# Documentation of Experiments – July 25th, 2019

Two county bridges located in Ponca and Waterloo were tested on July 25th, 2019. The tests were performed via loading the bridges using a Type 3 truck provided by the Nebraska Department of Transportation. This document aims at providing a description of the truck load, details of the sensor network, loading trajectories, and the recorded data files associated with each scenario. The recorded files for each bridge are separately placed in folders labeled according to the speed of the truck. In each folder the converted Microsoft Excel and MATLAB files are accompanied.

**Truck Description**

Truck Type 3 Nebraska Legal Truck (Sterling) was used for conducting the bridge loading. The axle’s loads were respectively 16320 lb. and 33000 lb. for steer and tandem wheels.

# Sensor Network

Details of sensor networks related to each bridge are documented in files named “C002800420P\_Instrumentation Plan.pdf” and “C002801720\_Instrumentation Plan.pdf”.

# C002800420P – Concrete Bridge in Ponca Road

Tests were performed at 0, 5, 15, 30, and 45 mph. A dense array of strain data was recorded while the truck traveled over the bridge. For each loading scenario, a recording was started a few seconds before the truck reached the bridge and it was stopped once the truck was completely off of the bridge. Tables 1-5 show the recorded \*.tdms files to each loading scenario. Figure 1 shows the trajectories of truck loading scenarios.

Table 1: Concrete Bridge – 0mph (Static) Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | PoncaConcreteBridge\_R1\_07\_25\_2019\_09\_55\_40 | North | East |
| 2 | PoncaConcreteBridge\_R2\_07\_25\_2019\_09\_59\_44 | South | West |
| 3 | PoncaConcreteBridge\_R3\_07\_25\_2019\_10\_04\_03 | North | East |
| 4\* | PoncaConcreteBridge\_R4\_07\_25\_2019\_10\_07\_53 | South | West |
| 5 | PoncaConcreteBridge\_R5\_07\_25\_2019\_10\_11\_35 | North | Middle |
| 6 | PoncaConcreteBridge\_R7\_07\_25\_2019\_10\_17\_37 | North | Middle |

\* An SUV crossed the east lane towards South Table 2: Concrete Bridge – 5mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | PoncaConcreteBridge\_R8\_07\_25\_2019\_10\_22\_31 | South | West |
| 2 | PoncaConcreteBridge\_R9\_07\_25\_2019\_10\_26\_07 | North | East |
| 3 | PoncaConcreteBridge\_R10\_07\_25\_2019\_10\_27\_34 | South | West |
| 4 | PoncaConcreteBridge\_R11\_07\_25\_2019\_10\_28\_44 | North | East |
| 5 | PoncaConcreteBridge\_R12\_07\_25\_2019\_10\_30\_07 | South | West |
| 6 | PoncaConcreteBridge\_R13\_07\_25\_2019\_10\_31\_26 | North | East |

|  |  |  |  |
| --- | --- | --- | --- |
| 7 | PoncaConcreteBridge\_R14\_07\_25\_2019\_10\_32\_54 | South | Middle |
| 8 | PoncaConcreteBridge\_R15\_07\_25\_2019\_10\_34\_01 | North | Middle |
| 9 | PoncaConcreteBridge\_R16\_07\_25\_2019\_10\_35\_31 | South | Middle |
| 10 | PoncaConcreteBridge\_R39\_07\_25\_2019\_11\_19\_56 | North | East |

Table 3: Concrete Bridge – 15mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | PoncaConcreteBridge\_R17\_07\_25\_2019\_10\_38\_21 | North | East |
| 2 | PoncaConcreteBridge\_R18\_07\_25\_2019\_10\_39\_19 | South | West |
| 3 | PoncaConcreteBridge\_R19\_07\_25\_2019\_10\_40\_29 | North | East |
| 4 | PoncaConcreteBridge\_R20\_07\_25\_2019\_10\_41\_44 | South | West |
| 5 | PoncaConcreteBridge\_R21\_07\_25\_2019\_10\_42\_33 | North | East |
| 6 | PoncaConcreteBridge\_R22\_07\_25\_2019\_10\_43\_24 | South | West |

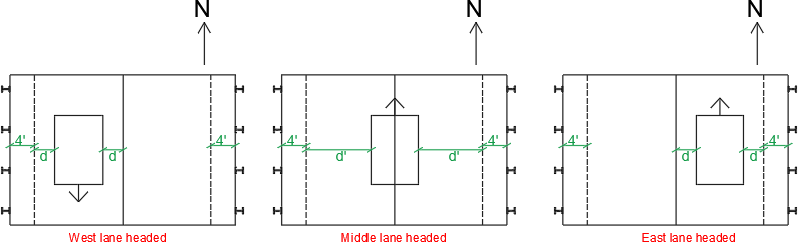
Table 4: Concrete Bridge – 30mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | PoncaConcreteBridge\_R23\_07\_25\_2019\_10\_45\_51 | North | East |
| 2 | PoncaConcreteBridge\_R24\_07\_25\_2019\_10\_48\_55 | South | West |
| 3 | PoncaConcreteBridge\_R25\_07\_25\_2019\_10\_50\_29 | North | East |
| 4 | PoncaConcreteBridge\_R26\_07\_25\_2019\_10\_51\_57 | South | West |
| 5 | PoncaConcreteBridge\_R27\_07\_25\_2019\_10\_53\_32 | North | East |
| 6 | PoncaConcreteBridge\_R28\_07\_25\_2019\_10\_54\_57 | South | West |
| 7 | PoncaConcreteBridge\_R29\_07\_25\_2019\_10\_57\_59 | North | Middle |
| 8 | PoncaConcreteBridge\_R30\_07\_25\_2019\_10\_59\_26 | South | Middle |
| 9 | PoncaConcreteBridge\_R31\_07\_25\_2019\_11\_01\_01 | North | Middle |
| 10 | PoncaConcreteBridge\_R32\_07\_25\_2019\_11\_02\_44 | South | Middle |

Table 5: Concrete Bridge – 45mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test  Run | TDMS file name | Direction  Traveled | Lane  Traveled |
| 1 | PoncaConcreteBridge\_R33\_07\_25\_2019\_11\_06\_17 | North | East |
| 2\* | PoncaConcreteBridge\_R34\_07\_25\_2019\_11\_08\_56 | South | West |
| 3 | PoncaConcreteBridge\_R35\_07\_25\_2019\_11\_10\_14 | North | East |
| 4\* | PoncaConcreteBridge\_R36\_07\_25\_2019\_11\_12\_43 | South | West |
| 5 | PoncaConcreteBridge\_R37\_07\_25\_2019\_11\_14\_01 | North | East |
| 6\* | PoncaConcreteBridge\_R38\_07\_25\_2019\_11\_16\_46 | South | West |

\* Speed: 41~42 mph



**Figure 1:** Showing the lanes traveled by the truck on the Concrete Bridge

# C002801720 – Steel Bridge in 1.2W 2.2N of Waterloo

Tests were performed at 0, 5, 15, 30 and 45 miles per hour. A dense array of strain data and a sparse array of acceleration data were recorded for each loading sequence. Table 6-10 respectively link the \*.tdms files to the loading sequences at 0, 5, 15, 30 and 45 mph. Figure 2 shows the trajectories of truck loading scenarios. In addition to live load tests where the lane, direction, and the traversing truck weight was known, 50 minutes of bridge response to normal traffic was measured. No traffic control was applied to the bridge, therefore, direction, loaded lane, speed, and weights of cars were unknown. The file name associated with this test is “WaterLoo steelBridge\_R53\_07\_25\_2019\_15\_35\_48” and is stored in the folder named “C002801720 - Operational Traffic Test”.

Table 6: Steel Bridge – 0mph (Static) Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | WaterLoo steelBridge\_R1\_07\_25\_2019\_14\_00\_33 | South | West |
| 2 | WaterLoo steelBridge\_R2\_07\_25\_2019\_14\_04\_51 | North | East |
| 3 | WaterLoo steelBridge\_R3\_07\_25\_2019\_14\_08\_45 | South | West |
| 4 | WaterLoo steelBridge\_R4\_07\_25\_2019\_14\_12\_46 | North | East |
| 5 | WaterLoo steelBridge\_R5\_07\_25\_2019\_14\_17\_01 | South | Middle |
| 6 | WaterLoo steelBridge\_R6\_07\_25\_2019\_14\_22\_42 | South | Middle |

Table 7: Steel Bridge – 5mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | WaterLoo steelBridge\_R7\_07\_25\_2019\_14\_27\_44 | North | East |
| 2 | WaterLoo steelBridge\_R8\_07\_25\_2019\_14\_29\_11 | South | West |
| 3 | WaterLoo steelBridge\_R9\_07\_25\_2019\_14\_30\_52 | North | East |
| 4 | WaterLoo steelBridge\_R10\_07\_25\_2019\_14\_32\_13 | South | West |
| 5 | WaterLoo steelBridge\_R11\_07\_25\_2019\_14\_33\_56 | North | East |

|  |  |  |  |
| --- | --- | --- | --- |
| 6 | WaterLoo steelBridge\_R12\_07\_25\_2019\_14\_35\_31 | South | West |
| 7 | WaterLoo steelBridge\_R13\_07\_25\_2019\_14\_37\_25 | North | Middle |
| 8 | WaterLoo steelBridge\_R14\_07\_25\_2019\_14\_39\_14 | South | Middle |
| 9 | WaterLoo steelBridge\_R15\_07\_25\_2019\_14\_41\_03 | North | Middle |
| 10 | WaterLoo steelBridge\_R16\_07\_25\_2019\_14\_42\_24 | South | Middle |

Table 8: Steel Bridge – 15mph Tests

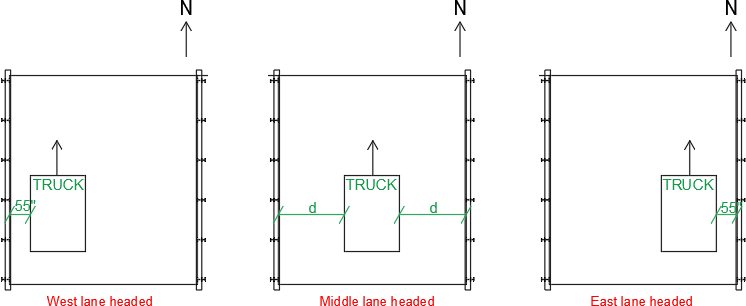
|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | WaterLoo steelBridge\_R17\_07\_25\_2019\_14\_44\_44 | North | East |
| 2 | WaterLoo steelBridge\_R18\_07\_25\_2019\_14\_46\_00 | South | West |
| 3 | WaterLoo steelBridge\_R19\_07\_25\_2019\_14\_47\_29 | North | East |
| 4 | WaterLoo steelBridge\_R20\_07\_25\_2019\_14\_48\_23 | South | West |
| 5 | WaterLoo steelBridge\_R21\_07\_25\_2019\_14\_50\_05 | North | East |
| 6 | WaterLoo steelBridge\_R22\_07\_25\_2019\_14\_50\_58 | South | West |
| 7 | WaterLoo steelBridge\_R23\_07\_25\_2019\_14\_52\_25 | North | Middle |
| 8 | WaterLoo steelBridge\_R24\_07\_25\_2019\_14\_53\_23 | South | Middle |
| 9 | WaterLoo steelBridge\_R25\_07\_25\_2019\_14\_54\_50 | North | Middle |
| 10 | WaterLoo steelBridge\_R26\_07\_25\_2019\_14\_56\_10 | South | Middle |
| 11 | WaterLoo steelBridge\_R27\_07\_25\_2019\_14\_58\_40 | North | Middle |
| 12 | WaterLoo steelBridge\_R28\_07\_25\_2019\_14\_59\_34 | South | Middle |

Table 9: Steel Bridge – 30mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | WaterLoo steelBridge\_R29\_07\_25\_2019\_15\_01\_06 | North | East |
| 2 | WaterLoo steelBridge\_R30\_07\_25\_2019\_15\_02\_53 | South | West |
| 3 | WaterLoo steelBridge\_R31\_07\_25\_2019\_15\_04\_08 | North | East |
| 4 | WaterLoo steelBridge\_R32\_07\_25\_2019\_15\_05\_35 | South | West |
| 5 | WaterLoo steelBridge\_R33\_07\_25\_2019\_15\_06\_49 | North | East |
| 6 | WaterLoo steelBridge\_R34\_07\_25\_2019\_15\_08\_25 | South | West |
| 7 | WaterLoo steelBridge\_R35\_07\_25\_2019\_15\_09\_40 | North | Middle |
| 8 | WaterLoo steelBridge\_R36\_07\_25\_2019\_15\_11\_08 | South | Middle |
| 9 | WaterLoo steelBridge\_R37\_07\_25\_2019\_15\_12\_20 | North | Middle |
| 10 | WaterLoo steelBridge\_R38\_07\_25\_2019\_15\_14\_13 | South | Middle |
| 11 | WaterLoo steelBridge\_R39\_07\_25\_2019\_15\_15\_27 | North | Middle |
| 12 | WaterLoo steelBridge\_R40\_07\_25\_2019\_15\_17\_15 | South | Middle |

Table 10: Steel Bridge – 45mph Tests

|  |  |  |  |
| --- | --- | --- | --- |
| Test Run | TDMS file name | Direction Traveled | Lane Traveled |
| 1 | WaterLoo steelBridge\_R41\_07\_25\_2019\_15\_18\_41 | North | East |
| 2 | WaterLoo steelBridge\_R42\_07\_25\_2019\_15\_20\_03 | South | West |
| 3 | WaterLoo steelBridge\_R43\_07\_25\_2019\_15\_21\_27 | North | East |
| 4 | WaterLoo steelBridge\_R44\_07\_25\_2019\_15\_22\_45 | South | West |
| 5 | WaterLoo steelBridge\_R45\_07\_25\_2019\_15\_24\_17 | North | East |
| 6 | WaterLoo steelBridge\_R46\_07\_25\_2019\_15\_25\_59 | South | West |
| 7 | WaterLoo steelBridge\_R47\_07\_25\_2019\_15\_27\_26 | North | Middle |
| 8 | WaterLoo steelBridge\_R48\_07\_25\_2019\_15\_29\_00 | South | Middle |
| 9 | WaterLoo steelBridge\_R49\_07\_25\_2019\_15\_30\_19 | North | Middle |
| 10 | WaterLoo steelBridge\_R50\_07\_25\_2019\_15\_31\_44 | South | Middle |
| 11 | WaterLoo steelBridge\_R51\_07\_25\_2019\_15\_33\_01 | North | Middle |
| 12 | WaterLoo steelBridge\_R52\_07\_25\_2019\_15\_34\_49 | South | Middle |



**Figure 2:** Showing the lanes traveled by the truck on the Steel Bridge