UNPAVED ROADS STUDY

The Differential Cost of Maintaining Gravel and Paved Roads

Town of Richmond, Maine

Nancy J. Churchill
Richard Lachance
Henry Coll

EXECUTIVE SUMMARY

The figures clearly demonstrate that it is much more cost effective in the long run to convert moderate and high use gravel roads to paved roads. Moderate use gravel roads are ones which must be graded between three and six times a year to keep them in good condition. High use gravel roads must be graded between seven and twelve times a year to be kept in good condition. The cost savings over time are very significant.

The exception is low use gravel roads. Here, the reverse is true. It is much more cost effective to leave unimproved low use gravel roads, those grade less than three times a year.

We will readily acknowledge that the figures used to calculate costs do not meet the criteria for scientific work. However, they are a fair representation of the kinds of costs incurred in maintaining roads in the Town of Richmond and, we suspect, other rural communities.

As a result of this study, a recommendation will be made to include in the town's road management policy a statement which encourages over time the conversion of moderate and high use roads to paved. Such conversions should not take precedence over maintenance work on paved roads where reconstruction and rehabilitation costs would make deferral of such maintenance counterproductive.

One final caution. This study is based on the premise that paved roads are and will be maintained in good condition. The long term costs of allowing paved roads to deteriorate cannot be overemphasized. With a long term capital plan and a strategy for maintaining good roads in place, we believe that small towns like ourselves as well as larger ones can benefit over time from a thoughtful gravel-to-paved road conversion program.

TOWN OF RICHMOND

UNPAVED ROADS STUDY

The purpose of this study is to determine the cost effectiveness of retaining gravel roads versus converting these roads to paved. The data was obtained by reviewing existing road management practices in the Town of Richmond. Understanding that roads are a long-term capital investment for the community, cost were projected for 50 years.

Of importance to note is that roads, be they paved or gravel, represent one of the most significant assets of a community. In small rural communities, the roads are frequently the community's most valuable asset. In Richmond, roads are surpassed only by buildings in terms of the local monies invested in their creation and maintenance.

It is our goal to maintain the roads of Richmond in good condition at the lowest possible cost to the community. This study helps understand how we can best achieve that goal.

COST ESTIMATES

The following is a differential study, the purpose being to understand the difference in cost between maintaining paved and unpaved roads. The study does not develop an absolute cost for either. For instance, the cost of roadside brush cutting is not included in the study because that cost is roughly the same per mile for both paved and unpaved roads. Also, the study examines cost per mile (1) of each type of road. The total cost in each category is the differential cost per mile.

Labor

Based on average actual cost of 1992 hourly wages plus 25% for benefits ($13.44)

Equipment

Based on 1992 State rates for equipment without operator with some minor adjustments (+/- 5%) for local considerations

Materials

Actual 1992 costs incurred or 1992 market price

ANNUAL COST OF MAINTAINING GRAVEL ROADS

PER MILE OF ROAD

Calcium Chloride

Calcium chloride is used on gravel roads to reduce dust and the dispersion of fines. Using calcium reduces the amount of gravel that would need to be replaced on a road to maintain its structural integrity and travel surface.

The current process involves breaking open large bags of calcium chloride and loading them into a 7 ton sander. Two employees are required to load the sander and one employee to operate the truck and sander. An estimate of 1 ton of calcium chloride per mile of road per year reflects the use on moderately traveled roads.

Labor cost	134.00
Equipment cost	240.00
Materials	250.00
Total Calcium Chloride Cost	624.00

Salt and Sand

Used during snow and ice storms. The following cost reflects only the cost differential between the cost of salt and sand on paved roads versus gravel roads for ice storms. It takes approximately four times as much salt and sand to maintain the public safety on an gravel road versus a paved road during an ice storm. (The amount of salt and sand for snowstorms is roughly equivalent).

The average number of ice storms, including freezing rain conditions, is five a year. Six yards of sand and salt are spread on each mile of gravel road for each storm.

Labor cost	54.00
Equipment cost	96.00
Materials	55.00
Total Salt and Sand Cost	205.00

Ditching

Ditching of gravel roads, the removal of debris and reshaping of roadside ditches, is performed more frequently than for paved roads. This is due in part to the amount of road gravel and debris which falls into ditches during grading. More frequently maintained gravel roads have ditches which frequently fill in faster and require paving more often.

Ditching involves a four employee crew using two trucks, a loader and a grader for 40 hours per mile. This work estimate is derived from ditching work which was performed in 1992 on Brown and Plummer Roads.

It is estimated that ditches on unpaved roads are cleaned and reshaped every three years.

Labor cost	717.00
Equipment cost	2,157.00
Materials	1,440.00
Total Ditching Cost	4,314.00

Gravel Replacement

Each year, gravel dissipates from roads either in the form of dust of from grading maintenance. This gravel needs to be replaced to maintain the structural integrity and travel surface of the road. An average gravel road will deteriorate at the rate of 1" per year. Because of the use of calcium chloride, our estimates are that the road deteriorates at half that rate or .5" per year.

Labor cost	893.00
Equipment cost	2,194.00
Materials	1,662.00
Total Gravel Replacement Cost	4,749.00

Other

Snowplowing, salt and sand during snow storms, brush clearing and minor maintenance work are generally the same as for paved roads. Thus, these costs were not calculated since they are the same per mile.

Annual Differential Maintenance Cost Per Mile - Gravel Road

As noted above, this figure does not include all the maintenance costs. It contains only those costs which are not the same as for paved roads. To reiterate, the purpose of this study is to explore the differential between the two types of roads over a 50 year time period so absolute costs are not necessary.

Annual Maintenance Cost Per Mile	7,735.00

Gravel Road Usage

A final factor which plays a considerable role is that of road usage. A high use gravel road will require more maintenance than a low use road. Thus, the cost of maintenance will vary considerably. There are several techniques for determining road use, including actually measuring the number of cars. However, a simple, straight forward technique would be to categorize a road by the amount of grading it required each year to maintain in good condition.

Low use roads would be graded twice a year or less. Moderate use roads would be those graded three to six times per year. High use roads are those graded between seven and twelve times each year.

The estimated cost differential would be 20% of the average rate for low use roads; 90% of the average rate for moderate use roads and 150% of the rate for high use roads. These cost differentials in no way address the quality of life issues associated with gravel roads. These differentials reflect only the distribution of actual costs.

Annual Differential Maintenance Cost Per Mile - Adjusted for Use

Low Use (20% of Annual Maintenance Cost)	1,547.00
Moderate Use (90% of Annual Maintenance Cost)	6,962.00
High Use (150% of Annual Maintenance Cost)	11,603.00

50 Year Cost Per Mile of Maintaining Gravel Roads

The following figures include an annual Consumer Price Index (CPI) of 4%. The Consumer Price Index is used to help adjust cost figures for the expected increase in materials, e.g. salt, sand and culverts. It is a figure which will also help quantify the increase in labor cost over this time period.

Low Use	274,863.00
Moderate Use	2,198,905.00
High Use	4,122,947.00

ANNUAL COST OF MAINTAINING PAVED ROADS

PER MILE OF ROAD

Resurfacing

In order to keep paved roads in good condition, routine maintenance such as patching of potholes must be performed. The largest cost maintenance item, however, is the cost of resurfacing. The Town of Richmond currently resurfaces with 1.5". In addition, to maintain roads in good condition a 10 year resurfacing plan needs to be followed. (See Road Surface Management System documentation for further discussion about the rate of deterioration of paved roads and maintenance techniques.)

Costs for resurfacing assume a 1992 cost of $28.00 per ton for 870 tons. The costs are then adjusted at estimated Consumer Price Index of 4% annually.

Year 10	36,043.00
Year 20	53,352.00
Year 30	78,974.00
Year 40	116,901.00
Total Resurfacing Cost	285,270.00

Ditching

Ditching work is the same as described above for gravel roads with the exception that ditch work is done between five and ten years for paved roads. An average of 7.5 years is used for the following figures.

Labor cost	287.00
Equipment cost	576.00
Total Ditching Cost	863.00

Other

Snowplowing, salt and sand during snow storms, brush clearing and minor maintenance work are generally the same as for gravel roads. Thus, these costs were not calculated since they are the same per mile.

Annual Maintenance Cost Per Mile - Paved Road

As noted above, this figure does not include all the maintenance costs. It contains only those costs which are not the same as for gravel roads. To reiterate, the purpose of this study is to explore the differential between the two types of roads over a 50 year time period so absolute costs are not necessary.

In addition, since resurfacing costs were essentially calculated for 50 years, it makes the derivation of fair annual cost somewhat problematic. Dividing the total resurfacing cost by 50 gives a distorted annual cost for resurfacing. However, the average annual cost figures are presented below for general information.

Ditching cost	863.00
Average Annual Resurfacing (Total/50 years)	5,705.00
Average Annual Maintenance Cost Per Mile	6,568.00

50 Year Cost Per Mile of Maintaining Paved Roads

The following figures include an annual Consumer Price Index (CPI) of 4%. They are a fairer assessment of cost and should be used to compare between paved and gravel road maintenance costs.

Ditching cost	306,535.00
Total Resurfacing cost	285,270.00
Total Cost	591,805.00

GRAVEL VERSUS PAVED ROADS

A COST ANALYSIS OVER 50 YEARS

Cost of Initial Paving

Using the above maintenance figures does not take into account the initial cost of converting a gravel road to paved. The preparation work in Richmond usually includes an average addition of between 4" - 6" of gravel on the road to be paved or 4400 yards per mile. Gravel is priced at $6.00 per yard i for screened gravel in place.

Costs of paving are calculated at $28.00 per ton for 1,449 tons.

Preparation Work	24,200.00
Paving	40,582.00
Total cost	64,782.00

Gravel to Paved - A Comparison

The following figures are for 50 years with a CPI of 4%.

Gravel Roads

Low Use	274,863.00
Moderate Use	2,198,905.00
High Use	4,122,947.00

from p.6

Paved Roads

Cost of converting	64,782.00
Cost of maintenance	591,805.00
Total	656,587.00