



# PAST, PRESENT, AND FUTURE OF ABC IN PUERTO RICO

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**SHRP2 INNOVATIVE BRIDGE DESIGNS FOR RAPID RENEWAL PEER WORKSHOP – ATLANTA**

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AUTORIDAD DE CARRETERAS Y TRANSPORTACION

# OVERVIEW



- ABC IMPLEMENTATION
- CURRENT AND FUTURE OF ABC IN PUERTO RICO



## PR infrastructure characteristics:

- Most of the low-volume local roads do not have alternate routes.
- High-volume roads cannot be closed for an extended period of time.
- Some construction materials are not readily available and need to be shipped from abroad.

ABC techniques address most of the challenging issues in PR that typically drive project cost and time.



## ABC innovations used in PR:

- Pre-fabricated Bridge Elements and Systems (PBES)
  - Total Bridge Reinforced Concrete
  - Fiber Reinforced Polymer (FRP) Deck Superstructure



## ABC innovations used in PR:

- Geosynthetic Reinforced Soil Integrated Bridge System (GRS/IBS)
- Other applications:
  - Carbon Fiber Reinforced Polymer (CFRP)
  - Thin Overlay with Broadcast Aggregates (TOWBA)

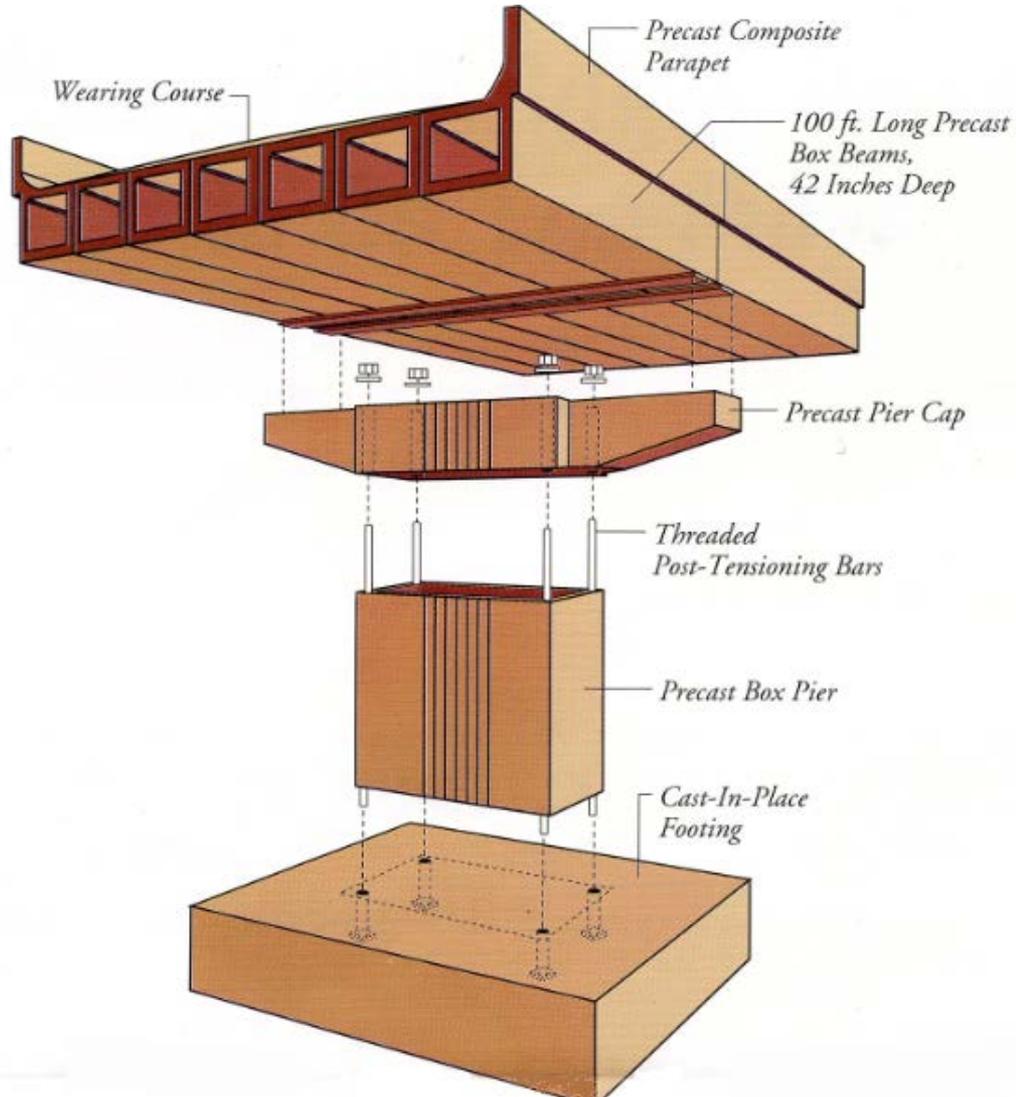
# ABC IMPLEMENTATION: PBES



## BALDIORIOTY DE CASTRO AVENUE OVERPASSES PROJECT

- Year: 1990 (Pioneered the use of ABC-PBES)
- AADT: 100,000
- 4 overpass bridges erected to replace signalized intersections
- 2-213m long (7 spans) and 2-274m long (9 spans)
- 72-hour limit of closure time for each bridge construction
- \$100,000 penalty per day of additional closure time
- First bridge completed in 36 hrs, the following in as few as 21 hrs

# ABC IMPLEMENTATION: PBES



# ABC IMPLEMENTATION: PBES - FRP



## BRIDGE 281, PR-139, PONCE

- Year: 2008
- Original Structure: Two-cell culvert
- AADT: 5,300
- Replaced by FRP Deck Superstructure and Pre-cast Substructure
- Proposed Structure: 20m long (2 spans)
- Cost: \$2.2M
- Duration: 1-year construction
- 2009 Outstanding Project of the Year Award (CIAPR South Chapter)



## BRIDGE 281, PR-139, PONCE

(BEFORE)





## BRIDGE 281, PR-139, PONCE

(AFTER)



# ABC IMPLEMENTATION: GRS/IBS

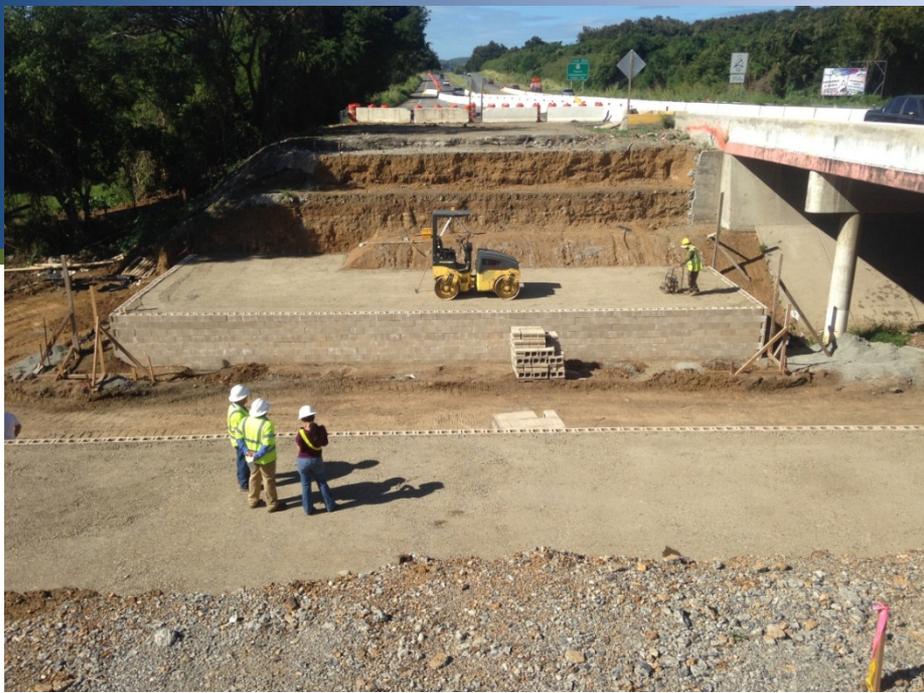


## BRIDGES 1121/1122, PR-2, YAUCO

- Year: 2013
- Original Structure: Three-span concrete slab bridge
- AADT: 40,000
- Replaced by GRS/IBS Substructure and voided slabs Superstructure
- Proposed Structure: 11.40m long (1 span)
- Cost: \$2.3M
- Duration: 11-month construction



# BRIDGES 1121/1122, PR-2 YAUCO





# ABC IMPLEMENTATION: CFRP



## BRIDGES 2028/2029, PR-52, CAYEY

- Year: 2004
- Structure: 51m long (2 spans) constructed in 1973
- AADT: 67,000
- Rehabilitation consisted of “hunge” beam reinforcement using CFRP
- Cost: \$500,000
- Load Test was performed before and after to validate results
- Results showed that Load Rating Factors increased from 0.44 to 1.02 for shear and from 1.03 to 1.88 for positive moment.
- The project’s success turned the use of CFRP into an institutionalized technique.



## BRIDGES 2028/2029, PR-52, CAYEY





## BRIDGES 2028/2029, PR-52, CAYEY





## BRIDGE 238, PR-111, LARES

### (BEFORE & AFTER)



#### Project Data:

- Cost: \$224,000
- Duration: 2-month construction





BRIDGE 1277, PR-7787  
OVER PR-52, CAYEY  
  
(BEFORE & AFTER)

Project Data:

- Cost: \$433,000
- Duration: 9-month construction



# ABC IMPLEMENTATION: PBES - TOWBA

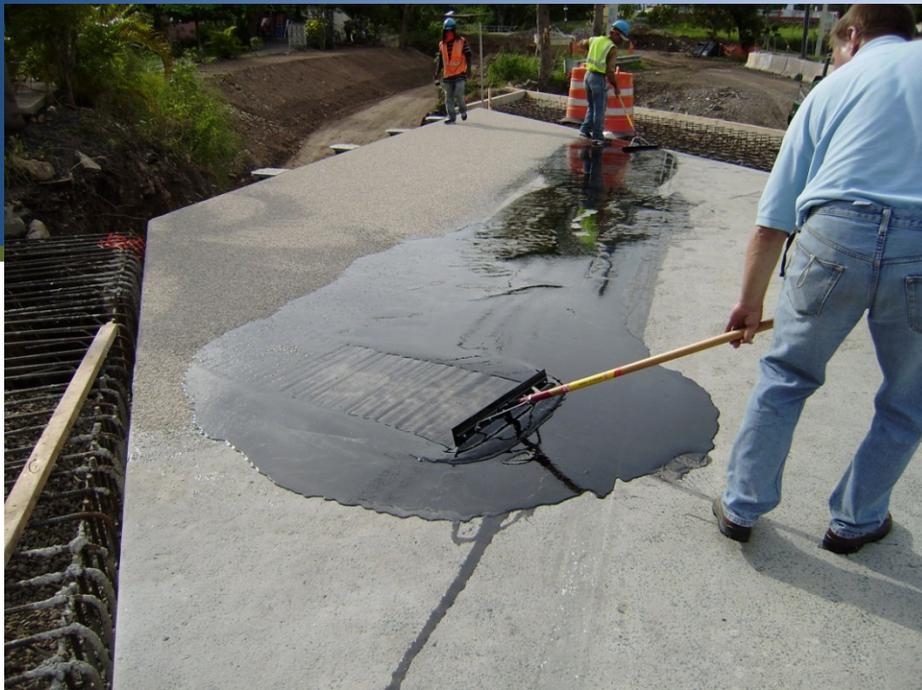


## BRIDGE 281, PR-139, PONCE PROJECT

- Year: 2008
- Original Structure: Two-cell culvert
- AADT: 5,300
- Proposed Structure: 20m long (2 spans)
- The installation of TOWBA was used to improve skid resistance and protect the FRP Deck Superstructure.
- Nowadays, this technique is widely used for preservation/rehabilitation in existing bridges and to improve deck durability in new bridges.



## BRIDGE 281, PR-139, PONCE



# CURRENT AND FUTURE OF ABC



ABC techniques currently undergoing:

- Pre-fabricated Bridge Elements and Systems (PBES)
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS/IBS)
- Other applications:
  - Carbon Fiber Reinforced Polymer (CFRP)
  - Thin Overlay with Broadcast Aggregates (TOWBA)

# CURRENT AND FUTURE OF ABC



## Future of ABC in Puerto Rico:

- Design-Build
- Construction Manager General Contractor (CMGC)
- Lateral Bridge Slide
- Pre-fabricated Pier Cofferdams



THANKS!