

Carbon Fiber Reinforced Polymer Prestressing

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2015 AASHTO Subcommittee on Bridges
and Structures*

Technical Subcommittee T-6, Composites



What is A.I.I.?

- AASHTO Innovation Initiative
 - Formerly AASHTO TIG
 - Innovation by transportation agencies, for transportation agencies
 - Leading edge, not bleeding edge
 - Agency teams that developed and proved the concepts



What is A.I.I.?

- AASHTO Innovation Initiative
 - Peer exchange, shared resources, lessons learned
 - Limited-time, hands-on help
 - Funded by States through AASHTO

What is CFRP?

- Corrosion-free option for pre-tensioning and post-tensioning applications on bridge components
- Comparable performance to steel in finished product: material handling, structural erection, constructability
- Anticipation of lower life cycle costs, including reduced maintenance and rehabilitation work

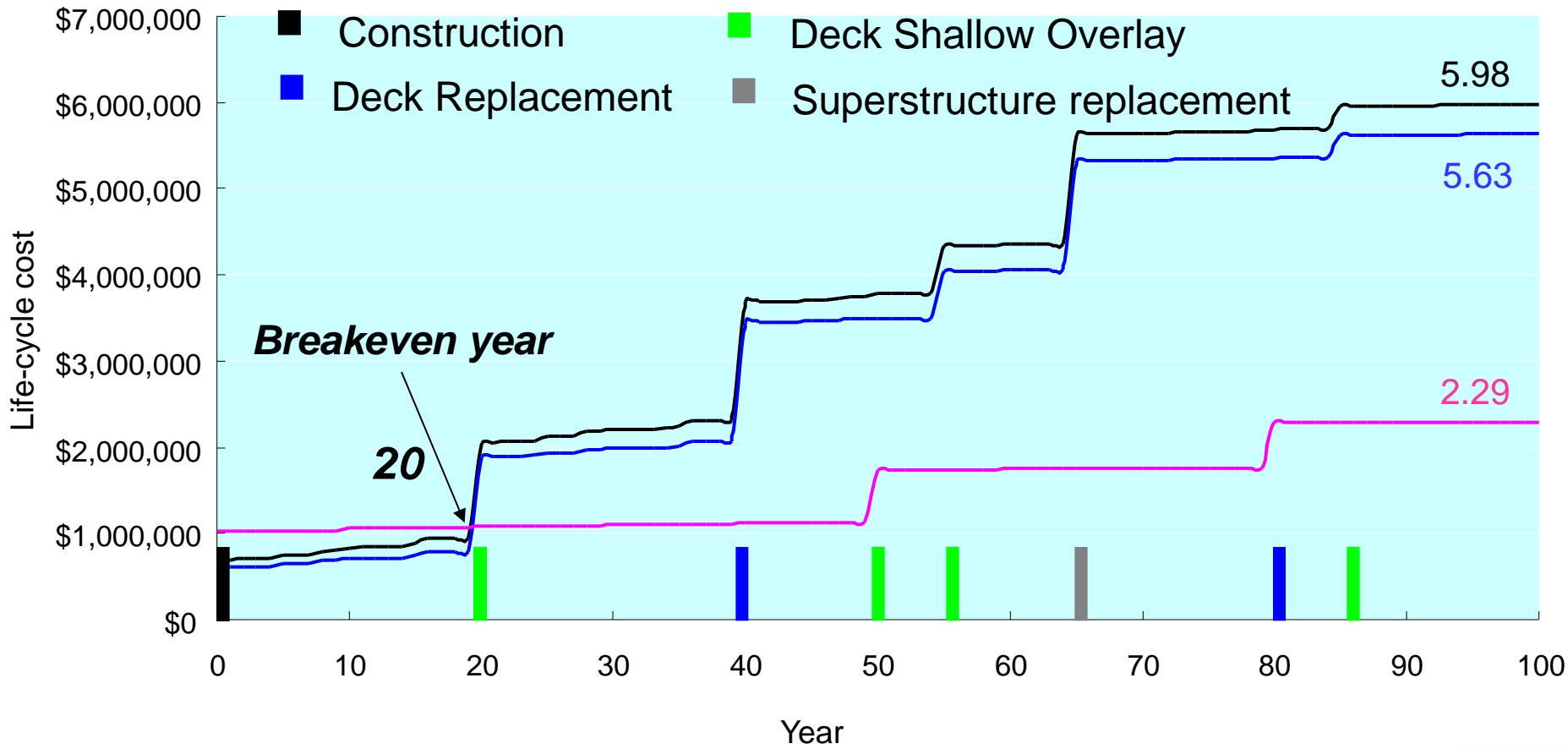
Other CFRP benefits?

- Cost, like steel, is a fraction of overall project budget, and is falling as applications, supply and technology advance
- Increased worker and motorist safety through less anticipated life cycle maintenance and rehabilitation work

Bridge Life Cycle Costs



— Black Steel Bridge — Epoxy-Coated Steel Bridge — CFRP Bridge



Michigan DOT Deployments

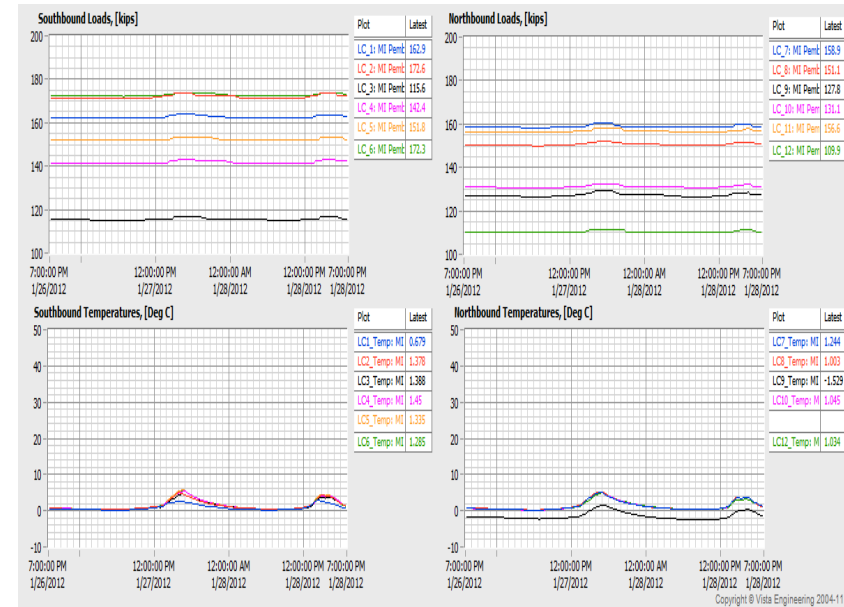
FY	REGION	LOCATION	BRIDGE ID	TECHNOLOGY DESCRIPTION	COMMENTS
2001	Southfield	Bridge Street over Rouge River	B01 of 63-20-35	CFRP prestressing, longitudinal and transverse post tensioning and deck reinforcement	
2011	Metro	Pembroke Ave over M-39	S09-82193	CFRP grid deck reinforcement, CFCC transverse post tensioning	803 feet of 40 mm cable used
2012	University	M-50 / US-127 BR ov RR	R01-38072	CFCC transverse post tensioning	1017 feet of 40 mm cable used
2013	Metro	WB M-102 over Plum Creek	B03-82141-4	CFCC deck reinforcement, longitudinal prestressing, shear stirrups	106,000 feet of 15.2 mm cable used
2014	Metro	EB M-102 over Plum Creek	B03-82141-3	CFCC deck reinforcement, longitudinal prestressing, shear stirrups	106,000 feet of 15.2 mm cable used
2014	Metro	I-94 EB over Lapeer Rd	S18-77111-3	CFCC transverse post tensioning	861 feet of 40 mm cable used
2015	Metro	I-94 WB over Lapeer Rd	S18-77111-4	CFCC transverse post tensioning	861 feet of 40 mm cable used
2015	University	M-100 over Sharp Drain	B02-23071	CFCC longitudinal prestressing	10,000 feet of 15.2 mm cable to be used
2015	North	M-66 over West Branch River	B01-67032	CFCC longitudinal prestressing	5200 feet of 15.2 mm cable to be used
2016	Southwest	M-86 over the Prarie River	B01-78061	CFCC longitudinal prestressed decked bulb-T beam	Potential candidate, structure study complete, still evaluating

Michigan DOT Deployments



- **Pembroke Avenue over M-39 in the City of Detroit**

Michigan DOT Deployments



➤ **Pembroke Avenue over M-39 in the City of Detroit**

Michigan DOT Deployments



➤ **M-50 over Norfolk Southern Railroad in the City of Jackson**

Michigan DOT Deployments



- **M-50 over Norfolk Southern Railroad in the City of Jackson**

Michigan DOT Deployments



- **M-102 over Plum Creek in the City of Detroit**

Michigan DOT Deployments



➤ M-102 over Plum Creek in the City of Detroit

Michigan DOT Deployments



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Michigan DOT Deployments



- **M-102 over Plum Creek in the City of Detroit**

Virginia DOT Deployments



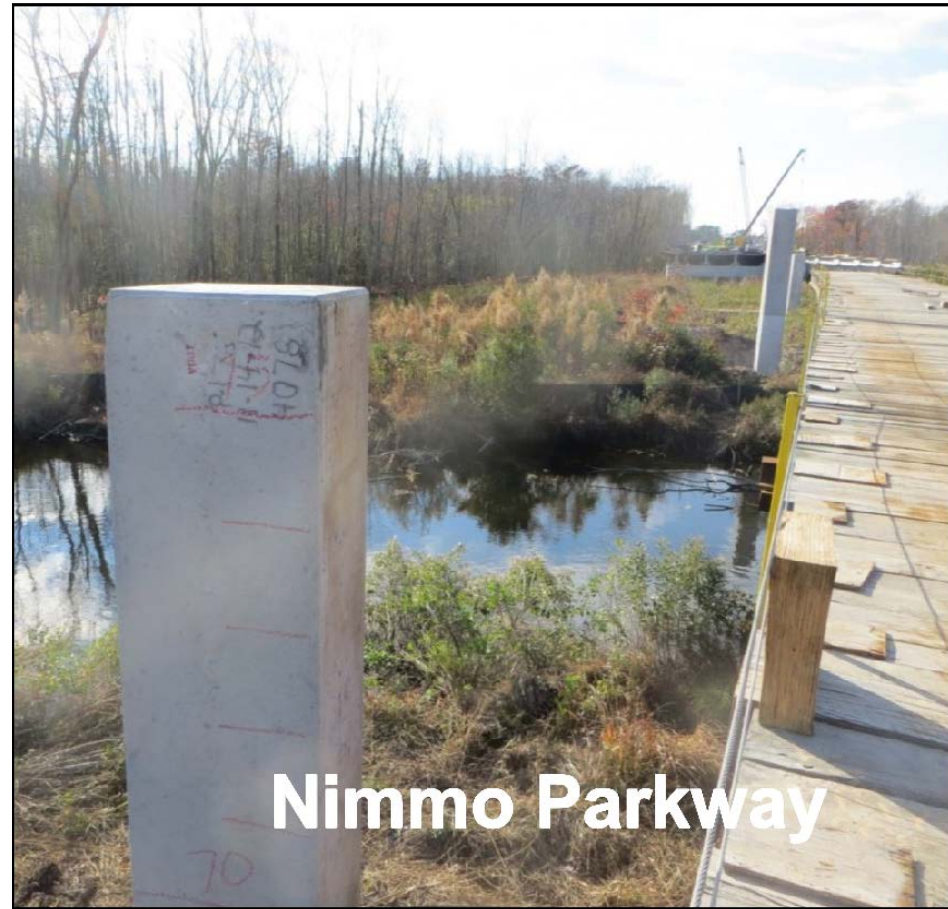
- **Nimmo Parkway in Virginia Beach**

Virginia DOT Deployments



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Virginia DOT Deployments



Nimmo Parkway

- **Nimmo Parkway in Virginia Beach**

Other States' Deployments

- Virginia DOT currently designing CRFP prestressed AASHTO girder
- Maine DOT has used CRFP prestressing strands for prestressed NEXT beams, and some stay cables for the Penobscot Narrows bridge
- Ohio DOT is currently designing their first CFRP prestressed concrete box beam bridge

Other States' Deployments

- Florida DOT performing research for CFRP use in prestressed piles and post tensioned segmental bridges
- Louisiana DOT used external longitudinal CFRP post tensioning tendons for bridge strengthening

Ongoing Research

- CFRP prestressed deck bulb-T beam pooled fund project with MI, IA, OR, WI & MN
- Long term durability and Michigan specific Design Guidelines
- EC6 & CFCC research by Florida DOT
- National research – NCHRP 12-97: *AASHTO LRFD Guide Specification for the Design of Concrete Bridge Beams Prestressed with CFRP Systems*
- Domestic Scan 13-03: Advances in FRP Composites in Transportation Infrastructure to start May 2015

All Marketing Approach

- Two pronged strategy:
 - General information for agencies interested in materials, and wanting more implementation information
 - More detailed technical design and construction support for agencies on the verge of implementation

All Marketing Approach

- Post sample designs, sample plans, material specifications for All Lead States Team website
- Deploy other technical resources and develop workshops and webinars to assist agencies in early stages of implementation
- Engage other groups, such as AASHTO SCOC, and SCOM

Summary

- Continue momentum of agency interest, and CFRP material benefits
- Assist states in implementation
- Work through AASHTO SCOBS on LRFD guide specifications balloting



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Thank you!

