

Should We Pave Our Gravel Roads? A Ten Part Answer

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When a local government considers paving a road, it is usually with a view toward reducing road maintenance costs and providing a smooth riding surface. But is paving always the right answer? After all, paving is expensive. How does a municipality or city know it is making the most cost-effective decision?

We will consider ten answers to the question, “*Should we Pave our Gravel Roads?*” In fact, they are ten parts of one answer. If one of the ten is not considered, the final decision may not be complete. The ten answers taken together provide a framework for careful decision making.

Answer 1: After Developing a Road Management Program

If the road being considered for paving does not fit into an administration’s road improvement program, it is quite possible that funds will not be used to the fullest advantage. The goal of a road management system is to improve all roads or streets by using good management practices. A particular road is only one of many in the road system.

A road management system is a common sense, step-by-step approach to scheduling and budgeting for road maintenance work. It consists of surveying the range and condition of all roads in the system, establishing short-term and long-term maintenance goals and prioritizing road projects according to budget constraints.

A road management system helps the agency develop its road budget and allows the use of funds wisely because its priorities and needs are clearly defined.

Through roadway management, local governments can determine the most cost-effective, long-term treatments for their roads, control their road maintenance costs, and spend tax funds more wisely. Local governments that stick with the program will be rewarded with roads that are easier and less costly to maintain on a yearly basis. Pertinent information about all roads will be readily available for years to come instead of scattered among files or tucked away in an employee’s head.

Steps in a Road Management Program:

1. Inventory the roads. The amount of time available and the kilometres of road in a municipality or city will determine how much detail to go into.
2. Assess the condition of the roads. Develop simple and easy techniques to use each year. Maintain a continuing record of the assessed condition of each road so that changes in condition can be noted easily and quickly.
3. Select a road management plan. Select the most appropriate treatment to repair each road, bridge, or problem area.
4. Determine overall needs. Estimate the cost of each repair job using generalized average costs and tally up the total. Establish long-range goals and objectives that in turn will help the agency justify its budget requests.
5. Establish priorities. Keep good roads in good shape (preventive maintenance) and establish a separate budget, or request a temporary increase, to reconstruct really bad roads.

Answer 2: When the Local Agency Is Committed to Effective Management

A commitment to effective management is an attitude. It is a matter of making sure that taxpayers' money is well spent – as if it were one's own money. It does not mean paving streets with gold but it does mean using the best materials available. It does not mean taking short cuts resulting in a shoddy project but it does mean using correct construction techniques and quality control. A commitment to effective management means planning for 5 or even 10 years instead of putting a band-aid on today's problem. It means taking the time to do things right the first time and constructing projects to last.

The horse and buggy days are over. We are in an age of travellers' demands, increasing traffic, declining revenues and taxpayer revolts. We are expected to do more with less. Building roads to last requires an attitude of excellence. Such an attitude helps to make better decisions, saves money in the long run, and results in a better overall road system.

Answer 3: When Traffic Demands It

The life of a road is affected by the number of vehicles and the weight of the vehicles using it. Generally speaking, the more vehicles using a road, the faster it will deteriorate.

The average daily traffic volumes (ADT) used to justify paving generally range from a low of 50 vehicles per day to 400 or 500. When traffic volumes reach this range, serious consideration should be given to some kind of paving.

Traffic volumes alone are merely guides. Types of traffic should also be considered. Different types of traffic (and drivers) make different demands on roads. Will the road be used primarily by standard passenger cars or will it be a connecting road with considerable truck traffic? Overloaded trucks are most damaging to paved roads.

The functional importance of the highway should also be considered. Generally speaking, if the road is a major road, it probably should be paved before residential or side roads are paved. On the other hand, a residential street may be economically sealed or paved while a road with heavy truck usage may best be surfaced with gravel and left unpaved until sufficient funds are available to place a thick load-bearing pavement on the road.

Answer 4: After Standards Have Been Adopted

Written standards in the areas of design, construction and maintenance define the level of service we hope to achieve. They are goals to aim for. Without written standards there is no common understanding about what a local government is striving for in road design, construction and maintenance. In deciding to pave a gravel road, is the local government confident it would be achieving the desired standards?

Design and construction standards do not have to be complex. It takes only a few pages to outline such things as right-of-way width, travelled way width, depth of base, drainage considerations (such as specifying minimum 500 mm culvert pipe), types of surfacing and the like.

Maintenance standards address the need for planned periodic maintenance. A good maintenance plan protects local roads, which for most municipalities or cities represents many millions of Rands of investment. It also is an excellent aid when it comes time to create a budget.

Considerations include:

- a) How often shall new gravel be applied to a gravel road?
(Some roads require it more than others do.)
- b) How many times per year are roads to be graded?
- c) How often and in what locations should road stabilizers be applied?
- d) What is our plan for checking road signs?
(Because of legal liability, a missing sign can be very costly if not replaced.)
- e) What is our plan for ditching and shouldering?

Answer 5: After Considering Safety and Design

Paving a road tempts drivers to drive faster. As speed increases, the road must be straighter, wider, and as free as possible from obstructions for it to be safe. Paving low volume roads before correcting safety and design inadequacies encourages speeds which are unsafe, especially when the inadequacies “surprise” the driver. Because of the vast kilometres of low volume roads, it is difficult to reduce speeds by enforcement.

Roads must be designed to provide safe travel for the expected volume at the design speed. To do this a number of physical features must be considered:

- Sight Distance
- Design Speed
- Alignment and Curves
- Surface Friction
- Lane Width
- Superelevation

It may be necessary to remove trees or other obstructions such as boulders from the road’s edge. Some engineers insist that no road should be paved that is less than 7 metres wide. If this standard is accepted, gravel roads must be widened before paving. Bridges may need widening. Considering these and other safety and design factors in the early stages of decision making can help to achieve the most economical road and one that will meet transportation needs. It makes no sense to pave a gravel road which is poorly designed and hazardous.

Answer 6: After the Base and Drainage Are Improved

“Build up the road base and improve drainage before paving.”

This cardinal rule cannot be stressed enough. If the foundation fails, the pavement fails. If water is not drained away from the road, the pavement fails. Paving a road with poor base or with inadequate drainage is a waste of money. It is far more important to ask,

“Does this road need strengthening and drainage work?”

than it is to ask,

“Should we pave this gravel road?”

Soil is the foundation of the road and, as such, it is the most important part of the road structure. A basic knowledge of soil characteristics in the area is very helpful and can help avoid failures and unneeded expense. Soils vary throughout the country. For highway construction in general, the most important properties of a soil are its size grading, its plasticity, and its optimum moisture content.

There is a substantial difference in the type of crushed stone or gravel used for a gravel road-riding surface versus that used as a base under a pavement. The gravel road surface needs to have more fines plus some plasticity to bind it together, make it drain quicker and create a hard riding surface. Such material is an inferior base for pavement. If pavement is laid over such material, it traps water in the base. The high fines and the plasticity of the material make the wet base soft. The result is premature pavement failure.

Answer 7: After Determining the Costs of Road Preparation

The decision to pave a gravel road is ultimately an economic one. Policy makers want to know when it becomes economical to pave.

There are two categories of costs to consider:

1. Total Road Costs, and
2. Maintenance Costs.

Local government needs to determine what the costs are to prepare a road for paving. Road preparation costs are the costs of construction before paving actually takes place.

For example, if standards call for a traveling surface of 7 metres and shoulders of 0.5 metres for a paved road, the costs of new material must be calculated. Removing trees, brush or boulders, adding new culverts or other drainage improvements, straightening a dangerous curve, improving slopes and elevations, constructing new guardrails, upgrading signs and making other preparations – all must be estimated.

Costs will vary greatly from project to project depending on topography, types of soils, availability of good crushed stone or gravel, traffic demands and other factors. One important factor is the standards. That is one reason why we should carefully consider what is contained in the road policy (#4 above). For larger projects it may be desirable to hire an engineering consulting firm (another cost) to design the road and make cost estimations. For smaller projects construction costs can be fairly closely calculated by adding the estimated costs of materials, equipment and labor required to complete the job.

Answer 8: After Comparing Pavement Costs, Pavement Life and Maintenance Costs

A second financial consideration is to compare maintenance costs of a paved road to maintenance costs of a gravel road. To make a realistic comparison we must estimate the years of pavement life (how long the pavement will be of service before it requires treatment or overlay) and the actual cost of paving. It is at this point that we can begin to actually compare costs between the two types of roads.

Consider the following maintenance options:

- A. For both paved and gravel roads, a local government must:
 - i. Maintain shoulders,
 - ii. Keep ditches clean,
 - iii. Clean culverts regularly,
 - iv. Maintain roadsides (brush, grass, etc.),
 - v. Replace signs and signposts.

- B. PAVED roadways require: patching – resealing (chip, slurry, crack seal) and striping.

- C. GRAVEL roadways require: re-graveling – grading and stabilization of soils or dust control.

Since the maintenance options in “A” are common to both paved and gravel roads, they do not have to be considered when comparing maintenance costs. These costs for either type of road should be about the same. But the costs of the maintenance options in “B” and “C” are different and therefore should be compared.

Answer 9: After Comparing User Costs

Not all road costs are reflected in a highway budget. There is a significant difference in the cost to the user between driving on a gravel surface and on a paved surface. User costs, therefore, are appropriate to consider in the pave/not pave decision. By including vehicle-operating costs with construction and maintenance costs, a more comprehensive total cost can be derived.

Vehicles cost more to operate on gravel surfaces than on paved surfaces, often 2 or 3 times greater than for bituminous concrete roads in the same locations. There is greater rolling resistance and less traction which increase fuel consumption. The roughness of the surface contributes to additional tire wear and influences maintenance and repair expenses. Dust causes extra engine wear, oil consumption and maintenance costs.

Answer 10: After Weighing Public Opinion

Public opinion as to whether to pave a road can be revealing, but it should not be relied upon to the exclusion of any one of points 1 – 9 already discussed. If a decision to pave is not based on facts, it can be very costly. Public opinion should not be ignored, of course, but there is an obligation by government leaders to inform the public about other important factors before making the decision to pave.

Stage Construction

Local government may consider using “stage construction design” as an approach to improving roads. This is how it works. A design is prepared for the completed road, from base and drainage to completed paving. Rather than accomplishing all the work in one season, the construction is spread out over 3- to 5-years. Paving occurs only after the base and drainage have been proven over approximately 1 year. Crushed gravel treated with calcium chloride serves as the wearing course for the interim period. Once all weak spots have been repaired, the road can be shaped for paving.

There are some advantages to keeping a road open to traffic for one or more seasons before paving:

1. Weak spots that show up in the subgrade or base can be corrected before the hard surface is applied, eliminating later expensive repair;
2. Risky late season paving is eliminated;
3. More kilometres are improved sooner;
4. The cost of construction is spread over several years.

Note: Advantages may disappear if timely maintenance is not performed. Surface may deteriorate more rapidly because it is thinner than a designed pavement.

Summary

Some local roads are not well engineered. Today, larger volumes of heavy trucks and other vehicles are weakening them at a fast rate. Paving roads as a sole means of improving them without considering other factors is almost always a costly mistake. Municipalities and cities should consider these ten points first. Carefully considering them will help to assure local government officials that they are making the right decision about paving a gravel road.

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