles (carried out prior to delivery).	Humes

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
A	ISSUED FOR	SRC		





1. THEORETICAL CRITICAL DIMENSION ----------
2. ACTUAL DIMENSION FAR END ----------
3. ACTUAL DIMENSION MID POINT ----------
4. ACTUAL DIMENSION NEAR END ----------
5. RL VARIATIONS:

A	D
B	E
C	F

CHECK RL's ALONG LENGTH OF FOOTING FOR VARIATIONS IN LEVELS (FOR GROUT PADS) AT CENTRELINE OF ARCH JOINTS

MARK LOCATION OF ARCHES EVERY 3rd JOINT. THIS MUST BE AT RIGHT ANGLES TO CENTRELINE OF FOOTINGS

Humes

TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

MARK CENTRELINE OF ARCH JOINTS ON NEAR FACE OF FOOTINGS AS SHOWN, PERPENDICULAR TO BRIDGE CENTRELINE EVERY THIRD ARCH JOINT.

CHECK AND MARK ANY RL VARIATIONS OF FOOTINGS AT ARCH JOINT CENTRELINES.

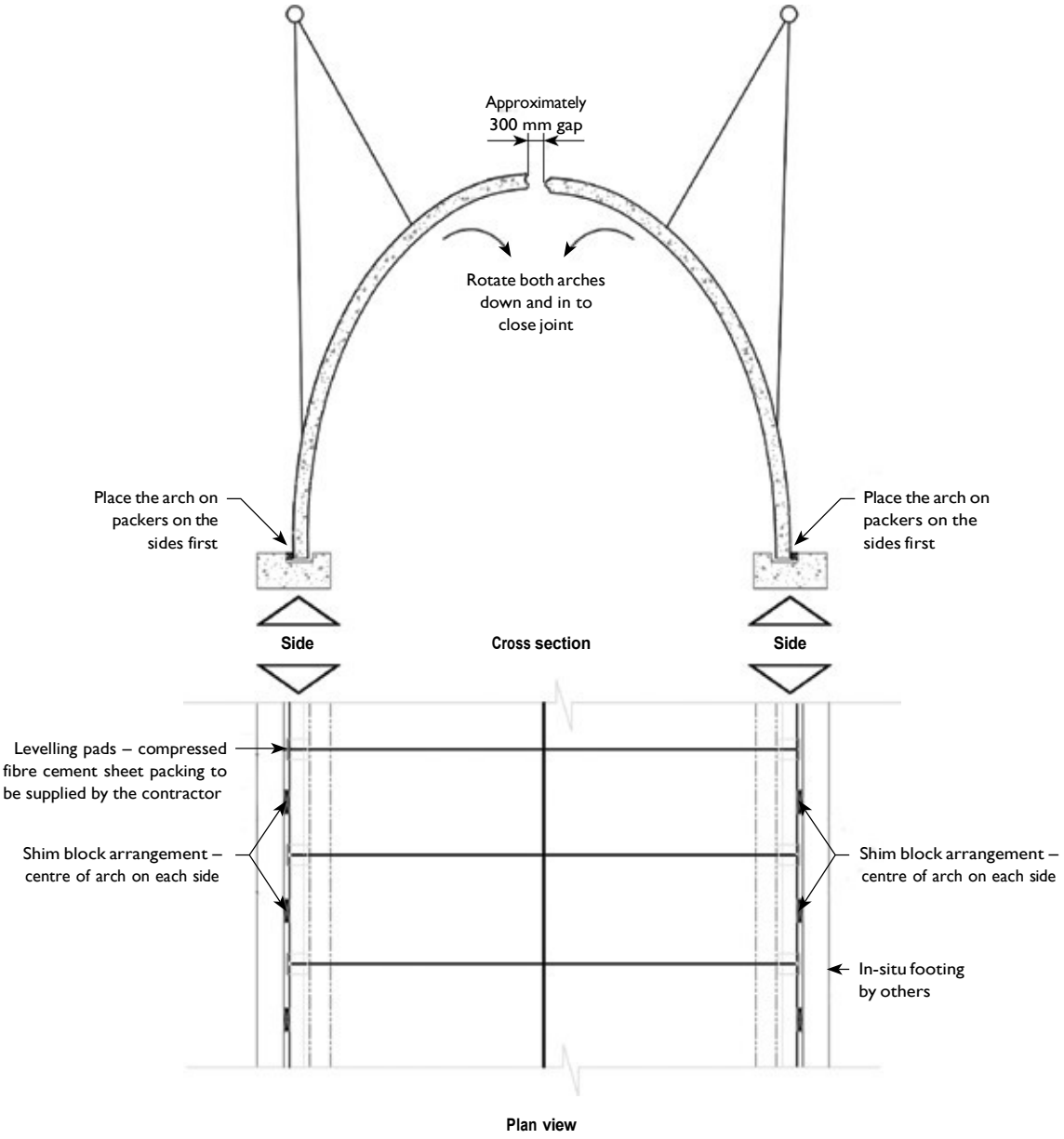
CEMEX Australia Pty Limited ABN 87 099 732 297

DSN.		
DWN.	SRC	18-07-08
CKD.		
APP.	WST	
SUPERSEDES		

HUMES
3P ARCH SYSTEM
PRE-ERECTION CHECKSHEET
CRITICAL DIMENSIONAL REQUIREMENTS

PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:1	A4	CHK-SHT-3P	A

Appendix 4 – Shim block configuration and installation process



Contact Information

National sales 1300 361 601
humes.com.au
info@humes.com.au

Head Office

339 Coronation Dr
Milton QLD 4064
Ph: (07) 3364 2800
Fax: (07) 3364 2963

Queensland

Ipswich/Brisbane
Ph: (07) 3866 7100
Fax: (07) 3866 7101

Rockhampton
Ph: (07) 4924 7900
Fax: (07) 4924 7901

Townsville
Ph: (07) 4758 6000
Fax: (07) 4758 6001

New South Wales

Grafton
Ph: (02) 6644 7666
Fax: (02) 6644 7313

Newcastle
Ph: (02) 4032 6800
Fax: (02) 4032 6822

Sydney
Ph: (02) 9832 5555
Fax: (02) 9625 5200

Tamworth
Ph: (02) 6763 7300
Fax: (02) 6763 7301

Victoria

Echuca
Ph: (03) 5480 2371
Fax: (03) 5482 3090

Melbourne
Ph: (03) 9360 3888
Fax: (03) 9360 3887

Tasmania

Launceston
Ph: (03) 6335 6300
Fax: (03) 6335 6330

South Australia

Adelaide
Ph: (08) 8168 4544
Fax: (08) 8168 4549

Western Australia

Gnangara
Ph: (08) 9302 8000
Fax: (08) 9309 1625

Perth
Ph: (08) 9351 6999
Fax: (08) 9351 6977

Northern Territory

Darwin
Ph: (08) 8984 1600
Fax: (08) 8984 1614

Humes

National Sales

1300 361 601
humes.com.au
info@humes.com.au

A MEMBER OF HOLCIM GROUP