Long-Term Pavement Performance (LTPP)

Ohio SPS-1 and -2 Dynamic Load Response (DLR) Data Processing

Draft Report

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EXECUTIVE SUMMARY

The DLR Study Team completed re-interpreting 4,290 Ohio SPS-1 DLR raw traces as in Table 3 and 9,240 Ohio SPS-2 DLR raw traces as in Table 4, correcting the data issues identified by DAOFRs Ecompex-75 to -77 for SDR 22.0, including trace peak time lag shift, incorrect sensor locations and wheelpath offsets. Using the methodology in Section 5, the DLR Study Team calibrated and smoothed the Ohio SPS-1 and 2 raw traces before categorizing those traces into three categories: “Good”, “Maybe”, and “Not Good” according to the trace categorization criteria in Section 5.5.1. For the Ohio SPS-1 data, the trace categorization QC results for smoothed and raw traces are listed in Table 13 and 14, respectively; about 24% of strain gauge traces, 55% of LVDT traces, and 99% of pressure cell traces were concluded to be “Good." For the Ohio SPS-2 data, due to significant noise in the raw traces, only smoothed traces were categorized and the QC result is listed in Table 17; about 61% of strain gauge traces and 15% of LVDT traces were concluded to be “Good.” Above all, only “Good” traces were used for further extraction of trace peaks and valleys for the upcoming SDR 27. Moreover, the sensor locations and the corresponding wheelpath offsets were corrected using Section 5.6 approach. In all, the newly created DLR data in SDR 27.0 appear to match the DLR raw traces as demonstrated by the charts in Section 9.

To facilitate future DLR data users in identifying the layout and status of each sensor in different test runs, the necessary information is listed as follows:

- Appendix A: Sensor layout in the Ohio SPS-1 DLR sections.
- Appendix B: Sensor status of the 23 Ohio SPS-1 DLR test jobs.
- Appendix C: Sensor layout in the Ohio SPS-2 DLR sections.
- Appendix D: Sensor status of the 24 Ohio SPS-2 DLR test jobs.

1. BACKGROUND

The Long-Term Pavement Performance (LTPP) Program conducted an internal review of the dynamic load response (DLR) data collected in 1996-97 from Route US-23 in Delaware County, north of Columbus, Ohio. Figure 1 shows the layout of Strategic Highway Research Program (SHRP) test pavement for Specific Pavement Studies (SPS) (*1*). The test sections were constructed by Ohio Department of Transportation (ODOT), which included forty test sections along a 3.5 mile length on US-23. The test sections encompassed the SPS-1, -2, -8 and -9 experiments. This study focused on the DLR data collected on Ohio SPS-1 (AC) and SPS-2 (PCC) test sections.

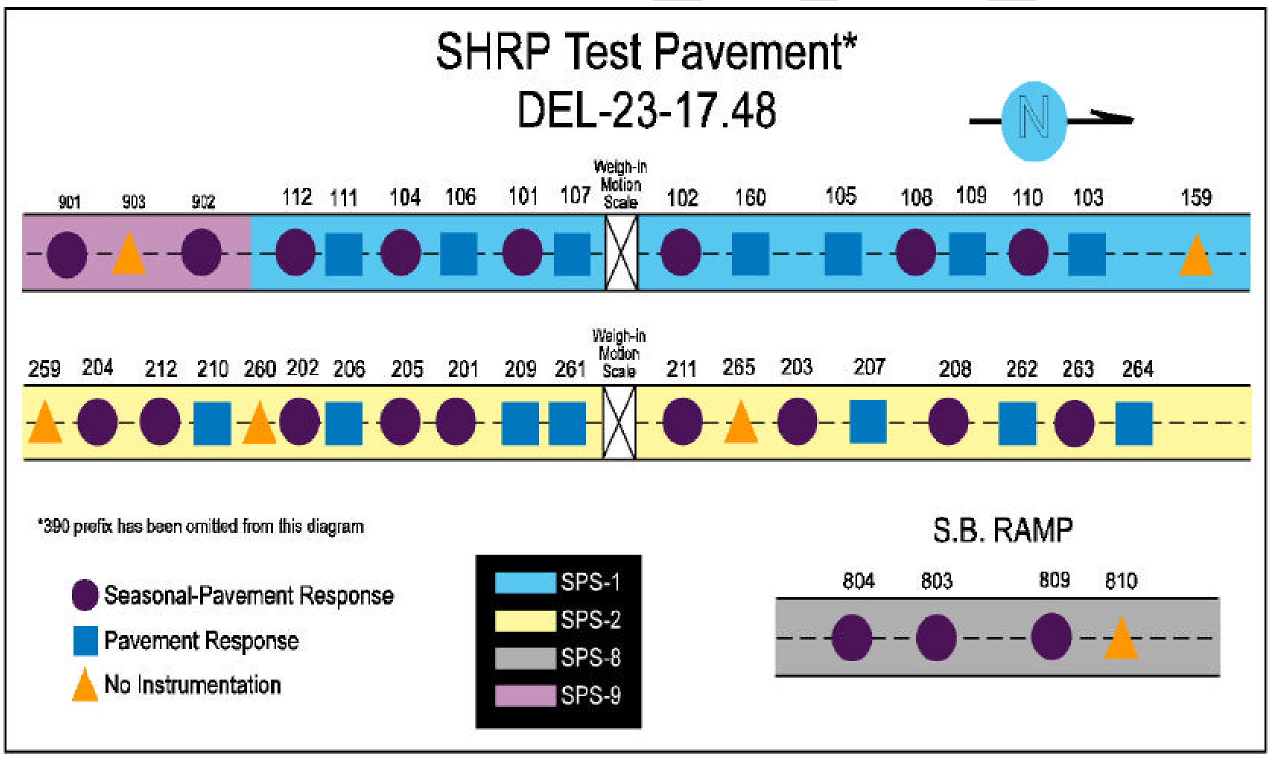


Figure 1: SHRP Test Pavement Layout (Courtesy of Cimini *(1)*)

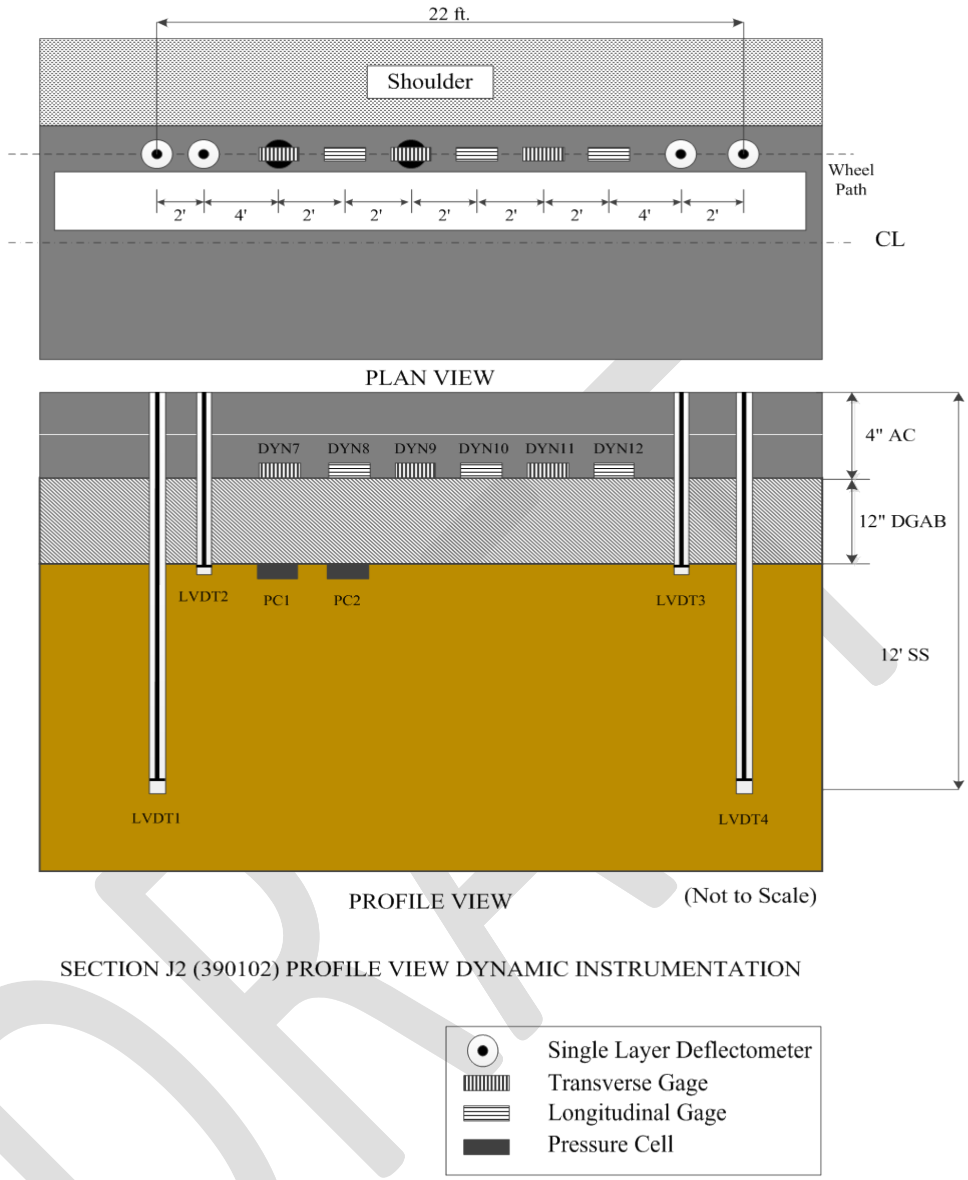


Figure 2: Ohio SPS-1 Section 390102 Sensor Layout

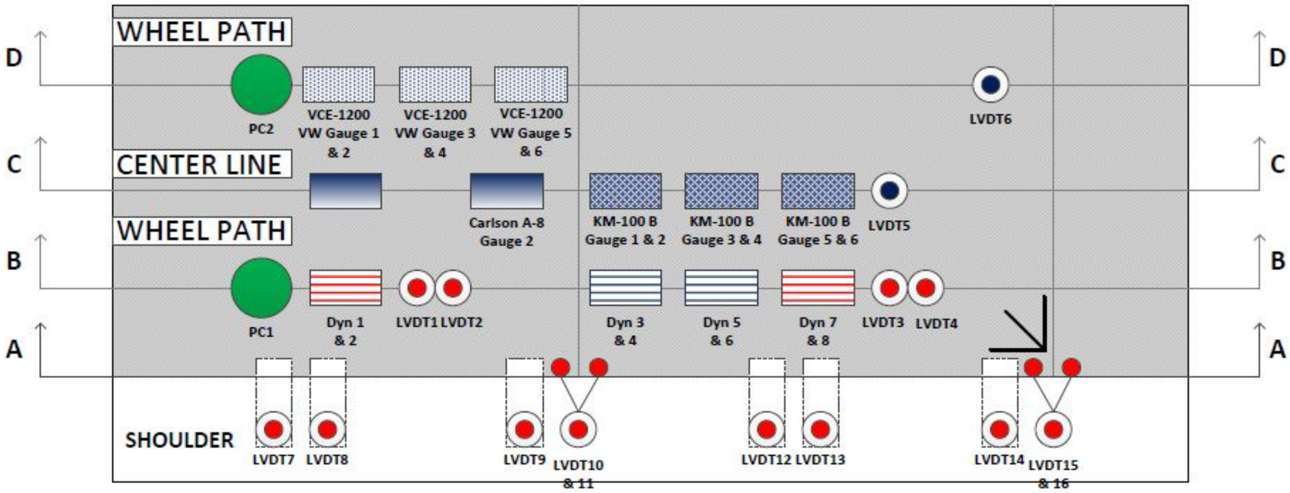
Figure 2 is a sample test section layout drawing, which shows the instrumentation of strain gauge, linear variable differential transformer (LVDT), and pressure cell sensors in plan and profile view, and pavement layer structure in profile view for test section 390102. Sensors were deployed on the defined right wheelpath which was 30 in. from the right pavement edge. A total of twelve sensors were deployed on test section 390102, which include four LVDTs (LVDT1 to LVDT4), two pressure cells (PC1 and PC2) and six strain gauges (Dyn7 to Dyn12). On the other hand, test sections 390104, 390108, and 390110 have a total of nine strain gauge sensors (Dyn10 to Dyn18), LVDTs and pressure cells remain the same as 390102 test section. It can be noticed in the profile view of Figure 2 that Dyn7, Dyn9, and Dyn11 were buried in the transverse direction whereas Dyn8, Dyn10, and Dyn12 were buried in the longitudinal direction. Trace pattern for a strain gauge sensor is contingent on the direction in which the sensor was laid. If a strain gauge was buried in the transverse direction, then the sensor would only display peaks (compressive strains) but no valleys (tensile strains) in a raw trace. In contrast, if a strain gauge was buried in the longitudinal direction, then it would display both peaks and valleys in a raw trace.

In terms of sensor locations, the metrics are listed as follows:

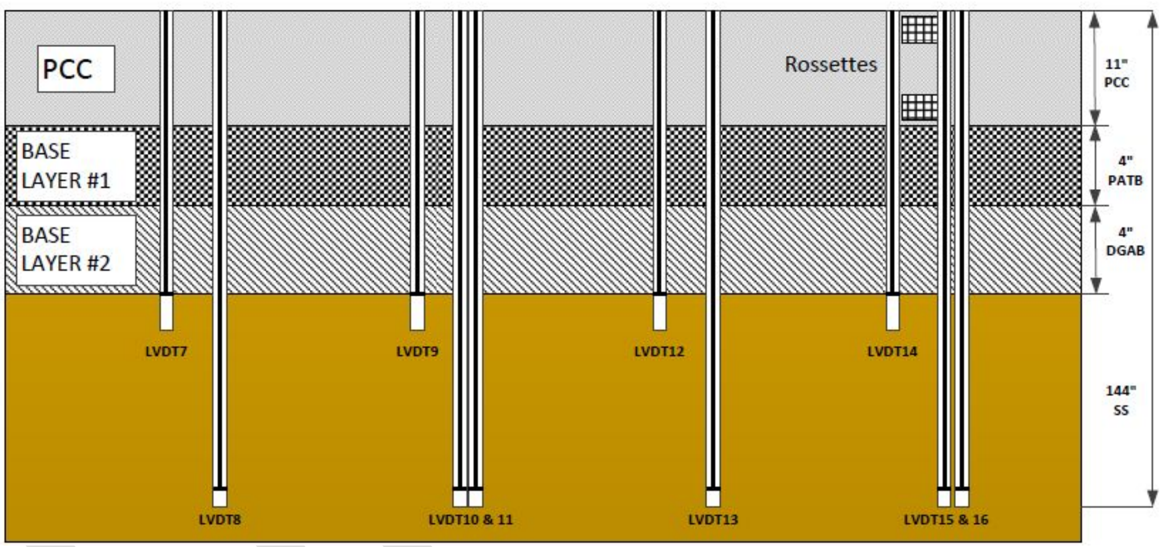
- For the Ohio SPS-1 (AC) test sections:
  - X_AC: Distance in mm along the direction of traffic as referenced from the start of the southernmost 1st LVDT gauge in the section.
  - Y_AC: Distance in mm from the shoulder joint as referenced from the start of the southernmost 1st LVDT gauge in the section.
  - Z: Distance in mm from the pavement surface to measurement point of sensor. Sensor layout of the Ohio SPS-1 test sections 390102, 390104, 390108, and 390110 can be seen in Appendix A.
- For the Ohio SPS-2 (PCC) test sections:
  - X: Distance in mm along the direction of traffic as referenced from the entry slab corner.
  - Y: Distance in mm from the shoulder joint as referenced from the entry slab corner.

- Z: Distance in mm from the pavement surface to measurement point of sensor. Sensor layout of the Ohio SPS-2 test sections 390201, 390205, 390208, and 390212 can be seen in Appendix C.

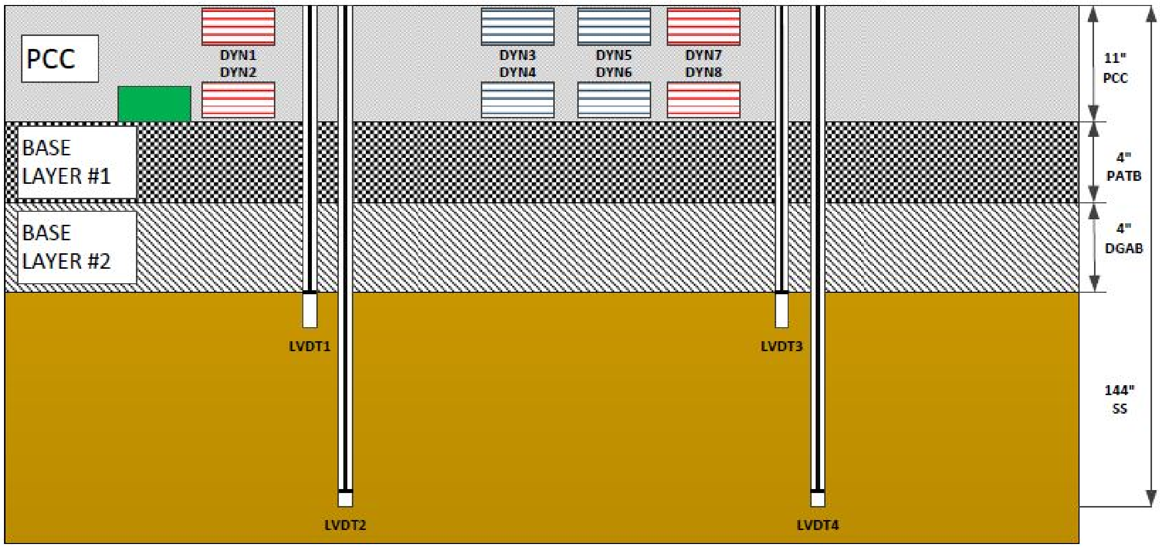
Figure 3 shows instrumentation of Ohio SPS-2 (PCC) sensors which include strain gauge (Dynatest), LVDT, pressure cell, rossettes PMR-60, KM-100B gauge, Carlson A-8 gauge, and VCE-1200 VW gauge in plan and profile view, and pavement layer structure in profile view for 390212 test section. However, the raw DLR traces for Ohio SPS-2 test jobs show time history data only for strain gauge and LVDT sensors; other sensors do not have recorded time history data. A total of sixteen LVDTs (LVDT1 to LVDT16) and eight strain gauges (Dyn1 to Dyn8) were deployed on Ohio SPS-2 test sections. Test sections 390201, 390205, 390208 have similar sensor instrumentation to that of test section 390212 as shown in figure 3.



PLAN VIEW



PROFILE VIEW (section A-A along shoulder edge) (NOT TO SCALE)



PROFILE VIEW (section B-B) (NOT TO SCALE)

Figure 3: Ohio SPS-2 Section 390212 Sensor Layout

Since the completion of the Ohio SHRP test site in 1996, nine series of controlled vehicle tests have been run to monitor dynamic response under known vehicle parameters and environmental conditions. For the Ohio SPS-1 test sections, a Series II test truck with a single or tandem rear axle was used in different test jobs (i.e., one rear axle configuration with load parameters was used in each test job). For Ohio SPS-2 (PCC) test sections, Series II and Series IV test trucks (each of which had a single or tandem rear axle configuration) were used in different test runs (i.e., within one test job, one test run used a single rear axle test truck while the other test run used a tandem rear axle test truck).

Detailed sensor layout in the Ohio SPS-2 DLR sections is listed in Appendix C while sensor status of each of the 24 test Jobs is listed in Appendix D.

2. PROBLEM STATEMENT

Several DLR data issues were identified by DAOFRs (Data analysis/operations feedback report) Ecompex-75, -76 and -77 [3, 4, 5] and the TSSC technical memorandum [6]: *Investigation of Ohio DLR data in LTPP Database*, which indicated that the Ohio SPS-1 DLR data in LTPP Standard Data Release (SDR) 22.0 has inconsistencies in strain gauge trace peak and its time stamp, sensor location, and wheelpath offset when compared to the Ohio SPS-1 DLR raw data. Similar inconsistencies were found in Ohio SPS-2 DLR data in SDR 22.0.

DAOFRs Ecompex-75 and -76 and the TSSC technical memorandum indicated that the Ohio SPS-1 DLR data in SDR 22.0 has time lag shifts in pavement deflection peak strains compared to the Ohio DLR raw data (i.e. the Test Control Software (TCS) data in ASCII format). A time lag shift was defined as the difference in time stamp between two peak strains.

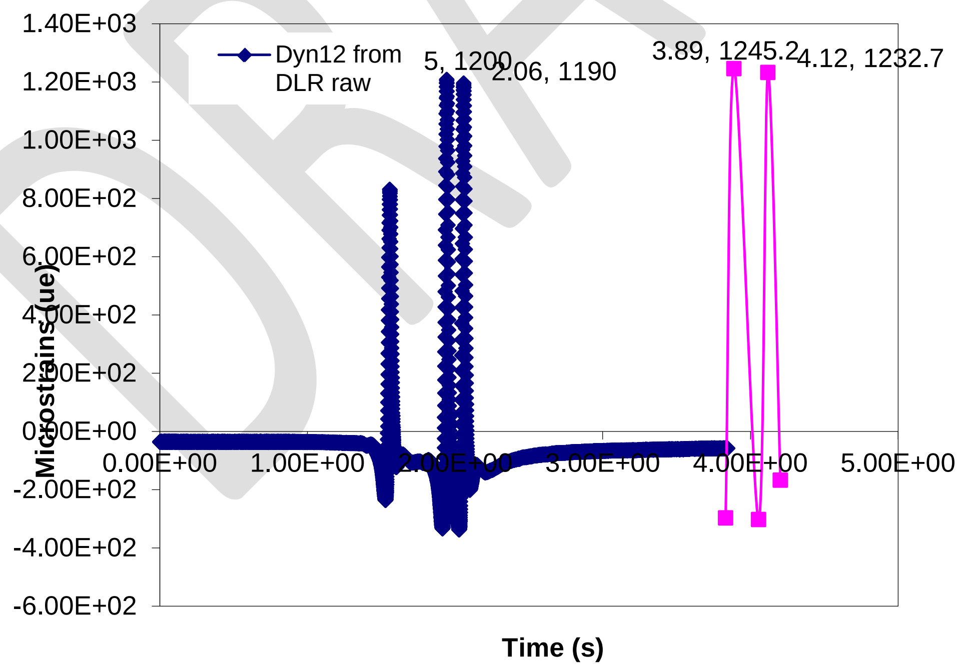


Figure 4: Comparison of Strain Gauge Dyn12 at 2000.579 Hz
for Section 390102: Test Job J2C Run 1 from the DLR raw traces vs. SDR 22.0

Figure 4 and Table 1 show the comparison of strain gauge Dyn12 peaks for a tandem-axle truck from both Ohio SPS-1 DLR data in SDR 22.0 and Ohio raw DLR data for test section 390102. It can be noticed from Figure 4 that TCS Dyn12 trace has three peaks. The first peak on the left was generated by the front axle, followed by next two peaks generated by the two rear axles. On the other and, Dyn12 trace in SDR 22.0 has only two rear-axles peaks, and misses the front-axle peak. When comparing strain gauge Dyn12 peak strain time stamps between the TCS DLR raw data and SDR 22.0 for Ohio section 390102 in J2C test job for Run1, a time lag shift factor of 1.92 (i.e., (4.12-3.89)/(2.06-1.95) = 1.92)) was found.

Table 1: Comparison of TCS (Ohio Raw Data) and SDR 22.0 Strain Gauge Dyn12 Data for Ohio section 390102

Test Name	Run	Test Date	TCS Truck ID	SDR22 Truck ID	Dyn12 Peak No.	TCS Raw		SDR 22 Raw		TCS raw vs. SDR 22 raw
						Dyn12 (microstrain	Time (s)	Dyn12 (microstrain)	Time (s)	Time Lag Shift Factor
J2C	1	8/5/1996	2B	2	1	1,210.00	1.94	1,245.20	3.89	1.92
J2C	1	8/5/1996	2B	2	2	1,180.00	2.06	1,232.70	4.12	
J2C	2	8/5/1996	2B	2	1	1,180.00	1.83	1,282.70	3.81	N/A
J2C	2	8/5/1996	2B	2	2	1,300.00	1.94	1,315.20	N/A	
J2E	2	8/6/1996	2C	1	1	1,270.00	1.43	1,282.70	2.85	2.01
J2E	2	8/6/1996	2C	1	2	1,540.00	1.70	1,537.70	3.39	
J2E	3	8/6/1996	2C	1	1	999.00	0.87	1,015.20	1.74	1.97
J2E	3	8/6/1996	2C	1	2	1,440.00	1.15	1,455.20	2.29	
J2E	10	8/6/1996	2C	1	1	472.00	1.24	480.10	2.49	2.01
J2E	10	8/6/1996	2C	1	2	1,650.00	1.40	1,650.30	2.81	
J2G	1	8/9/1996	2D	1	1	736.00	1.13	740.10	2.25	2
J2G	1	8/9/1996	2D	1	2	1,110.00	1.41	1,117.70	2.81	

Note: SDR 22.0 Truck ID 1 refers to a single rear axle truck and Truck ID 2 refers to a tandem rear axle truck.

The other two inconsistencies, one with strain gauge location and the other with wheelpath offset between the Ohio SPS-1 raw DLR data and DLR data in SDR 22.0, were reported in DAOFR Ecompex-77 [(5)]. Figure 5 below shows a sample sketch of strain gauge Dyn12 locations using Table 2 data. The strain gauge location of Dyn12 in the Ohio raw data was 16 ft. from the end station of Section 390102, whereas Dyn12 in SDR 22.0 was 8 ft. from the end station of the section.

Inconsistent wheelpath offsets between the Ohio raw DLR data and DLR data in SDR 22.0 are shown in Figure 5 and listed in Table 2. The Ohio wheelpath offset data were measured from the defined wheelpath, which was 30 in. from the right pavement edge, whereas SDR 22.0 wheelpath offset data were measured from the right pavement edge. However, the example in Figure 5 shows the Ohio wheelpath offset data as 23 in., whereas SDR 22.0 wheelpath offset data as 21 in., which means the total of the two offsets is 44 in., inconsistent with 30 in., the width of the defined wheelpath.

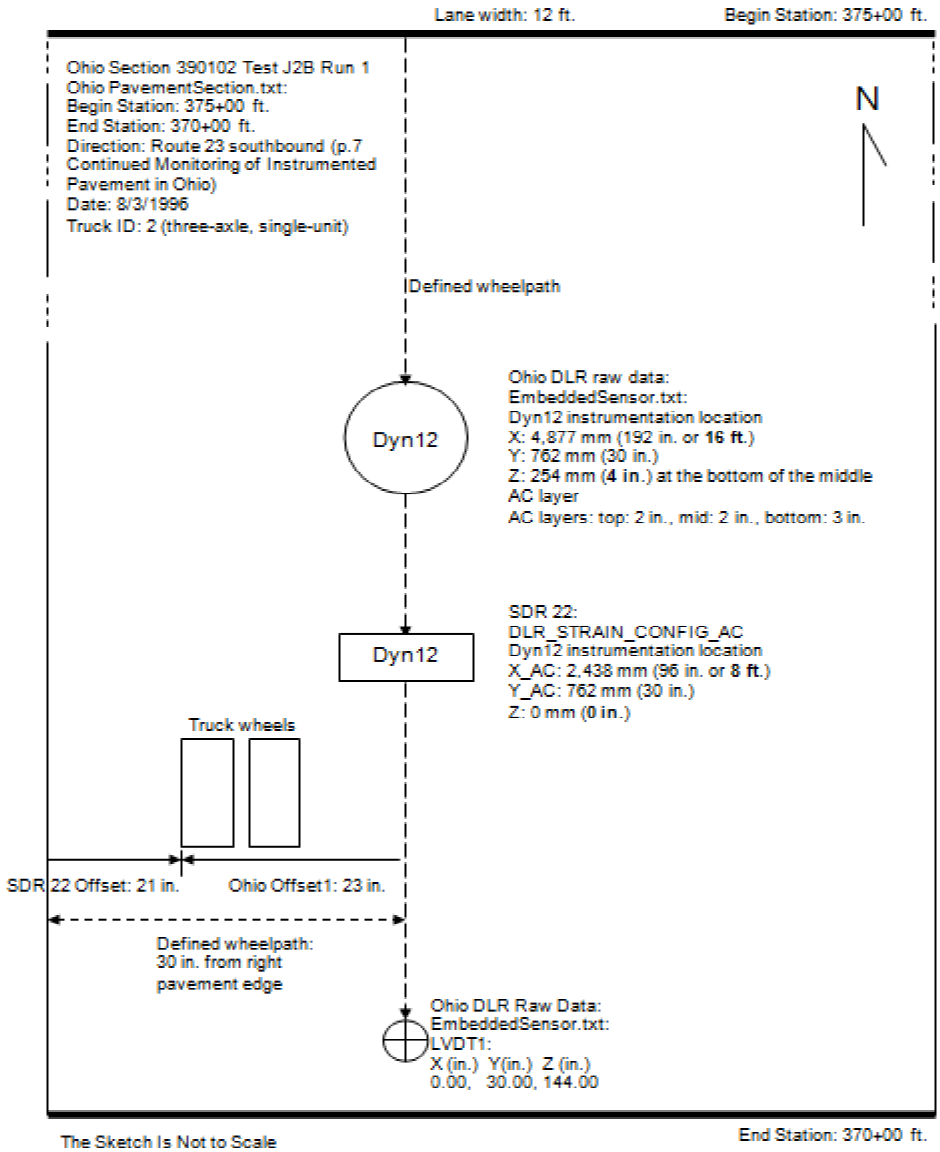


Figure 5: Sketch of Strain Gauge Dyn12 Locations and Wheelpath Offsets: Ohio Raw Data vs. SDR 22.0 on Section 390102 southbound lane

Table 2: Inconsistent Strain Gauge Locations between the Ohio Raw Data & SDR 22.0 Are in Bold Black

SDR 22: table DLR_STRAIN_CONFIG_AC						Ohio raw data (EmbeddedSensor.txt)		
Section_ID	Test_Name	TAG_ID	**X_AC**(mm/in.)	Y_AC(mm/in.)	Z(mm/in.)	**X**(in.)	Y(in.)	Z(in.)
390102	j2b	Dyn1	5486/**216**	762/30	**0**	**72**	30	**2**
390102	j2b	Dyn2	4877/**192**	762/30	**0**	**96**	30	**2**
390102	j2b	Dyn3	4267/**168**	762/30	**0**	**120**	30	**2**
390102	j2b	Dyn4	3658/144	762/30	**0**	144	30	**2**
390102	j2b	Dyn5	3048/**120**	762/30	**0**	**168**	30	**2**
390102	j2b	Dyn6	2438/**96**	762/30	**0**	**192**	30	**2**
390102	j2b	Dyn7	2438/**96**	762/30	**0**	**72**	30	**4**
390102	j2b	Dyn8	2438/96	762/30	**0**	96	30	**4**
390102	j2b	Dyn9	2438/**96**	762/30	**0**	**120**	30	**4**
390102	j2b	Dyn10	2438/**96**	762/30	**0**	**144**	30	**4**
390102	j2b	Dyn11	2438/**96**	762/30	**0**	**168**	30	**4**
***390102**	**j2b**	**Dyn12**	**2438/96**	762/30	**0**	**192**	30	**4**
390102	j2b	Dyn13	2438/**96**	1829/72	**0**	**72**	72	**4**
390102	j2c	Dyn12	2438/**96**	762/30	**0**	**192**	30	**4**
390102	j2c	Dyn13	2438/**96**	1829/72	**0**	**72**	72	**4**
390102	j2e	Dyn12	2438/**96**	762/30	**0**	**192**	30	**4**
390102	j2e	Dyn13	2438/**96**	1829/72	**0**	**72**	72	**4**
390102	j2g	Dyn12	2438/**96**	762/30	**0**	**192**	30	**4**
390102	j2g	Dyn13	2438/**96**	1829/72	**0**	**72**	72	**4**
390104	j4b	Dyn1	5486/**216**	762/30	**0**	**72**	30	**2**
390104	j4b	Dyn2	4877/**192**	762/30	**0**	**96**	30	**2**
390104	j4b	Dyn10	2438/**96**	762/30	**0**	**72**	30	**7**
390104	j4b	Dyn11	2438/96	762/30	**0**	96	30	**7**
390104	j4b	Dyn12	2438/**96**	762/30	**0**	**120**	30	**7**
390104	j4b	Dyn13	2438/**96**	762/30	**0**	**144**	30	**7**
390104	j4b	Dyn14	2438/**96**	762/30	**0**	**168**	30	**7**
390104	j4b	Dyn15	2438/**96**	762/30	**0**	**192**	30	**7**

*: Plotted in Figure 5

Note:

SDR 22: table DLR_STRAIN_CONFIG_AC:

X_AC: Distance along the direction of traffic as referenced from the ***start of the 1st LVDT gauge*** in the section.

Y_AC: Distance from the shoulder joint as referenced from the start of the 1st LVDT gauge in the section.

Z: Distance from the pavement surface to measurement point of sensor.

Ohio raw data (EmbeddedSensor table in DataFormat.pdf):

X float [inch] x coordinate measured from southernmost joint of first instrumented slab in PCC sections, or from ***southernmost deep LVDT*** in AC sections; increases to the north

Y float [inch] y coordinate measured from right edge of pavement; increases to the left

Z floats [inch] z coordinate measured from surface of pavement; increases downward; this makes a left-handed coordinate system in the northbound lane

Similar to DAOFRs Ecompex-75, -76, and -77, the Ohio SPS-2 (PCC) DLR data in SDR 22.0 has time lag shifts in pavement deflection peak strains compared to Ohio raw DLR data and also inconsistent sensor location and wheelpath offset values. Figure 6 below shows the comparison of strain gauge Dyn5 peaks for a tandem-axle truck from both Ohio SPS-2 DLR data in SDR 22.0 and Ohio SPS-2 raw DLR data for section 390201.

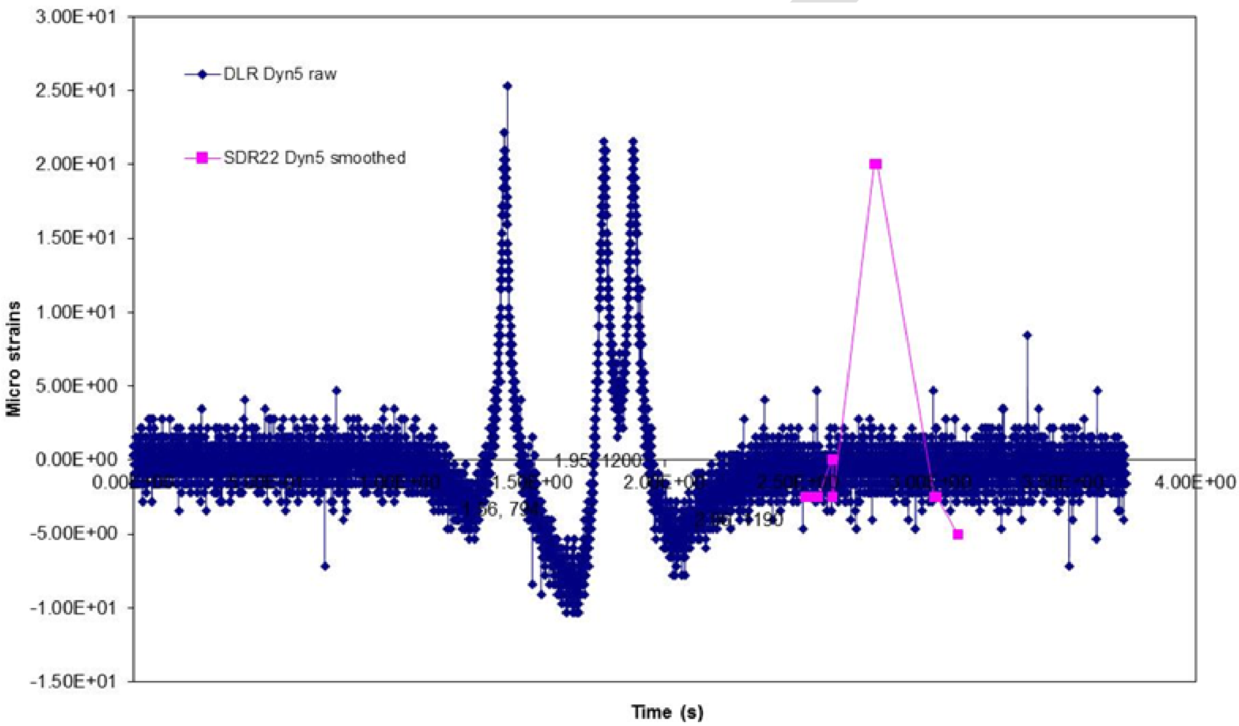


Figure 6: Comparison of strain gauge Dyn5 trace using the Ohio SPS-2 DLR raw data vs. SDR 22.0 for Ohio Section 390201 Test Job J1A Run 2 conducted on August 12, 1996

3. OBJECTIVE

The primary objective of this study is to address the Ohio SPS-1 (AC) and SPS-2 (PCC) DLR data issues in SDR 22.0 as identified by DAOFRs ECOMPEX-75 to -77 [3, 4, 5] and the TSSC technical memorandum [6] by re-interpreting the Ohio SPS-1 and 2 DLR raw traces. The processing of DLR raw data involves the following steps: 1) to smooth the raw traces; 2) to perform quality control (QC) analysis for strain gauge, LVDT, and pressure cell sensors into three categories: "Good", "Maybe", and "No Good" traces and to graphically represent the results obtained from QC analysis in the profile view of a test section's sensor layout; 3) to extract trace peaks and valleys; 4) to correct sensor locations and wheelpath offsets; 5) finally, to populate the DLR tables in the next SDR using the processed DLR data from this study.

4. DLR DATA

It is very important to define the DLR data used in this study. Ohio University (OU) submitted two data sets: the Ohio raw DLR data and the OU-processed DLR data. First, the Ohio raw DLR data contains the raw traces from each test job collected on Ohio SPS-1 and SPS-2 DLR test sections. Secondly, the OU-processed DLR data has text files pertaining to truck pass, truck run, truck peak, axle spacing, embedded senor, truck geometry, surface temperature, etc. for Ohio SPS-1, 2, 8, and 9 test sections.

In this study, the DLR raw traces collected by OPTIM Corporation's MEGADAC SERIES 3100 data acquisition system from the strain gauge, LVDT, and pressure cell sensors for SPS-1 and SPS-2 test sections were first converted to ASCII data format using the Test Control Software (TCS). To maintain consistency and clarity throughout this report, the author uses the word "DLR data” instead of ASCII formatted Ohio raw DLR data and “Ohio data” for OU-processed DLR data (text files).

4.1 Ohio SPS-1 Data

In the test job summary listed in Table 3, the Ohio SPS-1 DLR data contains a total of 34 test jobs, of which test jobs J2B, J8B, J8C, and J8F were empty, and test Jobs J6J4K, J6J4L, J8J5K, J8J5L, J10BX, J10J9K, J10J9L did not have information pertaining to sensor locations as in EmbeddedSensor.txt, TruckPass.txt, and TruckPeak.txt in the Ohio SPS-1 data. As a result, these eleven test jobs were excluded for processing due to incomplete information. A total of 23 test jobs were used for the Ohio SPS-1 DLR data processing. Each test job has test files or runs in ASCII format. For example, the test job J2A has a total of 16 test runs, with test run names AJ2A.001 to AJ2A.016. Each test run contains raw traces collected by strain gauge, LVDT, and pressure cell sensors. The naming convention for a test run like AJ2A.001 is: the second and the third alphabets represent the test job (e.g., J2 with 2 referring to Section 390102); the following alphabet represents visits to the site in alphabetical order (e.g., A for the first visit, B for the second visit, C for the third visit, etc., to the job site: J2), and the numeric extension represents the test run number for that particular visit to that particular site. Table 3 shows the test job names, test run count, sensors count (number of sensors deployed for a particular sensor type for a particular test section) and sensors trace count.

Table 3: Ohio SPS-1 DLR Raw Trace Count

Test Job	Test Section	Test Date	# Test Runs	# Strain Gauge (Count)	# LVDT (Count)	# PC (Count)	# Strain Gauge Traces (Sum)	# LVDT Traces (Sum)	# PC Traces (Sum)
J2A	390102	8/2/1996	16	6	4	2	96	64	32
J2C	390102	8/5/1996	10	6	4	2	60	40	20
J2D	390102	8/6/1996	16	6	4	2	96	64	32
J2E	390102	8/6/1996	13	6	4	2	78	52	26
J2F	390102	8/7/1996	8	6	4	2	48	32	16
J2G	390102	8/9/1996	12	6	4	2	72	48	24
J4A	390104	8/2/1996	16	9	4	2	144	64	32
J4B	390104	8/3/1996	13	9	4	2	117	52	26
J4C	390104	8/5/1996	10	9	4	2	90	40	20
J4D	390104	8/6/1996	15	9	4	2	135	60	30
J4E	390104	8/6/1996	13	9	4	2	117	52	26
J4F	390104	8/7/1996	12	9	4	2	108	48	24
J4G	390104	8/9/1996	12	9	4	2	108	48	24
J8A	390108	8/2/1996	16	9	4	2	144	64	32
J8D	390108	8/6/1996	15	9	4	2	135	60	30
J8E	390108	8/6/1996	13	9	4	2	117	52	26
J8G	390108	8/9/1996	12	9	4	2	108	48	24
J10A	390110	8/2/1996	16	9	4	2	144	64	32
J10C	390110	8/5/1996	10	9	4	2	90	40	20
J10D	390110	8/6/1996	16	9	4	2	144	64	32
J10E	390110	8/6/1996	12	9	4	2	108	48	24
J10F	390110	8/7/1996	13	9	4	2	117	52	26
J10G	390110	8/9/1996	12	9	4	2	108	48	24
							2,484	1,204	602
							4,290		

4.2 Ohio SPS-2 Data

Ohio SPS-2 DLR data contains a total of 24 test jobs and all of the test jobs were used for data processing. Table 4 shows the test job names, test run count, sensors count (number of sensors deployed for a particular sensor type for a particular test section) and sensors trace count. It can be observed from Table 4 that Ohio SPS-2 DLR data do not have any pressure cell sensors.

Table 4: Ohio SPS-2 DLR Raw Trace Count

Test Job	Test Section	Test Date	# Test Runs	# Strain Gauge (Count)	# LVDT (Count)	# Strain Guage Traces (Sum)	# LVDT Traces (Sum)
J1A	390201	8/12/1996	28	4	16	112	448
J1B	390201	8/13/1996	24	4	16	96	384
J1C	390201	8/14/1996	14	4	16	56	224
J5A	390205	8/12/1996	29	4	16	116	464
J5B	390205	8/13/1996	25	4	16	100	400
J5C	390205	8/14/1996	14	4	16	56	224
J8A	390208	8/12/1996	26	4	16	104	416
J8B	390208	8/13/1996	26	4	16	104	416
J8C	390208	8/14/1996	17	4	16	68	272
J12A	390212	8/12/1996	4	4	16	16	64
J12B	390212	8/13/1996	26	4	16	104	416
J12C	390212	8/14/1996	14	4	16	56	224
J5J1M	390205	7/29/1997	18	4	16	72	288
J5J1N	390205	7/30/1997	18	4	16	72	288
J5J1O	390205	7/30/1997	18	4	16	72	288
J5J1P	390205	8/6/1997	18	4	16	72	288
J8S3M	390208	7/29/1997	18	4	16	72	288
J8S3N	390208	7/30/1997	18	4	16	72	288
J8S3O	390208	7/30/1997	18	4	16	72	288
J8S3P	390208	8/6/1997	18	4	16	72	288
J12J10M	390212	7/29/1997	18	4	16	72	288
J12J10N	390212	7/30/1997	18	4	16	72	288
J12J10O	390212	7/30/1997	18	4	16	72	288
J12J10P	390212	8/6/1997	17	4	16	68	272
						1,848	7,392
						9,240	

5. METHDOLOGY

This section presents a step-by-step approach of the study methodology used to process the Ohio SPS-1 and SPS-2 DLR data using Matlab® [7]. For the Ohio SPS-1 data that has relatively distinct pavement deflection signal peaks and valleys, a peak finding algorithm was developed using the tools available in Matlab® software to perform the first five steps of the methodology. For the Ohio SPS-2 data that has indistinctive pavement deflection signal peaks and valleys with significant noise, a bandpass filter algorithm was developed using the Matlab® toolbox to perform the methodology. The methodology involves the following steps:

1. DLR data calibration
2. Gain adjustment factors
3. Smoothing the raw traces
4. Extracting trace peaks and valleys as well as their corresponding time stamps
5. Quality Control (QC) analysis
6. Correcting sensor locations and wheelpath offsets

5.1 DLR Data Calibration

5.1.1 Ohio SPS-1 Data Calibration

Ohio SPS-1 DLR data has two sensor types in need of data calibration: LVDT and pressure cells. The units of LVDT and pressure cell sensors in DLR data are in voltage. Calibration factors were obtained from OU, and it is clarified by LTPP team that all LVDT calibrations (approximately 600 LVDTs) are linear and pass through the origin with slopes ranging from 19.5 – 20.5 Volts per inch. Therefore, an average value of 20.0 V/in. was used to convert LVDT traces from voltage to pavement deflection in inches. For all of the pressure cell sensors, a factor of 10 psi/volt was used, which were generally correct to within ± 2%, according to OU [8]. Dynatest strain gauges are calibrated using the MEGADAC data acquisition system in the ¼ Wheatstone bridge setup and did not require any calibrations, units of strain gauge traces are in microstrain (μe). All calibrations for LVDT and pressure cell sensors were computed in Matlab®.

5.1.2 Ohio SPS-2 Data Calibration

The Ohio SPS-2 data had only one sensor type in need of data calibration: LVDT. The units of Ohio SPS-2 LVDTs are in voltage. Similar to Ohio SPS-1 data discussed above, LVDT calibration factors with an average value of 20.0 V/in. were used to convert LVDT traces from voltage to pavement deflection in inches. LVDT data calibrations were completed using Matlab®.

5.2 Gain Adjustment Factor

Once the data was calibrated, the next step was to normalize the sensor traces to base zero on the y-axis (pavement deflection) i.e. under no load conditions, so that the resulting peak values represented the change due to load response. A gain adjustment factor is an average of the first 500 data points in a calibrated raw trace which is subtracted from each trace data point to normalize the trace to zero in the y axis. Theoretically, the number of data points needed to determine a gain adjust factor is about ten percent of the data collection frequency for each sensor. If data collection frequency is 2000Hz, then the number of data points needed to determine a gain adjustment factor is 10% of 2000Hz, which is 200 data points per second. If data collection frequency is 500Hz, then the number of data points needed to determine a gain adjustment factor is 10% of 500Hz, which is 50 data points per second. In this study, the DLR Study Team decided to use the first 500 data points to average a gain adjustment because the Ohio SPS-1 gain adjustment factors appear to stabilize when the number of data points is about 500. Similarly, the DLR Study Team used the first 500 data points to determine a gain adjustment factor for the Ohio SPS-2 data.

5.2.1 Ohio SPS-1 Gain Adjustment Factor

Each Ohio SPS-1 time history dataset in the majority of the DLR raw trace files contained, on average, 5,000 data points. So a sample size of 10 percent (500 data points) of the time history measurements was considered reasonable to calculate the gain adjustment factor. The DLR Study Team also computed the gain adjustment factor considering 200, 300, and 400 data points at the start of the trace, but there wasn't any significant difference in mean values for these number of data points. For example, the computed mean values for AJ2A.007 file are -1.0470, -1.1168, -1.1345, and -1.1326 for 200, 300, 400, and 500 data points, respectively. A mean value of the first 500 data observations was subtracted from each observation of a sensor raw trace to normalize the trace to zero in the y axis (pavement deflection). For example, assuming that strain gauge Dyn12 trace in test job J2F had a total of six thousand observations, the mean value of the first 500 observations was subtracted from each observation of the total six thousand observations. The algorithm adjusted all sensor traces to base zero on y-axis for all files in J2F test job.

5.2.2 Ohio SPS-2 Gain Adjustment Factor

Each Ohio SPS-2 time history dataset in the majority of the DLR raw trace files contained, on average, close to 7,000 data points. Meanwhile, the Ohio SPS-2 data had significantly more noise and lower pavement deflection magnitude due to stiffer PCC compared to Ohio SPS-1 AC sections. Nevertheless, similar to Ohio SPS-1 data, a mean value of the first 500 data observations was subtracted from each observation of a sensor raw trace to normalize the trace to zero in the y axis (pavement deflection). However, in retrospect, due to significant noise in the Ohio SPS-2 data, the first 500 data points may not have been enough. For future research, the first 700 data points is recommended to be used to determine a gain adjustment factor for the Ohio SPS-2 data because it is about 10% of each Ohio SPS-2 time history dataset that contains, on average, close to 7,000 measurements.

Furthermore, due to significant noise in the Ohio SPS-2 data, it is extremely difficult to identify peaks and valleys in a raw trace. Thus, smoothing the Ohio SPS-2 raw traces becomes necessary, and only from a smoothed trace can peaks and valleys be extracted.

5.3 Smoothing Raw Traces

5.3.1 Smoothing Ohio SPS-1 Raw Traces

Smoothing of raw sensor trace was necessary to eliminate redundant local minima, local maxima, and noise in a trace. The DLR tables in SDR 22.0 have time stamp columns and location (pavement deflection value) stamp columns for both raw and smoothed traces for all strain gauge, LVDT, and pressure cell sensors. In this study, the mslowess function available in Matlab® bioinformatics toolbox was explored to smooth sensor traces. LOWESS stands for locally weighted scatterplot smoothing method, assumes a default span of 10 data samples. For more information on the mslowess function see reference [9]. For the Ohio SPS-1 raw traces collected by strain gauge, LVDT, or pressure cell, the mslowess function was used to smooth the raw traces, regardless of sensor type.

5.3.2 Smoothing Ohio SPS-2 Raw Traces

It is extremely difficult to extract pavement deflection peaks and valleys from the Ohio SPS-2 strain gauge raw traces that are significantly noisier and of lower deflection magnitude due to stiffer PCC sections. Figure 7 shows a comparison plot of a normalized raw trace in red vs. a moving median (MM)-smoothed trace in blue vs. a bandpass filter-smoothed trace in green as sampled from strain gauge DYN8 in Ohio SPS-2 390201 Test Name J1A Run 27. Figure 7 demonstrates the level of noise and magnitude of signal associated with a typical Ohio SPS-2 raw trace collected from a strain gauge compared to smoothed ones. On the other hand, the Ohio SPS-2 LVDT raw traces did not appear to be as noisy as did strain gauges and hence, the moving median function was used to smooth Ohio SPS-2 LVDT raw traces.

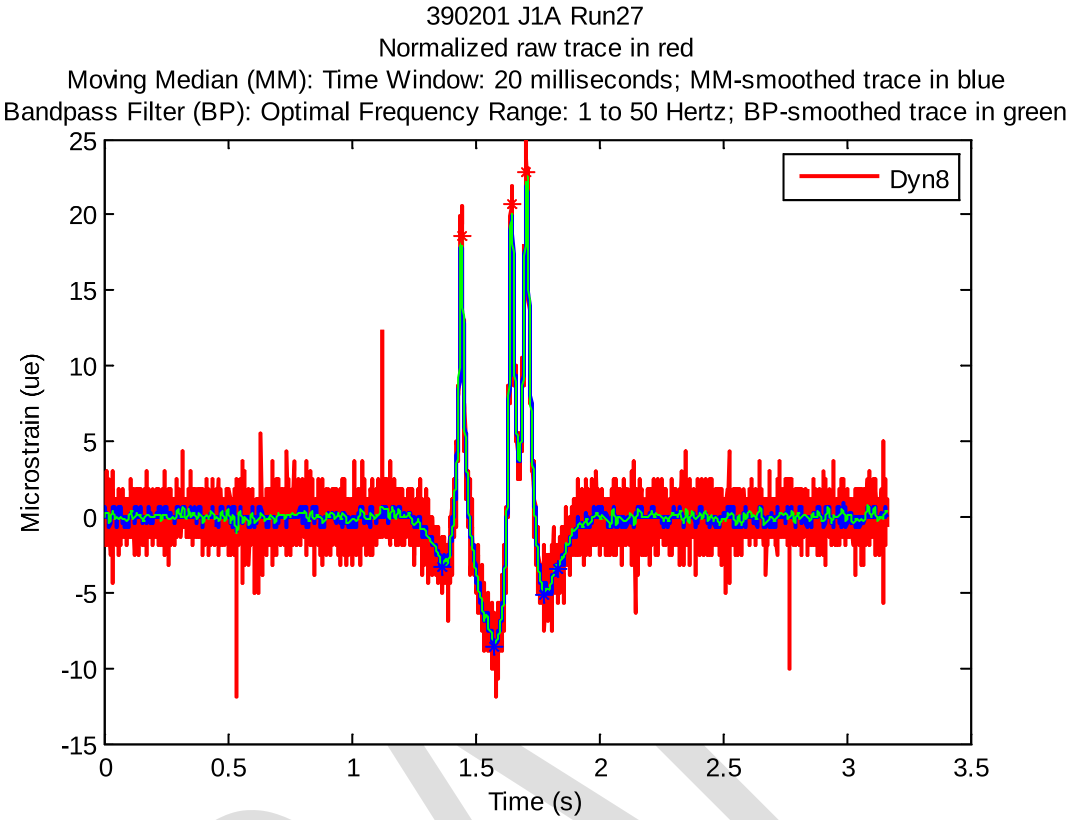


Figure 7: Comparison of a Normalized Strain Gauge Raw Trace in Red vs. an MM-smoothed Trace in Blue vs. a Bandpass Filter-smoothed Trace in Green

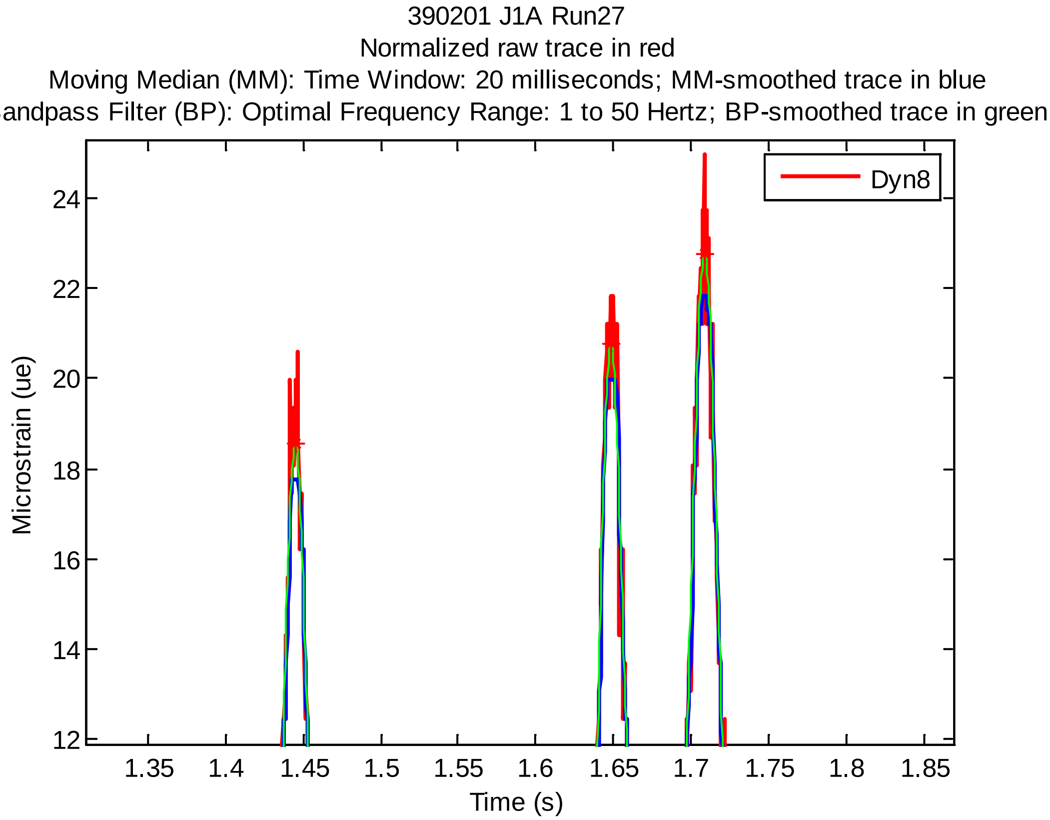


Figure 8: A Magnified View of the Three Trace Peaks in Figure 7, Showing the BP-smoothed Trace in Green Appears to Approximate the Raw Trace Peaks in Red Better Than the MM-smoothed race in Blue.

The bandpass filter function in Matlab® appears to be a feasible solution for filtering out the significant noise in Ohio SPS-2 strain gauge raw traces as demonstrated in Figure 8. Before filtering the noise, one can use the power density function in Matlab® to identify an optimal bandpass filtering frequency range by plotting the power density of a raw trace. Using the optimal filtering frequency range, one can further tighten the optimal range by comparing bandpass filter-smoothed trace plots created within various narrower frequency ranges in order to determine the optimal frequency range for the bandpass filter to smooth a raw trace. In general for the Ohio SPS-2 strain gauge raw traces, 1 to 50 Hertz appears to be the optimal filtering frequency range for the bandpass filter and thus, it was the filtering frequency range chosen for the bandpass filter to smooth the Ohio SPS-2 strain gauge raw traces. Figure 8 shows a magnified view of the three trace peaks in Figure 7, including a normalized raw trace from J1A Run 27 DYN8, a moving median-smoothed (MM with a moving average window of 20 milliseconds) trace, and a bandpass filter-smoothed trace. The bandpass filter-smoothed trace in green appears to *approximate* the raw trace peaks in red *better* than the moving median-smoothed trace in blue as sampled from strain gauge DYN8 in Ohio SPS-2 390201 Test Name J1A Run 27. Meanwhile in Figure 8, it also appears that the bandpass filter-smoothed trace in green demonstrates the least noise, compared to the normalized raw trace in red and the MM-smoothed trace in blue.

5.4 Extracting Trace Peaks and Valleys as well as Their Corresponding Time Stamps

5.4.1 Extraction of Ohio SPS-1 Trace Peaks and Valleys

The mspeaks function [10] of Matlab® was used to extract the trace peaks and valleys from both the raw and smoothed traces from strain gauges, LVDTs, and pressure cells for the Ohio SPS-1 data. The function finds the relevant peaks in a raw noisy peak trace data, and creates peak list, a two column matrix, containing the time stamp value and magnitude (location stamp) value for each peak. The mspeaks function has input arguments like height filter value and over segmentation filter value to locate peaks. Height filter value is a positive real value that specifies the minimum height for reported peaks and over segmentation filter value is a positive real value that specifies the minimum distance in time stamp units between neighboring peaks. When a trace is not smoothed appropriately, multiple maxima can appear to represent the same peak. Increasing this filter value will help to join over segmented peaks into a single peak. The default value for both the arguments is zero. The extracted trace peaks and valleys identified from the mspeaks function are used in QC analysis to categorize the sensor traces. Figure 9 shows the extracted peaks in red star and valleys in green star and other information (test job name, run number, truck speed, sensor location, truck type, truck loading, pavement layer structure, offset values and direction of strain gauge sensor) for a smoothed longitudinal strain gauge sensor Dyn11.

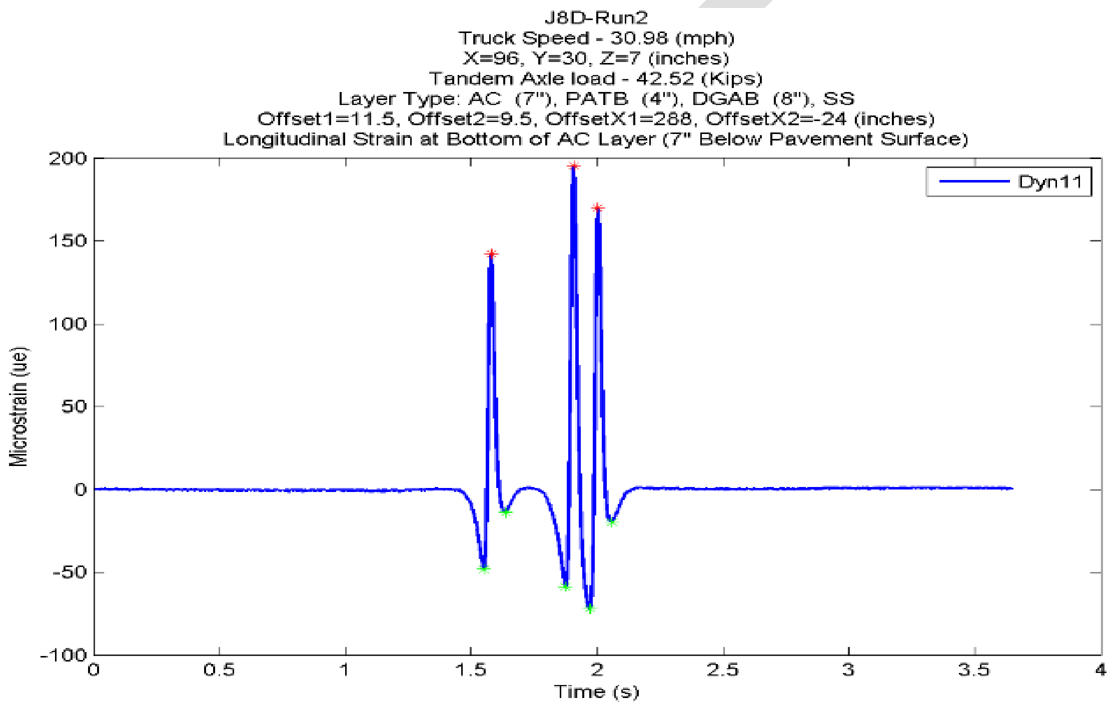


Figure 9: Extracted Trace Peaks and Valleys for Ohio SPS-1 Data

5.4.2 Extraction of Ohio SPS-2 Trace Peaks and Valleys

The mspeaks function of Matlab® was used to extract the trace peaks and valleys from the smoothed traces only for the Ohio SPS-2 data because the raw traces were too noisy to be extracted. Figure 10 shows the bandpass filter-smoothed trace from Test Job J1A Run 27 DYN8. The red stars in the figure indicate the pavement deflection signal peaks while the blue stars indicate the signal valleys extracted by the mspeaks function. The local valley (blue star) near time 2 seconds was manually removed before incorporating the extracted peaks and valleys as well as their time stamps into the DLR_STRAIN_TRACE_SUM_PCC table.

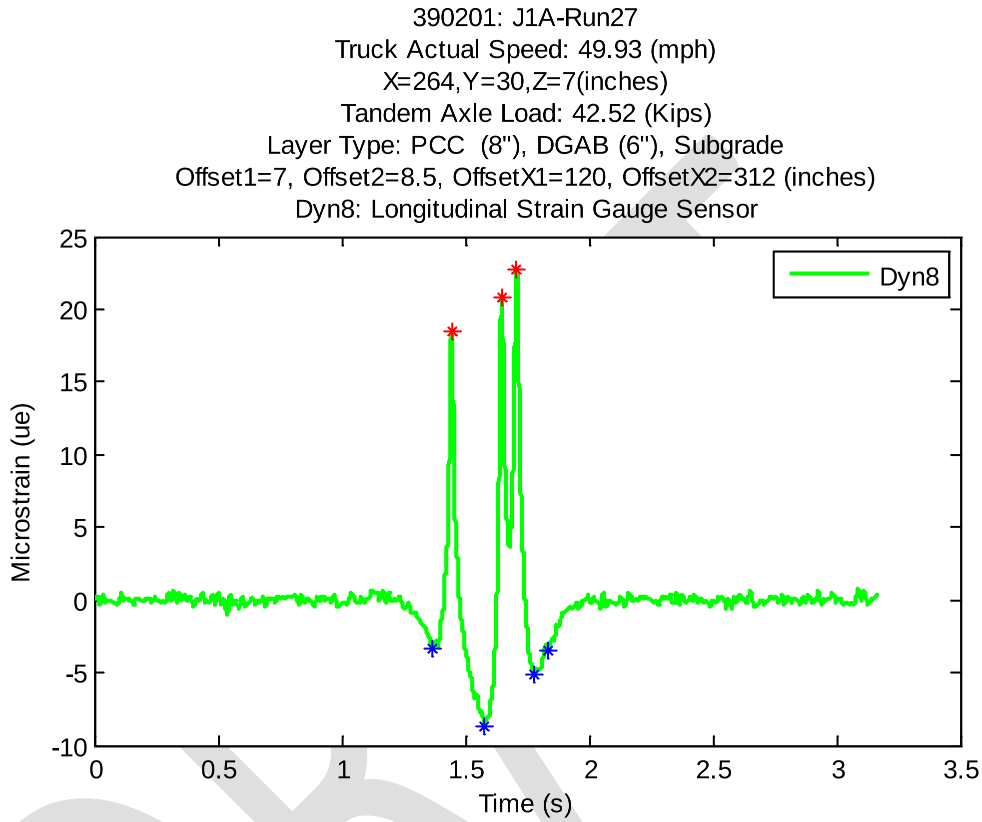


Figure 10: Extracted Trace Peaks and Valleys for Ohio SPS-2 Data

5.5 Quality Control (QC) Analysis

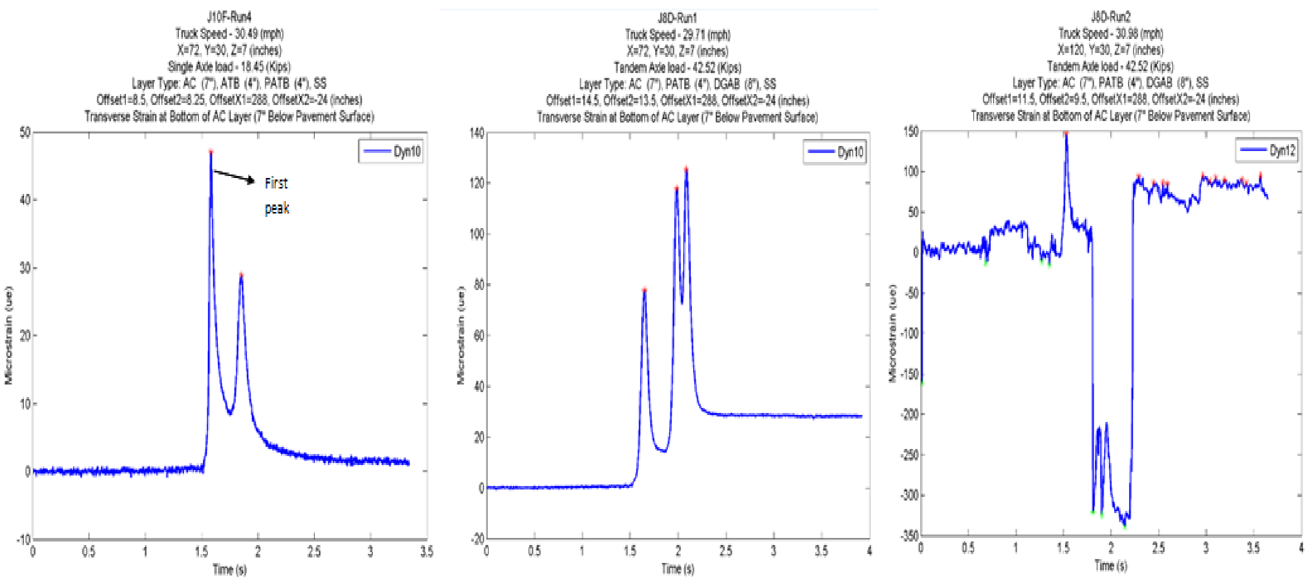
5.5.1 Ohio SPS-1 QC Analysis

QC analysis is a process to assess the data quality. It is important as it provides insight into data quality issues and helps in decision making. In this study, QC analysis was performed to categorize the sensor *raw* and *smoothed* traces into three quality categories: “Good”, “Maybe”, and “No Good” traces. QC check is developed based on three criteria. The rationale for the criteria is the number of peaks; two peaks in case of single-axle dump truck and three peaks for a tandem-axle dump truck, and difference in begin and end offset of a trace. An offset is a reference point of value averaging two hundred data points in a trace.

The three criteria used to categorize DLR raw and smoothed traces are:

1. Good trace: number of peaks should be equal to the number of test truck axles and the difference in begin and end offset is less than 10 percent of the first peak (peak considered from left in a trace chart in Figure 11.
2. Maybe trace: number of peaks should be equal to the number of test truck axles and the difference in begin and end offset is more than 10 percent of the first peak.
3. No Good trace: number of peaks less than or greater than test truck axles.

How the QC check criteria works is explained by considering transverse strain gauge traces and is shown in Figure 11. The figure has three transverse strain gauge trace charts for good, maybe, and no good traces. The first trace chart was categorized as Good trace; it satisfies the good trace criterion (i.e.) the number of peaks was equal to the number of test truck axles and the difference in begin and end offset was less than 10 percent of the first peak for a single-axle dump truck. The second trace chart satisfied the number of peaks (three peaks), but failed to satisfy the difference in begin and end offset less than 10 percent of first peak for a tandem-axle dump truck. The difference in begin and end offset was more than 10 percent, satisfied the maybe trace criterion and was categorized as Maybe trace. The third trace chart did not satisfy the number of peaks (three peaks) for a tandem-axle dump truck; there were multiple peaks identified in third trace chart and satisfied No Good trace criterion. It was categorized as No Good trace.



(A) Strain Gauge-Good trace (B) Strain Gauge- Maybe trace (C) Strain Gauge- No good trace

Figure 11: Ohio SPS-1 Transverse Strain Gauge Trace Categorization

Similar to the transverse strain gauge trace categorization shown in Figure 11, LVDT trace categorization is shown in Figure 12.

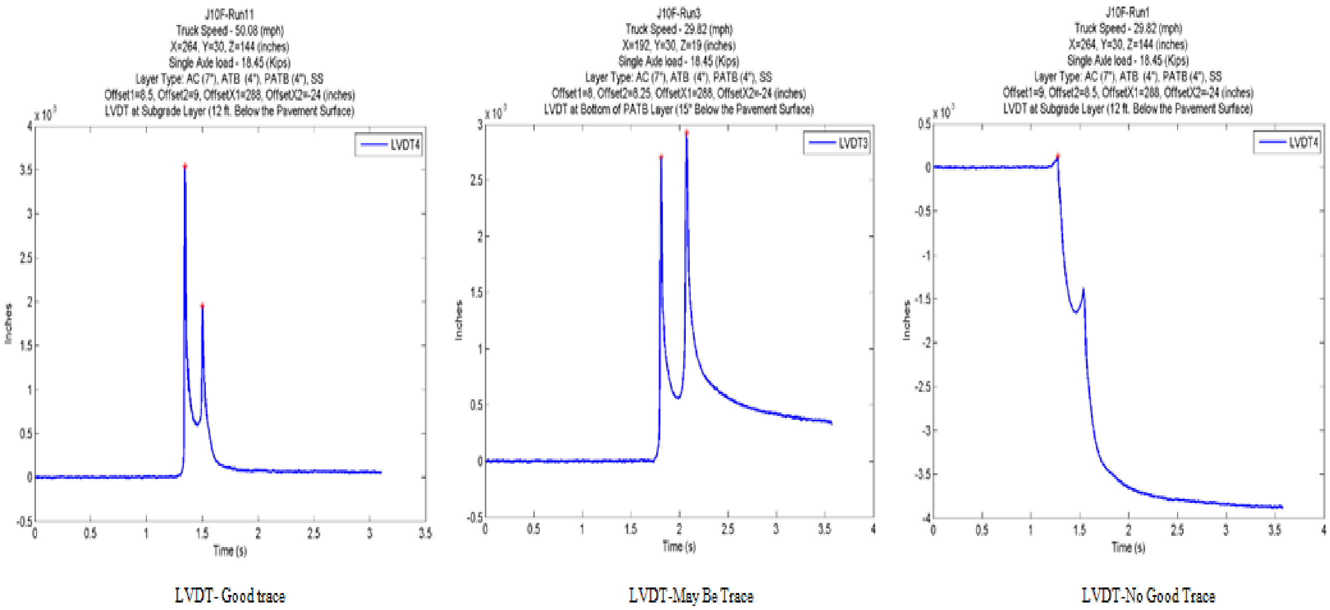
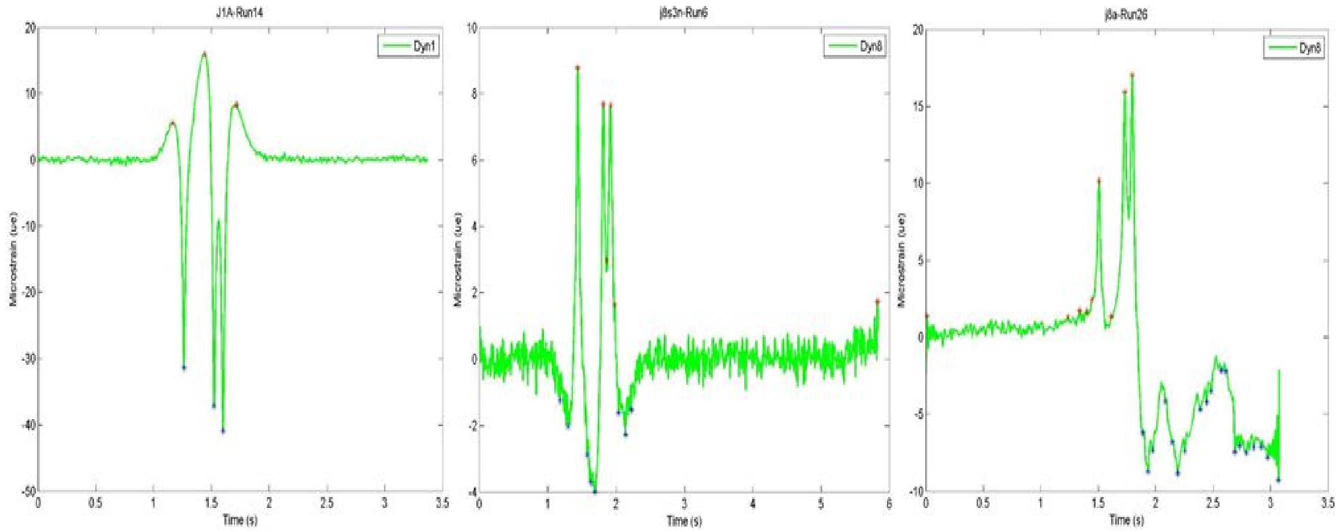


Figure 12: Ohio SPS-1 LVDT Trace Categorization

Almost all (99%) of the raw and smoothed traces from Ohio SPS-1 pressure cells were categorized as Good traces based on the criteria aforementioned.

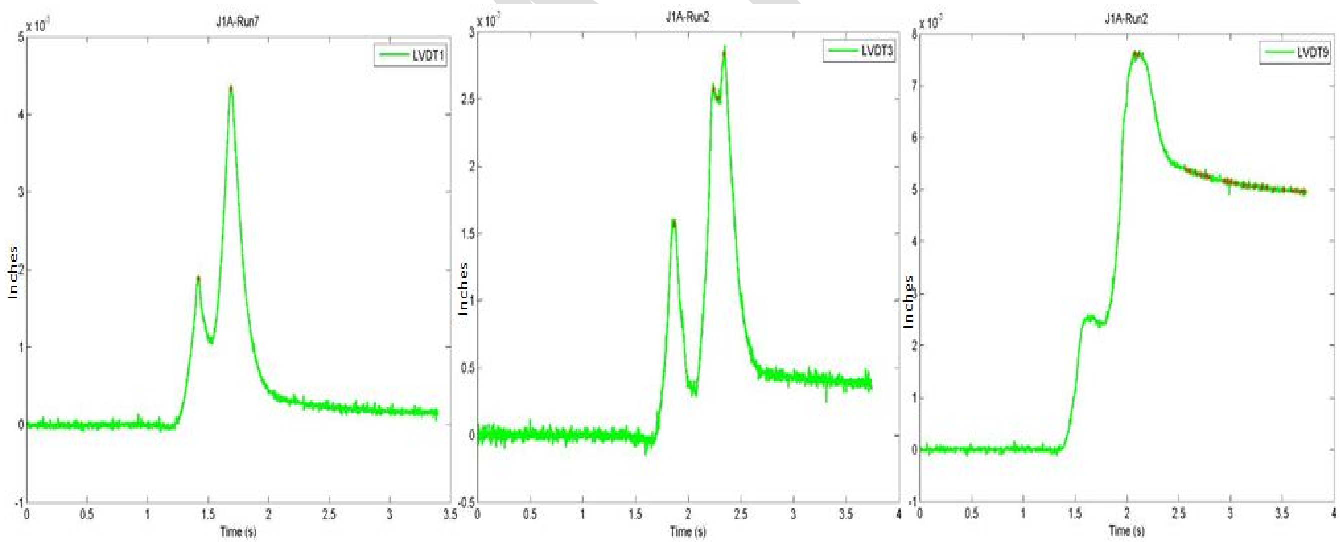
5.5.2 Ohio SPS-2 QC Analysis

Due to significant noise in Ohio SPS-2 strain gauge and LVDT raw traces, only smoothed Ohio SPS-2 strain gauge and LVDT traces were categorized using the trace categorization criteria in Section 5.5.1. Figures 13 and 14, show sample categorization results for longitudinal strain gauge and LVDT traces, respectively.



Strain gauge-Good Trace | Strain gauge-May Be Trace | Strain gauge-No Good Trace

Figure 13: Ohio SPS-2 Longitudinal Strain Gauge Trace Categorization



LVDT-Good Trace | LVDT-May Be Trace | LVDT-No Good

Figure 14: Ohio SPS-2 LVDT Trace Categorization

5.6 Correcting Sensor Locations and Wheelpath Offsets

Inconsistent sensor locations between Ohio SPS-1 and 2 data and SDR 22.0 were corrected using the embedded sensor data in the Ohio data set (EmbeddedSensor.txt). An inner join procedure, based on STATE_CODE, SHRP_ID, TAG_ID as matching columns, was used which joined all the columns in the DLR_STRAIN_CONFIG_AC table with the strain gauge sensor location (columns X, Y, and Z) in the embedded sensor data. LVDT and PC sensor locations in the DLR_LVDT_CONFIG_AC and DLR_PC_CONFIG_AC tables were also corrected using the same embedded senor data.

Similarly, the inconsistent wheelpath offset data in DLR_TEST_MATRIX were updated using the truck pass (TruckPass.txt), truck run (TruckRun.txt), and raw Ohio DLR ASCII data. However, the DLR_TEST_MATRIX table in SDR 22.0 has wheelpath offset records for both Ohio and NC test sections. Only Ohio wheelpath offset records were inner joined with STATE_CODE, SHRP_ID, SUBSERIES, and RUN_NUMBER as matching columns in the Ohio TruckPass.txt data. Since the wheelpath offset data for NC test sections is not available, the NC wheelpath offset records were not updated.

6. QC RESULTS

6.1 Ohio SPS-1 Data QC Results

This section presents the results obtained from the application of above discussed methodology to process DLR raw data. The results from this study are very important for two main reasons: it helps to make a decision as to which quality DLR data (good and maybe traces by test job and by sensor type) should be included into the next SDR, and the QC-processed DLR data can be used to determine the approaches and methodologies most appropriate for applications in pavement analysis and design processes.

6.1.1 Smoothed Trace Processing

As mentioned in the report earlier, the study considered 23 test jobs in Ohio SPS-1 DLR data. However, one test job at a time was processed using Matlab®. Test job J2F, that had eight test runs with run names AJ2F.001 to AJ2F.008, was used to illustrate the working of first four steps of the methodology in Matlab®. The peak finding algorithm developed was test job specific i.e., the algorithm ran through all the test runs/files in a particular test job. It imported all the runs/files in test job J2F into Matlab® environment. Calibration factors discussed in the first step of the methodology were applied to LVDT and pressure cell sensors to convert them into pavement deflection in inches and test vehicle loading in psi.

As discussed in the third step of the methodology, sensor traces for three sensor types: strain gauge, LVDT, and pressure cell sensors for all runs in test job J2F were smoothed using the mslowess function available in Matlab® bioinformatics tool box.

The QC part of the algorithm checked trace quality categorization for all smoothed sensor traces in J2F test job based on the three criteria discussed in the fifth step listed in the Methodology section of this report. The algorithm saved the QC results separately into MS Excel® file using sensor type and test job name as file name, for example, LVDT_J2F_QC, for LVDT sensor in J2F test job. QC results in MS Excel® file were checked manually for each smoothed trace to correct any improperly categorized traces. Table 5 shows the summarized QC results for each run number and sensor type for J2F test job. The numbers 1, 2, and 3 for sensors strain gauge (Dyn7 to Dyn12), LVDT (LVDT1 to LVDT2) and PC (PC1 and PC2) in Table 6 represent the trace quality in good, maybe, and no good trace categories respectively (i.e. 1: Good, 2: Maybe, and 3: No Good). In J2F test job there were 48 strain gauge traces of which sixteen traces were Good, i.e. the total of eight "1's" or Good traces under Dyn9 and the other eight "1's" under Dyn12 columns, respectively.

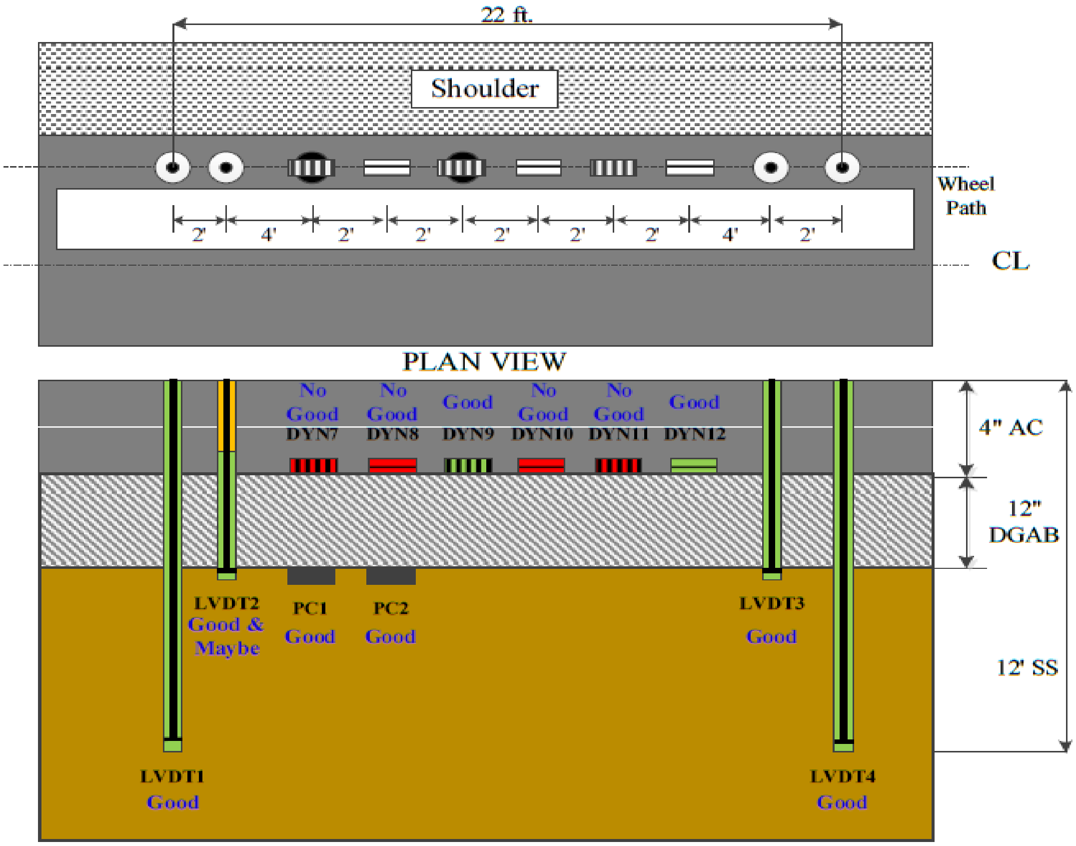
Table 5: Summarized QC Results for Smoothed Traces in Ohio SPS-1 J2F Test Job

J2F Test Job QC Results												
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	1	3	3	1	1	2	1	1	1	1
2	3	3	1	3	3	1	1	1	1	1	1	1
3	3	3	1	3	3	1	1	2	1	1	1	1
4	3	3	1	3	3	1	1	1	1	1	1	1
5	3	3	1	3	3	1	1	2	1	1	1	1
6	3	3	1	3	3	1	1	1	1	1	1	1
7	3	3	1	3	3	1	1	1	1	1	1	1
8	3	3	1	3	3	1	1	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	16**	0	32
LVDT	29	3	0
PC	16	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 16 is the total of eight "1's" under Dyn9 and other eight "1's" under Dyn12.

To make it easy for data users, the QC results obtained for J2F test job are graphically shown in Figure 15 with QC results table, i.e. the trace quality obtained from the two sensor types (strain gauge and LVDT) are graphically presented either in combination or separately in green, orange, and red colors to represent good, maybe and no good sensors either in combination or separately in a sensor layout drawing. For example strain gauge sensors Dyn7, Dyn8, Dyn10, and Dyn11 sensors are in red color representing data obtained from these sensors are in No Good quality, whereas Dyn9, Dyn12, LVDT1, LVDT3, and LVDT4 sensors are in green color representing data obtained from these sensors are in Good quality. LVDT2 sensor is represented in combination of orange and green colors which mean the data obtained from this sensor is in good quality for some runs and in Maybe quality for remaining runs in J2F test job. Except for three traces, the QC results obtained for pressure cell sensors are in good condition for all the traces; they are not represented in colors in the drawings. Graphical representation of QC results for all the 23 test jobs can be seen in Appendix B.



PROFILE VIEW (Not to Scale)

J2F Test Job QC Results

Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	1	3	3	1	1	2	1	1	1	1
2	3	3	1	3	3	1	1	1	1	1	1	1
3	3	3	1	3	3	1	1	2	1	1	1	1
4	3	3	1	3	3	1	1	1	1	1	1	1
5	3	3	1	3	3	1	1	2	1	1	1	1
6	3	3	1	3	3	1	1	1	1	1	1	1
7	3	3	1	3	3	1	1	1	1	1	1	1
8	3	3	1	3	3	1	1	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	16**	0	32
LVDT	29	3	0
PC	16	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 16 is the total of eight "1's" under Dyn9 and other eight "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 15: Graphical Representation of QC Results by Sensor Type for Section 390102 J2F Test Job

The peaks and valleys for the smoothed traces in J2F test job were extracted using the mspeaks function discussed in the fourth step listed in the Methodology section of this document. These extracted peaks and valleys for each trace were directly saved into a separate MS Excel® file using the sensor number by sensor type, test job name, and run number as file name, for example, Dyn12_J2F1, for Dyn12 sensor in J2F test job for run one. Based on the QC results, the peaks and valleys extracted for good traces for J2F test job are summarized in Table 6. For J2F test job two-axle test truck was used, and since sensor Dyn9 was laid in transverse direction, it has only two peaks, whereas sensor Dyn12 was laid in longitudinal direction therefore it has two peaks and four valley points.

Table 6: Peaks and Valleys Extracted For Smoothed Traces in J2F Test Job

TAG_ID	TEST_NAME	RUN	TIME_SMOOTH_1	STRAIN_VALUE_SMOOTH_1	TIME_SMOOTH_2	STRAIN_VALUE_SMOOTH_2	TIME_SMOOTH_3	STRAIN_VALUE_SMOOTH_3	TIME_SMOOTH_4	STRAIN_VALUE_SMOOTH_4	TIME_SMOOTH_5	STRAIN_VALUE_SMOOTH_5	TIME_SMOOTH_6	STRAIN_VALUE_SMOOTH_6
Dyn9	J2F	1	1.58	228.28	1.85	333.01								
Dyn9	J2F	2	1.59	759.57	1.84	296.37								
Dyn9	J2F	3	1.52	709.65	1.76	301.81								
Dyn9	J2F	4	1.50	718.30	1.74	276.85								
Dyn9	J2F	5	1.60	1,067.32	1.83	341.22								
Dyn9	J2F	6	1.52	822.41	1.71	281.21								
Dyn9	J2F	7	1.53	293.97	1.72	245.72								
Dyn9	J2F	8	1.43	481.43	1.62	228.29								
Dyn12	J2F	1	1.43	433.04	1.70	796.86	1.40	-110.72	1.47	-58.19	1.67	-196.59	1.75	-119.02
Dyn12	J2F	2	1.44	677.99	1.72	893.38	1.41	-173.41	1.49	-60.70	1.69	-214.46	1.77	-123.61
Dyn12	J2F	3	1.38	636.70	1.65	872.43	1.36	-167.57	1.43	-70.65	1.62	-229.22	1.70	-122.18
Dyn12	J2F	4	1.35	641.91	1.62	937.55	1.33	-179.50	1.40	-75.22	1.59	-225.53	1.67	-129.91
Dyn12	J2F	5	1.47	766.11	1.72	967.68	1.45	-217.15	1.51	-83.93	1.69	-242.25	1.77	-118.40
Dyn12	J2F	6	1.41	627.06	1.62	1,086.41	1.39	-225.64	1.45	-86.46	1.60	-277.34	1.66	-117.95
Dyn12	J2F	7	1.42	441.83	1.62	1,089.63	1.40	-185.48	1.46	-77.49	1.60	-280.45	1.66	-108.65
Dyn12	J2F	8	1.32	547.97	1.52	1,141.55	1.30	-212.76	1.36	-79.22	1.50	-284.95	1.56	-119.13

Note: The units of TIME_SMOOTH columns are in seconds and STRAIN_VALUE _SMOOTH columns are in microstrain (με).

6.1.2 Raw (unsmoothed) Trace Processing

The same above processing steps were applied to raw traces i.e. without smoothing sensor traces for J2F test job and the results are shown in Tables 7 and 8 below. Table 7 shows the summarized QC results for raw traces, it can be noticed that there is no change in QC results for raw traces compared to the QC results for smoothed traces for J2F test job. Table 8 shows the summarized peaks and valleys extracted for good raw traces.

Table 7: Summarized QC Results for Raw Traces in J2F Test Job

J2F Test Job QC Results												
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	1	3	3	1	1	2	1	1	1	1
2	3	3	1	3	3	1	1	1	1	1	1	1
3	3	3	1	3	3	1	1	2	1	1	1	1
4	3	3	1	3	3	1	1	1	1	1	1	1
5	3	3	1	3	3	1	1	2	1	1	1	1
6	3	3	1	3	3	1	1	1	1	1	1	1
7	3	3	1	3	3	1	1	1	1	1	1	1
8	3	3	1	3	3	1	1	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	16**	0	32
LVDT	29	3	0
PC	16	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 16 is the total of eight "1's" under Dyn9 and other eight "1's" under Dyn12.

Table 8: Peaks and Valleys Extracted for Raw Traces in J2F Test Job

TAG_ID	TEST_NAME	RUN	TIME_RAW_1	STRAIN_VALUE_RAW_1	TIME_RAW_2	STRAIN_VALUE_RAW_2	TIME_RAW_3	STRAIN_VALUE_RAW_3	TIME_RAW_4	STRAIN_VALUE_RAW_4	TIME_RAW_5	STRAIN_VALUE_RAW_5	TIME_RAW_6	STRAIN_VALUE_RAW_6
Dyn9	J2F	1	1.58	229.81	1.85	333.57								
Dyn9	J2F	2	1.59	761.85	1.84	297.43								
Dyn9	J2F	3	1.52	712.71	1.76	302.67								
Dyn9	J2F	4	1.50	719.66	1.74	278.99								
Dyn9	J2F	5	1.60	1,070.29	1.83	343.34								
Dyn9	J2F	6	1.52	825.52	1.71	282.34								
Dyn9	J2F	7	1.53	295.44	1.72	247.31								
Dyn9	J2F	8	1.43	483.47	1.62	229.69								
Dyn12	J2F	1	1.43	435.75	1.70	801.42	1.40	-111.18	1.47	-59.30	1.67	-196.81	1.75	-119.30
Dyn12	J2F	2	1.44	682.82	1.72	898.46	1.41	-174.14	1.49	-61.63	1.69	-214.77	1.77	-124.14
Dyn12	J2F	3	1.38	641.79	1.65	878.06	1.36	-168.92	1.43	-71.41	1.62	-230.17	1.70	-122.66
Dyn12	J2F	4	1.35	647.40	1.62	942.43	1.33	-180.81	1.40	-75.80	1.59	-226.44	1.67	-130.18
Dyn12	J2F	5	1.47	773.32	1.72	973.96	1.45	-218.65	1.51	-84.27	1.69	-243.03	1.77	-118.64
Dyn12	J2F	6	1.41	635.66	1.62	1,095.08	1.39	-226.93	1.45	-86.91	1.60	-278.18	1.66	-118.17
Dyn12	J2F	7	1.42	446.82	1.62	1,100.64	1.40	-186.37	1.46	-78.23	1.60	-282.00	1.66	-109.48
Dyn12	J2F	8	1.32	556.01	1.52	1,152.32	1.30	-214.07	1.36	-79.68	1.50	-285.95	1.56	-119.68

Note: The units of TIME_RAW columns are in seconds and STRAIN_VALUE_RAW columns are in microstrain (με).

The first peaks extracted for good sensor traces in J2F test job shown in Tables 6 and 8 were used to check how close the processed J2F data were in comparison with Ohio data peak file (TruckPeak.txt). Table 9 shows the comparison of Ohio data peak values with first peak values of smoothed and raw traces for strain gauge Dyn9 and Dyn12 sensors in J2F test job. Column X in Table 9 was the estimated position of front-axle at the time when peak occurred i.e., x coordinate measured from southernmost deep LVDT in AC sections. It can be observed from Table 9 that the smoothed and raw peak values were close to Ohio data peak values. However, there was a significant increase in smoothed and raw peak values for Dyn12 sensor compared to Ohio data peak values. The actual location of strain gauge Dyn9 sensor was X=120 in. and Dyn12 sensor was X=192 in. from the measured southernmost deep LVDT in AC sections, but the Ohio peak data (Truckpeak.txt) show multiple locations for sensors, which are two to three inches off the actual sensor location (see Table 18). From the observation it is anticipated that X values closer and below the actual sensor location have smoothed and raw peak values would be close to Ohio data peak values. For example, Dyn9 sensor for run one has Ohio peak value of 224.30 (μe) at X= 118.3 in. which is close and below the actual sensor location of X=120 in. and the smoothed and raw peak values 228.23 (μe) and 229.81(μe) extracted are very close to Ohio data peak value. Whereas Dyn12 sensor for run one has Ohio peak value of 411.40 (μe) at X=194.7 in. and is not a close match of first peak value extracted from smoothed and raw traces i.e. 433.04 (μe) and 435.75 (μe) at X=192 in.

Table 9: Comparing First Peak of Smooth and Raw Peak Values with Ohio Peak Value (truckpeak.txt)

Test Job	Run	Section Number	Sensor Name	X (in.)	Ohio Peak Value (με)	Smooth Peak Value (με)	Raw Peak Value (με)
J2F	1	"390102"	DYN9	118.3	224.30	228.28	229.81
J2F	2	"390102"	DYN9	121.8	751.90	759.57	761.85
J2F	3	"390102"	DYN9	121.5	702.10	709.65	712.71
J2F	4	"390102"	DYN9	121	709.90	718.30	719.66
J2F	5	"390102"	DYN9	121.8	1048.00	1,067.32	1,070.29
J2F	6	"390102"	DYN9	121.5	814.60	822.41	825.52
J2F	7	"390102"	DYN9	118.5	289.50	293.97	295.44
J2F	8	"390102"	DYN9	120.5	475.60	481.43	483.47
J2F	1	"390102"	DYN12	194.7	411.40	433.04	435.75
J2F	2	"390102"	DYN12	195.4	629.80	677.99	682.82
J2F	3	"390102"	DYN12	195.5	585.00	636.70	641.79
J2F	4	"390102"	DYN12	194.5	591.60	641.91	647.40
J2F	5	"390102"	DYN12	194.8	683.80	766.11	773.32
J2F	6	"390102"	DYN12	195.2	581.80	627.06	635.66
J2F	7	"390102"	DYN12	194.8	418.80	441.83	446.82
J2F	8	"390102"	DYN12	195.2	509.90	547.97	556.01

Begin offset, end offset, and range values are computed for all sensor traces in J2F test job. Table 10 shows begin offset, end offset, and range values for pressure cell sensor in J2F test job.

Table 10: Pressure Cell Sensor Begin offset, End offset, and Range values

Test File	PC1			PC2		
	Begin Offset	End Offset	Range	Begin Offset	End Offset	Range
AJ2F001	0.0000206	0.0172634	1.227	0.0000000	0.0223676	1.215
AJ2F002	0.0000675	0.0140629	1.300	-0.0000228	0.0189775	1.387
AJ2F003	-0.0000184	0.0141437	1.330	0.0000303	0.0200913	1.490
AJ2F004	0.0000341	0.0096094	1.329	0.0000631	0.0128362	1.495
AJ2F005	0.0000228	0.0115536	1.344	0.0000078	0.0179510	1.576
AJ2F006	-0.0000250	0.0099899	1.082	-0.0000269	0.0131659	1.336
AJ2F007	0.0000203	0.0076421	1.035	0.0000162	0.0112694	1.328
AJ2F008	0.0000191	0.0092828	1.126	-0.0000325	0.0102851	1.392

The above data processing steps used for smoothed and raw traces in J2F test job are repeated one by one for the remaining twenty two test jobs. The QC results summarized for all 23 test jobs for both smoothed and raw traces are shown in Tables 11 and 12. Similar to Tables 6 and 8 for J2F test job, DLR data tables were created separately for each sensor type from all the good traces for twenty three test jobs and will be included in future SDR.

Table 11: Summarized QC Results for Smoothed Traces

Test Job	No. of	Strain Guage			Total	LVDT			Total	Pressure Cell			Total
Name	Test Runs	Good	May be	No good		Good	May be	No good		Good	May be	No good	
J2A	16	32	13	51	96	39	7	18	64	32	0	0	32
J2C	10	12	0	48	60	26	4	10	40	20	0	0	20
J2D	16	17	8	71	96	45	11	8	64	32	0	0	32
J2E	13	15	0	57	72	41	7	0	48	24	0	0	24
J2F	8	16	0	32	48	29	3	0	32	16	0	0	16
J2G	12	16	8	48	72	38	10	0	48	24	0	0	24
J4A	16	46	5	93	144	32	32	0	64	32	0	0	32
J4B	13	30	5	82	117	24	24	4	52	26	0	0	26
J4C	10	15	9	48	72	16	12	4	32	14	0	2	16
J4D	15	30	15	90	135	32	27	1	60	30	0	0	30
J4E	13	26	15	76	117	40	12	0	52	26	0	0	26
J4F	12	24	33	51	108	24	24	0	48	24	0	0	24
J4G	12	24	7	77	108	24	24	0	48	24	0	0	24
J8A	16	48	48	48	144	21	43	0	64	31	1	0	32
J8D	15	45	45	45	135	22	38	0	60	30	0	0	30
J8E	13	39	44	34	117	23	29	0	52	26	0	0	26
J8G	12	36	37	35	108	36	12	0	48	24	0	0	24
J10A	16	15	5	115	135	26	15	19	60	30	0	0	30
J10C	10	10	0	80	90	6	19	15	40	20	0	0	20
J10D	16	19	21	104	144	13	43	8	64	32	0	0	32
J10E	12	12	17	79	108	27	15	6	48	24	0	0	24
J10F	13	61	12	44	117	31	16	5	52	26	0	0	26
J10G	12	12	34	62	108	36	12	0	48	24	0	0	24
Total	301	600	381	1,470	2,451	651	439	98	1,188	591	1	2	594

Table 12: Summarized QC Results for Raw Traces

Test Job Name	No. of Test Runs	Strain Guage			Total	LVDT			Total	Pressure Cell			Total
		Good	May be	No good		Good	May be	No good		Good	May be	No good	
J2A	16	32	13	51	96	39	7	18	64	32	0	0	32
J2C	10	12	0	48	60	26	4	10	40	20	0	0	20
J2D	16	17	8	71	96	45	11	8	64	32	0	0	32
J2E	13	14	0	58	72	39	9	0	48	24	0	0	24
J2F	8	16	0	32	48	29	3	0	32	16	0	0	16
J2G	12	16	8	48	72	38	7	3	48	24	0	0	24
J4A	16	46	2	96	144	32	32	0	64	32	0	0	32
J4B	13	30	2	85	117	24	24	4	52	26	0	0	26
J4C	10	15	2	55	72	14	14	4	32	14	0	2	16
J4D	15	30	15	90	135	32	27	1	60	30	0	0	30
J4E	13	26	15	76	117	39	13	0	52	26	0	0	26
J4F	12	24	1	83	108	24	24	0	48	24	0	0	24
J4G	12	24	7	77	108	24	24	0	48	24	0	0	24
J8A	16	48	48	48	144	21	43	0	64	31	1	0	32
J8D	15	45	45	45	135	22	38	0	60	30	0	0	30
J8E	13	39	44	34	117	23	29	0	52	26	0	0	26
J8G	12	36	37	35	108	36	12	0	48	24	0	0	24
J10A	16	15	5	115	135	24	18	18	60	30	0	0	30
J10C	10	10	0	80	90	6	19	15	40	20	0	0	20
J10D	16	19	21	104	144	13	43	8	64	32	0	0	32
J10E	12	12	17	79	108	27	15	6	48	24	0	0	24
J10F	13	61	12	44	117	30	17	5	52	26	0	0	26
J10G	12	12	34	62	108	36	12	0	48	24	0	0	24
Total	542	599	336	1,516	2,451	643	445	100	1,188	591	1	2	594

Table 13 shows the summarized QC results for smoothed traces in percentage for strain gauge, LVDT, and pressure cell sensors. It can be observed that of all the three sensor types pressure cell had the highest percentage of good traces with 99 percent followed by LVDT with 55 percent and the lowest was strain gauge sensor with 24 percent.

Table 13: Summarized QC Results in Percentage for Ohio SPS-1 Smoothed Traces

Quality Control Results for Smoothed Traces				
Sensor type	Good trace	May be trace	No good trace	Total
Strain Gauge	600	381	1470	2451
	24%	16%	60%	100%
LVDT	651	439	98	1188
	55%	37%	8%	100%
PC	591	1	2	594
	99%	0%	0%	100%
			Total	4,233

Similarly, Table 14 shows the summarized QC results for raw traces in percentage for strain gauge, LVDT, and pressure cell sensors. No significant difference in percentage was observed when compared to QC results of smoothed traces. Similar to Table 13, it can be observed that of all the three sensor types pressure cell had the highest percentage of Good traces with 99 percent, followed by LVDT with 54 percent and the lowest was strain gauge sensor with 24 percent.

Table 14: Summarized QC Results in Percentage for Ohio SPS-1 Raw Traces

Quality Control Results for Raw Traces				
Sensor type	Good trace	May be trace	No good trace	Total
Strain Gauge	599	336	1516	2451
	24%	14%	62%	100%
LVDT	643	445	100	1188
	54%	37%	8%	100%
PC	591	1	2	594
	99%	0%	0%	100%
			Total	4,233

6.2 Ohio SPS-2 Data QC Results

Similar to Table 9, Table 15 below shows the comparison of Ohio SPS-2 first peak smooth values of J1A test job and DYN1 sensor with Ohio data peak values (Truckpeak.txt). The extracted smooth values of J1A test job and DYN1 sensor match the Ohio peak values.

Table 15: Comparing First Peak of Smooth Values with Ohio Peak Value (truckpeak.txt)

Test Job	Run	Section Number	Sensor Name	X (in.)	Ohio Peak value (με)	Smooth Peak value (με)
J1A	1	"390201"	DYN1	82.3	-22.07	-22.53
J1A	2	"390201"	DYN1	85.2	-38.20	-38.68
J1A	3	"390201"	DYN1	82.6	-20.62	-20.22
J1A	4	"390201"	DYN1	85	-36.42	-36.75
J1A	5	"390201"	DYN1	82.5	-20.48	-20.07
J1A	6	"390201"	DYN1	85.7	-34.08	-34.64
J1A	7	"390201"	DYN1	82.4	-20.74	-20.73
J1A	8	"390201"	DYN1	85	-34.25	-34.15
J1A	9	"390201"	DYN1	82.4	-21.29	-21.28
J1A	10	"390201"	DYN1	84.4	-35.69	-35.75
J1A	11	"390201"	DYN1	81.8	-18.50	-18.05
J1A	12	"390201"	DYN1	85.3	-36.14	-35.73
J1A	13	"390201"	DYN1	82.8	-21.16	-20.77
J1A	14	"390201"	DYN1	85	-32.30	-31.41
J1A	15	"390201"	DYN1	82.1	-20.61	-20.16
J1A	16	"390201"	DYN1	85	-34.77	-34.12
J1A	17	"390201"	DYN1	82.1	-20.10	-19.69
J1A	18	"390201"	DYN1	85.1	-32.73	-32.08
J1A	19	"390201"	DYN1	82.2	-20.49	-19.45
J1A	20	"390201"	DYN1	84.3	-30.04	-29.23
J1A	21	"390201"	DYN1	82.7	-22.58	-21.49
J1A	22	"390201"	DYN1	84.3	-33.11	-31.97
J1A	23	"390201"	DYN1	82.1	-22.10	-20.99
J1A	24	"390201"	DYN1	84.8	-28.67	-27.59
J1A	25	"390201"	DYN1	82.2	-21.36	-19.78
J1A	26	"390201"	DYN1	83.9	-30.20	-29.13
J1A	27	"390201"	DYN1	84.3	-35.76	-34.43
J1A	28	"390201"	DYN1	85.1	-33.05	-32.11

Table 16 below shows summarized QC results for smoothed traces for all 24 Ohio SPS-2 test jobs.

Table 16: Summarized QC Results for Ohio SPS-2 Smoothed Traces

Test Job	No. of Test Runs	Strain Gauge			Total	LVDT			Total
		Good	May Be	No Good		Good	May Be	No Good	
J1A	28	112	0	0	112	103	7	282	392
J1B	24	96	0	0	96	30	28	278	336
J1C	14	56	0	0	56	55	34	107	196
J5A	29	9	0	107	116	45	4	357	406
J5B	25	75	0	25	100	46	18	286	350
J5C	14	42	0	14	56	23	12	161	196
J8A	26	78	0	26	104	68	13	283	364
J8B	26	87	0	17	104	70	6	288	364
J8C	17	52	0	16	68	55	12	171	238
J12A	4	16	0	0	16	9	5	42	56
J12B	26	102	2	0	104	75	10	279	364
J12C	14	51	3	2	56	68	3	125	196
J5J1M	18	72	0	0	72	67	8	177	252
J5J1N	18	72	0	0	72	52	8	92	152
J5J1O	18	49	3	20	72	58	5	189	252
J5J1P	18	64	0	8	72	53	5	194	252
J8S3M	18	16	0	56	72	10	7	235	252
J8S3N	18	20	9	43	72	3	9	240	252
J8S3O	18	17	1	54	72	12	2	238	252
J8S3P	18	15	2	55	72	0	2	250	252
J12J10M	18	0	11	61	72	24	20	208	252
J12J10N	18	11	7	54	72	15	9	228	252
J12J10O	18	9	15	48	72	21	2	229	252
J12J10P	17	0	0	68	68	25	50	163	238
Total	462	1,121	53	674	1,848	987	279	5,102	6,368

Table 17 below shows summarized QC results in percentage for smoothed traces for all 24 Ohio SPS-2 test jobs. It can be noticed that strain gauge had 61% of Good traces, whereas LVDT had 15% of Good traces.

Table 17: Summarized QC Results in Percentage for Ohio SPS-2 Smoothed Traces

Quality Control Results for Smoothed Traces				
Sensor Type	Good trace	May be trace	No good trace	Total
Strain Gauge	1,121	53	674	1,848
	61%	3%	36%	100%
LVDT	987	279	5,102	6,368
	15%	4%	80%	100%
			Total	8,216

7. DLR TRACE ISSUES

Some dubious sensor trace patterns were identified when processing the Ohio SPS-1 and 2 DLR data. For example, some sensor traces exhibited a flat, unresponsive pattern as in Figure 17 whereas some sensor traces indicated mislabeling a transverse strain gauge as a longitudinal one as in Figure 18.

7.1 Ohio SPS-1 Trace Issues

7.1.1 LVDT Trace Pattern Issue

All of the LVDTs were buried deep into the subgrade or close to the interface between the subgrade and the base layer in the Ohio test sections and thus, LVDT traces should not contain any trace valleys (no tensile strains) but peaks (compressive strains). However, LVDT3 sensor for test jobs J2A, J2C, J2D, J2E, J2F and J2G (test section 390102) showed a trace pattern similar to a longitudinal strain gauge trace that assumes valleys. Figure 16 shows LVDT3 trace in test job J2A with a trace pattern similar to a longitudinal strain gauge trace.

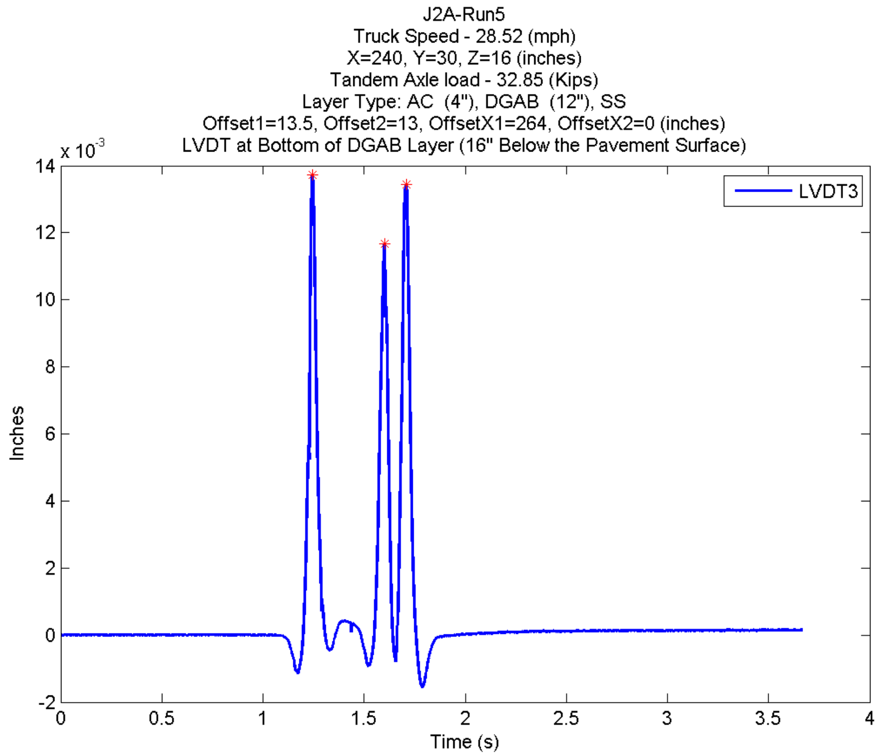


Figure 16: Transverse LVDT3 Trace Exhibiting a Longitudinal Strain Gauge Trace Pattern That Assumes Valleys

7.1.2 Strain Gauge Trace Pattern Issue

Strain gauge sensors Dyn10 and Dyn11 for test jobs J2A, J2C, J2D, J2E, J2F and J2G in test section 390102 showed a flat, unresponsive trace pattern. It was assumed that the sensors were not connected properly. Figure 17 shows flat strain gauge sensor Dyn10 trace in J2A test job.

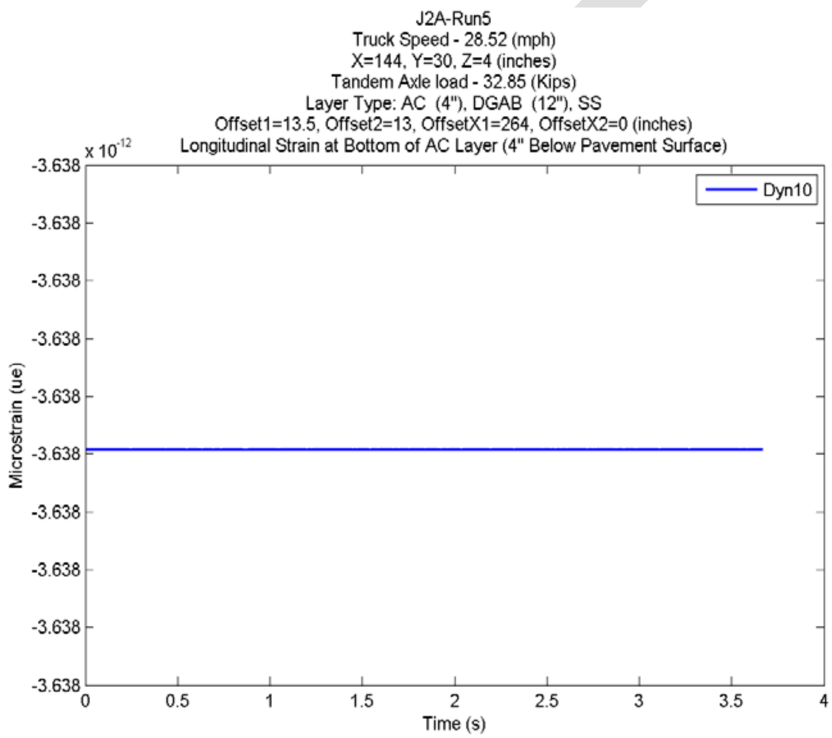


Figure 17: Unresponsive Strain Gauge Trace

Longitudinal strain gauges are expected to assume trace valleys whereas transverse strain gauges are not. However, longitudinal strain gauge sensor Dyn17 for test jobs J8A, J8D, J8E, and J8G (test section 390108) showed a trace pattern similar to a transverse strain gauge trace that assumed no valleys if the trace in Figure 18 is flipped upside. Figure 18 below shows longitudinal strain gauge Dyn17 trace in test job J8A which exhibited an upside down transverse strain gauge trace pattern.

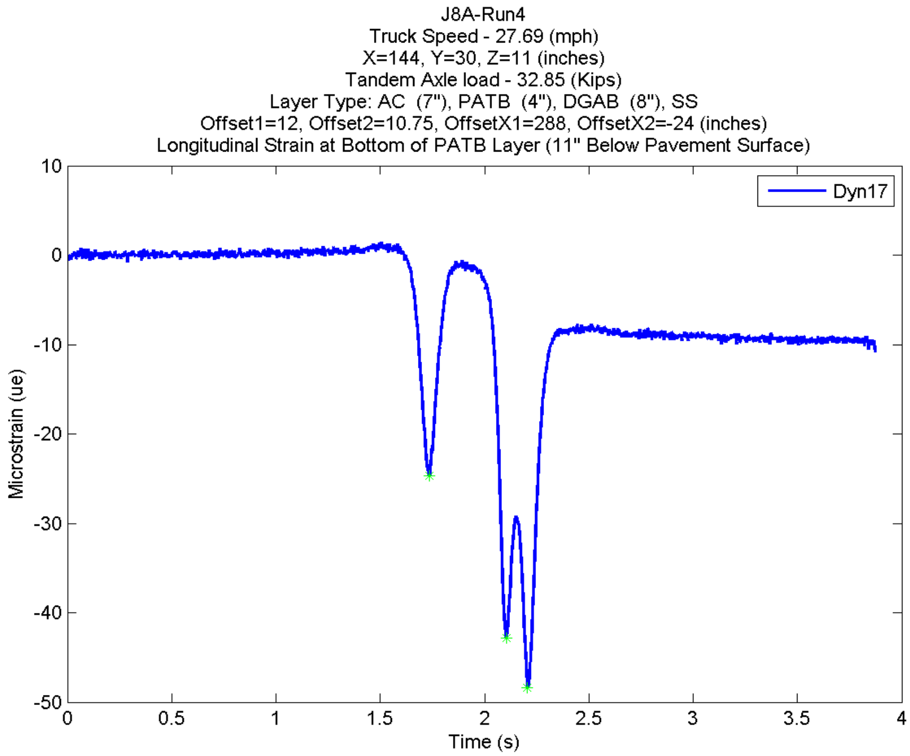


Figure 18: Longitudinal Strain Gauge Sensor Dyn17 Trace Exhibiting an Upside Down Transverse Strain Gauge Trace Pattern That Assumes No Valleys

It was assumed that the above two sensors LVDT3 and strain gauge Dyn17 for test sections 390102 and 390108 may have been mislabeled inadvertently. The data collection dates match for test jobs in both test sections. For example, the data collection date for J2A and J8A test jobs were the same. Similarly, data collection dates for J2D, J2E, and J2G test jobs were the same as J8D, J8E, and J8G test jobs respectively.

The peak data information contained in Ohio TruckPeak.txt file was unclear to understand. The data have peak values recorded for same sensor number and run number but at different sensor locations. Table 18 below shows sample Ohio truck peak data for 390102 test section, strain gauge sensor Dyn12, and run one. Column X in Table 18 was the estimated position of front-axle at the time when peak occurred i.e., x coordinate measured from southernmost deep LVDT in AC sections, and Column Peak Value showed the recorded front-axle peak values. The actual location of strain gauge sensor Dyn12 from the measured southernmost deep LVDT in AC sections was 192 in. (X=192 in.), but the Ohio truck peak data showed multiple sensor locations (X values) and it was also noticed in Table 18 that the peak value of 411.40 (με) at X=194.7 in. closely matched the first peak value extracted from the DLR data process i.e. peak value of 433.04 (με) at X=192 in.

Table 18: Sample Ohio SPS-1 Truck Peak Data for J2F Test Job (TruckPeak.txt)

Series	Subseries	Run	Section	Sensor Name	Sensor Number	X (in.)	Peak Value (με)
2	"F"	1	"390102"	"DYN"	12	30	-118.60
2	"F"	1	"390102"	"DYN"	12	55.8	758.00
2	"F"	1	"390102"	"DYN"	12	71	-203.30
2	"F"	1	"390102"	"DYN"	12	120.1	5.03
2	"F"	1	"390102"	"DYN"	12	171.5	-57.61
2	"F"	1	"390102"	"DYN"	12	194.7	411.40
2	"F"	1	"390102"	"DYN"	12	209.9	-114.10

The begin offset, end offset, and range values for strain gauges, LVDTs, and pressure cells obtained from the DLR raw traces did not match the begin/end offset and range values in SDR 22. Per the TSSC's recommendations, the begin offset, end offset, and range columns were removed and will not show up in the upcoming SDR 27.

7.2 Ohio SPS-2 Trace Issues

All the Ohio DLR SPS-2 data information was reviewed before processing to check if there are any data discrepancies. Data information include the Ohio SPS-2 TCS raw data, Ohio University (OU) data (.txt files), SDR 22.0 DLR data, and Shad Sargand et al. 2007 report *Evaluation of Pavement Performance on DEL 23* (2) for truck series, truck load and other relevant information. It is noticed that site visits ('A', 'B', and 'C') of Ohio SPS-2 test sections J1, J5, J8, J12 or (39-0201, 0205, 0208 and 0212 respectively) are inconsistent with Ohio SPS-2 subseries ('H', 'I', and 'J') of OU TruckRun.txt file. In contrast, site visits ('A', 'B', 'C', 'D', 'E', 'F' and

‘G’) of Ohio SPS-1 test sections J2, J4, J8 and J10 or (39-0102, 0104, 0108 and 0110 respectively), have matching subseries in TruckRun.txt file. However, the data collection dates of the Ohio SPS-2 test section visits A, B, and C match subseries H, I and J respectively of OU TruckRun.txt file. Since subseries ‘A’, ‘B’, ‘C’, ‘D’, ‘E’, ‘F’ and ‘G’ have already been used for Ohio SPS-1 in TruckRun.txt, it is assumed that OU assigned ‘H’, ‘I’, and ‘J’, in place of ‘A’, ‘B’, and ‘C’ for Ohio SPS-2. It is also noticed that wheelpath offset values in SDR 22.0 for Ohio SPS-2 were populated from subseries ‘H’, ‘I’, and ‘J’ of TruckPass.txt file for test sections ‘A’, ‘B’, and ‘C’, respectively. Table 19 below shows the inconsistency between the Ohio SPS-2 test section visits and the OU subseries.

Table 19: Ohio SPS-2 Inconsistency between Test Section Visits and Subseries

RAW OHIO-TCS DATA			Test Truck Series from Shad M. Sargand et al. report	**TruckRun.Txt**	
Test Job	# files/Runs	Test Date		Subseries	StartTime for run #1
J1A	28	8/12/1996	2	H	1996-08-12 15:15:00
J1B	26	8/13/1996	2	I	1996-08-13 11:00:00
J1C	14	8/14/1996	2	J	1996-08-14 10:11:00
J5A	29	8/12/1996	2	H	1996-08-12 15:15:00
J5B	26	8/13/1996	2	I	1996-08-13 11:00:00
J5C	14	8/14/1996	2	J	1996-08-14 10:11:00
J5J1M	18	7/29/1997	4	M	1997-07-29 13:10:00
J5J1N	18	7/30/1997	4	N	1997-07-30 10:20:00
J5J1O	18	7/30/1997	4	O	1997-07-30 13:32:00
J5J1P	18	8/6/1997	4	P	1997-08-06 07:18:00
J8A	26	8/12/1996	2	H	1996-08-12 15:15:00
J8B	27	8/13/1996	2	I	1996-08-13 11:00:00
J8C	17	8/14/1996	2	J	1996-08-14 10:11:00
J8S3M	18	7/29/1997	4	M	1997-07-29 13:10:00
J8S3N	18	7/30/1997	4	N	1997-07-30 10:20:00
J8S3O	18	7/30/1997	4	O	1997-07-30 13:32:00
J8S3P	18	8/6/1997	4	P	1997-08-06 07:18:00
J12A	4	8/12/1996	2	H	1996-08-12 15:15:00
J12B	27	8/13/1996	2	I	1996-08-13 11:00:00
J12C	14	8/14/1996	2	J	1996-08-14 10:11:00
J12J10M	18	7/29/1997	4	M	1997-07-29 13:10:00
J12J10N	18	7/30/1997	4	N	1997-07-30 10:20:00
J12J10O	18	7/30/1997	4	O	1997-07-30 13:32:00
J12J10P	17	8/6/1997	4	P	1997-08-06 07:18:00

Note: test truck series 2 and 4 were used for Ohio SPS-2. StartTime field in above table shows date with run time for first test run.

Ohio SPS-2 DLR sensors LVDT 5 and LVDT 6 were unresponsive for all test jobs (i.e.) LVDT 5 and LVDT 6 records have all zero values.

Ohio SPS-2 test jobs J5J1M, J5J1N, J5J1O, J5J1P, J8S3M, J8S3N, J8S3O, J8S3P, J12J10M, J12J10N, J12J10O, and J12J10P ASCII files had 32 LVDT sensors (LVDT1-LVDT32) unlike the other test jobs (J1A, J1B, J1C, J5A, J5B, J5C, J8A, J8B, J8C, J12A, J12B, and J12C) that only had sixteen LVDT sensors (LVDT1-LVDT16). The DLR Study Team processed only the first sixteen LVDTs (LVDT1-LVDT16) based on information present in EmbeddedSensor.txt file (shows only the first sixteen LVDTs).

Table 20 below shows strain gauge sensors for each Ohio SPS-2 test job that had time history data. For example, J1A test job had eight strain gauge sensors of which only four sensors (Dyn1, Dyn4, Dyn5, and Dyn8) had time history data and others strain gauge sensors (Dyn2, Dyn3, Dyn6, and Dyn7) did not have time history data.

Table 20: Strain Gauge Sensors that have Time History Data for Each Test Job

Test Job	Test Section	Strain Gauge Sensors that have Time History Data
J1A	390201	Dyn1, Dyn4, Dyn5 and Dyn8
J1B	390201	Dyn1, Dyn4, Dyn5 and Dyn8
J1C	390201	Dyn1, Dyn2, Dyn7 and Dyn8
J5A	390205	Dyn1, Dyn4, Dyn5 and Dyn8
J5B	390205	Dyn1, Dyn2, Dyn7 and Dyn8
J5C	390205	Dyn1, Dyn2, Dyn7 and Dyn8
J8A	390208	Dyn1, Dyn4, Dyn5 and Dyn8
J8B	390208	Dyn1, Dyn2, Dyn7 and Dyn8
J8C	390208	Dyn1, Dyn2, Dyn7 and Dyn8
J12A	390212	Dyn1, Dyn4, Dyn5 and Dyn8
J12B	390212	Dyn1, Dyn2, Dyn7 and Dyn8
J12C	390212	Dyn1, Dyn2, Dyn7 and Dyn8
J5J1M	390205	Dyn1, Dyn2, Dyn7 and Dyn8
J5J1N	390205	Dyn1, Dyn2, Dyn7 and Dyn8
J5J1O	390205	Dyn1, Dyn2, Dyn7 and Dyn8
J5J1P	390205	Dyn1, Dyn2, Dyn7 and Dyn8
J8S3M	390208	Dyn1, Dyn2, Dyn7 and Dyn8
J8S3N	390208	Dyn1, Dyn2, Dyn7 and Dyn8
J8S3O	390208	Dyn1, Dyn2, Dyn7 and Dyn8
J8S3P	390208	Dyn1, Dyn2, Dyn7 and Dyn8
J12J10M	390212	Dyn1, Dyn2, Dyn7 and Dyn8
J12J10N	390212	Dyn1, Dyn2, Dyn7 and Dyn8
J12J10O	390212	Dyn1, Dyn2, Dyn7 and Dyn8
J12J10P	390212	Dyn1, Dyn2, Dyn7 and Dyn8

Note: All Ohio SPS-2 test sections have eight strain gauge sensors deployed.

Similar to Table 18, Table 21 below shows multiple peak values for the same sensor name, number (DYN1) and run number (RUN 1). However, based on Embeddedsensor.txt file, the location of DYN1 sensor was 84 inches from the southernmost 1st LVDT (coordinate reference point), so the first peak value of -22.07 was compared to Ohio SPS-2 extracted smooth first peak values.

Table 21: Sample Ohio SPS-2 Truck Peak Data for J1A Test Job (TruckPeak.txt)

Series	Subseries	Run	Section	Sensor Name	Sensor Number	X (in.)	Peak Value (με)
2	"H"	1	"390201"	"DYN"	1	18.6	3.00
2	"H"	1	"390201"	"DYN"	1	82.3	-22.07
2	"H"	1	"390201"	"DYN"	1	153.9	11.14
2	"H"	1	"390201"	"DYN"	1	222	-44.72
2	"H"	1	"390201"	"DYN"	1	311.9	4.95

Note: In above table subseries 'H' infers 'A'.

In the DLR_STRAIN_TRACE_SUM_PCC table, strain gauge DYN8 from Test Job J5J1P Runs 1 to 10 collected at 499.964Hz on 8/6/1997 had significantly larger raw strain values compared to other Ohio SPS-2 strain gauge values that were mostly less than 100 microstrains. Thus, further investigation is needed for this strain gauge. Listed below in Table 22 are sample values from strain gauge DYN8 from Test Job J5J1P Runs 1 to 10 collected at 499.964Hz on 8/6/1997 where MIN/MAX_STRAIN_RAW_VALUEs are in microstrains.

Table 22: Raw Strain Gauge (DYN8) Values of J5J1P Test Job

STATE_CODE	SHRP_ID	TEST_NAME	RUN_NUMBER	TAG_ID	MIN_STRAIN_RAW_VALUE	MAX_STRAIN_RAW_VALUE
39	0205	J5J1P	1	DYN8	19939.61	19974.62
39	0205	J5J1P	2	DYN8	20024.00	20058.39
39	0205	J5J1P	3	DYN8	19990.25	20027.13
39	0205	J5J1P	4	DYN8	20066.51	20097.77
39	0205	J5J1P	5	DYN8	20164.66	20200.29
39	0205	J5J1P	6	DYN8	20224.04	20257.80
39	0205	J5J1P	7	DYN8	20269.05	20307.19
39	0205	J5J1P	8	DYN8	20340.94	20372.82
39	0205	J5J1P	9	DYN8	20386.58	20422.21
39	0205	J5J1P	10	DYN8	20458.47	20483.47

Currently, the first 500 trace data points were used to average a gain adjustment factor for Ohio SPS-2 data. On average, each Ohio SPS-2 time history dataset contains close to 7,000 data points whereas each Ohio SPS-1 time history dataset contains about 5,000 data points. However, in retrospect, due to significant noise in Ohio SPS-2 data, the first 500 data points may not be enough. For future research, the first 700 data points should be used to determine a gain adjustment factor for Ohio SPS-2 data because it is about 10% of each Ohio SPS-2 time history dataset that contains, on average, close to 7,000 measurements.

Similar to the Ohio SPS-1 data discussed at the bottom of Section 7.1.2, the Ohio SPS-2 begin offset, end offset, and range values for strain gauges and LVDTs obtained from the DLR raw traces did not match the begin/end offset and range values in SDR 22. Per the TSSC's recommendations, the begin offset, end offset, and range columns were removed and will not show up in the upcoming SDR 27.

8. UPDATES to THE OHIO SPS-1 and 2 DLR TABLES

This section summarizes the key updates made to the Ohio SPS-1 and 2 DLR tables in the upcoming SDR 27. In the five trace tables: DLR_STRAIN_TRACE_SUM_AC/PCC, DLR_LVDT_TRACE_SUM_AC/PCC, and DLR_PRESSURE_TRACE_SUM_AC, the following columns were updated:

- A new GAIN_ADJUST_FACTOR (average of the first 500 trace data points) column was added. A gain adjustment factor was subtracted from each raw trace data point to generate a normalized trace base zero on the y-axis i.e. under no load conditions, so that the resulting peak values represented the change due to load response. For the Ohio SPS-1 data, normalized raw or smoothed traces were used to extract the trace peaks and valleys. For the Ohio SPS-2 data that has significant noise in the raw traces, only normalized smoothed traces were used to extract the trace peaks and valleys even though the gain adjustment factor was determined using the raw trace data.
- A new DATA_COLLECTION_FREQUENCY (the frequency at which the trace data point was collected by the corresponding sensor identified by the TAG_ID (sensor ID) field) column was added.
- For the Ohio SPS-1 data:
    - TIME_RAW_* and STRAIN/LVDT/PRESSURE_VALUE_RAW_* are the timestamps and trace peak and valley location values updated using the data extracted from Ohio SPS-1 normalized raw traces.
    - TIME_SMOOTH_* and STRAIN/LVDT/PRESSURE _VALUE_SMOOTH_* are the timestamps and trace peak and valley location values updated using the data extracted from Ohio SPS-1 smoothed traces.
- For the Ohio SPS-2 data:
    - TIME_RAW_* and STRAIN/LVDT_VALUE_RAW_* columns were removed from the DLR database due to the fact that SPS-2 raw traces were too noisy to extract any meaningful peaks and valleys.

- TIME_SMOOTH_* and STRAIN/LVDT _VALUE_SMOOTH_* are the timestamps and trace peak and valley location values updated using the data extracted from Ohio SPS-2 smoothed traces.

In the five configuration tables: DLR_STRAIN_CONFIG_AC/PCC, DLR_LVDT_CONFIG_AC/PCC, and DLR_PRESSURE_CONFIG_AC, the following columns were updated:

- Initially, some newly added Ohio SPS-1 and 2 test jobs had missing sensor calibration information such as channel number, record status, input card, card gain, post gain, gauge resolution etc. Fortunately, by matching STATE_CODE, SHRP_ID, and TAG_ID (sensor ID) of existing test jobs that have sensor calibration information, those test jobs that had missing information could be populated regardless of test job names.
- The sensor locations in terms of X, Y, and Z coordinates were updated using the X, Y, and Z data in EmbeddedSensor.txt by matching section ID and sensor ID.
- The SENSOR_LAYER_NUMBER column was updated using the Z (sensor depth in inches) data and the LAYER column in EmbeddedSensor.txt and Ohio_Letter.pdf (has Ohio SPS-1 and 2 test section charts with information on layer type, thickness, test section start and end stations) [11].
- The strain gauge ORIENTATION column in the DLR_STRAIN_CONFIG_AC/PCC tables was updated using the DirCosX (1 for longitudinal) and DirCosY (1 for transverse) data in EmbeddedSensor.txt.

In the DLR_TEST_MATRIX table, the following columns were updated:

- RUN_TIME (the time of the test as determined by the data acquisition computer's internal clock): was updated using the timestamp in cell A3 of each AJ*.* raw trace file by matching STATE_CODE, SHRP_ID, TEST_NAME, and RUN_NUMBER.
- REVISION_DATE (Date of latest revision to the information stored in the DLR_TEST_MATRIX table): was set to August 24, 2012 when the DLR Study Team submitted the newly created Ohio SPS-1 and 2 DLR database.
- ACTUAL_SPEED (actual speed of the test truck in kilometers per hour): was newly added and populated using the SPEED data in TruckPass.txt. The DLR Study Team believes that this column will provide invaluable information for data users when interpreting DLR traces, in addition to the DESIRED_SPEED column.
- WHEEL_PATH_OFFSET1_M (distance from the edge of pavement to the outside of the *front* tire track for OH data) was updated using the OFFSET1 data in TruckPass.txt.
- WHEEL_PATH_OFFSET2_M (distance from the edge of pavement to the outside of the *rear* tire track for OH data) was updated using the OFFSET2 data in TruckPass.txt
- WHEEL_PATH_OFFSETX1_M (distance along the direction of traffic as referenced from the start of the southernmost 1st LVDT in the section to the location where the front axle wheelpath offset was measured) was newly added using the OFFSETX1 data inTruckPass.txt.
- WHEEL_PATH_OFFSETX2_M (distance along the direction of traffic as referenced from the start of the southernmost 1st LVDT in the section to the location where the rear axle wheelpath offset was measured) is newly added using the OFFSETX2 data in TruckPass.txt.
- When comparing the DLR_TEST_MATRIX table in SDR 22.0 to the five trace tables, the DLR Study Team found that the following nine (as in Table 23) out of the 724

records in DLR_TEST_MATRIX did not have any source data to populate the columns: ACTUAL_SPEED, WHEEL_PATH_OFFSET1_M, WHEEL_PATH_OFFSET2_M, WHEEL_PATH_OFFSETX1_M, WHEEL_PATH_OFFSETX2_M, and MATRIX_INDEX.

Table 23: The nine records in the DLR_TEST_MATRIX table in SDR 22.0 that did not have any source data to update with and thus, were removed.

STATE_CODE	SHRP_ID	TEST_NAME	RUN_NUMBER
39	104	J4A	7
39	104	J4D	12
39	104	J4F	9
39	108	J8D	3
39	110	J10E	1
39	201	J1B	6
39	205	J5A	29
39	205	J5B	5
39	212	J12J10P	2

Taking J10E Run 1 in Table 23 as an example, TruckPass.txt does not have any information for 390110 (J10E Run 1) as listed in Table 24. Therefore, the DLR Study Team did not include the nine records in Table 23 in the final DLR_TEST_MATRIX table in the upcoming SDR 27.

Table 24: TruckPass.txt does not contain any data for Section 390110 (J10E Run 1).

Series	Subseries	Run	Section	Actual_Speed	Offset1	Offset2	OffsetX1	OffsetX2
2	"E"	1	"390102"	28.77	10.000	10.000	264.00	0.00
2	"E"	1	"390104"	29.63	9.000	8.500	264.00	0.00
2	"E"	1	"390105"	28.31	9.500	9.500	264.00	0.00
2	"E"	1	"390108"	28.31	8.000	8.000	288.00	-24.00

Since the nine records in Table 23 were removed from the DLR_TEST_MATRIX table, 54 traces that did not have a matching record in the DLR_TEST_MATRIX were removed from the five trace tables in the upcoming SDR 27.

9. SAMPLE RESULTS

This section compares the DLR trace plots created using the Ohio SPS-1 DLR raw data, SDR 22.0 data, and the new Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) created using the methodology presented in this report for the Ohio SPS-1 and 2 data.

9.1 Ohio SPS-1 Data Sample Plots

Figures 19 to 21 show the sample plots of Ohio Section 390102 Test Job J2C Run 1 using the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for strain gauge Dyn12, LVDT1, and pressure cell PC1, respectively. It appears that the newly created data match the DLR raw traces.

Per the recommendation from Eric Weaver (FHWA HRDI-20: Pavement Design and Construction Team) for the strain gauges, the front axle pavement deflection peaks and valleys as well as their corresponding time stamps were also included in the newly created Ohio SPS-1 and 2 DLR database whereas the front axle deflections are missing in SDR 22.0 as depicted in Figure 19. Meanwhile, Eric suggested that the onset of the third valley near time point 1.8 seconds was not required to be included in the database because researchers will focus on the peaks and valleys in a trace. As a result, the SDR 27 Dyn12 raw trace in Figure 19 goes directly from the second valley to the third valley without matching the DLR raw Dyn12 trace in between the two valleys.

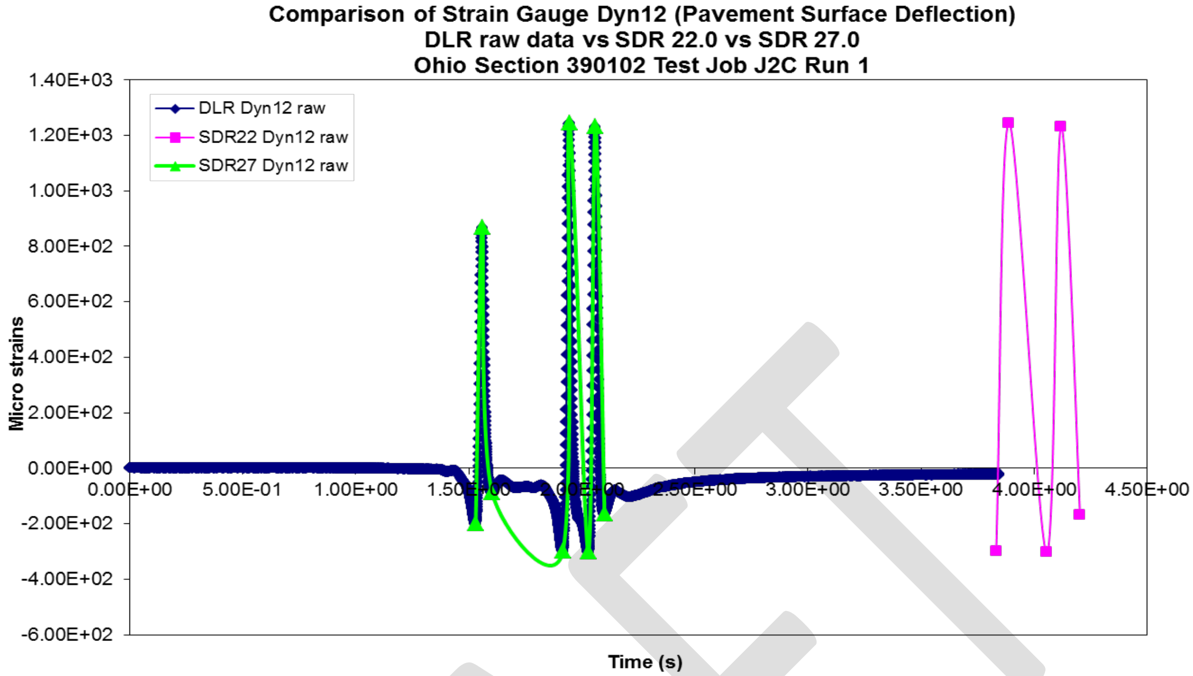


Figure 19: Comparison of strain gauge Dyn12 traces using the Ohio SPS-1 DLR raw data, SDR 22.0 data, and the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for Ohio Section 390102 test job J2C Run 1 conducted on August 5, 1996.

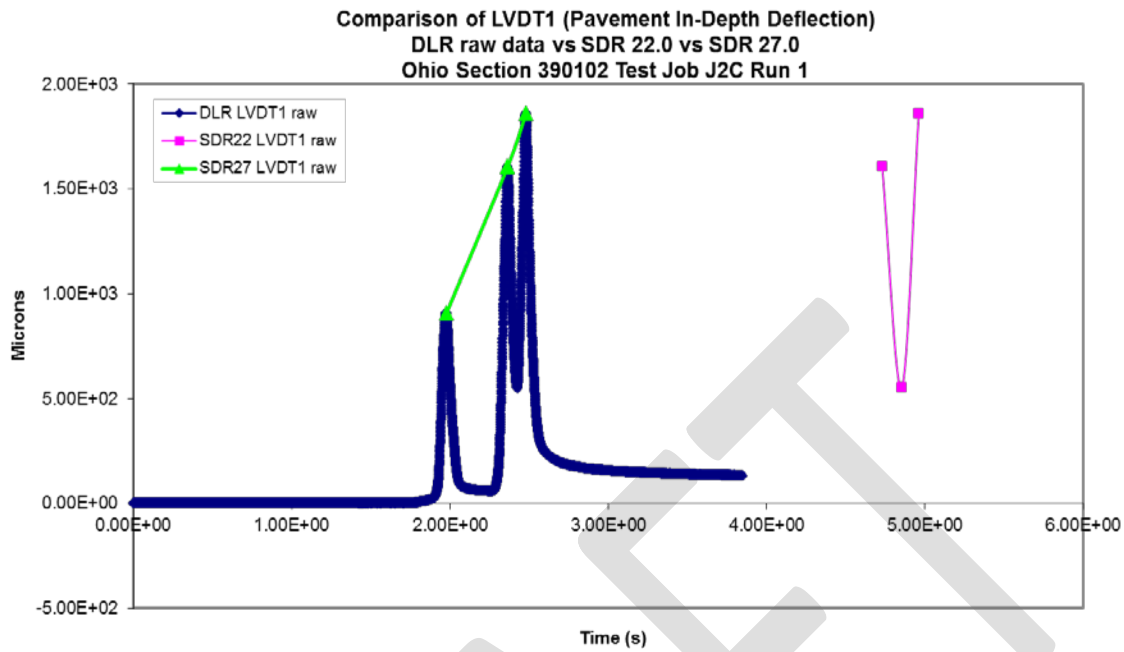


Figure 20: Comparison of LVDT1 traces using the Ohio SPS-1 DLR raw data, SDR 22.0 data, and the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for Ohio Section 390102 test job J2C Run 1 conducted on August 5, 1996.

Per Eric Weaver's recommendation for the LVDTs, only the peaks (but no valleys) and their corresponding time stamps were included in the Ohio SPS-1 and 2 DLR database as depicted in Figure 20.

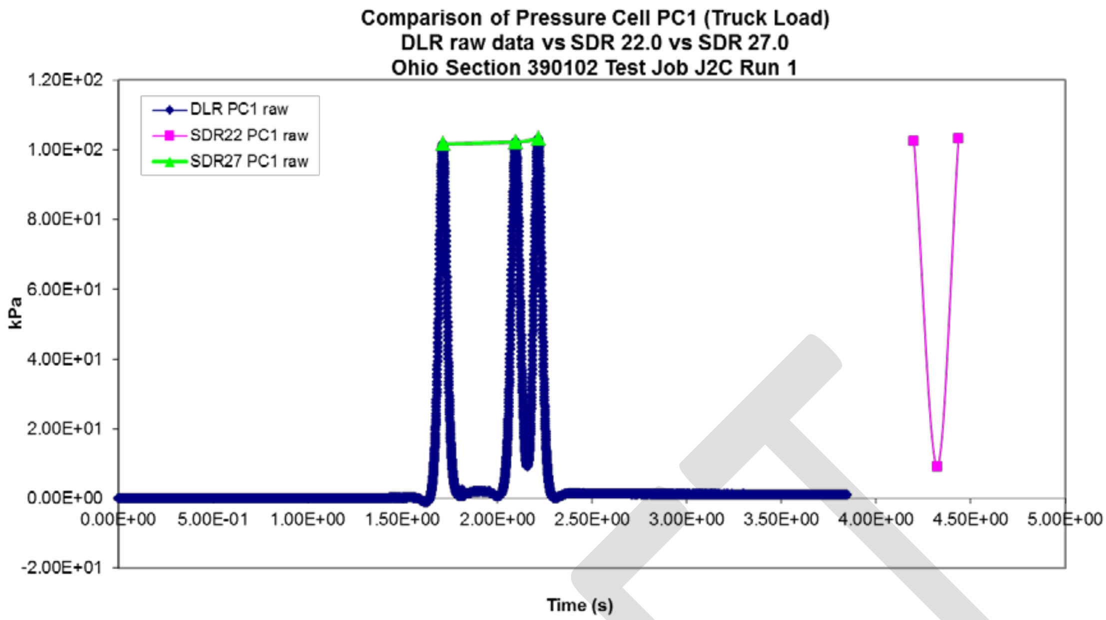


Figure 21: Comparison of pressure cell PC1 traces using the Ohio SPS-1 DLR raw data, SDR 22.0 data, and the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for Ohio Section 390102 test job J2C Run 1 conducted on August 5, 1996.

Per Eric Weaver's recommendation for the pressure cells, only the peaks (but no valleys) and their corresponding time stamps were included in the Ohio SPS-1 DLR database as depicted in Figure 21.

9.2 Ohio SPS-2 Data Sample Plots

Figures 22 to 23 show the sample plots of Ohio Section 390201 Test Job J1A Run 2 using the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for strain gauge Dyn5 and LVDT1, respectively. It appears that the newly created data match the DLR raw traces.

Per Eric Weaver's recommendation for the strain gauges, the front axle pavement deflection peaks and valleys as well as their corresponding time stamps were also included in the newly created Ohio SPS-1 and 2 DLR database whereas the front axle deflections were missing in SDR 22.0 as depicted in Figure 22. Meanwhile, Eric suggested that the third valley near time stamp 2.0 seconds in between the two tandem axle peaks was not required to be included in the database. As a result, the SDR 27 Dyn5 smoothed trace in Figure 22 goes directly from the second peak to the third peak without matching the third valley of the DLR Dyn5 raw trace in between the two tandem axle peaks.

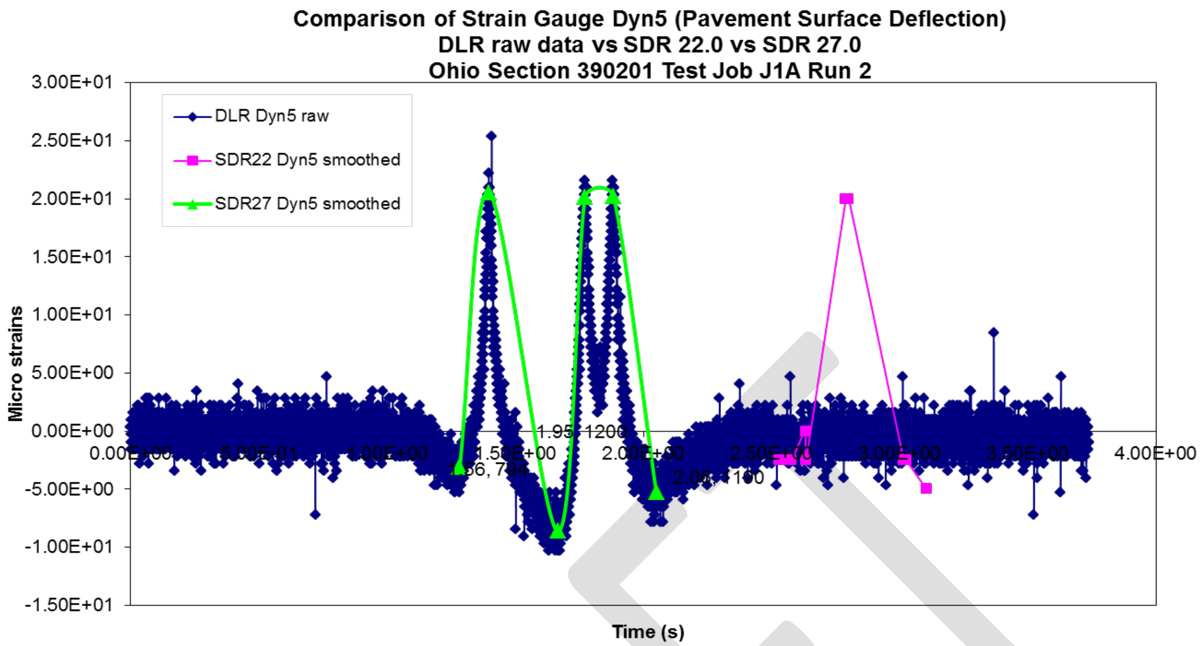


Figure 22: Comparison of strain gauge Dyn5 traces using the Ohio SPS-2 DLR raw data, SDR 22.0 data, and the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for Ohio Section 390201 test job J1A Run 2 conducted on August 12, 1996.

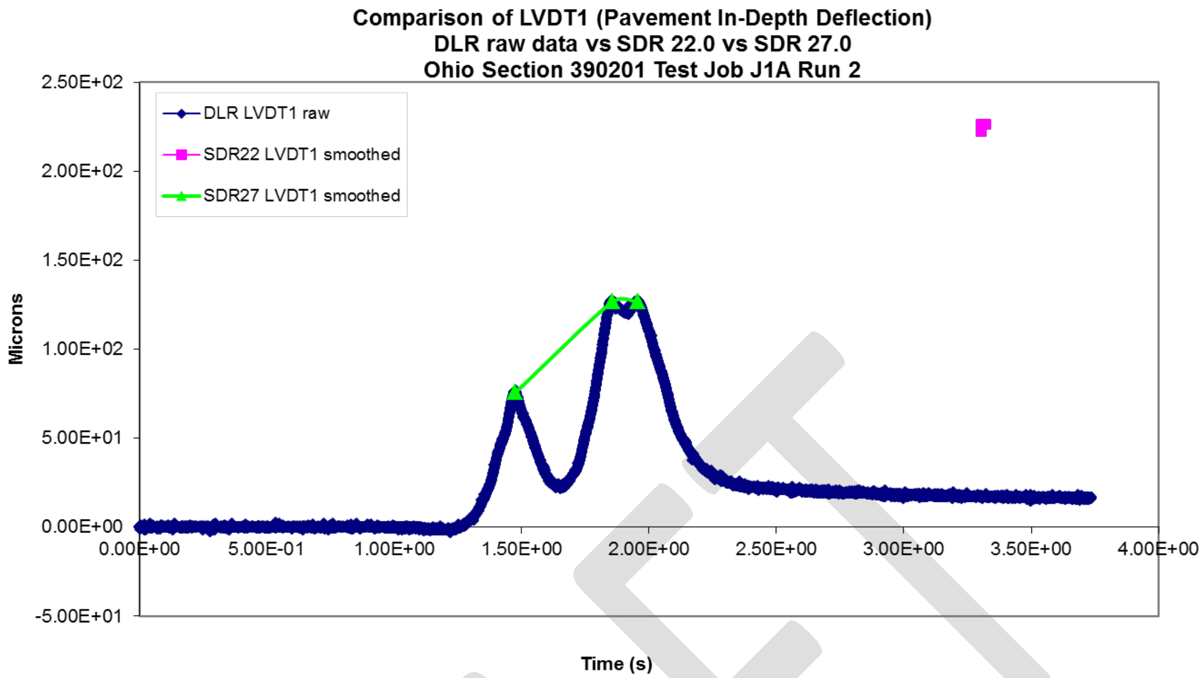


Figure 23: Comparison of LVDT1 traces using the Ohio SPS-2 DLR raw data, SDR 22.0 data, and the newly created Ohio SPS-1 and 2 DLR database (temporarily designated as SDR 27.0) for Ohio Section 390201 test job J1A Run 2 conducted on August 12, 1996.

Per Eric Weaver's recommendation for the LVDTs, only the peaks (but no valleys) and their corresponding time stamps were included in the Ohio SPS-1 and 2 DLR database as depicted in Figure 23.

10. CONCLUSIONS

The DLR Study Team completed re-interpreting 4,290 Ohio SPS-1 DLR raw traces as in Table 3 and 9,240 Ohio SPS-2 DLR raw traces as in Table 4, correcting the data issues identified by DAOFRs ECOMPEX-75 to -77 [3, 4, 5] and the TSSC technical memorandum [6] for SDR 22.0, including trace peak time lag shift, incorrect sensor locations and wheelpath offsets. Using the methodology in Section 5 of this report, the DLR Study Team calibrated and smoothed the Ohio SPS-1 and 2 raw traces before categorizing those traces into three categories: “Good”, “Maybe”, and “Not Good” according to the trace categorization criteria in Section 5.5.1. For the Ohio SPS-1 data, the trace categorization QC results for smoothed and raw traces are listed in Table 13 and 14, respectively; about 24% of strain gauge traces, 55% of LVDT traces, and 99% of pressure cell traces were concluded to be “Good." For the Ohio SPS-2 data, due to significant noise in the raw traces, only smoothed traces were categorized and the QC result is listed in Table 17; about 61% of strain gauge traces and 15% of LVDT traces were concluded to be “Good.” Above all, only “Good” traces were used for further extraction of trace peaks and valleys for the upcoming SDR 27. In addition, the sensor locations and the corresponding wheelpath offsets were corrected using the approach in Section 5.6. In all, the newly created DLR data in SDR 27.0 appear to match the DLR raw traces as demonstrated by the charts in Section 9.

Moreover, the QC results from the categorization criteria were manually checked, i.e. sensor status from visit to visit and run to run for all Ohio SPS-1 and 2 test jobs for smoothed and raw traces were checked. To facilitate future DLR data users in identifying the layout and status of each sensor from one test visit or run to another, the necessary information is listed as follows:

- Appendix A: Sensor layout in the Ohio SPS-1 DLR sections.
- Appendix B: Sensor status of the 23 Ohio SPS-1 DLR test jobs.
- Appendix C: Sensor layout in the Ohio SPS-2 DLR sections.
- Appendix D: Sensor status of the 24 Ohio SPS-2 DLR test jobs.

In addition, the first peak value extracted for good traces was compared with the TruckPeak.txt data from Ohio University, which indicated that the values were very close for most of the sensors for all test sections as presented in Table 18 (Ohio SPS-1) and Table 21 (Ohio SPS-2). Meanwhile, the data issues identified in the DLR raw traces are listed as follows in terms of Ohio SPS-1, Ohio SPS-2, and the issues common to both the Ohio SPS-1 and -2 data.

10.1 Ohio SPS-1 Data Issues

The Ohio SPS-1 data issues identified so far are listed as the following:

1. Some test jobs in DLR data did not have any test files and some files did not have information pertaining to sensor locations, truck pass, and truck peak in Ohio data. These test jobs were not considered for processing. As a result, only 23 out of 34 test jobs were considered for DLR data processing.
2. Strain gauge sensors Dyn10 and Dyn11 for test jobs J2A, J2C, J2D, J2E, J2F and J2G in test section 390102 showed a flat trace pattern.
3. All of the LVDTs were buried deep into the subgrade or close to the interface between the subgrade and the base layer in the Ohio test sections and thus, LVDT traces should not contain any trace valleys (no tensile strains) but peaks (compressive strains). However, LVDT3 sensor for test jobs J2A, J2C, J2D, J2E, J2F and J2G (test section 390102) showed a trace pattern similar to a longitudinal strain gauge trace that contains trace valleys.

4. Longitudinal strain gauges are expected to assume trace valleys whereas transverse strain gauges are not. However, longitudinal strain gauge sensor Dyn17 for test jobs J8A, J8D, J8E, and J8G (test section 390108) showed a trace pattern similar to a transverse strain gauge trace that assumed no valleys.
5. As indicated by Table 9, a significant difference between the extracted peaks and Ohio data peak for some sensors was observed, this could be due to the sensor locations reported in Ohio data (Truckpeak.txt) being about two to three inches off the actual sensor locations from the southernmost deep LVDT.
6. In Table 25, inconsistent Z coordinates (depth of the sensor from the pavement surface) for strain gauges DYN16 to 18 were found between Ohio 390108 section profile view and EmbeddedSensor.txt. Test names J8A, J8D, J8E, and J8G were conducted in Ohio section 390108, consisting of three AC layers (2", 2", and 3"), one PATB (4") base, one DGAB (8") base, and subgrade.

Table 25: Sample data from EmbeddedSensor.txt

Section	Name	Number	Model	X	Y	Z	Path	Layer	DirCosX	DirCosY	DirCosZ
390108	DYN	16	PAST-II AC	72	72	**7***	CL	**Bottom***	0	1	0
390108	DYN	17	PAST-II AC	96	72	**7***	CL	**Bottom***	1	0	0
390108	DYN	18	PAST-II AC	120	72	**7***	CL	**Bottom***	0	1	0

* indicates suspect data.

Ohio 390108 section profile view shows that DYN16 to 18 were buried at the bottom (Z=**11**" from the pavement surface) of the top PTAB base layer (4") which is below the three AC layers (2", 2", and 3"). In contrast, EmbeddedSensor.txt shows that DYN16 to 18 were buried at Z = **7**" (from the pavement surface) and Layer is "bottom", referring to the bottom of the lowest of the three AC layers (2", 2", and 3"). Thus, the DLR Study

Team recommends changing the Z coordinate of 390108 DYN 16 to 18 to **11**” from 7” and changing the Layer to “**Base PATB**” or “**Base**” from “Bottom” for this case.

7. The construction plan from one of the original DLR documents showed that two AC layers were planned for Ohio Sections 390102, 0104, 0108, and 0110. However, the section profile views of these sections showed three AC layers. Based on the construction plan, the SECTION_LAYER_STRUCTURE table in LTPP SDR 26.0 showed two AC layers with the bottom AC layer combining the two bottom AC layers (2” and 3”) shown in the profile views into a 5” AC layer while keeping the top 2” AC layer as the top AC layer. Thus, the DLR Study Team recommends revising the SECTION_LAYER_STRUCTURE table in order to show the *three* (instead of two) AC layers as displayed in the section profile views.

10.2 Ohio SPS-2 Data Issues

The Ohio SPS-2 data issues identified so far are listed as the following:

1. Due the fact that test job J12A1 is empty and test job J12J10M1 is a partial repeat of J12J10M, the two test jobs were not processed. As a result, only 24 out of 26 test jobs were considered for DLR data processing.
2. Site visits (‘A’, ‘B’, and ‘C’) of Ohio SPS-2 test sections 0201, 0205, 0208 and 0212 are inconsistent with Ohio SPS-2 subseries (‘H’, ‘I’, and ‘J’) of OU TruckRun.txt data. Since subseries ‘A’, ‘B’, ‘C’, ‘D’, ‘E’, ‘F’ and ‘G’ were already used for Ohio SPS-1 in TrcukRun.txt, it was assumed that, OU assigned ‘H’, ‘I’, and ‘J’ instead of ‘A’, ‘B’, and ‘C’ for Ohio SPS-2.
3. In the DLR_STRAIN_TRACE_SUM_PCC table, strain gauge DYN8 from Test Name J5J1P Runs 1 to 10 collected at 499.964Hz on 8/6/1997 had significantly larger raw strain

values compared to other Ohio SPS-2 strain gauge values that were mostly less than 100 microstrains as listed in Table 22. Thus, further investigation is needed for this strain gauge.

4. Ohio SPS-2 DLR sensors LVDT 5 and LVDT 6 were unresponsive for all test jobs (i.e.) LVDT 5 and LVDT 6 records had all zero values.
5. Ohio SPS-2 test jobs J5J1M, J5J1N, J5J1O, J5J1P, J8S3M, J8S3N, J8S3O, J8S3P, J12J10M, J12J10N, J12J10O, and J12J10P ASCII files had a total of thirty two LVDT sensors (LVDT1-LVDT32) unlike the other test jobs (J1A, J1B, J1C, J5A, J5B, J5C, J8A, J8B, J8C, J12A, J12B, and J12C that only had sixteen LVDT sensors (LVDT1-LVDT16). The DLR Study Team processed only the first sixteen LVDTs (LVDT1-LVDT16) based on information present in EmbeddedSensor.txt file (shows only first sixteen LVDTs).
6. As discussed in Section 5.2.2, the first 500 trace data points were used to determine the gain adjustment factor for Ohio SPS-2 data. On average, each Ohio SPS-2 time history dataset contains close to 7,000 data points whereas each Ohio SPS-1 time history dataset contains about 5,000 data points. However, in retrospect, due to significant noise in Ohio SPS-2 data, the first 500 data points may not be enough. For future research, the first 700 data points should be used to determine the gain adjustment factor for Ohio SPS-2 data because it is about 10% of each Ohio SPS-2 time history dataset that contains close to 7,000 measurements.

10.3 Ohio SPS-1 and 2 Data Issues

The data issues common to both the Ohio SPS-1 and -2 traces identified so far are listed as the following:

1. The proposed REF_LOC_NO, the distance between the beginning of a test section and the southernmost first LVDT which serves the origin of the sensor coordinate system, is not possible as the section beginning was not used as a reference for sensor location and sections have been since overlaid, making this measurement unattainable.
2. As listed in Table 18 (Ohio SPS-1) and Table 21 (Ohio SPS-2), the peak data information contained in Ohio TruckPeak.txt file was unclear to understand because it had multiple sensor location values for the same sensor and run.
3. The begin offset, end offset, and range values for strain gauges, LVDTs (for both Ohio SPS-1 and 2), and pressure cells (for Ohio SPS-1 only) obtained from the DLR raw traces did not match the begin/end offset and range values in SDR 22. Per the TSSC's recommendations, the begin offset, end offset, and range columns were removed and will not show up in the upcoming SDR 27.
4. The information on channel number, record status, input card, card gain, post gain, gauge resolution etc. in DLR_STRAIN_CONFIG_AC/PCC, DLR_LVDT_CONFIG_AC/PCC, DLR_PRESSURE_CONFIG_AC and run time in DLR_TEST_MATRIX presented in DLR tables in SDR was not found.
5. Inconsistent wheelpath offset field in DLR_TEST_MATRIX was updated only for Ohio test sections using the truck pass data in Ohio data set (TruckPass.txt). However, the DLR_TEST_MATRIX table in SDR had wheelpath offset records for both Ohio and NC test sections. Since the wheelpath offset data for NC test sections was not available, the wheelpath offset records for NC test sections were not updated.
6. As indicated by Table 23, the nine records in the DLR_TEST_MATRIX table in SDR 22.0 that did not have any source data to update with and thus, were removed. As a

result, 54 traces that did not have a matching record in the DLR_TEST_MATRIX were removed from the five trace tables in the upcoming SDR 27.

7. The DLR Study Team could not find any information to interpret data in the MATRIX_INDEX column (distinct coded reference number for controlled truck testing used to aggregate the tests according to the type of truck, vehicle speed, and general time of testing (early morning, midmorning, or afternoon) in DLR_TEST_MATRIX. Thus, we recommend removing the column for which we cannot provide any explanation.

Acknowledgement

The authors of this report would like to extend our gratitude to Roger Green from Ohio Department of Transportation and Dr. Shad Sargand's team at Ohio University for providing the DLR raw traces and the associated data files (*.txt) and to Eric Weaver from the FHWA Pavement Design and Construction Team (HRDI-20), Gary Elkins from AMEC (the LTPP Technical Support Service Contractor (TSSC)), Gabe Cimini from Stantec (the LTPP Northern Regional Contractor), and Mary Anne Deeney from ESCINC as well as the whole LTPP Team for your comments and support for the completion of such a complex, challenging project.

Reference

1. Cimini, Gabe (2010). Layout Information. Stantec, Tonawanda, New York.
2. Sargand, Shad et al. (2007). Evaluation of Pavement Performance on DEL 23, Report No. FHWA/OH-2007/05. Department of Civil and Environmental Engineering, Ohio University, Athens, Ohio.
3. Lin, Sean (2009). LTPP Data Analysis/Operations Feedback Report, Report No. Ecompex-75_Rev_1. Ecompex, Inc., McLean, Virginia.
4. Lin, Sean (2009). LTPP Data Analysis/Operations Feedback Report, Report No. Ecompex-76_Rev_1. Ecompex, Inc., McLean, Virginia.
5. Lin, Sean (2009). LTPP Data Analysis/Operations Feedback Report, Report No. Ecompex-77_Rev_1. Ecompex, Inc., McLean, Virginia.
6. Elkins, Gary (2009). Technical Memorandum: Investigation of Ohio DLR data in LTPP Database. AMEC, Reno, Nevada.
7. MATLAB version 7.11 (2010). MATLAB Copyright © 1984-2010 by The MathWorks Inc. Natick, Massachusetts.
8. Weaver, Eric (2000). Comparison and Quality Evaluation of LTPP DLR Data from Ohio and North Carolina. Federal Highway Administration, Turner-Fairbank Highway Research Center, Pavement Design and Construction Team (HRDI-20), McLean, Virginia.
9. The mslowess function of Matlab®: http://www.mathworks.com/help/toolbox/bioinfo/ref/mslowess.html. site last accessed December 29, 2011.

10. The mspeaks function of Matlab®:

http://www.mathworks.com/help/toolbox/bioinfo/ref/mspeaks.html?nocookie=true. site last accessed December 29, 2011.

11. Khoury, Issam (undated). Ohio_Letter.pdf: Ohio SPS-1 and 2 Test Section Charts with Information on Layer Type, Thickness, Test Section Start and End stations. Department of Civil and Environmental Engineering, Ohio University, Athens, Ohio.

APPENDIX A: Sensor Layout in the Ohio SPS-1 DLR Sections

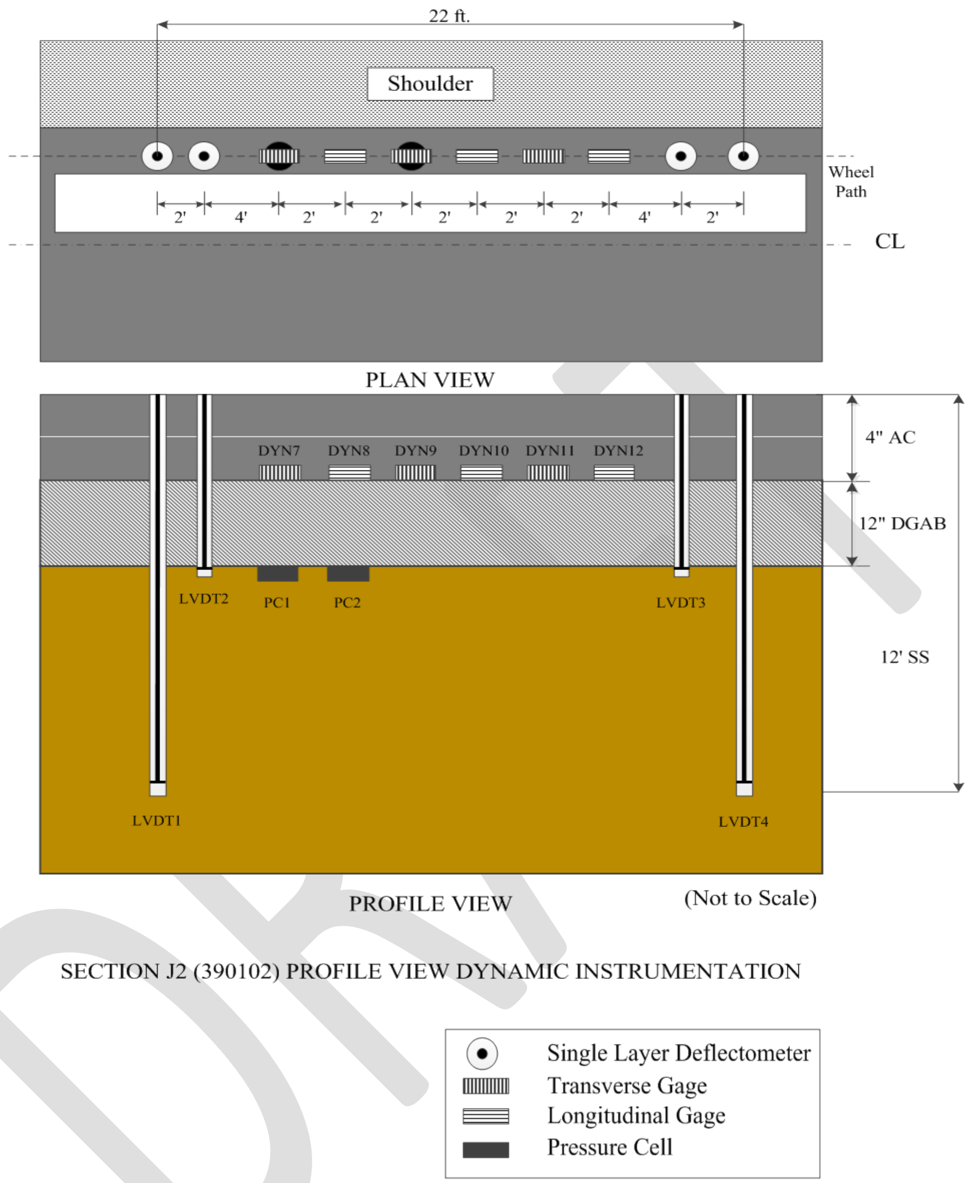


Figure 24: Section 390102 Sensor Layout

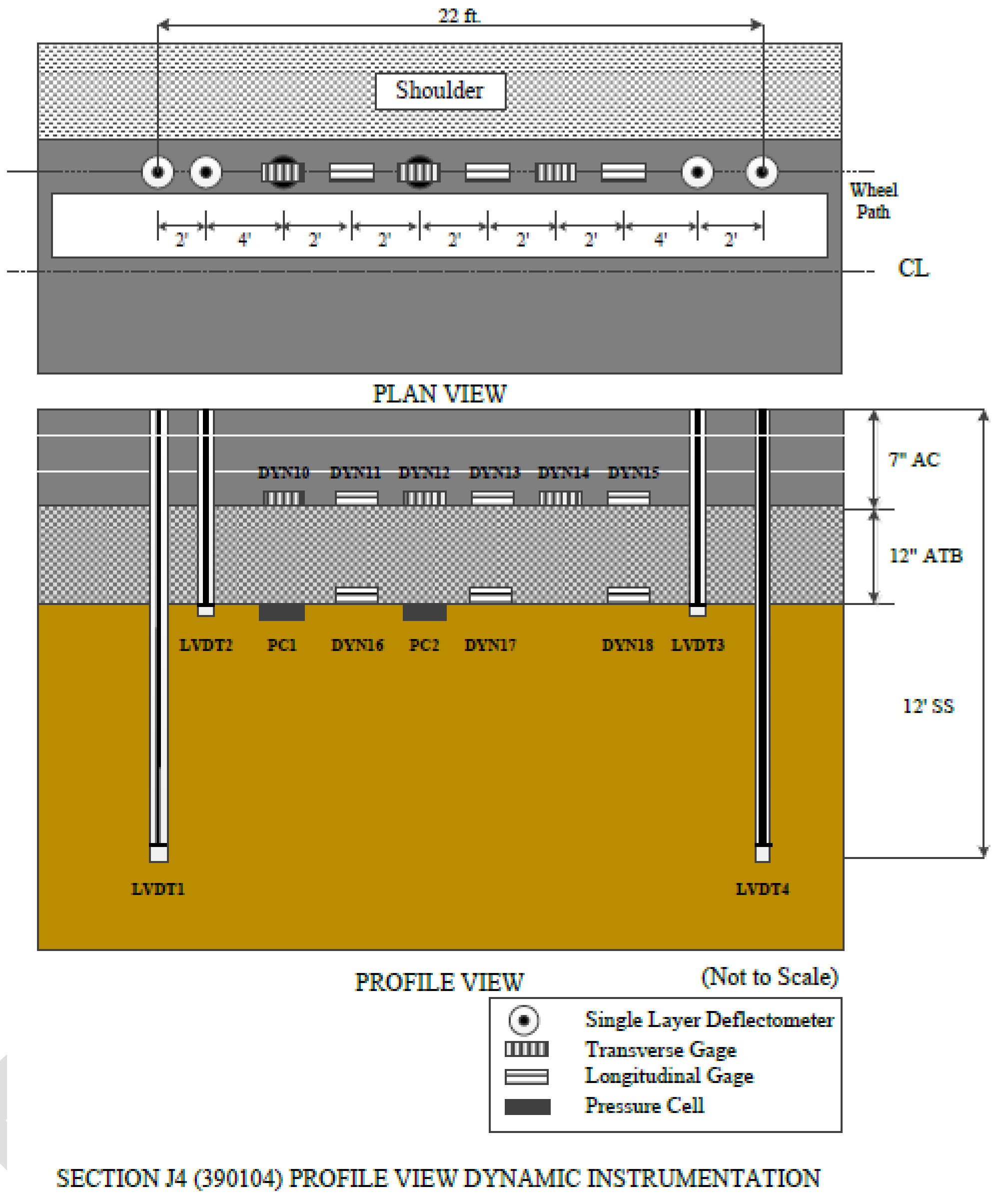


Figure 25: Section 390104 Sensor Layout

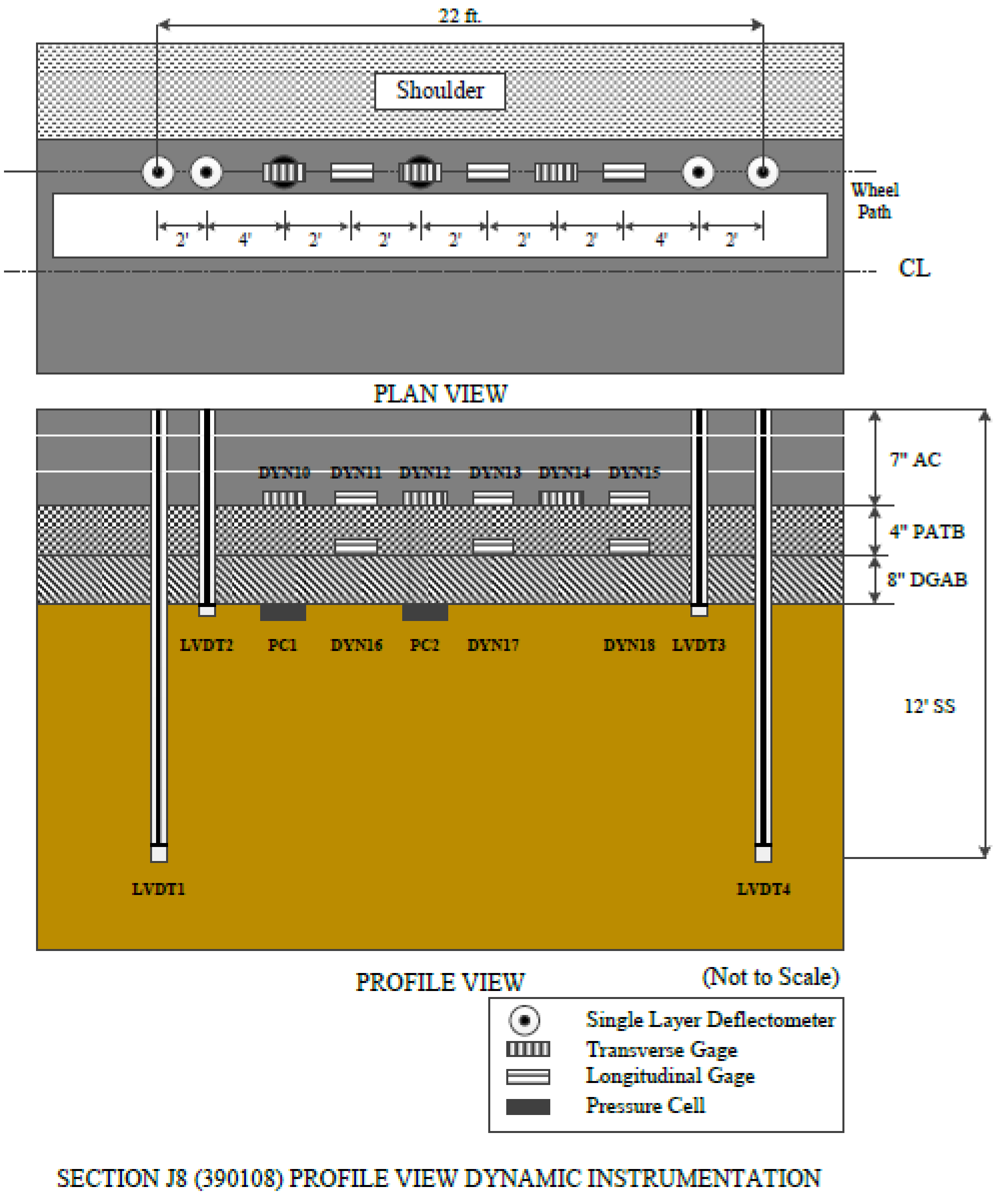


Figure 26: Section 390108 Sensor Layout

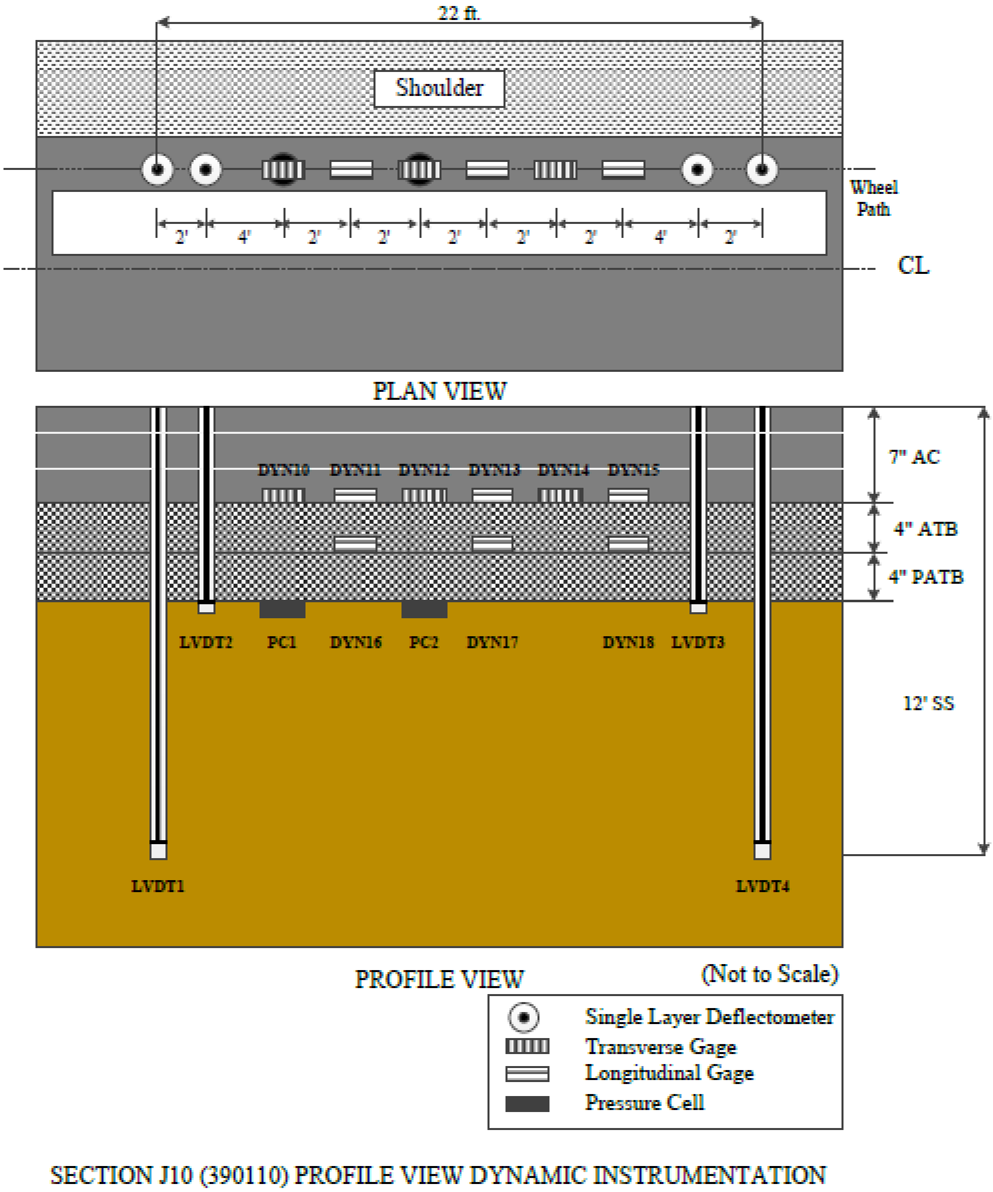
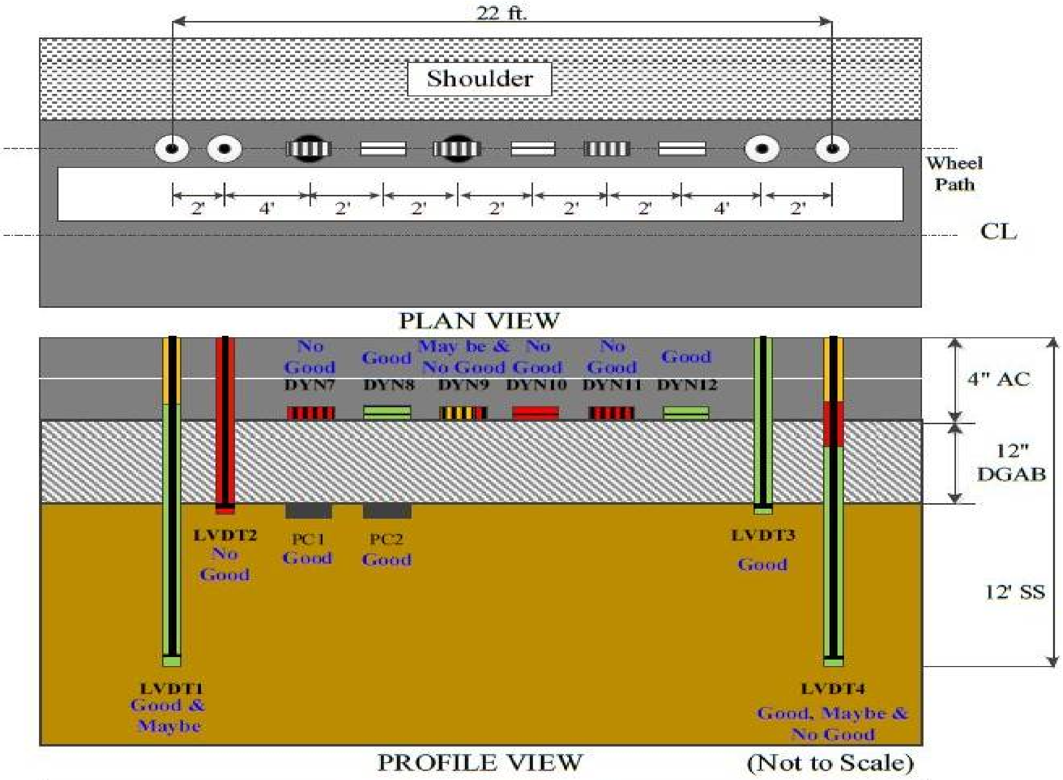


Figure 27: Section 390110 Sensor Layout

APPENDIX B: Sensor Status of the 23 Ohio SPS-1 DLR Test Jobs



J2A Test Job QC Results

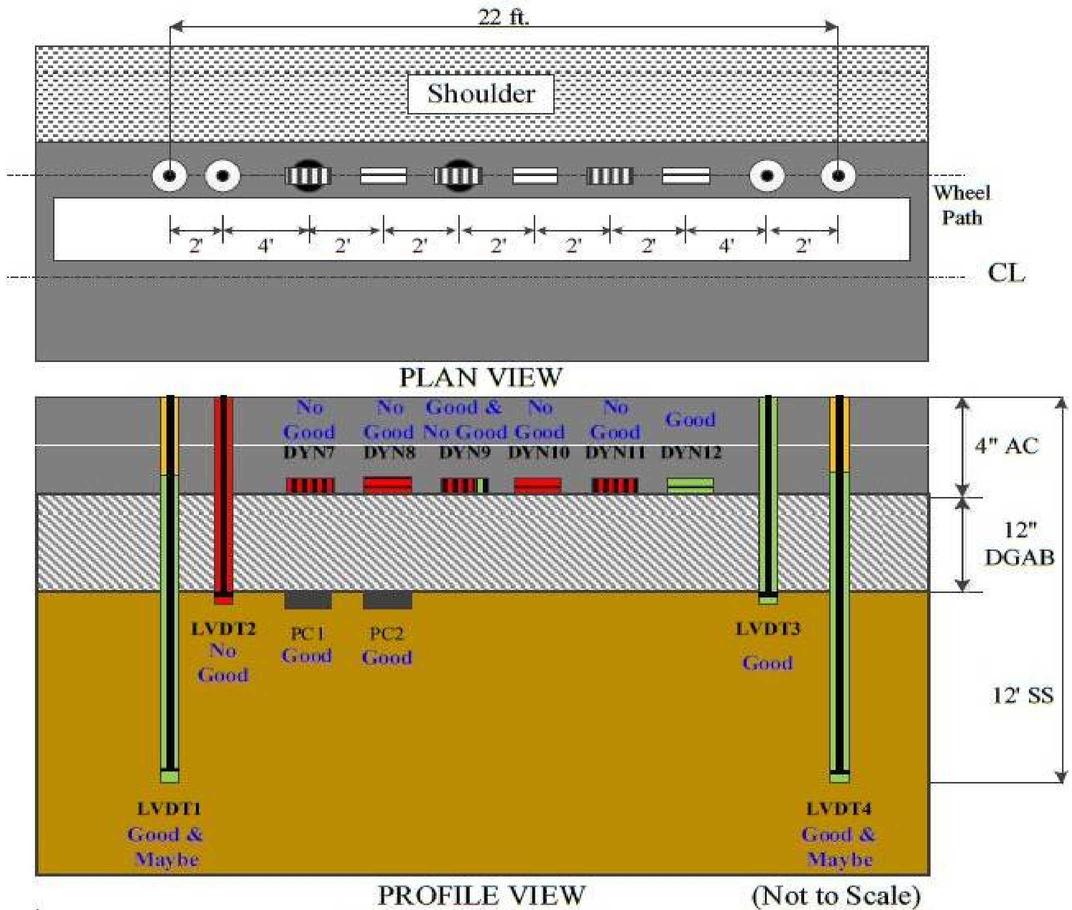
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	1	3	3	3	1	1	3	1	1	1	1
2	3	1	3	3	3	1	1	3	1	1	1	1
3	3	1	2	3	3	1	1	3	1	1	1	1
4	3	1	2	3	3	1	1	3	1	1	1	1
5	3	1	3	3	3	1	1	3	1	1	1	1
6	3	1	2	3	3	1	1	3	1	1	1	1
7	3	1	2	3	3	1	1	3	1	1	1	1
8	3	1	2	3	3	1	1	3	1	3	1	1
9	3	1	2	3	3	1	1	3	1	3	1	1
10	3	1	2	3	3	1	1	3	1	1	1	1
11	3	1	2	3	3	1	1	3	1	1	1	1
12	3	1	2	3	3	1	1	3	1	1	1	1
13	3	1	2	3	3	1	1	3	1	1	1	1
14	3	1	2	3	3	1	2	3	1	2	1	1
15	3	1	2	3	3	1	2	3	1	2	1	1
16	3	1	2	3	3	1	2	3	2	2	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	32**	13	51
LVDT	39	7	18
PC	32	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 32 is the total of sixteen "1's" under Dyn8 and other sixteen "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 28: Graphical Representation of QC Results by Sensor Type for Section 390102 J2A Test Job



J2C Test Job QC Results

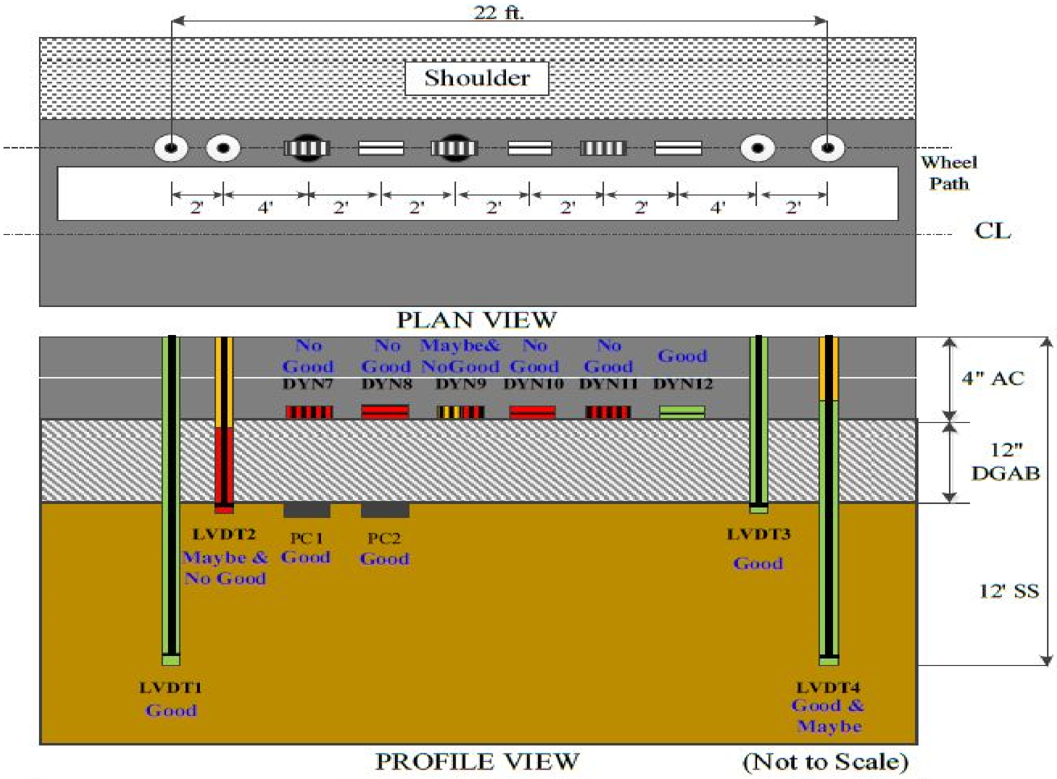
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	3	3	1	1	3	1	1	1	1
2	3	3	3	3	3	1	1	3	1	1	1	1
3	3	3	3	3	3	1	1	3	1	1	1	1
4	3	3	3	3	3	1	1	3	1	1	1	1
5	3	3	1	3	3	1	2	3	1	1	1	1
6	3	3	1	3	3	1	2	3	1	2	1	1
7	3	3	3	3	3	1	1	3	1	1	1	1
8	3	3	3	3	3	1	1	3	1	2	1	1
9	3	3	3	3	3	1	1	3	1	1	1	1
10	3	3	3	3	3	1	1	3	1	1	1	1

Sensor Type	Good traces*	May be traces*	No Good traces*
Strain gauge	12**	0	48
LVDT	26	4	10
PC	20	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 12 is the total of two "1's" under Dyn9 and other ten "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 29: Graphical Representation of QC Results by Sensor Type for Section 390102 J2C Test Job



J2D Test Job QC Results

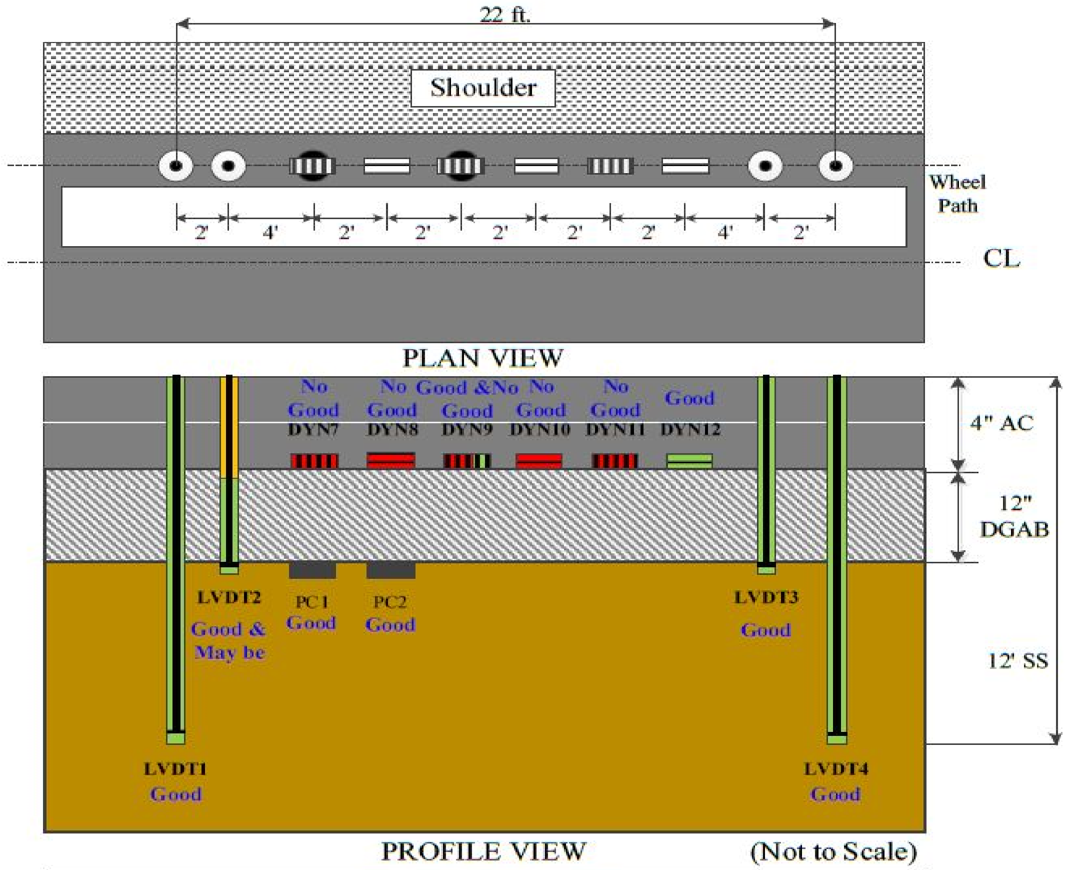
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	2	3	3	1	1	3	1	2	1	1
2	3	3	1	3	3	1	1	3	1	1	1	1
3	3	3	2	3	3	1	1	3	1	1	1	1
4	3	3	2	3	3	1	1	3	1	1	1	1
5	3	3	2	3	3	1	1	3	1	1	1	1
6	3	3	2	3	3	1	1	3	1	1	1	1
7	3	3	2	3	3	1	1	3	1	1	1	1
8	3	3	2	3	3	1	1	3	1	1	1	1
9	3	3	3	3	3	1	1	2	1	1	1	1
10	3	3	3	3	3	1	1	2	1	1	1	1
11	3	3	3	3	3	1	1	2	1	1	1	1
12	3	3	3	3	3	1	1	2	1	1	1	1
13	3	3	3	3	3	1	1	2	1	1	1	1
14	3	3	2	3	3	1	1	2	1	1	1	1
15	3	3	3	3	3	1	1	2	2	1	1	1
16	3	3	3	3	3	1	1	2	1	2	1	1

Sensor Type	Good traces*	May be traces*	No Good traces*
Strain gauge	17**	8	71
LVDT	45	11	8
PC	32	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 17 is the total of one "1" under Dyn9 and other sixteen "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 30: Graphical Representation of QC Results by Sensor Type for Section 390102 J2D Test Job



J2E Test Job QC Results

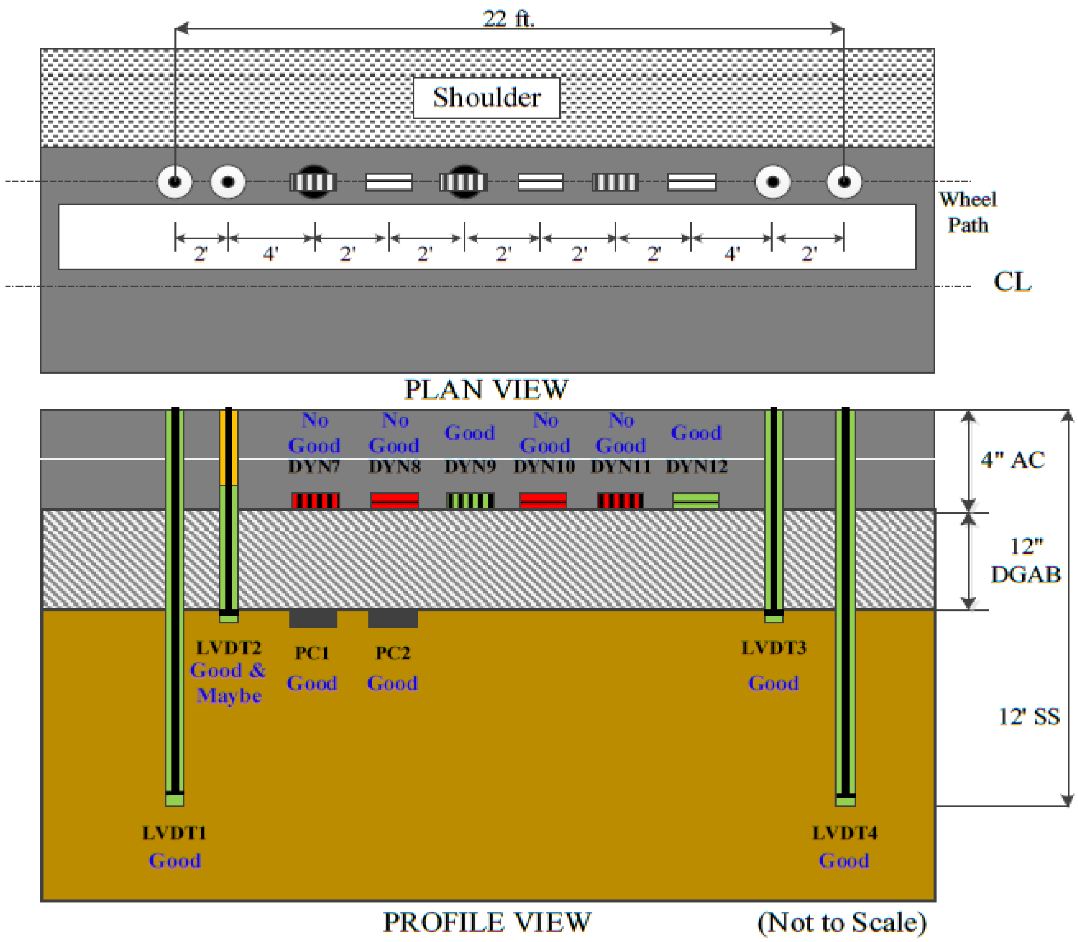
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	3	3	1	1	1	1	1	1	1
2	3	3	1	3	3	1	1	2	1	1	1	1
4	3	3	3	3	3	1	1	1	1	1	1	1
5	3	3	3	3	3	1	1	2	1	1	1	1
6	3	3	3	3	3	1	1	1	1	1	1	1
7	3	3	1	3	3	1	1	1	1	1	1	1
8	3	3	1	3	3	1	1	1	1	1	1	1
9	3	3	3	3	3	1	1	2	1	1	1	1
10	3	3	3	3	3	1	1	2	1	1	1	1
11	3	3	3	3	3	1	1	2	1	1	1	1
12	3	3	3	3	3	1	1	2	1	1	1	1
13	3	3	3	3	3	1	1	2	1	1	1	1

Sensor Type	Good traces*	May be traces*	No Good traces*
Strain gauge	15**	0	57
LVDT	41	7	0
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 15 is the total of three "1's" under Dyn9 and other twelve "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 31: Graphical Representation of QC Results by Sensor Type for Section 390102 J2E Test Job



J2F Test Job QC Results

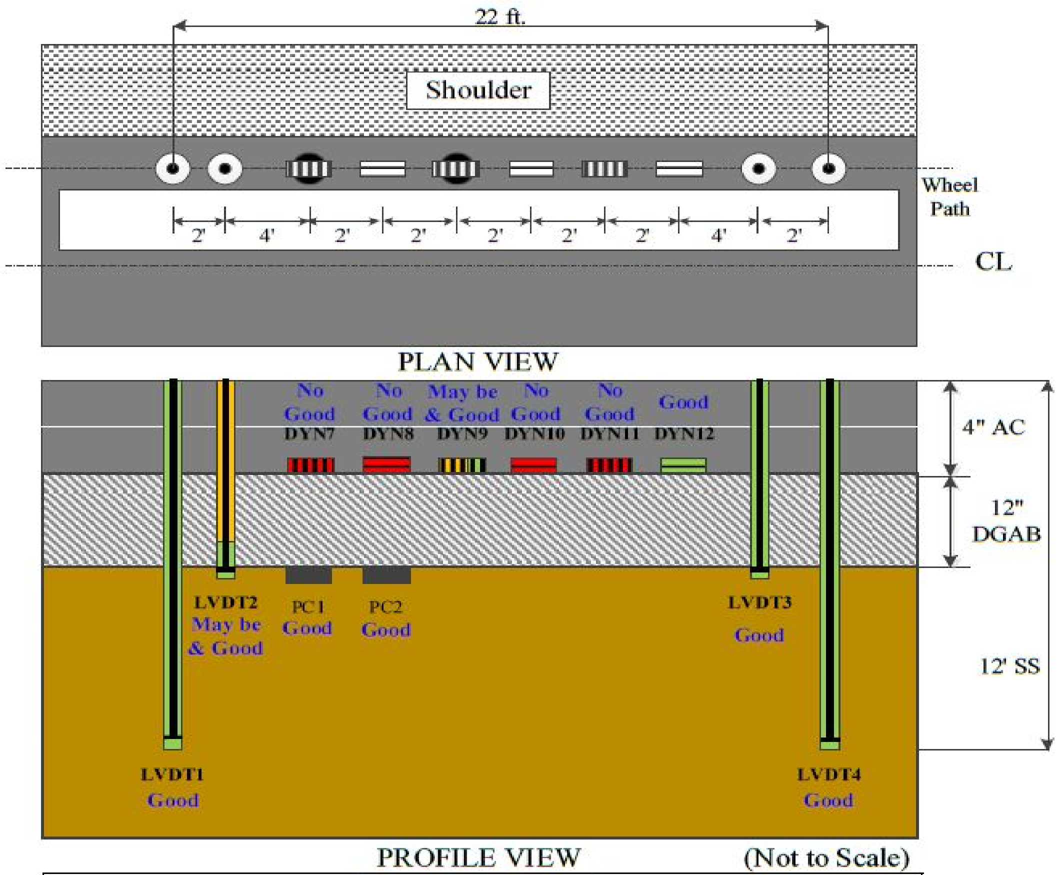
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	1	3	3	1	1	2	1	1	1	1
2	3	3	1	3	3	1	1	1	1	1	1	1
3	3	3	1	3	3	1	1	2	1	1	1	1
4	3	3	1	3	3	1	1	1	1	1	1	1
5	3	3	1	3	3	1	1	2	1	1	1	1
6	3	3	1	3	3	1	1	1	1	1	1	1
7	3	3	1	3	3	1	1	1	1	1	1	1
8	3	3	1	3	3	1	1	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	16**	0	32
LVDT	29	3	0
PC	16	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 16 is the total of eight "1's" under Dyn9 and other eight "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 32: Graphical Representation of QC Results by Sensor Type for Section 390102 J2F Test Job



J2G Test Job QC Results

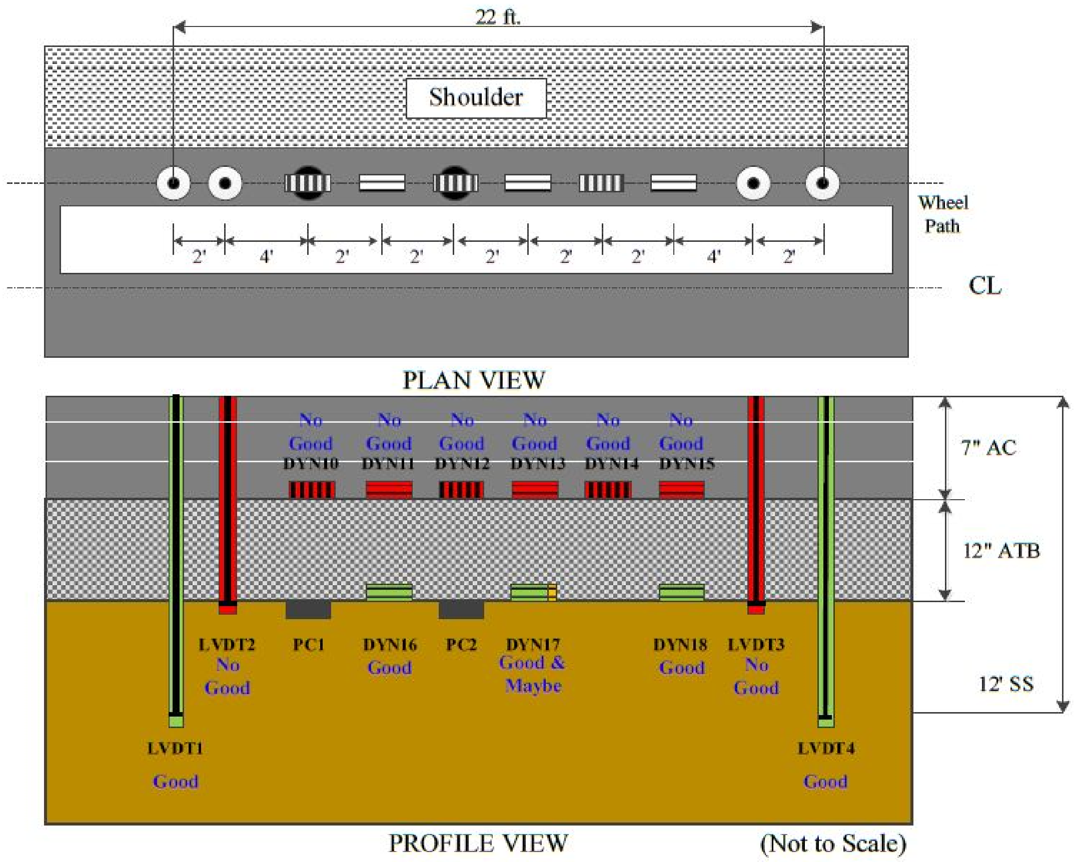
Run #	Dyn7	Dyn8	Dyn9	Dyn10	Dyn11	Dyn12	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	2	3	3	1	1	2	1	1	1	1
2	3	3	2	3	3	1	1	2	1	1	1	1
3	3	3	2	3	3	1	1	2	1	1	1	1
4	3	3	2	3	3	1	1	2	1	1	1	1
5	3	3	2	3	3	1	1	2	1	1	1	1
6	3	3	2	3	3	1	1	1	1	1	1	1
7	3	3	2	3	3	1	1	2	1	1	1	1
8	3	3	1	3	3	1	1	2	1	1	1	1
9	3	3	1	3	3	1	1	2	1	1	1	1
10	3	3	1	3	3	1	1	2	1	1	1	1
11	3	3	1	3	3	1	1	2	1	1	1	1
12	3	3	2	3	3	1	1	1	1	1	1	1

Sensor Type	Good traces*	May be traces*	No Good traces*
Strain gauge	16**	8	48
LVDT	38	10	0
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 16 is the total of four "1's" under Dyn9 and other twelve "1's" under Dyn12.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 33: Graphical Representation of QC Results by Sensor Type for Section 390102 J2G Test Job



J4A Test Job QC Results

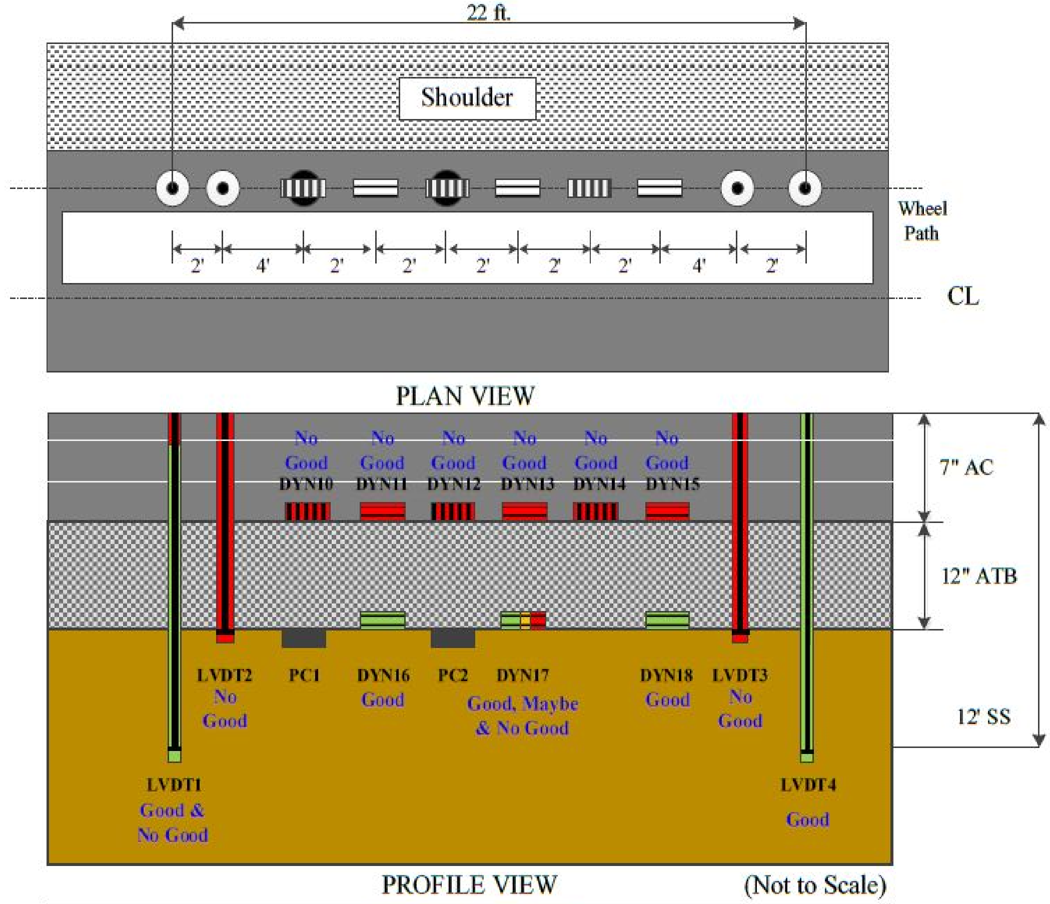
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	3	2	3	2	3	1	1	1	1	2	2	1	1	1
2	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
3	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
4	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
5	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
6	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
7	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
8	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
9	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
10	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
11	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
12	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
13	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
14	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
15	3	3	3	3	3	3	1	2	1	1	2	2	1	1	1
16	3	3	3	3	3	3	1	2	1	1	2	2	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	46**	5	93
LVDT	32	32	0
PC	32	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 46 is the total of sixteen "1's" under Dyn16, fourteen "1's" under Dyn17 and sixteen "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 34: Graphical Representation of QC Results by Sensor Type for Section 390104 J4A Test Job



J4B Test Job QC Results

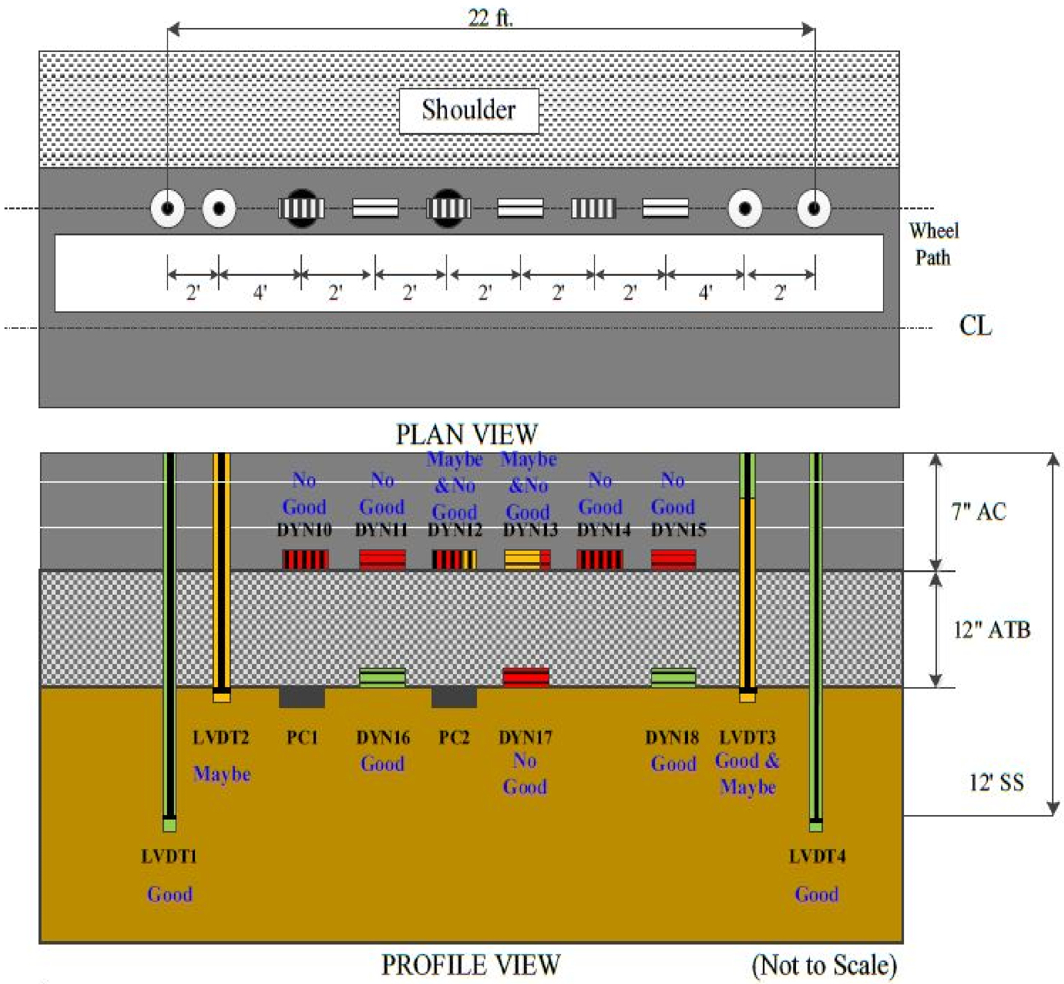
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	3	3	3	2	3	1	1	1	1	2	2	1	1	1
2	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
3	3	3	3	3	3	3	1	2	1	1	2	2	1	1	1
4	3	3	3	3	3	3	1	2	1	1	2	2	1	1	1
5	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
6	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
7	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
8	3	3	3	3	3	3	1	3	2	1	2	2	1	1	1
9	3	3	3	3	3	3	1	1	1	1	2	2	1	1	1
10	3	3	3	3	3	3	1	1	1	3	2	2	1	1	1
11	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
12	3	3	3	3	3	3	1	3	1	1	3	3	1	1	1
13	3	3	3	3	3	3	1	3	1	3	2	2	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	30**	5	82
LVDT	24	24	4
PC	26	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 30 is the total of thirteen "1's" under Dyn16, five "1's" under Dyn17 and twelve "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 35: Graphical Representation of QC Results by Sensor Type for Section 390104 J4B Test Job



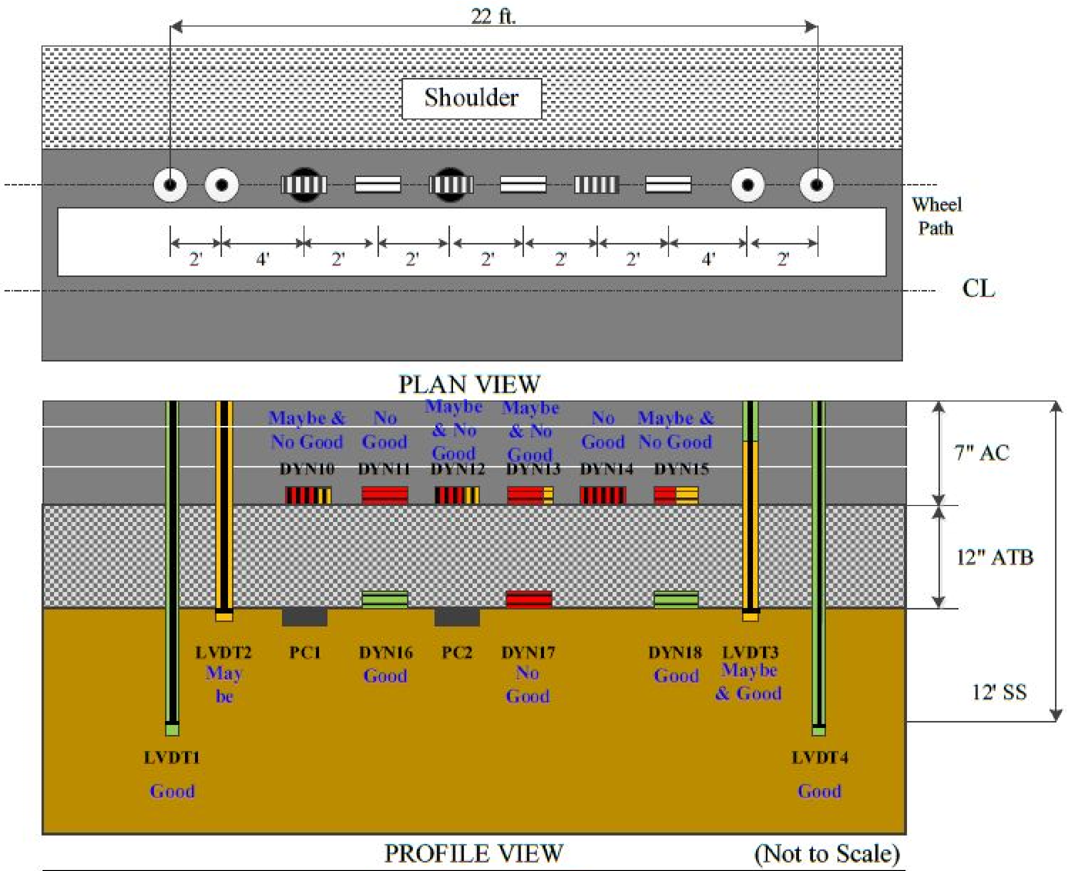
J4C Test Job QC Results																
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	1	3	2	3	2	3	1	3	1	1	2	2	1	1	1
2	3	3	3	2	3	3	1	3	1	1	2	2	1	1	1
3	3	3	3	2	3	3	1	3	1	1	2	2	1	1	1
4	3	3	2	2	3	3	1	3	1	1	2	1	1	1	1
5	3	3	3	2	3	3	1	3	1	1	2	1	1	1	1
6	3	3	3	2	3	3	1	3	1	1	2	2	1	1	1
7	3	3	3	2	3	3	1	3	1	1	2	2	1	1	1
8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	15**	9	48
LVDT	16	12	4
PC	14	0	2

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 15 is the total of one "1" under Dyn10, seven "1's" under Dyn16 and seven "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 36: Graphical Representation of QC Results by Sensor Type for Section 390104 J4CTest Job



J4D Test Job QC Results

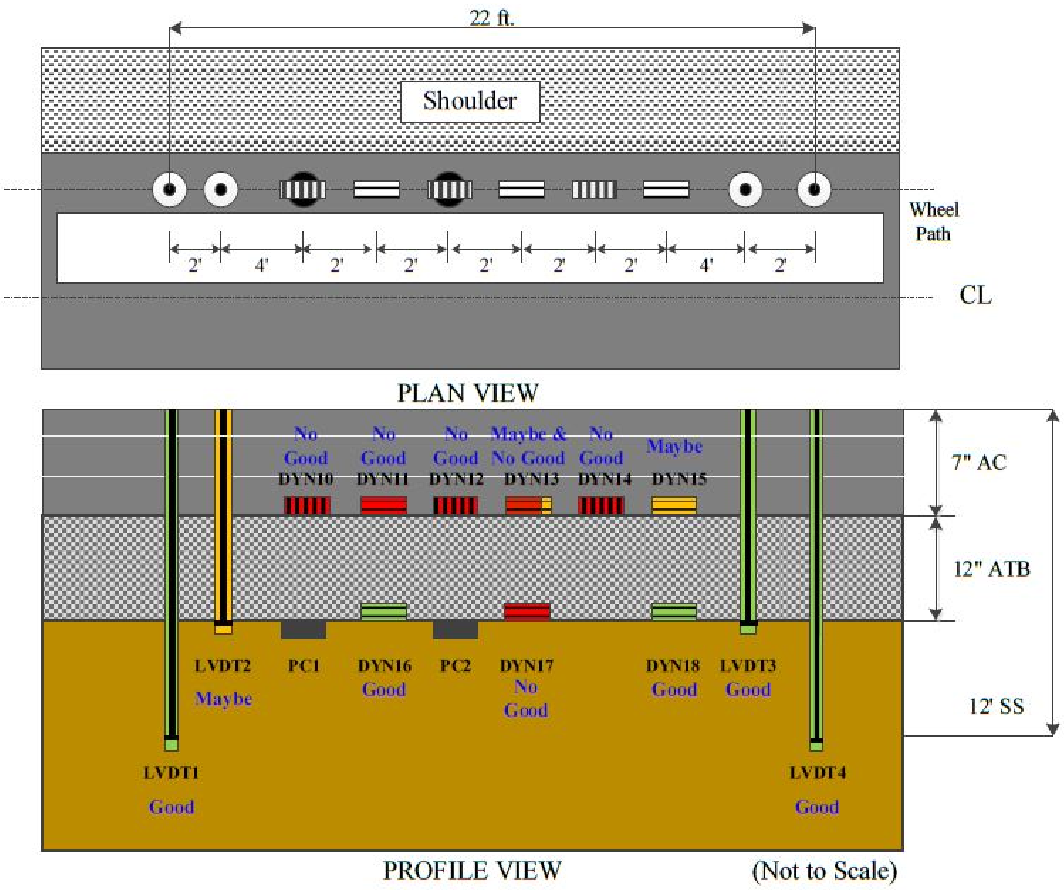
Run #	Dyn10	Dyn 11	Dyn 12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn 18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	2	3	2	1	3	1	1	2	2	1	1	1
2	3	3	3	2	3	2	1	3	1	1	2	2	1	1	1
3	2	3	2	3	2	2	1	3	1	1	2	2	2	1	1
4	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
5	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
6	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
7	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
8	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
9	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
10	2	3	2	3	3	3	1	3	1	1	2	1	1	1	1
11	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
12	3	3	3	3	3	3	1	3	1	3	2	2	1	1	1
13	3	3	3	3	3	3	1	3	1	1	2	1	1	1	1
14	3	3	3	3	3	3	1	3	1	1	2	1	1	1	1
15	3	3	3	3	3	3	1	3	1	1	2	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	30**	15	90
LVDT	32	27	1
PC	30	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 30 is the total of fifteen "1's" under Dyn16, and fifteen "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 37: Graphical Representation of QC Results by Sensor Type for Section 390104 J4D Test Job



J4E Test Job QC Results

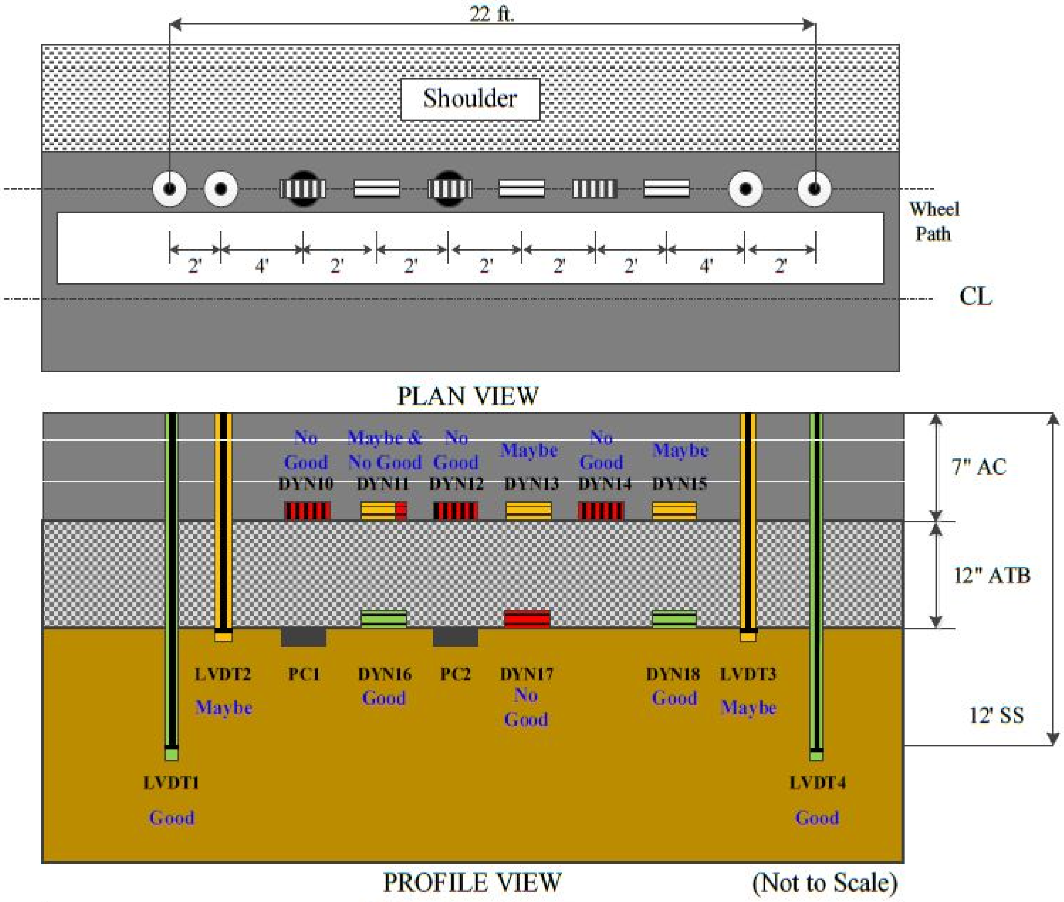
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
2	3	3	3	2	3	2	1	3	1	1	2	1	1	1	1
3	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
4	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
5	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
6	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
7	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
8	3	3	3	2	3	2	1	3	1	1	2	1	1	1	1
9	3	3	3	3	3	2	1	3	1	1	1	1	1	1	1
10	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
11	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
12	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1
13	3	3	3	3	3	2	1	3	1	1	2	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	26**	15	76
LVDT	40	12	0
PC	26	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 26 is the total of thirteen "1's" under Dyn 16, and thirteen "1's" under Dyn 18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 38: Graphical Representation of QC Results by Sensor Type for Section 390104 J4E Test Job



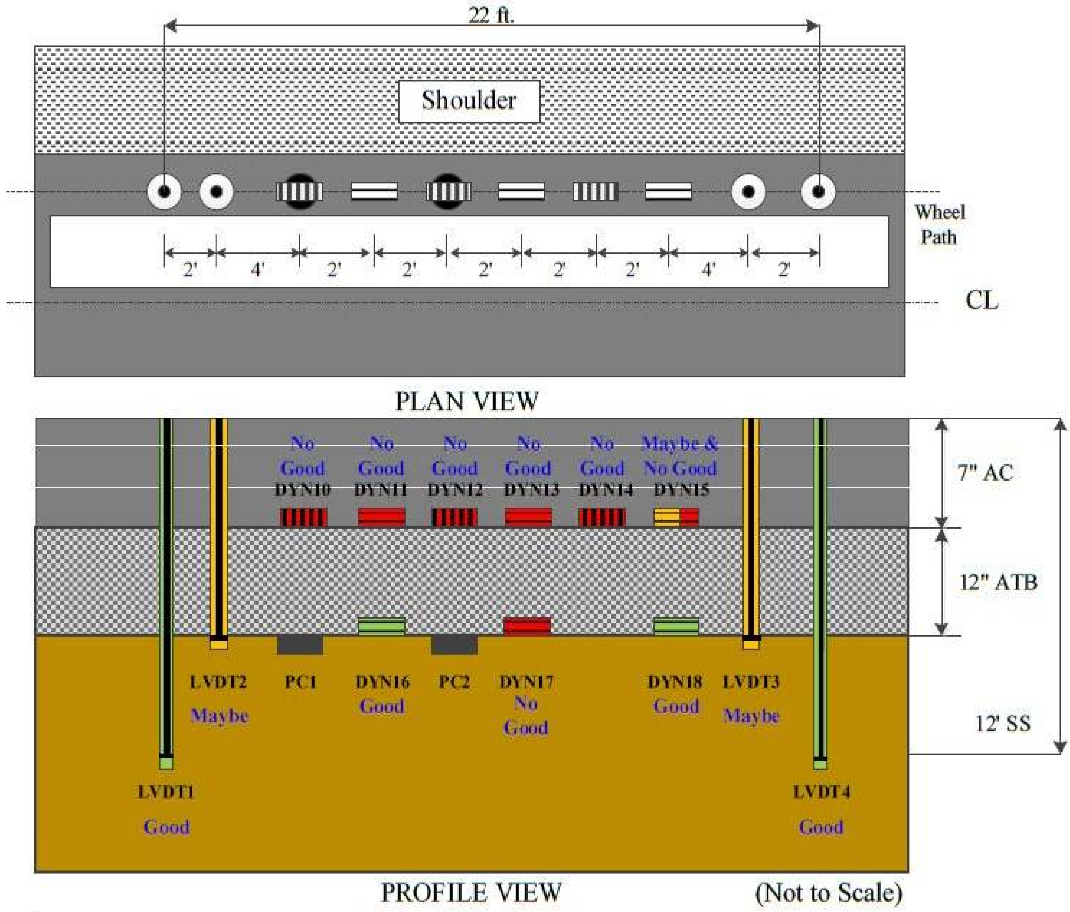
J4F Test Job QC Results															
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
2	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
3	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
4	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
5	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
6	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
7	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
8	3	2	3	2	3	2	1	3	1	1	2	2	1	1	1
9	3	3	3	2	3	2	1	2	1	1	2	2	1	1	1
10	3	3	3	2	3	2	1	3	1	1	2	2	1	1	1
11	3	3	3	2	3	2	1	3	1	1	2	2	1	1	1
12	3	3	3	2	3	2	1	3	1	1	2	2	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	24**	33	51
LVDT	24	24	0
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 24 is the total of twelve "1's" under Dyn16, and twelve "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 39: Graphical Representation of QC Results by Sensor Type for Section 390104 J4F Test Job



J4G Test Job QC Results

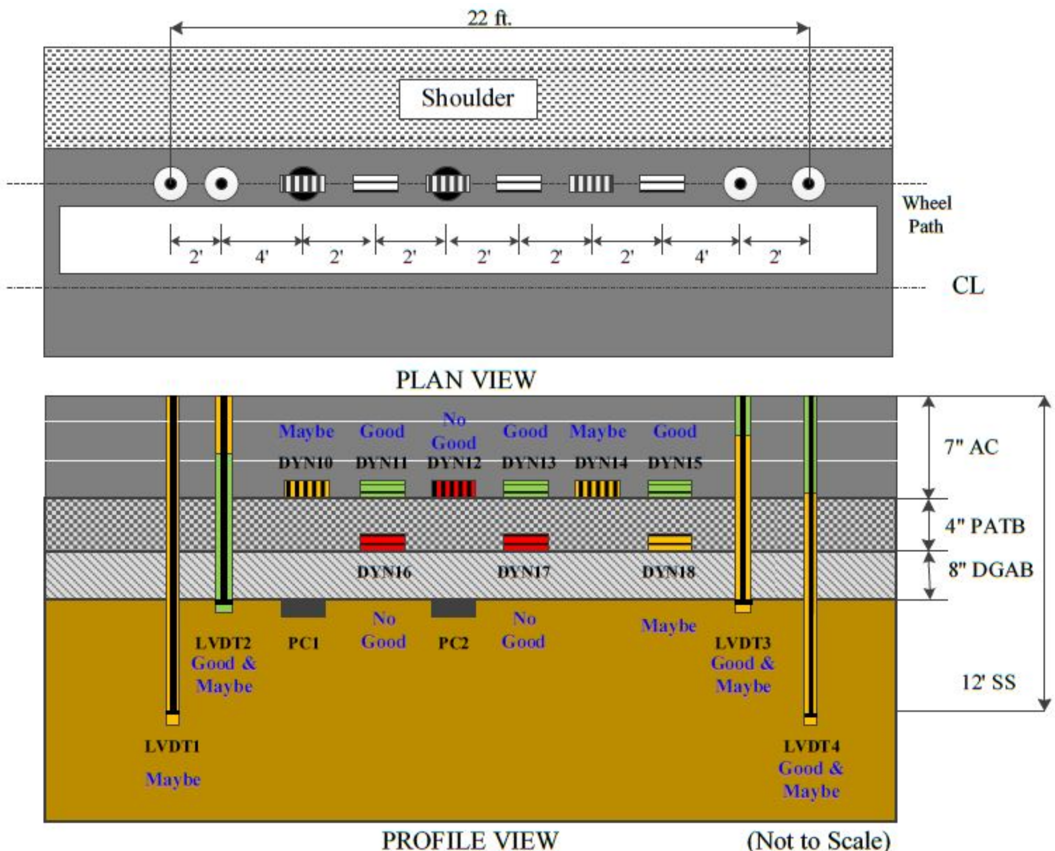
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
2	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
3	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
4	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
5	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
6	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
7	3	3	3	3	3	2	1	3	1	1	2	2	1	1	1
8	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
9	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
10	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
11	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1
12	3	3	3	3	3	3	1	3	1	1	2	2	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	24**	7	77
LVDT	24	24	0
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 24 is the total of twelve "1's" under Dyn16, and twelve "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 40: Graphical Representation of QC Results by Sensor Type for Section 390104 J4G Test Job



J8A Test Job QC Results

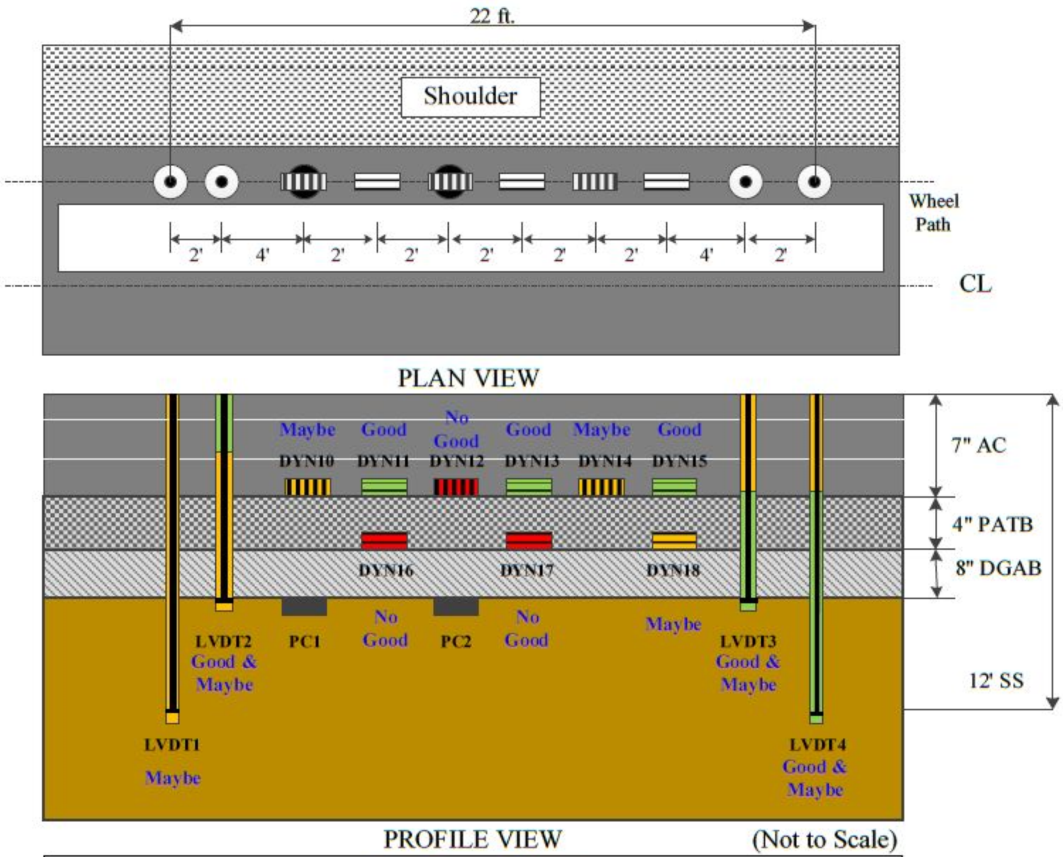
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	1	3	1	2	1	3	3	2	2	1	2	1	1	1
2	2	1	3	1	2	1	3	3	2	2	1	2	2	1	1
3	2	1	3	1	2	1	3	3	2	2	1	2	2	1	1
4	2	1	3	1	2	1	3	3	2	2	1	2	1	1	1
5	2	1	3	1	2	1	3	3	2	2	1	2	2	2	1
6	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
7	2	1	3	1	2	1	3	3	2	2	1	2	1	1	1
8	2	1	3	1	2	1	3	3	2	2	2	2	1	1	1
9	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
10	2	1	3	1	2	1	3	3	2	2	1	2	1	1	1
11	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
12	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
13	2	1	3	1	2	1	3	3	2	1	1	1	1	1	1
14	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
15	2	1	3	1	2	1	3	3	2	2	1	2	2	1	1
16	2	1	3	1	2	1	3	3	2	2	1	2	2	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	48**	48	48
LVDT	21	43	0
PC	31	1	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 48 is the total of sixteen "1's" under Dyn11, sixteen "1's" under Dyn13 and sixteen "1's" under Dyn15.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 41: Graphical Representation of QC Results by Sensor Type for Section 390108 J8A Test Job



J8D Test Job QC Results

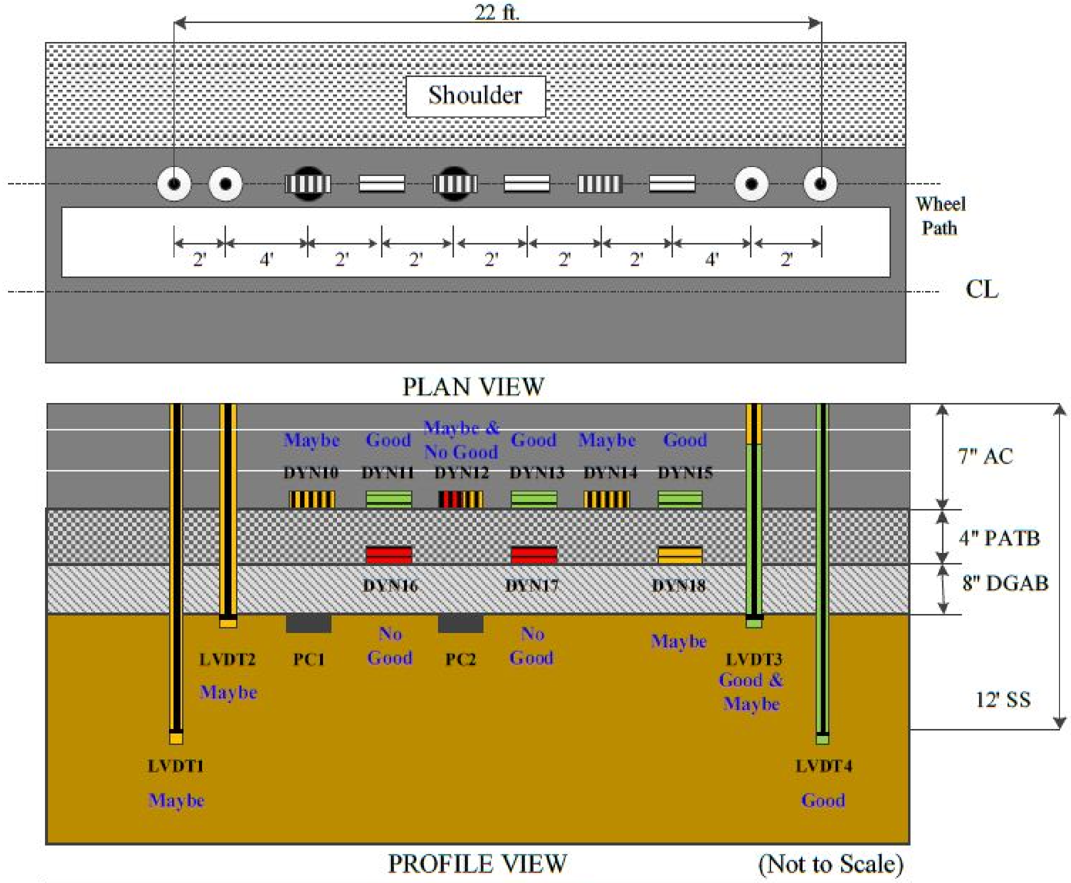
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	1	3	1	2	1	3	3	2	2	1	2	2	1	1
2	2	1	3	1	2	1	3	3	2	2	1	2	1	1	1
3	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
4	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
5	2	1	3	1	2	1	3	3	2	2	2	2	1	1	1
6	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
7	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
8	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
9	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
10	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
11	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
12	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
13	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
14	2	1	3	1	2	1	3	3	2	2	2	2	2	1	1
15	2	1	3	1	2	1	3	3	2	2	2	2	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	45**	45	45
LVDT	22	38	0
PC	30	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 45 is the total of fifteen "1's" under Dyn11, fifteen "1's" under Dyn13 and fifteen "1's" under Dyn15.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 42: Graphical Representation of QC Results by Sensor Type for Section 390108 J8D Test Job



J8E Test Job QC Results

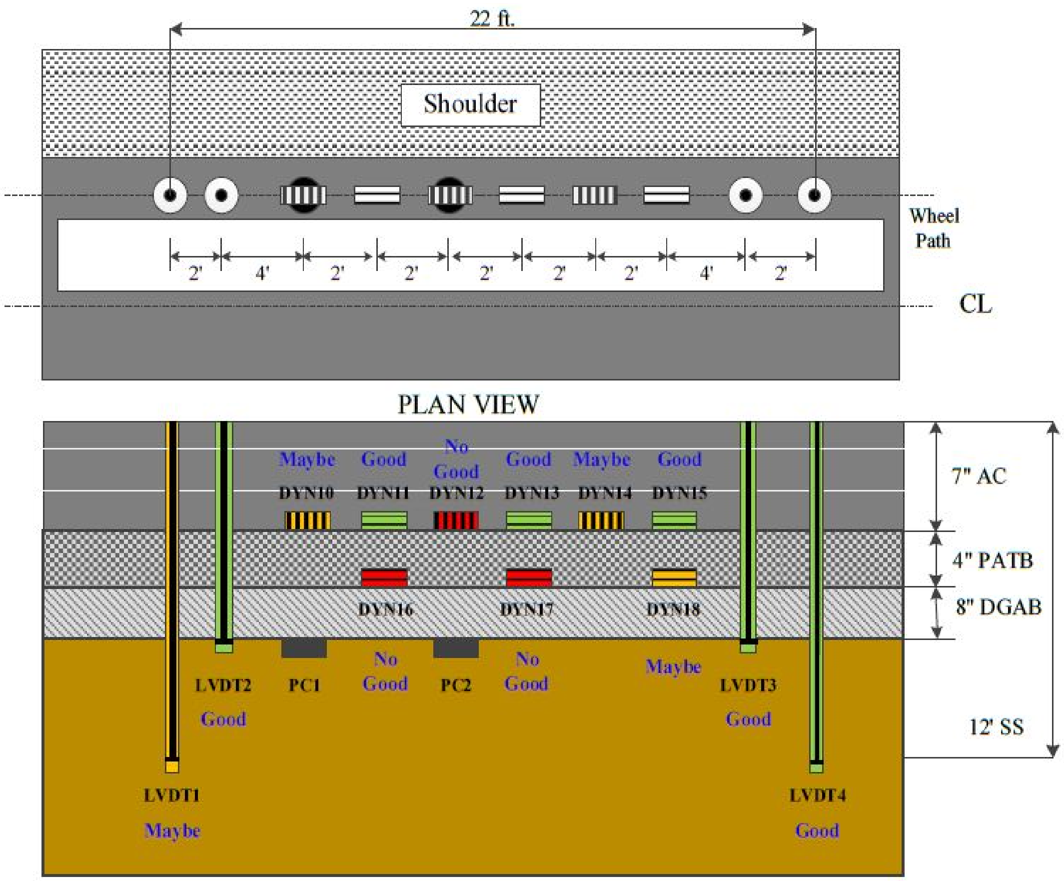
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	1	2	1	2	1	3	3	2	2	2	2	1	1	1
2	2	1	2	1	2	1	3	3	2	2	2	2	1	1	1
3	2	1	2	1	2	1	3	3	2	2	2	1	1	1	1
4	2	1	2	1	2	1	3	3	2	2	2	1	1	1	1
5	2	1	2	1	2	1	3	3	2	2	2	1	1	1	1
6	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
7	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
8	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
9	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
10	2	1	3	1	2	1	3	3	2	2	2	2	1	1	1
11	2	1	3	1	2	1	3	3	2	2	2	1	1	1	1
12	2	1	3	1	2	1	3	3	2	2	2	2	1	1	1
13	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	39**	44	34
LVDT	23	29	0
PC	26	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 39 is the total of thirteen "1's" under Dyn11, thirteen "1's" under Dyn13 and thirteen "1's" under Dyn15.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 43: Graphical Representation of QC Results by Sensor Type for Section 390108 J8E Test Job



PROFILE VIEW (Not to Scale)

J8G Test Job QC Results

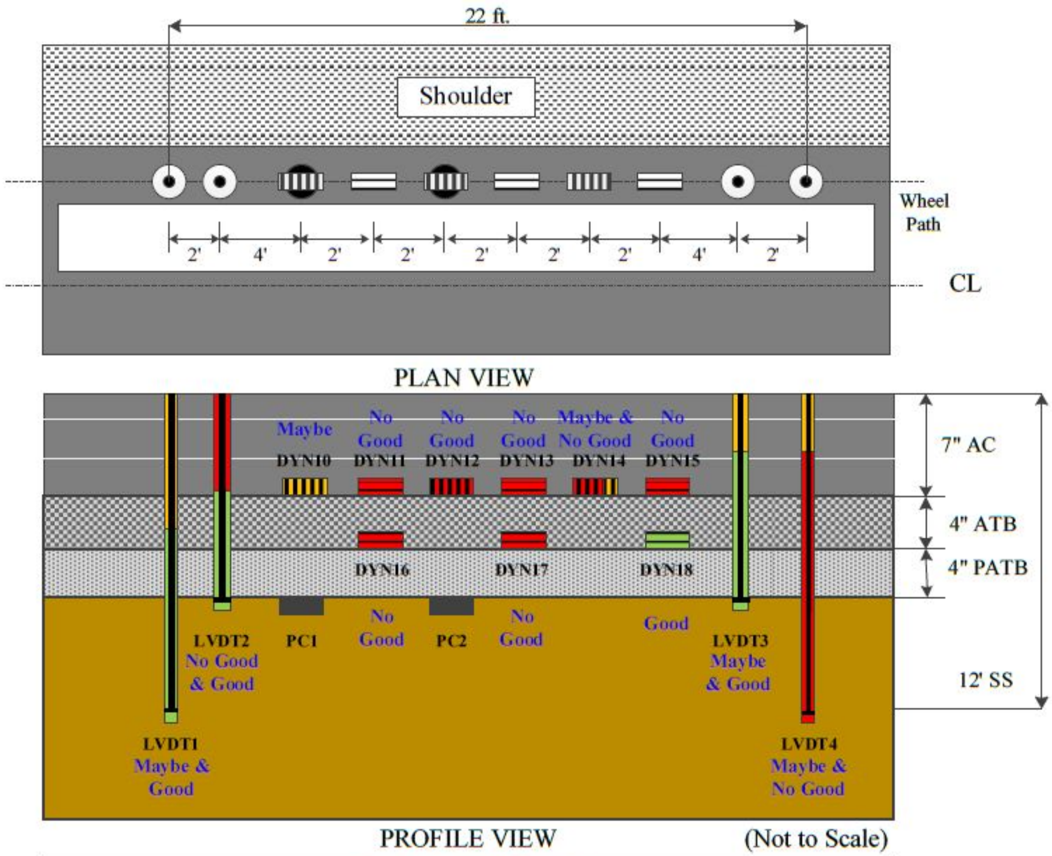
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	1	2	1	2	1	3	3	2	2	1	1	1	1	1
2	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
3	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
4	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
5	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
6	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
7	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
8	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
9	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
10	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
11	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1
12	2	1	3	1	2	1	3	3	2	2	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	36**	37	35
LVDT	36	12	0
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 36 is the total of twelve "1's" under Dyn11, twelve "1's" under Dyn13 and twelve "1's" under Dyn15.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 44: Graphical Representation of QC Results by Sensor Type for SPS-1 J8G Test Job



J10A Test Job QC Results

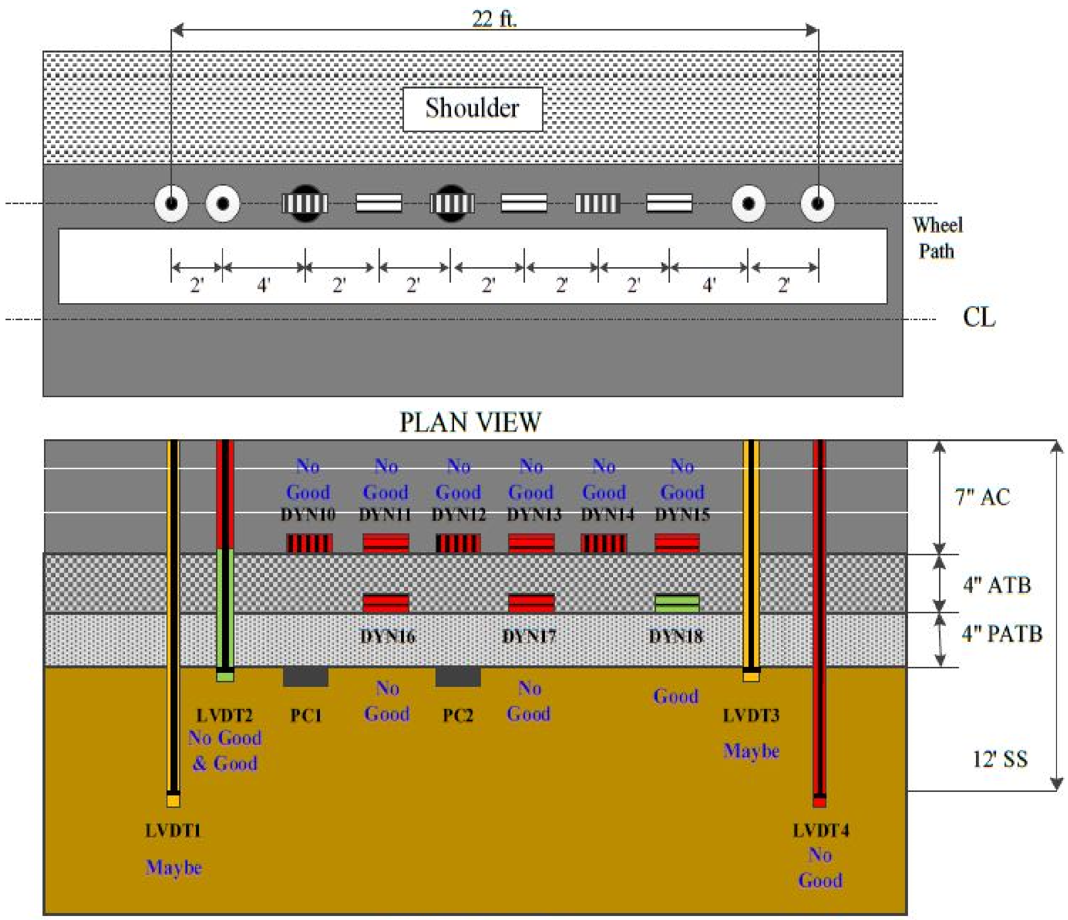
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
2	2	3	3	3	3	3	3	3	1	2	3	1	3	1	1
3	2	3	3	3	2	3	3	3	1	2	3	2	3	1	1
4	3	3	3	3	3	3	3	3	1	2	3	1	3	1	1
5	3	3	3	3	3	3	3	3	1	1	3	1	3	1	1
6	2	3	3	3	3	3	3	3	1	1	1	1	3	1	1
7	3	3	3	3	3	3	3	3	1	1	1	1	3	1	1
8	3	3	3	3	2	3	3	3	1	2	1	1	3	1	1
9	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
10	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
11	3	3	3	3	3	3	3	3	1	2	1	1	3	1	1
12	3	3	3	3	3	3	3	3	1	1	3	1	2	1	1
13	3	3	3	3	3	3	3	3	1	1	3	1	2	1	1
14	3	3	3	3	3	3	3	3	1	1	3	1	2	1	1
15	3	3	3	3	3	3	3	3	1	1	3	1	2	1	1
16	3	3	3	3	3	3	3	3	1	1	3	1	2	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	15**	5	115
LVDT	26	15	19
PC	30	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 15 is the total of fifteen "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 45: Graphical Representation of QC Results by Sensor Type for Section 390110 J10A Test Job



PROFILE VIEW (Not to Scale)

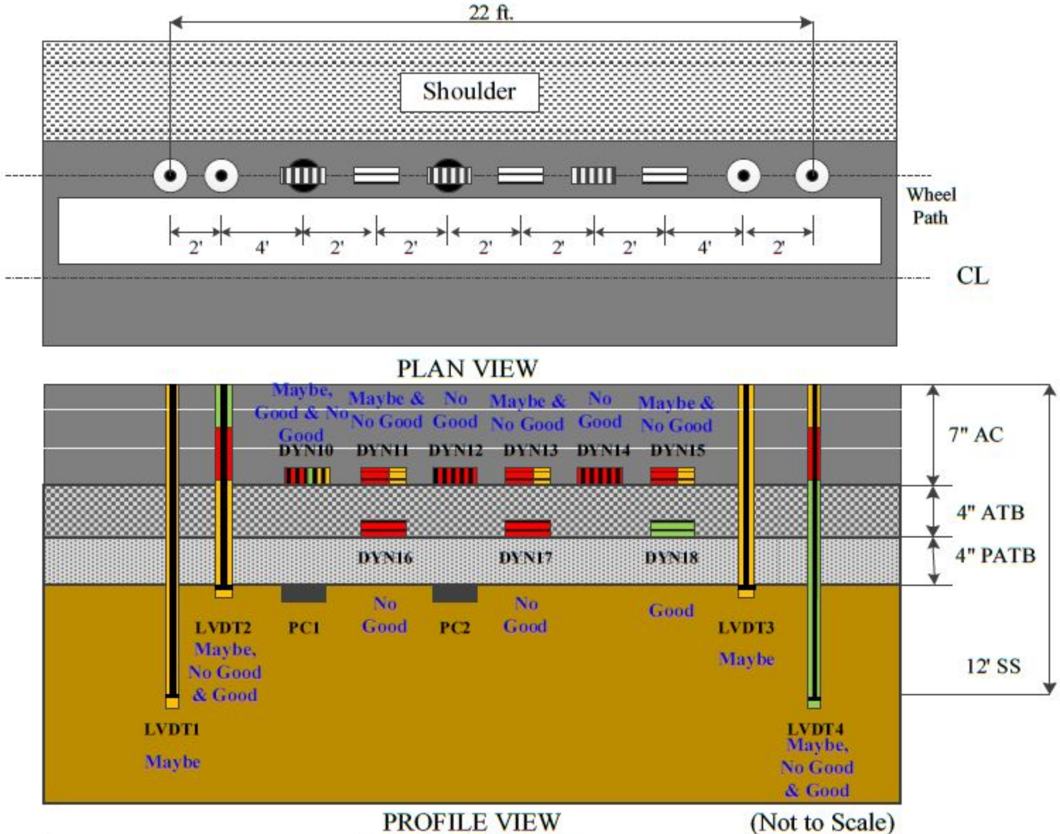
J10C Test Job QC Results															
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	3	3	3	3	3	1	3	3	3	3	1	1
2	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
3	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
4	3	3	3	3	3	3	3	3	1	2	3	2	3	1	1
5	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
6	3	3	3	3	3	3	3	3	1	2	3	2	3	1	1
7	3	3	3	3	3	3	3	3	1	2	2	2	3	1	1
8	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
9	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1
10	3	3	3	3	3	3	3	3	1	2	1	2	3	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	10**	0	80
LVDT	6	9	15
PC	20	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 10 is the total of ten "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 46: Graphical Representation of QC Results by Sensor Type for Section 390110 J10C Test Job



J10D Test Job QC Results

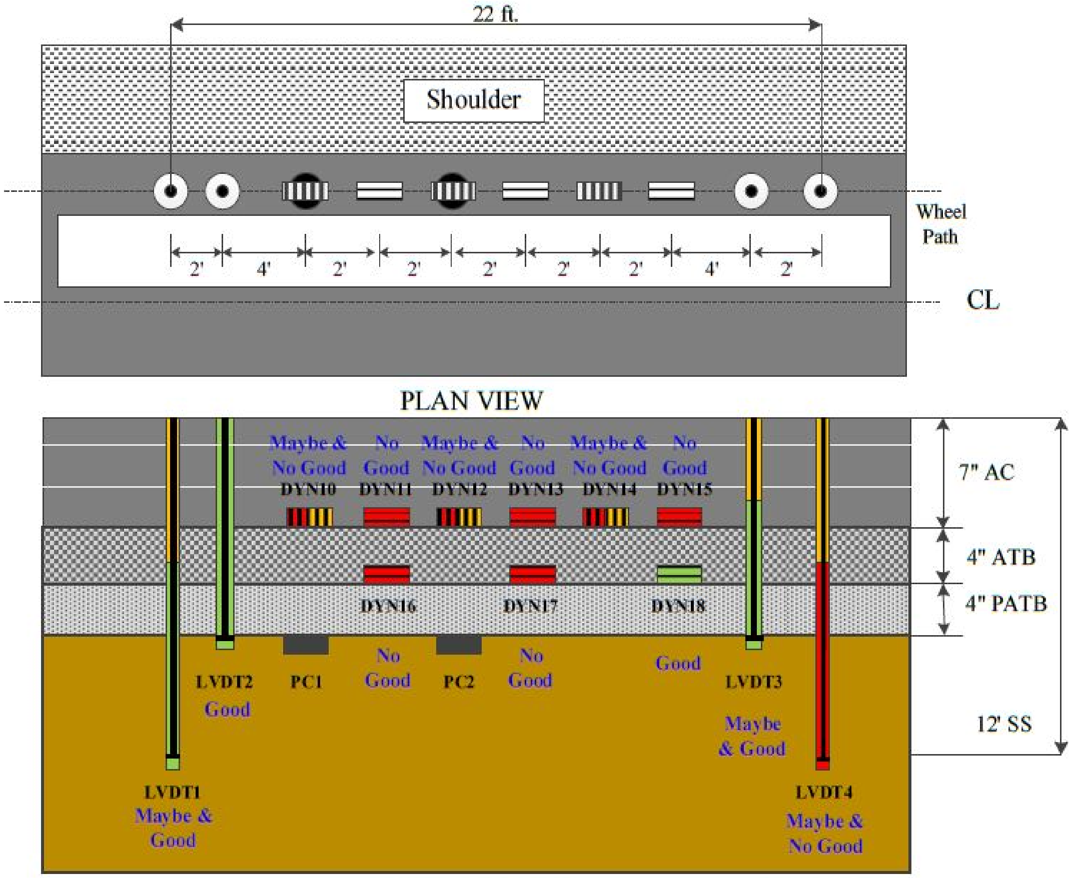
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	1	2	2	2	3	2	3	3	1	2	2	2	1	1	1
2	1	2	2	2	3	2	3	3	1	2	2	2	2	1	1
3	3	2	3	2	3	2	3	3	1	2	3	2	1	1	1
4	1	2	3	2	3	2	3	3	1	2	3	2	1	1	1
5	2	2	3	2	3	2	3	3	1	2	3	2	3	1	1
6	2	3	3	2	3	2	3	3	1	2	3	2	2	1	1
7	3	3	3	3	3	3	3	3	1	2	2	1	1	1	1
8	3	3	3	3	3	3	3	3	1	2	1	2	1	1	1
9	3	3	3	3	3	3	3	3	1	2	1	2	1	1	1
10	3	3	3	3	3	3	3	3	1	2	2	2	1	1	1
11	3	3	3	3	3	3	3	3	1	2	1	2	1	1	1
12	3	3	3	3	3	3	3	3	1	2	2	2	1	1	1
13	3	3	3	3	3	3	3	3	1	2	2	2	3	1	1
14	3	3	3	3	3	3	3	3	1	2	2	2	3	1	1
15	3	3	3	3	3	3	3	3	1	2	2	2	2	1	1
16	3	3	3	3	3	3	3	3	1	2	2	2	3	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	19**	21	104
LVDT	13	43	8
PC	32	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 19 is the total of three "1's" under Dyn10, and sixteen "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 47: Graphical Representation of QC Results by Sensor Type for Section 390110 J10D Test Job



PROFILE VIEW (Not to Scale)

J10E Test Job QC Results

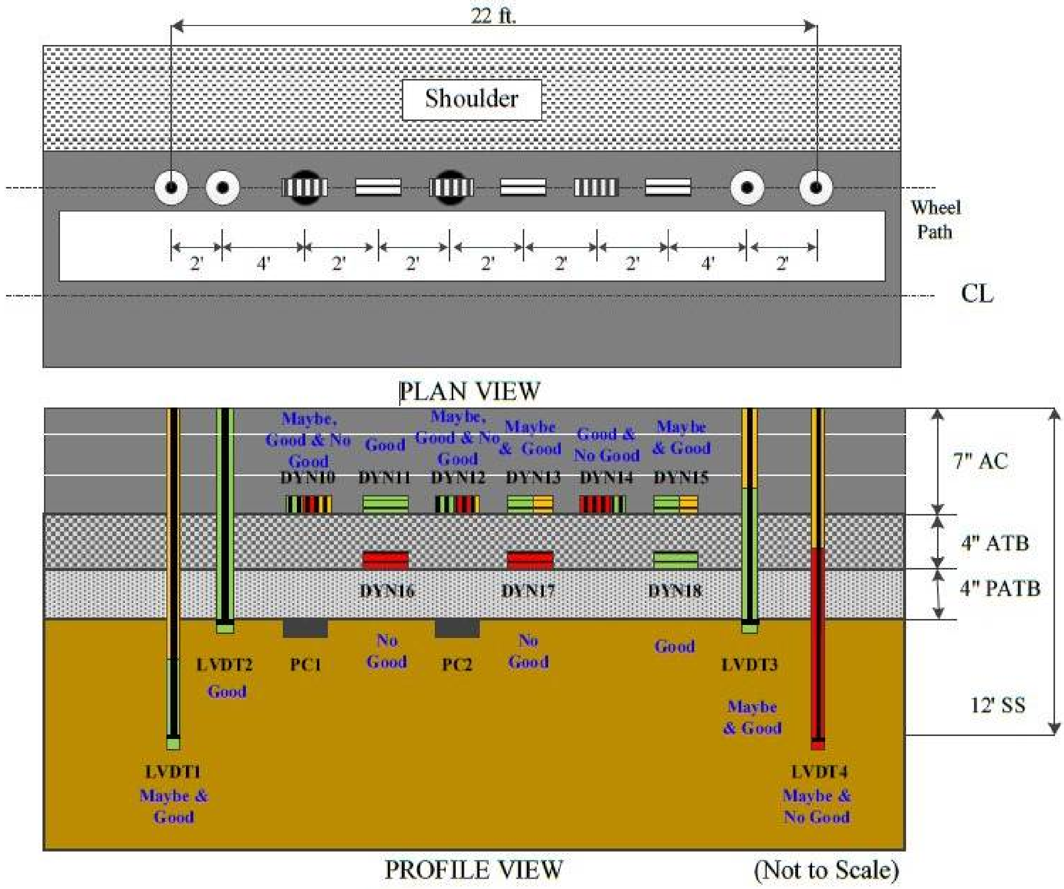
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	3	3	3	3	3	3	3	3	1	2	1	2	2	1	1
2	2	3	2	3	2	3	3	3	1	2	1	1	3	1	1
3	2	3	2	3	2	3	3	3	1	1	1	1	3	1	1
4	2	3	2	3	2	3	3	3	1	1	1	1	3	1	1
5	3	3	3	3	3	3	3	3	1	2	1	2	2	1	1
6	3	3	3	3	3	3	3	3	1	2	1	1	2	1	1
7	2	3	2	3	2	3	3	3	1	1	1	1	3	1	1
8	3	3	3	3	3	3	3	3	1	2	1	1	2	1	1
9	3	3	3	3	3	3	3	3	1	2	1	2	2	1	1
10	2	3	3	3	2	3	3	3	1	1	1	1	3	1	1
11	3	3	3	3	3	3	3	3	1	1	1	1	2	1	1
12	2	3	2	3	2	3	3	3	1	1	1	1	3	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	12**	17	79
LVDT	27	15	6
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 12 is the total of twelve "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 48: Graphical Representation of QC Results by Sensor Type for Section 390110 J10E Test Job



J10F Test Job QC Results

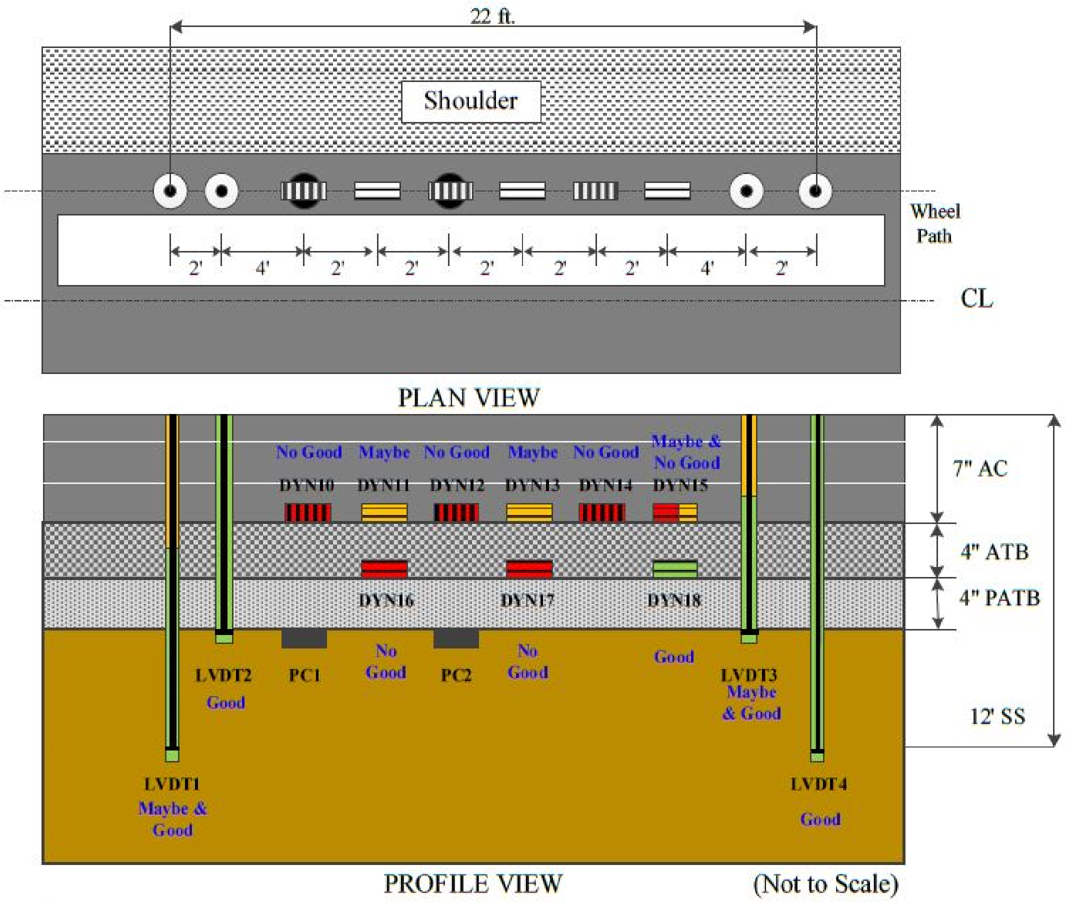
Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	1	2	1	2	1	3	3	1	2	1	2	3	1	1
2	1	1	1	1	1	1	3	3	1	2	1	2	3	1	1
3	1	1	1	1	1	1	3	3	1	2	1	2	3	1	1
4	1	1	1	1	1	1	3	3	1	2	1	1	3	1	1
5	1	1	1	1	3	1	3	3	1	2	1	1	2	1	1
6	1	1	1	1	3	1	3	3	1	2	1	2	2	1	1
7	3	1	3	1	3	1	3	3	1	1	1	2	3	1	1
8	1	1	1	1	3	1	3	3	1	2	1	1	1	1	1
9	2	1	3	1	3	1	3	3	1	2	1	1	1	1	1
10	3	1	3	2	3	1	3	3	1	1	1	1	1	1	1
11	1	1	2	2	3	2	3	3	1	2	1	1	1	1	1
12	3	1	3	2	3	2	3	3	1	1	1	1	1	1	1
13	3	1	3	2	3	2	3	3	1	1	1	1	1	1	1

Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	61**	12	44
LVDT	31	16	5
PC	26	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 61 is the total of seven "1's" under Dyn10, thirteen "1's" under Dyn11, six "1's" under Dyn12, nine "1's" under Dyn13, three "1's" under Dyn14, ten "1's" under Dyn15 and thireen "1's" under Dyn18.

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 49: Graphical Representation of QC Results by Sensor Type for Section 390110 J10F Test Job



J10G Test Job QC Results

Run #	Dyn10	Dyn11	Dyn12	Dyn13	Dyn14	Dyn15	Dyn16	Dyn17	Dyn18	LVDT1	LVDT2	LVDT3	LVDT4	PC1	PC2
1	2	2	3	2	3	2	3	3	1	2	1	2	1	1	1
2	3	2	3	2	3	2	3	3	1	2	1	2	2	1	1
3	3	2	3	2	3	2	3	3	1	2	1	1	1	1	1
4	3	2	3	2	3	2	3	3	1	2	1	2	1	1	1
5	3	2	3	2	3	2	3	3	1	2	1	2	1	1	1
6	3	2	3	2	3	2	3	3	1	2	1	1	1	1	1
7	3	2	3	2	3	2	3	3	1	1	1	2	1	1	1
8	3	2	3	2	3	2	3	3	1	1	1	1	1	1	1
9	3	2	3	2	3	2	3	3	1	1	1	1	1	1	1
10	3	2	3	2	3	3	3	3	1	1	1	1	1	1	1
11	3	2	3	2	3	3	3	3	1	1	1	1	1	1	1
12	3	2	3	2	3	3	3	3	1	1	1	1	1	1	1

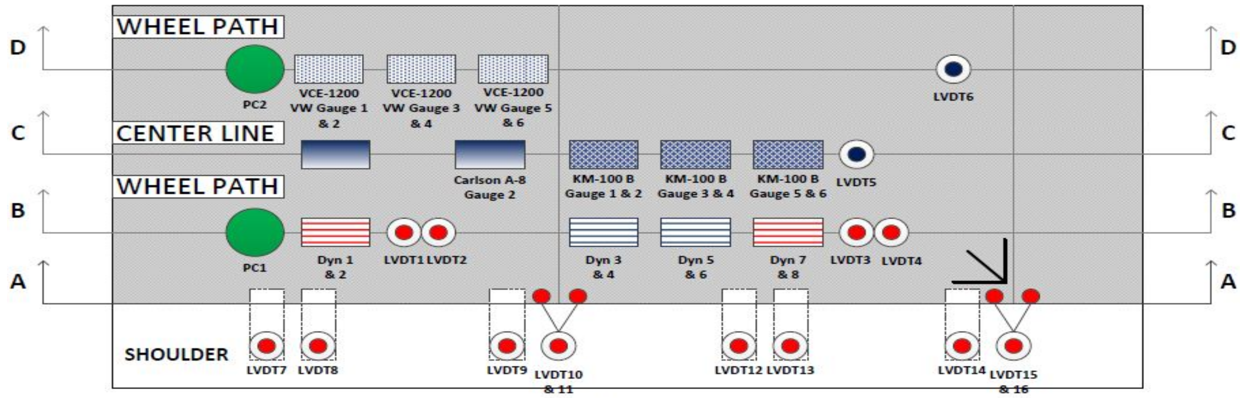
Sensor type	Good traces*	May be traces*	No Good traces*
Strain gauge	12**	34	62
LVDT	36	12	0
PC	24	0	0

Note: Numbers 1, 2, & 3 under each sensor (not from run #) in the above table represent 1: Good, 2: Maybe, and 3: No Good respectively. *: shows summarized trace counts for good, may be, and no good traces from the above table for each sensor type. **: 12 is the total of twelve "1's" under Dyn18.

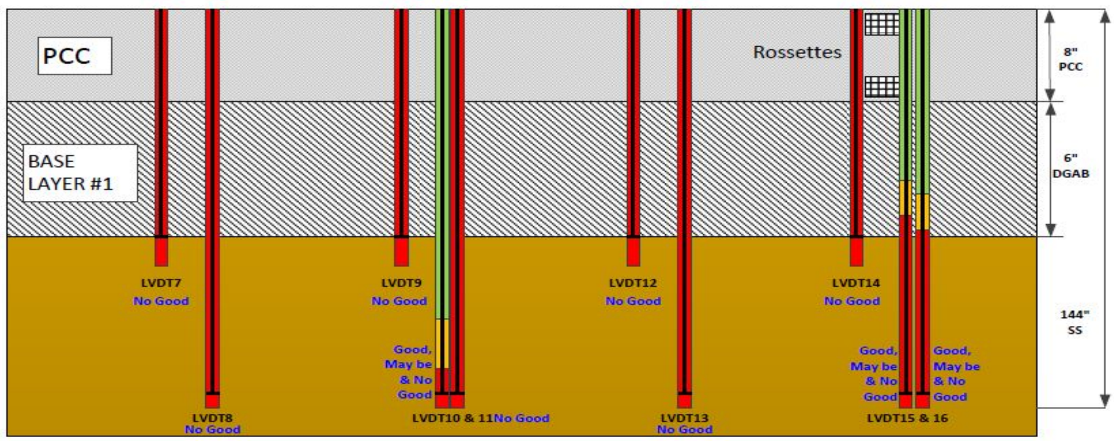
Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 50: Graphical Representation of QC Results by Sensor Type for Section 390110 J10G Test Job

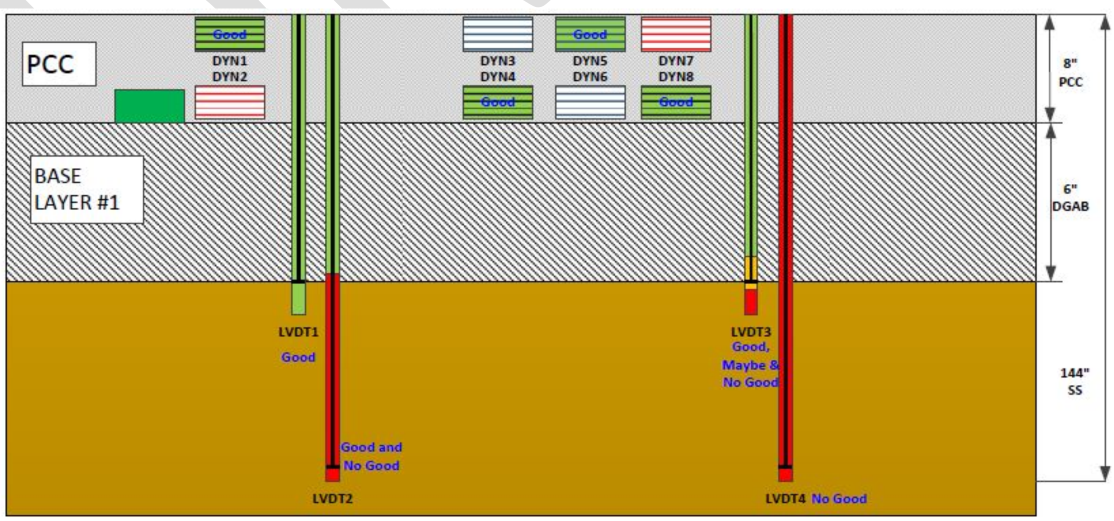
APPENDIX C: Sensor Layout in the Ohio SPS-2 DLR Sections



PLAN VIEW

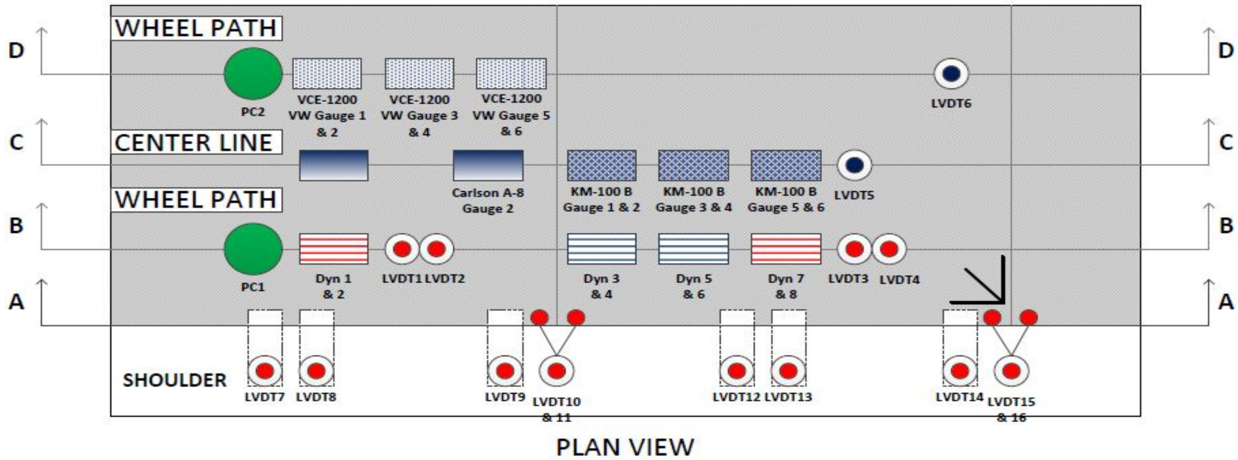


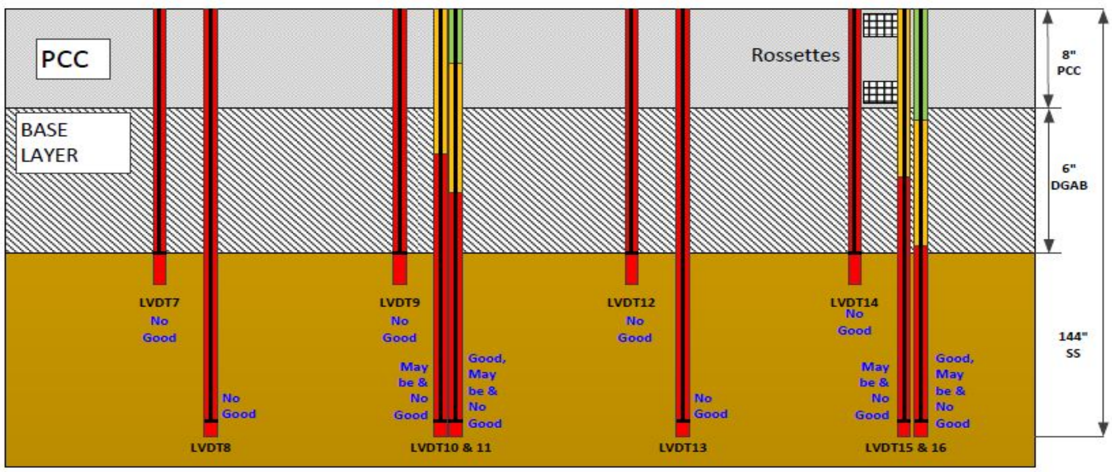
J1A Profile View Section A-A (Not to Scale)



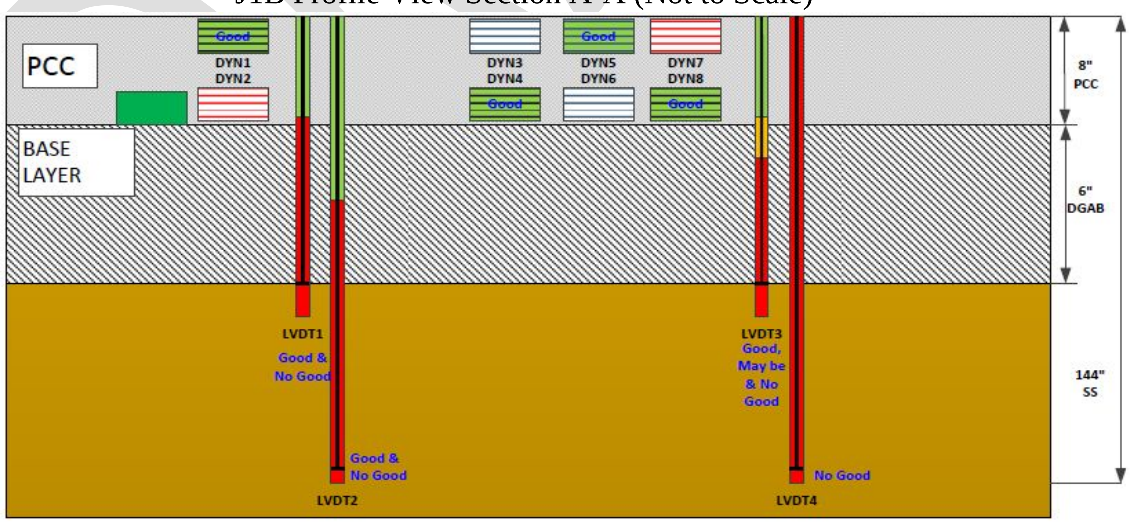
J1A Profile View Section B-B (Not to Scale)

Figure 51: Graphical Representation of QC Results by Sensor Type for Section 390201 J1A Test Job





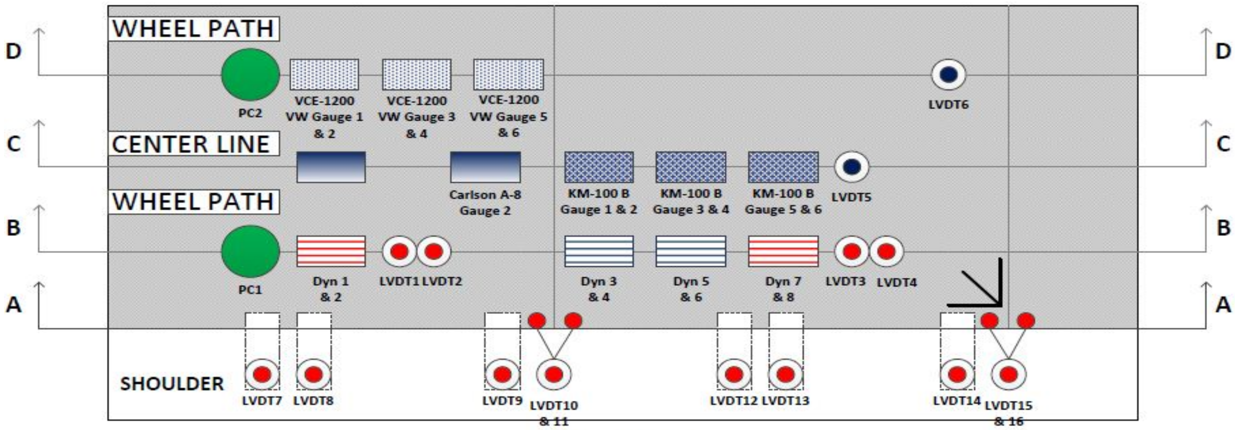
J1B Profile View Section A-A (Not to Scale)



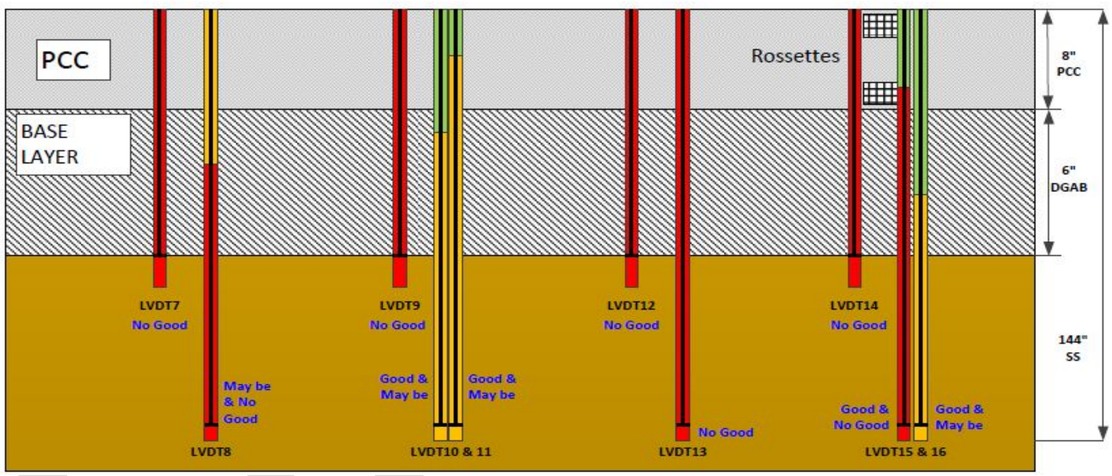
J1B Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

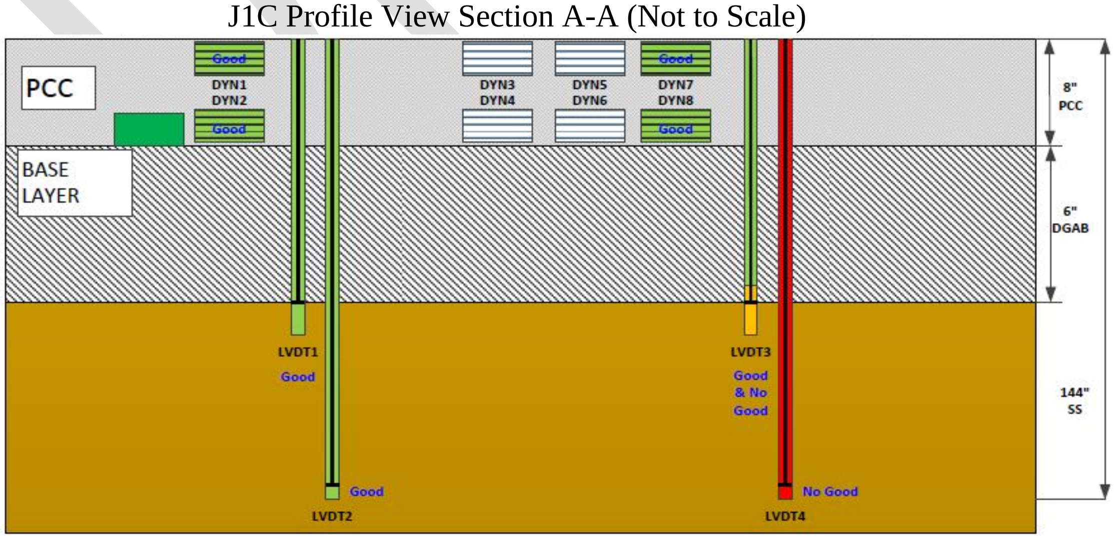
Figure 52: Graphical Representation of QC Results by Sensor Type for Section 390201 J1B Test Job



PLAN VIEW



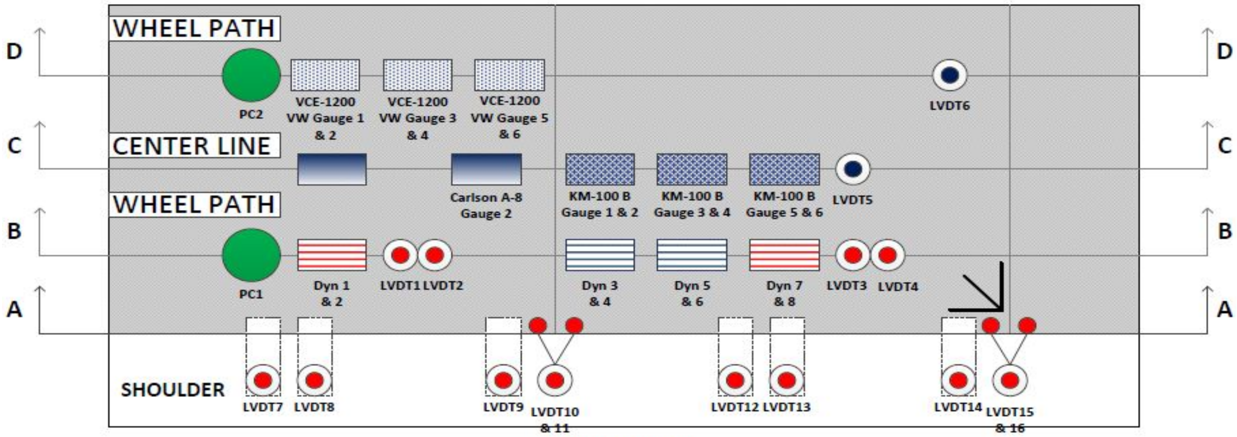
J1C Profile View Section A-A (Not to Scale)



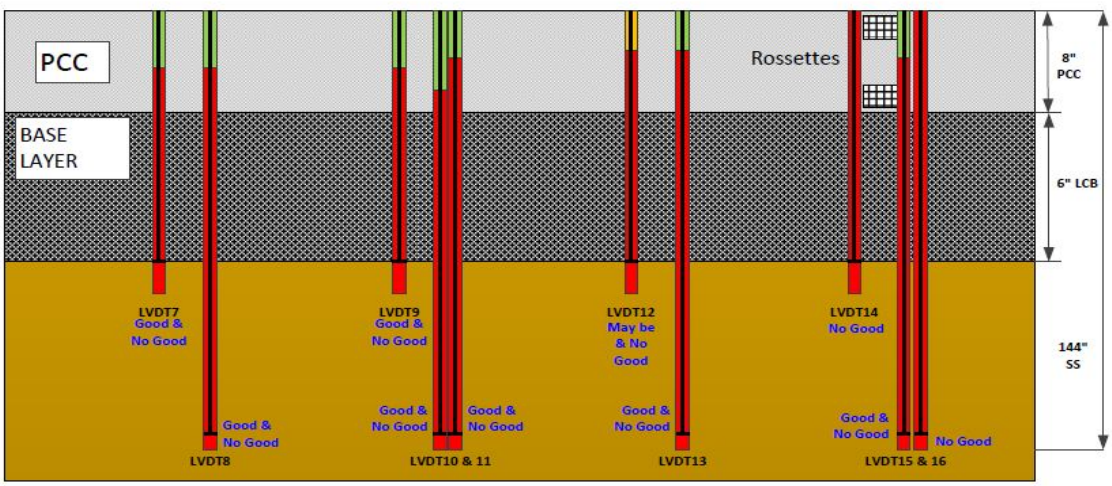
J1C Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

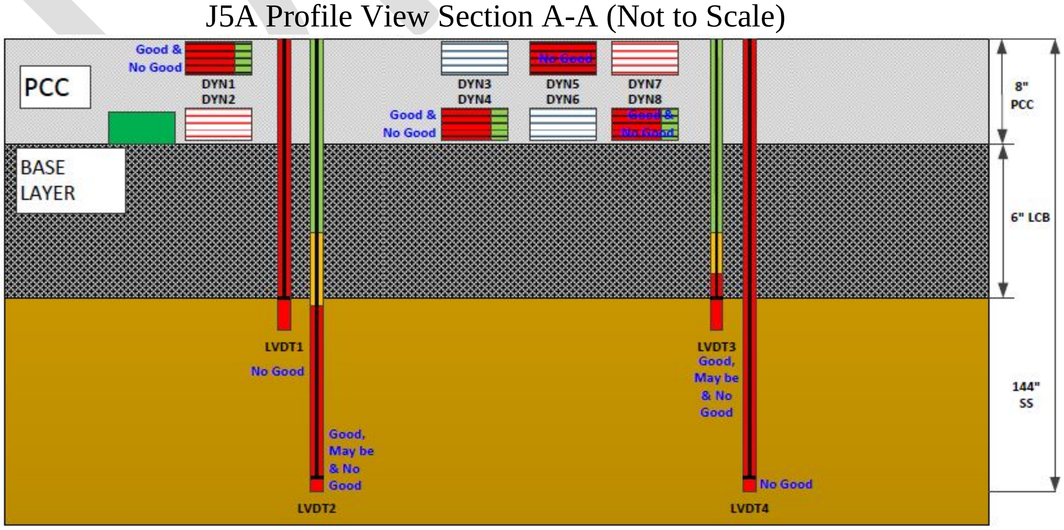
Figure 53: Graphical Representation of QC Results by Sensor Type for Section 390201 J1C Test Job



PLAN VIEW



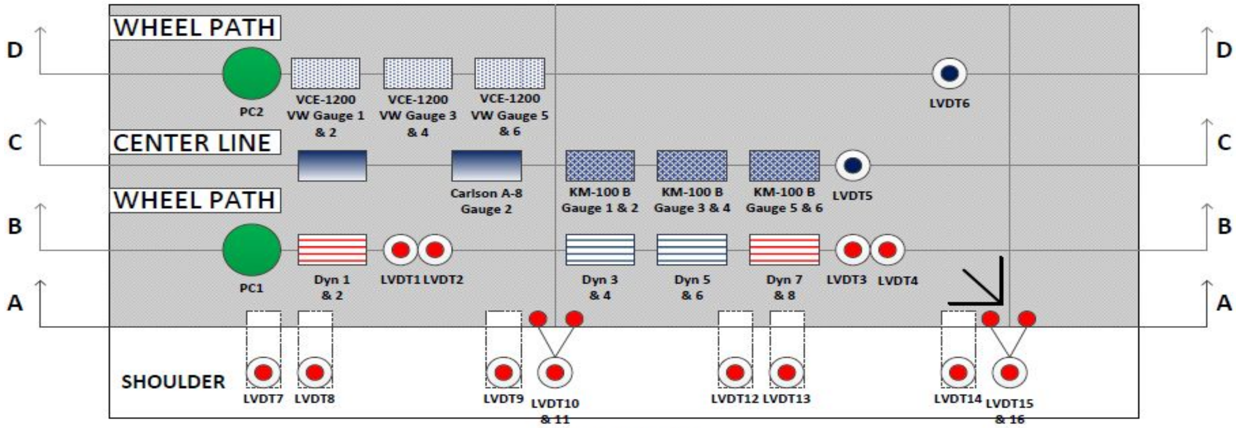
J5A Profile View Section A-A (Not to Scale)



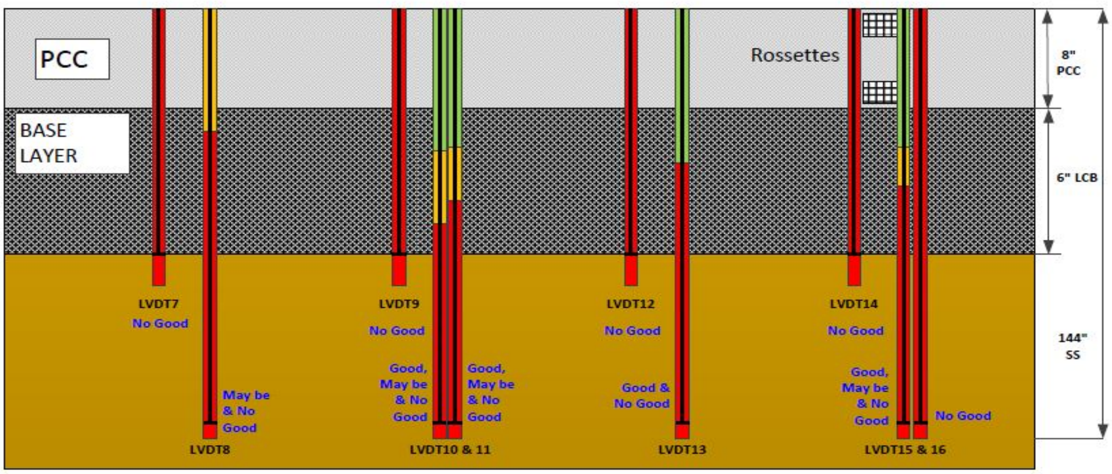
J5A Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

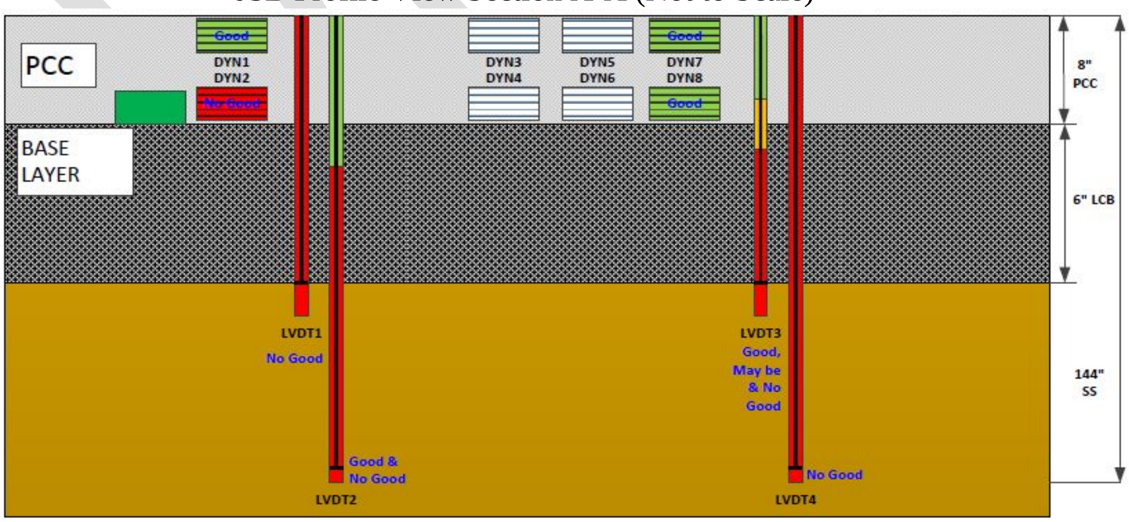
Figure 54: Graphical Representation of QC Results by Sensor Type for Section 390205 J5A Test Job



PLAN VIEW



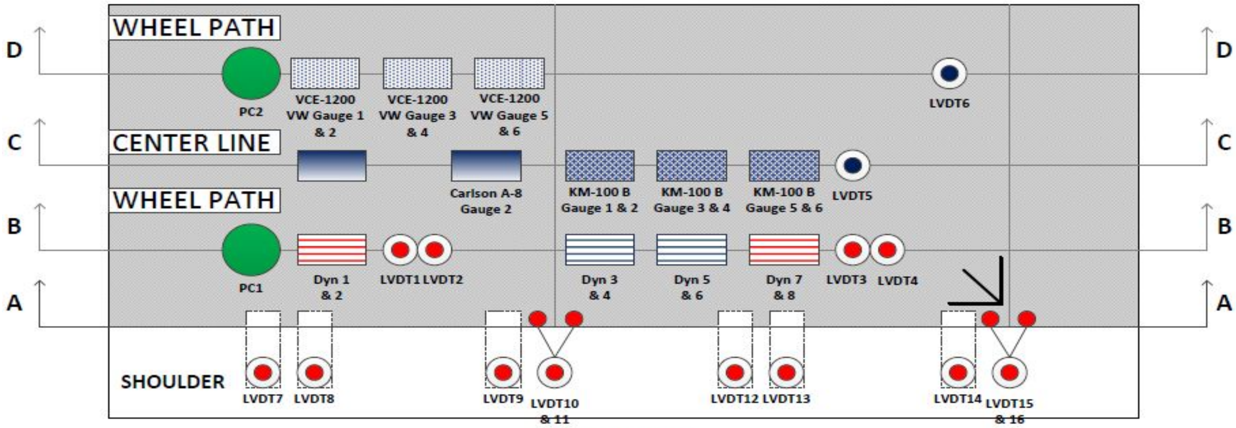
J5B Profile View Section A-A (Not to Scale)



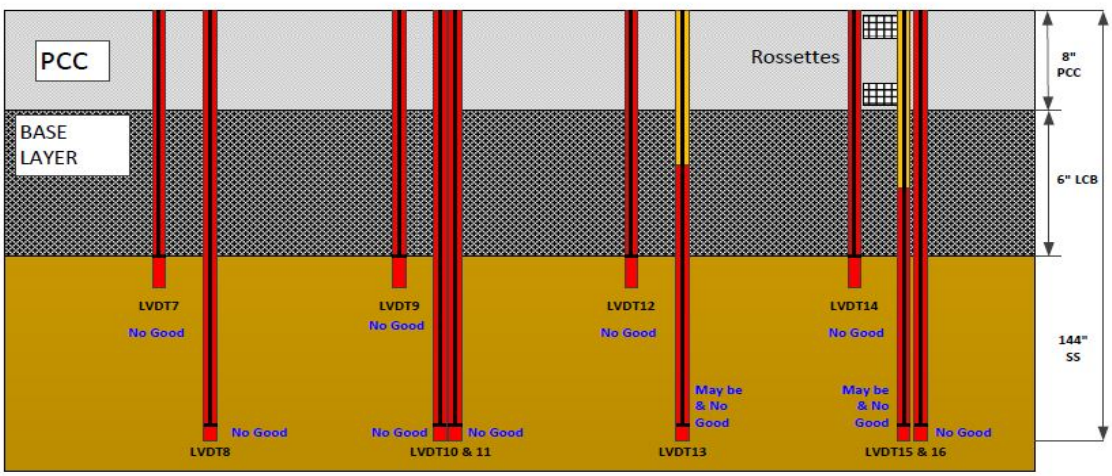
J5B Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

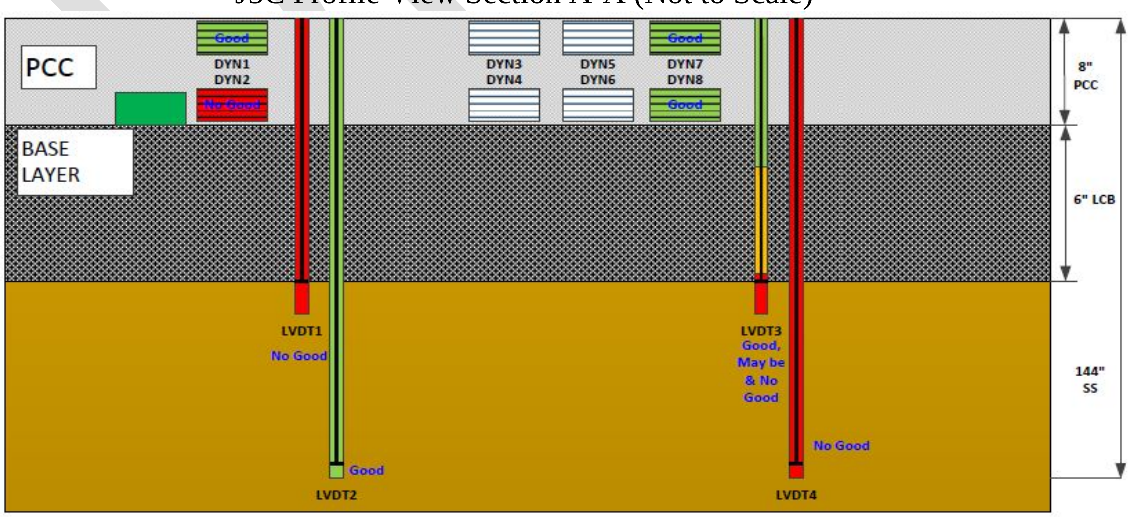
Figure 55: Graphical Representation of QC Results by Sensor Type for Section 390205 J5B Test Job



PLAN VIEW



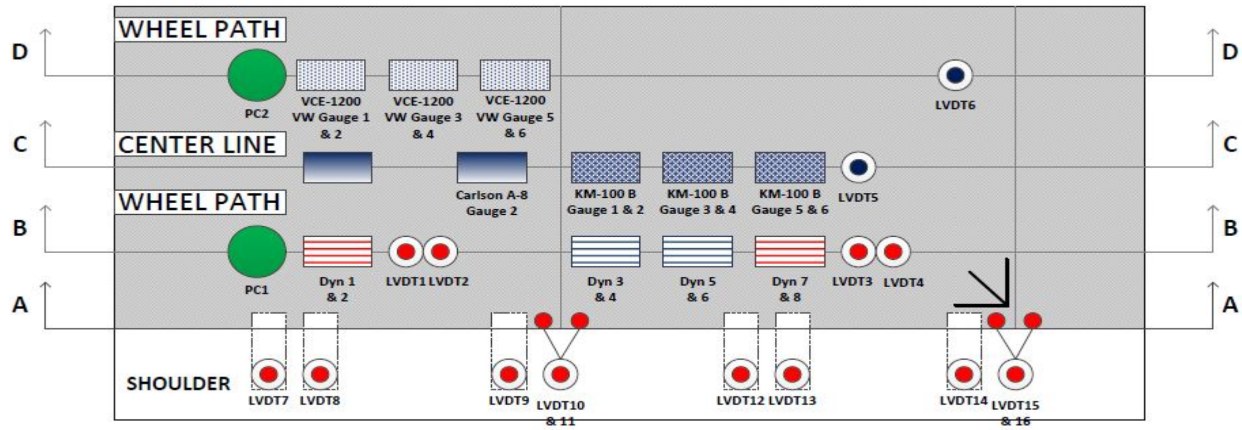
J5C Profile View Section A-A (Not to Scale)



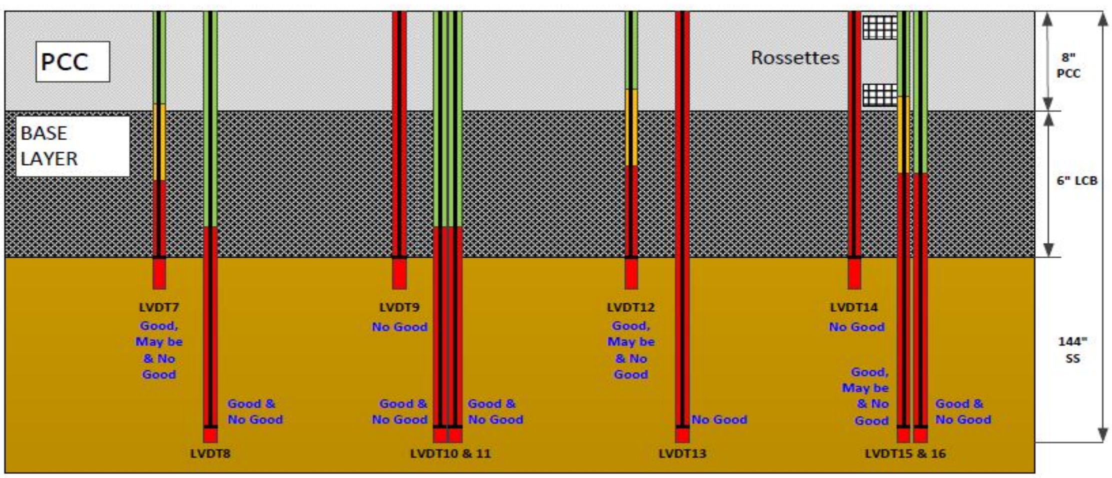
J5C Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

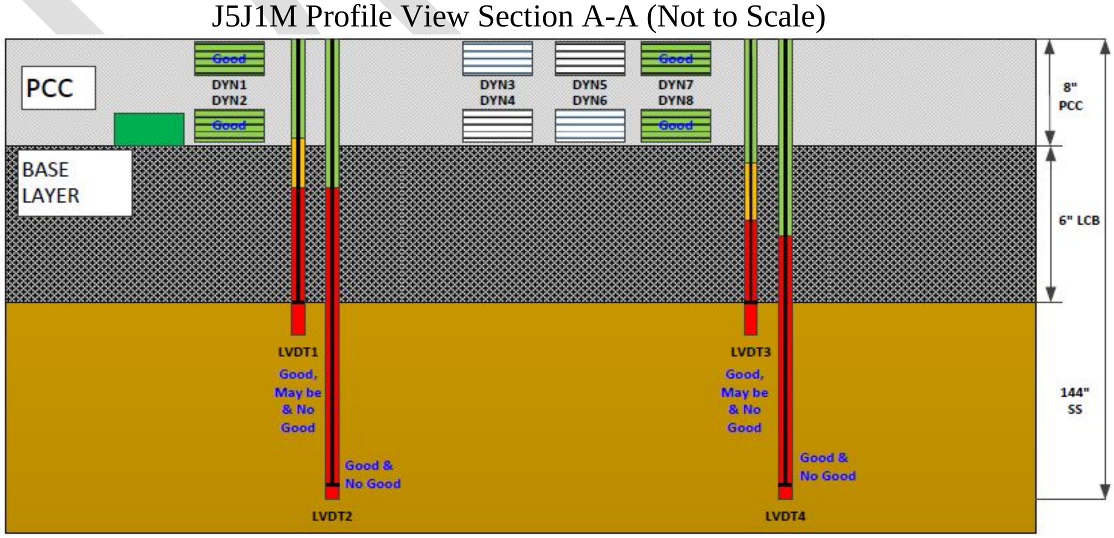
Figure 56: Graphical Representation of QC Results by Sensor Type for Section 390205 J5C Test Job



PLAN VIEW



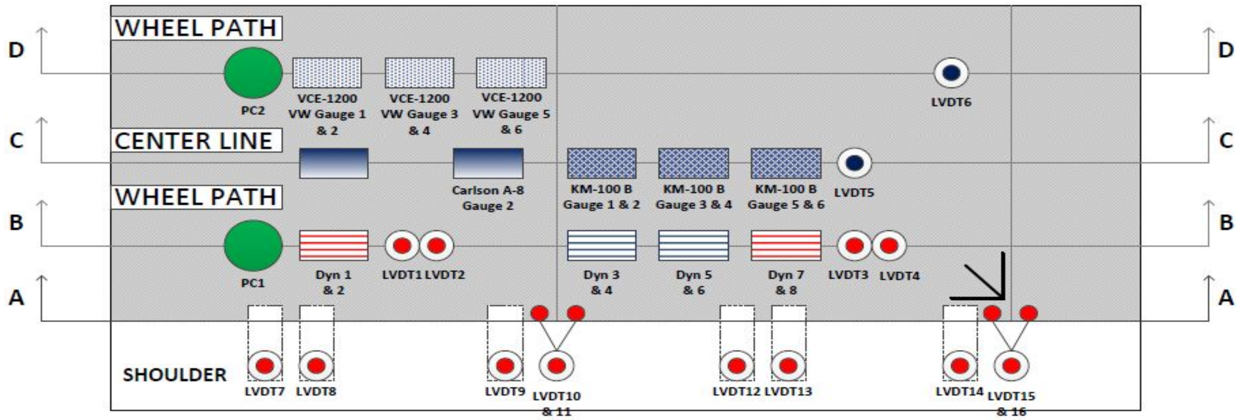
J5J1M Profile View Section A-A (Not to Scale)



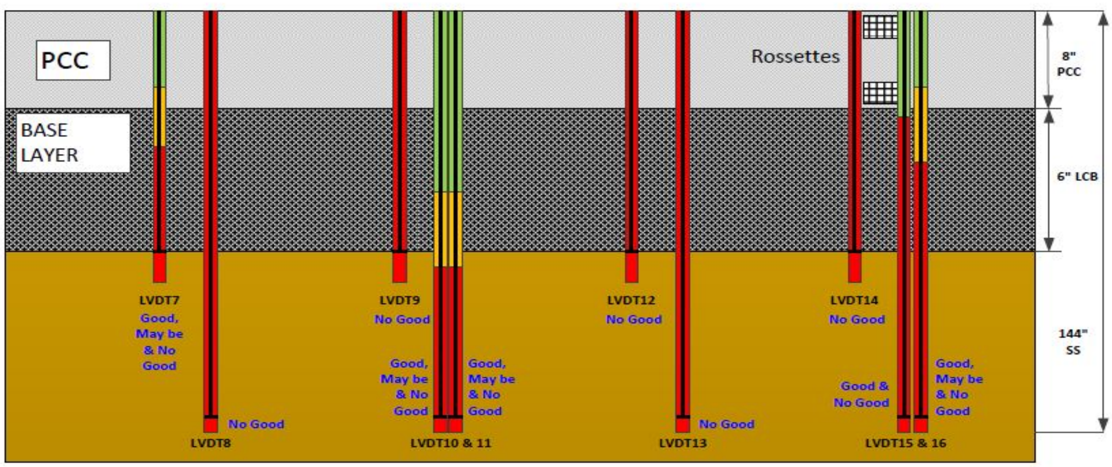
J5J1M Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

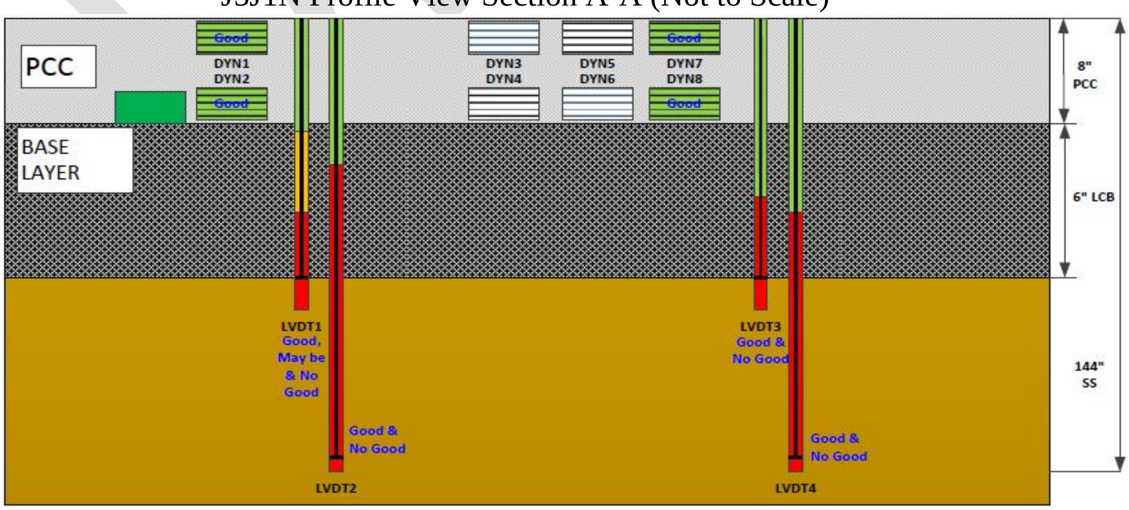
Figure 57: Graphical Representation of QC Results by Sensor Type for Section 390205 J5J1M Test Job



PLAN VIEW



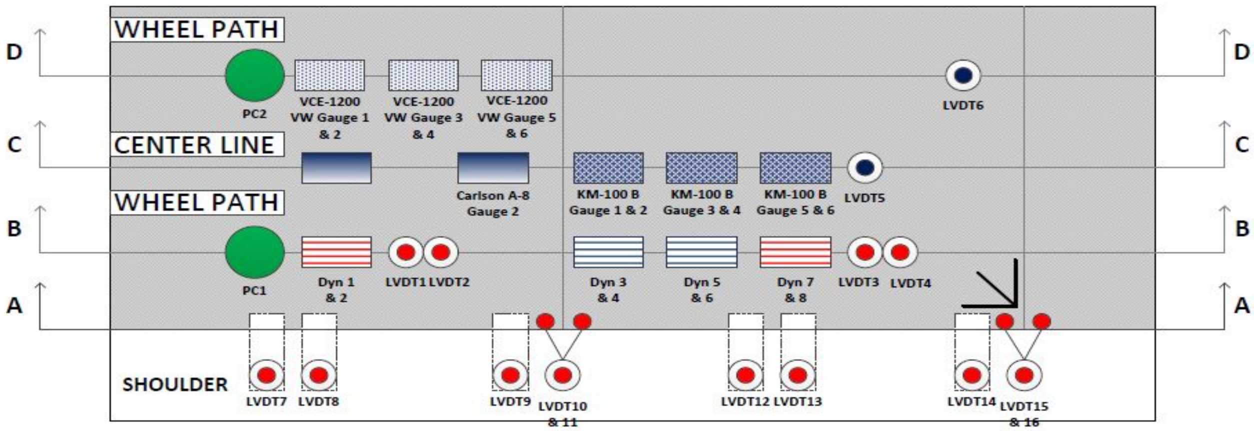
J5J1N Profile View Section A-A (Not to Scale)



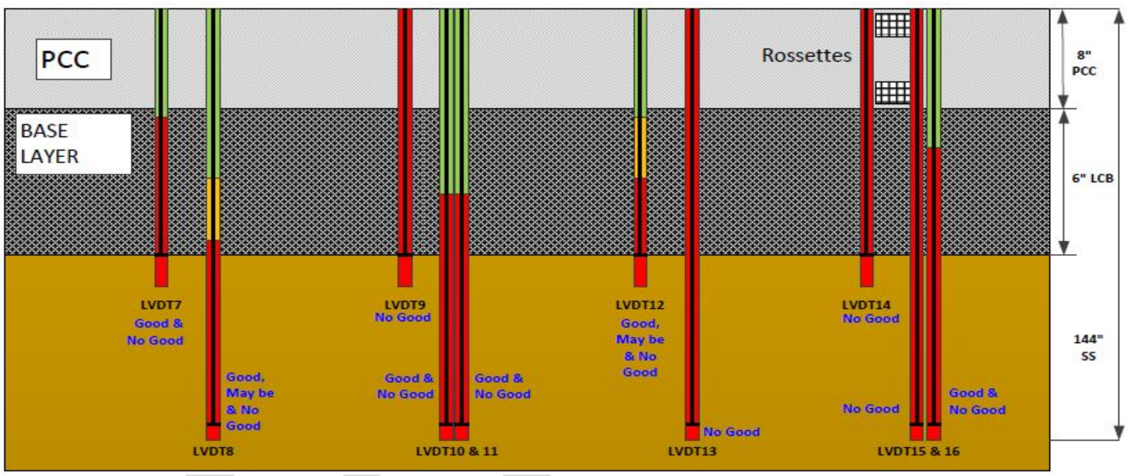
J5J1N Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

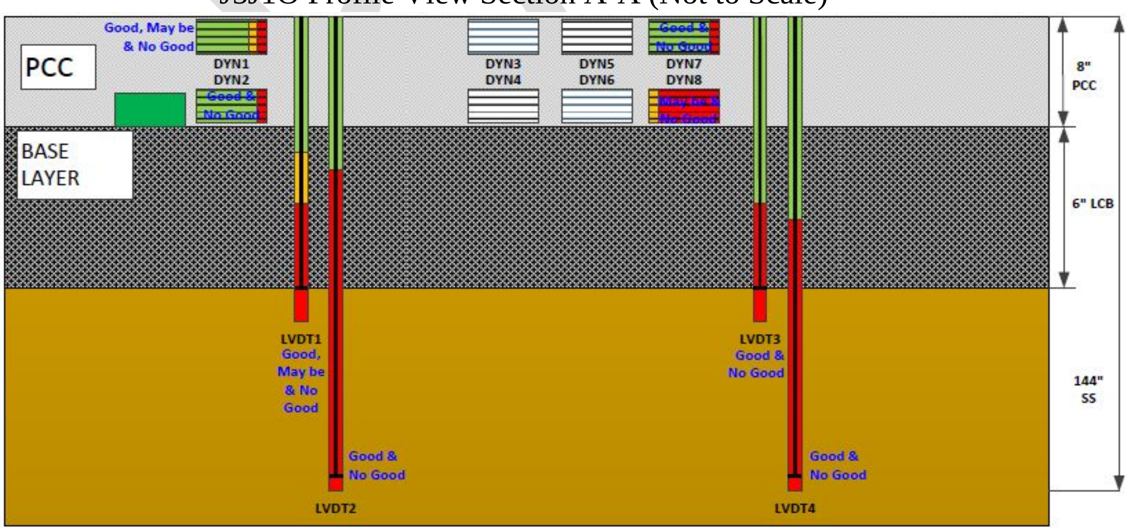
Figure 58: Graphical Representation of QC Results by Sensor Type for Section 390205 J5J1N Test Job



PLAN VIEW



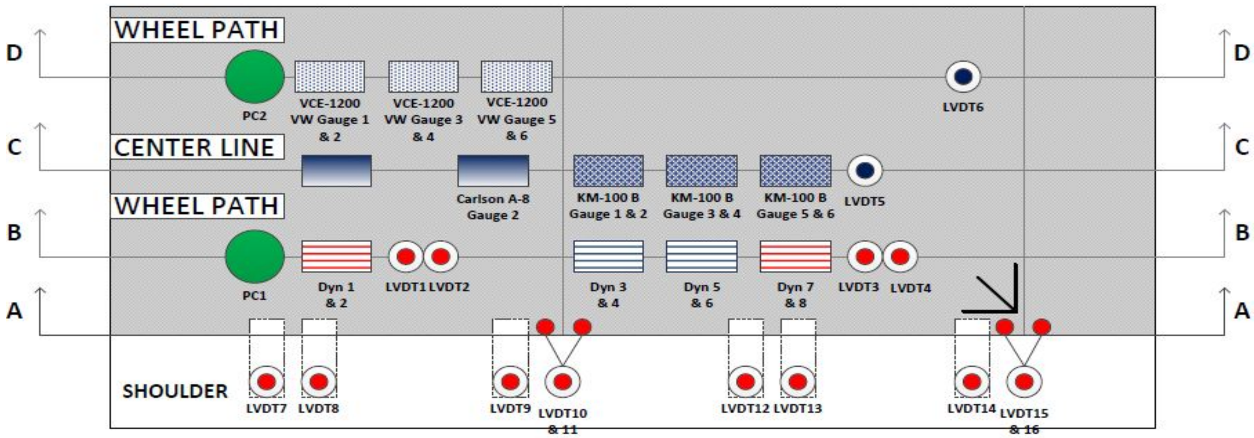
J5J1O Profile View Section A-A (Not to Scale)



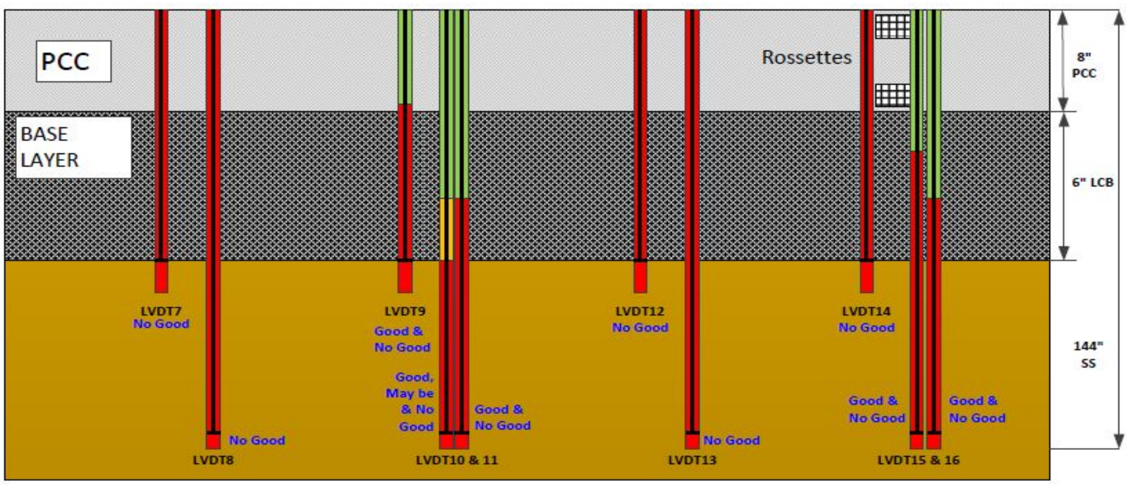
J5J1O Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

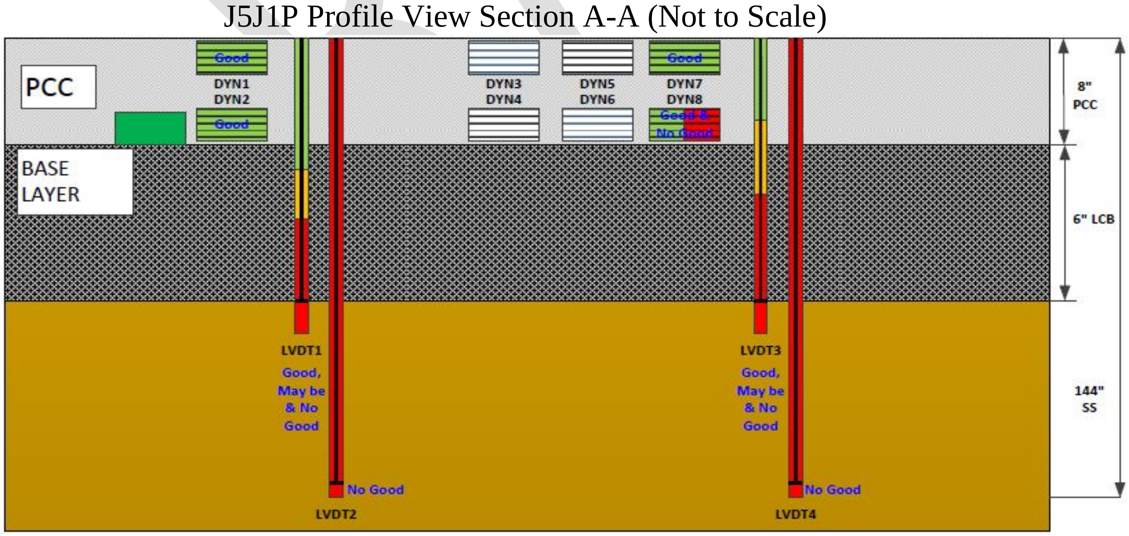
Figure 59: Graphical Representation of QC Results by Sensor Type for Section 390205 J5J1O Test Job



PLAN VIEW



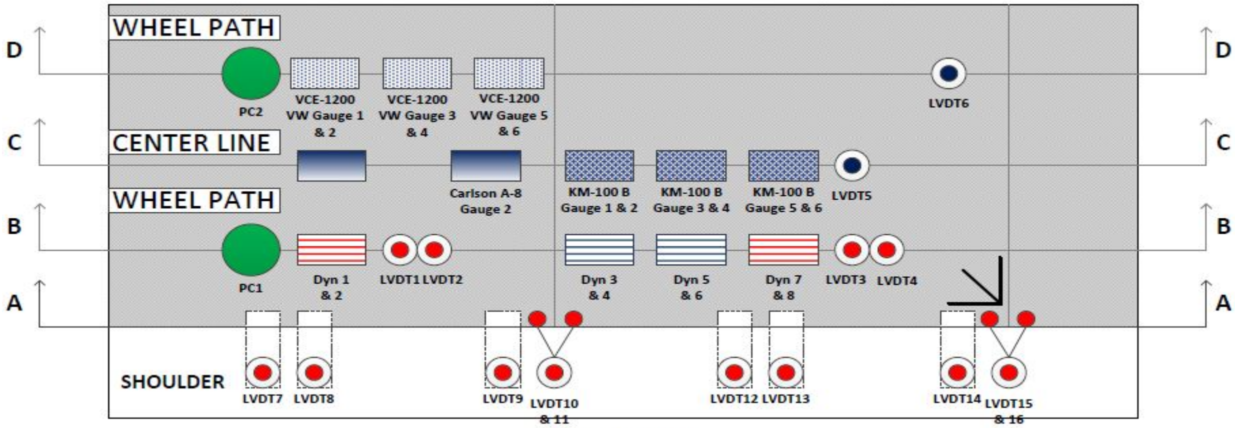
J5J1P Profile View Section A-A (Not to Scale)



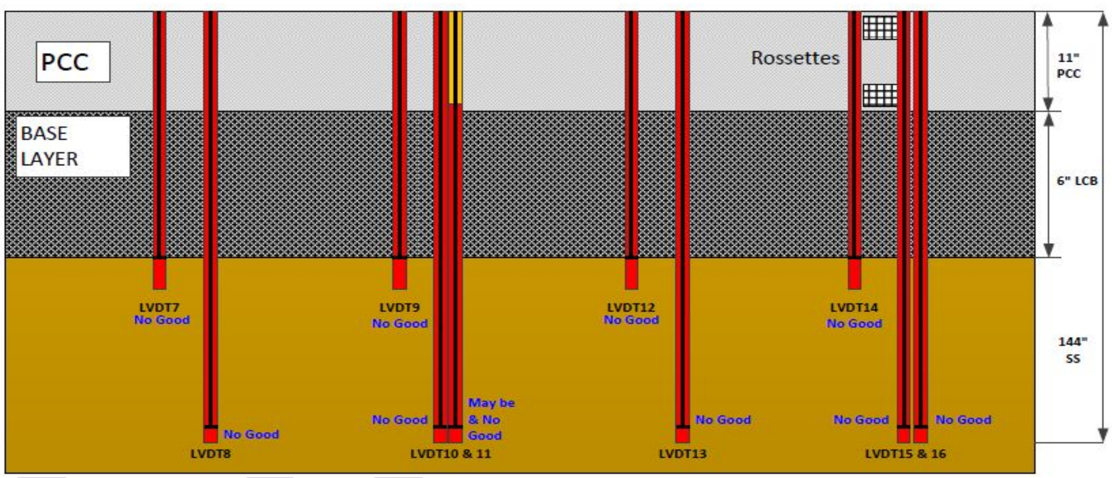
J5J1P Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

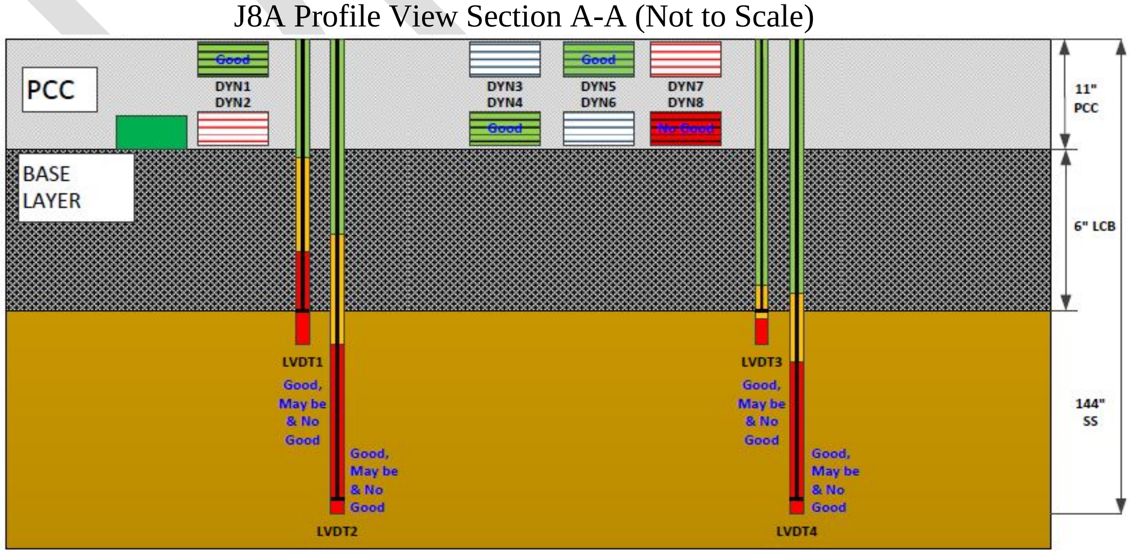
Figure 60: Graphical Representation of QC Results by Sensor Type for Section 390205 J5J1P Test Job



PLAN VIEW



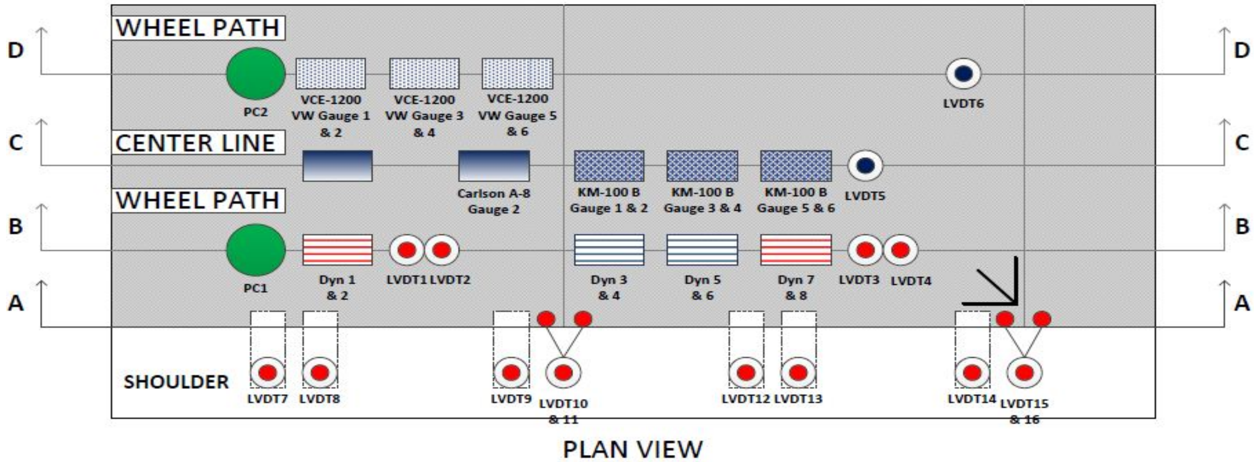
J8A Profile View Section A-A (Not to Scale)

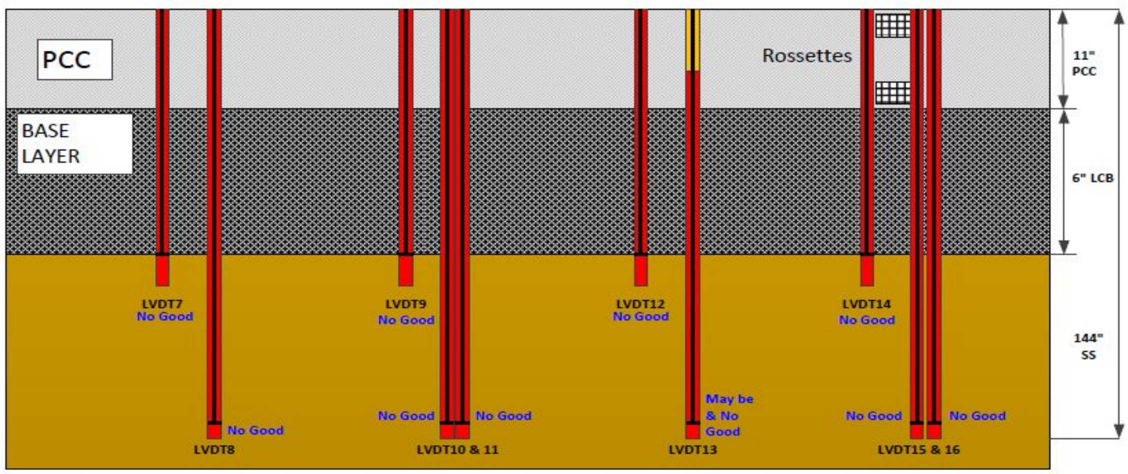


J8A Profile View Section B-B (Not to Scale)

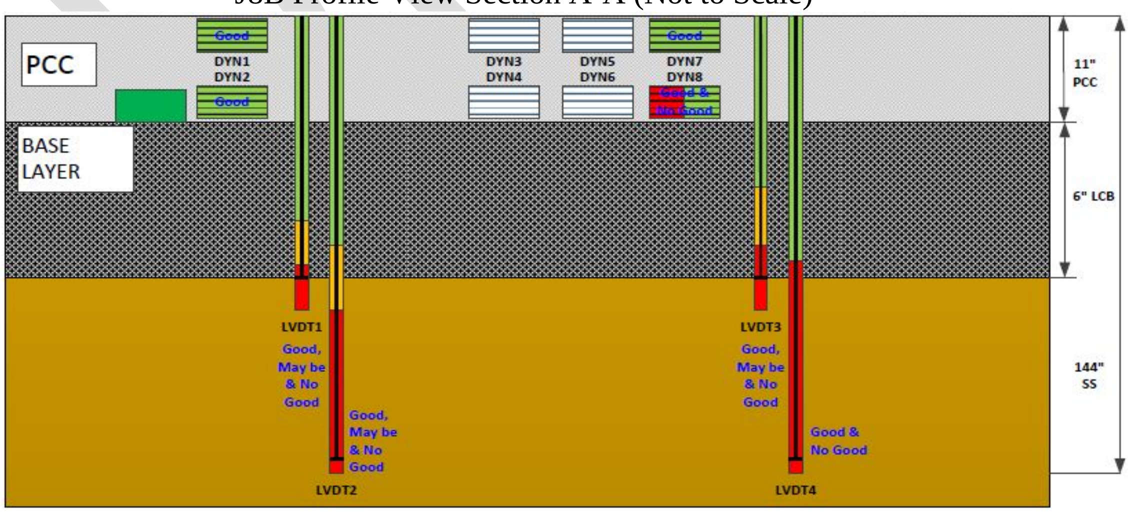
Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 61: Graphical Representation of QC Results by Sensor Type for Section 390208 J8A Test Job





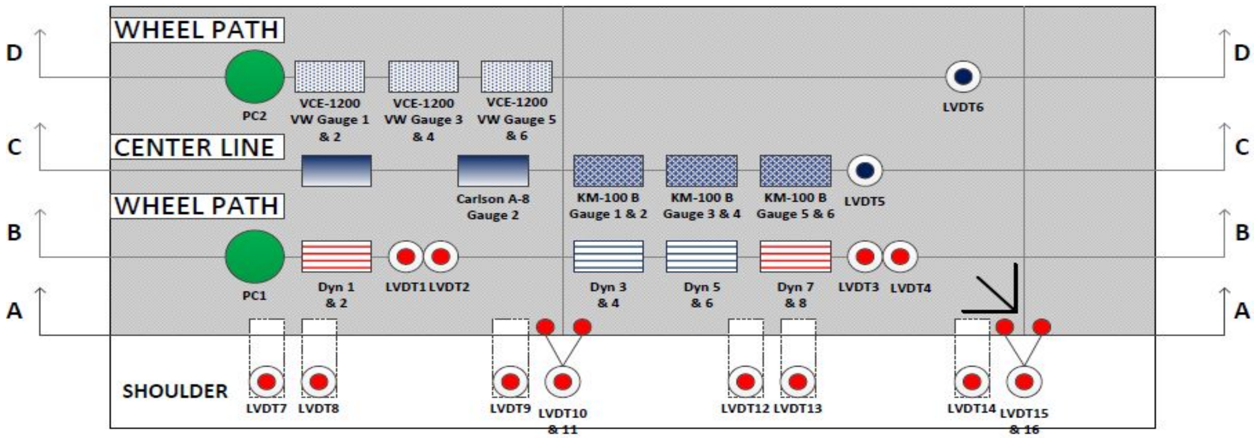
J8B Profile View Section A-A (Not to Scale)



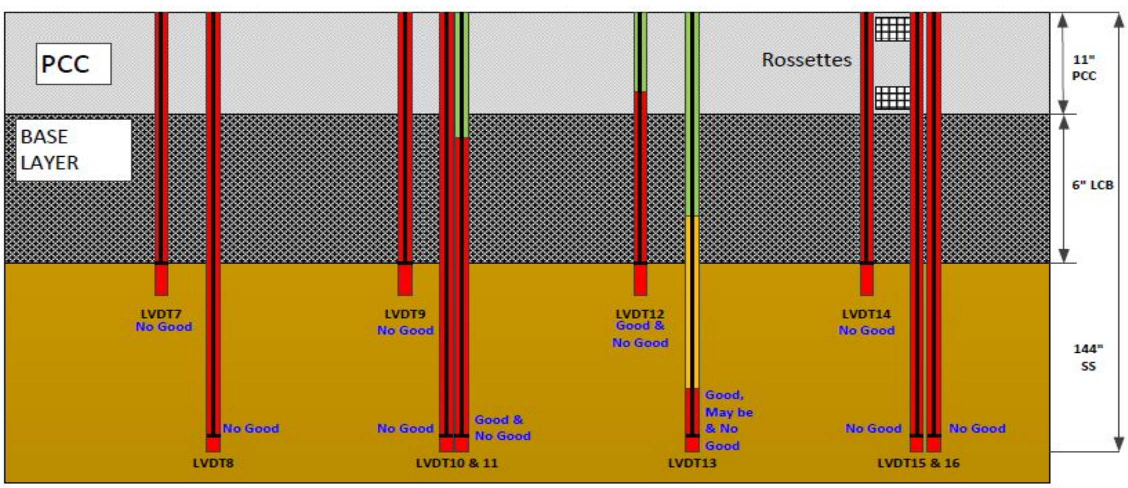
J8B Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

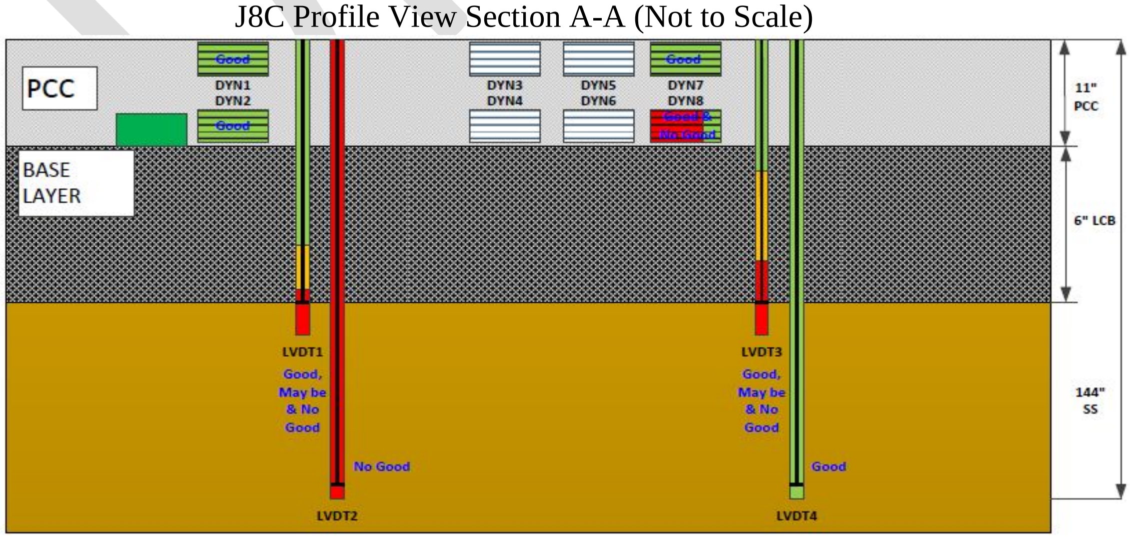
Figure 62: Graphical Representation of QC Results by Sensor Type for Section 390208 J8B Test Job



PLAN VIEW



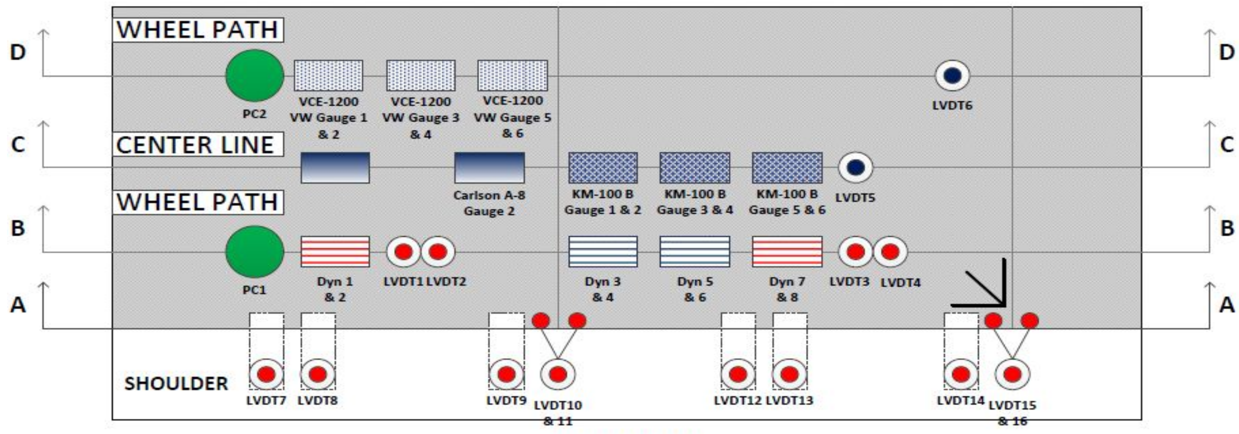
J8C Profile View Section A-A (Not to Scale)



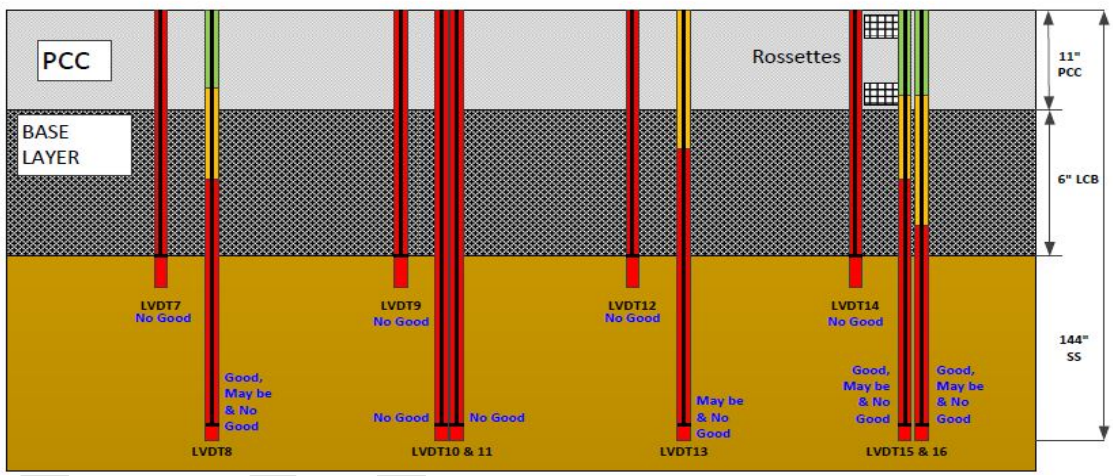
J8C Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

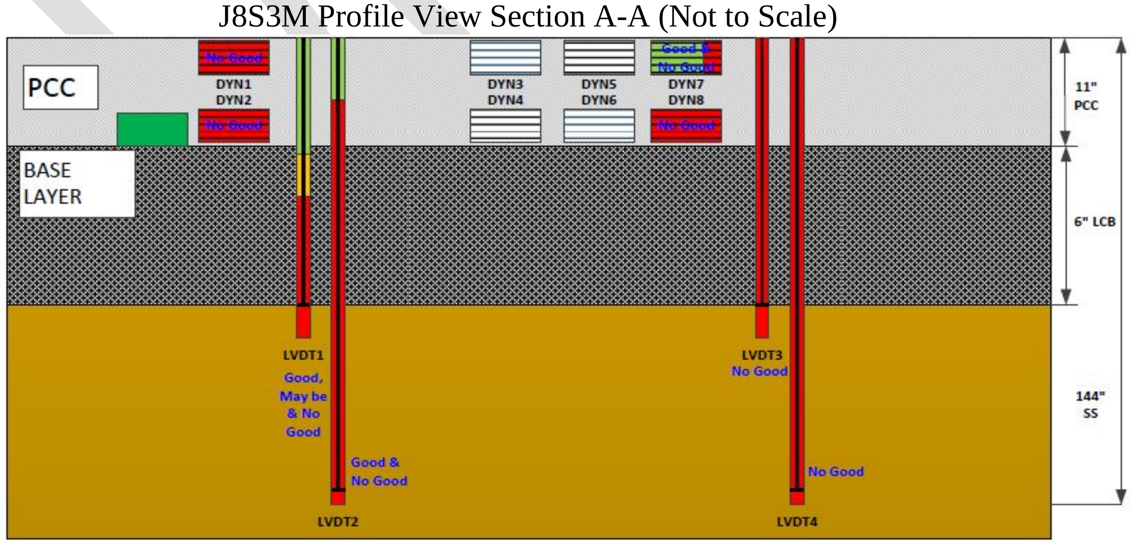
Figure 63: Graphical Representation of QC Results by Sensor Type for Section 390208 J8C Test Job



PLAN VIEW



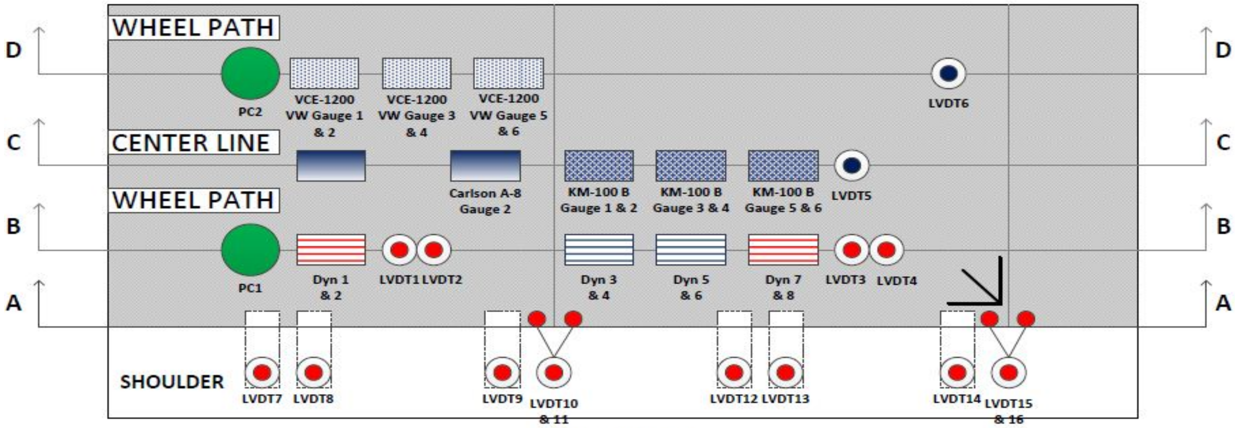
J8S3M Profile View Section A-A (Not to Scale)



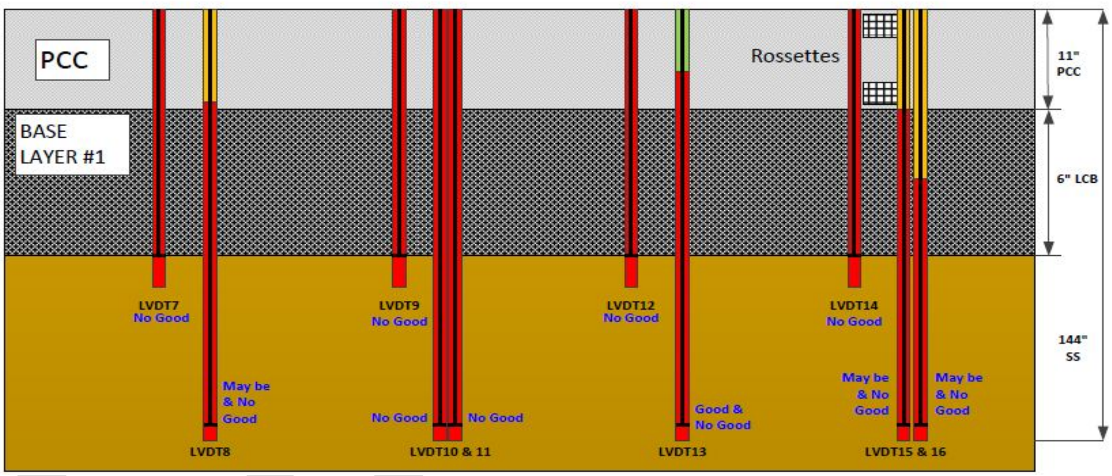
J8S3M Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

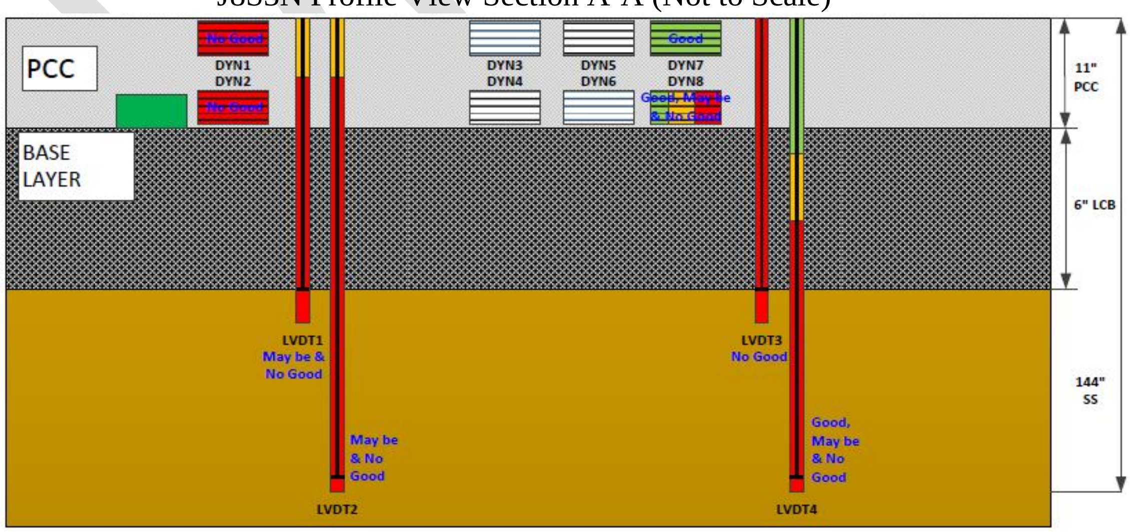
Figure 64: Graphical Representation of QC Results by Sensor Type for Section 390208 J8S3M Test Job



PLAN VIEW



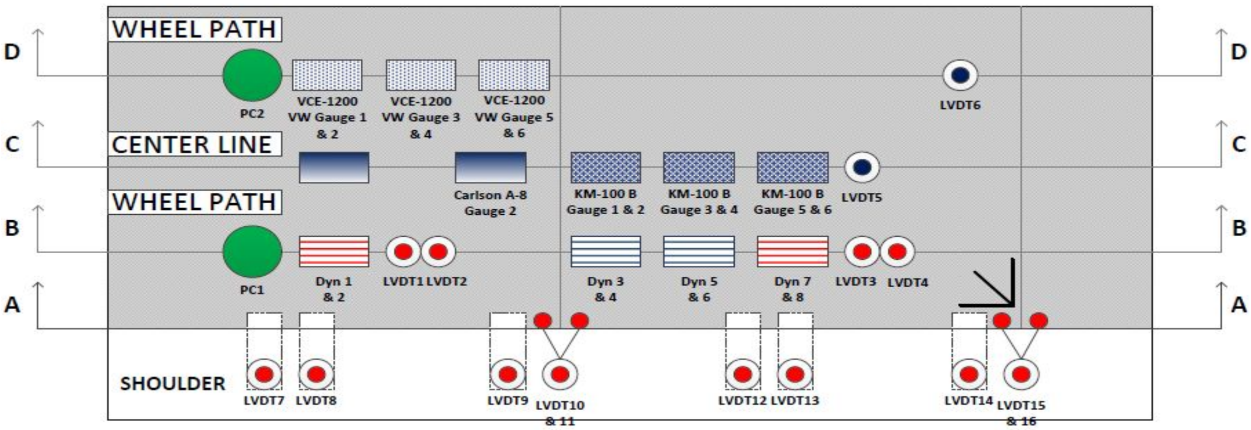
J8S3N Profile View Section A-A (Not to Scale)



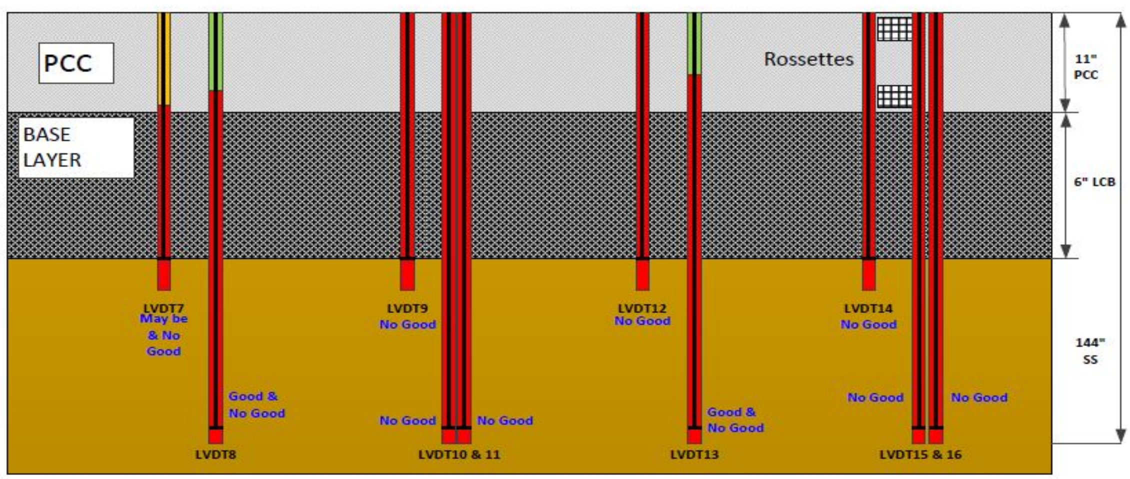
J8S3N Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

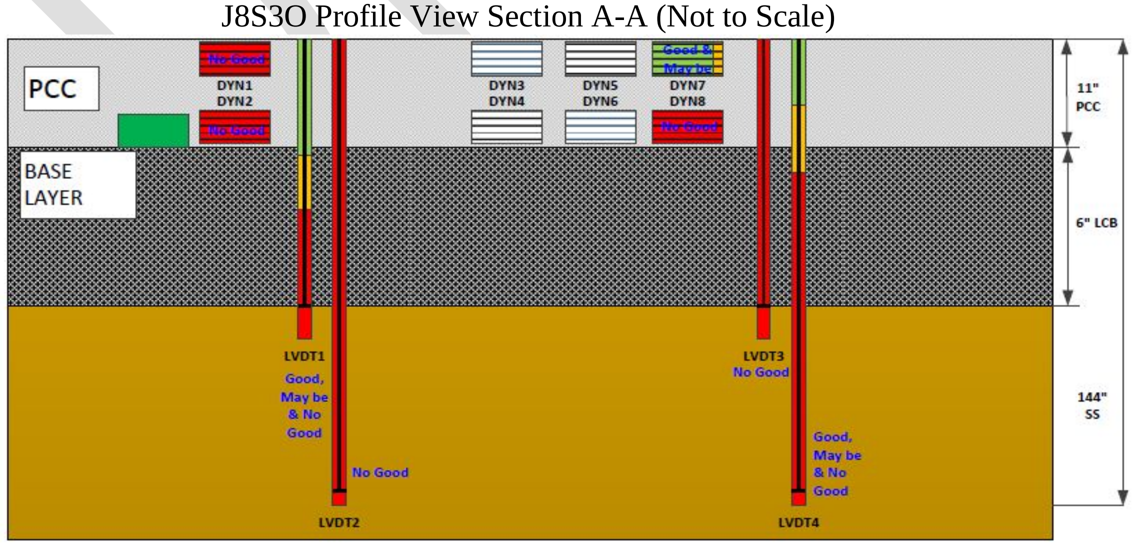
Figure 65: Graphical Representation of QC Results by Sensor Type for Section 390208 J8S3N Test Job



PLAN VIEW



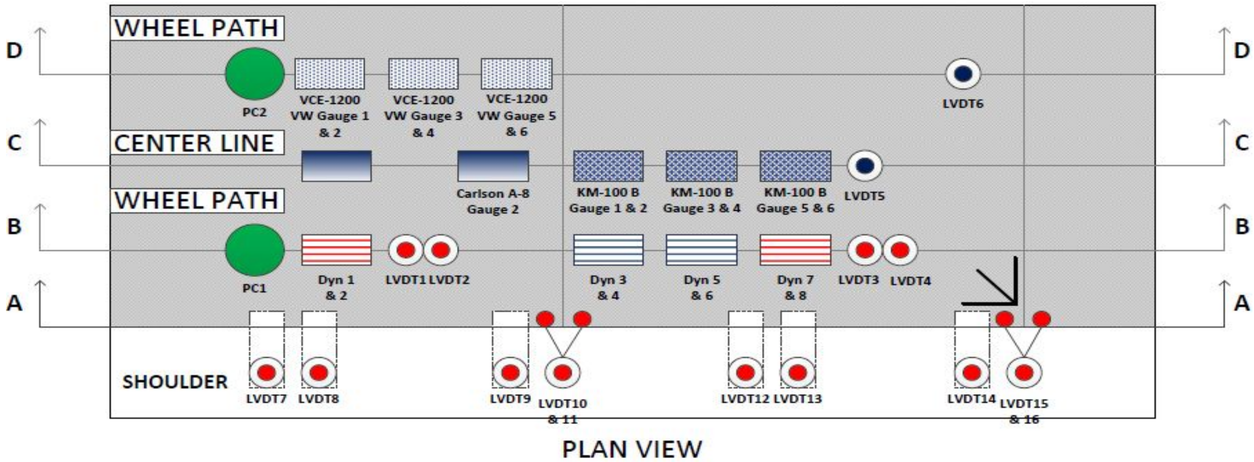
J8S3O Profile View Section A-A (Not to Scale)

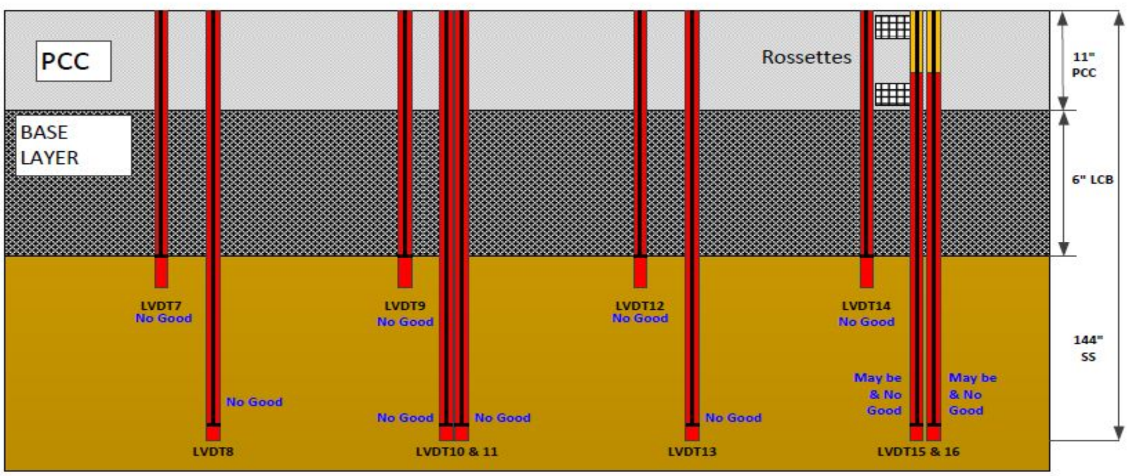


J8S3O Profile View Section B-B (Not to Scale)

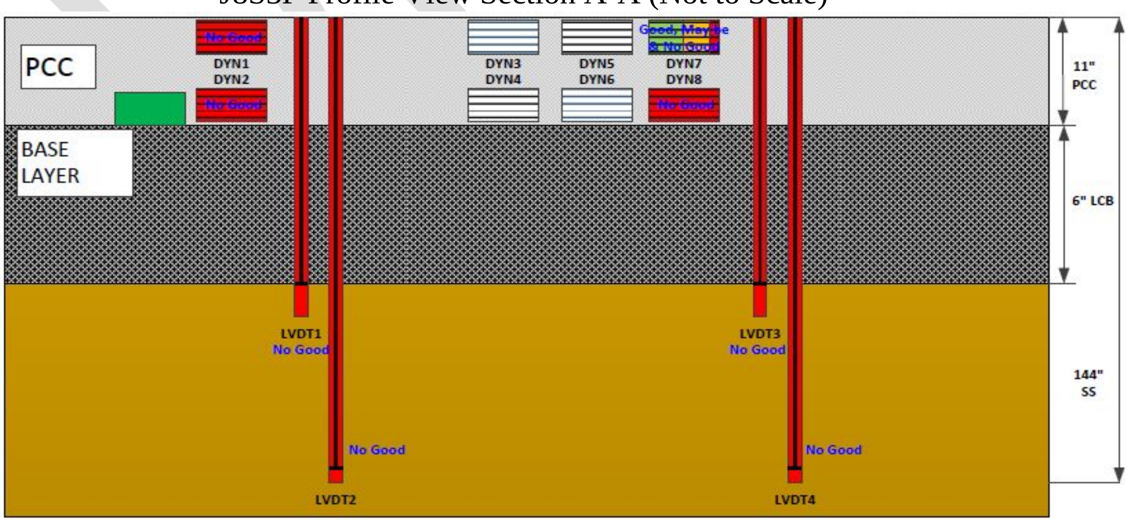
Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 66: Graphical Representation of QC Results by Sensor Type for Section 390208 J8S3O Test Job





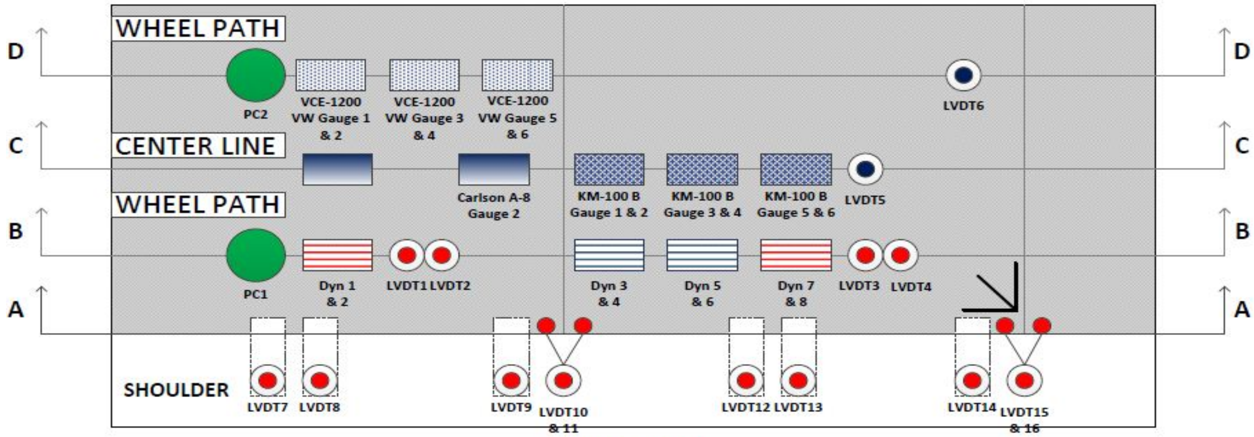
J8S3P Profile View Section A-A (Not to Scale)



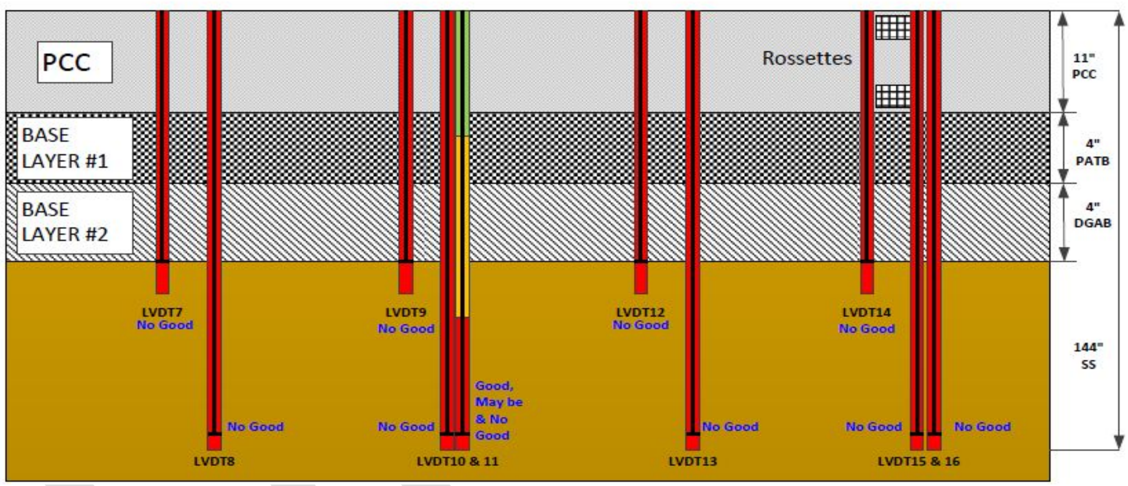
J8S3P Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

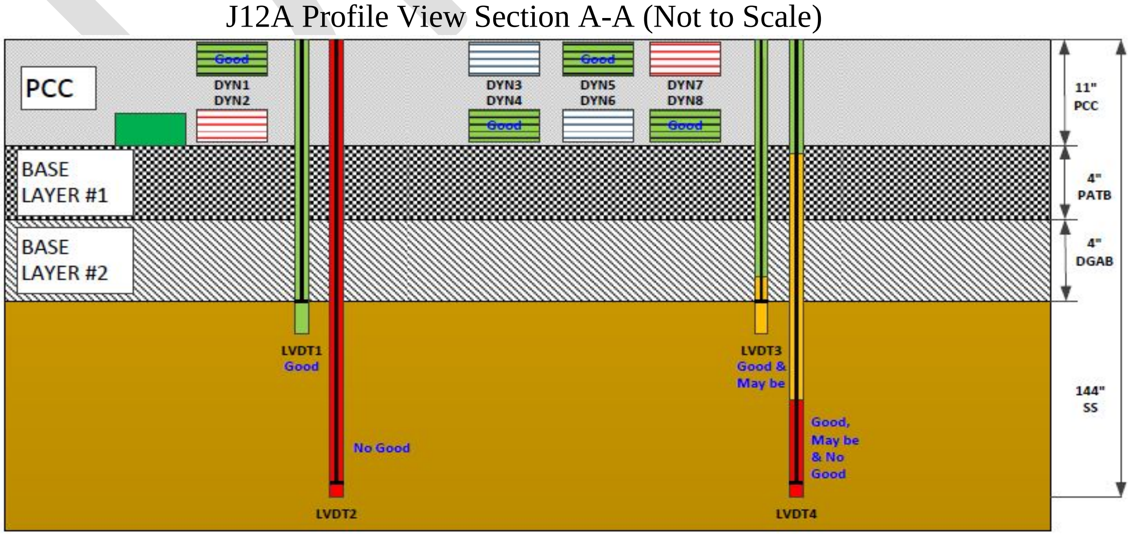
Figure 67: Graphical Representation of QC Results by Sensor Type for Section 390208 J8S3P Test Job



PLAN VIEW



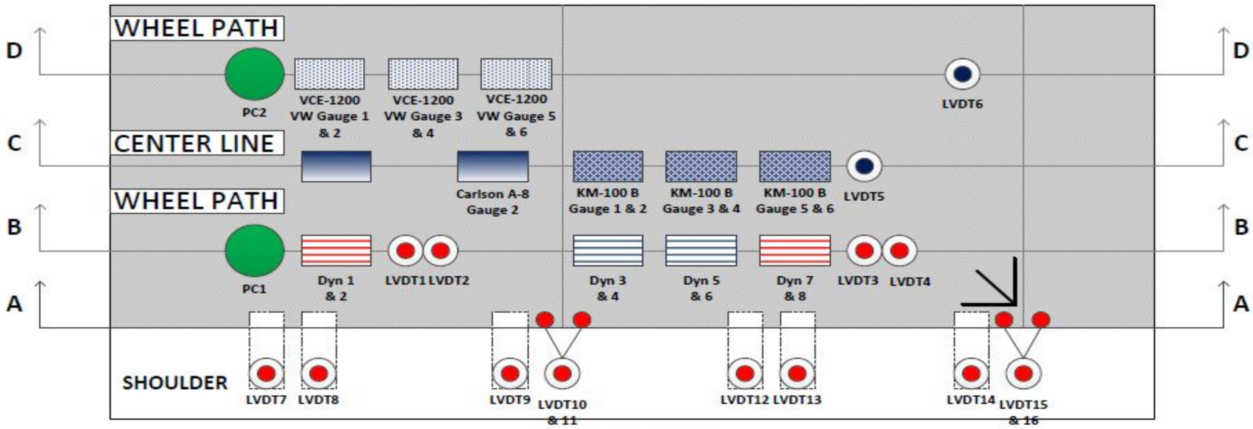
J12A Profile View Section A-A (Not to Scale)



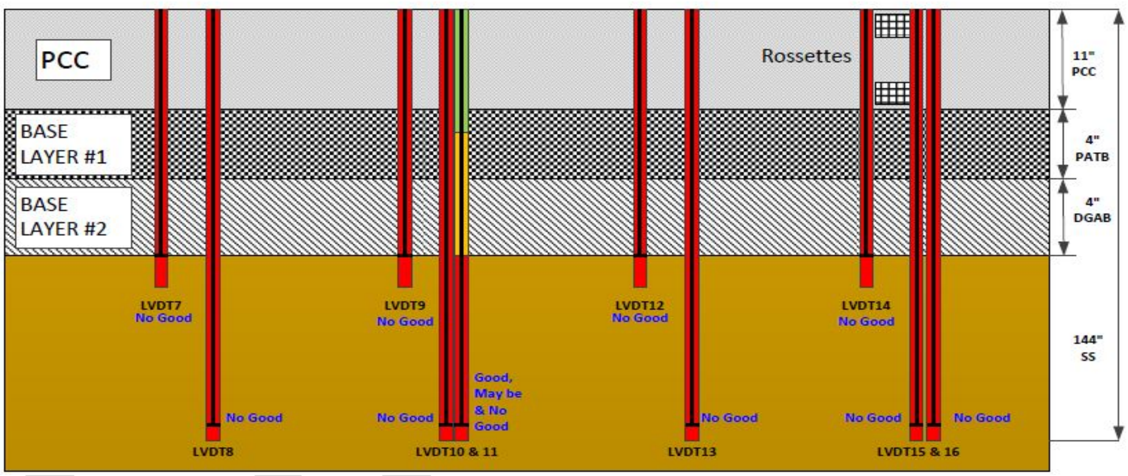
J12A Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

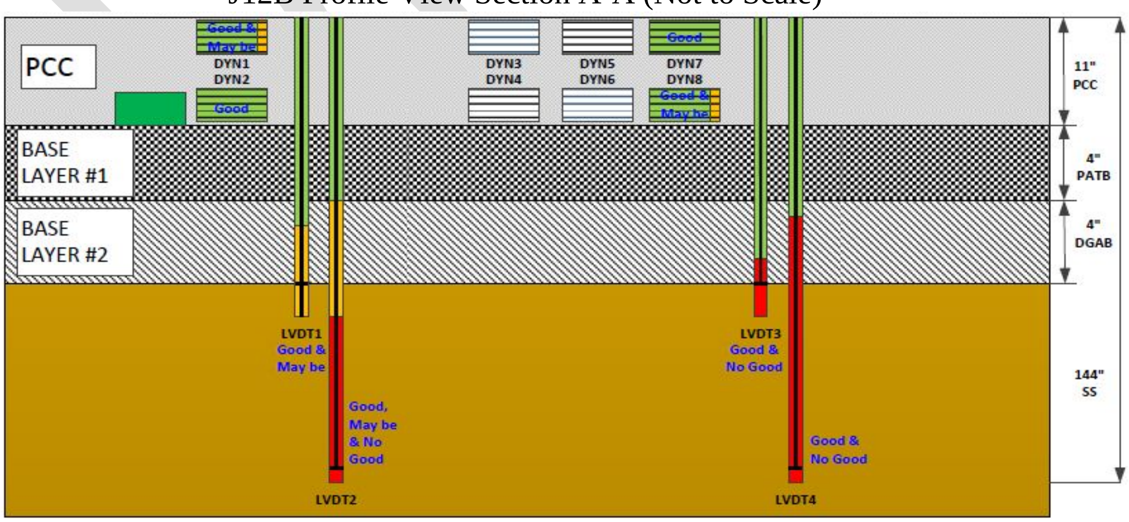
Figure 68: Graphical Representation of QC Results by Sensor Type for Section 390212 J12A Test Job



PLAN VIEW



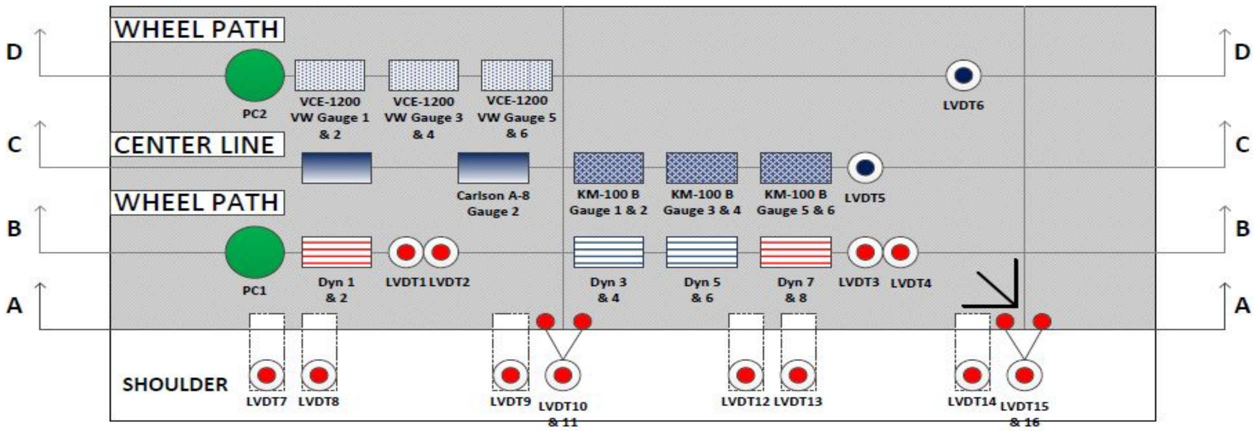
J12B Profile View Section A-A (Not to Scale)



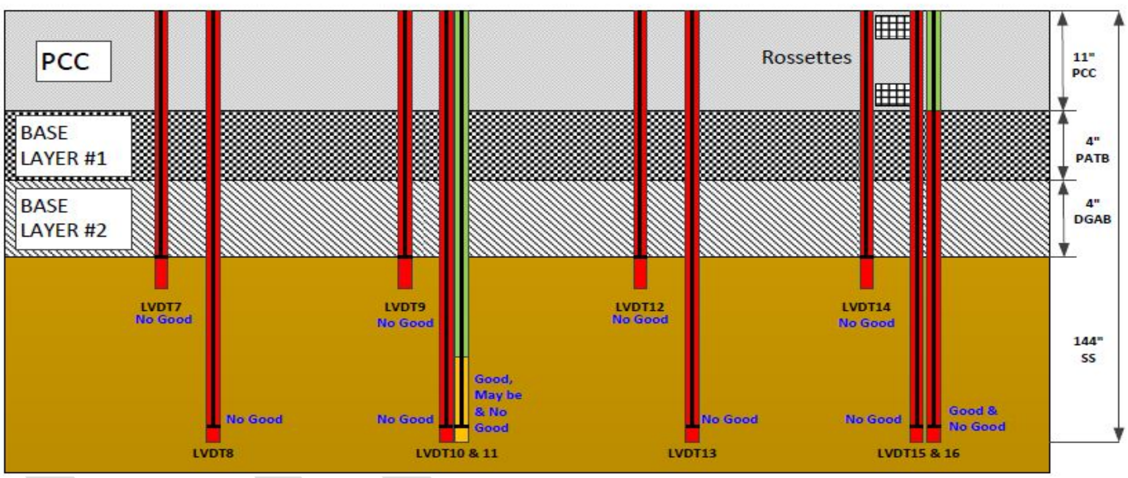
J12B Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

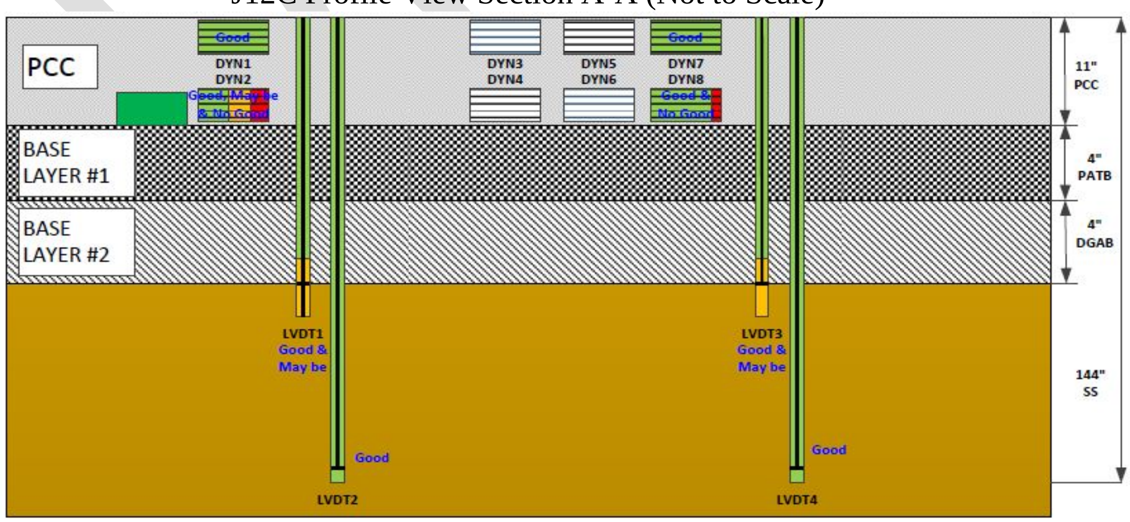
Figure 69: Graphical Representation of QC Results by Sensor Type for Section 390212 J12B Test Job



PLAN VIEW



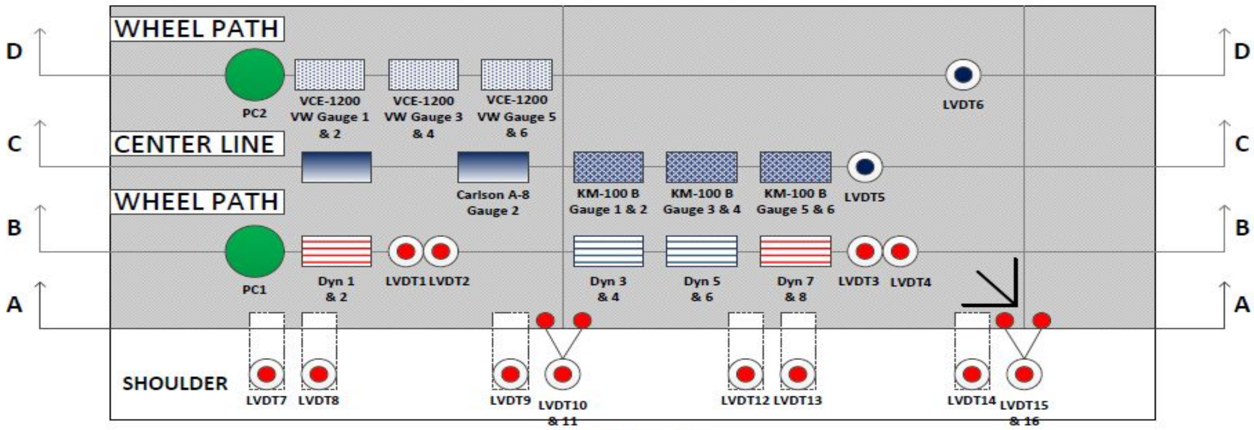
J12C Profile View Section A-A (Not to Scale)



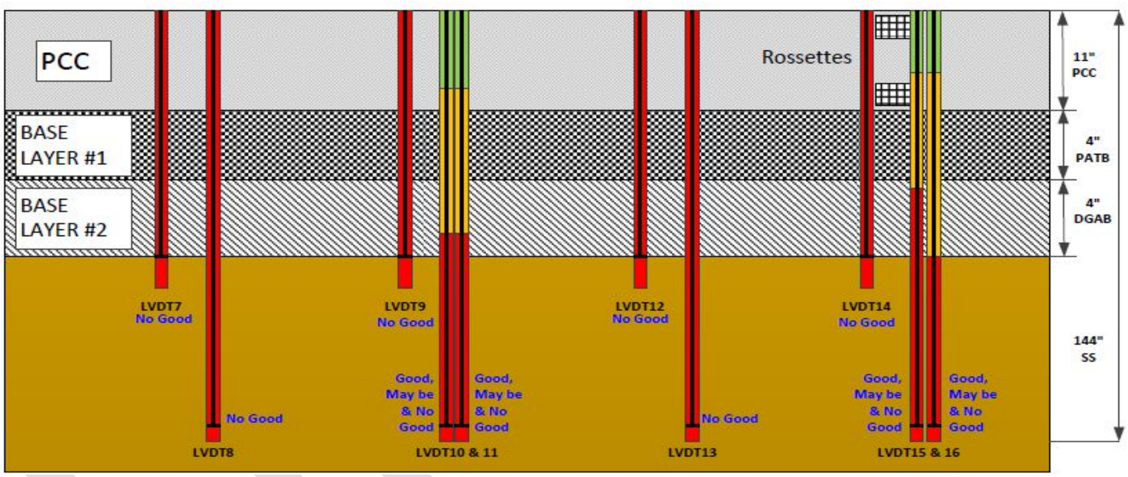
J12C Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

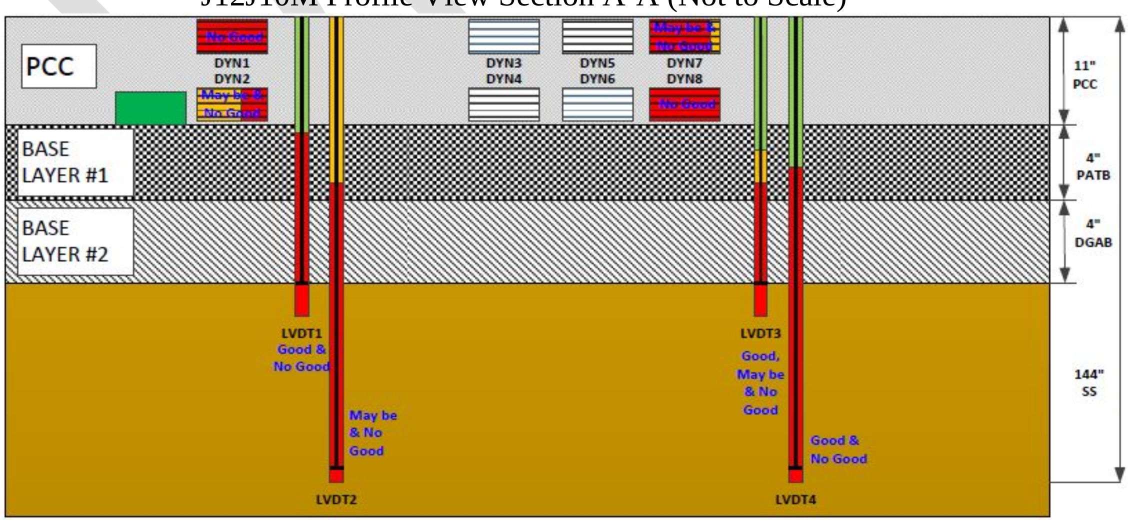
Figure 70: Graphical Representation of QC Results by Sensor Type for Section 390212 J12C Test Job



PLAN VIEW



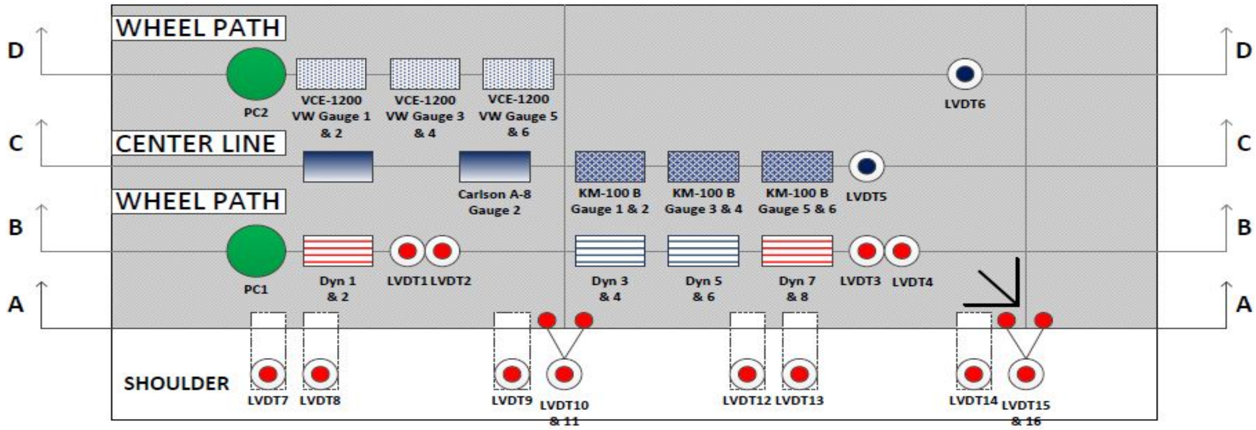
J12J10M Profile View Section A-A (Not to Scale)



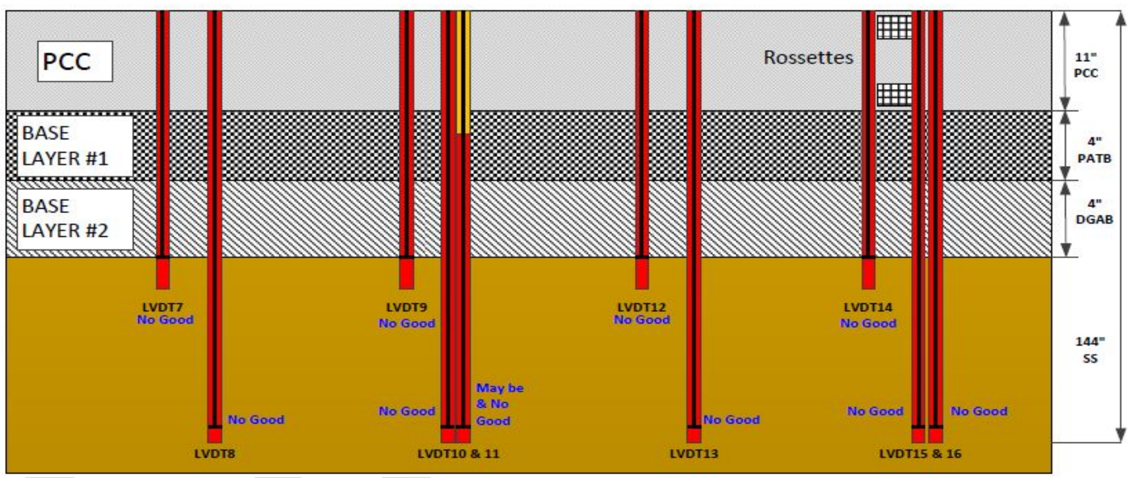
J12J10M Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

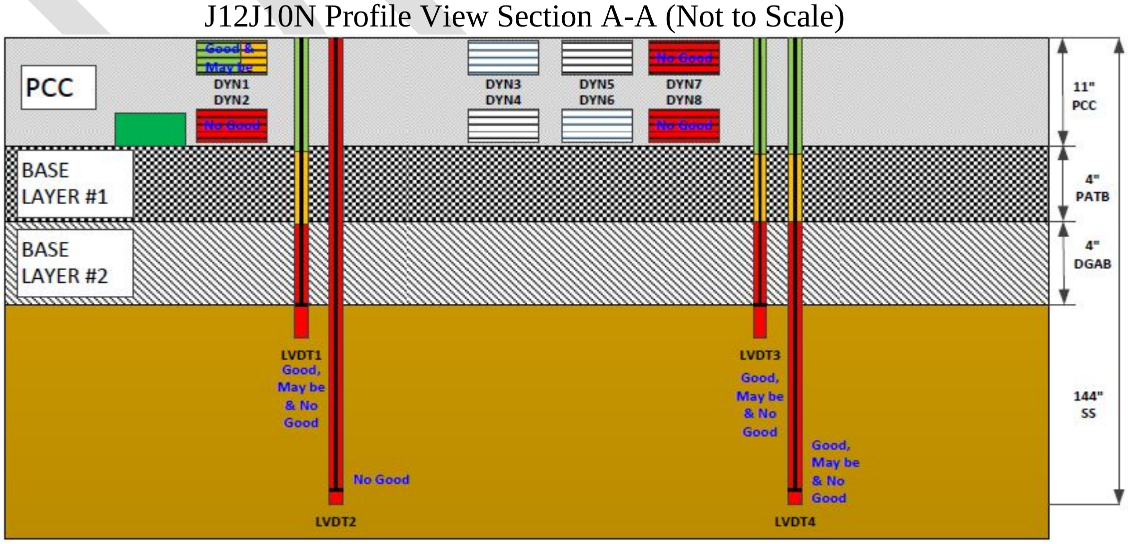
Figure 71: Graphical Representation of QC Results by Sensor Type for Section 390212 J12J10M Test Job



PLAN VIEW



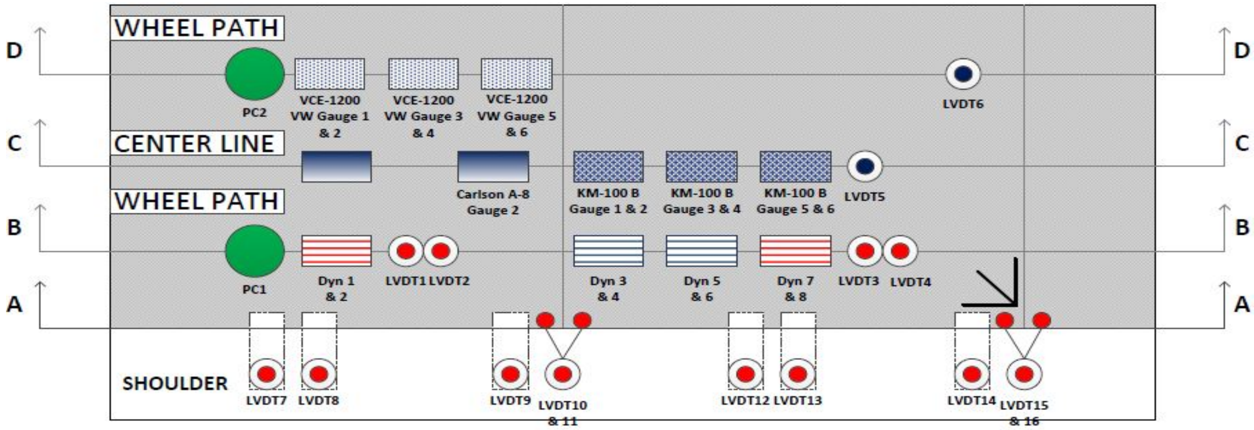
J12J10N Profile View Section A-A (Not to Scale)



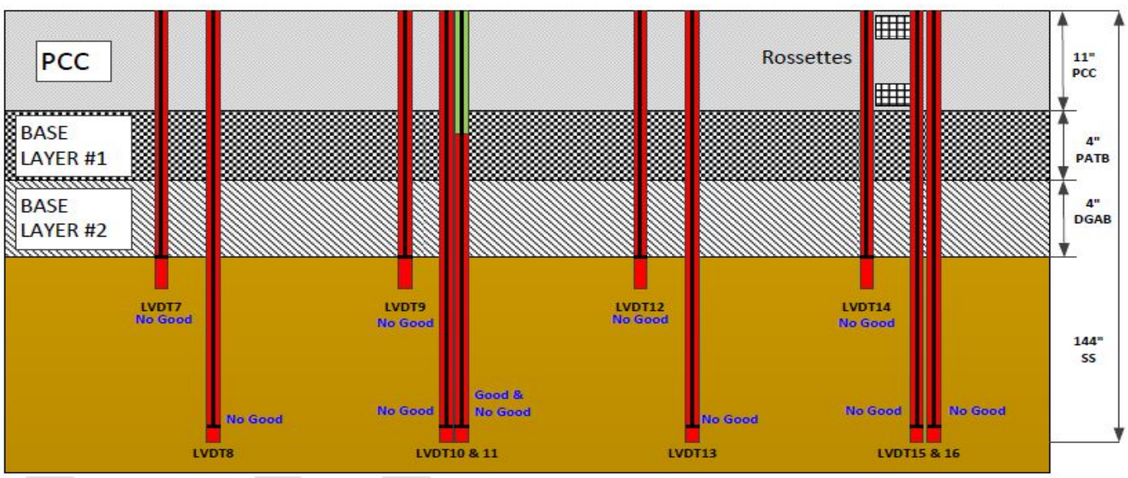
J12J10N Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

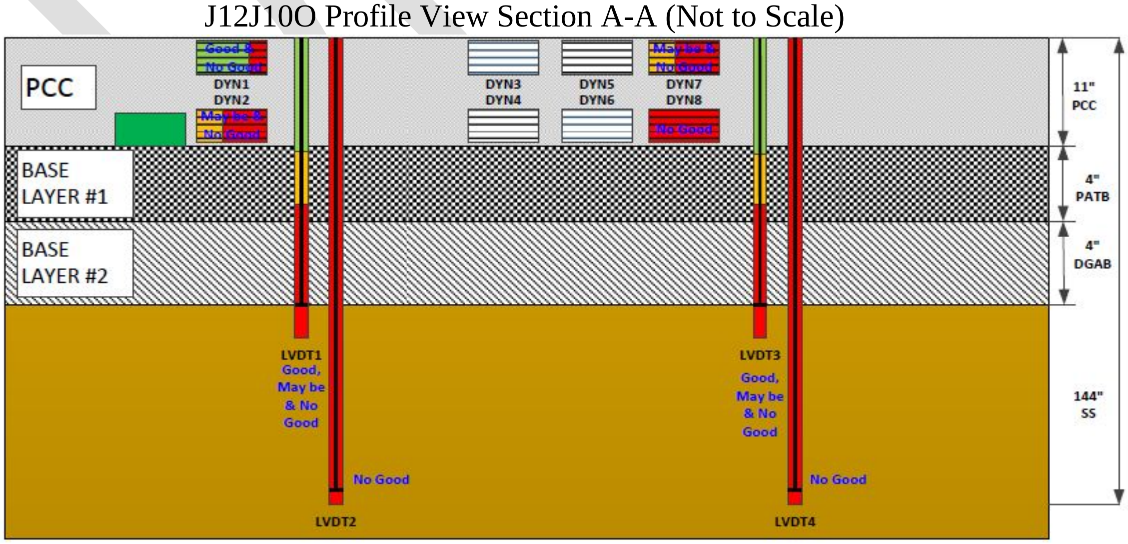
Figure 72: Graphical Representation of QC Results by Sensor Type for Section 390212 J12J10N Test Job



PLAN VIEW



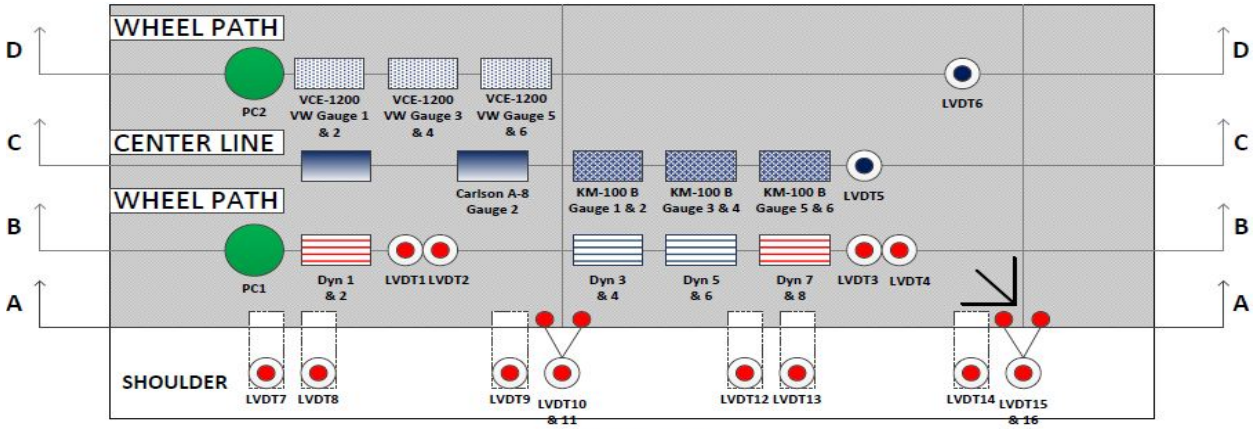
J12J10O Profile View Section A-A (Not to Scale)



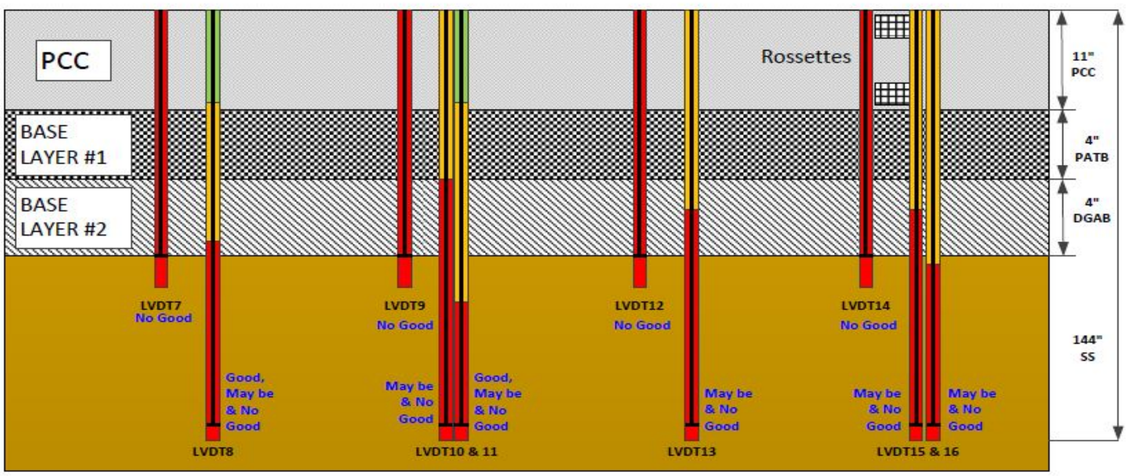
J12J10O Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

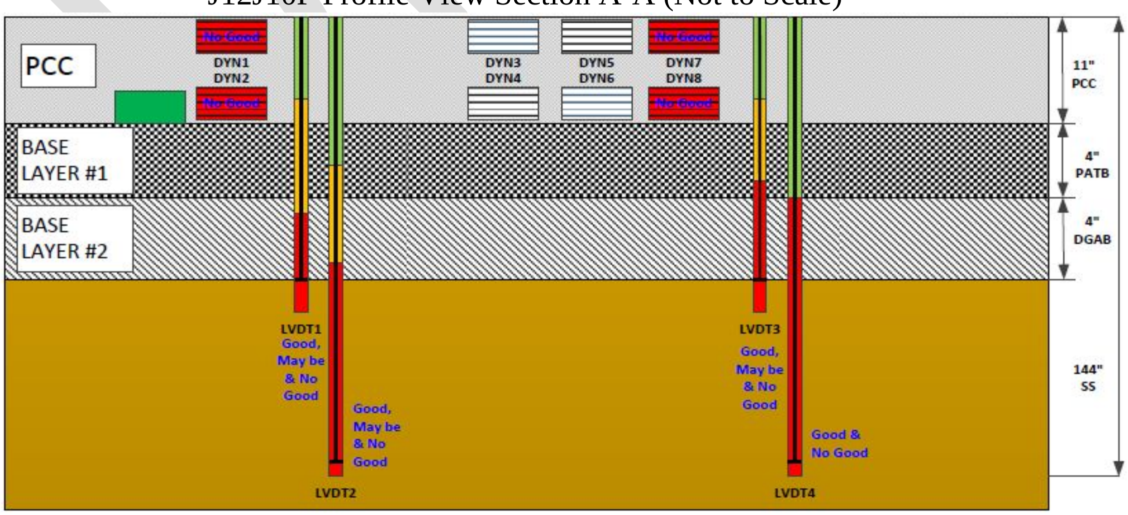
Figure 73: Graphical Representation of QC Results by Sensor Type for Section 390212 J12J10O Test Job



PLAN VIEW



J12J10P Profile View Section A-A (Not to Scale)



J12J10P Profile View Section B-B (Not to Scale)

Note: Sensor colors represent the status of a sensor based on QC results (Green: Good, Orange: Maybe, Red: No Good). The sensors with color combinations of more than one color represent status in combination. For example, if a sensor color is in a combination of green and orange then the status of the sensor is Good and Maybe.

Figure 74: Graphical Representation of QC Results by Sensor Type for Section 390212 J12J10P Test Job

APPENDIX D: Sensor Status of the 24 Ohio SPS-2 DLR Test Jobs

Table 26: Summarized QC Results for Smoothed Traces in Section 390201 J1A Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN4	DYN5	DYN8
2	1	1	1	3	3	3	3	3	2	3	3	3	3	3	2	1	1	1	1
3	2	1	1	2	3	3	3	3	3	3	3	3	3	3	2	1	1	1	1
2	3	1	1	1	3	3	3	3	1	3	3	3	3	2	1	1	1	1	1
3	4	1	3	2	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	5	1	1	1	3	3	3	3	1	3	3	3	3	2	1	1	1	1	1
3	6	1	1	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	7	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	8	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	9	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	10	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	11	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	12	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	13	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	14	1	3	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1
2	15	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	16	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	17	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	18	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	19	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	20	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	21	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	22	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	23	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	24	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	25	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1	1
3	26	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	27	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	28	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
QC	GOOD	28	15	25	0	0	0	0	12	0	0	0	0	10	13	28	28	28	28
	MAYBE	0	0	2	0	0	0	0	1	0	0	0	0	2	2	0	0	0	0
	NO GOOD	0	13	1	28	28	28	28	15	28	28	28	28	16	13	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 27: Summarized QC Results for Smoothed Traces in Section 390201 J1B Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN4	DYN5	DYN8
2	1	1	1	2	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	2	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	3	1	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	1	1
3	4	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	5	1	1	1	3	3	3	3	2	2	3	3	3	2	1	1	1	1	1
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	7	3	3	3	3	3	3	3	2	3	3	3	3	2	2	1	1	1	1
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	9	3	3	3	3	3	3	3	3	2	3	3	3	2	2	1	1	1	1
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	11	3	3	3	3	3	3	3	2	2	3	3	3	2	3	1	1	1	1
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	13	3	3	3	3	3	3	3	3	2	3	3	3	2	2	1	1	1	1
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	15	3	3	3	3	3	3	3	2	2	3	3	3	2	2	1	1	1	1
3	16	3	3	3	3	3	3	3	2	3	3	3	3	3	3	1	1	1	1
2	17	3	3	3	3	3	3	3	2	2	3	3	3	3	3	1	1	1	1
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	19	1	1	1	3	3	3	3	3	1	3	3	3	3	1	1	1	1	1
2	20	1	1	1	3	3	3	3	3	1	3	3	3	2	1	1	1	1	1
2	23	3	3	3	3	3	3	3	3	2	3	3	3	2	3	1	1	1	1
3	24	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	25	1	3	1	3	3	3	3	3	3	3	3	3	3	2	1	1	1	1
3	26	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
QC	GOOD	10	5	9	0	0	0	0	0	2	0	0	0	0	4	24	24	24	24
	MAYBE	0	0	1	0	0	0	0	7	7	0	0	0	8	5	0	0	0	0
	NO GOOD	14	19	14	24	24	24	24	17	15	24	24	24	16	15	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 28: Summarized QC Results for Smoothed Traces in Section 390201 J1C Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	1	1	2	3	3	3	3	2	2	3	3	3	3	2	1	1	1	1
2	2	1	1	1	3	3	3	3	1	2	3	3	3	3	1	1	1	1	1
2	3	1	1	1	3	3	3	3	1	2	3	3	3	3	1	1	1	1	1
2	4	1	1	1	3	3	3	3	1	2	3	3	3	3	2	1	1	1	1
2	5	1	1	1	3	3	3	3	2	2	3	3	3	3	2	1	1	1	1
2	6	1	1	1	3	3	3	3	2	2	3	3	3	3	2	1	1	1	1
2	7	1	1	1	3	3	2	3	2	2	3	3	3	3	2	1	1	1	1
2	8	1	1	1	3	3	2	3	2	2	3	3	3	3	1	1	1	1	1
2	9	1	1	1	3	3	3	3	2	2	3	3	3	3	1	1	1	1	1
2	10	1	1	1	3	3	3	3	2	2	3	3	3	3	2	1	1	1	1
2	11	1	1	1	3	3	2	3	2	2	3	3	3	3	1	1	1	1	1
2	12	1	1	1	3	3	3	3	2	2	3	3	3	3	1	1	1	1	1
2	13	1	1	1	3	3	3	3	2	2	3	3	3	3	1	1	1	1	1
2	14	1	1	1	3	3	2	3	1	1	3	3	3	1	1	1	1	1	1
QC	GOOD	14	14	13	0	0	0	0	4	1	0	0	0	1	8	14	14	14	14
	MAYBE	0	0	1	0	0	4	0	10	13	0	0	0	0	6	0	0	0	0
	NO GOOD	0	0	0	14	14	10	14	0	0	14	14	14	13	0	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 29: Summarized QC Results for Smoothed Traces in Section 390205 J5A Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN4	DYN5	DYN8
2	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	3	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	4	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	5	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	6	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	7	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	8	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	9	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	10	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	11	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	12	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	13	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	14	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	15	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	16	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	17	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	18	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	19	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	20	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	21	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	22	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	23	3	1	1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
3	24	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	25	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	26	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	27	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	3	1
3	28	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	3	1
2	29	3	1	3	3	1	1	1	1	1	2	1	3	1	3	1	1	3	1
QC	GOOD	0	13	24	0	1	1	1	2	1	0	1	0	1	0	3	3	0	3
	MAYBE	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	NO GOOD	29	15	3	29	28	28	28	27	28	28	28	29	28	29	26	26	29	26

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 30: Summarized QC Results for Smoothed Traces in Section 390205 J5B Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	3	3	3	1	3	3	3	3	2	3	3	3	3	2	3	1	3	1	1
3	4	3	3	2	3	3	3	3	2	3	3	3	3	3	3	1	3	1	1
2	5	3	3	3	3	3	2	3	2	2	3	1	3	1	3	1	3	1	1
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	7	3	1	3	3	3	2	3	1	1	3	1	3	1	3	1	3	1	1
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	9	3	1	3	3	3	2	3	2	2	3	1	3	1	3	1	3	1	1
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	11	3	1	3	3	3	2	3	1	1	3	1	3	1	3	1	3	1	1
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	13	3	1	3	3	3	2	3	1	1	3	1	3	1	3	1	3	1	1
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	15	3	1	3	3	3	2	3	1	1	3	1	3	1	3	1	3	1	1
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	17	3	3	3	3	3	2	3	1	1	3	1	3	1	3	1	3	1	1
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	19	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	20	3	1	1	3	3	3	3	3	3	3	1	3	1	3	1	3	1	1
2	21	3	3	3	3	3	2	3	1	2	3	1	3	1	3	1	3	1	1
2	23	3	3	3	3	3	2	3	1	1	3	1	3	1	3	1	3	1	1
3	24	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
3	25	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
3	26	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
QC	GOOD	0	7	6	0	0	0	0	7	6	0	10	0	10	0	25	0	25	25
	MAYBE	0	0	1	0	0	9	0	4	3	0	0	0	1	0	0	0	0	0
	NO GOOD	25	18	18	25	25	16	25	14	16	25	15	25	14	25	0	25	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 31: Summarized QC Results for Smoothed Traces in Section 390205 J5C Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	2	3	1	2	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	3	3	1	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	4	3	1	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	5	3	1	2	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	6	3	1	2	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	7	3	1	2	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	8	3	1	1	3	3	3	3	3	3	3	3	3	2	3	1	3	1	1
2	9	3	1	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	10	3	1	1	3	3	3	3	3	3	3	3	3	3	3	1	3	1	1
2	11	3	1	1	3	3	3	3	3	3	3	2	3	2	3	1	3	1	1
2	12	3	1	1	3	3	3	3	3	3	3	2	3	2	3	1	3	1	1
2	13	3	1	1	3	3	3	3	3	3	3	2	3	2	3	1	3	1	1
2	14	3	1	1	3	3	3	3	3	3	3	2	3	3	3	1	3	1	1
QC	GOOD	0	14	9	0	0	0	0	0	0	0	0	0	0	0	14	0	14	14
	MAYBE	0	0	4	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0
	NO GOOD	14	0	1	14	14	14	14	14	14	14	10	14	10	14	0	14	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 32: Summarized QC Results for Smoothed Traces in Section 390205 J5J1M Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	3	2	3	3	1	3	3	3	3	3	3	3	3	1	1	1	1
3	2	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	3	1	1	1	1	2	1	3	1	1	3	3	3	2	1	1	1	1	1
3	4	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	5	1	1	1	1	1	1	3	1	1	1	3	3	3	1	1	1	1	1
3	6	2	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	7	1	3	1	1	3	1	3	1	1	3	3	3	3	3	1	1	1	1
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	9	1	1	1	1	1	1	3	1	1	2	3	3	1	1	1	1	1	1
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	11	1	1	1	1	2	1	3	1	1	2	3	3	3	3	1	1	1	1
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	13	1	1	1	1	2	1	3	1	1	3	3	3	3	3	1	1	1	1
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	15	1	3	1	1	1	1	3	1	1	1	3	3	3	3	1	1	1	1
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	17	1	3	1	1	1	1	3	1	1	3	3	3	3	3	1	1	1	1
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
	GOOD	8	5	11	8	4	9	0	8	8	2	0	0	1	3	18	18	18	18
	MAYBE	1	0	1	0	3	0	0	0	0	2	0	0	1	0	0	0	0	0
QC	NO GOOD	9	13	6	10	11	9	18	10	10	14	18	18	16	15	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 33: Summarized QC Results for Smoothed Traces in Section 390205 J5J1N Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	1	1	1	3	3	3	2	2	3	3	3	3	3	1	1	1	1
3	2	2	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	3	1	3	1	1	3	3	3	1	1	3	3	3	1	3	1	1	1	1
3	4	2	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	5	1	1	1	1	3	3	3	1	1	3	3	3	1	1	1	1	1	1
3	6	2	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	7	1	3	1	1	2	3	3	1	1	3	3	3	3	3	1	1	1	1
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	9	1	3	1	1	3	3	3	1	1	3	3	3	3	2	1	1	1	1
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	11	1	3	1	1	1	3	3	1	1	3	3	3	3	3	1	1	1	1
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	13	1	3	1	3	2	3	3	1	1	3	3	3	3	3	1	1	1	1
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	15	1	3	1	1	1	3	3	1	1	3	3	3	3	3	1	1	1	1
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	17	1	3	1	1	1	3	3	1	1	3	3	3	3	3	1	1	1	1
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
QC	GOOD	8	2	12	8	3	0	0	8	8	0	0	0	2	1	18	18	18	18
	MAYBE	3	0	0	0	2	0	0	1	1	0	0	0	0	1	0	0	0	0
	NO GOOD	7	16	6	10	13	18	18	9	9	18	18	18	16	16	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 34: Summarized QC Results for Smoothed Traces in Section 390205 J5J1O Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	2	1	1	1	3	1	3	1	1	3	3	3	3	3	2	1	3	3
3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	3	1	1	1	1	1	1	3	1	1	2	3	3	3	1	1	1	1	3
3	4	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	5	1	1	1	1	1	1	3	1	1	2	3	3	3	3	1	1	1	3
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	7	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	9	1	3	1	3	1	1	3	1	1	1	3	3	3	3	1	1	1	3
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	11	1	3	1	3	1	1	3	1	1	2	3	3	3	3	1	1	1	3
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	13	1	3	1	3	1	3	3	1	1	1	3	3	3	3	1	1	1	2
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	15	1	3	1	3	1	3	3	1	1	1	3	3	3	3	1	1	1	2
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	17	1	3	1	3	1	2	3	1	1	1	3	3	3	3	1	1	1	3
3	18	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
QC	GOOD	9	3	10	3	7	5	0	8	8	4	0	0	0	1	16	17	16	0
	MAYBE	1	0	0	0	0	1	0	0	0	3	0	0	0	0	1	0	0	2
	NO GOOD	8	15	8	15	11	12	18	10	10	11	18	18	18	17	1	1	2	16

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 35: Summarized QC Results for Smoothed Traces in Section 390205 J5J1P Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	2	2	3	3	3	3	3	1	1	1	3	3	3	1	1	1	1	1	1
3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	1	1	1	1
2	4	1	3	3	3	3	3	1	1	1	3	3	3	1	1	1	1	1	1
3	5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	1	1	1	1
2	6	1	3	3	3	3	3	1	1	1	3	3	3	1	1	1	1	1	1
3	7	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	8	1	3	3	3	3	3	1	1	1	3	3	3	3	1	1	1	1	1
3	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	10	1	3	3	3	3	3	1	1	1	3	3	3	1	1	1	1	1	1
3	11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	12	1	3	2	3	3	3	1	1	1	3	3	3	1	1	1	1	1	3
3	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	14	1	3	2	3	3	3	1	1	1	3	3	3	1	1	1	1	1	3
3	15	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	16	1	3	1	3	3	3	1	1	1	3	3	3	1	1	1	1	1	3
3	17	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	18	3	3	1	3	3	3	1	1	1	3	3	3	1	1	1	1	1	3
QC	GOOD	7	0	2	0	0	0	9	9	9	0	0	0	8	9	18	18	18	10
	MAYBE	1	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
	NO GOOD	10	18	14	18	18	18	9	7	9	18	18	18	10	9	0	0	0	8

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 36: Summarized QC Results for Smoothed Traces in Section 390208 J8A Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN4	DYN5	DYN8
2	1	3	2	3	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	2	3	2	3	2	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	3	2	1	2	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	4	2	3	2	2	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	5	1	1	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	3
3	6	2	2	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	7	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	8	2	3	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	9	1	1	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	3
3	10	1	3	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	11	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	12	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	13	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	14	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	15	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	16	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	17	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	18	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	19	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	20	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	21	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	22	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	23	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	24	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	25	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	26	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
QC	GOOD	18	12	22	16	0	0	0	0	0	0	0	0	0	0	26	26	26	0
	MAYBE	4	3	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0
	NO GOOD	4	11	2	8	26	26	26	26	24	26	26	26	26	26	0	0	0	26

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 37: Summarized QC Results for Smoothed Traces in Section 390208 J8B Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	2	3	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	2	3	1	3	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	3	1	1	1	1	3	3	3	3	3	3	2	3	3	3	1	1	1	1
3	4	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	5	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	6	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	7	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	8	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	9	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	10	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	11	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	12	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	13	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	14	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	15	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	16	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	17	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	18	1	1	2	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
2	19	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	20	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	21	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	22	1	2	3	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	24	1	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	25	1	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	26	2	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
3	27	2	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3
QC	GOOD	22	14	18	16	0	0	0	0	0	0	0	0	0	0	26	26	26	9
	MAYBE	2	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	NO GOOD	2	10	7	10	26	26	26	26	26	26	25	26	26	26	0	0	0	17

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 38: Summarized QC Results for Smoothed Traces in Section 390208 J8C Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	3	3	1	3	3	3	3	3	3	2	3	3	3	1	1	1	3
2	2	3	3	3	1	3	3	3	3	3	3	2	3	3	3	1	1	1	3
2	3	2	3	3	1	3	3	3	3	3	3	1	3	3	3	1	1	1	3
2	4	1	3	2	1	3	3	3	3	3	3	2	3	3	3	1	1	1	3
2	5	1	3	1	1	3	3	3	3	3	3	2	3	3	3	1	1	1	3
2	6	1	3	2	1	3	3	3	3	3	3	2	3	3	3	1	1	1	3
2	7	1	3	2	1	3	3	3	3	3	3	1	3	3	3	1	1	1	3
2	8	1	3	1	1	3	3	3	3	3	3	1	3	3	3	1	1	1	3
2	9	1	3	1	1	3	3	3	3	3	3	1	3	3	3	1	1	1	3
2	10	1	3	1	1	3	3	3	3	1	3	1	3	3	3	1	1	1	3
2	11	1	3	2	1	3	3	3	3	1	1	1	3	3	3	1	1	1	3
2	12	1	3	1	1	3	3	3	3	3	1	1	3	3	3	1	1	1	3
2	13	1	3	1	1	3	3	3	3	3	3	1	3	3	3	1	1	1	3
2	14	1	3	1	1	3	3	3	3	3	3	1	3	3	3	1	1	1	3
2	15	1	3	1	1	3	3	3	3	3	3	2	3	3	3	1	1	1	1
2	16	1	3	1	1	3	3	3	3	3	1	2	3	3	3	1	1	1	3
2	17	1	3	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	3
QC	GOOD	14	0	10	17	0	0	0	0	2	3	9	0	0	0	17	17	17	1
	MAYBE	1	0	4	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
	NO GOOD	2	17	3	0	17	17	17	17	15	14	1	17	17	17	0	0	0	16

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 39: Summarized QC Results for Smoothed Traces in Section 390208 J8S3M Test Job

Truck-Axle	**Run#**	**LVDT1**	**LVDT2**	**LVDT3**	**LVDT4**	**LVDT7**	**LVDT8**	**LVDT9**	**LVDT10**	**LVDT11**	**LVDT12**	**LVDT13**	**LVDT14**	**LVDT15**	**LVDT16**	**DYN1**	**DYN2**	**DYN7**	**DYN8**
2	1	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	1	3
3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	3	2	3	3	3	3	2	3	3	3	3	2	3	3	3	3	3	1	3
3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	5	1	1	3	3	3	1	3	3	3	3	2	3	1	2	3	3	1	3
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	7	1	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	1	3
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	9	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	11	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	15	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	17	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
QC	GOOD	6	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	16	0
	MAYBE	1	0	0	0	0	1	0	0	0	0	2	0	1	2	0	0	0	0
	NO GOOD	11	17	18	18	18	16	18	18	18	18	16	18	16	15	18	18	2	18

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 40: Summarized QC Results for Smoothed Traces in Section 390208 J8S3N Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2
3	2	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	2
2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2
3	4	3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	1	2
2	5	3	2	3	2	3	2	3	3	3	3	3	3	2	2	3	3	1	1
3	6	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	2
2	7	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	1	1
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2
2	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2
2	11	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	1	2
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	15	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	17	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
QC	GOOD	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	18	2
	MAYBE	1	1	0	1	0	1	0	0	0	0	0	0	2	3	0	0	0	9
	NO GOOD	17	17	18	15	18	17	18	18	18	18	17	18	16	15	18	18	0	7

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 41: Summarized QC Results for Smoothed Traces in Section 390208 J8S3O Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	2	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	5	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	7	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	9	1	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3	1	3
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	11	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	13	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	15	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	17	1	3	3	3	1	3	3	3	3	3	1	3	3	3	3	3	1	3
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
QC	GOOD	7	0	0	1	2	1	0	0	0	0	1	0	0	0	0	0	17	0
	MAYBE	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	NO GOOD	10	18	18	16	16	17	18	18	18	18	17	18	18	18	18	18	0	18

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 42: Summarized QC Results for Smoothed Traces in Section 390208 J8S3P Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	1	3
3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	7	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3
2	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	15	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
3	17	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
2	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
QC	GOOD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
	MAYBE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0
	NO GOOD	18	18	18	18	18	18	18	18	18	18	18	18	17	17	18	18	1	18

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 43: Summarized QC Results for Smoothed Traces in Ohio SPS-2 J12A Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN4	DYN5	DYN8
2	1	1	3	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	1
3	2	1	3	1	2	3	3	3	3	2	3	3	3	3	3	1	1	1	1
2	3	1	3	1	2	3	3	3	3	1	3	3	3	3	3	1	1	1	1
3	4	1	3	2	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
QC	GOOD	4	0	3	1	0	0	0	0	1	0	0	0	0	0	4	4	4	4
	MAYBE	0	0	1	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0
	NO GOOD	0	4	0	1	4	4	4	4	1	4	4	4	4	4	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 44: Summarized QC Results for Smoothed Traces in Section 390212 J12B Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	1	3	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	2	1	1	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	3	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	4	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	5	1	2	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	6	2	3	1	3	3	3	3	3	3	3	3	3	3	3	2	1	1	2
2	7	1	1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	8	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	9	1	3	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	10	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	11	1	2	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	1
3	12	2	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	13	1	1	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	1
3	14	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	15	1	2	1	1	3	3	3	3	2	3	3	3	3	3	1	1	1	1
3	16	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
2	17	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
3	18	1	3	1	3	3	3	3	3	2	3	3	3	3	3	1	1	1	1
2	19	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	20	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	21	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
3	22	1	3	1	3	3	3	3	3	2	3	3	3	3	3	1	1	1	1
3	24	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	25	1	1	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	26	1	1	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
3	27	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1
QC	GOOD	24	10	25	12	0	0	0	0	4	0	0	0	0	0	25	26	26	25
	MAYBE	2	3	0	0	0	0	0	0	5	0	0	0	0	0	1	0	0	1
	NO GOOD	0	13	1	14	26	26	26	26	17	26	26	26	26	26	0	0	0	0

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 45: Summarized QC Results for Smoothed Traces in Section 390212 J12C Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	2	1	2	1	3	3	3	3	2	3	3	3	3	3	1	1	1	1
2	2	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	3	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	2	1	1
2	4	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	3	1	1
2	5	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	6	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	7	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	2	1	1
2	8	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	9	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	10	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	3
2	11	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	12	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	2	1	1
2	13	1	1	1	1	3	3	3	3	1	3	3	3	3	3	1	1	1	1
2	14	1	1	1	1	3	3	3	3	1	3	3	3	3	1	1	1	1	1
QC	GOOD	13	14	13	14	0	0	0	0	13	0	0	0	0	1	14	10	14	13
	MAYBE	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0
	NO GOOD	0	0	0	0	14	14	14	14	0	14	14	14	14	13	0	1	0	1

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 46: Summarized QC Results for Smoothed Traces in Section 390212 J12J10M Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	2	2	1	3	3	3	2	2	3	3	3	2	2	3	3	3	3
3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3
2	3	1	2	1	1	3	3	3	2	2	3	3	3	2	2	3	3	3	3
3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	5	1	3	1	1	3	3	3	1	1	3	3	3	1	1	3	3	3	3
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	7	1	3	1	3	3	3	3	3	3	3	3	3	3	2	3	2	3	3
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
2	9	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
2	11	1	3	1	1	3	3	3	2	2	3	3	3	2	2	3	2	3	3
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
2	13	1	3	1	3	3	3	3	2	2	3	3	3	3	2	3	2	3	3
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
2	15	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
2	17	1	3	1	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
QC	GOOD	8	0	8	4	0	0	0	1	1	0	0	0	1	1	0	0	0	0
	MAYBE	0	2	1	0	0	0	0	4	4	0	0	0	3	6	0	10	1	0
	NO GOOD	10	16	9	14	18	18	18	13	13	18	18	18	14	11	18	8	17	18

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 47: Summarized QC Results for Smoothed Traces in Section 390212 J12J10N Test Job

Truck-Axle	**Run#**	**LVDT1**	**LVDT2**	**LVDT3**	**LVDT4**	**LVDT7**	**LVDT8**	**LVDT9**	**LVDT10**	**LVDT11**	**LVDT12**	**LVDT13**	**LVDT14**	**LVDT15**	**LVDT16**	**DYN1**	**DYN2**	**DYN7**	**DYN8**
2	1	2	3	2	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
3	2	3	3	3	1	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	3	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
3	4	3	3	3	2	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	5	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
3	6	3	3	1	1	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	7	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	9	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	11	2	3	1	3	3	3	3	3	2	3	3	3	3	3	1	3	3	3
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
2	13	1	3	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
2	15	1	3	2	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
2	17	1	3	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
3	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
QC	GOOD	7	0	6	2	0	0	0	0	0	0	0	0	0	0	11	0	0	0
	MAYBE	2	0	4	1	0	0	0	0	2	0	0	0	0	0	7	0	0	0
	NO GOOD	9	18	8	15	18	18	18	18	16	18	18	18	18	18	0	18	18	18

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 48: Summarized QC Results for Smoothed Traces in Section 390212 J12J10O Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	3	1	3	1	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
3	4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	5	1	3	1	3	3	3	3	3	1	3	3	3	3	3	1	3	3	3
3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
2	7	1	3	1	3	3	3	3	3	1	3	3	3	3	3	1	2	3	3
3	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2	2	3
2	9	1	3	1	3	3	3	3	3	3	3	3	3	3	3	2	3	2	3
3	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	2	3
2	11	1	3	1	3	3	3	3	3	1	3	3	3	3	3	2	3	2	3
3	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	2	3
2	13	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	2	3
2	15	1	3	1	3	3	3	3	3	1	3	3	3	3	3	2	3	3	3
3	16	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
2	17	1	3	1	3	3	3	3	3	1	3	3	3	3	3	2	3	3	3
3	18	3	3	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
QC	GOOD	8	0	8	0	0	0	0	0	5	0	0	0	0	0	9	0	0	0
	MAYBE	1	0	1	0	0	0	0	0	0	0	0	0	0	0	7	2	6	0
	NO GOOD	9	18	9	18	18	18	18	18	13	18	18	18	18	18	2	16	12	18

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.

Table 49: Summarized QC Results for Smoothed Traces in Section 390212 J12J10P Test Job

Truck-Axle	Run#	LVDT1	LVDT2	LVDT3	LVDT4	LVDT7	LVDT8	LVDT9	LVDT10	LVDT11	LVDT12	LVDT13	LVDT14	LVDT15	LVDT16	DYN1	DYN2	DYN7	DYN8
3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	2	2	1	2	1	3	1	3	2	1	3	2	3	3	2	3	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	4	2	1	2	1	3	1	3	2	1	3	2	3	2	2	3	3	3	3
3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	6	2	1	1	1	3	2	3	2	2	3	2	3	2	2	3	3	3	3
3	7	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	8	2	2	2	1	3	2	3	2	2	3	2	3	2	2	3	3	3	3
3	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	10	2	1	2	1	3	2	3	2	2	3	2	3	2	2	3	3	3	3
3	11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	12	2	1	1	1	3	2	3	2	2	3	2	3	2	2	3	3	3	3
3	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	14	1	1	1	1	3	3	3	2	2	3	2	3	2	2	3	3	3	3
3	15	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	16	1	1	1	1	3	3	3	3	2	3	3	3	2	2	3	3	3	3
3	17	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
QC	GOOD	2	7	4	8	0	2	0	0	2	0	0	0	0	0	0	0	0	0
	MAYBE	6	1	4	0	0	4	0	7	6	0	7	0	7	8	0	0	0	0
	NO GOOD	9	9	9	9	17	11	17	10	9	17	10	17	10	9	17	17	17	17

Note: Numbers 1, 2, and 3 under each sensor column (not from run# column) in the above table represent 1: Good, 2: Maybe, and 3: No Good traces respectively. Numbers 2 and 3 under Truck- Axle column represent 2: two axle truck and 3: three axle truck.