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**Progress Report – July-September 2023.**

**Title:** Assessment and Repair of Prestressed Bridge Girders Subjected to Over-height Truck Impacts Pooled Fund Project

**Project Number:** TR202011

**Principal Investigator (PI):** Mohamed ElGawady PhD (PI)

**Co-PI(s):** William Schonberg PhD, PE (Co-PI)

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| **Award date:** | **1/1/2021** | | |
| **Scheduled completion date:** | **12/31/2023** | **% of project completed to date:** | **79%** |
| **Total budget:** | **$**805,000 | **% of budget expended to date:** | **70%** |
| **Draft report due:** | **9/30/2023** | **Final report due:** | **12/1/2023** | |

Provide a short description of the **work currently underway**.

*Use* [*additional notes section*](#bookmark=id.1t3h5sf) *if you need to provide more information.*

***Task 2. Experimental testing of bridge girders subjected to lateral impacts:***

* 2nd girder is being prepared for testing.

***Task 4: Residual Capacity:***

* Determine the flexural capacity of damaged prestressed girders considering the bi-axial bending due to loss of strands.

***Task 5: Repair Evaluation:***

* Preparing the flexural testing of the 1st repaired beam

Provide a short description of the **noteworthy activities/accomplishments** during this reporting period.

*Use* [*additional notes section*](#bookmark=id.1t3h5sf) *if you need to provide more information.*

***Task 2. Experimental testing of bridge girders subjected to lateral impacts:***

The 1st bridge girder was tested (Figs. 1 through 8).

***Task 5: Repair Evaluation:***

* Preparing the flexural testing of the 1st repaired beam. The repair implemented as follows.

GRABB-IT strand splicing of 0.5-inch size were used to splice the damaged strands. High pressure lubricant (Goop fluid) was used to lubricate the strand splicing chucks. This step was crucial to ensure the smooth operation of the prestressing system and maintain its longevity.

**Stressed Prestressing strands to 26 kips:**

Per the American Association of State Highway and Transportation Officials (AASHTO) guidelines, we successfully stressed the prestressing chucks to 26 kips.

**Prepared Formwork for Damaged Area:**

Formwork was prepared for the damaged area. This involved the precise measurement and assembly of the formwork to facilitate the subsequent concrete repair work.

**Used Non-Shrinkage Grout Concrete for Repairs:**

To ensure the integrity of the repaired structure, five and half non-shrinkage grout bags were used as the primary repair material. This type of grout minimizes the risk of cracking and shrinkage, which is essential for the longevity of the repair.

**Grout placing:**

Following the formwork preparation and material selection, the non-shrinkage grout was placed into the damaged area. Additionally, concrete cubes were made for quality control purposes to monitor the strength and durability of the concrete used for repairs.

**Surface preparation and application of CFRP:**

Repair any cracks or defects in the concrete using an appropriate repair mortar and grinding the surface of the concrete beam to a desired roughness. dust, dirt, and contaminants were removed, ensuring the surface was dry before proceeding. This step is crucial to ensure a strong bond between the CFRP material and the concrete surface. The CFRP was cut to the required length and applied to the concrete surface.

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| A person in a blue lift on a platform  Description automatically generated  Fig. 1: Lifting the cart with the crane and holding its weight using the releasing mechanism system | |
| A person working on a trailer  Description automatically generated with medium confidence  Fig. 2: The cart impacted the girder after release. | |
| A large white beam in a workshop  Description automatically generated  Fig. 3: Cracking mapping and concrete spalling on the girder front. | |
| A large metal structure in a building  Description automatically generated  Fig. 4: Concrete cracking and spalling at the girder rearA person measuring a wall  Description automatically generated  Fig. 5: Prestressing strands yielding at the girder front | |
| A broken white piece of metal  Description automatically generated with medium confidence  Fig. 6: Prestressing strands yielding at the girder rear | |
| A black and white photo of a machine  Description automatically generated |
| At the impact moment (T = 0) |
| A satellite on a machine  Description automatically generated |
| T = 180 msec |
| A machine with a square object  Description automatically generated with medium confidence  Concrete spalling at bottom flange  Concrete spalling at top flange |
| T = 260 msec |
| A machine with a piece of metal  Description automatically generated |
| T = 360 msec |
| A broken wall with wires and wires  Description automatically generated with medium confidence |
| T = 520 msec |
| A black and white photo of a broken wall  Description automatically generated |
| T = 1080 msec (time of maximum deflection) |
| A black and white photo of a broken piece of metal  Description automatically generated |
| T = 1105 msec |
| A broken metal plate with wires  Description automatically generated with medium confidence |
| T = 1146 msec (End of girder rebound) |

Figure 7. High speed camera footage for the girder lateral displacement and damage propagation

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| A graph of a graph  Description automatically generated |
| (a) |
| A graph showing a number of data  Description automatically generated with medium confidence |
| (b) |

Figure 8. (a) Impact and reaction force time histories, (b) Girder Acceleration time history

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| A metal rods in a wood shelf  Description automatically generated | |
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| A large concrete beam in a factory  Description automatically generated | |
| A person working on a concrete wall  Description automatically generated  A group of men using a tool to drill a concrete wall  Description automatically generated  A person lying on the floor with a tool  Description automatically generated |

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| A person in a white suit with a red bucket  Description automatically generated |
| A group of people in white protective suits painting a surface  Description automatically generated |
| A close-up of a concrete beam  Description automatically generated |
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| Figure 9. Repair of the 1st girder |