Network-Level Pavement Condition Data Collection
Quality Management Plan

Version 2.0

Prepared by

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

BISMARCK, NORTH DAKOTA

www.dot.nd.gov

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March, 2018

Document Change Control

The following is the document control for revisions to this document.

Version No	Date of Issue	Author(s)	Brief Description of Change
1.0	March, 2018	Stephanie Weigel	Initial Publication
2.0	October, 2019	Stephanie Weigel	Updated Section 3: Pavement Condition Data Collection Vehicle Calibration

Definitions

The following are definitions of terms, abbreviations, and acronyms used in this document.

Term	Definition
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society of Testing and Materials
DMI	Distance Measuring Instrument
GPS	Global Positioning Systems
HPMS	Highway Performance Monitoring System
IP	Inertial Profiler
IRI	International Roughness Index
LTPP	Long-Term Pavement Performance
PMS	Pavement Management System
QC	Quality Control
QM	Quality Management

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Introduction

The North Dakota Department of Transportation (NDDOT) has conducted semi-automated pavement condition surveys in-house since 1991 using equipment purchased from a vendor. NDDOT has purchased replacement data collection vehicles in 1996, 2003, 2009 and 2019. Prior to 2013, the collection was semi-automated with distress scoring done manually using images collected from the vehicle. In 2013 the vehicle purchased in 2009 was upgraded to the 3D system to become fully automated for crack detection and analysis used for distress scoring along with adding a gyro for geometric data collection.

Data Collection

NDDOT collects pavement condition data on approximately 8,500 lane miles annually. Both directions are collected on interstates and multi-lane highways (driving lane only). One direction is collected for two-lane highways, alternating directions each year. Data collected as part of the network-level pavement condition data is reported for every 0.100 mi of the surveyed length for the Highway Performance Monitoring System (HPMS) and reported by NDDOT segment length for NDDOT's Pavement Management System (PMS). Data is collected in both wheel paths over 100 percent of the length of the network. The collected data is shown in the following table.

Network Level Condition Data Items Collected

General Data	Asphalt and Composite Pavements	Jointed Concrete Pavements and Concrete Overlays	Continuously Reinforced Concrete Pavements
• Location (highway, MP, offset, length, latitude & longitude determined by GPS coordinates) • Roadway events (bridges, railroad crossings, rumble strips, construction) • Perspective and ROW Images • Optional Geometric Data (horizontal and vertical curves, cross-slope, super-elevation)	• IRI • Bleeding • Longitudinal Cracking • Transverse Cracking • Block Cracking • Alligator Cracking • Raveling/ Weathering • Bituminous Patching • Rutting	• IRI • Corner Breaks • Longitudinal Cracking • Transverse Cracking • Corner Breaks • D Cracking • Longitudinal Joint Spalling • Transverse Joint Spalling • Broken Slabs • Bituminous Patching • Concrete Patch Deterioration • Faulting	• IRI • Longitudinal Cracking • Transverse Cracking • D Cracking • Longitudinal Joint Spalling • Transverse Joint Spalling • Blow-Up Repairs • Bituminous Patching • Concrete Patch Deterioration

1. QUALITY MANAGEMENT APPROACH

The purpose of managing quality is to validate that the deliverables are completed with the acceptable level of care necessary to achieve the desired results. Quality Management (QM) assures the character of the data collection deliverables and describes the processes and procedures to be used for ensuring the desired outcomes are achieved.

This QM plan identifies key activities, processes, and procedures for ensuring quality data. Below is a brief explanation of each of the sections of the QM plan that follow.

Section 2. Deliverables, Protocols, and Quality Standards	The data collection deliverables subject to quality review, protocols used to collect, and quality standards that are the measures used to determine a successful outcome for a deliverable. The criteria to describe when each deliverable is considered complete and correct are defined by the Pavement Management Engineer. Deliverables are evaluated against these criteria before they are formally approved.
Section 3. Quality Control (QC)	The QC activities that monitor, provide feedback, and verify that the data collection deliverables meet the defined quality standards.
Section 4. Acceptance	The acceptance testing that will be used to determine if quality criteria are met and corrective actions that will be taken for any deliverables not meeting criteria.
Section 5. Quality Team Roles and Responsibilities	The quality-related responsibilities of the data collection team.
Section 6. Quality Reporting Plan	The documentation of all QM activities – including quality standards, QC, acceptance, and corrective actions – and the format of the final QM report.
Section 7. Acceptance of QM Plan	Signature page for acceptance of the QM Plan.

2. DELIVERABLES, PROTOCOLS, AND QUALITY STANDARDS

The key deliverables, protocols used for collection, and associated quality standards are described below. Quality standards define, when applicable, the resolution, accuracy, and repeatability or other standards that will be used to determine the minimum characteristics of each deliverable. See Section 4 for the Acceptance Testing Plan.

Deliverable	Protocols	Resolution	Accuracy (compared to reference value)	Repeatability (for three repeat runs)
Longitudinal Profile	AASHTO M 328-10, AASHTO PP 70-14, AASHTO R 56-14, AASHTO R 57-14, ASTM E950	0.002 inch	+/- 5%	+/- 5%
IRI (left, right, and average)	AASHTO M 328-14, AASHTO R 43-13, AASHTO R 57-14, ASTM E1926	1 in/mile	+/- 5%	+/- 5%
Rut Depth (average and maximum)	AASHTO PP 69-10, AASHTO PP 69-14 (Automated), AASHTO PP 70-14 (Automated), AASHTO R 48-10	0.01 inch	+/- 0.019 inch	0.06 inch
Faulting (average)	AASHTO R 36-13	0.01 inch	0 .06 inch	0.06 inch
Distress Identification and Rating	AASHTO PP 67-10, AASHTO PP 67-14 (Automated), AASHTO PP 68-10, AASHTO PP 68-14 (Automated), AASHTO R 55-10 (Manual), ASTM E1656-11, LTPP Distress Identification Manual, NDDOT Distress Scoring Guide	Varies	+/- 20 percent	N/A
GPS (latitude and longitude)	N/A	Submeter (static)	Submeter (static)	N/A
Perspective and ROW Images	N/A	2500 X 2000 per camera	Signs legible, proper exposure and color balance	N/A

Deliverable	Protocols	Resolution	Accuracy (compared to reference value)	Repeatability (for three repeat runs)
Pavement Images	N/A	N/A	2 mm cracking visible and detected	N/A

3. QUALITY CONTROL

The focus of QC is on data collection deliverables and processes. QC monitors the deliverables to verify that they are of acceptable quality and are complete and correct. The following table identifies:

- The major deliverables that will be tested for satisfactory quality level.
- The quality expectations for the deliverables.
- The QC activities that will be executed to control and monitor the quality of the deliverables.
- How often or when the QC activities will be performed.
- NDDOT's QC process is explained in NDDOT's Pavement Management Section Manual.

Deliverable	Quality Expectations	QC Activity	Frequency/Interval
IRI, DMI	95 Percent Compliance With Standards	Initial Equipment Configuration, Calibration, Verification	Pre-Collection (Annually)
		Daily Equipment Checks and Monitor Real-Time	Daily
		Control, Blind, or Verification Testing	Weekly
		Inspect Uploaded Data Samples	Weekly
		Inspect Processed Data	During Manual QC
		Final Data Review	Prior to RIMS Upload
Rut Depth, Faulting, GPS Coordinates, Longitudinal Grade	95 Percent Compliance With Standards	Initial Equipment Configuration, Calibration, Verification	Pre-Collection (Calibration at time of equipment purchase)
		Daily Equipment Checks and Monitor Real-Time	Daily
		Control, Blind, or Verification Testing	Weekly
		Inspect Uploaded Data Samples	Weekly
		Inspect Processed Data	During Manual QC
		Final Data Review	Prior to RIMS Upload
Distress Rating	80 Percent Match: Manual vs Automated	Initial Rater Training	Pre-Collection (as needed)
		Intra-rater Checks	During Manual QC
		Final Data Review	Prior to RIMS Upload

Deliverable	Quality Expectations	QC Activity	Frequency/Interval
Perspective, ROW and Pavement Images	98 Percent Compliance With Standards of Each Control Section and Not More Than 5 Consecutive Images Failing to Meet Criteria	Startup Checks, Real-Time Monitoring, and Field Review	Daily
		Uploaded Samples Review	Weekly
		Final Review	Prior to Processing

Pavement Condition Data Collection Vehicle Calibration

NDDOT's pavement condition data collection vehicle is calibrated by NDDOT once a year for IRI calibration on both asphalt and concrete pavement. The DMI is also calibrated at this time. This is done annually before roadway collection begins. NDDOT's certification process is in accordance to AASHTO R56. Before IRI calibration, the bounce test, block test and DMI calibration will be performed on the pavement condition data collection vehicle by NDDOT employees in accordance to AASHTO R56.

Block Test:

The block test is used to calibrate the right and left wheel path lasers.

- 10 measurements are taken on 4 different sized gauge blocks of known thickness. The thickness of each block is as follows: 0.25'', 0.50'', 1.00'' and 2.00''.
- The 10 measurements for each block are then averaged to get 1 average measurement that will be compared to the actual thicknesses.
- The absolute difference of the actual block thickness and average block thickness is then calculated.
- The absolute difference should be less than or equal to 0.01 in for each gauge block.
- If an average for any block does not fall within the acceptable range, the laser will be recalibrated, and the block test will be repeated for that block size.
- The following table will be completed for both wheel paths and saved for the calibration log:

Block Test Calibration Certification - RIGHT WHEEL PATH

Vehicle:	
VIN:	
Date:	
Operator:	

	Block Height (Inches)				
Test Number	Base Plate	0.25"	0.50"	1.00"	2.00"
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Actual Block					
Average					
Difference					
Stand. Deviation					
Max.					
Min.					

Note: Absolute difference of each block should be less than or equal to 0.01 in

Test Site Location:

<u>Bounce Test</u>:

The bounce test is used to verify the proper function of the accelerometers with relation to the wheel path lasers.

- The bounce test will be performed for the right and left wheel path.
- The static portions result in an IRI of less than 3 inch/mile and the bounce portion IRI is less than 8 inch/mile.
- If NDDOT employees cannot get the vehicle within tolerances, the manufacturer will be contacted for further instructions/recommendations to bring it within tolerance.
- The following table will be completed for both wheel paths and saved for the calibration log:

Bounce Test Calibration Certification

Vehicle:	
VIN:	
Date:	
Operator:	

Note: Static portion IRI less than 3 in/mile; Bounce portion IRI less than 8 in/mile
Note: The two static portions should be about the same
Note: Start and let run for 10 seconds, bounce 13 times, let run for 10 seconds, End

Right Screen Shot:

Static IRI	Bounce IRI	Static IRI

Left Screen Shot:

Static IRI	Bounce IRI	Static IRI

<u>Distance Measuring Instrument (DMI):</u>

The DMI calibration is done to ensure the vehicle is accurately measuring a specific distance between two points. Recalibration is done weekly to account for tire wear or new tires.

- The calibration site shall be at least 1000 feet in length with a clearly marked starting and ending point.
- The start and end collection points are triggered using a photocell and reflective tape to eliminate any human error.
- At least three auto-triggered runs at the low-speed and high-speed test speeds should be made.
- The average of the absolute differences for both the low-speed and high-speed run must be less than 0.15 percent.
- The following table will be completed and saved for the calibration log:

Distance Measuring Instrument (DMI) Calibration Certification

Vehicle:	
VIN:	
Date:	
Operator:	

Actual Distance (Feet):	
Acceptable Tolerance:	0.15%
Acceptable Difference:	

Note: Minimum test distance is 1000 Feet

Note: Minimum of 3 runs must be made at the lowest test speed and 3 at the highest test speed

Low Speed: Speed =

	Surveyed Distance	Difference (Feet)	Acceptable (Y/N)
Run 1			
Run 2			
Run 3			
Run 4			
Run 5			
Average:			

High Speed: Speed =

	Surveyed Distance	Difference (Feet)	Acceptable (Y/N)
Run 1			
Run 2			
Run 3			
Run 4			
Run 5			
Average:			

Test Site Location:

<u>IRI:</u>

To pass NDDOT's certification, the pavement condition data collection vehicle must pass North Dakota Department of Transportation's Inertial Profiler Certification Program. A SurPRO reference profiler creates the baseline profile for comparison against the data collection vehicle. The following apply:

- A certification site with a minimum length of 528 feet in length is set up on asphalt or concrete pavement with an IRI ranging between 95 to 135 in./mile (medium-smooth roughness). An additional site with IRI ranging between 30 to 75 in./mile (smooth) is set up on asphalt or concrete (whichever pavement type was not used for medium-smooth) so the data collection vehicle is certified on both asphalt and concrete in the medium-smooth and smooth range. The smooth site was unable to be used in 2019.
- Both wheel paths will be certified. The speed at which the profiler collects the data shall be 55 mph.
- A reference profile using the SurPRO is collected first using the following process:
  - First the SurPRO is calibrated for distance over a specified portion of the site.
  - After the distance calibration, a closed loop is collected on one of the wheel paths using the SurPRO. Then a total of 5 runs (3 will be selected to meet R56 8.2.2, Note 2) is collected on the same wheel path. This process is repeated on the remaining wheel path.

- Must complete a minimum of 5 runs (will do 10 runs at 55 mph) on both asphalt and concrete pavement (only asphalt done in 2019). The master reference profile of the selected runs from the data collection vehicle are loaded into ProVAL for analysis using the Profiler Certification Module. The 5 runs must pass the following criteria:
  - The reference profile and each inertial profile shall be compared using an IRI filter (without the 250mm filter).
  - The IRI from each inertial profile being evaluated must be within 5% of the IRI from the reference profiler,
  - The mean cross-correlations of repeatability between each inertial profile must be at least 92%,
  - The mean cross-correlation of accuracy between each individual inertial profile and the reference profile must be at least 90%, and
  - The distance of each run must be within 0.2% of the actual length of the test section using the DMI.
- An official document is produced from the ProVAL analysis indicating a passing grade. See below for a summary showing a passing grade.
- If the vehicle does not pass certification, the following will be completed:
  - Perform the bounce test and block test again.
  - Collect an additional minimum of 5 runs for comparison.
  - The manufacturer will be contacted for further instructions/recommendations on how to get the vehicle to meet the criteria.

Analysis: Profiler Certification

Inputs
Maximum Offset (ft): 5.00
Minimum Repeatability (%): 92
Minimum Accuracy (%): 90
Basis Filter: IRI (with 250mm Filter)
Comparison Filter: IRI (with 250mm Filter)

Selections

File	Profiles	Basis	Run	Sample Interval
15MY1220	Right	Yes	0	1.0000000
Run1	Right	No	1	1.0601280
Run6	Right	No	7	1.0602000
Run8	Right	No	9	1.0601280
Run2	Right	No	3	1.0601280
Run5	Right	No	6	1.0601280

Summary Results

Accuracy (%)

Run	Right
1	90.13
3	91.38
6	92.84
7	93.02
9	92.50

Statistics

Statistic	Repeatability - Right	Accuracy - Right
Comparison Count	10	5
% Passing	100.00	100.00
Mean	97.00	91.97
Minimum	94.91	90.13
Maximum	98.49	93.02
Standard Deviation	1.2	1.2
Grade	Passed	Passed

Repeatability - Right Correlations (%)

Run	3	6	7	9
1	98.11	96.04	97.28	94.91
3		97.33	98.49	96.03
6			97.60	98.10
7				96.13

Repeatability - Right Offsets (ft)

Run	3	6	7	9
1	0.0	0.1	0.0	0.2
3		0.2	0.0	0.2
6			-0.1	0.0
7				0.2

VAN RESULTS

Detailed Results

Repeatability - Right

Basis	Comparison	Correlation (%)	Shape Coefficient	Roughness Coefficient	Offset (ft)	Basis IRI (in/mi)	Comparison IRI (in/mi)	IRI Difference (%)
Run1	Run2	98.11	0.990	99.15	0.0	166.21	164.16	-1.24
Run1	Run5	96.04	0.987	97.29	0.1	166.21	164.19	-1.22
Run1	Run6	97.28	0.986	98.63	0.0	166.21	163.94	-1.37
Run1	Run8	94.91	0.990	95.85	0.2	166.21	165.64	-0.34
Run2	Run5	97.33	0.997	97.59	0.2	164.16	164.19	0.02
Run2	Run6	98.49	0.997	98.82	0.0	164.16	163.94	-0.13
Run2	Run8	96.03	1.000	96.07	0.2	164.16	165.64	0.90
Run5	Run6	97.60	0.999	97.68	-0.1	164.19	163.94	-0.15
Run5	Run8	98.10	0.997	98.40	0.0	164.19	165.64	0.88
Run6	Run8	96.13	0.997	96.47	0.2	163.94	165.64	1.04

Accuracy - Right

Comparison	Correlation (%)	Shape Coefficient	Roughness Coefficient	Offset (ft)	Basis IRI (in/mi)	Comparison IRI (in/mi)	IRI Difference (%)
Run1	90.13	0.980	92.02	0.0	165.79	166.21	0.26
Run2	91.38	0.988	92.50	-0.1	165.79	164.16	-0.98
Run5	92.84	0.991	93.67	0.2	165.79	164.19	-0.96
Run6	93.02	0.993	93.68	-0.1	165.79	163.94	-1.11
Run8	92.50	0.989	93.58	0.2	165.79	165.64	-0.09

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Pavement Condition Data Collection Vehicle Verification

Weekly verification is done on the pavement condition data collection vehicle. The verification is performed at the beginning of the week before collection begins. The verification site is 1,000 feet long on asphalt pavement that is not scheduled for construction or maintenance so the condition stays constant during the collection cycle. The verification site is used to verify the DMI, IRI and Rut.

- The baseline for average IRI and average Rut is established by taking the average of 10 initial runs.
- The weekly verification is one run.
    - The tolerances for verification are: 5% for IRI and 0.05 inch for Rut
- The weekly run is added to the Verification Site Spreadsheet to compare the Left Wheel Path IRI, Right Wheel Path IRI, Left Wheel Path Rut, Right Wheel Path Rut, Grade, Heading and Cross Slope to the baseline for acceptable data.
- If the vehicle does not fall within the tolerances, the following will be completed:
    - An additional run is made of the verification site.
    - All weekly runs for the season will be graphed vs. time to confirm the lack of progressive change in the data.

        - If progressive change is noted, the test site will be run with alternate equipment (typically, NDDOT Materials and Research's profiler) to confirm or refute the noted change.
        - If progressive change is not noted, the manufacture will be contacted for further instructions on how to get the vehicle to meet the criteria.
    - If any run is found to be out of tolerance and not corrected, the week's collection may need to be recollected.

<u>Additional Calibration</u>

The pavement condition data collection vehicle will be recalibrated by performing the block test and bounce test when:

- The air pressure in the tires is changed.
- The vehicle is realigned.
- Any other work is done on the vehicle that may affect the wheel path laser.

<u>Initial QC Checks</u>

Each week the pavement condition data collected will be uploaded to a work station in the office along with a network drive for backup. The following initial QC checks will be performed:

- Verify all image data is present by marking all records and finding first/last image. If no errors are returned, the images are ready for processing.
- Verify all sensor data is complete by processing raw files for left or right IRI. If no errors are returned, it's verified that there is complete sensor data (besides rutting which comes from the 3D).
- Run Auto Crack on the data. Run Auto Crack using most of the processors.
- After letting Auto Crack run for 3 days, on the remaining processors, verify all sensor data is present by running the .cfl file for IRI, HRI, Rutting, texture, Faulting and gyro.

<u>QC Checks of All Distress Data for Final Acceptance and Reporting</u>

At the end of the pavement condition data collection year the following QC will be performed:

- Populate averages in the database by updating summary.
- Run severity analysis and GPS update start/end as required.
- Drive all segments (at work station) to ensure starting/ending points for each record are correct. Fix as necessary and save .sec file. Use notes from van. If changes are made, may need to rerun the update summary and GPS start/end.
- Check the quality on the images by viewing all images while manually entering patching scores.
- All starting/ending points that need to be fixed will be fixed in the office.
- Run Auto Class (crack classification) on all previously processed data.
- Manual QC Checks for Automated Crack Detection and Analysis:
    - 2-3% of all pavement types will be manually scored and compared to the automated analysis.
    - The entire mile will be scored rather than the first tenth of each mile as previously done manually.
    - During all phases of comparative scoring between the automatic and manual ratings, differences of no more than 20% of the manual deductions will be considered acceptable.

        - Any differences between the manual scoring and automated scoring of 9 or greater will be reviewed in detail.
        - The manufacturer will be kept informed of the results and any patterns in the differences that are noted.
    - Random samples of each pavement type will be used each year so the same miles are not always manually checked against the automated analysis.
        - Samples will include multiple miles within each condition category (i.e. excellent, good, fair and poor).
        - 50% of the segments will stay the same each year and 50% will be new randomly chosen segments
    - All distresses will be compared from year to year to flag any substantial differences from the previous year and looked at more closely.
        - Substantial differences will be considered any segment with an overall distress that is a minimum of 12 less than the previous year or 6 more than the previous year.
- All seals (micro, slurry, chip) will have to manually be given a distress score since it carries over from the previous year.
- All thin lift overlays will have to manually be given a patch score along with any other roadway that previously had a patch score.
- Some distresses that have substantial variations may have to be field verified.
- Throughout the process, the manufacturer will be informed of any major discrepancies in case any changes need to be made to the automated crack detection and analysis software.
- If the equipment is replaced or has a significant upgrade, for the first 2 years of collection following the replacement/upgrade, 5% of all pavement types will be manually scored and compared to the automated analysis.
    - The year prior to the replacement/upgrade will be considered "base data" for comparisons.
    - If a significant discrepancy occurs for the first 2 years following the replacement/upgrade, or any other years where automated results are used, the discrepancies can be compared back to "base data". By doing so, it can be determined if the algorithm needs to be modified or not.
    - The third year after the replacement/upgrade then 2-3% of all pavement types will be manually scored and compared to the automated analysis.

4. ACCEPTANCE

The focus of acceptance is to validate that deliverables meet the established quality standards. Following is a description of acceptance testing, the frequency to be performed, and corrective actions for items that fail to meet criteria.

Deliverable	Acceptance (Percent Within Limits)	Acceptance Testing & Frequency	Action if Criteria Not Met
IRI, Rut Depth, Faulting, GPS Coordinates, Longitudinal Grade	95 Percent Compliance With Standards	Weekly verification testing. Global database check for range, consistency, logic, and completeness and inspection of all suspect data. Daily monitoring of data completeness during collection.	Recalibration and possible recollection
Distress Rating	80 Percent Match*: Manual vs Automated	At end of annual collection, check accuracy of automated crack detection and QC pre-set percentage of automated distress scores compared to manual distress score.	Contact Vendor to discuss correction of crack detection software.
Perspective, ROW and Pavement Images	98 Percent Compliance With Standards of Each Control Section and Not More Than 5 Consecutive Images Failing to Meet Criteria	Weekly verification testing. Daily monitoring for clarity, brightness and no bugs or raindrops during collection.	Clean camera, contact vendor if issues with clarity or brightness can't be resolved by data collection team. Possible recollection.

*Match = Distress manual score vs distress automated score = 0-6 point difference

Acceptance of data is explained in NDDOT's Pavement Management Section Manual.

5. QUALITY TEAM ROLES AND RESPONSIBILITIES

The following identifies the quality-related responsibilities of the data collection team and lists specific quality responsibilities.

Team Role	Assigned Resource	Quality Management Responsibilities
Pavement Management Section Leader	Pavement Management Engineer	• Set quality standards, acceptance criteria and corrective actions • Assess effectiveness of QM procedures • Recommend improvements to quality processes • Assure practice of QC measures in QM Plan • Assure proper protocols used • Assure training for all personnel skill levels • Issue certification upon completion of training • Assure correction of all quality issues and changes in procedures as needed • Document all QC activities
Data Collection Manager, Distress Rating, QC	Both Pavement Management Transportation Project Managers	• Communicate weekly with Pavement Management Section Lead on data collection progress • Assure annual equipment configuration, calibration, cerification and verification • Perform weekly verification at test site • Perform daily and/or periodic equipment start-up checks, tests, inspections and calibrations • Perform daily review of data logs and video samples • Assure real-time monitoring of data and video quality • Assure documentation of all field QM activities and reporting of any problems using SFN 18329 • Perform initial rater training and assure raters adequately trained in protocols (perform retraining as needed) • Assure complete uploading and processing of all pavement condition data. This includes uploading to backup drives. • Perform all QC checks on the automated crack detection and analysis.

6. QUALITY REPORTING PLAN

The Pavement Management Transportation Project Manager(s) will monitor quality through QC activities and report data quality exceptions as part of weekly status reporting, or more frequently if conditions warrant. Quality is monitored through acceptance testing and quality issues are addressed by the data collection team as soon as issues are discovered.

The data collection team will keep the Pavement Management Engineer informed of weekly progress. The team will also keep the Pavement Management Engineer informed of any major QC issues or equipment issues. The Pavement Management Engineer will try and resolve any issues that the data collection team is unable to in order to keep data collection going as efficiently as possible.

The data collection team will track any QC issues during collection using the Pavement Management Field Sheet, SFN 18329. See Appendix A for the form.

Final QM Reporting

Data Collection Team – Upon completion of all annual pavement data collection, the data collection team files the Pavement Management Field Sheets, the data collection team's daily journal (which includes a summary of daily work, team members and any QC issues), documentation of equipment calibration and maintenance, results of all control, verification, and blind site testing, and documentation of other problems encountered (not listed on the Pavement Management Field Sheets or daily journal) and corrective actions taken.

Pavement Management Engineer – Upon completion of all annual pavement data collection, the Pavement Management Engineer will assist the data collection team with an issues or concerns the team may have or need help resolving. The Pavement Management Engineer and the data collection team will discuss how the annual collection went and if there are any areas that can be improved upon to make collection go more efficiently.

7. AGENCY AND DATA COLLECTOR QM PLAN ACCEPTANCE

Quality Management Plan accepted by Division Director:

Scott D. Zainhofsky, PE
Planning/Asset Management Engineer

Date: 10/16/19

APPENDIX A

PAVEMENT MANAGEMENT FIELD SHEET

North Dakota Department of Transportation, Planning

SFN 18329 (Rev. 02-2008)

Highway

SET #	DATE	HIGHWAY/STREET	DIR.	LANE	FROM MILEPOINT	TO MILEPOINT	PROFILER FILE NAMES	

NO M.P.	MISSED M.P.	REMARKS (WEATHER, BAD POINTS, ETC.)