Chapter 1
ROAD SURFACE

Description

Unpaved roads carry local traffic between rural lands and communities, and provide connecting links between paved collector roads. More than 25 % of the roads in the Choctawhatchee, Pea, and Yellow River watersheds have an unpaved or gravel surface. Most of these roadways consist of sandy to sandy clay loam soil material. These roadway surfaces and ditches are subject to erosion and degradation which lead to sedimentation within watercourses, streams, and rivers.

Importance to Maintenance & Water Quality

Disturbances to unpaved roadway surfaces and ditches, and poor road surface drainage always result in deterioration of the road surface. This deterioration is the erosion which accounts for a large percentage of unpaved road maintenance costs and stream sedimentation. Frequent, excessive, and unnecessary disturbances to the roadways are all too common because of political pressure from the public to continually blade roads, and the common practice of wholesale blading adopted by administrators and operators over the years. Proper and timely surface maintenance, selectively performed, will help reduce the amount of roadway being disturbed, and will reduce the amount and frequency of disturbance to the section of roadway requiring maintenance.

Proper, timely, and selective surface maintenance, which includes water disposal, prevents and minimizes erosion problems, thereby lengthening the life of the road surface which in turn lessens frequency and cost of maintenance. This will also decrease the amount of sediment carried into surface waters. Frequent and excessive disturbance of the roadway surface and ditches, and failure to direct surface water from the road surface to a drainage channel results in deterioration of the road surface, which leads to other roadway problems which may impair traffic flow and traffic safety, among other things.

Surface Profile, Grading, and Drainage Characteristics

General

Do not disturb roadway sections which *do not* need maintenance while repairing, blading, or grading those sections which do. When routine maintenance is being performed, limit the amount of disturbed areas to that which can be re-established to the desired final shape by the

end of the work day. To minimize opportunity for degradation of the roadway, it is best not to blade, grade, or drag if rain or freezing temperatures are favorable within the 48 hour forecast. As much as possible, avoid non-essential or non-emergency work near streams or stream crossings during the "wet" months of the year. Save this work for drier seasons.

It is best to limit roadway blading to times when there is enough moisture content to allow for immediate re-compaction. Often, an optimum time for this is soon after a rain while the surface materials are still moist but not too wet. Blading with little moisture content in the soil is futile, and is often a causative factor in road surface degradation such as "washboarding" and other problems associated with loss of fines.

As shown in figure 1-1, crown roads 3/4 to 1 inch for each foot of road width, measured from the center of the roadway to the outside edge, to ensure good drainage. Roads in deep loose sands may be crowned 1/4 inch or less for each foot of road width from center of the roadway to the back of ditch. In this instance, there is no defined ditch front slope due to the excessively erosive nature of the sand. Rather, the extra road width provides drainage at the outer edges of the roadway. Proper crowning and compacting of the road surface quickens the removal of runoff, thus protecting the road surface from degradation.

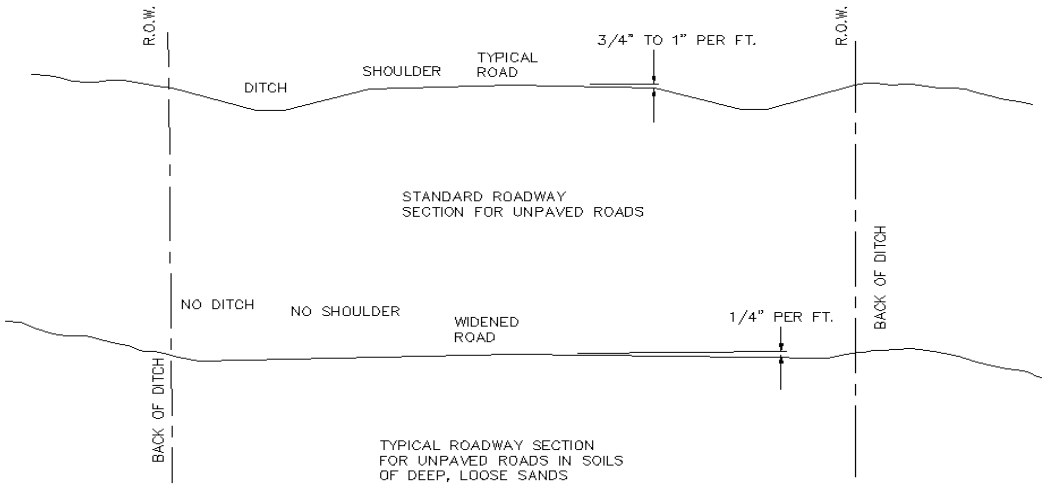

*Figure 1-1. Typical Sections - Unpaved Road*way

Exhibit 1.1a - Examples of 3/4" to 1' crown with road ditches in place. Water sheds readily off the crowned road surface and into the ditches. Proper drainage off the roadway surface helps to maintain a good “crust” which stabilizes the roadway and helps provide a good riding surface.

Exhibit 1.1b - Examples of 0" to 1/4" crown with no road ditches in place. Water infiltrates the soil of the sandy and flat road surface minimizing runoff from the roadway. The water that sheds from the roadway is readily removed from the road surface into the roadway edges allowing a passable lane in the center of the roadway.

Exhibit 1.1 - Typical Crowns and Sections Of Unpaved Roadways

Proper moldboard forward tilt for blading.

Proper blade angle and wheel lean.

Unnecessary Blading. Road is adequate.

Rutted, weathered, and rough surfaces require blading. Blading shaves high spots and fills low spots.

Exhibit 1.2 - Blading

Performance

Blading and Dragging

Blading and dragging is a smoothing operation which pulls loose material from the side of the road or spreads wind-rowed aggregate to fill surface irregularities and restore the road crown. It is performed with the moldboard tilted forward with light down pressure on the motor grader blade as shown in figure 1-2. The angle of the moldboard is adjusted to between 30 and 45 degrees, and in most cases, the front wheels are tilted slightly 10 to 15 degrees toward the direction the aggregate should roll.

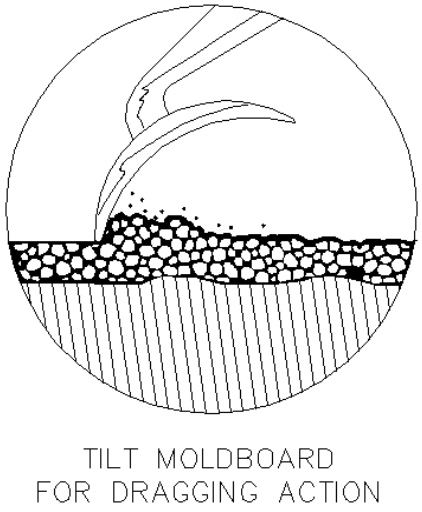

Figure 1-2. Blading

The following should be adhered to when blading:

a. Avoid blading during extended dry periods to minimize the loss of fine aggregates and minimize “washboarding”.

b. Blading/dragging speed depends on the operator’s skill, type and condition of machine (grader), tire pressure, and road surface condition. Normally, **three miles per hour in second gear is advised**.

c. Periodically blade the road surface against traffic flow to prevent aggregate from drifting onto ends of bridges, culverts, intersections, and railroad crossings. This is commonly referred to as “back dragging”.

d. On hill crests, avoid cutting into the road surface, gradually adjusting the blade up as the front wheels pass over the crest and then down as the rear wheels follow (figure 1-3a).

e. In valleys or swags, gradually adjust the blade down as the front wheels pass the lowest point and then adjust the blade up as the rear wheels follow. This will prevent loose, easily erodible materials from piling up where runoff and concentrated flows frequently occur, thus preventing loss of valuable road fill, and preventing massive sedimentation to local streams and waterways (figure 1-3b).

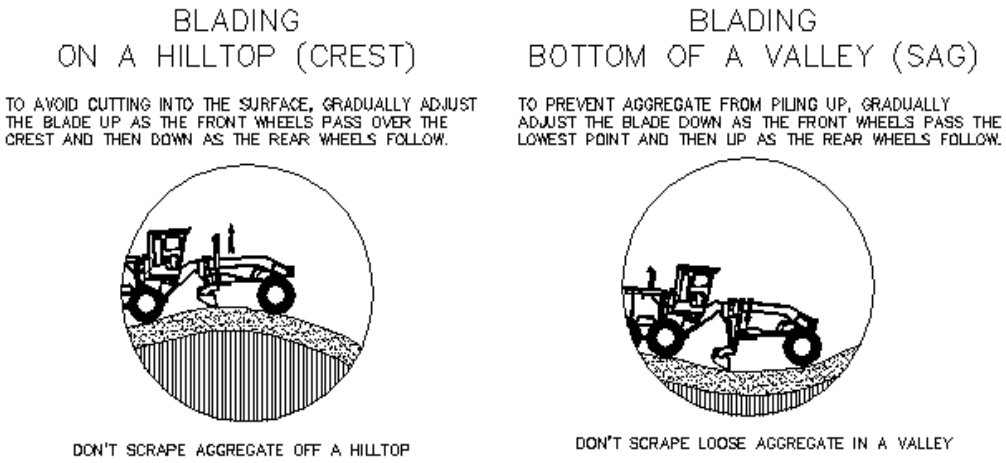

Figure 1-3. Blading on Hill Crests and in Valleys or Swags

Reconstructive Grading

Reconstructive grading consists of cutting through, redistributing, and re-compacting the road surface crust, and/or adding new road fill material to obtain the desired roadway shape and profile. This method is used when reshaping the roadway or when the correction of major surface defects such as deep ruts, soft spots, severe erosion, etc. is necessary. Figure 1-4a shows motor grader cutting operations performed with the moldboard tilted backward with sufficient down pressure on the blade to produce a cutting action. Breaking the crust with a scarifying rake may be required before moldboard work can be performed (see figure 1-4b).

Deep rutting often requires grading work. Such ruts are frequently caused by heavy machinery such as farm equipment and feed trucks.

Exhibit 1.3 - Grading

Clay surface layer placed over sandy roadway surface

Clay blended into roadway surface with scarifier and blade

Aggregate blended into clay surface layer with scarifier

Exhibit 1.4 - Grading Using Scarifier and Blade

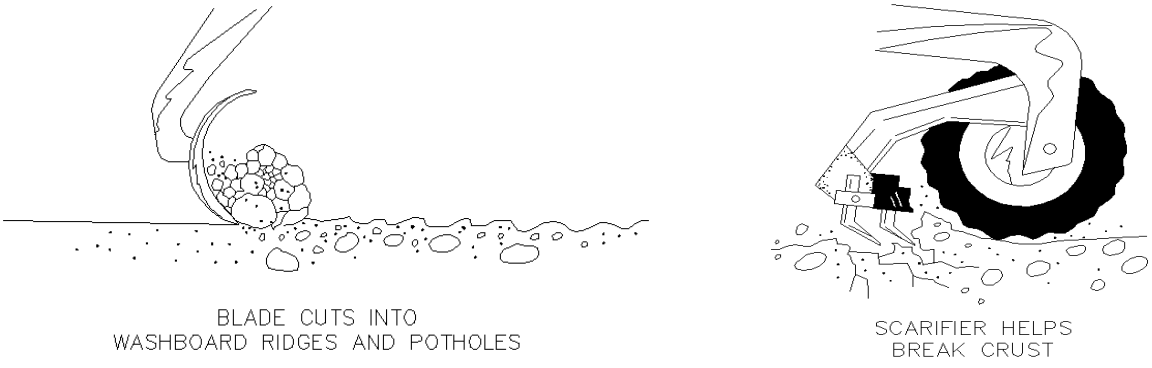

Figure 1-4. Grading Tools

The following should be adhered to when grading:

a. Perform grading cutting operations with the outer edge of the moldboard at the road surface's edge.

b. If the road ditch is not to be re-worked along with road grading operations, keep a minimum of one foot from the ditch line so that vegetation or rock stabilization is not disturbed. In this case, grading work must always bring the road surface back up to and slightly above the ditch line elevation to allow road surface runoff to flow into the ditch and not create a *false ditch* down the roadway (figure 1-5).

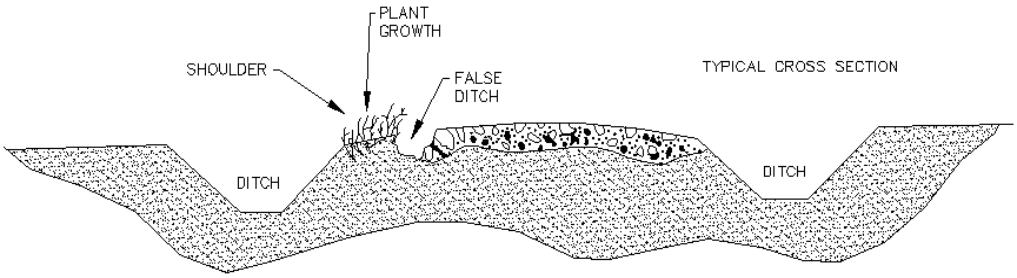

Figure 1-5. False Ditch

c. Lightly scarify the existing road surface before adding new material. This blends the soils and improves cohesion.

d. Adding new material should be done by running the dump truck down the center of the

roadway and dumping as it travels. The new material should then be blended with the scarified old material using a grader, and compacted.

e. To reduce potential roadway degradation, the entire width of the of the roadway disturbed by grading should be compacted by the end of the day.

f. Positive drainage to road ditches or other outlets must be established throughout the entire finished road surface.

Distress Conditions

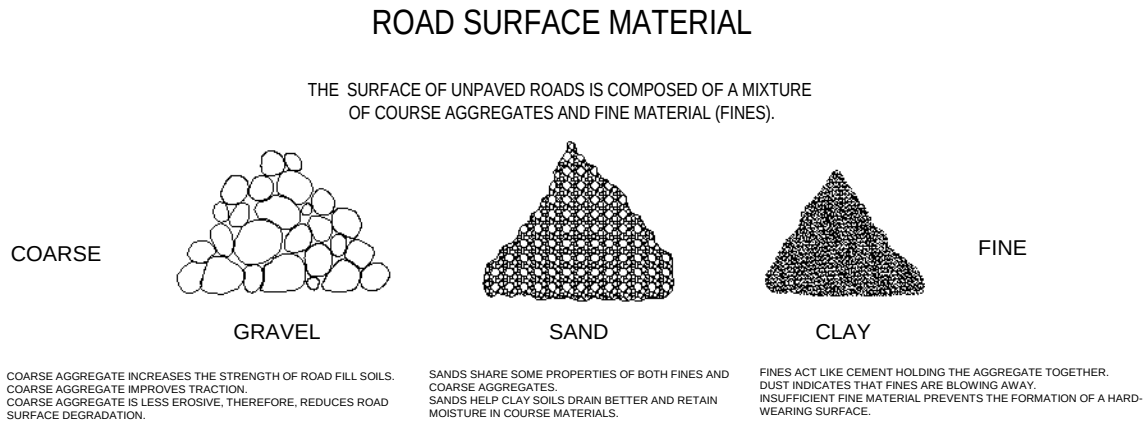

Figure 1-6. Aggregate Comparison

Surface Deteriorations

Dust

Dust in the air is a loss of fine, binder aggregates from road surfaces. Loss of these fines leads to other types of road distresses such as loss of cohesion and compaction of the road fill material, and reduced capacity to maintain moisture in the road fill. These deficiencies also tend to feed on themselves, compounding the problems - especially the lack of moisture within the road fill. Mechanically adding water to the road surface for dust control is a very short-term, expensive, and infeasible solution. In some cases, dust can be reduced by applying chemical additives which draw moisture from the air to improve fine aggregate cohesion, however, this also can be an expensive solution and may be feasible only in the most severe cases.

Ravelling

Ravelling is the loss of coarser aggregates. This is brought about when the coarser aggregates are worn away by traffic after fine, binder aggregates have been lost due to dust or erosion. Correct by grading or blading with the addition of fines or other binder to improve surface gradation and composition.

Slipperiness

Slipperiness is caused when the road surface contains excessive fine aggregates in proportion to coarser aggregates, especially within the crust. Traffic wear can reduce coarse aggregates to finer aggregates, thus dis-proportioning the original road fill aggregate mix. During wet weather, the road surface becomes slippery and may become impassible. This problem can be corrected by mixing the surface fines with coarser aggregate by grading and/or blading the road surface and compacting back in place. Occasionally, coarser aggregate will need to be hauled in and added to the roadway.

Surface Deformations

Surface deformation problems are almost solely the end result of excessive moisture in the road fill and thus can be reduced with proper road surface and road ditch maintenance.

Rutting

Ruts are longitudinal depressions in the wheel paths caused by high moisture content in the subsurface soil or base, inadequate surface course thickness, and /or heavy traffic loads. Rutting can be corrected by adding suitable material, grading, crowning, and rolling the road surface. Do not simply fill ruts with stone or soil. Filing ruts with stone can lead to new ruts being generated beside the original ones and thus would be an expensive and temporary “fix” which can also interfere with grading. The surface must be re-mixed and properly bladed or graded in more severe cases.

Areas of sustained and repeated rutting may require more severe measures. An elaborate drain system and/or geotextile fabric foundation with a crushed stone road fill may be used to correct severe rutting problems.

Corrugating/“Washboarding”

Corrugating/“washboarding” is a series of ridges and depressions across the road surface caused by the lack of surface cohesion. This lack of cohesion is a result of the loss of fines in the road surface which, in turn, is usually a result of very dry conditions within the road surface. These conditions are aggravated and enhanced by excessive vehicle speeds and high traffic volumes.

Where surface fines are segregated from coarser aggregates, blading with sufficient moisture content can repair the road surface. When the causative problem is of loss of fines, blading alone is not recommended. The problem will only recur shortly thereafter. The problem is best corrected by scarifying the road surface while damp, thereby re-mixing the road surface with a good percentage of fines, regrading, re-establishing the crown, and compacting the surface.

Depressions

Depressions are localized low areas one or more inches below the surrounding road surfaces caused by settlement, excessive moisture content, and improper drainage. These are larger areas not to be confused with potholes.

Depressions should be corrected by filling them with a well-graded aggregate, then grading the effected road surface, and compacting. Underdrains or cross drains may be necessary to improve drainage and prevent recurrence.

Potholes

Potholes are small depressions or voids in the road surface one or more inches deep which are caused by excessive moisture content, poor drainage, poorly graded aggregate, or a combination of these factors. Potholes may be corrected by patching with well-graded materials and compacting, and/or spot grading. Large areas of potholed road surface indicate a poor road fill condition over an extended section of roadway, and thus may require the re-grading, re-crowning, and re-compacting of the affected roadway section to mix aggregates into a well-graded road fill and improve road surface drainage. Underdrains may also be necessary in these areas to drain the sub-grade.

Softspots

Softspots are areas of the road surface and/or sub-grade made weak by poor drainage. These areas depress under vehicular weight and almost always develop one or more of the other types of surface deformations. These areas can be corrected by improving drainage conditions or

False ditch created by vegetal impediments

False ditch created by shoulder traffic and rutting

Washboarding

Slipperiness

Rutting

Exhibit 1.5 - Roadway Surface Problems

Soil stockpile located on the crest of a hill where runoff is minimal

Soil stockpiles located on a well vegetated hillcrest and away from concentrated flow channels

Exhibit 1.6 - Storing and Stockpiling Soil Materials

replacing the soft spot with more drainable materials. Depending on the cost effectiveness and feasibility of each, the following methods may be used to correct soft spots:

a. Improving the drainage of the road fill and/or sub-grade with underdrain. This method is outlet dependent.

b. Improving the drainage of the road fill and/or sub-grade by grading road ditches low enough to remove water from beneath the problem area. This may involve piping to move water from one side of the road to the other. This method is outlet dependent.

c. Patching the soft spot area with a suitable material such as well-graded stone or gravel.

d. A combination of the above.

Storing and Stockpiling Soil Materials

Improper storing or stockpiling of soil material can increase the amount of sediment that enters streams and damage sensitive areas, particularly wetlands. Soil materials should not be placed in or along wetlands, drainage ditches, swales, streambanks, areas within 50 feet of (and drain into) a waterway, and against slopes that are more than 2 horizontal to 1 vertical. Always ensure the area down slope of the storage area has an adequate vegetated filter strip to trap sediments, or use a properly installed and maintained silt fence or other barrier. Seed or vegetate any fill or spoil disposal areas as soon as possible.

Plan erosion-safe storage and stockpiling areas ahead of time, especially in the winter and early spring when rainfall can be high and vegetative cover minimal. Level to gently sloping, grassed areas usually provide good storage sites. Hilltops, ridges, and inactive or active borrow pits also often provide good sites. These planned storage areas will help reduce sedimentation and will also provide the opportunity to utilize these materials later when needed for roadway repairs. This can reduce overall maintenance costs by saving fill material and making it conveniently and readily available. Figure 1-7 illustrates proper stockpiling techniques of soil materials.

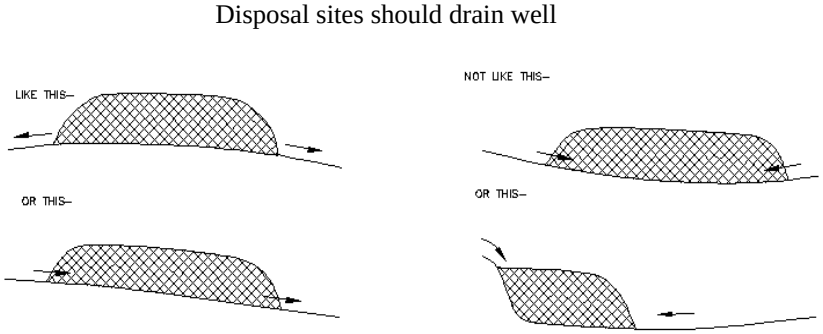

Figure 1-7. Soil Material Storage Site Configuration