

## Precast Arch Bridge Installation Guide



# Precast Bridge Installation Guide for BEBO<sup>®</sup> and CON/SPAN<sup>®</sup> Bridge Systems

## Getting Started – Foundation Prep and Layout

- Always start each day with a safety briefing and follow standard construction safety best practices.
- The number of laborers required can vary depending on the complexity of the installation, site conditions, and experience.
- Structure limits, survey, and layout, are to be performed by the contractor, or their surveyor, to allow the structure to be installed per specifications. Chalk lines are recommended to layout the structure limits prior to installation.
- Select the installation starting point, sequence of erection, duration of installation, and communicate this information to your Contech representative.
- Install shim packs at the correct elevation in keyway prior to installation of arch units for ease of setting units.



## Site Access & Delivery

- The site must be easily accessible for over the road trucks prior to the arrival of the crane and delivery of the precast elements. Communicate the desired route to your Contech representative well in advance.
- Deliveries will likely be wide loads. Verify any local limitations/restrictions on wide loads (i.e. weight restrictions, curfews, or overhead height restrictions).
- Coordinate the delivery sequence and number of loads per day with your Contech representative. This may require an onsite, or off-site, staging area for trucks. When staging trucks, it is often a best practice to have a jockey truck available to shuttle loads on the day of the installation. The jockey truck will come at an additional hourly cost, but it can save significant amounts of time and money in the long-run. If staging trucks, plan to stack empty trailers as needed.



## Crane Selection & Handling Precast Units

- The contractor, or his crane subcontractor, is responsible for supplying all rigging equipment (i.e. cables, rolling blocks, shackles, etc.). Contech will supply the specialty lifters for attaching to inserts in precast units. Choosing the correct crane with appropriate capacity can save time and money on the day of the installation.
- All rigging procedures must follow the OSHA standards, and no picking cable angle should go beyond the 60 degree minimum from horizontal.
- A double drum/line crane is recommended for all arch structures but mandatory on any twin leaf structure.
- Cable lengths will be specific to each project and application. Please contact your Contech representative for your project-specific minimum rigging lengths.

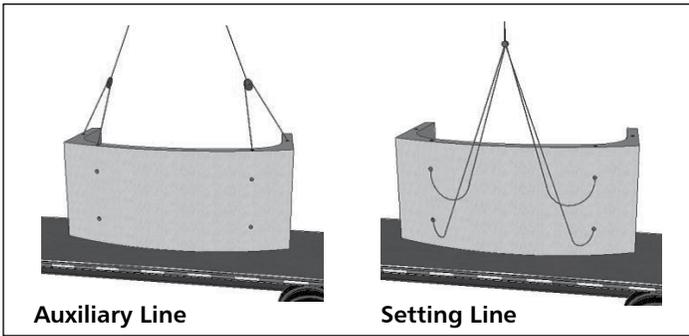


fig. 1

## DOUBLE DRUM/LINE ROTATING PROCEDURE (Span 12' - 49')

(FIG. 1 – FIG. 2):

### Requirements:

- ☑ Full capacity on both main & auxiliary line rigging to handle the weight of the arch.
- ☑ 2 cables from crane block to roller blocks (per line).
- ☑ 2 roller blocks with necessary cables.
- ☑ Multiple shackles of varying size.
- ☑ Specialty lifters provided by Contech.

### Rotating Procedure: (fig. 2)

1. Pick off of the trailer with auxiliary line. Keep setting line slack.
2. Begin picking arch with main/setting line, while lowering the auxiliary line, and transferring load to the main/setting line until the unit is rotated in its setting position.
3. Unhook the auxiliary line and set unit into place.

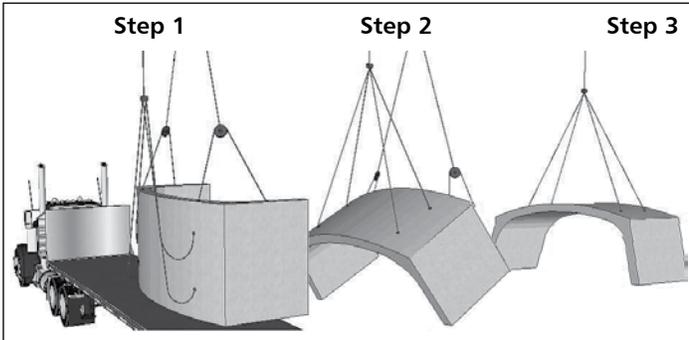


fig. 2

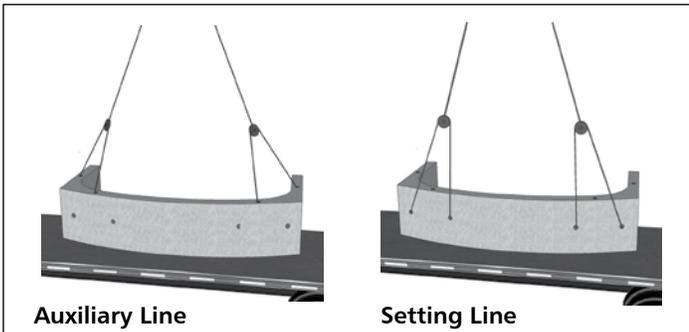


fig. 3

## DOUBLE DRUM/LINE ROTATING PROCEDURE (Span 50' - 65')

(FIG. 3 – FIG. 4):

### Requirements:

- ☑ Full capacity on both main & auxiliary line rigging to handle the weight of the arch.
- ☑ 2 cables from crane block to roller blocks (per line).
- ☑ 4 roller blocks with necessary cables.
- ☑ Multiple shackles of varying size.
- ☑ Specialty lifters provided by Contech.

### Rotating Procedure: (fig. 4)

1. Pick off of the trailer with auxiliary line. Keep setting line slack.
2. Begin picking arch with main/setting line, while lowering the auxiliary line, and transferring load to the main/setting line until the unit is rotated in its setting position.
3. Unhook the auxiliary line and set unit into place.

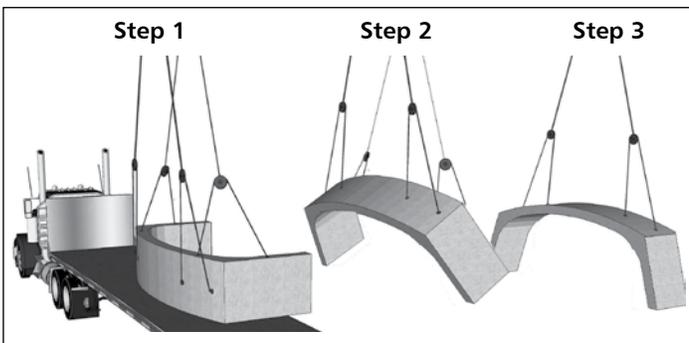


fig. 4

## Installing Arch Units

- Arch installation to begin with a few workers on each foundation to guide the pieces into their final position.
- Arches are set on top of Masonite shims used for leveling, which are provided by Contech.
- Follow project specifications for arch alignment in keyway, joint alignment, and layout of the structure. Verify the units are set in accordance with the project's specifications and tolerances.
- The number of arches that can be set per day will vary depending on ease of access for trucks, complexity of the installation, site conditions, and experience.



## Installing Twin-Leaf Arch Units



- Twin-Leaf (two pieces) arches require two double-drum cranes for handling and installing arches.
- Once each crane has a half-arch section rotated for installation, using the chalk reference line for guidance, place the bottom of each section onto the shims in the keyway. Block the outside of each half-arch section with the hardwood wedges provided. (Masonite shims and hardwood wedges are provided by Contech).
- The two leaves are slowly lowered to meet each other, and are connected together at the crown joint by a curved connection bolt provided by Contech. This curved connection bolt is be tightened once the arches have been wedged tight in their correct alignment and once the cranes have released the weight of the arches.
- The contractor will also need to provide a safe method for accessing the top of the half-arch sections. A man-lift is often used.
- Be sure to double-check the span and rise of the arches once cranes have released the weight. Follow project specifications for arch alignment in keyway and layout of the structure. Verify the units are set in accordance with the project's specifications and tolerances.
- Once all units have been installed, place the additional crown joint steel as directed in the project plans and specifications. Concrete used in the crown joint closure pour cannot be poured until the grout in the keyway has reached design strength, and must meet project specifications. Crown joint closure pour must meet design strength prior to the backfill process beginning.



## Installing Precast Detached Headwalls

- Headwalls will be shipped face down with four points on the back of the wall to be used for unloading the wall from the truck.
  - If using a single line crane, place the wall on the ground and use the top two lift points to rotate the wall upright for installation. A double drum crane will allow for rotating the wall upright without setting the wall down. Adjust cable lengths as needed to improve the wall alignment for installation.
- Use Contech provided hardware for attaching headwall pieces to arch sections.
- Detached headwalls must be installed prior to the installation of precast wingwalls.
- In some cases, temporary bracing of the arch bridge unit may be required prior to setting headwalls. See Contech drawings to determine when bracing of end units are required.



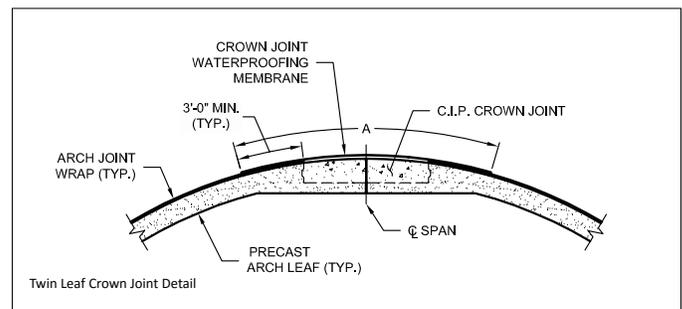
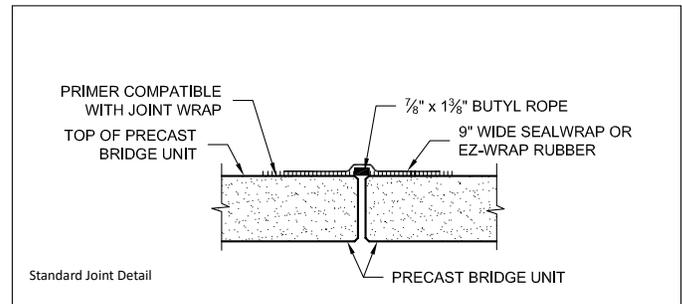
## Installing Precast Wingwalls

- Wingwalls will be shipped face down with four points on the back of the wall to be used for unloading the wall from the truck.
  - If using a single line crane, place the wall on the ground and use the top two lift points to rotate the wall upright for installation. A double drum crane will allow for rotating the wall upright without setting the wall down. Adjust cable lengths as needed to improve the wall alignment for installation.
- Note that the wingwall anchors hang down behind and 6" below the wingwall foundation. Pay close attention to the foundation plans in order to avoid conflicts between the backside of the wingwall foundation and the wingwall anchors.
- Use Contech provided Masonite shims for leveling the wall as it sits on the foundation, along with the Contech provided hardware for attaching wingwall pieces to arch sections.
- After installing the walls, and prior to backfill, place 24" wide filter fabric at vertical joints between walls. Filter Fabric is provided by Contech.



## Sealing Joints

- Contech precast bridge structures utilize a soil tight joint between bridge units. Joints should be sealed BEFORE grouting the keyway.
- There are three components to Contech's joint seal detail:
  - 7/8" butyl rope, primer, and a 9" wide joint wrap.
- The 9" wrap sealant should overlap a minimum of 6" and shingled downhill as needed. All joint treatment should extend from the bottom of arch leg over the arch and end at the opposite bottom of arch leg. All bridge unit joints, headwall/bridge joints, twin-leaf arch crown joints (see project specifications), and lifting insert locations should be sealed.
- The butyl rope, primer, and 9" joint wrap are supplied by Contech. Some applications may require a full membrane wrap, which would be provided by others. Refer to individual project specifications.



## Grouting

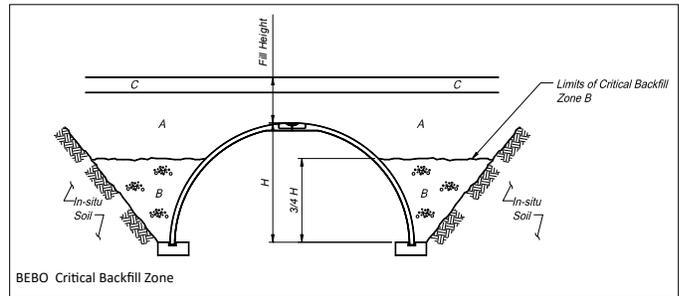
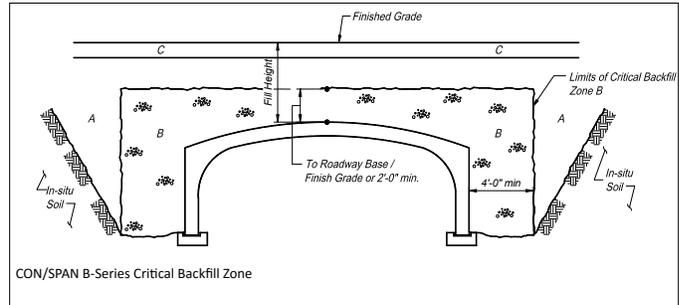
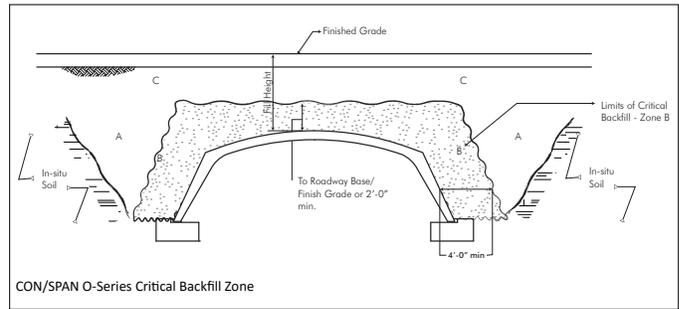
- See project and Contech specifications for grout type and strength to be used.
- Grout the full depth of bridge foundation keyway as grout must flow completely under the arch leg.
  - It is good practice to inspect the inside of the leg to confirm that grout has filled the keyway.
- All lift insert locations to be grouted prior to applying joint wrap sealant.
- For detached precast headwalls, the 3" threaded rod sleeves shall be filled one at a time by removing the nuts and washer, filling the sleeve completely, then replacing washer and tightening the nuts.
- For precast wingwalls, attach a 2x4 to the foundation in front of and behind the wall to act as a form, then fill the space with grout. Make sure the grout flows under wall. Fill the space between the wingwall anchor and the back of footing. The grout should match the anchor width and depth below the top of footing (a minimum of 2'-6" wide x 6" deep).



## Backfill

- Backfill material must meet project or Contech specifications, whichever is more stringent. **For fill heights over 12'**, no backfill work can begin until a backfill compaction testing plan has been coordinated with, and reviewed by, Contech.
- Backfill is considered as all replaced excavation and new embankment adjacent to the precast bridge structure. All foundation grout must reach full design strength prior to beginning backfill operations.
- Use only mechanical tampers or approved compacting equipment to compact all backfill and embankment immediately adjacent to each side of the structure and over the top of the structure to a minimum depth of 1'.
- In order to prevent unbalanced stresses, place and compact fill to within 2 feet of the same elevation on both sides of the structure.
- All backfill material must be approved by the engineer of record.
- Verify all project specific backfill requirements on contract drawings.

NOTE: At no time may equipment exceeding the design live load be operated over the structure.



In-situ material must be sufficiently stable to allow support of the precast units

Zone A: Embankment or overfill material shall be properly graded and compacted, per project specifications

Zone B: Structural backfill material per Contech Engineered Solutions and project specifications. (Generally, a well-graded angular sand or gravel placed in 8" lifts and compacted to 95% of the maximum dry density, per AASHTO T-99 specification)

Zone C: Roadway base and surface materials, per project specifications.

## Tool Checklist

Tools and equipment essential for setting a precast bridge supplied by the contractor include:

- A minimum of 2 - 60" spud or "Burke" bars
- A 48" or 72" spirit level
- Long, straight, clean 2"x4" for blocking and wingwall grout forming
- A transit level to provide elevation transfers
- A minimum of 2 - 8' ladders
- Chalk line or spray paint marking materials
- Large adjustable crescent or box end wrenches

## Material Checklist

The following materials are supplied by Contech:

- Structure installation drawings
- Masonite shims
- Hardwood wedges (BEBO only)
- Primer, Butyl rope and Wrap joint sealing material
- Connection plates, washers, threaded rods and nuts for wall connections
- Field Consultants available for on-site assistance. \*

\*Tools checklist is not an all inclusive list of required equipment needed to complete installation but a supplemental reference for specialty items. Contractor is responsible for all equipment and tools necessary for proper installation.

# Appendix A – Suggested Procedure for Pinning Bridge Units When Removing Stabilizer Rod/Strand

This procedure applies to all CON/SPAN units with a tie-rod, or cable strand, which are used to keep the arch at the specified span dimension during installation. Site conditions may require these to be removed prior to installation of the arch units. It is Contech’s recommendation that the tie-rods or cables are left in place until the backfill process has started. The tie-rods or cables are only removed as a last resort. Consult with your Contech representative to determine if this will be required. You will need rebar pins and hardwood wedges or blocks (see below) to complete the installation. While the crane is fully supporting the arch unit in the setting position, perform the following:

1. Check span of the arch as it lays on the truck prior to lifting and compare to span on approved drawings.
2. Use the DESIGN span dimension to mark control points of the arch unit in the keyway and pull a chalk reference line. Use this line as a working reference during arch installation to verify the span of the structure is accurate.
3. If the units have strand stabilizers, cut the strand with a pipe or chop saw near the inside face of one leg. Pull the strand through the opposite leg. Use caution when cutting the strand as it may be in tension and release suddenly. If the units have threaded rod stabilizers, slowly release the nut on the outside of the leg and remove the rod.
4. Lower the arch unit into place on the foundation. CRANE MUST SUPPORT THE FULL UNIT WEIGHT UNTIL BLOCKS AND PINS ARE INSTALLED SECURELY.
5. After the arch has been lowered into place, and the crane releases the weight, measure arch span for accuracy to make sure it match the specified span. If the arch has moved beyond the specified span, then you will need to pick the arch up again and use additional blocking to secure the arch at the correct span.
6. See chart below for the number of blocks and pins required.
7. For units requiring 2 blocks and 2 pins, measure 12” in from the outside edge of the unit and mark the foundation.
8. For units requiring 1 block and 1 pin, mark the foundation at the center on the arch unit.
9. At each mark, drill 6” into the foundation and drive a 12” long rebar pin into place. The pins should be in contact with the outside of the arch leg.
10. After pinning and blocking, slowly release the load from the crane. Re-check the span for accuracy. If the span is not within tolerance add additional blocking if necessary, reset the unit.
11. After the keyway grout has reached its design strength, the temporary hardwood blocks/wedges shall be removed, and their voids filled with grout.

SPAN	UNIT	# BLOCKS <i>(minimum)</i>	# PINS <i>(minimum)</i>	PIN SIZE	DRILLBIT SIZE
12 - 32	Exterior	2	2	#7	1”
	Interior	1	1	#7	1”
33 - 42	Exterior	2	2	#7	1”
	Interior	2	2	#7	1”
43 - 50	Exterior	2	2	#9	1 ¼”
	Interior	2	2	#9	1 ¼”
51 - 65	Exterior	2	2	#10	1 ⅜”
	Interior	2	2	#10	1 ⅜”

Note: Exterior units = a unit that will receive a headwall.  
Interior unit = a unit that will NOT receive a headwall.



# Pre-Construction Checklist

Contech Primary Contact: \_\_\_\_\_

Phone: \_\_\_\_\_

Contractor Primary Contact: \_\_\_\_\_

Phone: \_\_\_\_\_

Project Site Address: \_\_\_\_\_

- Review site accessibility (double drop/low riding/spotting)
- Expected number of truckloads \_\_\_\_\_
- Expected number of installation days \_\_\_\_\_
- Maximum piece weight \_\_\_\_\_
- Crane reach & expectations \_\_\_\_\_
- Necessary rigging \_\_\_\_\_
- Cables/rolling blocks \_\_\_\_\_
- Foundation preparation
- Unloading units
- Review cable tie height if applicable
- Attached or detached endwalls and hardware \_\_\_\_\_
- Installation of exterior joint wrap
- Internal sealing required     Y             N
- Internal sealing material specifications
- Grouting materials and procedure
- Backfill procedures - in situ or imported fill \_\_\_\_\_
  - Even backfill lifts
  - 95% compaction
- Construction traffic loading
- Pipe and riser connection details
- Contractor labor expectations
- 8 inch lift thickness
- Safety considerations
- Review installation specifications from approved contract drawings.

## SUPPORT

- Drawings and specifications are available at [www.ContechES.com](http://www.ContechES.com).
- Site-specific design support is available from our engineers.

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