

# O-Ring Culvert Installation Guide

## Foundation Bed Preparation

Use standard construction procedures for the construction of the bed for Box Culvert Systems. As with any construction project, take all standard safety precautions.

- **Sub-grade must meet or exceed box design bearing pressure established by Rotondo Environmental Solutions (RES)! Prepare the sub-grade in accordance with the project specification and any available geotechnical report prepared for the project. Consult project geotechnical engineer when available.**
- Follow the project plans for the geometry, location and elevations. The bottom of the box culvert must not vary in elevation from the plan dimensions more than 1/4 inch per 10 feet. Deviations in the foundation bed surface will make it more difficult to set the units and control width of joints.
- Install (2) two wooden rails down the length of box system to screed top surface of sand or stone bedding. The two (2) outside rails should be set at an approximate 6" or more offset from edge of precast concrete box culvert. These rails if set properly can be used to control elevations and alignment.
- Use a small clean angular stone or sand for the top two (2) inches under the box culvert element only to assist in meeting proper elevations. The horizontal alignment of the outside rail is critical when setting the units, particularly on longer structures.



## Site Access

Prepare the site for easy access before delivery of the precast units or the arrival of the crane, and communicate the truck route to the Rotondo Environmental Solutions (RES) representative.

## Delivery

Provide access for the trucks delivering the units to be unloaded next to the crane, and include a convenient turn around for the trucks to back into the unloading area. Additional room for tipping of units that are delivered on their side may also be necessary. Expect rutting on non-paved surfaces due to the weight of the trucks, so a piece of equipment should be available to repair and level the surface.



- When the inside rise of the box reaches 8'-0" or greater, the product may be delivered on its side due to overall height restrictions. If the product is shipped on its side, the load will become over-width and will be subject to restrictions on the permit.
- Delivery of oversize loads (i.e. width, weight, etc.) will be subject to restrictions on permits and equipment availability which will result in a longer delivery schedule.

## Crane Selection

A representative from the crane company should visit the jobsite prior to the selections of the size crane. **The project SAFETY Inspector should provide the crane company representative with all job requirements prior to arrival so that onsite delays can be avoided!** The crane representative and/or contractor should determine the distance from center of the crane's position to the center of the final position of the precast units. The RES representative will provide you with the weights of the precast units. The weight and the distance from the center of the crane's position to the center of the final position of the precast units determines the crane size. The end units are typically the heaviest and also require the longest reach.

Locate the crane as close to the installation as possible. The staging area for the crane must be stabilized and crane supplier should be prepared to provide outrigger mats.

- The crane company must provide all rigging cables and shackles. **All cables should be adequately sized to pick the heaviest section! The cables should be free of any deformed kinks to insure full capacity is provided!**
- The crane company must provide a double drum crane that is setup with both the main and auxiliary for rotating if the precast product is delivered on its side and needs to be rotated.

- The crane company must provide (2) swivel blocks if the precast product is delivered on its side and needs to be rotated.

## Other Considerations

Other opportunities to improve site conditions before installation include the following precautions.

- Clear all tree branches and remove or shield overhead obstacles (i.e. wires, etc) that may interfere in any way during erection of the precast units.
- Dewater the site to a level below the bottom of the box culvert. A properly dewatered site will speed up the job and result in better workmanship.

## Box Culvert Units

Box units have differing sets of lift points, based on the span and center of gravity. Two to six cables with a minimum length of 20' for spans under 24' are needed. Coordinate the supply of these cables between the RES representative and the crane supplier. Coordinate the lifting mechanisms necessary to connect the cables to the unit (type and source) with your RES representative.

Units delivered upright may be lifted off the trucks and set directly in place. Units delivered on their side require special care and should be discussed prior to shipping of units.

1. The Main hoist should be hooked to the top slab lifting points and the auxiliary would be connected to lifting point at the bottom of the product. Lift precast unit off the trailer with the main and auxiliary hoists then allow trailer to pull out from under the product. Once the trailer is clear of the product, lower the auxiliary hoist until product is upright.



2. Disconnect the auxiliary hoist connect points and set the unit in place.

## Setting Units

Prepare to set units by cleaning the total bed area and confirm its length and layout. Then do the following:

1. When checking the length of box, allow for 1/2" joint creep for each joint between units. For example, if you have six units 8' wide, allow for five joints at 1/2" for a total length of 48'-2 1/2". This creep may increase to 3/4" (verify with approved drawings). Once you have laid out the total length on one outside rail, starting at one end turn a 90° angle to the opposite side and layout the starting point on the outside wooden rail. Follow the same procedure at opposite ends of the footings and chalk a reference line (to the outside of the units) for alignment purposes.
2. Provide a string line down one side that is offset 2" so that a lateral measurement can be taken for each section and maintain proper alignment. For multiple cell installations, locate string line down the center of each cell to minimize the overall variance.
3. Select a crew of five to six and assign one as the leader (decision maker) to provide the signals to the crane operator. Have a short safety meeting between all crew members before beginning to set units.
4. The first section set is typically located at the outlet end unless site conditions dictate something else. The alignment of this first unit is critical to the alignment of the rest of the units. Stay out from underneath the unit until the unit is set on the bed.



5. In order to prevent bedding material from collecting between joints, take a shovel or rake and remove bedding material (shallow trench) along the edge of the joint. Removing this material will provide a place for excess bedding material that collects when installing the next section. This process should be repeated for each section that is installed.



6. Apply joint lube to face of wedge shaped O-Ring gasket on male end and female surface for ease of installation. One of the most effective

methods used to apply joint lube has been a **4" roller with handle**. This tool allows the person applying the joint lube to perform the task without using a step ladder!



9. The most responsible person (decision maker) should watch top joint surface and direct the lowering of the section. Once the male joint is in line with the female, stop lowering and instruct the people inside to start drawing sections together with come-a-longs **SLOWLY!**



7. Align section with previously installed section and lower until joint is close to top slab of previously installed piece.



10. Continue to lower slightly and instruct the people inside to continue drawing sections together with come-a-longs **SLOWLY!** **CAUTION! Do NOT add to the length of the come-a-long handle with a cheater/leverage bar! This will overload the come-a-long and connections creating an UNSAFE situation! This procedure will also damage the come-a-long and create significant installation delays!**



8. The installation will require a minimum of two **(2) 3-ton come-a-longs with 20' of chain length (provided by others)** to draw sections together. **If the installation has multiple cells, a minimum of four (4) come-a-longs may be preferred.** Connect one 3-ton come-a-long to each side of inside wall face and take up access slack (do not draw sections together!).

11. Follow the process in the previous step until the inside joint width reaches 1/2" with a tolerance of minus (-) 1/4", plus (+) 1/2". **DO NOT over stress the come-a-longs to bring the sections together!** Over stressing the come-a-longs will results in fracturing a joint

and/or pullout failure of wall anchor which would be a safety concern! **Local agencies such as Montgomery County, MD will reject any section that has a joint fracture during installation!**



**Note:** When setting successive units you will achieve better joints and save time if the unit to be set is hanging such that the top of the unit is vertical or leaning slightly in from the previously set unit. If necessary, add a shackle to the cables to lengthen.

12. Grout or plug the lift holes.



## Pipe Connection Details

Openings for pipes will be cast into precast units. Holes oversized to accommodate piping without a pipe boot should be grouted with non-shrink grout prior to backfilling.

## Backfill Material

The backfill of a box culvert structure is an important element of the overall structure. Not only is it important to provide the necessary support for the structure, it is also important to support any roadway approaches above the installation.

## Backfill Procedure

1. Place and compact backfill in layers until the density is not less than 95% of the maximum dry density. All material outside the Critical Backfill Zone must be good quality well-compacted embankment or in situ soil.

2. Do not place backfill against any structural element until approved by the engineer. Avoid damage to waterproofed surface.
3. Use mechanical tampers or approved compacting equipment to compact all backfill and embankment immediately adjacent to each side of the installation and over the top of the installation to a minimum of 1'.



4. Place backfill within 4' of each side of the units in lifts of eight inches or less (loose depth). Do not use heavy compaction in this area or over the installation until it is covered to a depth of 1', unless the design cover is less than 1'. Lightweight dozers and graders may be operated over units having one foot of compacted cover. But heavy earthmoving equipment (larger than a D-4 Dozer weighing in excess of 12 tons and having track pressure of 8 psi or greater) requires 2'. As a precaution against introducing unbalanced stresses in the vault units, place and compact the backfill to within 2' of the same elevation on both sides of the installation before proceeding to the next layer.

**Note:** No equipment in excess of the design load noted on the manufacturers shop drawings is permitted over the installation.

