



By Kelly Crowell  
Contributing Author

# Air bag deployment

## Safety device used to repair spans in lower Alabama

**D**o not count out those good ole' boys from L.A. (Lower Alabama) when faced with an obstacle.

Instead of accepting a problem and assuming the easy way out, they view that as a challenge to see how they can get the job done with limited resources.

The Houston County, Ala., Road & Bridge Department recently utilized an innovative idea to replace deteriorating bearing pads on precast concrete bridges utilizing flat-form high-pressure air bags used in fire department rescue operations.

### In need of rescue

Last year, during regular bridge inspections, the county bridge inspectors discovered deterioration and excessive distortion of bridge bearing pads in 16 precast concrete bridges within the county. They observed areas of concrete on concrete, spalling and cracks as a result of premature bearing-pad deterioration. These conditions can be

attributed to a fiberboard material specified for bearing pads in precast bridges built in the mid 1980s to the mid-1990s.

The county bridge inspectors began monitoring the conditions and prioritized the bridges by degree of damage. Some were placed on a six-month inspection schedule and some on an annual inspection schedule. One bridge was within a couple years of having its rating lowered, which would impact public travel and safety. A lowered rating would have forced rerouting of school buses and public works vehicles and the bridge itself would eventually have to be decommissioned and rebuilt at considerable cost and inconvenience to the public.

A decision was made to proactively repair the bridges rather than wait until deterioration caused the lowering of the bridge's load rating. Typically, this type of project would be contracted out by small counties, but Houston County knew it had capable employees and was confident they could remove and replace the bearing pads themselves with considerable savings.

Some of the spaces were not big enough to allow the air bags to slide in to inflate. To solve this problem, plans were quickly made to buy several 20-ton hydraulic bottle jacks.

Houston County Engineer Barkley Kirkland, P.E., has only been in that role officially for a year; yet he and his staff are already making bold changes in the way business is conducted within the county and are gaining recognition around the state for their innovative approaches to dealing with situations.

While the R & B staff was literally standing under the highest priority bridge discussing how to raise it enough to remove and replace the eroding pads, the idea of using emergency rescue air bags came up. The air bags would be a perfect fit in the gap made by the eroded pads and could raise the bridge span up enough to rake out the deteriorated bearing-pad material and allow the insertion of the new bearing pads.

After consulting with a local fire department rescue specialist and an air-bag vendor to see if this technique was workable and safe to use in this application, all agreed it could be done. That was the green light that Kirkland and his crew needed to proceed with the project.

The Road and Bridge crew moved forward with the trial and county engineering staff calculated how many air bags would be needed to raise the bridge span enough to remove and then replace the bearing pads into the space. The county bought high-pressure flat-form air bags of various sizes and air hoses and built their own manifold system. Based on the bridge's weight and the air-bag lifting capacity, it was calculated that a simple 13-hp air compressor would be strong enough to inflate the air bags enough to access the bearing pads.

The air-bag vendor provided training to the R & B crew and even offered to buy the bags back if the project did not work or if they were not satisfied. There was no way they could lose.

Wood scaffolding was built from the ground up to use as a work platform for the removal and replacement of the bearing pads. A scraper tool had to be designed and built by the R & B shop to remove the degraded bearing pads. This flat pancake head was designed with a slightly bent handle to improve safety so workers' hands would not get pinched between the handle and bridge. This ergonomic design improved accessibility to back edges of the area to get all debris out.

## Ideas fill bag approach

The crew then installed air bags at each intermediate bent cap across the span and

began inflating them simultaneously. The intermediate bent caps began to rise and the bridge deck rose enough for work to be performed at each span. When the crew got to the abutments they encountered a problem. Some of the spaces were not big enough to allow the bags to slide in to inflate. Also, years of sand and grout debris had the bridge locked down and it would not rise off of the



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caps. So the crew backed up and ran at the problem again. How could one break the caps free from the abutment so the air bags could do the job? Then the idea of strategically placing hydraulic bottle jacks at the abutments came up.

Plans were quickly made to buy several 20-ton hydraulic bottle jacks to use at the abutments. The crew began gathering the cribbing needed to access the space under the bridge to reach the abutment.

Oak mats were built up to reach the level needed to insert the jacks. The mats provided a stable footprint to support the jacks while elevating the abutment bridge sections for work to be performed. Once in place, the hydraulic bottle jacks did the job and broke the bridge free from the caps and allowed the insertion of the air bags. Once the bridge broke free at the abutments, it lifted pretty easily after that and the intermediate bents could be lifted with just air bags.

Lessons were learned from the first bridge and ideas were refined and then it was on to the second bridge. This one happened to be over water, so scaffolding up from the ground was not a viable option. The county asked the Alabama Department of Transportation (ALDOT) how they handled work on the underside of bridges. They occasionally use a snoop truck, but that would not work in this situation. Since the R & B crew had to raise the bridge to replace the pads, the increased weight of the snoop truck on the bridge would have only added more weight to the lift. So the county moved on to Plan B.

For smaller jobs like this one, ALDOT uses a scaffold system that hangs from chains attached to the bridge. ALDOT representatives provided pictures of a typical job setup and offered to let the county use their scaffolding chains and walk boards.

The county felt they could improve on the design of the swing scaffold platform. They measured the ALDOT walk boards and then the Road and Bridge shop designed and built a hook-and-ladder frame system which would accommodate the borrowed walk boards. The framework mounts from the top side of the bridge secured on the barrier rail and hangs down, allowing for a stable work platform under the bridge. Once this framework is in place, county workers used an excavator to lift and slide the walk boards in place. The combination of the solid framework and walk boards provided stability and safety for workers and provided a method to work over water where they cannot easily build scaffolding. This design and technique was such a success that they have decided to continue to use this method even when not working over water. It is easy to install and saves time and material and therefore saves money.

## More on the way

As the project began, the bridge was closed to traffic during working hours for the safety of workers underneath. At the end of each workday, the air-bag system was removed to allow the bridge to be returned to service. This allowed for minimum disruption and inconvenience to the public.

Eight of 16 affected bridges in the county have been completed and each one brought new techniques and refined the process to make the job more streamlined, efficient and safe.

The timeframe for the bridge bearing-pad-replacement repairs ranged from 3-5 days from setup to completion depending on the length of the bridge. The actual setup and work was accomplished by using only six county R & B workers working 10-hour days.

For the eight bridges that have been completed so far, the comparisons of costs for repair vs. replacement are staggering:



The timeframe for the bridge bearing-pad-replacement repairs ranged from 3-5 days from setup to completion depending on the length of the bridge.

- If bridge damage had gotten to the point of lowering the bridge ratings and having to decommission and replace, it would have cost more than \$4 million to replace all eight bridges and would have taken six months to replace each one;
- To hire a contractor to replace the bearing pads, it would have cost \$500,000 to repair eight bridges. Each bridge would have been out of service for a period of two weeks while the work was being done; and
- To replace the bearing pads in-house using flat-form high-pressure air bags, it cost only \$80,000 to repair all eight bridges, and each one was put back in service daily after working hours.

The county also decided to buy the bearing-pad Neoprene material in a bulk roll and cut custom-sized bearing pads instead of buying pre-cut pads. They saved more than 66% in material costs by doing it this way.

As the county staff continued talking with ALDOT about their bearing-pad deterioration problem and how they addressed it, ALDOT went back and revisited their bridges and found one bridge they had acquired through road swaps that had the same bearing-pad deterioration problem. ALDOT adopted this innovative technique to repair their bridge.

Houston County has had other Alabama counties approach them about repairing their bridges as contractors. While this is not an option, Houston County R & B staff has offered to go and look at their bridges and give advice. The next time Houston County repairs a bridge using this method they will issue an invitation through the Association of County Engineers of Alabama (ACEA) to anyone who is interested in observing the work.

Houston County submitted information on this project to the ACEA and received the John F. Courson Excellence in County Engineering Award for 2014 for their forward-thinking approach in solving the problem.

Like most counties, resources are limited and getting work done can be a challenge. Houston County's small R & B department used a half-dozen employees and saved their taxpayers potentially millions of dollars by not accepting the norm and looking for a creative solution when faced with a challenge. **R&B**

Crowell is the Houston County safety director, Dothan, Ala.

For more information about this topic, check out the Bridges Channel at [www.roadbridges.com](http://www.roadbridges.com).

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### REQUEST FOR LETTERS OF INTEREST FOR DESIGN-BUILD SERVICES

The Missouri Department of Transportation (MoDOT) is soliciting Letters of Interest from companies interested in providing Design-Build services for the replacement of Interstate 70 bridges in Columbia, Missouri.

The project's primary purpose is to rebuild three Interstate 70 bridges in Columbia, Missouri.

One Design-Build team will be selected to design and construct the project. In addition to design and construction, quality management, maintenance of traffic and environmental management may be included as part of the contract. MoDOT will use a Best Value selection process to evaluate the ability of the Design-Build proposers to meet or exceed the project goals.

**An informational meeting is scheduled from 1 p.m. to 3 p.m., Wednesday, November 19, 2014, at the Columbia Activity and Rec Center, 1701 Ash Street, Columbia, MO 65203.** It is anticipated the Request for Qualifications (RFQ) will be released this same day. At the meeting, a presentation will be made on the project, followed by a question and answer period and time for networking.

Firms interested in receiving Interstate 70 Columbia Bridges Design-Build information should send a one-page **Letter of Interest** to MoDOT by registered mail, or similar delivery method that indicates proof of receipt, no later than Wednesday, November 12, 2014, to ensure that you receive all information. An email will also be accepted to [Columbia.70@modot.mo.gov](mailto:Columbia.70@modot.mo.gov). The Letters of Interest will allow MoDOT to compile a list of interested companies for notices and any announcements relating to the I-70 Columbia Bridges Design-Build Project.

Address all letters or email to:

**Travis Koestner, P.E.**  
Missouri Department of Transportation  
1511 Missouri Boulevard  
Jefferson City, MO 65109.



Include in your Letter of Interest the company name and a contact person at your company including, address, phone and fax numbers, and e-mail. Please indicate if your firm is a Disadvantaged Business Enterprise (DBE).

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