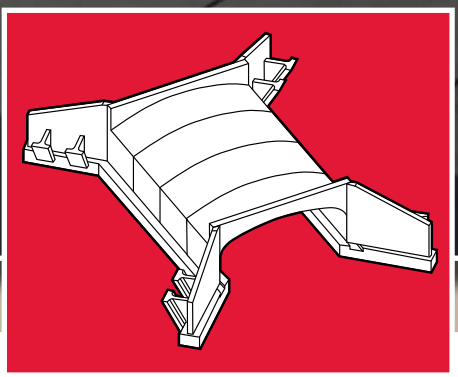
ArchCast™ Bridge

3-Sided Precast Concrete Bridge Structure



Installation Manual

COUNTY® MATERIALS CORPORATION

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Safety

All standard safety precautions and best practices should be followed and be a primary concern. Always check rigging connections, tag lines and rigging devices thoroughly before lifting units. Always start each day with a safety briefing.

Tools:

- Two 60" pry bars
- 48" spirit level
- Transit Level
- Long straight 2"x4"
- Two 8 foot step ladders
- One 16 foot extension lader
- Chalk line or spray paint
- Large crescent or box end wrenches
- Two "come-alongs" for use with 2-piece bolt-on headwalls and wingwalls
- Proper rigging and lifting eyes

Materials Checklist:

- Installation drawings
- Shims (5"x5"x1/4" and 1/8" masonite shims)
- Joint wrap material
- Connection plates, washers, threaded rods and nuts for connections

A properly planned and prepared foundation is needed to ensure a successful installation.

Foundation and Footings

Following standard construction procedures and safety precautions is an important precondition for a successful ArchCast™ Bridge installation. Additional steps for setting the foundation include:

- Grades and elevations must be set according to the approved project drawings.
- Forms must be constructed in a rigid manner to eliminate movement during placement. Maintain a tolerance of no more than 1/4" every 10 feet.
- Concrete must have a minimum compressive strength of 75% of the 28-day design strength before placing bridge units.
- Ensure subgrade preparation is in accordance with project specifications and available geotechnical reports for the project.
- Deviations in the top surface of footings will make it difficult to set units.
- For culvert footings constructed on a slope, the same slope shall be carried to the ends of the wingwall footings.
- Follow proper anchor clearance.
- The footing top should have a floated surface finish and must not vary more than 1/4" in 10 feet. The horizontal alignment of the keyway is critical to set units properly.
- If precast wingwalls are utilized, the back of the wingwall footing must be formed with a uniform surface to avoid using sawing and jackhammering.
- Wingwall footings must be cleared of dirt and large concrete burrs.
- Make sure the area behind the precast wingwalls are adequately excavated to allow clear placement of the wingwalls and anchors to be placed.
- In all cases follow project plans regarding dimensions and placement. Mistakes will lead to delayed installation and lost time and money.

Verify any local traffic restrictions prior to delivery of units to your site.

Site Readiness

Ensure your site is ready for a problem-free delivery. Prior to delivery communicate with your County Materials representative and take into consideration delivery accessibility.

In advance, make sure the site is accessible, open, dry and compacted. Trucks must be able to pull in and out under their own power.

- Ensure there is a route and proper access for delivery trucks, including a convenient turn around area to allow trucks to back in.
- Plan for unloading space next to the crane.
- Before delivery, verify local restrictions on wide loads or of temporary lane closures that may be necessary.
- Contractors are responsible for flagmen and traffic control.
- Expect rutting on non-paved surfaces. Have proper maintenance on hand to repair and level surface between deliveries.
- Keep in contact with your County Materials representative with any delays and confirm your schedule before delivery. It is not recommended to erect units in the rain.

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Be sure the crane you choose is rated to handle the job.

Crane Selection

Proper crane selection and site preparation are vital the in ArchCast™ Bridge installation. Several conditions should be prepared before hand:

- Have a representative from the crane company visit the construction site to determine proper sizing and stabilizing of site.
- Locate the crane as close to the foundation as possible.
- ArchCast™ Bridge unit weights will be provided by County Materials and should be used in considering crane size. Note that the end unit is usually the heaviest and has the longest reach.
- Before crane operation begins survey the site for tree branches, overhead power lines, underground utilities and other obstacles.
- De-water the site to a level below the top of the footing to ensure safety and speed installation.

Have at least 4 people on site for the installation.

Before Installation

For maximum safety and efficiency be prepared before delivery. Always follow standard construction safety best practices.

- Have at least four people on site. More may be required depending on each install.
- If the crane supplier does not provide a signaler, designate one person to signal. This person is in addition to the four-person minimum.
- Clean the foundation of any debris, mud or water.
- Choose a starting point. When the foundations are sloping start at the lowest elevation.

Tipping bridge units upright with rolling blocks.

Units delivered on a truck bed.

Units being staged on the ground prior to installation.

Handling Precast Units

Bridge Units:

- Bridge units are typically shipped on their sides and require planning before shipping the units. These units will be lifted off the truck and set onto the ground on their sides.
- If using a single line crane, lift the unit off of the truck straight up, then place on the ground. Use the top four lift points to rotate the unit upright. It is helpful to rotate the unit to vertical with a pair of rolling blocks or equalizing slings.
- To prevent spalling of the legs, a bed of soft sand/soil material should be provided in the tipping area.
- Using a double drum crane will allow for rotating the unit upright without setting the unit down.
- Units will have four lift inserts in the side and four in the top. Use four cables no less than 20 feet long (for spans under 24 feet) and cables 30 feet long (for unit spans between 28-42 feet). Coordinate cables with the ArchCast and crane suppliers.
- Units delivered upright may be lifted off the trucks and set directly in place.

Precast Wingwalls:

- Wingwalls are typically delivered lying flat on the truck and set onto the ground lying flat using all four lift points. Rotate wingwall units by using only the top two lift points.
- Wingwalls are then set in place. Be prepared for units being unbalanced and not hanging in a straight vertical position during installation.*

Detached Headwalls:

- Detached headwalls are delivered with their outside face down. They will be set on the ground using three lift points.
- Rotate headwalls upright using the top two lift points and lift unit into place.

** Since lifting inserts for headwalls and wingwalls cannot be located at the center of gravity, a come-along is recommended to be used in the rigging to plumb and level the units.*

First unit being set.

Shim pads are used to control elevation.

2"x4"s and chalked line are used for alignment.

Setting ArchCast™ Bridge Units

Follow these guidelines for setting the bridge units

- Allow for ½" joint between units. Once you have laid out the total length on one footing, starting at one end turn 90 degrees to the opposite footing and lay out the starting point. Follow the same procedure at opposite end of footing and chalk a reference line to the outside of the units. Layout the center line of each joint.
- Set shims one foot in from the corner of each unit. Use the high point if applicable as the control elevation. Add one inch to this elevation and set all shim pads to this elevation.
- If installing units on a sloping grade, shoot elevation control points at approximately 50 feet increments and run a sting line between these elevations to set other shims.
- Projects typically start by setting an end unit with or without an attached headwall. The alignment of this first unit is critical and determines the alignment of all remaining units.
- At each starting line, secure a 2"x4" to the top of the footing. This will act as a stop for each unit and help with alignment. Stay out from underneath the unit until it is supported on the footing.
- One person should be ready with a spud bar at each side to help position units as the crane lowers them into place.
- Leaning the top of units away from the previous set unit before setting in place will create better joints and save time.
- Spud the unit up against the 2x4 blocks and check for alignment with the chalked line. Then check the vertical alignment. Adjustments can be made with shims to achieve the required front face alignment.
- Never use hands under a unit to adjust shims. Always use a stick or tool to reach under units.
- When setting successive units the joints should be ⅛" to ¾". Place a shim in the tightest area to maintain this opening. Match a rough face with a smooth face.
- Properly adjust the lifting cable lengths so cables on the far side of the adjacent unit are longer than the near side cables.
- Units with spans more than 24 feet will be shipped and installed with a horizontal cable tie between the legs, normally located 2 feet above the bottom of the leg. This cable cannot be removed until after grouting has been completed and achieved the required strength. On end units, it is also recommended that the legs be blocked solid to the keyway before setting headwall units.

Tip units slightly for easier fit.

Second unit is lowered into place.

Last unit is set, before setting the headwalls and wingwalls.

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Headwall unit is moved into position.

Setting the Headwalls

- Before setting the headwall units, bolt up the tie plates to the top of the arch units.
- The top and bottom of the headwall must be cleaned before setting into place.
- Each headwall piece should be marked for a specific location on the bridge to match casting of the headwall units.
- The front face of the headwall should be placed flush against the front-end bridge unit.
- A spud bar may be necessary to align the holes over the inserts in the unit's top.
- After the headwall has been set, place in the first bolt. After all three bolts have been inserted use the double nuts on the bolts to thread in as far as possible.
- Remove the nuts one at a time before backfilling, and grout the sleeve surrounding the bolts. Replace the nuts and waterproof as explained in the Sealing Joints section.

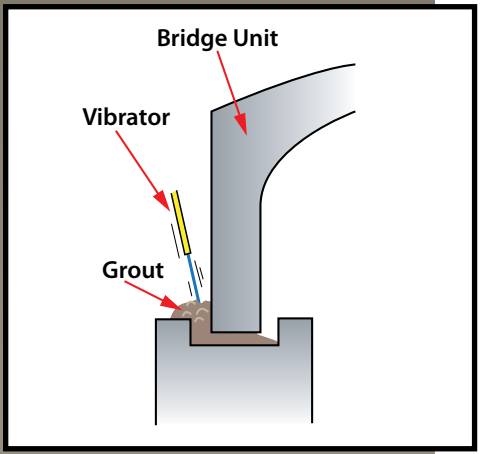
Headwall units are bolted into place.

The finished headwall.

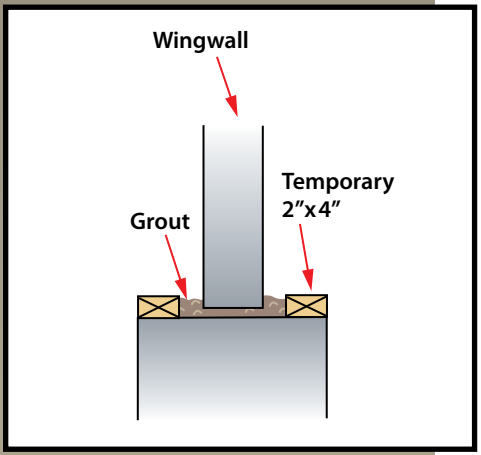
Setting the Wingwalls

- Clean the footings of any debris and set shims using the same procedure used for the bridge units. Check for proper clearance at the bottom of wingwall anchor.
- It is important to check the overall clearance behind the wingwall before units are hooked up and ready to install. Wingwall anchors will extend a minimum of 4 feet behind the wall.
- Before setting the wingwall, loosely fasten the connection plates to the end bridge unit. Then, push the wall back against the bolted plates.
- A long bolt may be used to help pull the wall back and align the holes. When starting to fasten the plates the wall can still be several inches away from its final position.
- When the wall is tight against the plates and holes are lined up, use a shorter bolt.
- Install the drainage pipes before backfilling.

Bolted plates are shown attached.



Use vibrator to ensure proper grouting .



Grouting the Wingwalls .

Grouting

Follow the grout mix outlines from the project specification. Admixtures may be added to make a more flowable fill. Follow these guidelines for each unit:

- Completely grout underneath bridge unit legs and to the top sides of the keyway.
- Grout underneath the wall and between the wall anchor and footing.
- Grout must fill the keyway. For bridge foundation keyway, inspect the inside of the leg to ensure it is filled.
- Fill grout underneath wingwall and between the wall anchor and footing.
- Create a temporary keyway by attaching a 2"x4" on both sides of the wall to act as forms.
- After mounding the grout on the outside of the leg, vibrate the grout until it passes through to the other side.
- If required, grout or plug the lift insert recesses, then seal with mastic or a piece of joint wrap material.
- Completely fill the void between the bottom of the wall anchor and the top of the footing. The grout should match the anchor width and depth from the top of the footing. This should be a minimum of 2½ feet long and 6" wide.

Grouting the bolts of the headwall.

Joint wrap in progress.

Sealing Joints

- Butt joints are created in between two adjoining bridge units. Clean the joint surfaces of any debris. These joints should be covered with a 1"x2" piece of butyl rope and a minimum of 9" wide joint wrap.
- Use a primer compatible with the joint wrap, and apply a minimum of 9" wide on either side of the joint.
- Continuously cover the joint from the bottom of one bridge section leg across the top of the opposite bridge section leg. Laps of joint wrap should be six" minimum with the overlap running down.
- Joints that form between the end unit and the headwall should also be sealed. If precast wingwalls are used, the joint between the end bridge unit and the wingwall should be sealed with the same type of wrap or as indicated by the engineer.

Backfilling

After the grout has achieved design strength begin backfilling and follow all project specifications. Backfilling is a critical component for the overall structure because it provides support and is important for the roadway approach support.

- For heights of fill more than 12 feet, no backfilling should begin until a compaction testing plan has been completed and approved by an ArchCast representative and the owner.
- The Critical Backfill Zone is defined as a minimum of 4 feet on either side of the structure, and from the base of the unit to two feet above the crown.
- When fill heights are less than two feet, the finished grade will be the boundary of the Critical Backfill Zone.
- For span less than 24 feet, and fill heights less than 12 feet, the backfill material must meet AASHTO classifications: A1, A2, A3, or A4. For fill heights greater than 12 feet, or spans longer than 24 feet, only backfill materials meeting A1 or A3 should be used.
- Maximum dry density will be determined by AASHTO T-99 or other approved methods.
- Have project engineer approve all backfill material. Backfill should not be placed against any structural element until approved by the engineer.
- Drainage pipe must first be installed behind the wingwalls before backfilling.
- Use only approved compacting equipment for all backfill and embankment up against the side of the structure and on top of the structure to a minimum depth of 1 foot.
- Lightweight dozers and graders may be operated over units only with a minimum of one foot compacted cover. Heavier equipment (larger than a D-4 dozer weighing more than 12 tons) requires a minimum of 2 feet cover.
- Any equipment that weighs more than the design load indicated by the manufacturer's drawings and specifications must be pre-approved.
- Pay close attention to operating compaction equipment too close to the wingwalls or headwalls. A minimum distance of 4 feet is recommended. Use smaller compaction equipment in these areas.
- In the Critical Backfill Zone place backfill in lifts of 8" or less.
- Compact backfill in layers to 95% of the maximum dry density. Material outside of the Critical Backfill Zone must be high quality, well compacted embankment or in-situ soil.
- To prevent unbalanced stresses, place and compact fill less than 2 feet in difference of elevation on both sides.

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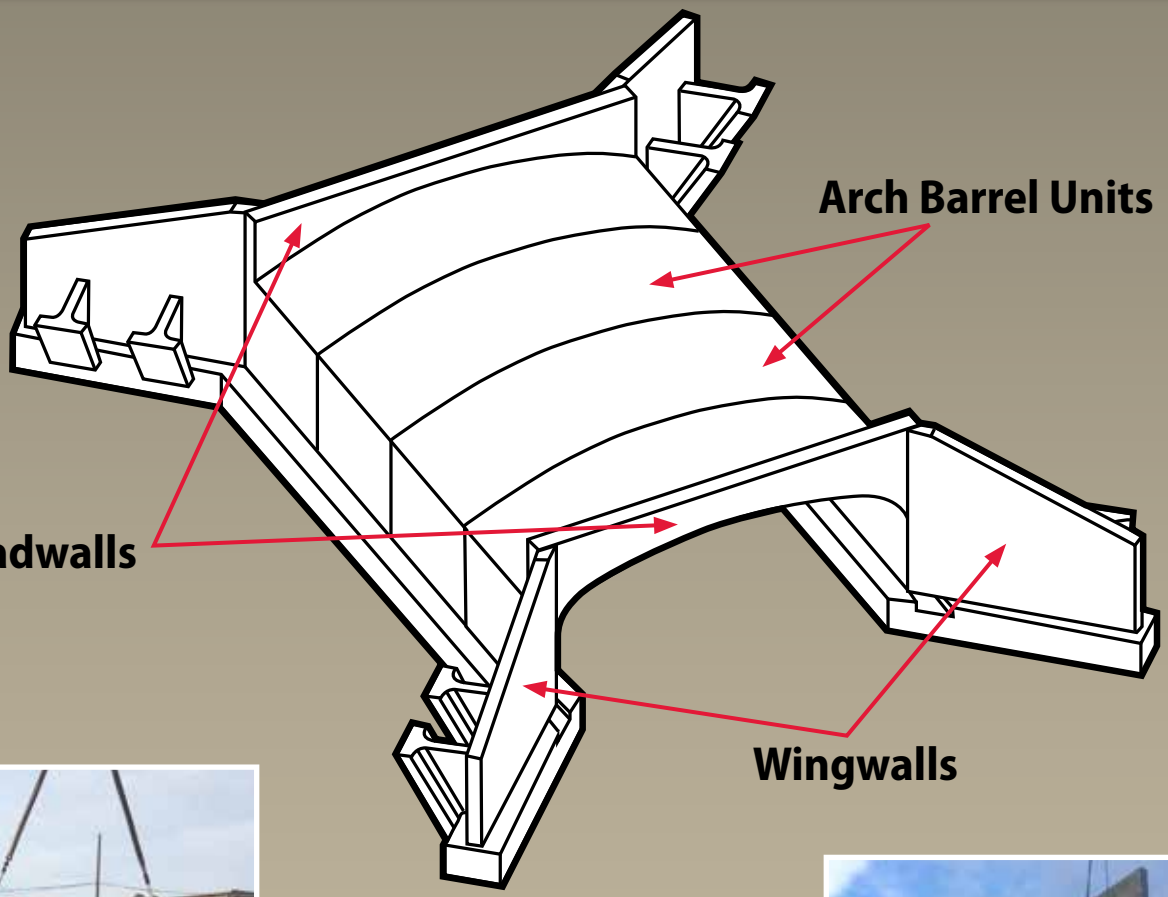

To order or purchase ArchCast Bridge units, contact via email at: info@countymaterials.com

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