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BUREAU OF LAND MANAGEMENT

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H-9113-2 Roads Inventory and Condition Assessment Guidance & Instructions

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1. Explanation of Material Transmitted: Added: Guidance on page 1-1, paragraph 3; concerning condition assessment periodic inspection requirements for Federal Lands Transportation roads versus non-surfaced roads.
2. Reports Required: N/A
3. Material Superseded: H-9113-2, Release Number 3-389.
4. Filing Instructions: File as directed below.

REMOVE

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All of Release Number 3-398

H-9113-2  
(38 pages)

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## **Chapter 1 - Overview**

### **1.1 Introduction**

This handbook provides the Bureau of Land Management (BLM)'s standard process for the inventory and condition assessment of BLM roads as defined in Manual Section 9100 – Facilities Planning, Design, Construction, and Maintenance.

All BLM roads are required to complete a baseline comprehensive condition assessment that includes Geographical Information System (GIS) spatial data as well as BLM asset management system inventory and condition assessment information tabular data. Roads are excluded that have been identified by each state not to be condition assessed based on the following reasons:

- Physically inaccessible
- Not a BLM road
- Environmental Hazard
- Isolated and extremely remote
- Roads in storage (Western Oregon)
- Condition assessment problems, noted and transmitted to BLM COTR.

BLM surfaced roads (aggregate, paved, etc.) should be re-inspected on a regular interval (not to exceed 10 years) in accordance with the BLM's overall asset management program, utilizing the provided methodology (GIS spatial information is generally not collected during re-inspections unless a specific need for updated information has been identified). Non-surfaced roads are inspected as needed on a local basis, or after events such as severe storms, or on a discovery basis. All Bureau roads that have been included in the Federal Lands Transportation (FLT) designated network are to be inspected on a five year cycle.

New roads entering the BLM asset management system are also required to complete the inventory and assessment process prior to their entry into the BLM asset management system.

### **1.2 Background**

The BLM is required to annually report the inventory and physical condition of its transportation infrastructure systems.

Consistency and integrity of information and process is essential to the BLM's ability to accomplish that objective and be directly linked to the effectiveness of the BLM's asset management program.

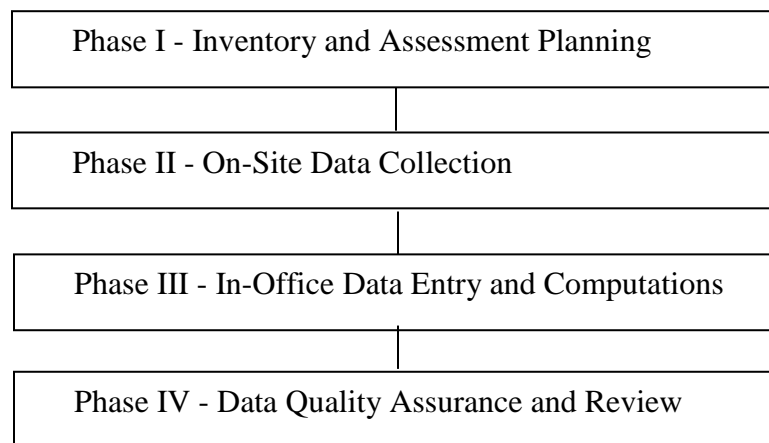
In order to provide a reasonable, consistent, and auditable process, BLM must:

1. Create a maintainable inventory of roads.
2. Support a condition assessment program that determines road condition and needs.
3. Develop reasonable cost estimates to correct any deferred maintenance deficiencies.
4. Work uniformly and consistently across the BLM road inventory.
5. Provide a cost effective auditable approach to managing BLM roads.

### 1.3 Process

This handbook describes the methodology and approach for use in the inspection of all BLM roads irrespective of whether the inventory and assessment is accomplished by BLM personnel or outside support (other federal agencies or contract).

The typical condition assessment contains several distinct phases which are illustrated below. Small scale assessments may inherently combine steps for efficiency of the effort and will dictate the appropriate assignment of roles and responsibilities, however the process itself (inventory and condition assessment standards) should not be modified regardless of road length, surface type, or geographical location.



### 1.4 Inspector Qualifications

Road inventory and assessment should be accomplished by individuals experienced in the construction, maintenance, and repair of rural road systems. The road inspection process requires a mix of driving and walking with physical inspection of culverts and other appurtenances as necessary.

Inspectors must be able to recognize and accurately record the required inventory items and condition assessment deficiencies as described and in general adhere to the prescribed process.

- BLM Road Inspectors – Individuals accomplishing the road inspection process must be approved by the State Engineer with jurisdiction over the roads.
- Non-BLM Road Inspectors – Qualifications should be included as part of the scope of work or memorandum of agreement and conform to the requirements outlined previously.

## 1.5 Project Phases

The typical road assessment project contains several distinct project phases. Individual phases may be accomplished by the same individual or by a team of personnel depending on the scale and complexity of the assessment effort.

**Phase I – Inventory and Assessment Planning** - The planning phase consists of data gathering and schedule coordination. An Assessment Leader will work with the BLM State Engineer and Field Office personnel to collect mapping, begin/end points of road segments, land ownership change locations, segment change locations, and other pertinent information on each road segment to be inventoried and assessed. The Assessment Leader will transfer the collected data to the Field Assessment Personnel. The Assessment Leader will also provide scheduling coordination for assessment personnel and BLM Field Office staff. The Assessment Leader is responsible for determining the need for special tools or equipment required by the Field Assessment Personnel to carry out the work in the field.

**Phase II - On-Site Data Collection** - On-site data collection will be accomplished by approved personnel. They will traverse all the roads identified for inventory and assessment and accomplish the required data collection and condition assessment. It is desirable to have a BLM Field Office staff member accompany assessment personnel whenever possible.

**Phase III - In-Office Data Entry and Computations** - Data collected on-site will be downloaded at the designated office location for data cleansing and computations. GIS spatial data will be validated and updated to BLM data standards. Previously developed deferred maintenance unit costs and current replacement value unit costs will be applied to deficiencies observed and road segments inventoried.

**Phase IV - Data Quality Review** - Completed inventory and condition assessment information will be independently reviewed in the office for conformance with BLM requirements. Spatial data, tabular data, photos, and required supporting documentation should all be reviewed as an integrated package prior to delivery to the BLM.

**Delivery of Data to BLM** - Completed inventory and condition assessment information will be provided to the BLM in electronic format for validation by the BLM and entry into the BLM's asset management system.

## 1.6 Conducting an Inventory & Condition Assessment for BLM Roads

This section provides detailed guidance for the completion of each of the four project phases associated with completing an inventory and condition assessment for BLM roads.

The official inventory of roads resides within the BLM asset management system and each road has a unique identifier within that system. Roads and road segments are named by the BLM States and naming conventions vary across the system.

BLM roads are comprised of road segments which are continuous sections of road with consistent surface type, dimension, jurisdiction, maintenance intensity, and general construction standards conforming to the BLM standard definition of a road (reference Manual Section 9100 – Facility Planning, Design, Construction, and Maintenance).

BLM road inventory and condition assessments are accomplished at the road segment. Each road segment is tracked, inventoried and assessed individually within the BLM asset management system.

## **A. Phase I - Inventory and Assessment Planning**

The inventory and assessment planning phase validates the current road inventory contained within the BLM asset management system and establishes the work plan for on-site data collection.

### **1. General**

The Assessment Leader will prepare a field assessment schedule identifying all the roads planned for inventory and assessment and provide it to the designated BLM contact in advance of beginning on-site data collection (Field Work).

The Assessment Leader will gather all available information concerning the roads to be assessed, such as road maps, begin/end points, land ownership information, previous assessments, and spatial data. Base information including road segment name, unique identifier, maintenance information, surface type, and road limits will be downloaded from BLM's asset management system and provided to the assessment team as part of the planning package.

Road segmentation, categorization, asset class, and related inventory decisions should be made by the BLM Field Office prior to the inspection process to maximize the efficiency of the on-site data collection.

Corrections to the road inventory should be completed by authorized BLM personnel within the BLM asset management system to maintain consistency between the inventory, condition assessment process and baseline data.

Roads that are extremely distant or remote from the Field Office should be reviewed with BLM personnel to determine the viability of inclusion into the assessment effort. In general, all asphalt surfaced roads should be assessed regardless of distance. Aggregate and naturally surfaced roads should be assessed if they are less than one hour drive time from adjacent roads identified for assessment. A list of roads (and their associated road segments) recommended for exclusion due to remoteness should be forwarded to the State Engineer for approval at the conclusion of the planning process. Road segments recommended for exclusion should not exceed 5 percent of the total road inventory (based on lane miles).

Roads in storage status as defined in the Bureau's asset management system are not currently open, operated, or maintained, but may be reopened at a future date. Storage roads are not required to have Comprehensive Condition Assessments until they are placed in an operational

status and maintained. Storage status should not be used for seasonally closed roads, which would remain open in operating status through their normal seasonal closures.

BLM State or Field Offices may have existing GIS (spatial) information that conforms to BLM requirements. If existing data is available, it may be utilized in lieu of collecting new GIS data with the prior approval of the State Engineer and BLM National Data Steward.

The Assessment Leader will coordinate with local BLM staff to determine if special equipment or procedures are required by assessment personnel for work in that area. A safety briefing for assessment personnel will also be scheduled prior to conducting the field assessment. Safety briefings will be reviewed and documented.

## 2. Specific Tasks

The Assessment Leader will complete the following tasks prior to commencing on-site data collection:

- i. Obtain a current inventory of all roads to be inspected from the BLM asset management system (typically conducted on a Field Office basis).
- ii. Schedule a roads inventory and condition assessment planning session with the assigned local BLM Point of Contact (POC).
- iii. Provide the local BLM POC a list of requested information (maps, maintenance information, access issues, previous inspections, construction projects, seasonal concerns, jurisdictional issues, availability of GIS data, etc) for assembly prior to scheduled planning session.
- iv. Meet with the local BLM POC to develop the work-plan for the identified roads.
  - Update inventory as necessary to reflect field conditions
  - Establish seasonal issues and a safety plan
  - Review existing roads information
  - Validate compliance of selected roads to BLM Manual Section 9113 – Roads.
  - Identify roads that may be considered remote, inaccessible, or placed in storage status and evaluate the feasibility of assessment. If roads are recommended for exclusion, summarize and provide the recommendation to the State Engineer for concurrence. (In general, roads recommended for exclusion should not exceed five percent of the total lane miles.)
  - Determine road segmentation requirements if current road segments are not consistent in their basic definition (road, primitive road, trail), surface type, jurisdiction, maintenance intensity, or general construction and segment in accordance with BLM guidance.
  - Develop a recommended work-plan/field schedule for the inspection process. Document rationale/decisions that influence work flow or any determination to forgo inventory and condition assessment of a particular road.
  - Develop a safety plan and determine if special equipment is required.
- v. Obtain concurrence from the local BLM POC on the work-plan.

- vi. Provide the work-plan to assessment personnel.

### **3. Summary**

Phase I: Inventory and Assessment Planning. In summary, the following tasks will be performed in the office by the Assessment Leader, with assistance from BLM staff, to prepare for on-site (field) data collection:

- Prepare field schedule.
- Collect road maps and other pertinent data.
- Prepare a listing of road and road segment information (unique id, name, surface type, location, map coordinates, etc).
- Prepare a listing of road and road segments recommended for exclusion and obtain approval from the State Engineer (unique id, name, surface type, location, map coordinates, etc.).
- Determine road segmentation updates (begin/end points, land ownership and surface type changes).
- Determine if special equipment is required.
- Schedule safety briefing.
- Document work plan decisions and rationale for assessment personnel.

### **B. Phase II - On-Site Data Collection**

The on-site data collection phase implements the inventory and assessment work-plan to complete the field portion of the roads assessment program. It requires assessment personnel to conduct a field visual assessment (FVA) of all the road segments within the work-plan.

#### **1. General**

On-Site data collection may be accomplished by BLM personnel, other agencies, or contractor personnel as long as it is completed in accordance with standard BLM methodology and practice. On-Site data collection is generally accomplished from a vehicle driven across all accessible road segments by the assessment personnel using the work-plan developed in Phase I – Inventory and Assessment Planning.

#### **2. Specific Tasks**

Assessment personnel will complete the following tasks as part of the site data collection Phase.

- i. Review work-plan from Phase I.
- ii. Contact local BLM POC and schedule on-site data collection event(s).



- iii. Complete logistics for assessment personnel (transportation, lodging, etc).
- iv. Prepare work data. See paragraph C – On-Site Data Collection Tools.
- v. Prepare Tool List (typical tool list provided below).
- vi. Mobilize at the Local Field Office.
- vii. In-Brief with Local BLM POC.
- viii. Execute Work-Plan by completing inventory and condition assessment for identified roads.
  - a. Existing/Re-inspections - Collect GIS (spatial), inventory, and condition assessment (tabular) information for all Baseline Comprehensive Condition Assessments on each Road Segment (unless GIS data has already been completed and validated).
  - b. Collect inventory and condition assessment information for all comprehensive re-inspections on each Road Segment.
  - c. New/Baseline - Collect GIS (spatial), Inventory, and condition assessment (tabular) information for all Baseline Comprehensive Condition Assessments on new Road Segments (unless GIS data has already been completed and validated).
  - d. Document deviations from the established work-plan including rationale and modification.
  - e. Document additional segmentation requirements based on segmentation guidance. See paragraph E. Road Segmentation.
  - f. Upload/transfer data to the office in accordance with the work-plan.
  - g. Follow established access, safety, and communication plan.
- ix. At the conclusion of the work-plan, meet with local BLM POC and conduct an Out-Brief

### **3. On-Site Data Collection Tools**

The list below is provided as a general reference for assessment personnel. Specific tools necessary for the inventory and condition assessment of roads in a specific location will be included as part of the work-plan.

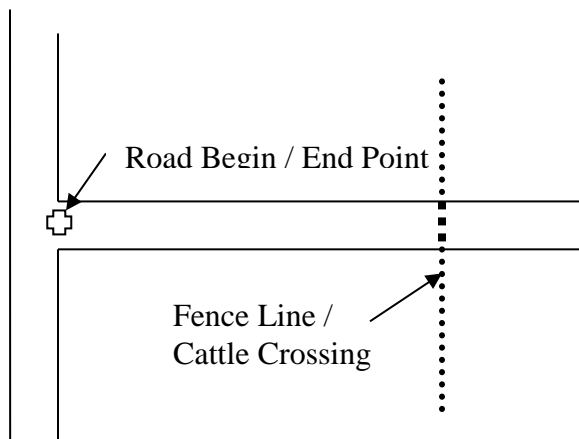
- Clipboard and notepaper
- Computer and accessories such as spare batteries and power charger
- Digital camera and accessories
- GPS Device meeting current BLM data requirements
- 25' measuring tape

- Rock hammer
- Safety equipment (fire extinguisher, flares, reflective vests, first aid kit)

#### 4. Road Designation, Location, and Name

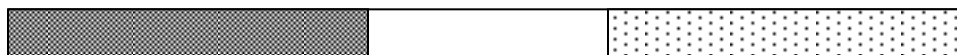
Road designation, unique identifier, road name and road begin / end points will be provided by BLM Field Office staff. If the begin / end point of a road is not known when the assessment personnel begin their work, the point will default to the example shown below.

*Default begin/end point:* At an intersection with a road, the beginning point of the BLM road will be at the edge of travel lane of the intersecting road along the centerline of the BLM road.



Road route designations and road names will be provided by the BLM and may vary from state to state.

The BLM-designated Maintenance Intensity will be provided by BLM staff, but will not influence the road segment assessment process. Known locations of surface type and land ownership changes will be mapped in the office.



Asphalt Surface

Native Material

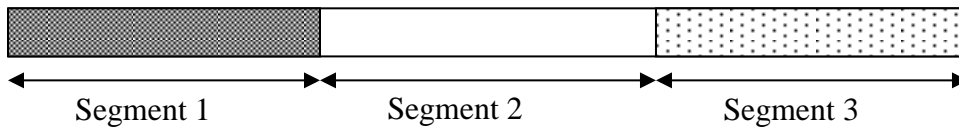
Gravel Surface

#### 5. Road Segmentation

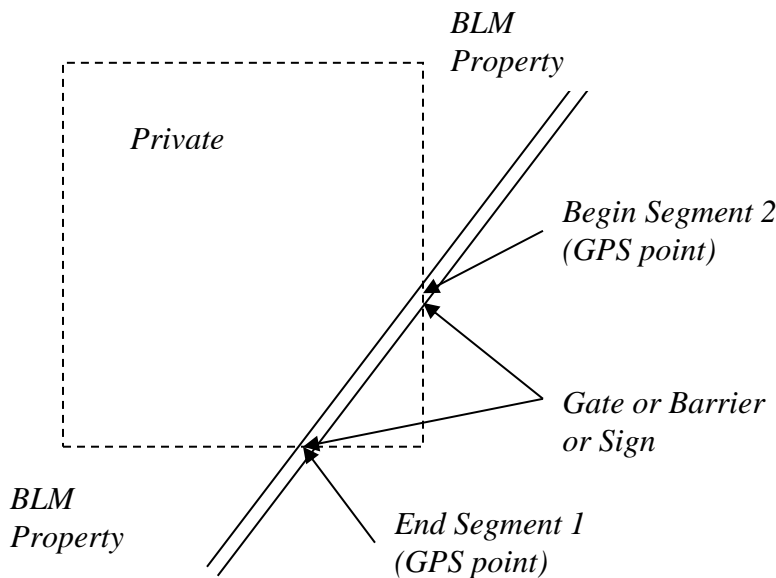
Road segment designations will be pre-determined in the office using the information at hand. States will provide GPS coordinates of legal jurisdiction/agreement segment breaks for use by assessment personnel.

Road segments must be homogeneous in nature. Therefore, a change in road surface type, or width of lanes (one-lane  $\leq 15'$ , two-lanes  $> 15'$  in width) will signal a change in road segment. The previous example road will have three segments as shown below. If a gravel road segment has an asphalt apron at its intersection with an asphalt road, it will still be considered one segment, and not divided into two segments.

On unpaved road surfaces, short portions of the road may vary in width for pull-out areas, wide turns/curves, intersections, cattle guard gates, and turn-around areas. The width change of a road must be greater than four feet and continue for a minimum distance of  $1/10^{\text{th}}$  mile for a segment change to occur.



Road segments will begin/end when private property, state land, or any non-BLM land is encountered as shown in the following diagram unless the BLM has easement or jurisdiction of the road. If assessment personnel are uncertain about jurisdiction, they should note the location of the questionable segment in the data file with a GPS point and a comment note and continue assessing the road portion as a single segment.



If a road is barricaded, the assessment personnel will make every effort possible to reach the road from the other side of the property in order to complete the road segment inventory and assessment. Some roads may not connect, leaving the remaining segment inaccessible. Inaccessible roads should be noted with a GPS comment before proceeding on to the next road segment.

## 6. On-Site Measurements for Inventory

Assessment personnel are required to perform seven basic tasks during the course of the on-site inventory data collection:

- i. Validate surface type and width for each road segment designation. All data will be based on a coordinate system, not road mile markers. However, if a GPS unit is not available, note mile markers.
- ii. Note predominate terrain type (flat, rolling, or mountainous).
- iii. Note if the road segment should be considered a “primitive road” based on Manual Section 9100 – Facility Planning, Design, Construction, and Planning).
- iv. GPS road centerline at specified interval (interval not to exceed 25 feet).
- v. GPS locations of potential segmentation changes based on surface type and width changes.
- vi. Take digital photos of typical road.
  - a. Begin/end of road (note: end photo looking back onto road).
  - b. Potential health and safety items.
- vii. Identify and GPS potential health and safety items and location.

Photos will be taken in landscape view and developed in .jpeg format. The photo number given by the digital camera will be recorded into the photo number field in the inventory database.

Potential health and safety deferred maintenance items are those that may pose a serious threat to public or BLM employee health and safety. Potential health and safety items include such things as road washouts, damaged guardrail, falling rocks and collapsed culverts. Potential health and safety events are not always points – they may be noted as lengths or areas. All potential health and safety items will be inventoried so that BLM officials can locate the item.

## 7. On-Site Measurement for Deferred Maintenance

Assessment personnel will identify and quantify deferred maintenance on all road segments as well as appurtenances located along the road segment (cattle guards, signage, rails, etc.) in accordance with the BLM standard included in this Manual Section.

Each road segment will be assessed for deferred maintenance items. Deferred maintenance is defined as maintenance that was not performed when it should have been or was scheduled to be and which is put off or delayed for a future period. Deferred maintenance includes items such as culvert cleanout and repair, aggregate replacement, and medium to severe potholes and ruts.

Deferred maintenance does not include items that were not originally constructed (e.g., if ditches were not originally constructed for the road segment, they can not become a deferred maintenance item).

Annual maintenance is defined as the maintenance tasks accomplished on a regular basis to keep assets in acceptable condition. Grading of low-severity ruts, minor culvert maintenance, potholes and roadside brushing of light vegetation are examples of annual maintenance and are not to be recorded as deferred maintenance.

Likewise, component renewal items, such as programmed overlays, are not considered deferred maintenance unless the condition of the road is not currently acceptable and an overlay is needed immediately.

The type of assessment to be used is the Field Visual Assessment method. The following features will be inspected and assessed from the inspection vehicle along the entire length of the road segment:

- Cross Section/Positive Drainage
- Ditch Condition
- Corrugations/Wash Boarding
- Potholes
- Ruts
- Loose Aggregate (gravel roads)
- Missing Aggregate (gravel roads)
- Cracking (paved roads)
- Vegetation Removal
- Rock Slides/Fallen Debris
- Other Appurtenances
  - Signs
  - Cattleguards
  - Gates
  - Low water crossings
  - Culverts

Deficiencies on these features will be noted on assessment forms as the vehicle proceeds along the road segment. At the end of the segment, deficiencies noted will be tallied and saved for each road segment. (Note: deferred maintenance is collected on appurtenances but they are not inventoried or spatially located.)

Culvert condition will be inspected and assessed on every fourth culvert, starting at the second culvert on each segment found in the field. For culvert inspection, the Assessment Personnel will get out of the vehicle and physically inspect the culvert for deficiencies. Results of the culvert inspections (roughly ¼ of all culverts) must be converted by multiplying the deficiencies by a factor of 4 to represent the entire road segment. Culvert deficiencies will also be tallied at the end of the road segment and saved.

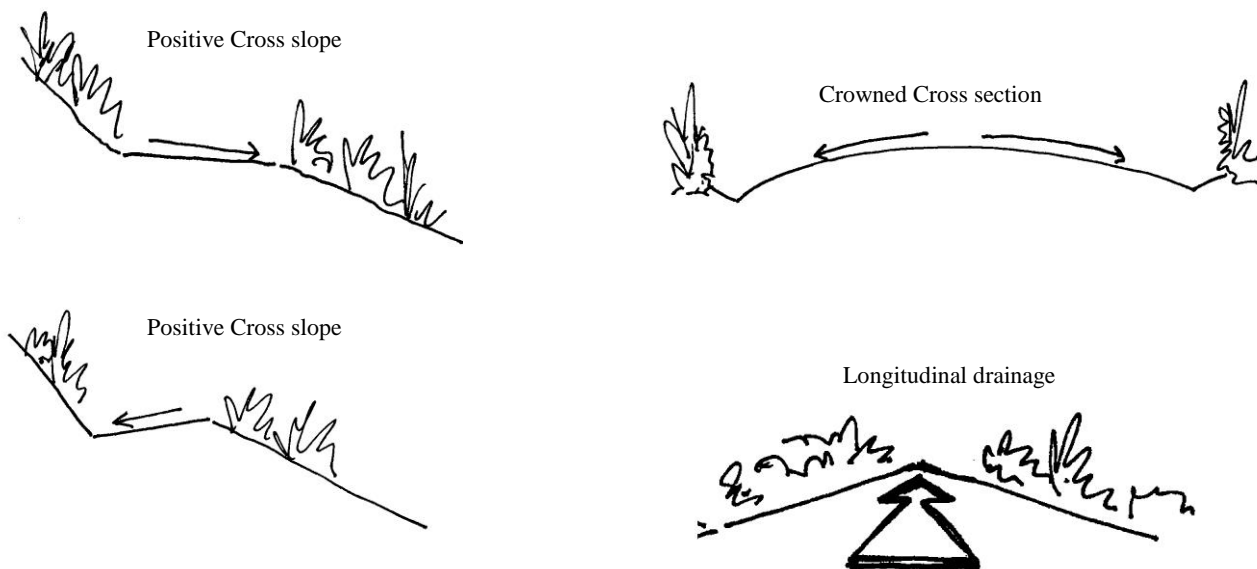
## 8. On-Site Inspection Protocols

The method of estimating and recording each of the deficiencies is discussed on the following pages. Each deficiency will also be assigned a severity level of medium or high. (Low-severity indicates annual maintenance needs). Different severity levels may exist within the same segment resulting in multiple entries of a single deficiency. *The severity level is based on the perception of the field inspector while driving the road segment.* For example, a pothole will be rated as medium or high severity based on the inspector's view from the vehicle – the inspector will not physically measure the depth of the pot hole to determine its severity.

Linear estimations for cross section, ditch, corrugations, ruts, vegetation removal, loose or missing aggregate, and cracking will be made from the inspection vehicle rather than physically measuring the deficiency with a tape measure. A quick reference guide has been provided at the end of this section.

### a. Cross Section/Positive Drainage

BLM roads may have three types of drainage: Longitudinal drainage (water drains in the direction of the road), cross slope drainage (water is drained across the road surface) and crowned road drainage (roads that have a crown where water drains from the center to the road edge). Assessment of cross section will be made by noting if there is positive drainage for the road surface. Corrective actions for improper cross section will be either grading of high areas or filling of low areas. A cross section deficiency will be noted in the field as an estimate of the length, width and depth of the area to be graded or filled.

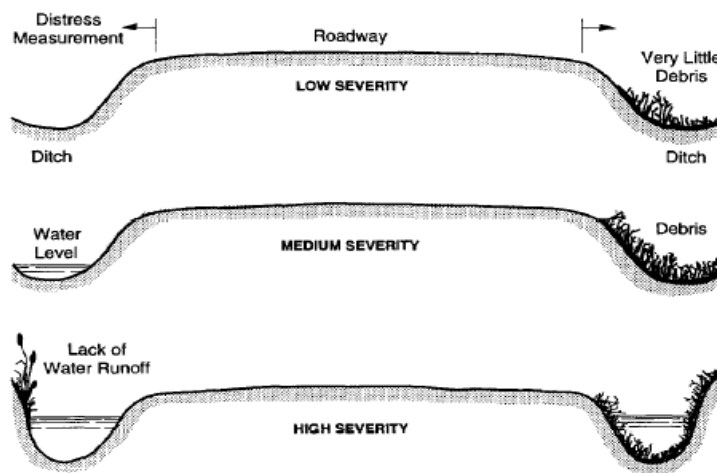


### b. Ditch Condition

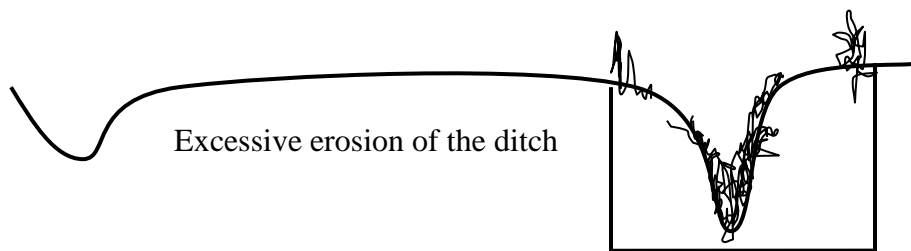
Poor drainage due to an inadequate ditch section may cause water to pond and weaken the road bed. Ditch deficiency is estimated in linear feet parallel to the centerline of the road. The maximum length of ditch

condition deficiency is two times the length of the road segment. Low severity drainage distress is characterized by evidence of ponding water in the ditches and overgrowth or debris in the ditches. Low severity is considered annual maintenance and will not be assessed as a deficiency. Medium severity includes low severity conditions plus erosion of the ditches into the edge of the road. Medium severity will be calculated as deferred maintenance. At the highest severity, ditch deficiency includes evidence of ponding water, water running across the road, overgrowth or debris in the ditches and severe erosion of the ditches into the road surface.

Existing ditches will be assessed for deferred maintenance/cleaning even if it is evident that the ditch does not outlet anywhere or have positive drainage (i.e. would quickly silt back in). If a ditch was “built” and is half full, it will have deferred maintenance assigned. Deferred maintenance will be assigned even if it is evident that the ditch was filled in by improper road maintenance grading. A ditch may also have erosion problems and require fill material. Inspectors will note the severity of the condition as well as the length, width and depth of ditch cleaning or fill.



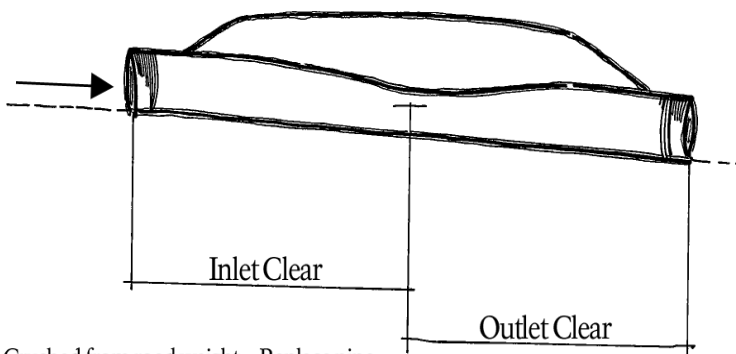
(Source: USACE Technical Manual 5-626)



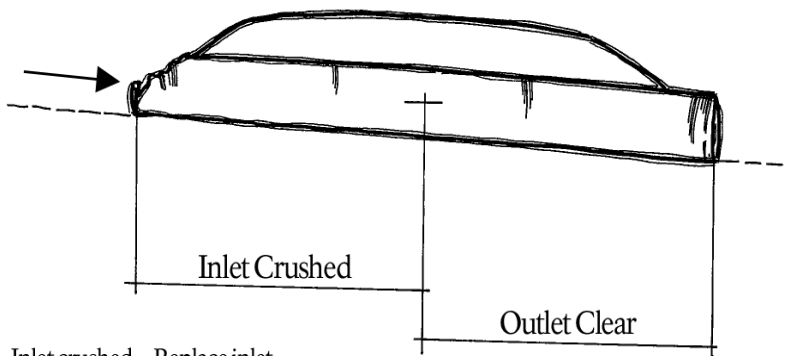
c. Culvert Condition

Poor drainage may also result from blocked or crushed culverts. The following diagrams provide guidance for deferred maintenance items and areas to be noted, as well as the corrective action to be captured for each deficiency. If a road intersects the road being assessed, and the intersecting road has a culvert that lies in line (in the ditch) with the road being assessed, the culvert is not considered part of the road being assessed – it is part of the intersecting road.

In addition to visual inspection of culverts, the field crew will test metal culverts for rust pitting with a rock hammer or similar tool. If significant rust is encountered on the pipe interior, the pipe will be replaced.



Crushed from road weight - Replace pipe  
 Length = measured length of existing pipe  
 Depth = <6', 6-14', >14'  
 Diameter = measured diameter of existing pipe



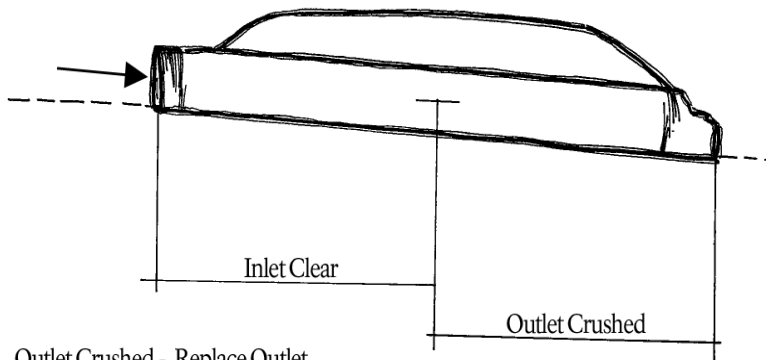
Inlet crushed - Replace inlet



Length = 6' if pipe is larger than 24" diameter; replace entire length of pipe if diameter is 24" or less  
 Depth = <6', 6-14', >14'  
 Diameter = measured diameter of existing pipe



The minimum replacement for a crushed inlet is 6 feet of pipe if the diameter is greater than 24 inches and the entire length of pipe if the diameter is 24 inches or less. These are just guidelines to follow, actual estimates may differ.

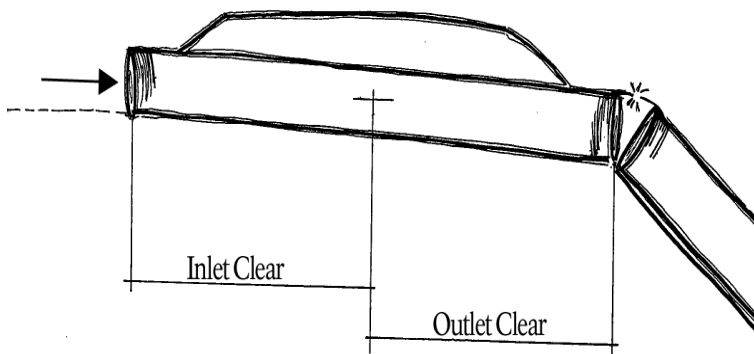


Outlet Crushed - Replace Outlet

Length = 6' if pipe is larger than 24" diameter; replace entire length of pipe, if diameter is 24" or less

Depth = <6', 6-14', >14'

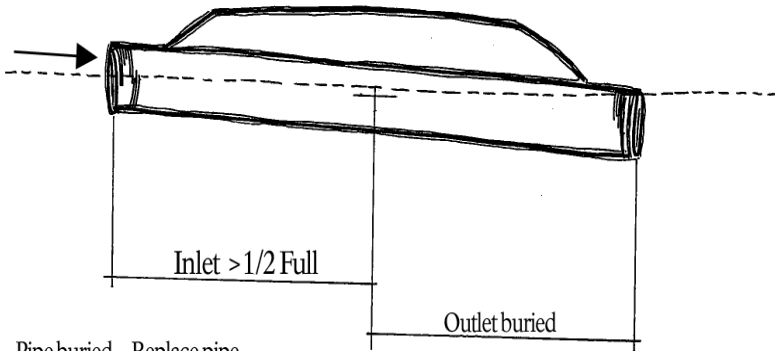
Diameter = measured diameter of existing pipe



Reattach outlet drain

Reattach pipe – 1 each



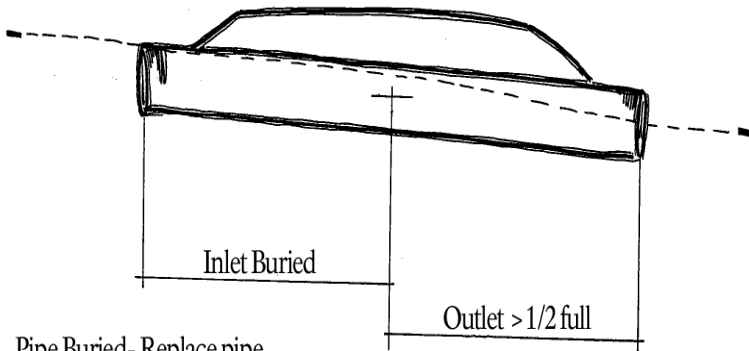


Pipe buried - Replace pipe

Length = measured length of existing pipe

Depth = <6', 6-14', >14'

Diameter = measured diameter of existing pipe

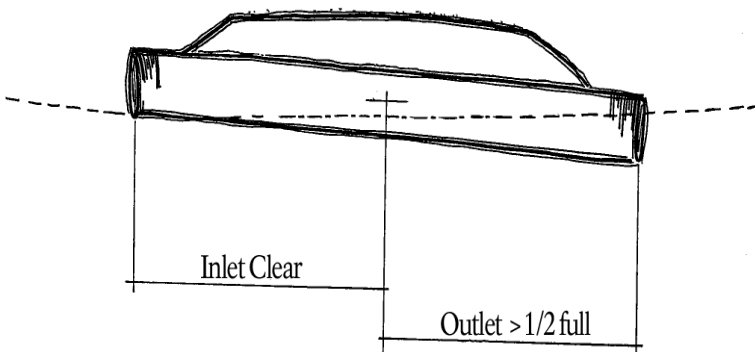


Pipe Buried - Replace pipe

Length = measured length of existing pipe

Depth = <6', 6-14', >14'

Diameter = measured diameter of existing pipe



Outlet > 1/2 full - Replace pipe

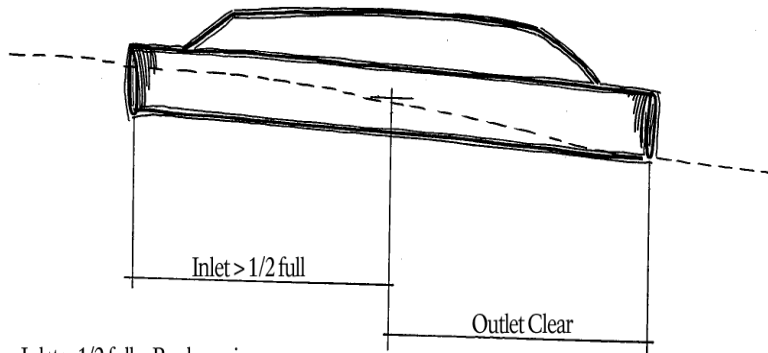
Length = measured length of existing pipe

Depth = <6', 6-14', >14'





Diameter = measured diameter of existing pipe

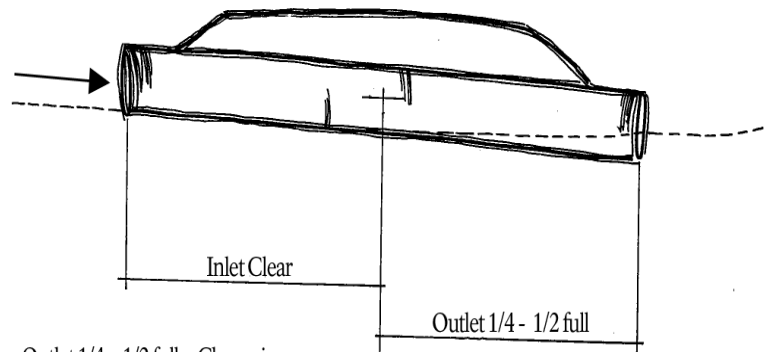


Inlet > 1/2 full - Replace pipe

Length = measured length of existing pipe

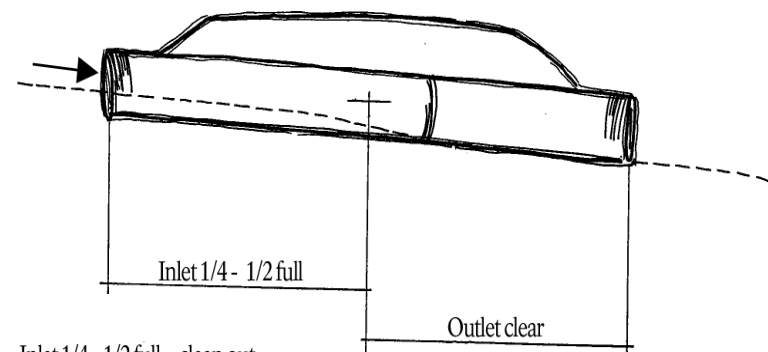
Depth = <6', 6-14', >14'

Diameter = measured diameter of existing pipe



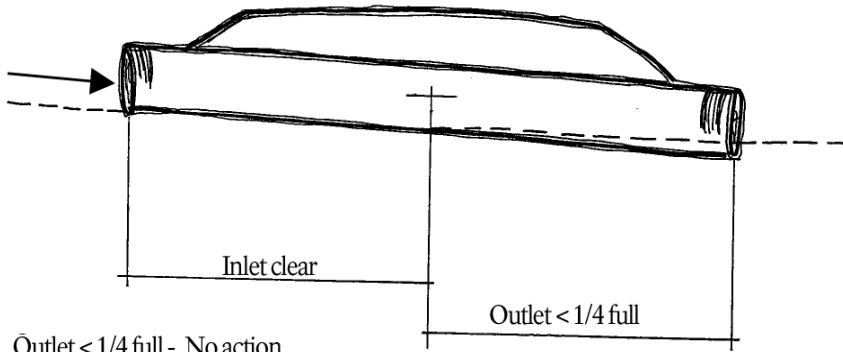
Outlet 1/4 - 1/2 full - Clean pipe

Clean out pipe – 1 each

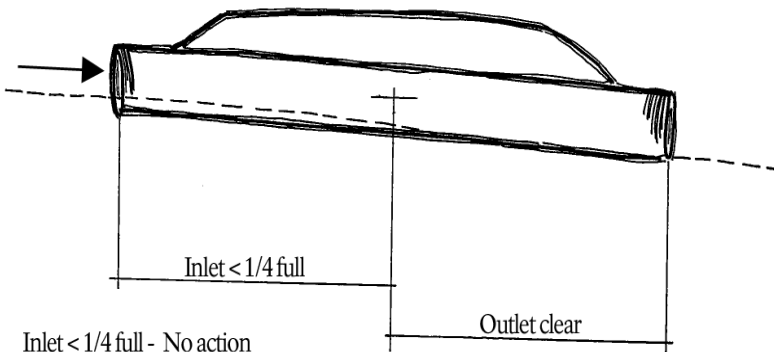


Inlet 1/4 - 1/2 full - clean out

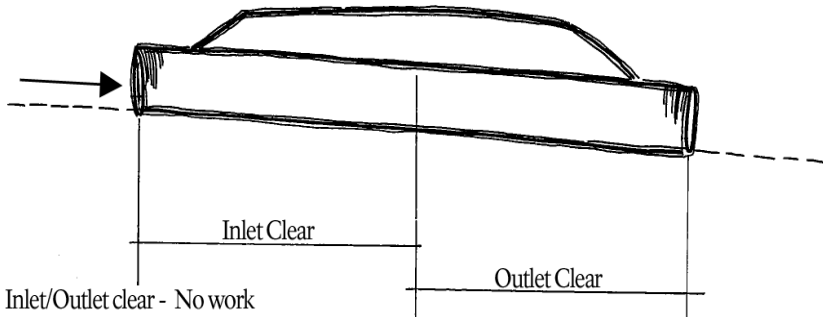
Clean out pipe – 1 each



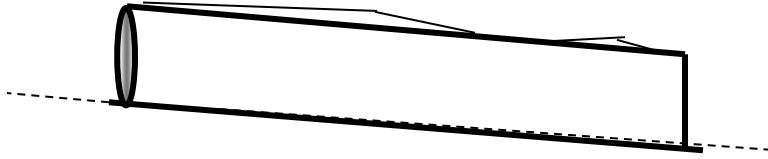
Outlet < 1/4 full - No action  
No action – do not collect information



Inlet < 1/4 full - No action  
No action – do not collect information



Inlet/Outlet clear - No work  
No action – do not collect information



No Cover over Pipe – Replace Surfacing

Aggregate replacement or grading for natural surfaces

All culverts should be covered by a minimum of 1 foot or  $\frac{1}{2}$  the culvert diameter of fill, whichever is greater.



The following photographs provide additional guidance about the types of deferred maintenance that may be encountered when assessing culverts.



d. Corrugations.

Corrugations are closely spaced ridges and valleys at fairly regular intervals perpendicular to the direction of travel. This type of distress is usually caused by traffic and is formed in areas of acceleration or deceleration. Corrugations are estimated in square feet of surface area and cannot exceed the total area of the road segment.

At a low severity level, the corrugations are small and are considered to be annual maintenance. At medium severity levels, corrugations will cause an uncomfortable ride. Corrugations of high severity will pull the steering wheel in the driver's hands and cause the assessment personnel to proceed at a slower pace.

The following photograph shows a natural surfaced road with severe corrugations.



e. Potholes

Potholes are bowl-shaped depressions in the road surface produced when traffic and weather conditions wear away small pieces of the surface material. Potholes are estimated by counting the number found on the road segment and recording them by severity level. Potholes are assumed to be 2' in diameter for estimating purposes.

Low severity potholes are considered annual maintenance items and data will not be collected for them. Medium severity potholes are noticeable when driving. High severity potholes will jolt the inspection vehicle if driven over.

The following photograph provides an example of potholes in an asphalt surface.

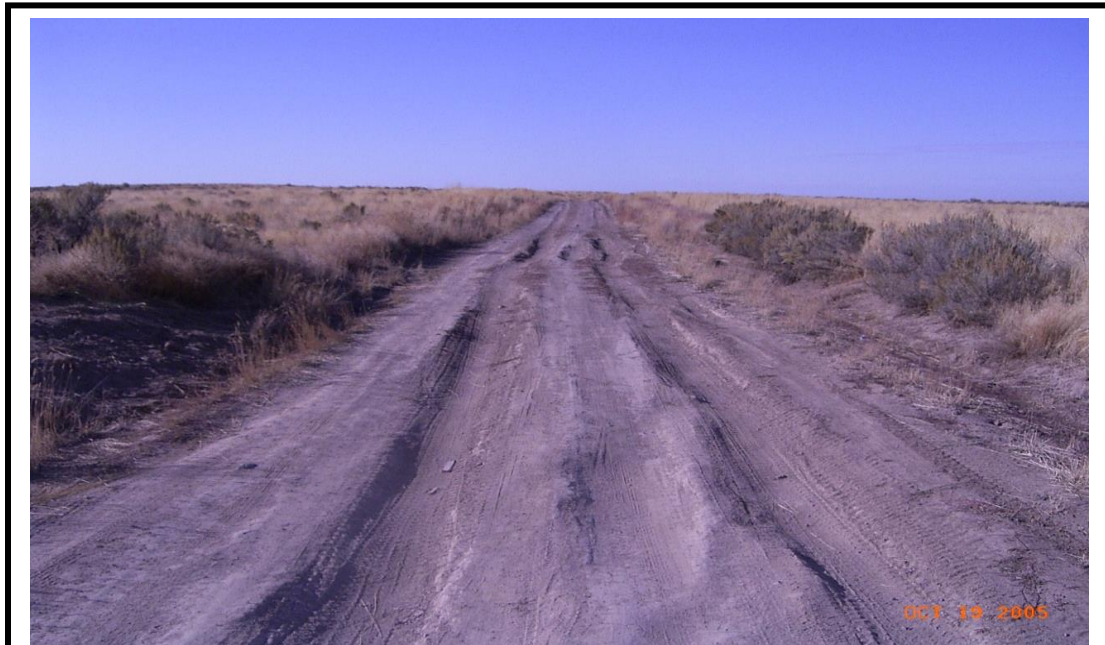




f. Ruts

A rut is a permanent surface deformation that is typically in a vehicle wheel path parallel to the road centerline. Ruts may also occur perpendicular to the road. Ruts are estimated in square feet of surface area. Low severity level ruts are considered to be annual maintenance items and information will not be collected. Medium severity ruts provide an uncomfortable ride. High severity ruts provide a rough ride in the inspection vehicle and cause the inspection personnel to proceed at a slower pace.

The following photographs show natural surfaced roads with severe rutting.



g. Loose Aggregate (gravel roads)

Over time, traffic will dislodge aggregate away from the normal road wheel path and cause it to form berms at the edge of the road. Aggregate can also be depleted from the road surface by weathering and drainage erosion. Loose aggregate is estimated in square feet of aggregate berm. Low severity berms are annual maintenance items with no data collection required. Medium severity berms create a wheel path that is noticeable to the driver when passing over it. Aggregate berms of high severity are difficult for a vehicle to maneuver over.

h. Missing Aggregate (gravel roads).

Aggregate roads may be made of limestone, “pit run”, or other local crushed aggregate. A general indication of whether aggregate replacement is required is visually noticeable areas of “lost” rock. Replacement of lost aggregate will be estimated by square feet. Field inspection notes should indicate whether a full depth replacement (6”) or aggregate overlay (3”) is needed. The photograph below illustrates a road with missing aggregate.

(Note: For road segments in Western Oregon, if there is evidence that the depth of road base plus aggregate is less than 12”, an overlay or replacement will be noted for the *entire* road segment.)



i. Cracking (paved roads)

Several types of cracking may occur on paved roads depending on subsurface conditions, traffic loading, and pavement type/thickness. Common types of surface distress cracking for asphalt pavements are shown in the following table. Cracking distress is estimated in either linear feet or square feet of surface deformation.



Distress Type	Description
Asphalt Block Cracking	A pattern of cracks that divides the pavement into approximately rectangular pieces.
Asphalt Fatigue Cracking	Occurs in areas subjected to repeated traffic loadings. Can be a series of interconnected cracks in early stages of development. Develops into many-sided, sharp-angled pieces, usually less than 1 foot on the longest side. Fully develops into an alligator pattern in most severe stages.
Asphalt Raveling	Wearing away of the pavement surface caused by the dislodging of aggregate particles and loss of asphalt binder.



j. Vegetation Removal.

Vegetation removal will be estimated in linear feet along the road shoulders and/or centerline and in square feet at culvert inlet/outlets. Along the road, low severity indicates some encroachment of the road shoulder, medium indicates encroachment to the road travel edge, and high severity indicates encroachment into the travel way. Vegetation removal is also captured for vegetation in a ditch or near a drainage inlet. Light vegetation along the roadside is considered annual maintenance. Likewise, tumbleweeds are a seasonal issue and are treated as an annual maintenance item.

Trees blocking the drainage ditch of a road or encroaching into the road are estimated per each for trunk size less than approximately 6" in diameter and greater than approximately 6" in diameter. The following photographs illustrate vegetation control items.





k. Other Appurtenances

Cattleguards and adjacent gates will be inspected for deferred maintenance. Inspections will note missing grates, missing wings, or the need to reset the cattleguard to grade.

Low water crossings and water bars will be noted if concrete or asphalt replacement is needed or if gravel needs to be re-graded.

Damaged or missing signs are counted as road deficiencies.

These deficiencies are reported as deferred maintenance on the road segment however these items are not inventoried.

The following table provides a quick reference to deficiencies estimated in the field and deferred maintenance corrective actions.

Road Protocol Conditions	Deferred Maintenance	Standard Measurements	Corrective Action
Cross Section / Positive Drainage	Low areas	Length, Width, Depth	Fill - embankment
	High areas	Length, Width, Depth	Grading
Ditch Condition	Ditch silted in	Length, Width, Depth	Ditch cleaning - remove material.
	Excessively eroded ditch	Length, Width, Depth	Fill-embankment - add material to eroded area.
Culvert Condition	Buried Pipe	Length, Diameter, Depth	Replace pipe
	Full of Debris	Length, Diameter, Depth	Replace pipe
	Crushed	Length, Diameter, Depth	Replace pipe
	<1/2 full of debris	Quantity (number of pipes to clean)	Clean Pipe
	1/2+ full of debris	Length, Diameter, Depth	Replace pipe
	Inlet / Outlet crushed	Length, Diameter, and depth	Replace Inlet / Outlet - 6' if diameter > 24". Replace pipe, if diameter 24" or less.
	No cover over pipe	Length, Width and Depth	Replace surface material
Corrugations	Washboarding/corrugations	Length, Width and Severity Level	Grading
Potholes	Potholes - Natural	Number and average depth( 4-6" or >6")	Grading
	Potholes - Aggregate	Number and average depth( 4-6" or >6")	Aggregate replacement
	Potholes - Asphalt	Number and average depth( 4-6" or >6")	Machine patching

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<b>Road Protocol Conditions</b>	<b>Deferred Maintenance</b>	<b>Standard Measurements</b>	<b>Corrective Action</b>
Ruts	Rutting - Natural	Length, Width and Severity Level	Grading
	Rutting - Aggregate	Length, Width and Severity Level	Aggregate replacement
	Rutting - Asphalt	Length, Width and Severity Level	Machine patching
Loose Aggregate	Loose Aggregate	Length, Width	Grading
Missing Aggregate	Missing Aggregate	Length, Width (Depth is 3")	Aggregate Overlay
Missing Aggregate	Missing Aggregate	Length, Width (Depth is 6")	Aggregate Replacement
Cracking (paved roads)	Block Cracking	Length	Crack Sealing
	Fatigue Cracking	Length and Width	Chip seal or Sealcoat
	Raveling	Length and Width	Bituminous Machine Patching
Vegetation Removal	Vegetation hand clearing	Length and Width	Brush removal with hand saw
	Vegetation at culvert inlet/outlet	Each	Brush removal with hand saw
	Brush Mowing	Length and Width	Clearing, brush mowing with tractor
	Tree Removal < 6"	Quantity – Each	Remove selective trees
	Tree Removal > 6"	Quantity – Each	Remove selective trees
<b>Other Appurtenances</b>			
Cattleguard	Replace wing(s)	Quantity – Each	Replace Cattleguard wings
	Replace entire cattleguard (8x14)	Quantity – Each	Replace entire Cattleguard (wings, base, grate, etc.)
	Repair wing(s)	Quantity – Each	Repair wings (reattach, etc)
	Cleaning	Quantity - Each	Clean cattleguard
	Missing/Damaged Gates	Quantity – Each	Replace gates
Guardrail	Damaged Guardrail	Length	Replace Guardrail
Signage	Damaged or Missing Sign	Quantity - Each	Replace Sign

*Field Data Entry*

A paper form (Appendix A - Road Condition Assessment Form) is used to capture deficiencies found on the road segment. At the end of each road segment, deficiencies are tallied and saved.

**9. Field Assessment Checklist**

The following checklist is provided to promote field work that is organized and efficient. The checklist emphasizes the need for the Field Assessment Personnel to establish a clear and repeatable work routine each time they begin and end the assessment of any given road. These steps are not all inclusive, but do represent the minimum that is required. Establishing a repeatable routine is the most effective way to eliminate errors and omissions and to increase efficiencies.

- Obtain your assessment schedule and any background information available on each road listed on the schedule. Confirm all travel arrangements.
- Contact and verify the schedule with the PM, Assessment Leader, and/or the BLM Field Office personnel. Arrange to meet BLM staff as they are to accompany the Assessment Personnel.
- Assemble the required tools and equipment to conduct the onsite inventory and assessment work.
- Ensure that all electronic equipment is functioning prior to leaving the home base.
- Review the schedule to determine the roads to be assessed that day.
- Arrange for pickup or rendezvous of escorts.
- Once at the site, follow detailed instructions provided for gathering and entering data.
- Remember to take photos and GPS shots as required (baseline versus re-inspection).
- Review data gathered for assessment for completeness prior to leaving a road segment..
- Document inaccessible roads and rationale for no-inspection.
- Document roads that do not appear to meet road definition (Manual Section 9113 - Roads).

**10. Summary**

Summary of Tasks Phase II - On-Site Data Collection. Tasks to be completed in the field include:

- Inventory of the entire length of all road segments (name, length, width, surface type, terrain, primitive road).
- Identification of potential health and safety items on the entire length of all road segments.
- Measurement of road deficiencies.
- Identify inaccessible/Not Inspected Road Segments and Rationale.
- Identify road segments that do not meet BLM Road Definition (Manual Section 9113 - Roads).

### **C. Phase III – In-Office Data Entry**

Phase III requires assessment personnel to complete the inventory and assessment process through a review of the collected information, alignment of GIS spatial data, photos, inventory, and deferred maintenance information. Office staff will review the data for completeness and communicate any missing data elements to assessment personnel. Assessment personnel will review their road segment information posted in the holding database when they return to the office. They are responsible for the completeness and correctness of all data gathered.

#### **1. General**

In-Office Data Entry may be completed by the assessment personnel or a combination of office staff and assessment personnel as necessary to complete the data requirements. In-Office Data Entry includes:

- Inventory
  - GIS spatial data (collected with a GPS device) review and cleanup
  - Attachment of Road photos to Roads
  - Review of Road and Road Segment Inventory data and alignment with GIS Spatial Information
- Condition Assessment
  - Validate quantities for each deficiency
  - Validate appropriate cost models were attached to each deficiency
  - Validate deficiencies are connected to the appropriate road segment
  - Follow-up with Local BLM POC on Critical Health and Safety

#### **2. Specific Tasks**

Assessment personnel (which would generally include personnel from Phase II as well as office support staff) will complete the following tasks:

- i. Review on-site data collected under Phase II.
- ii. Validate GIS spatial data aligns with road segments in work-plan (Phase I).
- iii. Clean up GIS spatial data (extra data points, lack of coverage, etc.) to produce good GIS linework.
- iv. Create “bridge” spatial segments if necessary to provide continuous segments.
- v. Review inventory and deferred maintenance data for accuracy and completeness utilizing the BLM Deferred Maintenance Costing System.
- vi. Validate appropriate deferred maintenance cost models are attached to each deficiency.
- vii. Attach recommended Asset Classification and associated CRV Model.



- viii. Create ad-hoc cost estimates to correct deficiencies if required.
- ix. Review office data and develop integrated work product (combination of GIS spatial data, tabular inventory data, photos, and deferred maintenance data) for each road segment.

### **3. Summary – Phase III – In-Office Data Entry**

At the conclusion of in-office data entry assessment personnel will have a complete roads inventory and condition assessment product that has been reviewed and determined to be complete by assessment personnel. Tasks that will have been completed include:

- Completed GIS spatial data compliant with BLM GIS data standards (if required)
- Completed Inventory requirements for roads assigned within the work-plan
- Determined deferred maintenance requirements for each road segment
- Integrated all work products into a result suitable for independent quality review

## **D. Phase IV Data Quality Assurance and Review**

Phase IV will be accomplished by individuals who were not involved in Phase II and Phase III. The independent review is intended to validate the quality and completeness of the information collected during the previous Phases. The independent review is not intended to imply acceptance by the BLM, but rather validate that all the required work products are complete and prepared for submittal to the BLM.

### **1. General**

This effort should generally be accomplished by knowledgeable personnel (ideally assessment personnel not involved with the specific effort or Field Office) and also reviewed by the Assessment Leader. At the conclusion of this Phase, the Assessment is complete and should be ready for delivery/transfer to the BLM POC.

### **2. Specific Tasks**

Tasks to be completed in this phase include:

- i. Review of field notes against database.
- ii. Review of GPS road spatial information in GIS system.
- iii. Review of Inventory database fields for completeness.
- iv. Review of deferred maintenance calculations for reasonableness.
- v. Validation of selected Asset Class/Cost Code and associated CRV model.

- vi. Review of Integrated Work product.
- vii. Review of Road Segments not inspected and associated rationale.
- viii. Development of Submittal package for the completed work plan:
  - For all baseline road segments identified for inventory and assessment
    - GIS Spatial data in BLM specified format
    - Road Segment Inventory complete in specified format
    - Photos attached to inventory in specified format
    - Appropriate Cost Model and CRV data in specified format
    - Deferred maintenance deficiencies in specified format
  - For all baseline recommended new road segments
    - GIS Spatial data in BLM specified format
    - Road Segment Inventory complete in specified format
    - Photos attached to inventory in specified format
    - Appropriate Cost Model and CRV data in specified format
    - Deferred maintenance deficiencies in specified format
  - For all re-inspected road segments
    - Road Segment Inventory complete in specified format
    - Photos attached to inventory in specified format
    - Appropriate Cost Model and CRV data in specified format
    - Deferred maintenance deficiencies in specified format
- ix. Submit data to BLM for review and acceptance.

### **3. Summary**

Phase IV – Quality Assurance and Review. At the conclusion of the quality assurance and review (Phase IV) deliverables should be complete in accordance with the work-plan and BLM inspection standards and ready for review and acceptance testing by the BLM. Deliverables should be provided electronically in accordance with the work plan and statement of work. Partial submittals should only occur when they are part of the work-plan and partial submittals still require a complete set of data for each road segment.

The completed submittal will have been independently reviewed and approved for submittal to the BLM POC in the specified format and delivered, constituting the end of the work-effort for specific work plan (note individual field offices may include multiple work plans and a work plan may be as simple as a single road or as complex as an entire BLM Field Office inventory of roads).

**APPENDIX A – ROAD CONDITION ASSESSMENT FORM**



**APPENDIX B – GUIDANCE ON TERRAIN TYPES**

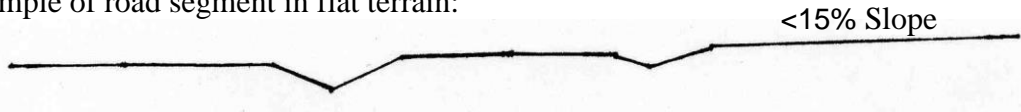
Guidance on Terrain Types.

The following examples are to be used to determine the terrain type for a road segment. Each road segment will have only one 'average' terrain type.

Flat Terrain

Road segments in flat terrain (<15% side slopes) have little elevation deviation from the surrounding area. These road segments may be elevated or depressed slightly and are commonly found in open plains areas. Road in flat terrain would require only minimal earthwork in construction.

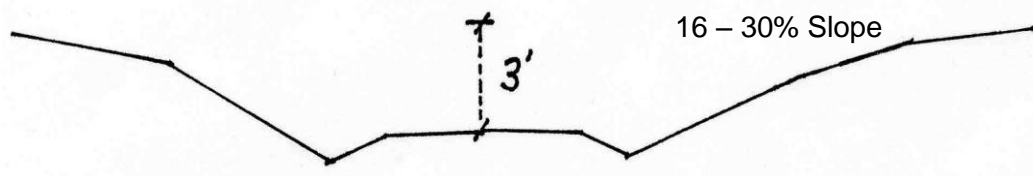
Example of road segment in flat terrain:



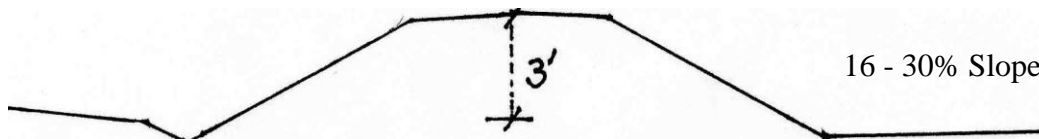
Rolling Terrain

Road segments in rolling terrain (16 – 30% side slopes) will deviate an average of 3 feet from the surrounding land. Earthwork required to construct a road in rolling terrain will average 3 feet of cut or fill height.

Example of road segment in cut in rolling terrain:



Example of road segment in fill in rolling terrain:



### Mountainous Terrain

Road segments in mountainous terrain (>30% side slopes) are characterized by steep back slopes and fore slopes. Typically, construction of roads in mountainous terrains will be more costly due to increased excavation or fill heights and difficulties of transporting equipment and materials to the road site.

Example of road segment in mountainous terrain:

