FAQs

What makes PBES a good choice?

Rapidly expanding technologies associated with materials and equipment have made it possible for components of bridges and assembled composites of bridge components-sometimes even entire bridges-to be prefabricated. Bridge engineers are increasingly turning to prefabrication of bridge elements and systems to save money, to solve project-specific challenges, and to increase the quality of bridges by conducting fabrication in a controlled environment.

What are the advantages of PBES for bridge construction?

Prefabricated bridge elements and systems offer bridge designers and contractors significant advantages in terms of construction time, safety, environmental impact, constructibility, and cost.

- Minimized traffic disruption – months to days
- Reduced onsite construction time
- Reduced Environmental impact
- Improved work zone & worker safety
- Lower initial and Life-Cycle Costs
- Improved product quality – controlled environment, cure times, easier access, etc.

Contact Information

For training or more information on this Every Day Counts Initiative, please contact your local FHWA Division Office.

To learn more about EDC, visit:
http://www.fhwa.dot.gov/everydaycounts

About Every Day Counts

Every Day Counts (EDC) is designed to identify and deploy innovation aimed at shortening project delivery, enhancing the safety of our roadways, and protecting the environment.

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PBES

Prefabricated Bridge Elements & Systems (PBES) Technology

U.S. Department of Transportation
Federal Highway Administration

What is PBES?

With prefabricated bridge elements and systems (PBES), many time–consuming construction tasks no longer need to be done sequentially in work zones. Generally, PBES are manufactured off the bridge alignment to reduce on-site construction time relative to conventional practice. An old bridge can be demolished while the new bridge elements are built at the same time off–site, under controlled conditions, then brought to the project location ready to erect. This form of accelerated bridge construction (ABC) benefits budget-challenged Federal, State, and local transportation agencies, by:

- Reducing on-site construction time
- Reducing environmental impacts
- improved work zone & worker safety
- lowering initial and Life-Cycle Costs
- Improved product quality – controlled environment, cure times, easier access, etc.

Traffic and environmental impacts are reduced, constructability is increased, and safety is improved because work is moved out of the right-of-way to a remote site, minimizing the need for lane closures, detours, and use of narrow lanes. Prefabrication of bridge elements and systems can be completed in a controlled environment without concern for job-site limitations, which increases quality and can lower costs. Prefabricated bridge elements especially tend to reduce costs where use of sophisticated techniques would be needed for cast-in-place work, such as in long water crossings or higher structures, like multi-level interchanges.

Self-propelled modular transporters (SPMTs) move bridge superstructure into place in hours, minimizing traffic disruption.

How Does It Work?

The use of prefabricated bridge elements and systems (PBES) allows Federal, State and local agencies to build new (and replace exisitng) bridges in a faster, simpler way. The lion's share of the construction work is done off-site, usually in a nearby staging area, and the new bridge superstructure is lifted or "rolled" into place. This method takes advantage of precast elements to minimize the impact of the project on motorists by reducing the time needed for roadway workzones.

I-95 over the James River in Virginia was completed in October 2009. Preconstructed composite units (PCUs) were lifted into place during nighttime closures from 7:00 pm to 6:00 am the next day.

Placement of Fiber Reinforced Polymer (FRP) deck panels on steel girders of a 125-foot through-truss bridge at MD Route 24, north of Baltimore, near Rock Creek State Park.

Case Study: Pioneer Crossing Bridge

Motorists and news crews were curious about the huge concrete structure they'd seen from I-15 at Pioneer Crossing in Utah. It is part of Utah's **Cor**ridor **E**xpansion (CORE) effort aimed at restoring and renovating I-15 in Utah County. As part of this effort, the Utah Department of Transportation is raising the bar in using self-propelled modular transporters (SPMTs) to move bridge spans into place. The south bridge span over the I-15 northbound (NB) lanes for a new diverging diamond interchange was moved into place with SPMTs on Friday night, October 16, 2009. The span over the southbound (SB) lanes was moved into place just 2-days later on Sunday night. Then, the existing four-span bridge was dismantled without reducing the three-lane capacity in each direction on I-15. On the weekend of June 4-6, 2010, the north bridge for the interchange was moved into place from a staging area in the northwest quadrant outside the interchange SB ramp--approximately 1200-feet from the bridge. The span over the SB lanes of I-15 was moved into place on Friday night, and the span over the NB lanes of I-15 was moved into place on Sunday night. These bridges over I-15 are the largest multi-girder spans moved with SPMTs in the United States to date.

The two spans of the north bridge were constructed on temporary support piers in the staging area. On June 3, the SPMTs were moved under the span to be placed over the SB lanes. The 186-foot-long span had nine 96-inch prestressed concrete Washington State bulb tees in the cross section. The span had a 45-degree skew and also weighed 2100 tons. Two lines of SPMTs had to be configured to support the massive span at each end. At acute corners of the spans, two double rows of trailers (one row of 4-axle and one of 6-axle side-by-side) was used and at obtuse corners two double rows of 6-axle trailers were used. Each axle could carry a load of 30 tons. Special tower stand jacks raised and lowered the span off the temporary supports and onto the new substructure elements, respectively. Chains were also used to help control the distance between the double lines of SPMTs. On the top of the bridge, piano-like wire was placed at the diagonals of the span to measure any span distortion. To avoid over-stressing the deck concrete, only 3 inches of distortion was allowed.

On Friday night, traffic control for the move got underway. At 8:00 p.m., one lane (of three NB and SB on I-15) in each direction was closed and then at 9:00 p.m. another. While lanes were being closed, the heavy mover subcontractor had workers positioning the span carried by the SPMTs as close to I-15 as possible for the move to begin at 10:00 p.m. A rolling road block was completed by the Utah State Police at that time to allow the SPMTs to move the west span of the north bridge of the interchange out onto I-15 and clear of the SB off-ramp. At approximately 10:15 p.m. the traffic was stopped on the SB lanes and the SPMTs moved onto I-15 SB, turned, and began going SB toward the bridge site. After stopping the traffic for 32 minutes, the one lane of SB traffic was allowed to proceed and was detoured onto the SB ramps around the bridge site. Traffic was released to flow on the ramps at 10:47 p.m. The NB traffic was similarly detoured so that the contractor had all of I-15--both SB and NB--to perform operations without traffic influence. By 1:00 a.m. the west span of the north bridge was setting on the bearings, and the SPMTs were being readied for movement back to the staging area. By 6:00 a.m. the traffic was flowing freely on I-15 NB and SB.

On Saturday, the SPMTs were configured to support and move the east span of the north bridge off the span's temporary construction supports. Cables were installed between the lines of the SPMTs to maintain the geometry of the span being lifted and moved. The span was positioned next to I-15 for the move Sunday night. By approximately 2:40 a.m. the east span of the north bridge was in place on the substructure supports. The contractor's work was complete and I-15 was opened for the rush-hour traffic on Monday morning.

Prefabricated I-15 bridge at Pioneer Crossing in UT.

The Main Components of PBES:

Prefabricated Elements:

Superstructure:

- Deck Panels: Partial & Full-Depth
- Beams: More Efficient Shapes
- Composite Units

Substructure:

- Pier Caps, Columns, & Footings
- Abutment Walls, Wing Walls, & Footings
- Bent Caps

Prefabricated Systems:

Superstructure:

Increasingly, innovative bridge designers and builders are finding ways to prefabricate entire segments of the superstructure.

Substructure:

A substructure system may consist of individual pier(s) or prefabricated bent caps supported by prefabricated column(s) and/or prefabricated abutment elements.

Total Bridge:

Total prefab bridge systems offer maximum advantages for rapid construction and depend on a range of prefabricated bridge elements that are transported to the work site and assembled in a rapid-construction process.