Gravel to asphalt. When should you convert?

GRAVEL ROADS need frequent maintenance. In dry weather, residents complain about dust; in wet weather ruts and potholes are the problem. Converting to hard surface roads seems like a good solution, and maybe it will save money on maintenance. Or will it? When are conditions right to upgrade and why?

Researchers at Iowa State University found answers to some of those questions. They identified issues and decision processes, and developed economic analysis tools for deciding to convert a road. The Minnesota counties being studied chose asphalt as their preferred hard surface. Local Wisconsin officials should find this study very helpful for planning an upgrade and helping the public understand the choices.

The report, ***Economics of Upgrading an Aggregate Road,*** describes the steps taken to gather cost information. First, to gather "historic" costs for maintaining gravel roads the researchers reviewed annual state aid reports from four Minnesota counties. Reported gravel maintenance costs per mile varied from county to county from $1,597 to $1,997. This disparity led the researchers to develop a formula for calculating a maintenance cost estimate.

"Estimated" costs for comparable road miles proved to be significantly higher than historic costs: $4,160 per mile. This is an annual average for a 28' cross section. Using a five-year maintenance cycle they estimate four years of normal grading at $1,400 per year plus re-graveling/resurfacing in YEAR FIVE at $15,000.

($1400 x 4) + $15,000 = $20,8005

$20,8005 ÷ 5 = $4160

The notable difference from historic cost suggests that local officials may prefer to use estimates to budget for future maintenance costs. Relatively accurate cost predictions for labor, equipment and materials are needed, however. The method can be a valuable resource when expense records are sketchy and when material sources or maintenance methods have changed. The report lists detailed assumptions and calculations that local officials can adapt.

In a similar calculation for Hot Mix Asphalt (HMA) pavements, annual maintenance was calculated at $2,460 per year. This is based on a seven-year cycle that includes painting traffic control markings, routine edge rutting, and annual cleaning, along with a chip seal or other surface treatment at YEAR SEVEN. It does not include the initial reconstruction and paving investment.

As traffic volumes increase, so do annual maintenance costs for both road surface types. However, they increase faster on aggregate roads. "We wanted to find out if the savings in maintenance costs would offset the initial investment for asphalt any time in the life of the road," says Duane Smith of Iowa State University's Civil Engineering department, one of the authors.

Annual costs to maintain gravel roads increase with traffic count.

The researchers' conclusion is: No. "The maintenance savings alone could not justify the investment in the HMA upgrade," the report concludes.

Upgrade decisions usually involve other considerations: quality of life for neighbors, safety for road users, and encouraging local economic development, for example. Unfortunately, it is hard to put a monetary value on these benefits.

In practice, these Minnesota counties begin to convert their roads as traffic volumes grow through the range of 100-200 a day. "We found that at 200 vehicles a day very few miles were still in gravel, and there was a noticeable jump in costs for gravel road maintenance," says Smith. For roads with 150-199 vehicles per day, counties had paved about 50% of the mileage. Nearly all roads carrying 300 per day are paved (see table).

It takes several years to include a road upgrade in a construction program. With traffic volume growing steadily on most roads, the report recommends, "it seems reasonable [for local officials] to commence planning for the upgrade when traffic volumes reach 100 vehicles per day." In making the case, they can take advantage of the issues, cost data, sample calculations, and references gathered in this report.

Upgrading decisions usually involve safety, quality of life and other factors.

Surface-related maintenance cost per mile vs traffic volume (AADT) for four Minnesota counties from 1997 to 2001

Traffic volume	Cost/mile for gravel	Gravel mileage	Cost/mile for bituminous	Bituminous mileage	Total mileage	Percent bituminous
0-49	1,639	252	767	3.6	256	1%
50-99	1,851	359	2,041	33.8	393	9%
100-149	1,788	143	2,116	70.6	214	33%
150-199	1,878	71	1,958	84.2	155	54%
200-249	2,466	34	1,446	120	154	78%
250-300	2,746	1	1,623	109	110	99%
300+	1,847	10	1,199	887	897	99%

Source: ***Economics of Upgrading an Aggregate Road, Jahren et.al.,*** Minnesota Department of Transportation, January 2005, Table 4, page 17.

Economics of Upgrading an Aggregate Road is available at www.lrrb.org/PDF/200509.pdf