AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2010 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 11, 2009

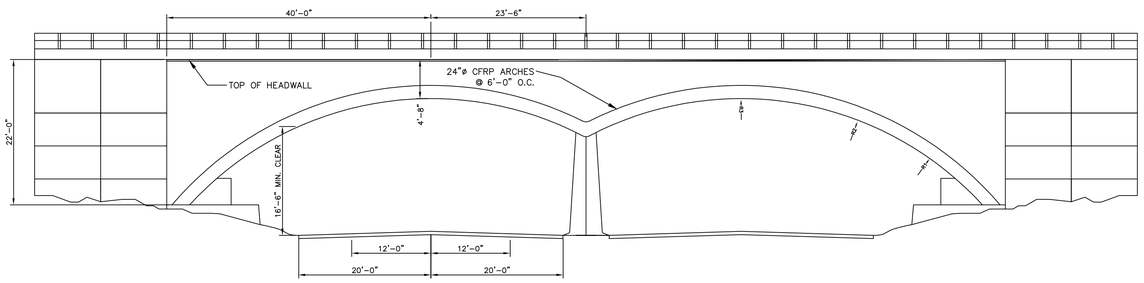
Sponsor	*Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.*	1. Sponsoring State DOT: Maine		
		2. Name: Kenneth Sweeney		
		Title: Director, Bureau of Project Development		
		Mailing Address: 16 State House Station		
		City: Augusta	State: Maine	Zip Code: 04333-0016
		E-mail: ken.sweeney@maine.gov	Phone: 207-624-3400	Fax: 207-624-3401
		3. Date Submitted: 07/21/2009		
		4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group? Please check one: ☒ Yes ☐ No		
Technology Description (10 points)	*The term "technology" may include processes, products, techniques, procedures, and practices.*	5. Name the technology: Rigidified FRP Tube Arch Bridges		
		6. Please describe the technology: Site infused FRP tube-arches are used as both formwork and reinforcing for cast-in-place buried concrete arch bridges. All required tubes for a single span bridge can be placed in one work day without using heavy equipment. The tubes are tied into the footing formwork and an FRP decking system is attached. After the pouring the footings, the arches are filled with self-consolidating concrete. Soil is placed and compacted over the decking up to the required level, and the roadway is paved. The system includes the FRP tubes, decking, and a headwall system.		
		7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.) Please check one: ☒ Yes, images are attached. ☐ No images are attached.		
State of Development (30 points)	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.*	8. Please describe the history of the technology's development. Funded by the U.S. Army Natick Soldier Center, the AEWC/University of Maine researched and developed the Rigified FRP Tube Arch Bridge technology. In 2008 the AEWC successfully constructed the Neal Bridge in Pittsfield. As a result of the project, a new company, Advanced Infrastructure Technologies, LLC, was created to commercialize and further develop this bridge technology.		
		9. For how long and in approximately how many applications has your State DOT used this technology? The first bridge made with Rigified FRP Tube Arch Bridge technology, the Neal Bridge, was installed in the Fall of 2008 in Pittsfield, Maine. Advanced Infrastructure Technologies (AIT), MDoT, and AEWC are now working together to build six additional tube-arch bridges over the next two years. Advanced Infrastructure Technologies, LLC, is currenlty designing these bridges for spans ranging from 30 ft to 70 ft.		
		10. What additional development is necessary to enable routine deployment of the technology? The AEWC is currently working with AIT to reduce installation costs through more refined modeling techniques, and to improve inspection and maintenance training methodologies. In addition, structural testing of the longer span systems needs to be completed to confirm functionality of design tools.		
		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.		
		Organization	*Name*	*Phone*	*E-mail*
		Gardner Construction Enterprises	Randy Gardner	207 478-6369	gcenterprises1@myfairpoint.net

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? Smaller stakeholders without ready access to large equipment, such as municipal governments and private industries, can self-install bridges using the Rigified FRP Tube Arch Bridge technology. Being both cheaper and more comapct than pre-cast components, shipping costs and requirements are lower. Also, with abbreviated construction time, there are fewer traffic interruptions and detouring, reducing the inconvenience to both personal and commercial traffic.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. This innovative technology improves the ability to construct economical bridges and shows progress towards making the next set of installed bridges less expensive than traditional alternatives. We anticipate a long, low-maintenance service life for these structures due to the combination of composite materials and a joint-free, rebar-free bridge structure, which also leads to substantial fiscal benefits. Construction safety concerns would be greatly reduced through minimal usage of heavy machinery, such as cranes, and an overall minimization of on-site work. This technology, by employing the use of factory manufacturing, lessens the potential for on-site accidents and improves the overall safety of construction. This technology improves current transportation effectiveness and efficiency by minimizing the obstruction of traffic in that, after the footing is placed the bridge can be open for traffic within one week. Minimizing traffic obstructions and detouring is also beneficial to the environment. By reducing the carbon footprint of bridge construction, both through reduced material delivery expenditure and extended lifespan, an original and 'green' technology has been created.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? The Rigified FRP Tube Arch Bridge can not only replace traditional bridge structures, but can be installed in locations that heavy equipment can't easily access. This may include national parks and other areas that demand minimal environmental impact, remote areas in the United States, and in developing countries.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? Organization should contact Advanced Infrastructure Technologies, LLC to design and manufacture a Rigified FRP Tube Arch Bridge system.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? As it is a pre-engineered bridge system, the Rigified FRP Tube Arch Bridge technology is easily adopted. AIT recommends that contractors participate in two four-hour training sessions. The learning curve for installation is very short, as the process closely mimics existing construction techniques.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? To further assist deployment, drawings are available, specifically those of the successful Neal Bridge and other various geometries. Material specifications, installation videos and guides are also available; additional formal training materials continue to be developed. For general information, a summary report and testing results about the technology are available and more specificially, a Manual for Bridge Evaluation-based report on the Neal Bridge has been completed. The Neal Bridge was load rated using both testing and analysis and the report is available as an exemplar for future load ratings.
		18. What organizations currently supply and provide technical support for the technology? The AEWC at the University of Maine and Advanced Infrastructure Technologies, LLC.

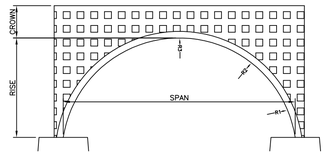
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The intellectual property is owned by the University of Maine and licensed to Advanced Infrastructure Technologies, who are currently the only suppliers of the primary system components.
Submit Completed form to		***http://transportation1.org/tig_solicitation/Submit.aspx***

AEWC RIGIDIFIED INFLATABLE ARCHES
VARIOUS GEOMETRIES FOR
INTERSTATE OVERPASS/UNDERPASS, STREAM CROSSING AND RAILWAY OVERPASS

INTERSTATE OVERPASS
NORTH AND SOUTH DIRECTIONS
MINIMAL MEDIAN



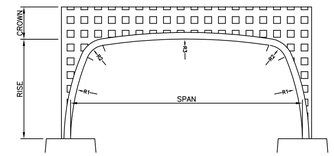
SINGLE RADIUS ARCH
OTHER GEOMETRIES AVAILABLE



SPAN	RISE	CROWN
30'	7'-15'	3'8"+
45'	10'-24'	4'4"+
60'	14'-30'	4'10"+
70'	15'-35'	4'10"+
MAX SKEW APPROX. 30 DEG.		
NO MAX OR MIN WIDTH		
ANY ROAD SLOPE/VERT. CURVE		

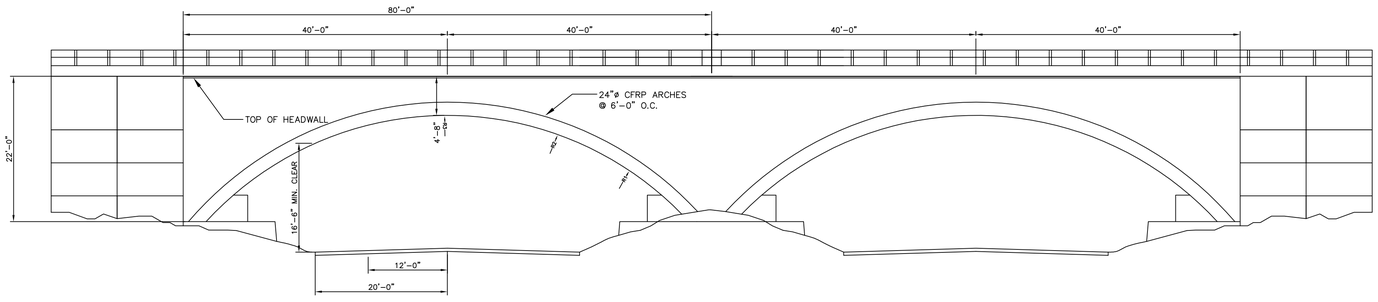
NOTE: TUBE DIAMETER MAY VARY THROUGHOUT LENGTH OF ARCH

VARIABLE RADIUS ARCH
GREATER CLEAR AREA FOR GIVEN SPAN

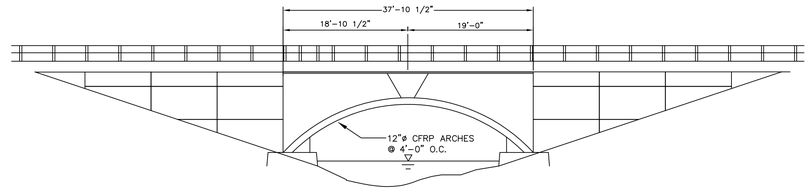


NOTE: ALL RADII INFINITELY VARIABLE FOR ARBITRARY ARCH GEOMETRY

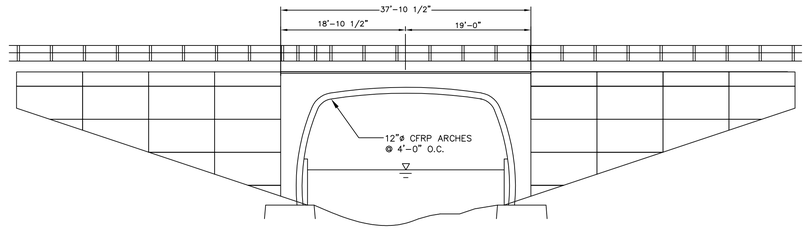
INTERSTATE OVERPASS
NORTH AND SOUTH DIRECTIONS
40' MEDIAN



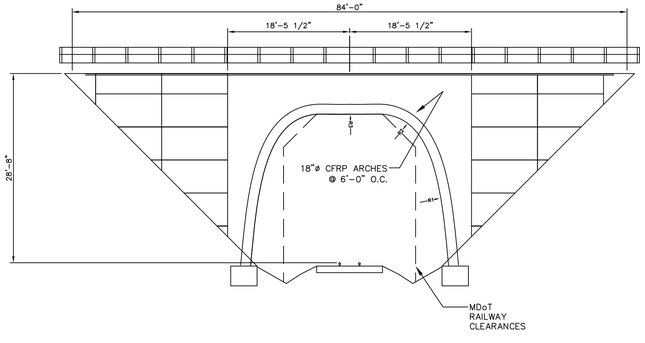
SHALLOW STREAM CROSSING



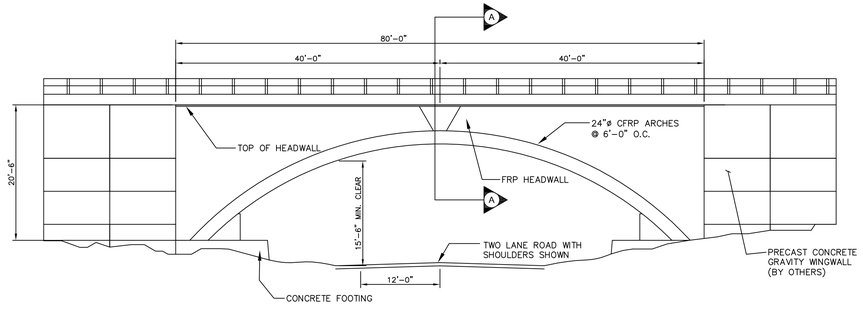
DEEP STREAM CROSSING

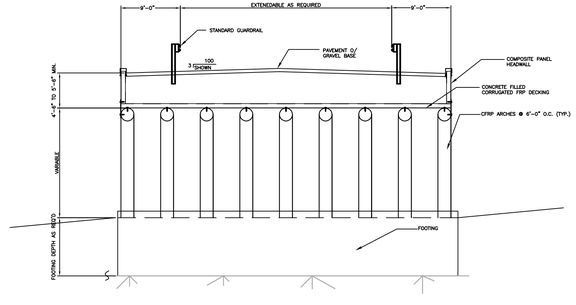


SINGLE TRACK RAILWAY CROSSING



TYPICAL GRADE CHANGE
TWO-LANE ROAD CROSSING/
INTERSTATE UNDERPASS






B5


B6


B7


B8


B9