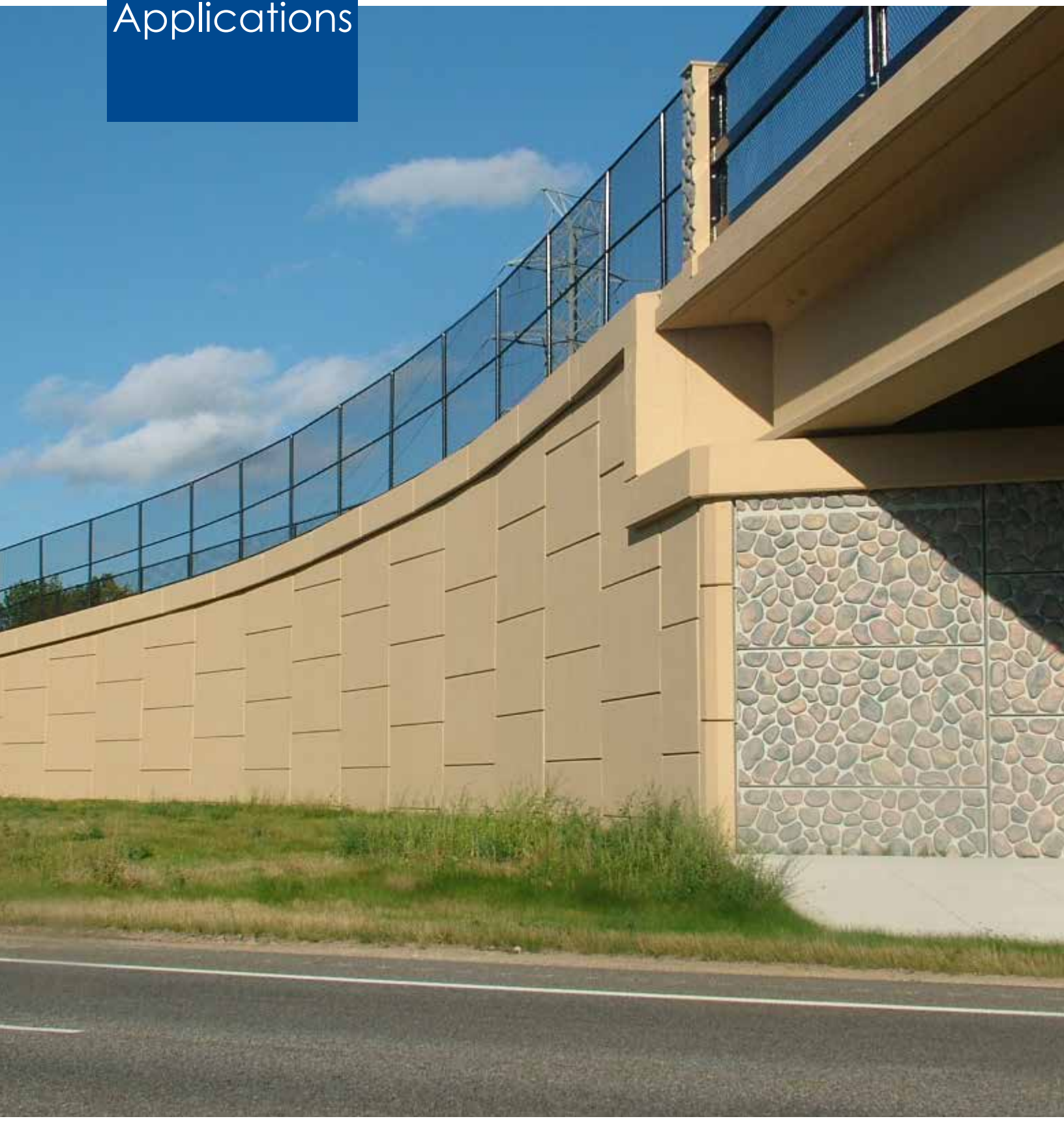
Bridge Applications

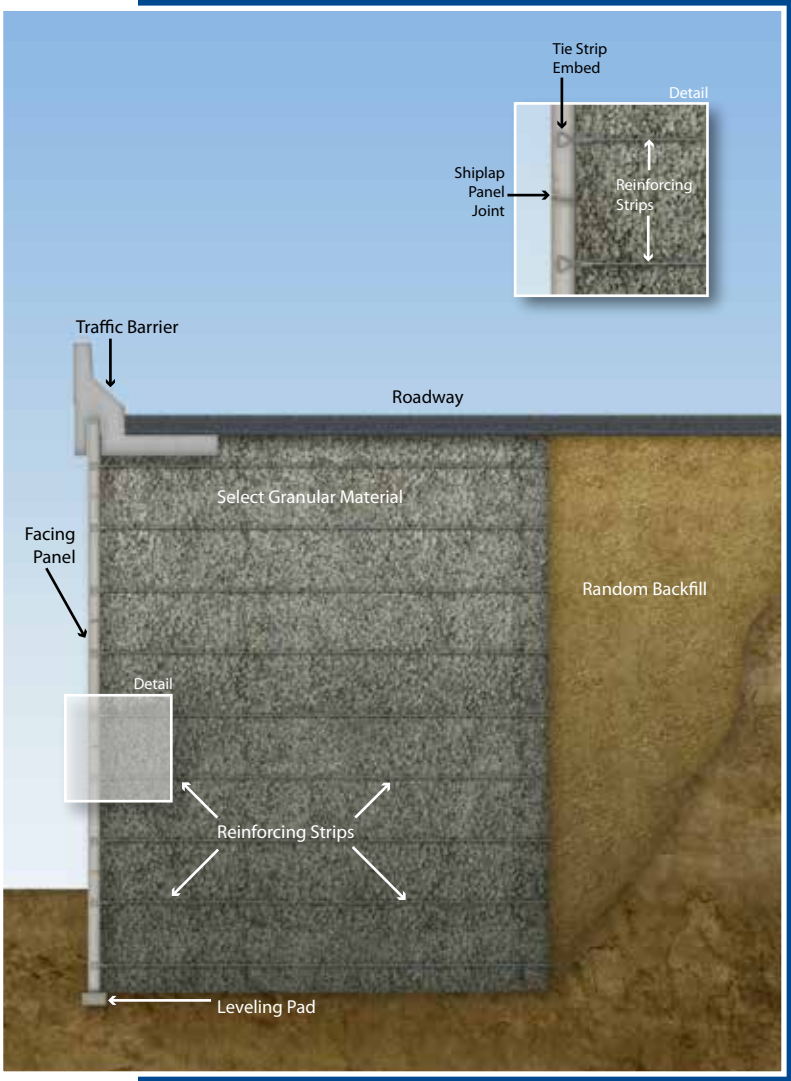
REINFORCED EARTH®



Technology

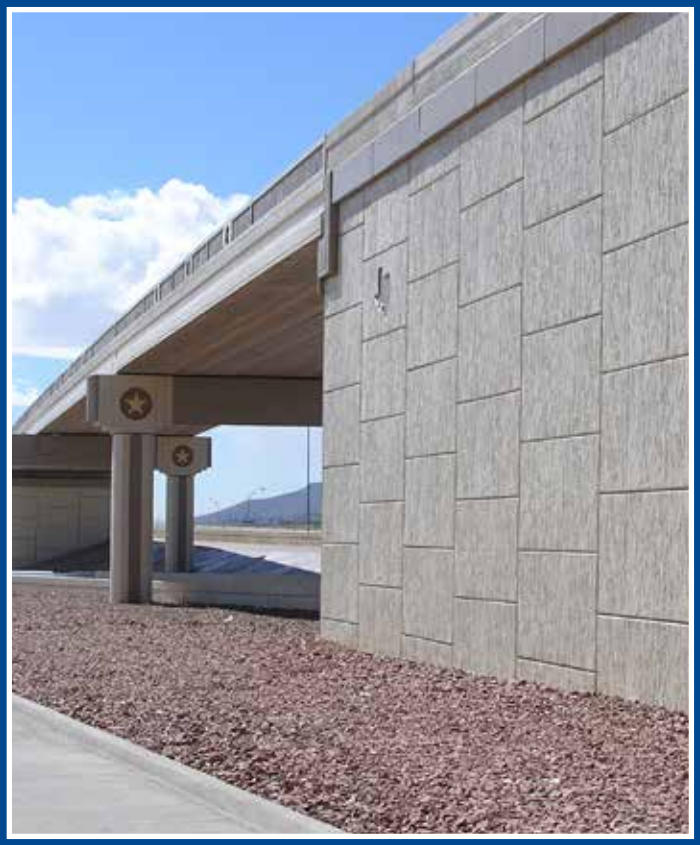
The Reinforced Earth Company (RECo) offers a variety of bridge abutment and bridge crossing solutions, each are based on project specific requirements. Bridge abutments are considered critical structures and the unique strength and load distribution capabilities of Reinforced Earth® address that criticality in an economical and structurally efficient way. For many bridges, a spread footing bridge seat can be supported directly on the reinforced soil, thus eliminating the need for piles. When piles are necessary, they are easily fitted between the reinforcing strips or the strips can be pivoted to clear the piles, resulting in a simple retaining wall surrounding the abutment structure. In both configurations, the shallow foundation depth typical of Reinforced Earth structures and the limited use of cast-in-place concrete lead to significant time and cost savings.

TechSpan® precast arches provide the ideal solution for short to medium span bridges with precast concrete segments that offer rapid installation. By combining the TechSpan precast arch system with Reinforced Earth retaining walls, you can enjoy the aesthetics of a truly arch-shaped opening with headwalls and wing walls that provide a natural and pleasing look. Both systems provide a structure with a long service life and superior seismic qualities and low maintenance requirements.

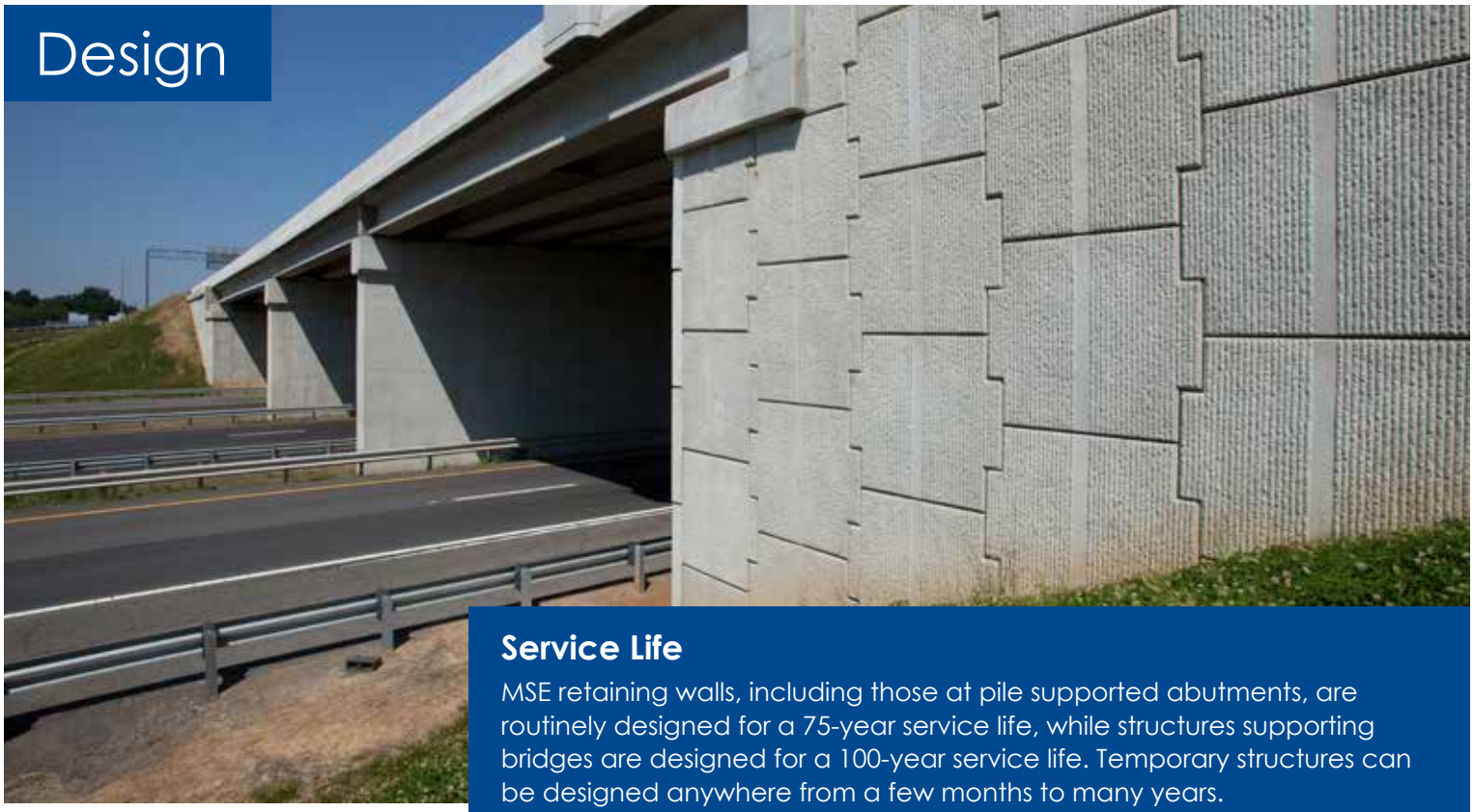


Reinforced Earth Wall Typical Section

Reinforced Earth retaining structures are an economical way to meet ordinary and extraordinary earth retention and load support needs for highways and bridges, railroads and mass transit systems, waterfronts, airports, loading docks, industrial and mining facilities and commercial and residential developments. Each wall is a coherent gravity structure, custom-engineered by RECo to project-specific requirements including applied loading, foundation conditions, and aesthetics.



Design



Service Life

MSE retaining walls, including those at pile supported abutments, are routinely designed for a 75-year service life, while structures supporting bridges are designed for a 100-year service life. Temporary structures can be designed anywhere from a few months to many years.

Select Backfill

Typically* the select granular backfill material used in the mechanically stabilized earth structure shall be reasonably free from organic and otherwise deleterious materials, have a minimum shear strength of 34° and shall conform to the following gradation limits as determined by AASHTO T-27:

Sieve Size	Percent Passing
4 inches	100
3 inches	75-100
No. 200	0-15

In addition, the backfill shall conform to project specific requirements for Plasticity Index, Soundness, and Electrochemical testing.

*Typical shear strength and gradation limits are noted, values outside of these limits are possible and will be evaluated and on a case by case basis.

			Span Ranges			
Application	**Rapid Construction**	**Eliminates "Bump" in Bridge**	**≤80 feet**	**80-200 feet**	**200-300 feet**	**300+ feet**
REspan	√	√	√	√		
True Abutment	√	√	√	√	√	
Mixed (Pile) Abutment	√		√	√	√	√
Techspan Bridge	√	√	√			

Options

Temporary Abutment

TerraTrel® wire-faced MSE walls provide a cost-effective solution for applications where aesthetics are not a critical requirement. TerraTrel may be used for permanent and temporary applications such as service roads, low volume state roads, and phased construction of bridges in lieu of other methods of shoring such as sheeting or pile and lagging walls; this allows traffic to flow on the lanes of an existing bridge while the new MSE abutments and bridge are constructed. If significant settlements or preload conditions are anticipated for a structure, a two-staged MSE wall can be utilized combining TerraTrel and a precast or cast-in-place facing.

Completed Acute Corner

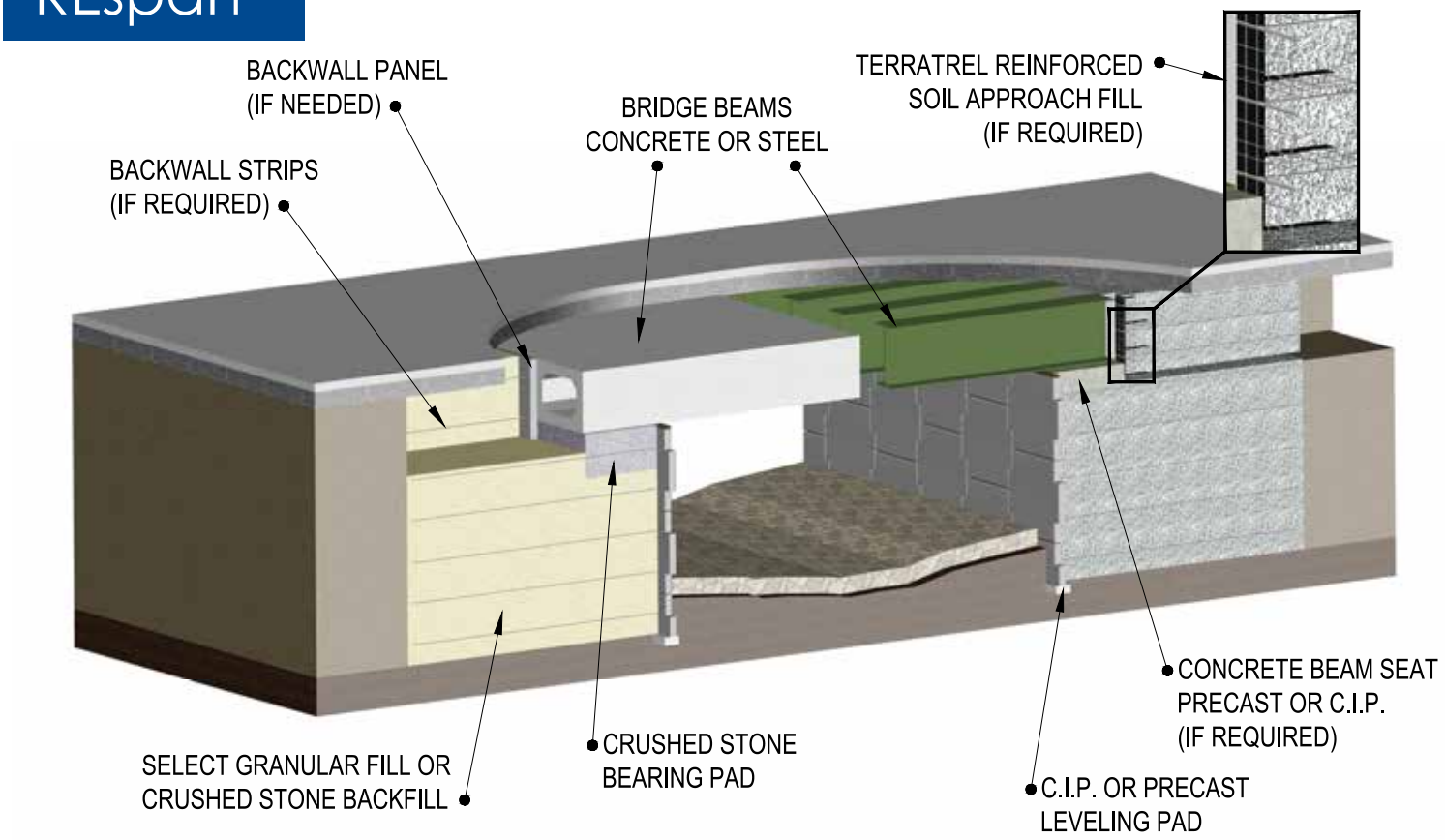
Two-Stage Application

Phased Construction

Acute Corner under Construction

The design of the earth reinforcement system for acute corners less than 60 degrees is unique. The nose portion of the structure is designed as an internally tied bin structure with at-rest earth pressures from top to bottom. The reinforcing strips are designed as tension members only and are generally at low stress due to the bin effect (soil arching) and the conservative number of strips used. The connections to the panels are all double shear structural connections. The tied bin section is separated from the adjacent normally reinforced portion of the structure by slip joints. In addition, reinforcing strips are extended back from the nose portion of the structure to tie this relatively light section back into the major portion of the mass. The performance of this system has been remarkable due to its high strength and flexibility. In addition, the individual reinforcing strips and numerous connection locations on the backs of the panels make the system very versatile and constructible in the presence of obstructions such as piles.

REspan



Economic Solution for Short to Medium Span Bridges

- Design in accordance with AASHTO specifications
- Reduced construction cost and time
- Construction in all weather conditions
- Fully engineered making field changes unnecessary
- Inextensible steel reinforcements
- No time dependent movements
- Precast concrete facing panels
- More durable than concrete masonry units

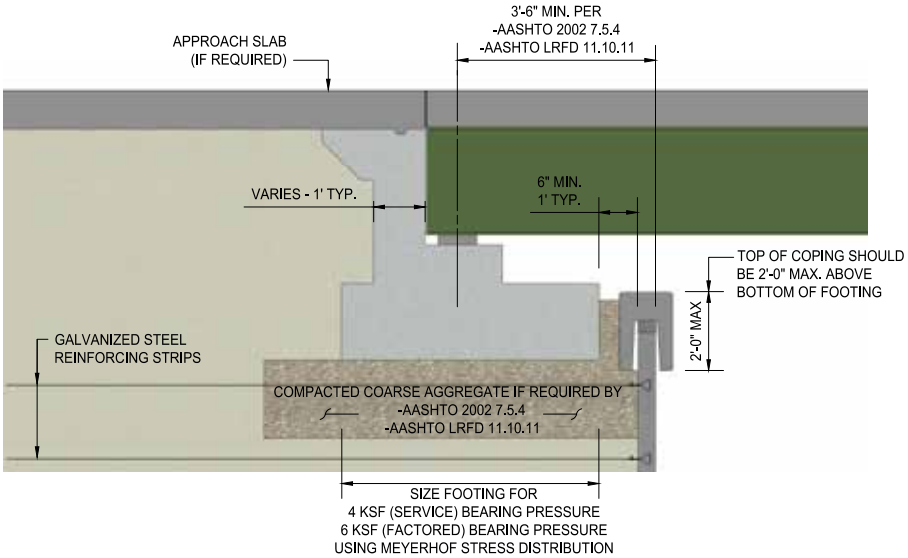
True Abutments

Abutment construction falls on the critical path of any bridge project. So scheduling certainty at this stage is crucial to timely project completion. With a rapid and predictable construction procedure, Reinforced Earth true abutments certainly meet this requirement. A faster installation of Reinforced Earth true abutments translates directly into less labor and lower costs.

In a true Reinforced Earth abutment, the bridge beams are supported on a spread footing bearing directly on the MSE structure. The bearing stresses beneath the beam seat are distributed into the reinforced soil, so soil reinforcement density is higher near the top of the structure and may decrease with depth as the bearing stresses dissipate. A primary technical advantage of Reinforced Earth structures is their ability to support extremely large loads and distribute them evenly to the subgrade soils.

Economy

True Reinforced Earth abutments are a superior and often more economical solution in cases where poor foundation soils might otherwise dictate use of deep piles or other remedial foundation treatments. Because of its flexibility, a Reinforced Earth abutment can withstand considerable settlements arising from consolidation of the foundation soils. And even when extraordinary corrective measures must be taken before construction of the abutments, Reinforced Earth can still allow the realization of significant cost savings. An additional benefit typical of all true MSE abutments is the approach embankment leading up to an MSE abutment is continuous with the compacted granular fill on which the bridge seat rests. Therefore, if the embankment settles due to movement within the foundation soils, the bridge seat moves with it rather than being rigidly fixed in position by piles. The "bump at the end of the bridge" is eliminated, with resulting reduced maintenance cost.



TYPICAL ABUTMENT SEAT FOR REINFORCED EARTH WALLS

In a typical design of a true abutment, the beam seat is sized so the centerline of bearing is at least 3 feet behind the MSE wall face and the bearing pressure on the reinforced soil is approximately 4 kips per square foot.

However, variations from the typical noted above are possible since each MSE true abutment is designed to project specific requirements including, but not limited to, beam seat dimensions, bearing pressure and distance from the wall face.

Mixed Abutments

A mixed abutment has piles supporting the bridge seat with the MSE walls retaining the fill beneath and adjacent to the end of the bridge. Both true and mixed Reinforced Earth abutments are used for bridges with integral abutments as well as for conventional bridges. Integral bridge abutments, have neither joints nor bearings, thus reducing cost and maintenance. Integral bridges are generally supported on piles, so pile deflection caused by thermal movements of the superstructure must be accommodated by the reinforced soil of the MSE structure.

In some cases a portion of the lateral load on the pile-supported seat is transmitted to the MSE fill. This load can be resisted by MSE reinforcements in the wall or by reinforcements extending from the backwall of the seat.

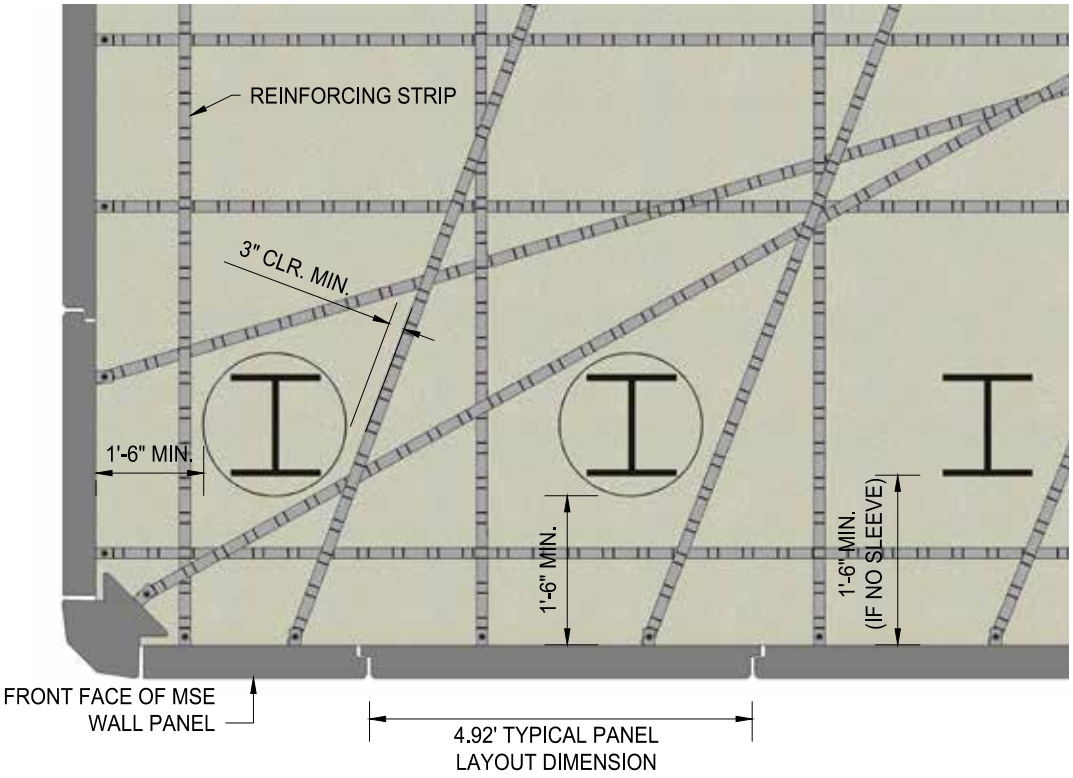
Piles

When significant negative skin friction is anticipated, a casing around each pile may be provided, extending through the reinforced fill.

REINFORCING STRIP SKEW AT ABUTMENT PILES

In order to provide adequate clearance for placement of soil reinforcements and small compaction equipment, a minimum 18-inch clear distance is recommended between the back face of MSE panels and the nearest edge of pile/shaft or pile sleeve.

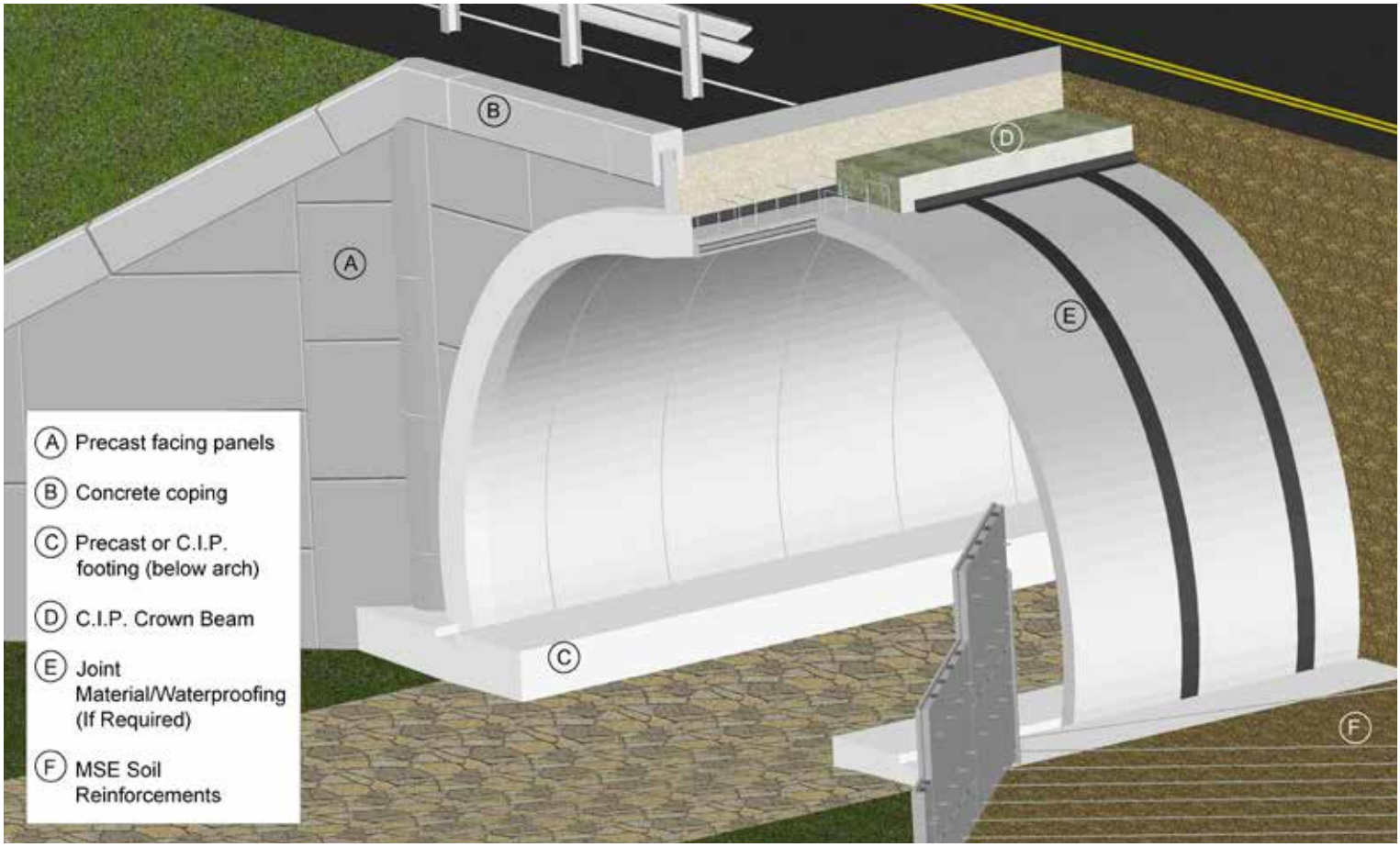
Strip-type MSE reinforcements with bolted connections may simply be skewed around piles, while systems utilizing welded wire mats or continuous geosynthetic reinforcements require special details to transfer the reinforcements and their load around the piles. These design details are applicable to both traditional non-integral and integral pile supported MSE abutments.



REINFORCING STRIP SKEW AT ABUTMENT PILES

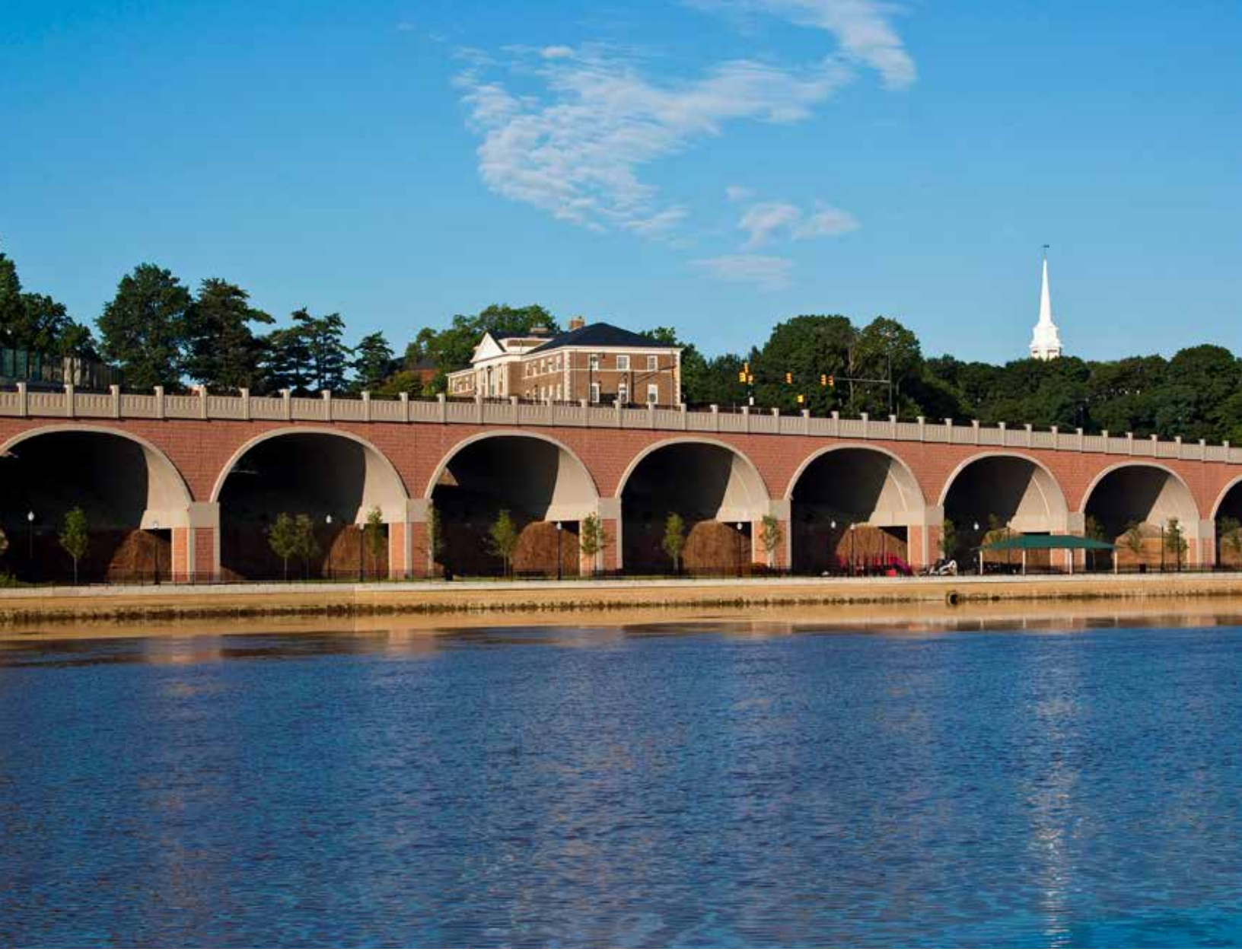
Precast Arch Bridges

TechSpan® is a three-pin, two-piece, funicular curve shaped arch. The Reinforced Earth Company offers custom-designed precast concrete arches that deliver maximum economy and the flexibility of site-specific clearance envelopes. Each TechSpan arch is carefully tailored and optimized, structurally and geometrically, to meet the individual needs of the project. The system can be designed to accommodate high fills, heavy live loads, and altering loading conditions. TechSpan arches can be installed over existing roads, live rail or other service, with minimal disruption. The design methodology utilizes finite element analysis and funicular curve theory, resulting in minimum use of materials, maximum arch durability, and a cost effective total solution that is simple and efficient to install.



Advantages

- Precast concrete elements shipped to site
- Uninterrupted traffic flow
- Construct with a three man crew and one crane (two cranes required first half day)
- Rapid, simple and predictable installation
- No falsework or scaffolding
- No post tensioning necessary
- Durability of precast concrete gives long service life with low maintenance
- No maintenance of bearings or joints
- High quality control standards
- Shape minimizes bending moments
- Designed to clearance box dimensions



REINFORCED EARTH®

SCAN to see our locations across the United States

800.446.5700

www.reinforcedearth.com