



Gravel Roads Maintenance and Design

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Introduction

Good gravel road maintenance or rehabilitation depends on two basic principles:

proper use of a motorgrader (or other grading device) and use of good surface gravel. The use of the grader to properly shape the road is obvious to almost everyone, but the quality and volume of gravel needed is not as well understood. It seems that most gravel maintenance/rehabilitation problems are blamed on the grader operator when the actual problem is often material related. This is particularly true when dealing with the problem of corrugation or “washboarding.” The problem is often perceived as being caused by the grader but is primarily caused by the material itself. This manual will help provide a better understanding of what makes good surface gravel.

Another important matter to consider is the dramatic change in the vehicles and equipment using low volume roads. Trucks and agricultural equipment are increasing in size and horsepower. The trend is toward even larger machinery. The effect of larger and heavier vehicles on our paved roads is well understood. There is a definite need to build stronger bases and pavements. But the effect on gravel roads is just as serious and often is not recognized. For this reason, a section on the design of gravel roads is included. The strength of the subgrade and depth of the material needed to carry today's heavy loads must be considered. Proper drainage is also important.

The final section of the manual covers innovations in the gravel road maintenance/rehabilitation industry. Change is constant in almost every aspect of this modern world and maintaining gravel roads is no exception. There are new ways of stabilizing roads, new methods of dust control, new and different kinds of equipment available for maintenance/rehabilitation of gravel roads, and even new surface materials such as recycled asphalt being used. Not all of these innovations may be available or practical for every local government entity, but everyone is encouraged to take an objective look at each of them. Then an informed decision can be made about changing the way gravel roads are designed and maintained within a particular jurisdiction.

Section I: Routine Maintenance and Rehabilitation

Understanding Road Cross Section

Everyone involved in gravel road maintenance must understand the correct shape of the entire area within the road's right-of-way. Figure 1 shows a typical cross section of a gravel road. If states have minimum standards or policies for low-volume roads, they must be followed.

In order to maintain a gravel road properly, operators must clearly understand the need for three basic items: a crowned driving surface, a shoulder area that slopes directly away from the edge of the driving surface, and a ditch. The shoulder area and the ditch of many gravel roads may be minimal. This is particularly true in regions with very narrow or confined right-of-ways. Regardless of the location, the basic shape of the cross section must be correct or a gravel road will not perform well, even under very low traffic.

Paved roads are usually designed and then constructed with careful consideration given to correct shape of the cross section. Once paving is finished, the

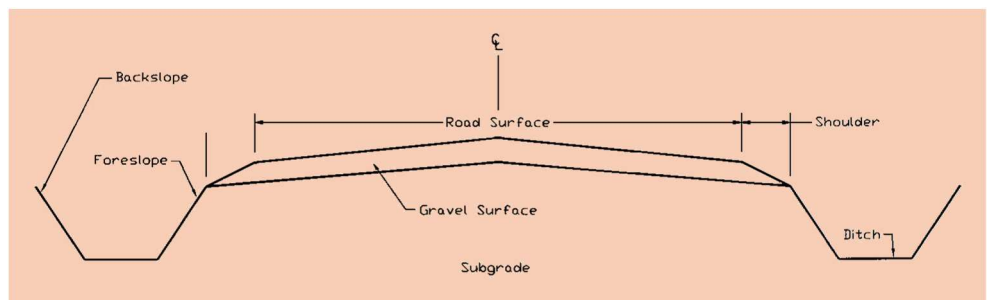


Figure 1: The components of the roadway cross section.

roadway keeps its shape for an indefinite period of time. Gravel roads are quite different. Unfortunately, many of them are not constructed well initially. In addition, gravel roads tend to rut more easily in wet weather. Traffic also tends to displace gravel from the surface to the shoulder area and even to the ditch during dry weather. Managers and equipment operators have the continual responsibility of keeping the roadway properly shaped. The shape of the road surface and the shoulder area is the equipment operator's responsibility and is classified as routine maintenance.

Keeping the foreslope and ditch established and shaped is often the maintenance operator's responsibility as well. Obviously, the whole idea here is to keep water drained away from the roadway. Standing water at any place within the cross section (including the ditch) is one of the major reasons for distress and failure of a gravel road. There is sometimes a need for specialized equipment to do major reshaping of the cross section, especially in very wet conditions. However, the operator of routine maintenance equipment must do everything possible to take care of



This road, located in Poland, has very poor cross section with no ditches. Consequently, water drains down the roadway itself and after many years of erosion, the roadway is several feet lower than its original elevation. (Courtesy of Mary O'Neill, Office of Remote Sensing, South Dakota State University)

This well-traveled road in Ecuador performs well in a region that receives approximately 200 inches average annual rainfall. (Courtesy of Ron Anderson, Tensar Earth Technologies, Inc., USA)



Understanding Road Cross Section

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the roadway since budgets often do not allow for the use of extra equipment and manpower on gravel roads.

The recommended shape of each part of the cross section will be discussed in detail later in this manual. When a gravel road is maintained properly, it will serve low volume traffic well. Unfortunately, most gravel roads will fail when exposed to heavy hauls even when shaped properly. This is due to weak subgrade strength and marginal gravel depths which are often problems with gravel roads. The low volume of normal traffic does not warrant reconstruction to a higher standard. However, improper maintenance can also lead to very quick deterioration of a gravel road, especially in wet weather. The maintenance equipment operators must always work at maintaining the proper crown and shape.



Example of a gravel road with good shape of cross section. Notice crown in driving surface and proper shape of shoulder and ditch.



An example of a well shaped gravel road shoulder that slopes away from the driving surface and drains water to the inslope and ditch.



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