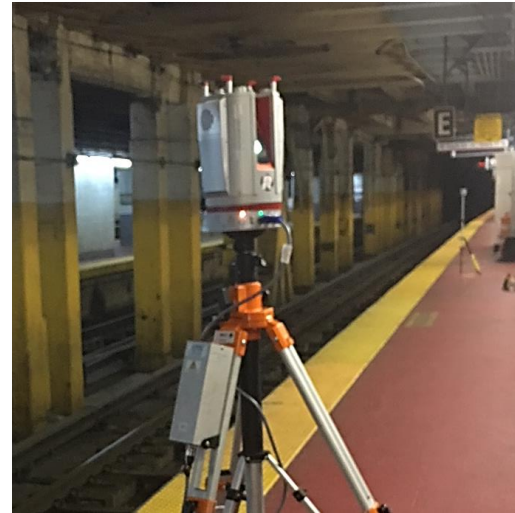




Innovative Surveying Tools for Construction

Tony Thelen - SSI

The Tool Chest





UAV Collection

**“The Simple
Power of a
PICTURE”**

UAV Construction Monitoring I-75



May 24th

UAV Construction Monitoring I-75



July 20th

UAV Construction Monitoring

I-75

September 14th

UAV Construction Monitoring I-75



November 13th

UAV Construction Monitoring I-75



UAV Construction Monitoring GHIB



October 10th

UAV Construction Monitoring GHIB



January 16th

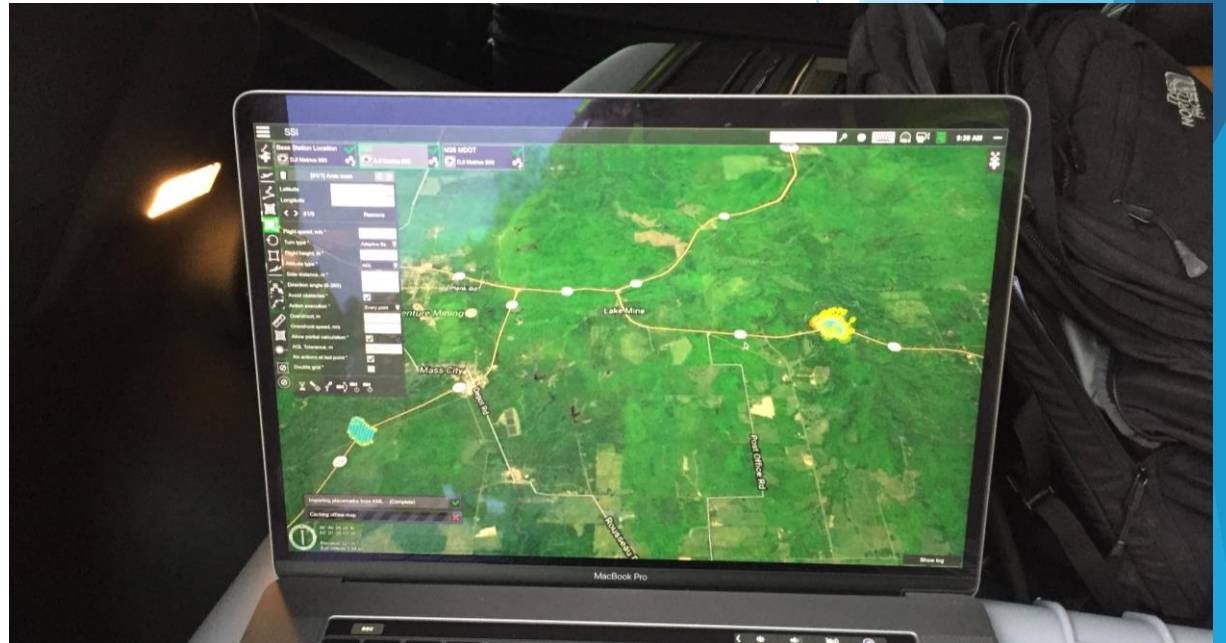
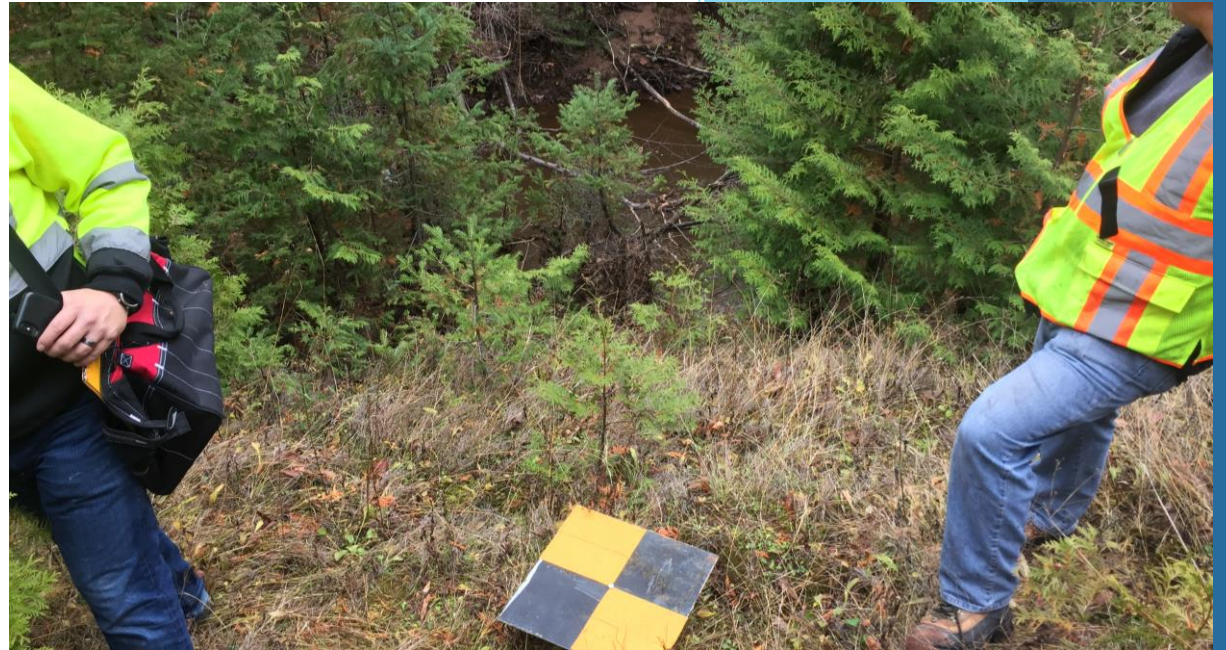


Virtual “Bucket Truck” Surveys

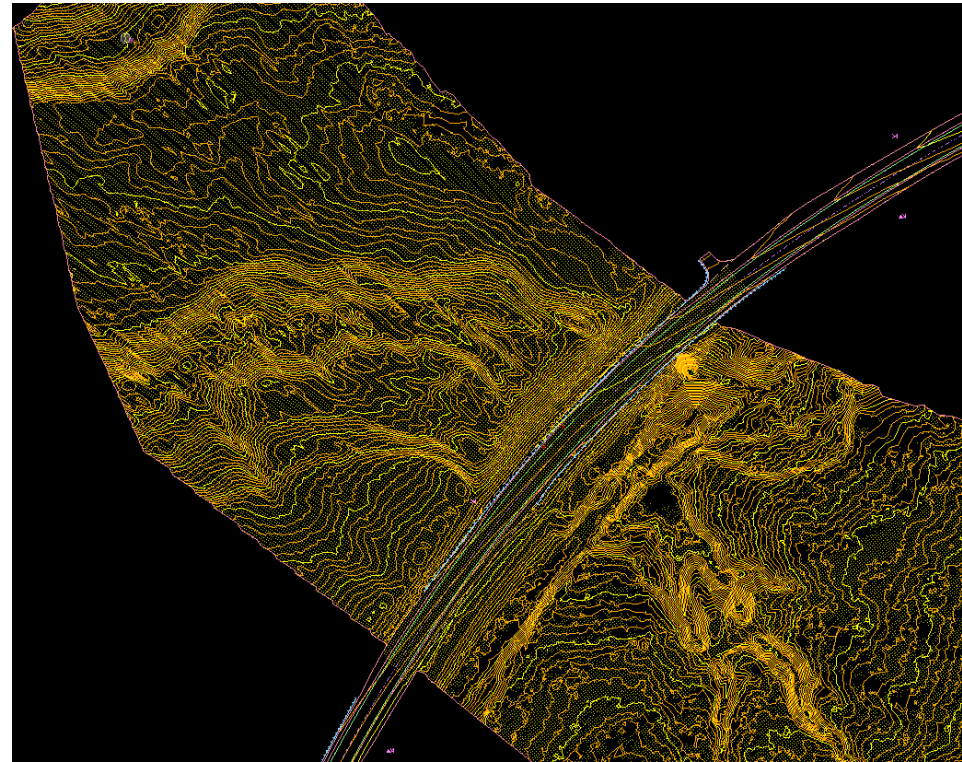
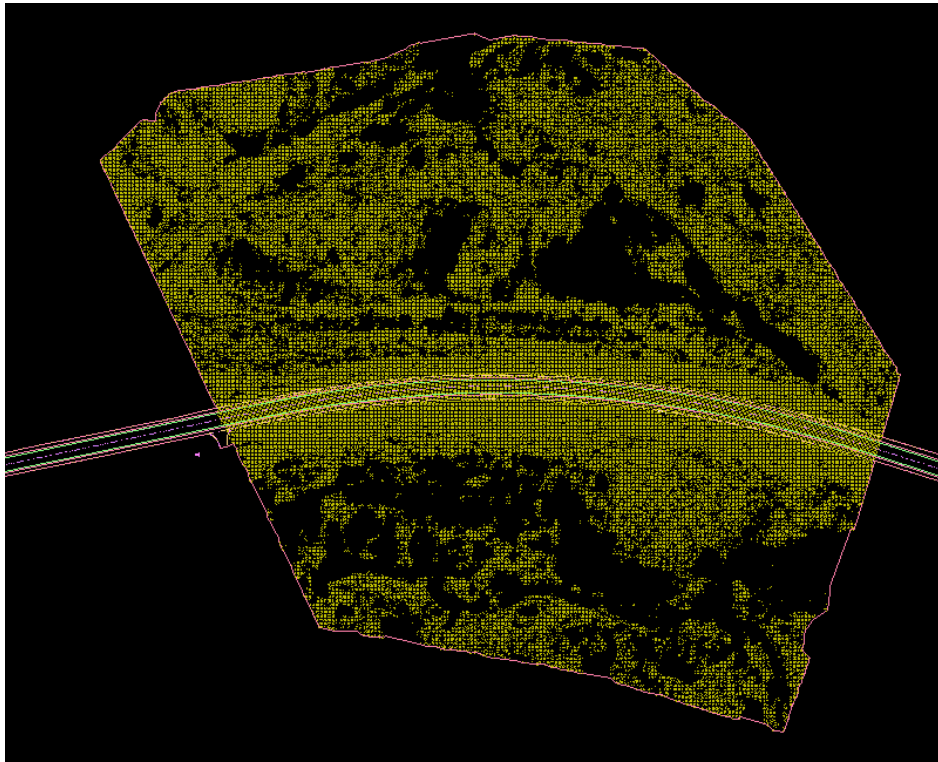


Slope Failures and Tough Conditions



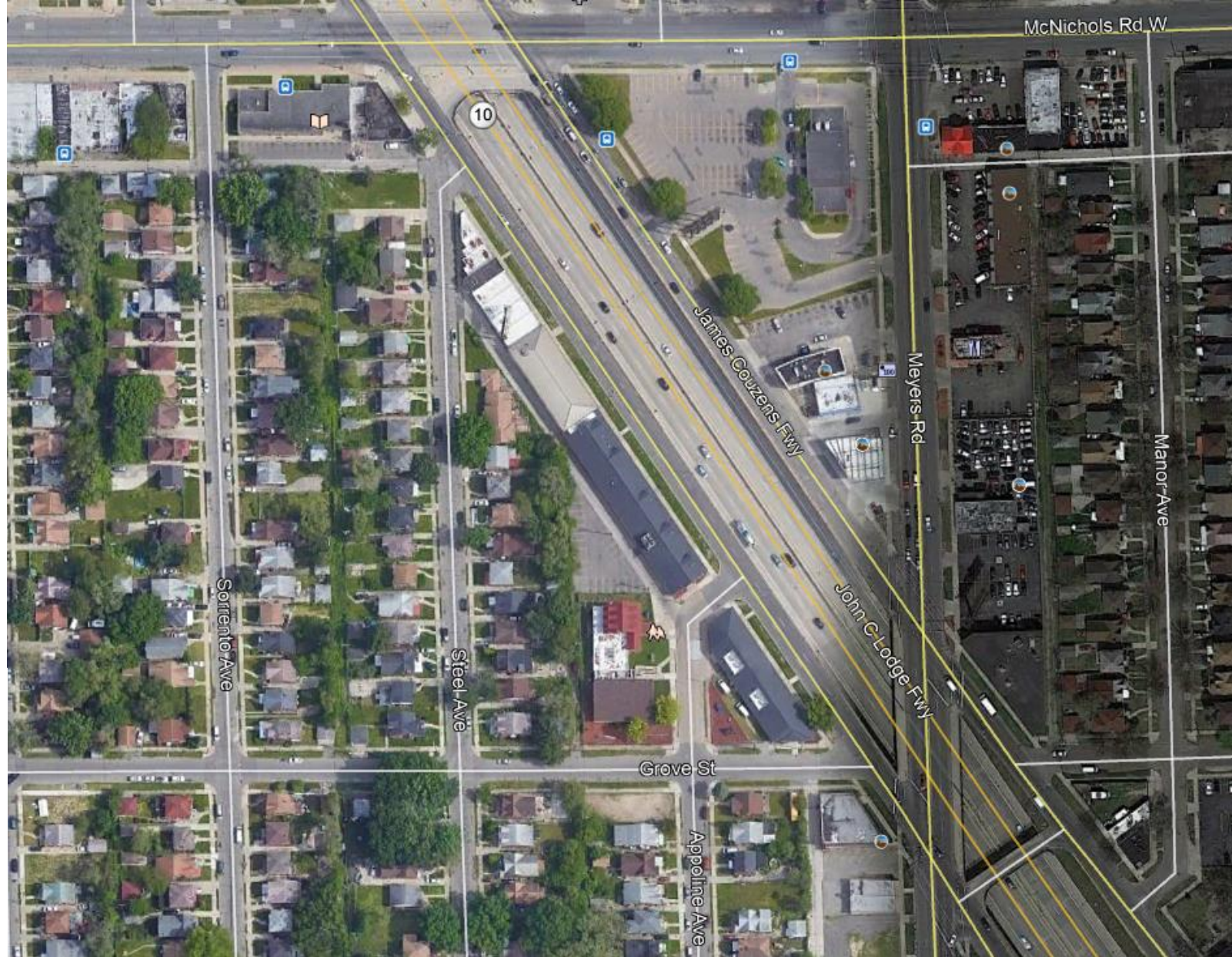


Vegetation Penetration and LiDAR Detail



M-10 Wall Monitoring

Using Mobile LiDAR



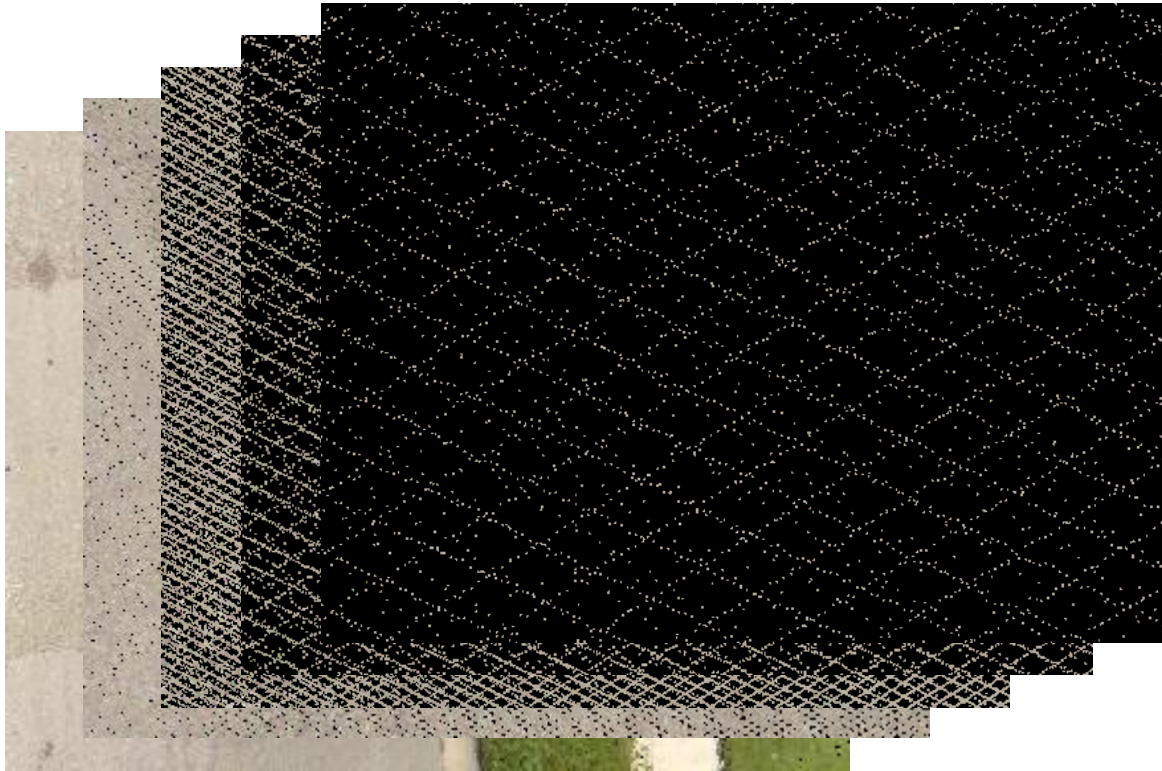


Collection



- ▶ Project spanned over a 2-year time period (in 2014 & 2015)
- ▶ Utilized Mobile LiDAR with multiple pass technique
- ▶ Collected data at highway speeds with zero disruption to daily traffic
- ▶ Dual head LiDAR scanner was critical to allow for “forward and backward looking data

Collection



Process

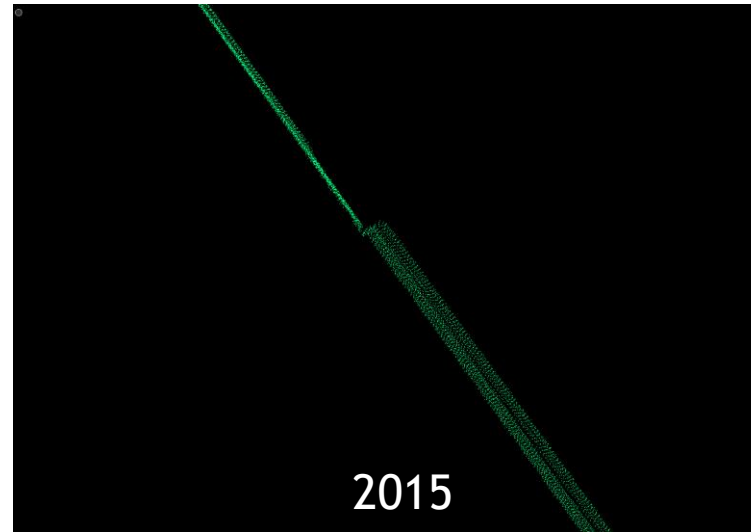
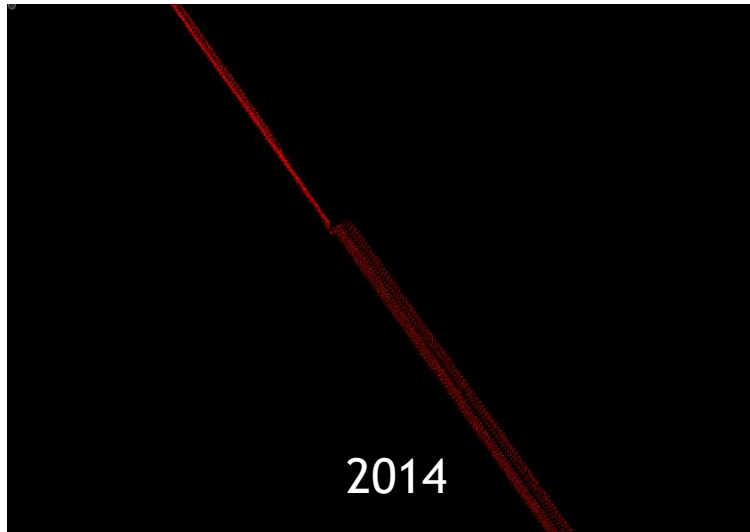
- ▶ SSI compared multiple passes between 2014 to ensure equipment was calibrated and ranging errors met project specifications
- ▶ The same process was performed for the 2015 scan data
- ▶ Once the 2014 and 2015 scans were validated independently, the two datasets were compared to show critical areas

2014 vs 2015 scan data comparison

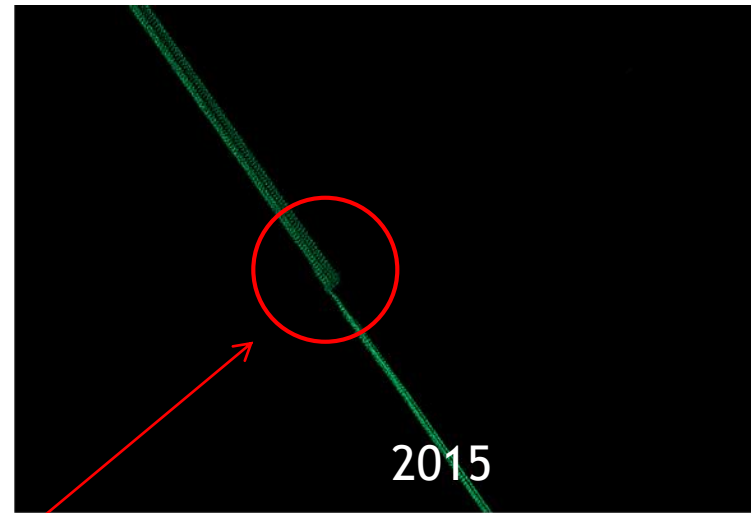
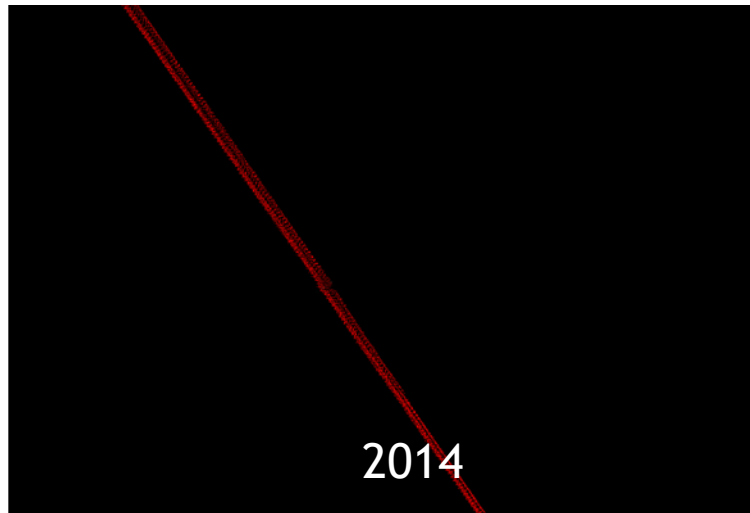
AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL
273+20	273+30	273+40	273+50	273+60	273+70	273+80	273+90	274+0	274+10	274+20	274+30	274+40	274+50	274+60
0.011	0.009	0.072	0.079	0.074	0.074	0.069	0.067	0.064	0.064	0.062	0.058	0.023	0.021	0.026
-0.003	-0.007	0.072	0.079	0.074	0.074	0.068	0.067	0.064	0.063	0.062	0.057	0.023	0.015	0.020
-0.004	-0.007	0.070	0.072	0.072	0.064	0.069	0.066	0.063	0.064	0.061	0.055	-0.006	0.013	0.018
-0.003	-0.001	0.071	0.069	0.065	0.064	0.067	0.062	0.062	0.058	0.057	0.058	-0.003	0.013	0.026
-0.004	-0.003	0.064	0.065	0.064	0.059	0.067	0.061	0.056	0.054	0.053	0.054	0.015	0.015	0.021
0.002	0.004	0.061	0.062	0.061	0.059	0.059	0.056	0.057	0.053	0.051	0.052	0.007	0.017	0.022
0.008	0.008	0.055	0.059	0.057	0.055	0.055	0.052	0.052	0.053	0.049	0.049	0.010	0.021	0.021
0.008	0.003	0.051	0.060	0.059	0.061	0.058	0.043	0.060	0.052	0.044	0.052	0.009	0.015	0.014
0.009	0.004	0.051	0.057	0.053	0.052	0.051	0.047	0.048	0.049	0.046	0.045	0.008	0.016	0.021
0.007	0.005	0.048	0.049	0.049	0.046	0.040	0.044	0.041	0.042	0.044	0.039	0.014	0.013	0.022
0.006	0.008	0.040	0.053	0.045	0.041	0.045	0.046	0.041	0.041	0.039	0.037	0.014	0.016	0.024
0.007	0.006	0.041	0.045	0.043	0.041	0.040	0.041	0.038	0.039	0.032	0.039	0.013	0.019	0.019
0.011	0.009	0.035	0.047	0.038	0.033	0.040	0.038	0.028	0.039	0.032	0.035	0.010	0.012	0.019
0.010	0.007	0.029	0.041	0.031	0.033	0.031	0.028	0.027	0.032	0.028	0.032	0.008	0.012	0.015
0.008	0.008	0.026	0.028	0.026	0.029	0.027	0.027	0.023	0.026	0.023	0.028	0.011	0.019	0.016
0.007	0.008	0.026	0.038	0.028	0.021	0.020	0.020	0.015	0.024	0.022	0.022	0.011	0.014	0.010
0.005	0.006	0.022	0.035	0.024	0.020	0.018	0.025	0.016	0.020	0.021	0.005	0.013	0.008	0.009
0.011	0.007	0.027	0.021	0.024	0.009	0.013	0.010	0.013	0.014	0.019	0.004	0.010	0.006	0.008

Any results over the established ranging noise error of +/- 0.02' was considered to a potential area of movement. The data clearly shows movement between stations 273+40 and 274+30.

North End



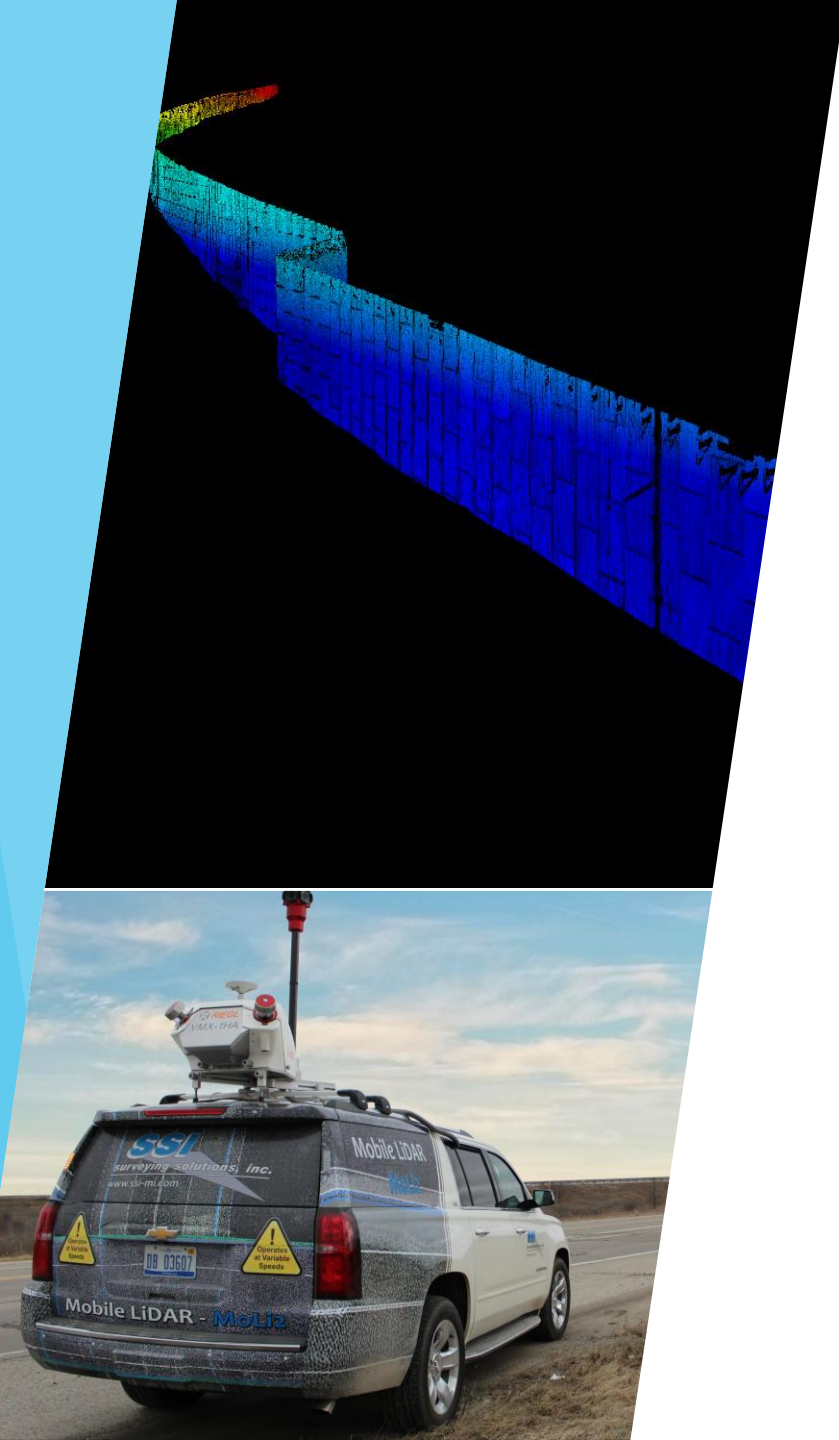
South End



This joint was identified as a critical area and confirmed by visual inspection.

Project Recap

- ▶ This method was developed to quickly identify potential areas of movement along large stretches of freeway
- ▶ SSI's method eliminated field crew exposure to dangerous traffic conditions while also protecting the driving public
- ▶ This project also provided lessons learned to be considered moving forward on future projects
- ▶ SSI's program can be used to identify and target specific areas of concern resulting in much more efficient data collection. Once critical areas are identified further investigation and repair can be done



Beam Deflection



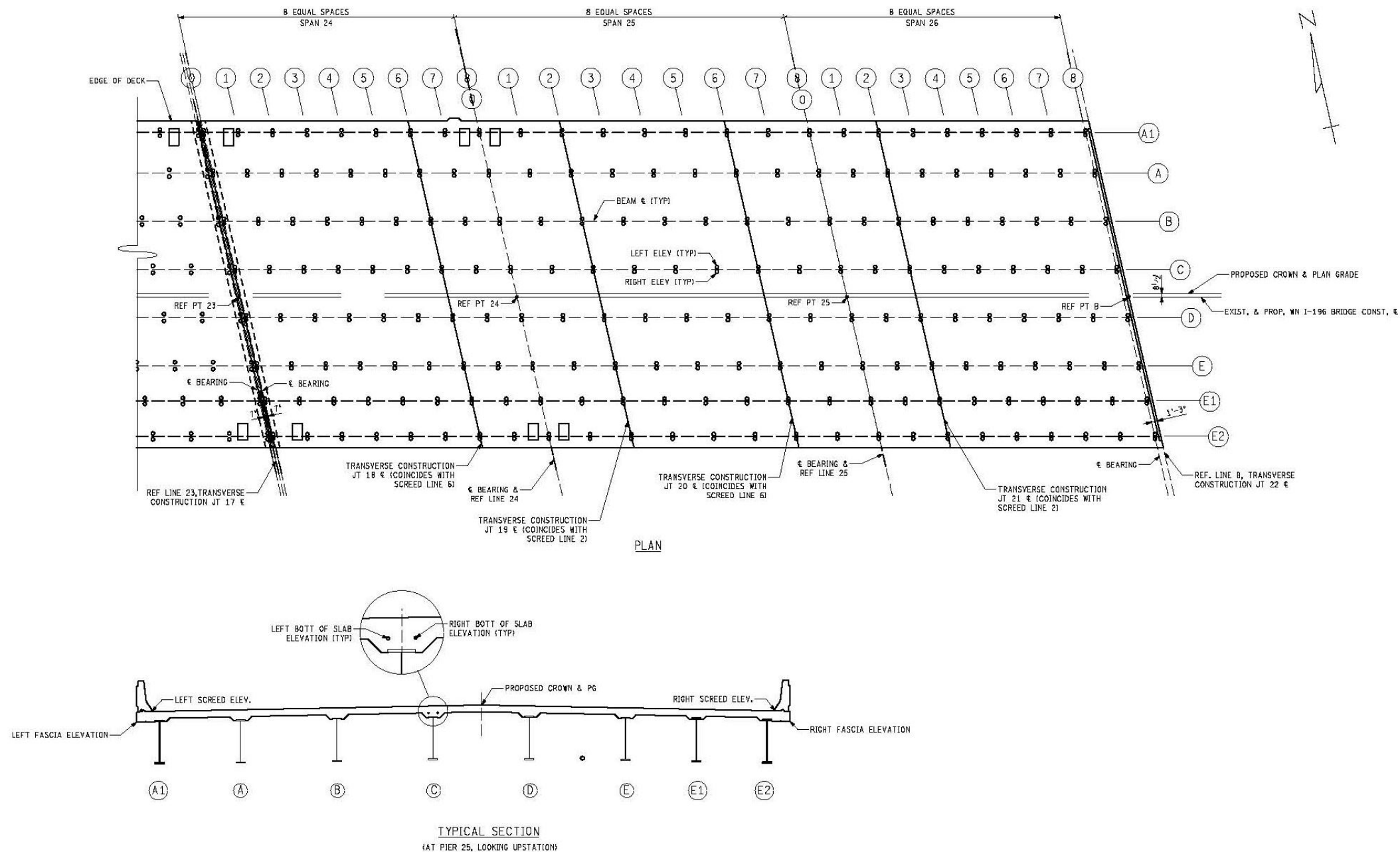


Prior to Construction









PLAN REVISIONS					
NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE



NO SCALE

DRAWN BY: AECOM	DATE: 06-31-18
CHKD BY: AECOM	DESIGN UNIT: OCCHILTO
FILE: B01-4_41027_screed_006.dgn	TSC: GRAND RAPIDS

CS: 41027 (41028)
JN: 109771A, 118123A

SLAB AND SCREED (SPANS 24-26)
WB I-196 OVER GRAND RIVER & US-131
B01-4 OF 41027

DRAWING	SHEET
B01-4	CONST
SCREED	376
006	

WB I-196 OVER THE GRAND RIVER

BEAM DEFLECTION COMPARISON

CONTRACT ID: 41027-109771
CONTRACTOR: ANLAAN

MDOT SURVEYOR: SSI

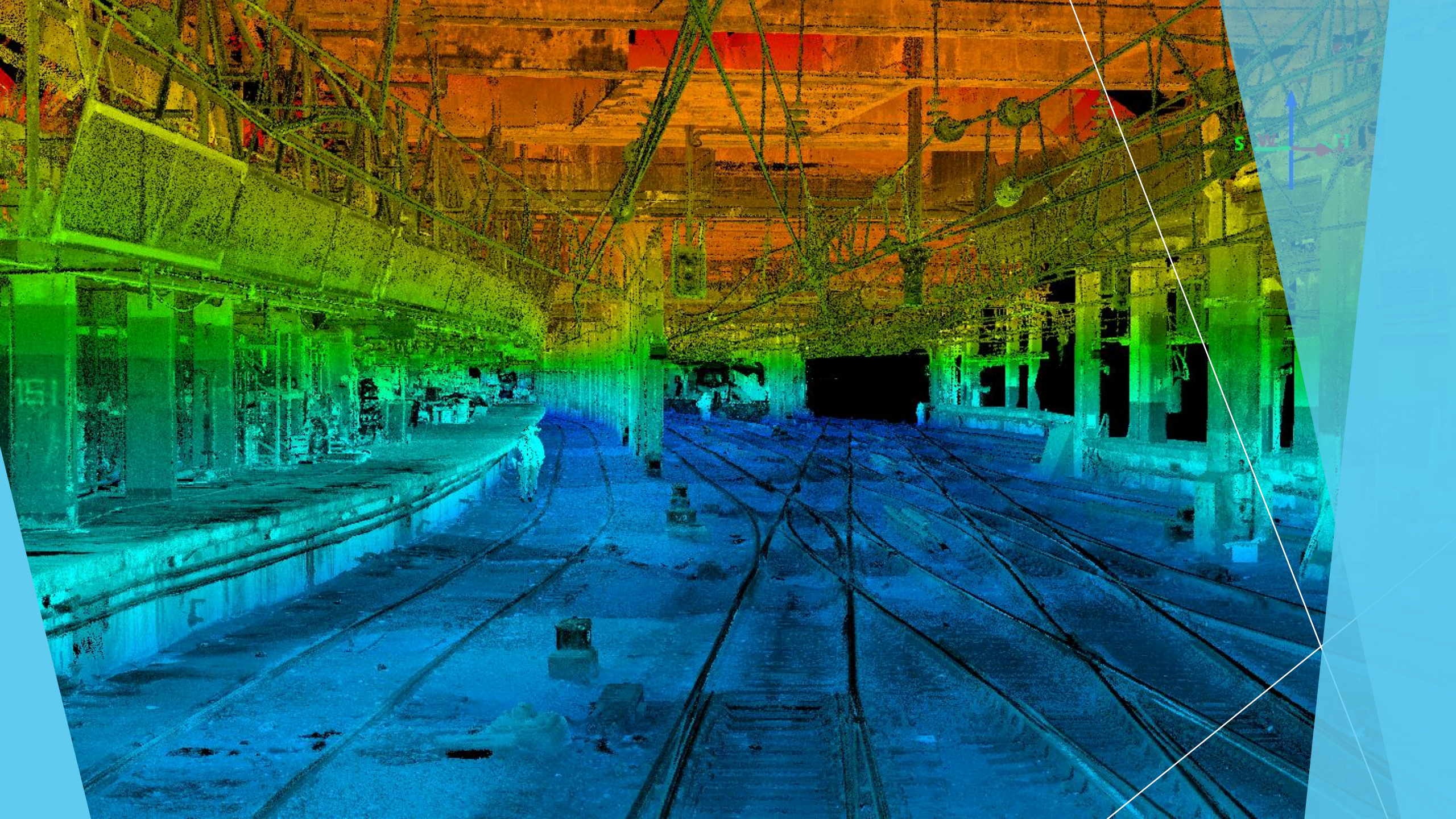
DATE: 10/31/2019

Bridge Location: WB I-196 over Grand River & US-131

Bridge No.: B01-4 of 41027

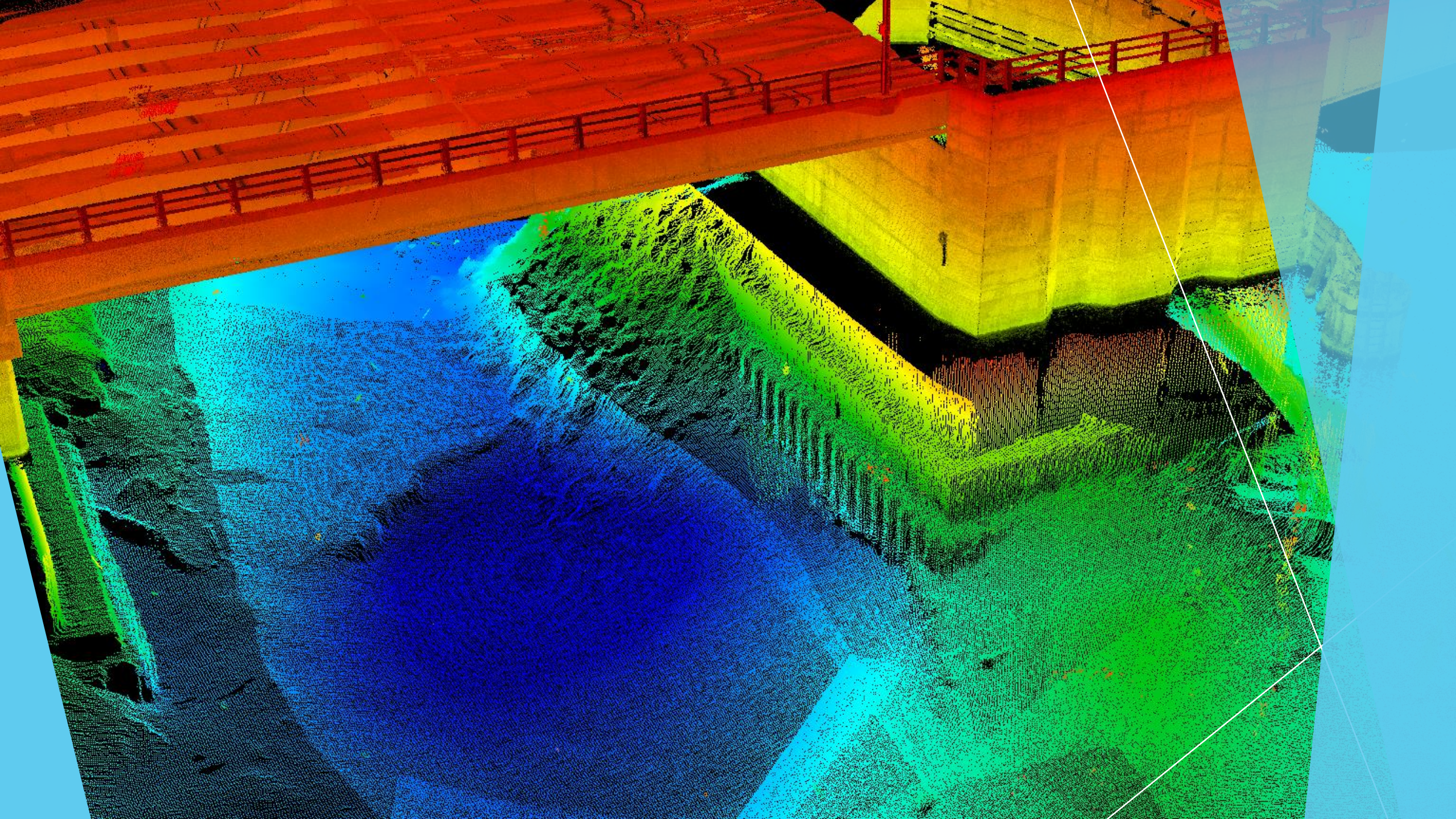
BEAM	DESCRIPTION	SPAN 21			SPAN 22			SPAN 23			SPAN 24			SPAN 25			SPAN 26		
		PIER 20	MID SPAN	PIER 21	PIER 21	MID SPAN	PIER 22	PIER 22	MID SPAN	PIER 23	PIER 23	MID SPAN	PIER 24	PIER 24	MID SPAN	PIER 25	PIER 25	MID SPAN	ABUT B
A1	TOP OF BEAM (FROM HAUNCH)	645.76	645.00	644.15	644.11	643.15	642.28	642.28	641.82	641.41	641.37	641.26	641.16	641.15	641.12	641.30	641.30	641.44	641.68
	PRE-LOAD DEFLECTION		0.05			-0.04			-0.02			0.00		-0.10				-0.05	
	BOTTOM BEAM (NEW DECK)	639.99	639.20	638.35	638.27	637.34	636.44	636.45	636.01	635.66	636.62	636.47	636.31	636.34	636.47	636.46	636.48	636.63	636.93
	POST-LOAD DEFLECTION		0.03			-0.01			-0.05			0.01		0.07				-0.01	
A	BOTTOM OF BEAM (DECK ON)	639.31	638.54	637.75	637.65	636.72	635.88	635.87	635.65	635.27	636.63	636.57	636.40	636.41	636.73	636.55	636.66	636.92	637.28
	DEFLECTION (DECK ON)		0.01			-0.04			0.08			0.06		0.25				-0.05	
	TOP BEAM (FROM HAUNCH)	645.60	644.79	643.98	643.98	642.91	642.20	642.20	641.80	641.40	641.32	641.28	641.22	641.22	641.31	641.38	641.38	641.60	641.88
	PRE-LOAD DEFLECTION		0.00			-0.18			0.00			0.01		0.01				-0.03	
	BOTTOM BEAM (NEW DECK)	639.36	638.54	637.68	637.64	636.69	635.88	635.87	635.59	635.27	636.59	636.54	636.42	636.40	636.56	636.56	636.62	636.89	637.20
	POST-LOAD DEFLECTION		0.02			-0.07			0.02			0.03		0.08				-0.02	
C	BOTTOM OF BEAM (DECK ON)	639.51	638.84	637.98	637.85	637.00	636.03	636.10	635.93	635.52	636.91	636.86	636.72	636.80	636.86	636.89	637.02	637.26	637.68
	DEFLECTION (DECK ON)		0.10			0.06			0.12			0.04		0.01				-0.09	
	TOP BEAM (FROM HAUNCH)	645.82	645.01	644.21	644.21	643.13	642.42	642.42	642.06	641.75	641.64	641.59	641.55	641.55	641.65	641.72	641.72	641.97	642.30
	PRE-LOAD DEFLECTION		-0.01			-0.19			-0.03			0.00		0.01				-0.04	
	BOTTOM BEAM (NEW DECK)	639.57	638.77	637.93	637.87	636.86	636.06	636.10	635.81	635.54	636.91	636.83	636.74	636.76	636.93	636.92	636.96	637.22	637.60
	POST-LOAD DEFLECTION		0.02			-0.10			-0.01			0.00		0.09				-0.06	
D	BOTTOM OF BEAM (DECK ON)	639.50	638.84	637.92	637.80	637.06	636.09	636.08	635.94	635.55	636.95	636.87	636.76	636.82	636.79	636.90	637.06	637.26	637.77
	DEFLECTION (DECK ON)		0.13			0.12			0.13			0.01		-0.07				-0.15	
	TOP BEAM (FROM HAUNCH)	645.78	644.95	644.16	644.16	643.10	642.39	642.39	642.06	641.70	641.66	641.60	641.55	641.59	641.66	641.75	641.75	641.96	642.34
	PRE-LOAD DEFLECTION		-0.02			-0.17			0.01			0.00		-0.01				-0.09	
	BOTTOM BEAM (NEW DECK)	639.59	638.72	637.86	637.84	636.85	636.08	636.09	635.85	635.56	636.96	636.89	636.77	636.79	636.92	636.92	636.98	637.24	637.61
	POST-LOAD DEFLECTION		0.00			-0.11			0.02			0.02		0.06				-0.06	
E	BOTTOM OF BEAM (DECK ON)	639.29	638.64	637.70	637.59	636.79	635.90	635.91	635.73	635.36	636.77	636.72	636.67	636.70	636.59	636.81	636.92	637.16	637.67
	DEFLECTION (DECK ON)		0.14			0.04			0.10			0.00		-0.16				-0.13	
	TOP BEAM (FROM HAUNCH)	645.56	644.74	643.96	643.96	642.91	642.23	642.23	641.89	641.51	641.46	641.45	641.42	641.42	641.54	641.62	641.62	641.86	642.23
	PRE-LOAD DEFLECTION		-0.02			-0.19			0.02			0.01		0.02				-0.06	
	BOTTOM BEAM (NEW DECK)	639.34	638.49	637.64	637.62	636.67	635.90	635.91	635.68	635.35	636.76	636.73	636.64	636.66	636.82	636.79	636.84	637.15	637.54
	POST-LOAD DEFLECTION		0.00			-0.09			0.05			0.03		0.10				-0.04	
E1	TOP OF BEAM (FROM HAUNCH)	645.58	644.80	643.91	643.91	642.97	642.16	642.16	641.75	641.40	641.52	641.36	641.24	641.24	641.25	641.42	641.42	641.68	642.05
	PRE-LOAD DEFLECTION		0.05			-0.06			-0.03			-0.02		-0.08				-0.05	
	BOTTOM BEAM (NEW DECK)	639.84	639.01	638.13	638.07	637.18	636.34	636.34	635.96	635.65	636.80	636.62	636.43	636.43	636.54	636.59	636.61	636.91	637.28
	POST-LOAD DEFLECTION		0.02			-0.03			-0.03			0.00		0.03				-0.03	
E2	TOP OF BEAM (FROM HAUNCH)	645.58	644.80	643.92	643.92	642.98	642.17	642.17	641.76	641.40	641.37	641.28	641.23	641.23	641.25	641.42	641.42	641.61	641.90
	PRE-LOAD DEFLECTION		0.05			-0.06			-0.02			-0.02		-0.08				-0.05	
	BOTTOM BEAM (NEW DECK)	639.84	639.01	638.12	638.08	637.15	636.34	636.35	635.99	635.67	636.65	636.54	636.43	636.41	636.51	636.60	636.60	636.84	637.15
	POST-LOAD DEFLECTION		0.03			-0.06			-0.02			0.00		0.00				-0.03	













Thank
You!