**Click here to enter Program or Project Title**

**Progress Report – Click here to enter a date.**

**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:** | **75%** |
| **Total budget:** | **$**805,000 | **% of budget expended to date:** | **67%** |
| **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:***

* Preparing testing the first three girders.
* Finalize the finite element models.

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

* Determine the flexural capacity of damaged prestressed girders considering the bi-axial bending due to loss of strands.
* Preparing a paper that will be submitted to TRB

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

* Strand splices and CFRP were acquired from different suppliers
* Repair options are finalized.

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:***

Three girders were delivered to the structural lab at Missouri University of Science and Technology (Fig. 1). The three girders represent the first patch of testing girders and will be tested for three different repair methods. Severe damages are targeted for the three girders to account for the worst-case scenario of bridge girder subjected to vehicle collisions. Each girder will be impacted and then repaired. The repaired girder will be flexural tested under four-point static loading to determine its capacity.

The impact test setup is ready (Fig. 2), and several dry tests were conducted (Fig. 3) to ensure the stability of the impact cart and the integrity of the track structural system. Lateral supports HP 10x34 steel beams were installed, and two 250 kips load cells were mounted at the bottom and top flanges at both girder ends to record the reaction forces. A release lever with a capcity of 6000 lbs was installed on a 10x34 HP steel section to hold the impact cart and release it from the top of the track (Fig. 4).

Three cylinders were tested after 28 days from casting and the average compressive strength was found to be 8.2 ksi (Fig. 5).

Twenty-eight strain gages were attached to the girder stirrups and strands along the girder length to monitor the strain changes due to the impact loading. Seven Kistler shock piezoelectric accelerometer with a capacity of 5000 g were attached to the girder to record the girder acceleration and the girder dynamic response (Fig. 6). All accelerometers are connected to an eight-channel piezoelectric to analog converter. Three load cells were mounted on the impact cart front to record the impact forces. Four load cells will be mounted on the left and right lateral supports to record the reaction forces. High speed camera (Fig. 7) with one million frame per second (FPS) will record the girder deflection. All measurement devices are connected to a data acquisition system with sampling rate of 50 Khz.

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| A person standing on a flatbed trailer in a building  Description automatically generated with low confidence |

Figure 1. Delivery of the girders to the structural lab.

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Uplift supports

Lateral supports

Figure 2. Track test setup

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| A picture containing machine, engineering, industry, steel  Description automatically generated  Impact location |

Figure 3. Girder-impact trial

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| **A picture containing tool, metal, household hardware  Description automatically generated** |
| **A picture containing engineering, machine, indoor, steel  Description automatically generated** |
| A picture containing machine, engineering, steel, red  Description automatically generated |
| A picture containing building, red, window, outdoor  Description automatically generated  **Release lever** |

Figure 4. Release mechanism for the impact cart

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| A picture containing ground, gas, abandoned, dirty  Description automatically generated |

Figure 5. Cylinder testing

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| A picture containing electrical wiring, cable, heat-shrink tubing, electronic engineering  Description automatically generated  Accelerometer  Mounting plate |
| A picture containing boat, electrical wiring, engineering, ship  Description automatically generated  Accelerometer |
| *A white box with many switches on top of a stool  Description automatically generated*  Accelerometer signal converter |

Figure 6. Accelerometers installation

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| A picture containing engineering, steel, machine, indoor  Description automatically generated |
| A close-up of a projector  Description automatically generated with medium confidence |

Figure 7. High speed camera