Appendix 3: Survey Results

Summary of survey/interview responses from Bridge owners or maintainers is presented in this section.

Butler Co., OH: A telephone interview was conducted with the interviewee regarding the Tech-21 bridge in June 2003. Interviewee said that he would fax/email the inspection reports for the bridge to the research team. Interviewee said that he was not that familiar with the project, but to date, he has not heard of any problem with the bridge. The bridge was inspected by Burgess & Nipple as per Ohio DOT format (Ohio DOT inspection standards and schedule).

California: California DOT was contacted and a message was left for the contact person. At present, the research team has not obtained a response from California.

Delaware: Delaware DOT was contacted, and personal interview was conducted in the Delaware DOT offices by research team member on September 5, 2003. Two FRP deck bridges in Delaware were discussed. Interviewee indicated that one of the bridges, Muddy Run in Bear, DE was state owned and maintained while the other bridge was owned by the Delaware Memorial Bridge Authority.

Interviewee indicated that the Muddy Run Bridge was built in 1998, and has undergone several inspections and load tests. The load tests (conducted at various times within the first year after construction) did not indicate any problems or changes in behavior. Inspections were generally conducted visually, and no defects or problems were noticed in any of the inspections. No special inspection guidelines have been established by the DOT, but an inspection manual prepared by the deck manufacturer was under review by the DOT for acceptance. Interviewee provided the research team member with plans for the bridge as well as the latest SI&A report. He also promised to send a presentation that had photographs of the bridge and various details.

Interviewee also mentioned that there were no problems noted as far as the wearing surface was concerned. The wearing surface was thick (2") latex modified concrete. Also, there was a preinstalled 3/4" binder course on the panels when they arrived from the factory. The joint details were also well thought out, and included application of FRP sheets both at the top and bottom surface of the deck.

The deck was manufactured by Hardcore, and the design and instrumentation was managed by University of Delaware.

Georgia: Interviewee indicated that GADOT does not have FRP decks. The DOT has planned to install a FRP deck on an old truss bridge to bring up the rating, but the bridge was eventually removed from service.

Some of the concerns expressed by the interviewee regarding use of FRP decks were: 1) Problems with overlays and delamination of overlays; 2) Potential problems with attachment of railing to deck; 3) The effect of impact on the railing and the deck; 4) Reparability of the deck and whether impact or other such action might damage the deck beyond repair.

The interviewee indicated that due to the higher cost of FRP deck, the use of these decks would most likely be in circumstances where there is definitive advantage, such as on weight restricted bridges, and if overlay problems are resolved, then on movable bridges.

Illinois: Illinois DOT was contacted by research team member in July 2003. The interviewee indicated that Illinois DOT has one bridge in Jacksonville, IL. Interviewee indicated that the bridge was inspected once soon after construction in Winter 2002, and only visual inspection was performed. Interviewee also indicated that Illinois DOT does not have any special inspection procedures or guidelines for FRP decks, however the shear connection detail between the deck and steel stringers were considered as critical details during construction, and special emphasis was exerted during the inspection of this area.

Illinois DOT was conducting durability testing on the material by taking coupons and subjected them to the environment outside the Illinois DOT Laboratory. The coupons will be tested for tension, compression, moisture absorption, and UV damage at various intervals to obtain information about the weathering characteristics of the material. In addition, the materials division is planning to instrument the bridge and conduct load testing to obtain long-term in-service information about the deck. The interviewee sent bridge construction report, photographs, and the plans for the bridge.

Iowa: Iowa DOT was contacted by research team member in June 2003. Interviewee mentioned that they have one bridge that was opened to traffic in 2003 (53rd Ave Bridge over Crow Creek, Iowa City), constructed through the IBRC program. Other bridges were planned, but due to budget issues, were not constructed. Interviewee indicated that the bridge has not been inspected, and that they do not have any specific guidelines or information on inspection of these decks. As per the Interviewee's knowledge, Iowa DOT to date was unaware of any problems with the FRP deck. The interviewee suggested that the research team should contact Iowa State University who is championing the FRP deck program in Iowa.

Kansas: Kansas DOT was contacted by research team member in June and once again in July 2003. At present, the research team has not obtained a response from Kansas.

Maine: Maine DOT was contacted in September 2003. The interviewee indicated that Maine has 4 FRP Bridge decks, some on steel stringers and others on timber glulam stringers. The interviewee indicated that the FRP deck design and inspection/observation was being done by the Advanced Engineered Wood Composites Center of University of Maine at Orono. The interviewee indicated that most of the information on the deck type, makeup, and details would be available from University of Maine.

The interviewee indicated that the FRP deck bridges are inspected on the biennial inspection cycle along with all other regular bridges. The FRP deck bridges are state owned, and are on secondary highways with ADT's less than 3000. No special inspection methods are currently used for inspecting the FRP decks, and as per the interviewee's knowledge, no special inspection methods or techniques are likely to be used in the future. The contract also did not require the manufacturers to provide any inspection manuals or other guidelines for the FRP decks.

As per the interviewee's knowledge, the FRP decks were performing well, and at this time, he was unaware of any issues or problems associated with the FRP deck bridges. The FRP deck bridges are instrumented by University of Maine, and have been load tested by the University. The interviewee further said that University of Maine at Orono will have additional details and data on design, construction, inspection, and testing of the FRP deck bridges in Maine. University of Maine was contacted to obtain further information on the FRP decks in Maine. At present, the research team has not obtained a response from the University of Maine.

Maryland: Maryland DOT was contacted in September 2003 to discuss the experiences with FRP decks in the state. The interviewee indicated that although there are four FRP deck bridges in Maryland, only one of these is state owned while the others are county owned. The interviewee provided details on the state's experience with the FRP deck bridge on MD Route 24 over Deer Creek.

The interviewee indicated that the deck was composed of Martin Marietta DuraSpan sections. The bridge is an old truss bridge with a superstructure composed of floorbeams and stringers. The transversely placed FRP deck sections span over closely spaced longitudinal stringers. The railing on the bridge is directly connected to the superstructure while the curb is attached to the deck. The concrete curb was cast in the field, and the reinforcement dowels are embedded in

concrete pumped in a 2 feet wide section of the FRP deck along its outside edges. Cutouts in the FRP cross-section are provided for shear studs, and initially, the deck rests on steel angles attached to the edges of the top flange of stringers. The space between the deck bottom surface and the stringer top surface and contained within the angles is filled with concrete grout to form a cast in place haunch. The concrete is pumped until the concrete fills the cutouts for shear connectors. Transverse joints between the deck panels are glued together using epoxy adhesive, and two layers of FRP splice strips. A conventional bituminous asphalt wearing surface was used on this bridge. The thickness varied from 1-1/2 inches at the edge to about 4-1/2 inches at the crown. The roadway curvature was accomplished by varying the asphalt thickness.

The interview indicates that no problems were encountered during or after construction of the bridge. A load test was conducted after completion of the bridge. In addition, regular biennial inspections have been conducted on the bridge. No special inspection guidelines exist at this time, and the inspection typically consists of visual inspection of the deck. No special techniques, such as tap test or chain drag, are used during the inspection of the FRP deck. Based on inspections and observations to date, the bridge is performing better than expected, and the interviewee indicated that he is very happy with the performance of this FRP deck, and would readily recommend use of this deck if justified by the project needs. The interviewee sent plans and details of the bridge to the research team member.

New York: New York DOT was contacted by research team member in June 2003. The in interviewee indicated that there are eight FRP deck bridges, and one FRP deck bridge is under construction. The interviewee sent all inspection reports for all the FRP bridge decks to date. The interviewee indicated that there are no published or formal inspection guidelines in the state. Inspection is typically limited to visual inspection, but tap test and chain drag methods have also been used on some bridges. Thermography has been used on one bridge on an experimental basis where delamination was observed through the visual inspection. Inspection has revealed delamination of the top laminate as the main problem on some decks along with deterioration and delamination of wearing surface. On some of the decks, large delamination/air bubbles were observed on the deck top surface. The delamination was easily visible despite the overlay. Tap test using hammers was conducted, and the delaminated area was observed to be visibly vibrating after the tapping. These decks were replaced.

The interviewee indicated that the use of FRP decks is more expensive than other conventional materials. The interviewee believed that

despite the higher cost, FRP could be useful in specific circumstances where speed of construction or lower weight is required.

Ohio: Ohio DOT was contacted by research team member in July 2003. The interviewee provided substantial information on FRP decks in Ohio, mostly on the Salem Ave Bridge. Interviewee mentioned that ODOT owns two bridges, Salem Ave. Bridge and a Dar County. In addition, 10 to 12 other FRP deck bridges in Ohio are owned by counties and cities. Interviewee indicated that he would try to obtain contact information for the county and city engineers who are associated with FRP deck bridges in Ohio.

The interviewee indicated that Ohio DOT bridges are inspected by the state inspection personnel, while the county or city bridges are inspected by their owners, either using in-house staff, or through utilizing consultants. Currently, Ohio does not have any standardized inspection manuals or other memoranda for inspection of FRP deck bridges.

Interviewee mentioned that on the Salem Avenue Bridge, four different deck types were used to comparatively evaluate their performance. The interviewee indicated that the decks manufactured by Creative Pultrusions performed suitably. The interviewee indicated that the manufacturers were supposed to provide inspection/maintenance manuals for all the four deck types. However, these manuals were never finalized by ODOT. The interviewee indicated that he would try to procure draft copies of the inspection manuals. The ADTT on this bridge is 30,000. However, no specific problem directly related to traffic was noted on the FRP decks.

The interviewee indicated that some of the specific problems observed on the Ohio DOT FRP bridge decks were:

1. Overlay failure, especially at the FRP panel joints due to expansion/contraction.

2. Panel to panel joints are a problem, and typically fail despite being epoxied/adheared together. On the Salem Avenue Bridge, the overlay over the joints was removed and replaced with a 400x expansion PolyCarb wearing material over 6 inch strips over the joints. This treatment seems to be working well.

3. Delamination was observed on some deck panels. Destructive testing showed that delamination was observed in the top laminate, whereas the wearing surface remained well adhered to the deck.

4. Typically, construction problems exist at the shear stud/haunch location. The specific concern appears to be that the deck may not be bearing solidly on the concrete haunch, resulting in

vibration/lift-off from the seating. This condition could also result in punching of the stud through the top laminate if heavy load impacts a non-seated area.

5. Inspection of shear studs is a problem. Although the deck is not composite, it is necessary for the deck to be held firmly in place. Failure of the studs may result in the deck coming off the beams.

6. The deck freezes faster than concrete decks, and the interviewee felt that this could be a problem in winter.

7. Creative Pultrusions sections appear to be performing better as they have given the least amount of performance problem.

8. Destructive testing was conducted on the removed panels at University of Cincinnati.

Oregon: Oregon DOT was contacted by research team member in June 2003. The interviewee provided contacts for other potential interviewees in the DOT who would be able to provide specific information about the FRP decks in Oregon. At present, the research team has not obtained a response from the other interviewees who were contacted.

West Virginia: West Virginia DOT was contacted by research team member in June 2003. The interviewee discussed the Hanover Bridge (SR 23) over S Branch of Potomac in Pendleton County. The interviewee indicated that he was involved in design of the bridge. The original deck design consisted of octagonal sections initially developed for US Army Corps of Engineer research project by West Virginia University. However, the deck section type was later changed by West Virginia University to the sinusoidal sandwich section manufactured by Kansas Structural Composites. Based on conversations the interviewee had with the resident engineer, the sinusoidal section based deck had significant delamination and warping problems during construction.

The interviewee further informed that there were also problems along the panel joints, and heavy leakage of water had been noted in the biennial inspection reports. The interviewee sent the plans and inspection reports for two FRP deck bridges in West Virginia.