Quality
Assurance
Program

Field Data Collection & Entry Manual

Maintenance and Operations Division

March 2018

Contents

1 INTRODUCTION

The purpose of the Quality Assurance Program is to enhance asset management and fulfill the DOT&PF mission. Our mission is to *"Keep Alaska moving through service and infrastructure"*. This mission can only be fulfilled through proactive transportation asset management.

An important part of the department's proactive asset management is the Quality Assurance Program with annual field condition inspections conducted all across the highway system. The inspections assess the level of service DOT&PF staff provides to the highway system users through regular preventive maintenance and construction activities. The purpose of this manual is to document the procedures for consistent data collection on road and roadside features and the elements of accurate data entry in the QA module.

Beginning with the QA Pilot Program in the spring of 2005, the number of QA segments inspected statewide was 125. During the pilot program DOT collected the data with existing staff. In 2006 the number of segments surveyed was increased to 500 and a contractor was hired to perform data collection. In 2010 the department increased the number of inspected segments to 1,000 in an effort to provide a data set that is statistically more reliable and representative of the data population.

Using the random selection method the higher the number of total segments inspected, the higher the confidence level is for the inventory results. It appears that inspecting 1,000 segments, even though this places a burden on the DOT staff, has decreased the volatility between comparison years. The payback for the time and money invested to inspect 1,000 segments may be at least near the crossing point for a desirable cost to benefit comparison. During the 2017 - 2018 inspection season a total of 1,500 segments were collected which came closer to the cost to benefit break point. For the 2018 - 2019 inspection season the department increased the inspections to 3,000 segments or about 5% of the system highways which in other states have proven to provide a better cost to benefit results for the investment.

In states where the entire highway system is inter-connected, the number of segments which are to be inspected is easily adjusted without dramatically increasing the cost. However in Alaska, the cost does dramatically increase for data collection because of the number of roads at rural communities accessible only by air and/or ferry.

The bridges are excluded from the QA inspection process and is accomplished separately by the bridge inspectors from Design and Engineering Services. Bridge data is collected and stored in the Bridge Management system (BrM 5.2.3) by Bridge Engineering. Bridge deficiencies are shared with M&O to allow maintenance crews to address and correct deficiencies in a timely manner.

Pavement Management evaluations are performed by a DOT Pavement Engineer and the capture of the International Roughness Index (IRI), Rutting, Potholes, Cracking and Alligator Cracking is performed by contract. The resulting data are imported into the QA module and the module provides ratings for each on the QA report card (see Attachment 2).

The Quality Assurance Program Manual is maintained by the DOT&PF Commissioner's Office. If you have questions please contact the Commissioner's Office at (907) 465-3900.

2 Maintenance Management System Annual Preparation

Each year the Quality Assurance (QA) module randomly selects the one-tenth mile (528') inventory segments. There are several procedures which must be performed before and after the random selection is made.

Before

- The MMS must be, at minimum, setup for the next fiscal year.
    - Entering the Fiscal Year, Pay Periods and Holiday table data.
    - Exclude the road segments which are not representative of the rest of the highway system or are scheduled for construction or are found to be on a bridge deck so they do not appear in the inventory list.
    - Exclude an additional five-tenths of a mile (1/2 mile) either side of a construction zone to prevent inspection segment from falling in the traffic control (flagger) zone for the construction.

After

- Once the QA module randomly selects the inventory list, evaluate the system chosen roads to assure there are no data anomalies.
    - Typically the contractor will inspect all of the segments, however during budget constraint years the extremely remote segments may at the department's discretion be inspected by DOT staff to control the contract cost.
    - The QA Project Manager will negotiate with the QA contractor at contract amendment to determine who will inspect which segments.

Note: The fiscal year setup is the State fiscal year which begins July 1st of each year and ends June 30th of the following year. This allows the State to have Legislative Authority approved and funding in place in order to obligate Federal Highway Administration grant funding.

3 QA Data Collection Procedures

The Department's Maintenance Management System (MMS) Quality Assurance (QA) module identifies approximately 3,000 randomly selected data survey segments from the approximately 5,820 centerline miles of state highway inventory. The Trimble GPS Tablets with the Collector App provided by the department are used to inspect and record the tenth-mile segments (528 feet). A QA inspection contractor (hereafter QA contractor) will inspect and collect all the segments identified in the contract unless otherwise instructed by DOT&PF QA Project Manager.

Each DOT region will have at least one dedicated QA inventory team with two persons per team. Each region will also identify two alternate inspectors to fill in if one or both regular members are unavailable. These teams are region wide teams, under regional direction rather than under the direction of a District or Station.

SAFETY FIRST

Prior to conducting inspections, review this Pre-activity Safety Plan for QA/QC inspections.

- Inspect the vehicle lights, flashers and rotating beacons before beginning operations each day.
- Ensure that all appropriate personal protective equipment and traffic control devices are available and used.
- Always wear required safety equipment, reflective vest, safety glasses, etc.
- Wear proper clothing and footwear for the conditions.
- Do not attempt to conduct inspections in metropolitan areas during rush hour traffic.
- Activate the rotating beacon, flashing lights on vehicle, survey signs, place cones for safety and use appropriate traffic control measures where necessary.
- Determine what the individual segment may require for safety devices before beginning each inspection.
- When performing data collection always try to walk facing traffic and have the second inspector on the team serve as a spotter.
- On divided highways and highways with heavy traffic it may be necessary to evaluate centerline striping from the shoulder of the road as accurately as possible without entering the traffic lane.

Remember, none of the data you are collecting is worth your life or that of another team member, safety is first and foremost.

Conducting the Inventory

The following guidelines are intended to aid the field personnel with locating the QA inventory segment.

- Using the Trimble Kenai GPS tablet to locate on the moving map the inspection segment.
- Mark the begin and end points with paint across the fog line at the edge of the shoulder or place a pin flag when necessary so that the segment can be located again for Quality Control (data entry instructions are found in Section 4 QA Inventory Process..
- If you plan to use it, check the tire pressure and calibrate the DMI at the beginning of each day and any time the ambient air temperature changes more than 20 degrees or the drive distance between inspection segments is more than 100 miles.
- The vehicle odometer may be used in locations where the Satellite signals are not available and the vehicle does not have a DMI.
- Segments are always in the increasing direction from the starting mile point. For example: If segment location is 43.2 of the Parks Highway the inspection segment is from mile point 43.2 to 43.3.
- If any portion of the segment falls on a bridge structure the segment is to be moved forward or backward to avoid including the bridge structure or surface.
- If any portion of the segment falls in a construction zones or closed section of highway, relocate the segment outside of the construction zone/closed section, but as close to the original segment as possible, using a full tenth-mile road segment.

- Indicate the segment as an alternate segment in the Collector App or inventory form and place drop pins for begin and end indicating the new segment location.
- Label the drop pins with the segment ID number.
- Do not assign the alternate segment location to a different, nearby highway unless absolutely necessary.
- If it is necessary to select a different road for an alternate segment the road selected should be similar to the original segment and the inspector should enter the road name of the new location in the comments.
- Segments located in areas that are not the maintenance responsibility of Alaska DOT shall not be evaluated and reassigned as an alternate segment, appropriately.
- Should a segment or a portion there of fall on a city maintained road, move the inspection segment so the inspections is on a state maintained road in its entirety.
- Measure the tenth-mile length for highway on and off ramps starting from where the center of the ramp lane would intersect the Fog Line of the highway (as if the fog line were continuous).
- Conduct field measurements and observations at the segment and record the data.

4 QA Inventory Process

The following highway features are at the heart of the MMS QA Assessment/Inventory process. The recorded results of the segment inspections are used by the QA module to evaluate the level of service currently being provided to the traveling public and commercial vehicle operations. The QA assessment contains two broad categories: Road Surface ratings and Road Side ratings. As each of these features are inspected the results are entered onto the ESRI ArcGIS Collector App (see Attachment 1 Screen Shots) and then loaded to the QA module which extrapolates the probable feature condition statewide and identifies an overall level of service. This level of service is presented in a Report Card rating the current level of service for each feature, in scores labeled from A to F (see Attachment 2 Report Card).

Pavement surface deficiencies for Cracking, Alligator Cracking, International Roughness Index and Pavement Rutting are imported from the Pavement Management System. The surface Pavement Markings, Pavement Striping, Driving Surface Width, Shoulder Widths and Bike Path/Lane Widths are collected by the QA inspection team.

Mark the survey segment with a painted strip across the fog line (color choice determined each year at the annual training meeting) for the beginning and end of the segment. For gravel roads or where paint cannot be used a survey pin flags or survey stakes are used. A Quality Control Teams (QC) will visit and re-evaluate 5% of the segments inspected by the QA Contractor Teams each year.

QA Inventory Using the ESRI ArcGIS Collector App

The inspection/inventory form header information in Collector is self-explanatory, with the following exceptions.

- When using the ESRI ArcGIS Collector App the begin mile point for the segment is indicated with a red dot on the State centerline, the end mile point is indicated with a blue dot on the centerline.
- The inspection form is accessed by clicking on or tapping the begin mile point and selecting edit.
- Select the name of the inspection Team.
- If an alternate site is necessary, place a "Y" in the ALT_SITE_FLAG field. The Collector App allows you to place a Dropped Pin to mark the beginning and end for alternate inspections segments. Place the Dropped Pins by pressing and holding the desired location on the road centerline. When a Plus Sign (+) appears release and the Dropped Pin will appear and open a dialog window. Click on the three dots in the bottom right of the dialog window, select Add to My Places and the name field window will appear. Enter the original Site number for the alternate segment and BEG for begin location. Repeat this procedure and enter the Site number END for the other Dropped Pin. Enter a comment in the Comment field with the original Site/Segment ID and indicate why an alternate segment was chosen.
- After you enter the inspection data and submit the inspection the begin mile point dot will turn green indicating the segment has been inspected.
- If the segment is inspected as a QC segment enter a "Y" in the field. Note: The QC entry is made only if the results are different from the QA inspection.
- Detailed instructions on use of the Kenai and the Collector App are provided each year at the annual QA Training and Kickoff meeting.

Always carry blank paper inspection forms in case you experience computer failure.

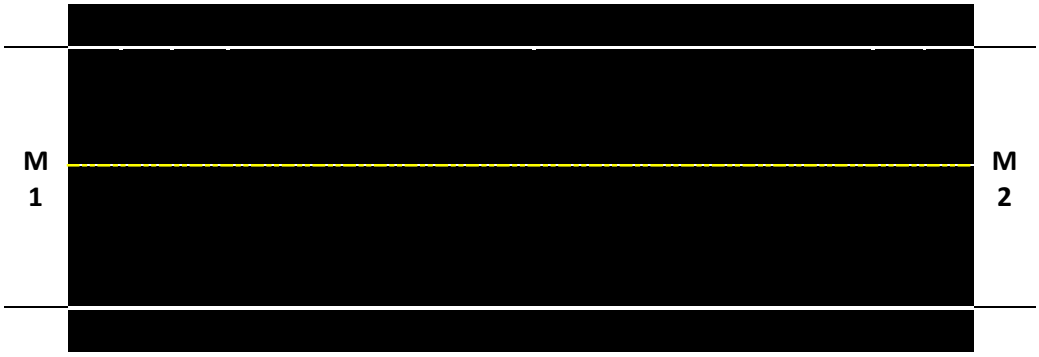
Segment Pictures
The Collector App allows you to attach photos to the begin mile point marker for the segment which is red until you enter an inspection date and then it will turn green on Submit. The three mandatory photos are one up-station from the begin inspection point (the red begin mile point marker), one from the end point looking down-station (the blue end point marker) and a photo of the vegetation with a scale reference like a survey state or a measuring wheel for height. The up-station photo should be taken first. There is no mandatory sequence for the rest of the photos, however they should be taken as encountered while moving up-station. Additional photos are taken of plugged culverts and other anomalies as necessary. Using this method the down-station photo would normally be the last one taken.

Photo labeling is not necessary since they are all attached to the begin inspection point.

5 Paved Road

Paved Driving Surface Measurement
The paved roadway driving surface (from inner edge of fog line to inner edge of fog line) at both of the segment end points are measured, then the average surface width in feet is calculated by adding both together and dividing by 2 for the segment, and the result is entered in this field.

Average Driving Surface Width

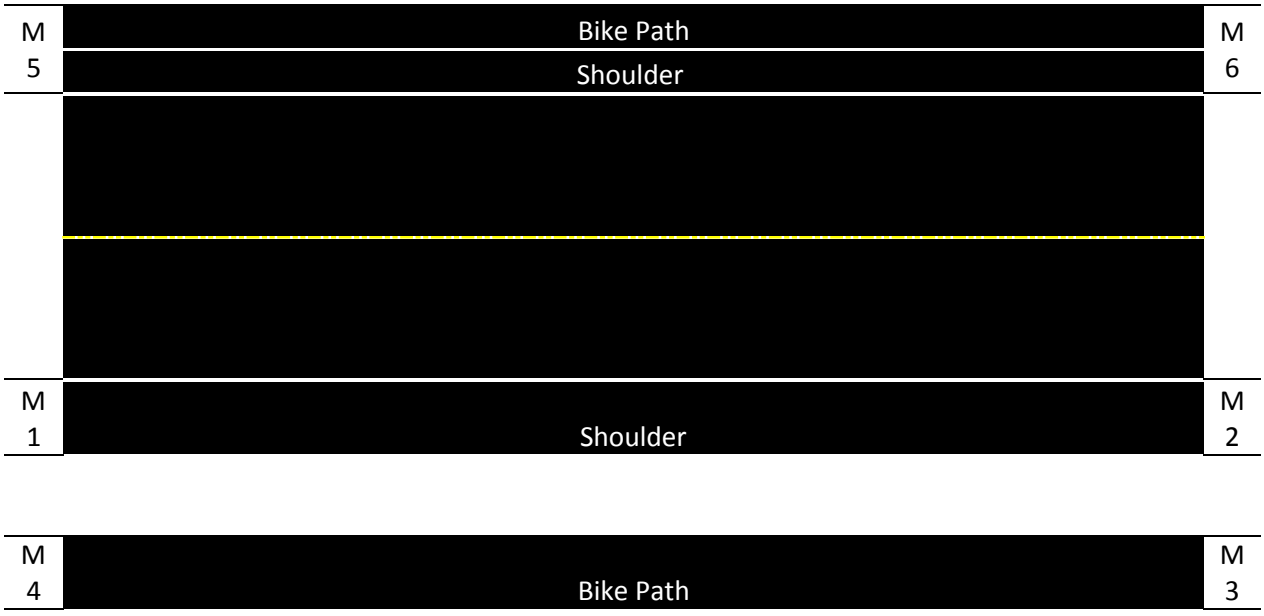


$$\frac{M1 + M2}{2} = \text{Average}$$

Paved Shoulder Measurement

The average paved shoulder width, which is the sum of widths measured at both ends and rounded to the nearest whole foot and divided by 2, with the right and left shoulder added together is entered in the field. Paved turnouts, bike paths/lanes and sidewalks are counted as part of the shoulder widths with the same formula as above applied. Do not enter gravel shoulders widths for a paved road.

Average Shoulder Width



$$\frac{M1 + M2 + M3 + M4 + M5 + M6}{6} = \text{Average}$$

6 Gravel Road

Gravel Driving Surface

The average roadway driving surface width, from "apparent" shoulder to "apparent" shoulder, in whole feet for the segment is entered in this field. The "apparent" shoulder is identified by sighting up and down the road segment to see where the edge of commonly used driving lane is, by observing tire tracks, the shoulder break from road grading, etc. The standard gravel road driving surface is considered to be 24 feet wide.

Gravel Surface Material

The amount and type of gravel along with the presence of a crowned centerline determines whether the road surface is acceptable or requires maintenance activities to restore it to the as-built condition. Normally, a gravel road will have 6" of crown, or fall, from its center line to the driving surface edge (a typical driving lane is 12' wide with a total driving surface width of 24'). For gravel roads with heavy traffic like the Dalton Highway crown gravel thickness should be eight (8"For gravel roads with wide shoulders and/or turnouts, the same fall rate should continue to the ditches.

The road surface should be comprised of at least six (6") inch of ¾ minus (crushed gravel surfacing) at the crown and one (1") inch at the shoulder. For gravel roads with heavy commercial truck traffic like the Dalton Highway, eight (8") inches of compacted ¾ minus is recommended at the crown and a minimum of 2" at the shoulder. The road should be graded relatively smooth, with a crown at centerline to facilitate proper drainage that prevents ponding of water on the road surface. If the segment is not gravel an N/A is placed in the field or the letter identifying the rating for gravel roads as E (Excellent), G (Good), F (Fair), P (Poor) or U (Unsatisfactory) using the following criteria:

1. Does the gravel road segment have a crown to provide proper drainage to both sides of the road?
2. Is there a berms at the shoulders which will trap water on the road?
3. Does the gravel road segment have at least six inch (6") of compacted ¾ minus surface gravel at the crown?
4. Does the gravel road segment have at least one inch (1") of compacted ¾ minus surface gravel at the shoulder?
5. Is the gravel road segment surface free of wash boarding and/or potholes?
6. Is the gravel road surface free of obvious subsurface failures in the form of soft spots or sink holes?

If the gravel road has these deficiencies or fails to meet these minimum criteria it is considered to have a U (Unsatisfactory) rating and has failed the inspection (many rural roads do fail). The following example pictures will help you decide how to rate the gravel road.

E (Excellent) Gravel Road Example

This example has a crown, sufficient compacted surface material (6” typical to 8” on the Dalton Highway) at the crown and (1” typical to 2” on the Dalton Highway) on the shoulders, does not have any rutting, potholes, wash boarding, soft spots or sinkholes and no obstruction to water draining from the shoulders.

G (Good) Gravel Road Example

This example has a crown, sufficient surface material (6” typical to 8” on the Dalton Highway) at the crown and (1” typical to 2” on the Dalton Highway) on the shoulders and only has a few small rutting. The surface is free of potholes, wash boarding, soft spots or sinkholes and has no obstruction to water draining from the shoulders. However, the surface material is loose on the driving surface and shoulders, it contains too many fines producing dust and requires frequent watering.

F (Fair) Gravel Road Example

This example has a crown, sufficient compacted surface material at the shoulders but not on the crown. There are no soft spots or sinkholes and the water will drain from the shoulders, however there is some wash boarding and potholes. This road would need to be graded, gravel recovered from the ditches, the crown reshaped and the road re-compacted.

P (Poor) Gravel Road Example

This example does not have the required ¾ minus surface material or a crown, there are ruts, potholes and visible soft spots. The water does appear to drain off the shoulders. Even in this poor condition the road is still passable in a small passenger vehicle. This road will need to be resurfaced, ditches reestablished and vegetation cleared.

U (Unsatisfactory) Gravel Road Example

This example has all the problems previously identified to be unsatisfactory. There is no ¾ minus surface material or crown, the embankment on the left and berm on the right side will hold water on the road. The depth of the ruts and soft spots would be difficult, if not impossible, for a small passenger vehicle to negotiate. This road will need to be rebuilt, ditches established, culverts installed and vegetation cleared.

Gravel Shoulder

For paved roads do not enter gravel shoulders in the Collector App or the QA module for shoulder width. The average shoulder surface width, for both shoulders in whole feet, is entered in this field. Each side's shoulder width is the distance from the edge of the apparent driving surface to the shoulder break or fore slope of the ditch. Gravel bike paths are counted as a part of the shoulder width, even when separated from the shoulder.

7 Paved Road Surface Ratings

Alligator Cracking (this evaluation may be required in future years, but is not required for 2018)

Measure the length and the width of the alligator cracking. Then multiply that length by the width to calculate the total square feet of alligator cracking (both paved driving surface and

shoulders). Divide this square footage by the square footage of the entire segment 528' times the width of the roadway (both driving surface plus shoulders) and enter the percent result (i.e. 2%, 3%, and up to 10% are common values for roads plagued with alligator cracking) in the Percent of segment (ALLIGATOR_CRACKING) field.

Cracks (this evaluation may be required in future years, but is not required for 2018)
Measure any crack opening greater than (>) 1/8 inch wide in the paved driving surface or shoulder. Enter the total length of all cracks, rounded to the nearest whole foot, in linear feet for the segment (CRACKS) field. The writing tip of a standard retractable ballpoint pen makes a good gauge for a crack greater than 1/8" wide.

Potholes
Potholes are entered on the QA inventory form as a unit count of each for two categories, those which are 4 to 12 inches in diameter and those which are greater than (>) 12 inches in diameter.

Pavement Striping
Painted striping (PS_FEAT_INV) is a count of the number of lines painted along the segment, which includes dashed centerlines, solid centerlines and fog lines. Each solid stripe or dashed lane line is counted and entered on the QA inventory form as a whole number. The pavement striping quality assessment to be made at the segment is to inspect and determine what is the number of striped lines where greater than (>) 1/3 of the line is worn, missing or obliterated. Write that number in the (PS_FEAT_ASSMNT) field to the right of the stripe inventory count.

Pavement Markings
Painted markings (are counted as the number of diagonal lines on a medium/divider, horizontal lines at a cross walk, hold/stop lines, lettering or turn arrows. The evaluation field on the QA inventory form records the number of markings where greater than (>) 1/3 of the painted symbol or line is worn, missing or obliterated.

8 Road Side Ratings

Culverts
The culvert inventory is also captured in Collector for the QA segment. It is a count field (C_FEAT_INV) of the total culverts found within the segment. This includes any driveway or side street culverts that are maintained by the State. The evaluation field (C_FEAT_ASSMNT) is a count of the culverts which are 50% or greater (>) blocked or has less than 12 inches (") of gravel cover over the top of the culvert. For culverts on Fish passage streams, there must be enough gravel inside the culvert to cover the corrugation on the floor and look like a natural part of the adjacent stream beds. The gravel should not block more than one quarter (¼) of the culverts circumference.

Ditches
The total quantity of ditching (D_FEAT_INV) to be noted in the Collector App are the actual linear feet of drainage ditches in the segment which are at least one (1') foot (or greater) in

depth and have a fore and back slope. The evaluation field (D_FEAT_ASSMNT) is used to record the number of actual linear feet of ditch which are 50% or greater (>) blocked. This is a change, since in the past for the legacy MMS the total ditch length for both sides was measured and then divided by two (2).

Guardrail Panels
The inventory field (GP_FEAT_INV) is a count of the total number of panels found within the segment. The evaluation or assessment field (GP_FEAT_ASSMNT) is the number of panels which are functionally impaired to the point that they may not serve their intended purpose (i.e. the panel or post are compromised to the point that they may not prevent a vehicle leaving the highway). Or, for example if the panel is torn or cut or there are three or more consecutive posts broken, rotten or missing. Up to three posts may be omitted during installation if additional overlapping panels are added to stiffen the rail.

Guardrail Ends
The inventory field (GE_FEAT_INV) is a count of the total number of guardrail ends in the segment. The evaluation or assessment field (GE_FEAT_ASSMNT) is the number of ends which are functionally impaired to the point that they may not serve their intended purpose (i.e. the ends or deceleration system are compromised to the point that they may increase the probability of death or injury). Indications of impaired ends: If the end is partially activated, there are broken posts, stiffener bars are bent or broken, or tension cables are broken or slack, there is a stub post greater than 4 inches exposed above the surface, or the grade is greater than 10:1 due to erosion.

Guardrail Height
The height is measured from the top edge panel to the finish grade and has a tolerance of not less than twenty six and one half (26 ½”) inches and not greater than thirty six (36”) inches (see Attachment 3 for diagrams and detailed instructions). Enter the total number of guardrail panels (GH_FEAT_ ASSMNT) which are out of tolerance and may not serve their intended purpose (i.e. having the panel(s) at a wrong height may increase the probability of a vehicle going under or over the guardrail). See Section 13 Attachment 3 for the height measurement standards.

Traffic Signs
The inventory field (TS_FEAT_INV) is a count of the total number of signs within the segment, including markers on delineators (only signs maintained by DOT are to be counted). If the sign has legend on both sides it is counted as two (2) signs. The assessment field (TS_FEAT_ASSMNT) is a count of the total number of signs where 1/3 or more of the legend or symbol or background is illegible, missing, obliterated or the reflectivity of the sign is visibly compromised. Do not count temporary construction signs.

Average Width of Vegetation Management
The average width (AVG_WIDTH_VEG_MGMT) is measured and calculated for both sides of the road and entered in the field.

Vegetation Hydro Axe

For this feature the length (HYDRO_AXE_LEN), which is the inventory, of the area which **normally would be cut** with a hydro axe is measured and entered in the QA inventory form. If the area needs to be cut the width (HYDRO_AXE_WID) which would be cut by Hydro Axe is entered, otherwise the width is 0.

Vegetation Side Arm Mower
For this feature the length (SA_MOWER_LEN), which is the inventory, of the area which **normally would to be cut** with a side arm mower is measured and entered in the QA inventory form. If the area needs to be cut the width (SA_MOWER_WID) which would be cut by side arm mower is entered, otherwise the width is 0.

Vegetation Standard Mowing
For this feature the length, (STD_MOWER_LEN), which is the inventory, of the area which **normally would to be cut** with a standard mower is measured and entered in the field. If the area needs to be cut the width (STD_MOWER_WID) which would be cut by standard mower is entered, otherwise the width is 0.

9 MMS Data Loading Procedures

When the data is collected with the Trimble Kenai GPS tablet and the ArcGIS Collector App use the instructions below. An export file from ArcGIS is imported into the MMS which includes the site pictures. If the inventory or assessment is conducted with a paper form, the loading of data from the inventory form into the QA module is a straight typing of values and comments in the MMS QA module as described below with the following exceptions: pictures are labeled manually with the inspection site number and are imported separately into the MMS.

Alternate Segment
If it is necessary to select a different road for an alternate segment, the road selected should be similar to the original segment. Enter the road name of the new location in the Comments field, however, only the original, randomly selected road name and the mile point are displayed in the QA module. When using the Collector App a pin flag is dropped on the map for the alternate location begin and end which are labeled as Begin or End with the original segment/site number.

Paved Road Width
The data collected for driving surface width is measured inside of the fog lines, or the seam between the driving surface and the shoulder and rounded to the nearest foot.

Paved Shoulder
Paved bike paths are not counted as paved shoulders, even if connected to the shoulder.

Paved Bike Paths

Paved bike paths whether connected to the shoulder of the road or separated are measured and counted as part of the shoulder.

Alligator Cracking, Cracking, International Roughness Index and Rutting

These deficiencies are imported from the PMS into the MMS the year after they are collected by the PMS contractor.

Vegetation Management

There are nine entry fields for vegetation management. The average width of vegetation managed at the inspection segment. The other eight entry fields are for the length and width of area that would normally be cleared by the type of equipment that would be used to do the work. The current types of equipment reported for Vegetation Management are Hydro Axe (HYDRO_AXE), Standard Mower (STD_MOWER) and Side Arm Mower (SA_MOWER). As these assessments are made, remember to add a comment about line of sight obstructions for intersections and curves if an obstruction is not readily visible in the photos.

Ditches

Enter the linear feet of all ditch in the right of way for both sides of the road, to the nearest foot.

10 Definition of Terms and Acronyms

Fog Lines and Pavement Width Measurements

For the purposes of QA field data collection**, the fog line is considered part of the paved shoulder**. Thus the shoulder area is measured from the inside of the fog line nearest the driving surface to the outside of the paved shoulder. On roads without a fog line the seam between the shoulder and driving surface can be used as the boundary.

Level of Service – The purpose of QA is to measure the level of service provided by Alaska DOT&PF to the traveling public and the Commercial Trucking Industry. The QA module also provides tools to predict how the level of service will change if funding is increased or decreased. The QA Level of Service goals are outlined in Attachment 4. **Beginning in 2010, the number of segments collected was doubled to 1,000 segments. The program has been improved and updated for 2010 to better depict the level of service. In 2016 the number of segments were increased to 1,500 for the 2017 - 2018 inspection season. In 2017 the FHWA approved funding to increase the number of segment inspected to 3,000 for the 2018 - 2019 inspection season, again the increase was to more accurately measure and predict changes to the level of service.** The

program information can be downloaded from the M&O Statewide Home Page. Look for the Maintenance Management System and Quality Assurance Program data presentation pages at: http://www.dot.state.ak.us/stwdmno/index.shtml

MMS – The Maintenance Management System is a software application used to record and report maintenance work activities. The system was developed to provide an electronic timesheet, stockpile usage inventor and as a methodology provides for asset management through the Quality Assurance module.

QA – The Quality Assurance module of the MMS is used in conjunction with inspections of highway features to predict the statewide highway system condition and the level of service provided to the traveling public and commercial vehicle operations. The QA module allows the department to evaluate the level of service for each feature listed in the QA inventory form. The ability to predict how the level of service is changed if the maintenance budget is increased or decreased based on a standard rate of change per year is a valuable tool. The QA module is a key element of our proactive asset management program.

MP – Mile Points are used in the state GIS linear referencing system and when measuring to find a particular location on a highway or other CDS route.

Mile Post – A historical mile marker is a highway feature and is identified in the right of way by a small green sign with a number. Note: A mile post and a mile point are not always at the same location on the highway.

CDS Route Number – Alaska DOT&PF identifies each road in the Highway Analysis System (HAS) with a Coordinated Data System (CDS) Route Number. Each road has a route name (the CDS Route Number) and a route description (the posted road name).

ESRI ArcGIS Collector App – The Collector App is used on the Trimble Kenai GPS tablet running Windows 10 OS to locate the inspection segments on the road network and record the inventory/inspection results.

PMS – The Pavement Management System is the application designed to record and report pavement conditions for the Departments Pavement Engineer. Data in the PMS pertains to the pavement surface only as seen by vehicle instrumentation and does not include potholes, pavement markings, pavement striping or roadside features.

11 Attachment 1 – MMS QA Electronic Inventory Form Definitions

FY	Fiscal Year cannot be changed
ASSMNT_DATE	Date of the inspection
SITE_ID	Inspection segment number
BEG_MP	Begin Mile Point is where the inspection segment begins on the highway
TEAM_ID	Select your name
RTE	CDS route number for the highway
ALT_SITE_FLAG	Choose "Y" for yes if this is an alternate location for the segment
QC_FLAG	Choose "Y" for yes if this is a QC segment
DRIVING_SURFACE_PAVED	The measured width at begin and end of segment averaged.
SHOULDER_PAVED	The measured width at begin and end of segment for both sides of the road averaged.
GRAVEL_SURFACE	N/A for paved highways otherwise Pass or Fail
DRIVING_SURFACE_GRAVEL	The measured width at begin and end of segment averaged.
SHOULDER_GRAVEL	The measured width at begin and end of segment for both sides of the road averaged.
CRACKS	Measured length for all cracks in the segment
ALLIGATOR_CRACKING	The measure and calculated total percent of Alligator Cracking in the segment (Alligator Cracking L * W) / (Segment L * W) = % of Segment
POTHOLES_4	Count the number of Potholes between 2 and 12 inches in diameter
POTHOLES_12	Count the number of Potholes < 12 inches in diameter
AVG_WIDTH_VEG_MGMT	The average width of vegetation managed on both sides of the road
HYDRO_AXE_LEN	Hydro Axe - The measured length that if cut would require this type of equipment
HYDRO_AXE_WID	Hydro Axe - The measured width that requires cutting by this type of equipment
STD_MOWER_LEN	Standard Mower - The measured length that if cut would require this type of equipment
STD_MOWER_WID	Standard Mower - The measured width that requires cutting by this type of equipment
SA_MOW_LEN	Side Arm Mower - The measured length that if cut would require this type of equipment
SA_MOW_WID	Side Arm Mower - The measured width that requires cutting by this type of equipment
COMMENTS	Comments about any of the finding above or below the Comments box
C_FEAT_INV	Culvert Feature Inventory - Count of the total culverts in the inspection segment
C_FEAT_ASSMNT	Culvert Feature Assessment - Count of the total culverts in the inspection segment 50% or < blocked

D_FEAT_INV	Ditching Feature Inventory - Measure the ditching on both sides of the road and divide by 2
D_FEAT_ASSMNT	Ditching Feature Assessment - Measure the ditching that is 50% or < blocked on both sides of the road and divide by 2
GP_FEAT_INV	Guardrail Panel Feature Inventory - measure the total length of rail in the segment
GP_FEAT_ASSMNT	Guardrail Panel Feature Assessment - measure the total length of rail in the segment damaged
GE_FEAT_INV	Guardrail End Feature Inventory - count the total number ends in the segment damaged
GE_FEAT_ASSMNT	Guardrail End Feature Assessment - count the total number ends in the segment damaged or activated
GH_FEAT_ASSMNT	Guardrail Height Feature Assessment - measure the height of rail, if > 26 1/2" or < 36” it Fails (New standard for 2018)
TS_FEAT_INV	Traffic Sign Feature Inventory - count the total number of signs in the segment
TS_FEAT_ASSMNT	Traffic Sign Feature Assessment - count the total number of signs in the segment damaged
PS_FEAT_INV	Pavement Striping Feature Inventory - Count the total in the segment
PS_FEAT_ASSMNT	Pavement Striping Feature Assessment - If damage is 1/3 or < it Fail
PM_FEAT_INV	Pavement Markings Feature Inventory - Count the total in the segment
PM_FEAT_ASSMNT	Pavement Markings Feature Assessment - If damage is 1/3 or < it Fail

NOTE: With the deployment of the new AgileAssets systems the pavement data for Cracks and Alligator Cracking will be collected by the Pavement Management System for import into the MMS. It is important to recognize that the pavement data will be almost a year old since the new pavement data is not available until well after the MMS QA inspection season is over. Therefor the previous year’s pavement data is used.

12 Attachment 2 – MMS QA Report Card and Trends

Alaska DOT Quality Assurance Report Card

2018	Service Level A				Service Level B				Service Level C				Service Level D				Service Level F			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Gravel Surface Material										P							C			
Cracks				←C		P														
Alligator Cracking						P											C→			
Potholes					C→	P														
Pavement Striping										P				C→						
Pavement Marking										P		←C								
Pavement Rutting										PC										
Pavement IRI										PC										
Culverts						P									C→					
Ditches	C					P														
Guardrail Panels						P			C→											
Guardrail Ends						P					C									
Guardrail Height						P		C												
Traffic Signs						P									C→					
Vegetation Management - Hydro Axe						P				C										
Vegetation Management - Side-Arm Mowing						P							C→							
Vegetation Management - Standard Mowing						P								C						

C = Existing Service Level (2015)
P = Proposed Service Level
CP = Existing and Proposed are the same
NOTE: IRI and RUT data is still being processed and will be updated as soon as available.

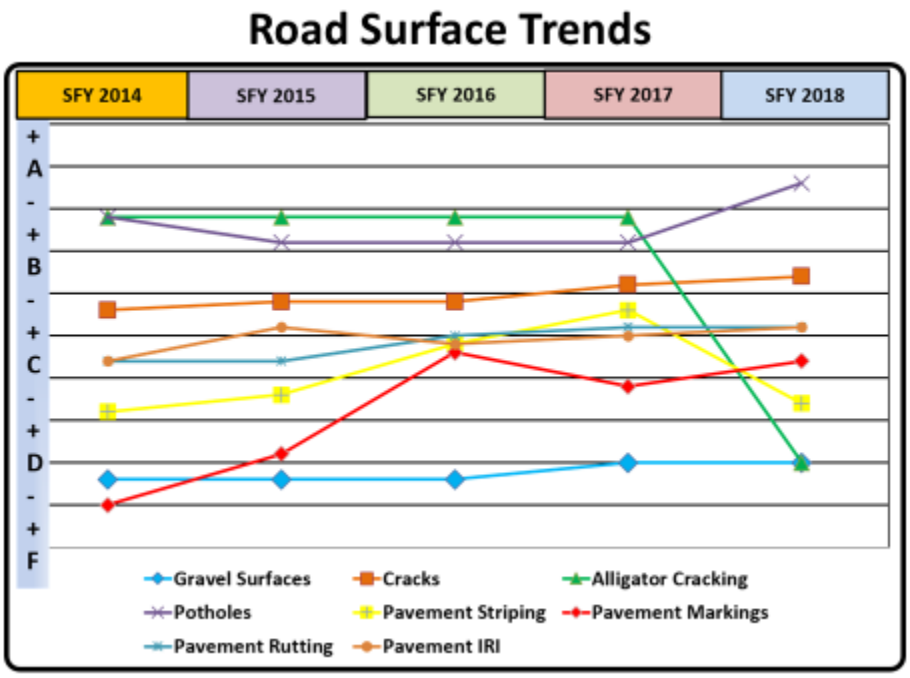
2017 – 2018 Condition & Remedy

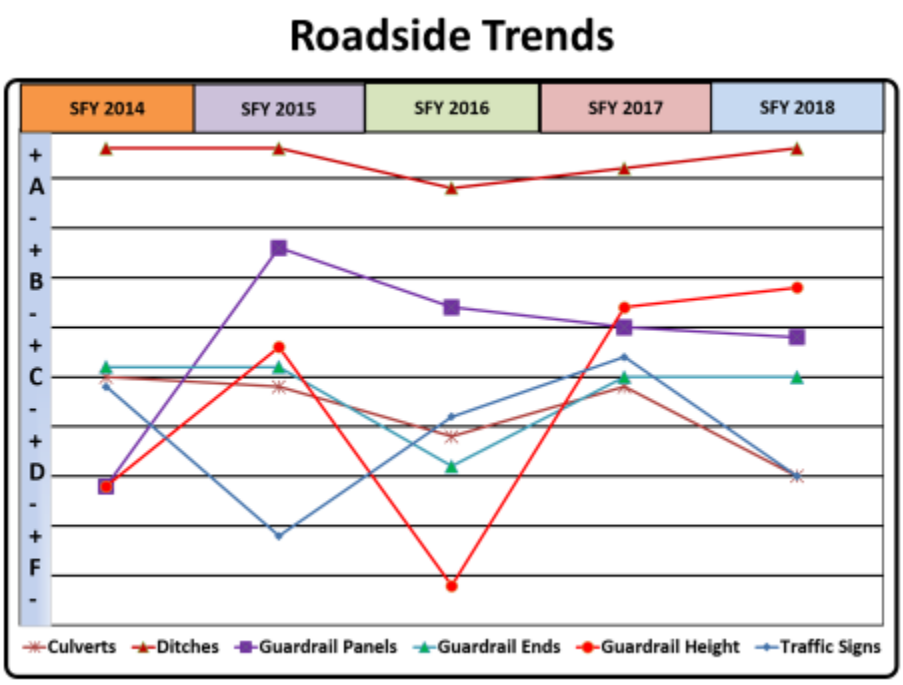
Asset	FY17 Condition	FY18 Condition	Remedy
Gravel Surface Material	F+	F+	$32.7M to raise the rating to a C
Cracks	C-	B-	$3M to raise rating to a B
Alligator Cracking	B+	F+	$4.86M to raise the rating to a B
Potholes	B	A	Desired rating for this asset is a B
Pavement Striping	C-	D	$503.2K to raise the rating to a C
Pavement Marking	D+	C-	$22.5K to raise the rating to a C
Pavement Rutt	C	C	Data still being processed, desired rating B
Pavement IRI	C	C	Data still being processed, desired rating B
Culverts	C	D	$11.2M to raise rating to a B
Ditches	C	A+	Desired rating for this asset is a B
GuardrailPanels	B+	C+	$575.5K to raise rating to a B
GuardrailEnds	C	C	$457.5K to raise rating to a B
GuardrailHeight	B-	B	Desired rating for this asset is a B
Traffic Signs	C	D	$461.4K to raise rating to a B
Vegetation Management - Hydro Axe	C	C	$418.6K to raise rating to a B
Vegetation Management - Sidearm Mower	C	F+	$293.7K to raise rating to a B
Vegetation Management - Standard Mower	F	F	$269.9K to raise rating to a B

Improvement
Decrease

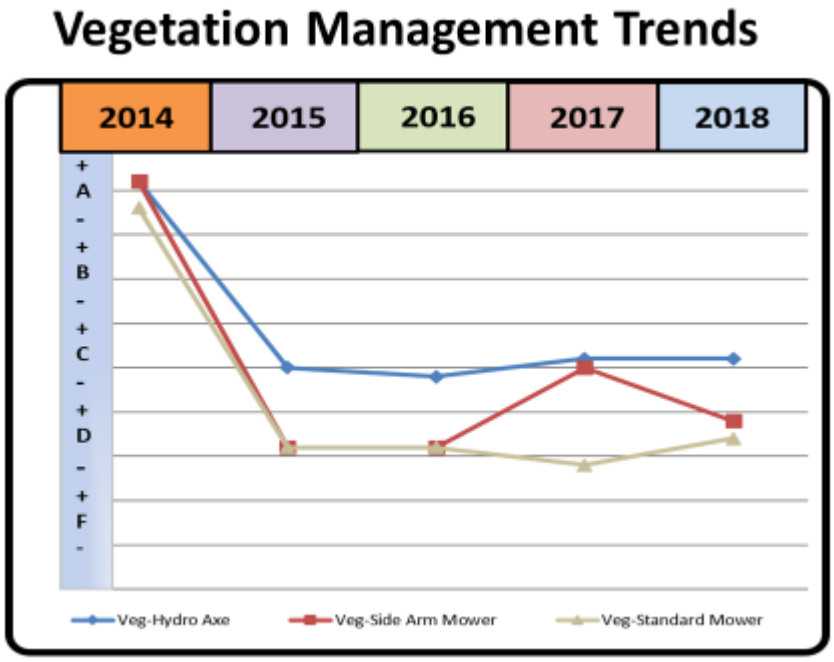
Estimated rating for IRI and RUT - data is still being processed.

Attachment 2 (Cont.)





Attachment 2 (Cont.)



13 Attachment 3 – Guardrail Height Measurement

Guardrail Panel Height Tolerance

The height of guardrail is determined from years of crash testing. The standard for W-Beam guardrail as of January 16, 2017 was set at 29” by FHWA. Beginning in January 2018 the new Guardrail height standard installation height will be 31”. Existing guardrail that is in good condition was grandfathered and does not require height modification.

Crash testing has shown the height is important for the proper performance of the guardrail in vehicle impacts. An installation too low may allow a larger vehicle with a relatively high center of gravity to climb the barrier, while too high of an installation may let a smaller vehicle slip underneath. Nominal construction tolerance for a new installation is +/- 1”, and AASHTO recommends guardrail to be rebuilt if the height varies more than +/- 1” from the standard height.

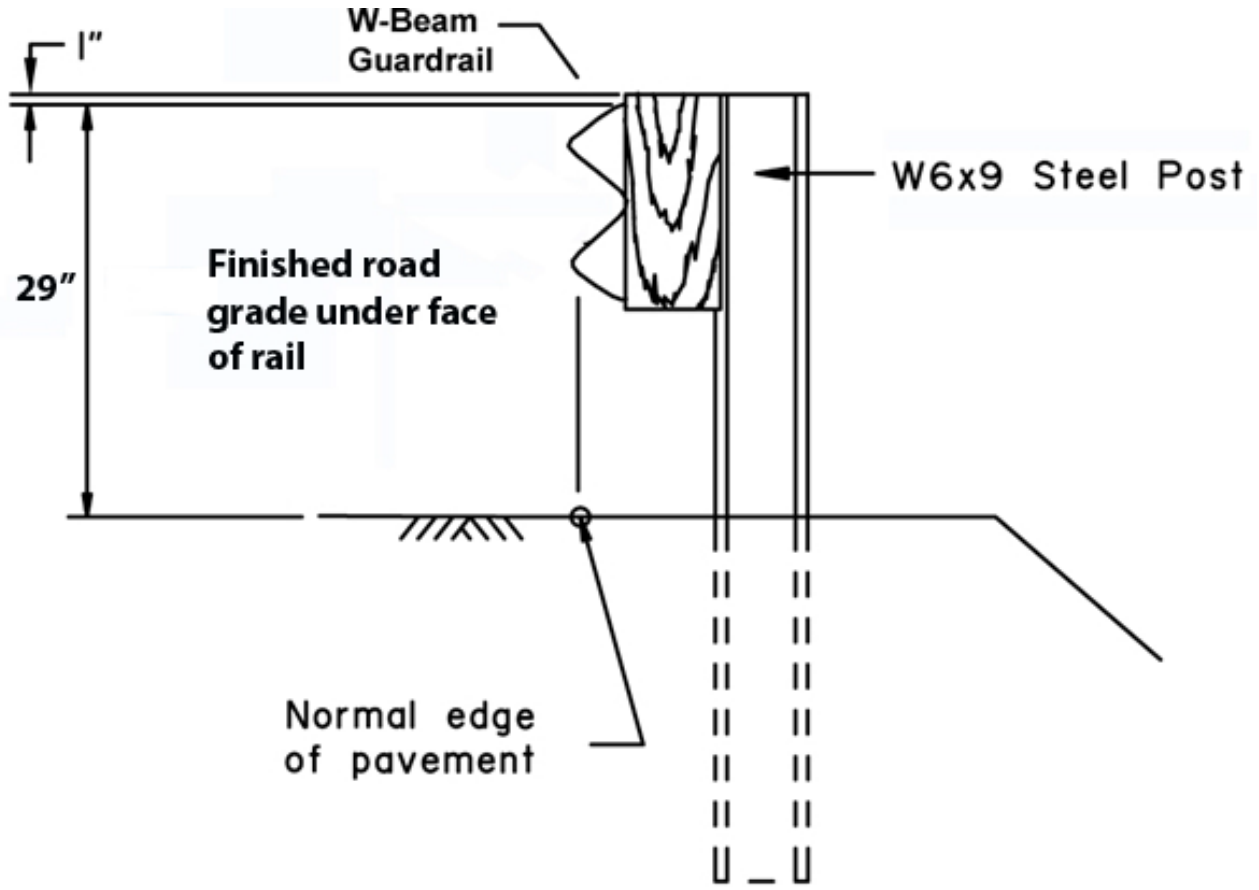
A change in height is typically caused by resurfacing projects, frost heave or the post being undermined by water. Excessive winter sand and gravel buildup is a maintenance issue and not a tolerance failure. Scrape away excess sand and gravel down to grade before measuring height.

W-Beam Guardrail is measured to top edge of panel the minimum height is 26 ½ inches measured as depicted in the diagram below. Measurement is taken at the top of the panel to the finish grade. The maximum height for guardrail installed before January 1, 2018 is no longer listed in the Standard Drawings Manual. FHWA/ASHTO testing of W-Beam at 36 inches indicated that guardrail would retain vehicles of various sizes.

As of January 1, 2018 all Guardrail must be between 26 ½ inches and 36 inches to pass inspection. The following diagrams provide new installation heights only.

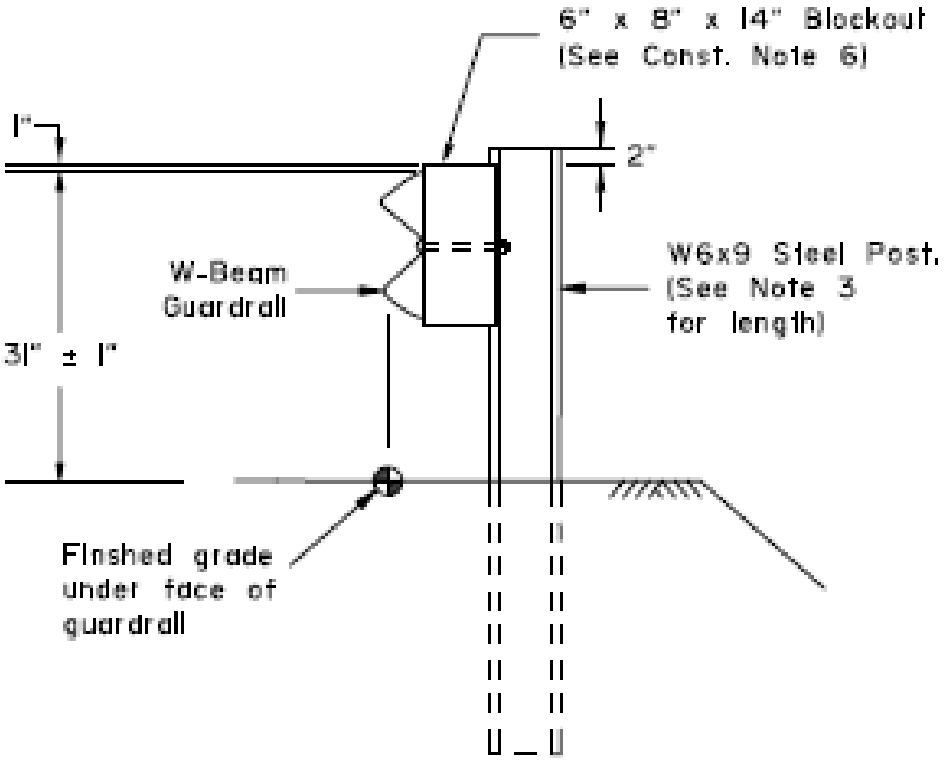
Attachment 3 (cont.)

W-Beam Guardrail installed after January 16, 2017 and before January 1, 2018.



Attachment 3 (cont.)

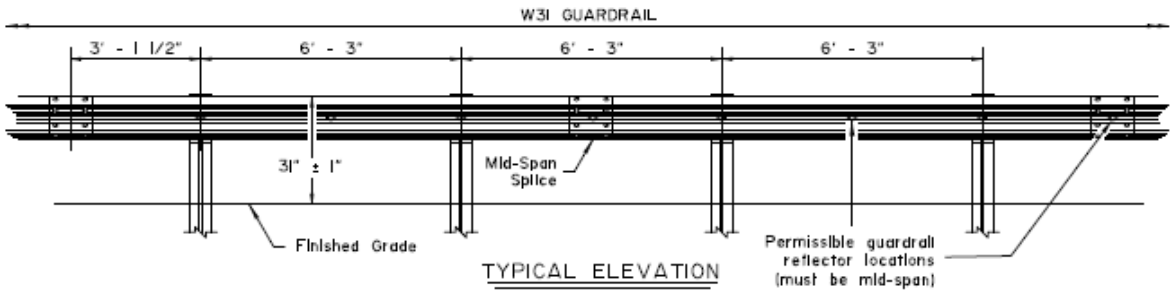
Effective January 1, 2018 the new guardrail height issued in the DOT&PF Standard Drawing Manual list the standard height for W-Beam guardrail cannot be lower than 26 ½ inches and not higher than 36 inches. The following installations diagrams are on steal post, 6” x 8” wooden post may also be used.



TYPE II POST INSTALLATION

(Facilitates raising rail for future overlays.)

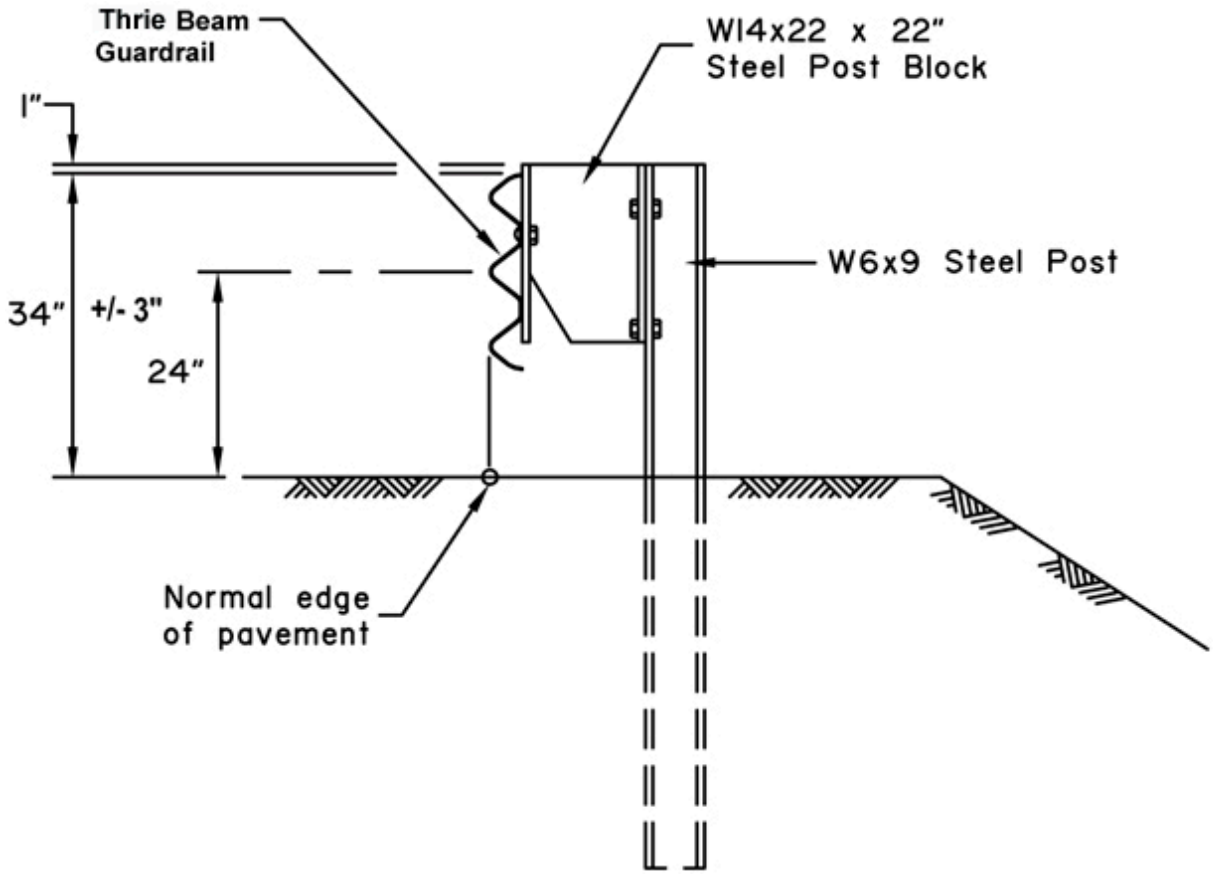
You can identify guardrail installed after January 1, 2018 by the guardrail splice being between, rather than on the post. Guardrail reflectors are mounted on the post rather than the guardrail.



TYPICAL ELEVATION

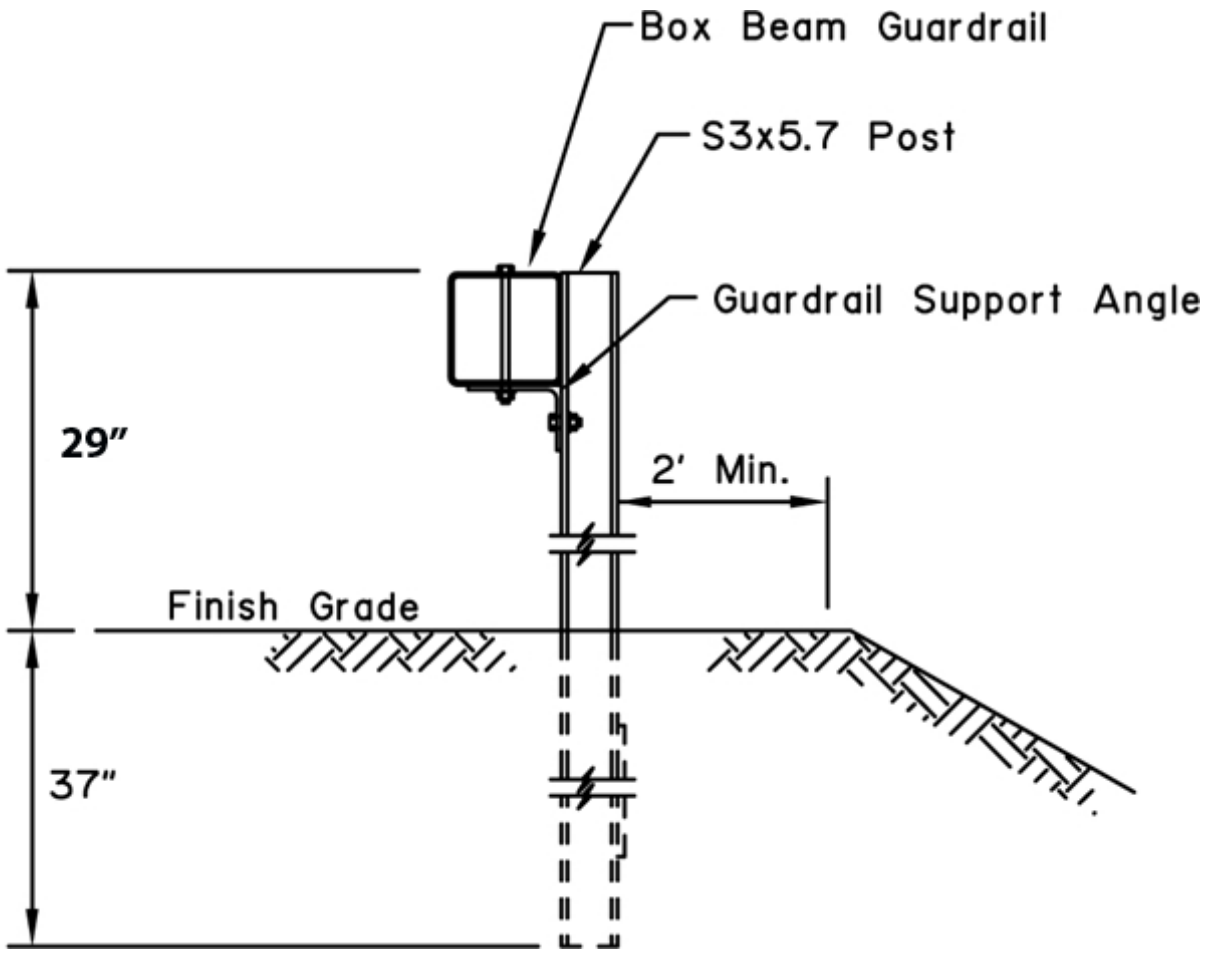
Attachment 3 (cont.)

Thrie-Beam Guardrail is measured to top edge of panel 34 inches +/- 1 inch for new installations. Measurement is taken at the face of the beam to the normal edge of pavement or the finish grade as depicted below. The maintenance inspection standard for guardrail height cannot be lower than 26 ½ inches and not higher than 36 inches.



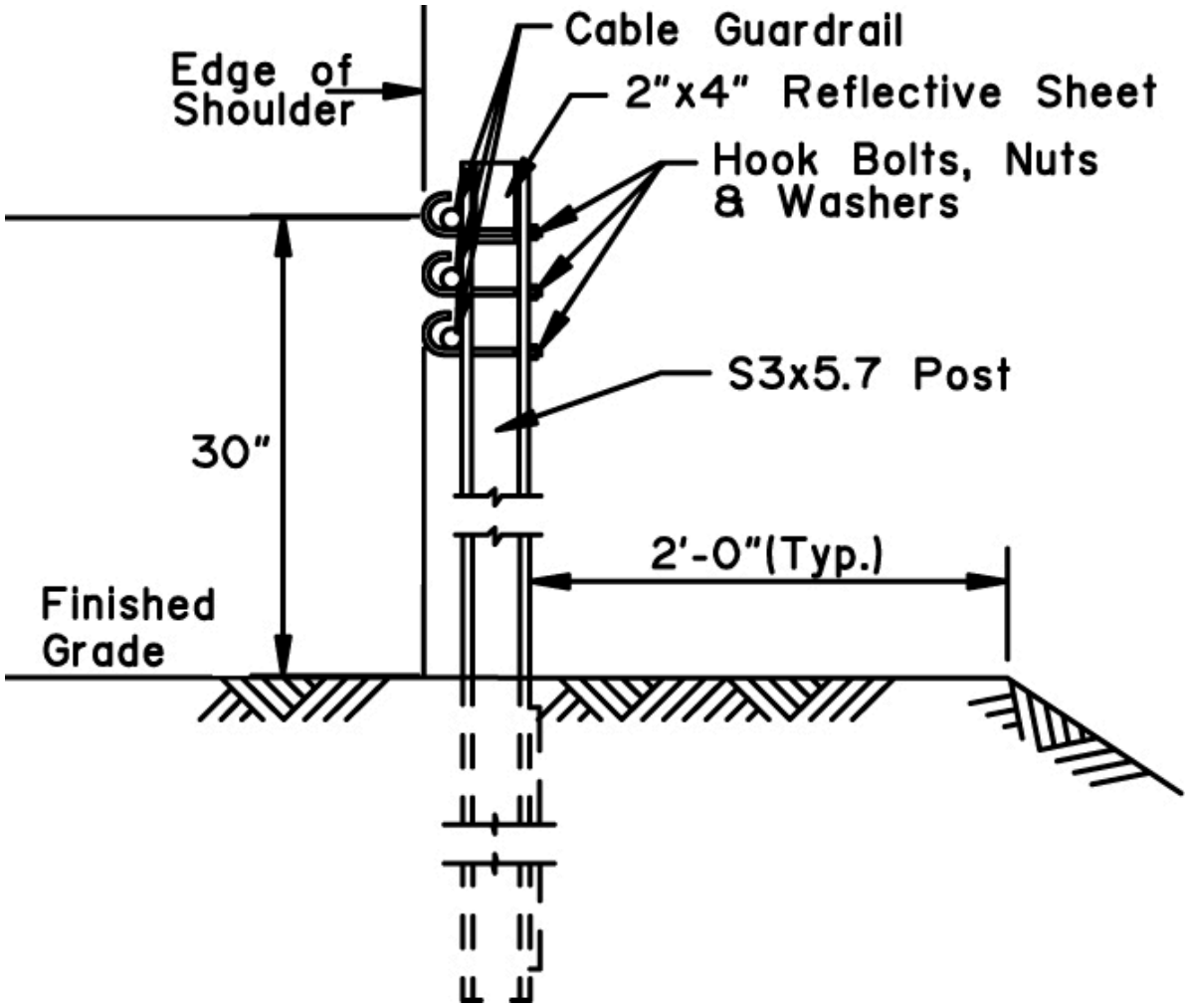
Attachment 3 (cont.)

Box Beam Guardrail is measured to top edge of beam 29 inches and the new installation standard is +/- 1 inch. Measurement is taken at the face of the bean to the finish grade as depicted below. This type guardrail is typically used on bridges in Alaska and the height does no change due to frost heave or undermining by water. However when used on the highway the height tolerance is +/- 3 inches.



Attachment 3 (cont.)

Cable Guardrail is measured to the center of upper cable 30 inches and the installation standard is +/- 1 inch. The measurement is taken at the face of the cable to the finish grade as depicted below. The top cable cannot be lower than 26 ½ inches or higher than 34 inches.



The FHWA recommends tensioning the cables after installation to improve the performance of the system by reducing deflection and increasing the potential to capture the impacting vehicle. The installation temperature is also a critical factor. A forth cable may be added to reduce the probability of a small vehicle slipping under the bottom cable. The FHWA recommends agencies specify a minimum tension at a discreet installation temperature for high tension cable, and plan follow-up inspections to ensure the desired tension is maintained.

Attachment 3 (cont.)

Tensioning standards have not been set by Alaska DOT&PF for low tension cable guardrail, which is the only cable rail that is installed at this time. However until there is a standard, measure the height to the center of the top cable at the post and the height of the cable mid span. Both height measurements should be the same as long as the edge of the shoulder is consistent between posts.

14 Attachment 4 – QA Level of Service Goals

NOTE: The QA Level of Service goals will be reviewed again before the end of the 2018 calendar year.

Level of Service Goals - Surface

- Gravel Surface – C
- Cracks – B
- Alligator Cracking – B
- Potholes - B
- Pavement Striping – C
- Pavement Markings – C
- Pavement Rutting – B
- Pavement IRI - B

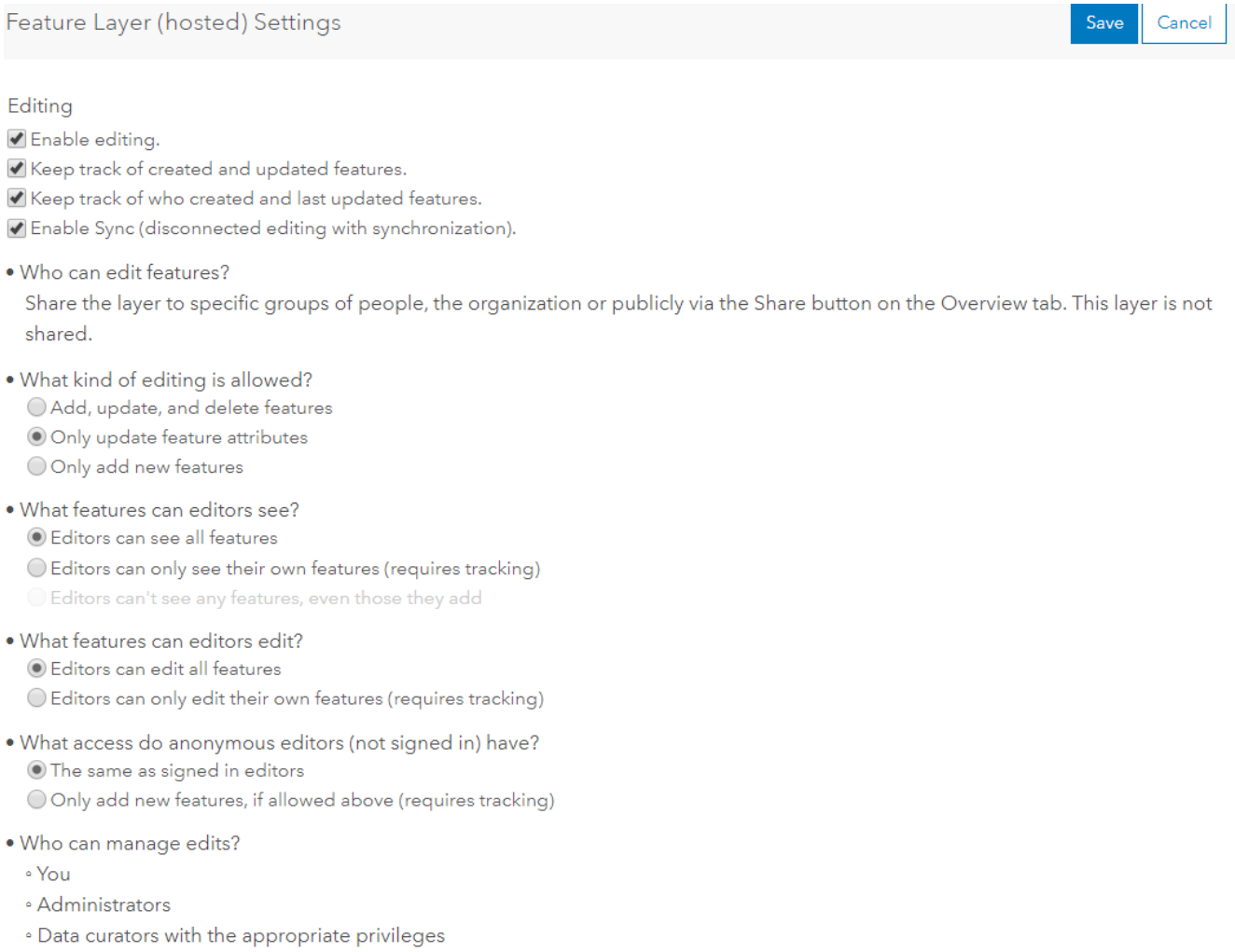
Level of Service Goals - Roadside

- Culverts – B
- Ditches – B
- Guardrail Panels – B
- Guardrail Ends – B
- Guardrail Height – B
- Traffic Signs – B
- Vegetation - B

15 Attachment 5 – ESRI ArcGIS Collector App & MMS Setup Checklist

The following checklist provides the sequence of events necessary to prepare the MMS and the ArcGIS and Collector App for each year's inventory and inspection season.

1. ArcGIS settings for Collector setup:



2. MMS Setup:
    a. As mentioned earlier the MMS must be setup for the new Fiscal Year (FY), which begins in July, in order to prepare the database.

Attachment 5 (cont.)

b. Run and have the three regions review the excluded segments for the new FY and have them verify with construction so the planned construction segments plus 1/10 mile on either of the construction are excluded.
c. Once the excluded segments are loaded in the new FY run the MMS highway QA/QC inspection list and have the regions review and approve the QC sites they will inspect.
d. Publish the inspection contract or amendment for signature, the inspection period is from May 1st to July 31st for the Contract.
e. Export an Excel Spreadsheet CSV file and crate a Geospatial database or as described in the AgileAssets manual.
f. Coordinate with the AgileAssets MMS manager to insure the fields and format match and required fields are prepopulated.
g. Deliver the spreadsheet with the inspection segments to the GIS section so they can prepare the Geodatabase.
h. Once the Geodatabase is published download it to the Trimble GPS tablets into the Collector App.
i. Have Megan Byrd or the new manager for the Cell Phone SIM Cards activate the cards for the three Contractor's tablets.
j. Once the testing is completed to insure functionality and accuracy by both Wireless and Cell phone download of the data, have the production path setup (setup is done by either the Department GIS section or ESRI ArcGIS) and then download it to Collector App on each tablet.
k. View and track progress as the inspection data is transmitted from the field to the ESRI ArcGIS Cloud, then to the Department GIS server and Map.
l. When the DOT QC team is ready to go to work, have the Cell Phone SIM cards activated for their tablets. The QC inspections, based on staff availability, should be completed by the second week in September to meet the regional M&O Chief's deadline.
m. After each team completes their inspections for the season have the SIM cards deactivated to save money. The GCI SIM cards can be turned on and off as needed and you retain the SIM for the next inspection season.