ANSWERS TO FREQUENTLY ASKED QUESTIONS ABOUT GRAVEL ROADS

FRANKLIN REGIONAL
COUNCIL OF GOVERNMENTS

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Introduction

Gravel roads (also referred to as Dirt and Unpaved roads) make up a substantial proportion of the nation's road network, especially in rural areas. In recent years there has been a heightened sense of awareness towards the impact gravel roads have on the surrounding environment, being seen as a major nonpoint source of pollution (gravel and soils) in adjacent water bodies. The Franklin Regional Council of Governments (FRCOG) was originally going to produce a manual on the best practices for constructing and maintaining gravel roads. During its research for the manual it was seen that there was already a number of readily available resources that cover this subject comprehensively. Therefore, this report is intended to provide answers to frequently asked questions regarding gravel roads and provide a reference for numerous resources that are available on the subject. For quick reference, italicized words may found in the Glossary at the end of this publication.

Gravel Roads in Franklin County

Franklin County is the most rural county in the Commonwealth of Massachusetts and as a result a third (580 miles) of its total road miles are gravel roads. Table 1 shows the breakdown of paved and gravel road mileage by Franklin County town. This table includes all roadways including Massachusetts Highway Department (MassHighway), Town, State Forest, and Metropolitan District Commission (MDC) maintained roadways listed in the 2000 Yearend version of the Road Inventory File, a computerized database maintained by MassHighway. It should be noted that none of the roadways maintained by MassHighway are gravel. Figure 1 shows the Franklin County road network by surface type and shows that the concentration of gravel roadways is in the more rural areas of the County.

Table 1: Road Mileage by Surface Type of the Franklin County Road Network

Town	Surface Type		Town Totals	Percent Gravel	Town	Surface Type		Town Totals	Percent Gravel
	Paved	Gravel				Paved	Gravel		
Ashfield	56.31	26.68	82.99	**32%**	**Leyden**	10.98	27.17	38.15	**71%**
Bernardston	41.41	16.53	57.94	**29%**	**Monroe**	9.59	8.75	18.34	**48%**
Buckland	43.48	6.11	49.59	**12%**	**Montague**	93.54	21.55	115.09	**19%**
Charlemont	41.38	16.23	57.61	**28%**	**New Salem**	38.36	65.31	103.67	**63%**
Colrain	38.80	47.73	86.53	**55%**	**Northfield**	56.85	26.80	83.65	**32%**
Conway	41.96	28.95	70.91	**41%**	**Orange**	85.42	17.08	102.50	**17%**
Deerfield	79.92	20.27	100.19	**20%**	**Rowe**	21.28	14.78	36.06	**41%**
Erving	32.41	6.62	39.03	**17%**	**Shelburne**	48.81	10.23	59.04	**17%**
Gill	31.76	11.62	43.38	**27%**	**Shutesbury**	17.46	24.30	41.76	**58%**
Greenfield	126.20	4.70	130.90	**4%**	**Sunderland**	29.33	16.91	46.24	**37%**
Hawley	23.91	24.54	48.45	**51%**	**Warwick**	35.00	29.52	64.52	**46%**
Heath	24.75	34.70	59.45	**58%**	**Wendell**	24.54	41.71	66.25	**63%**
Leverett	26.48	16.43	42.91	**38%**	**Whately**	33.49	14.76	48.25	**31%**
County Totals	**1113.42**	**579.98**	**1693.40**	**34%**					

Source: Road Inventory File - Yearend 2000, MassHighway Planning

Figure 1: Franklin County Road Network by Surface Type

Frequently Asked Questions About Gravel Roads

Roadway Structure

What is a Gravel Road?

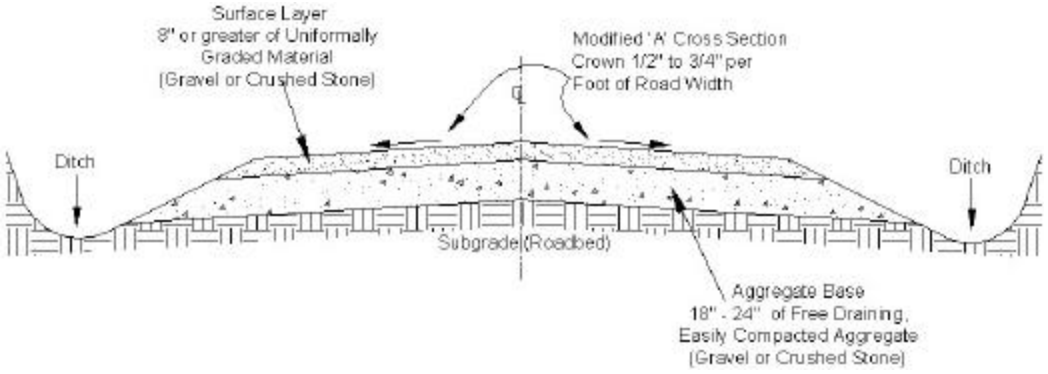
In Franklin County the term "gravel road" is generally used to refer to all unpaved roadways. A true gravel road is a roadway whose *surface layer* is constructed of mineral *aggregate* materials (such as sand, gravel, pebbles or crushed stone) that are generally obtained from gravel pits and quarries. A Dirt road is wholly constructed from the native materials present along the road alignment which, depending on the part of the country, can be topsoil, clay, silt or sand. Gravel and dirt roads are maintained by the same equipment and methods and suffer similar distresses, but dirt roads tend to deteriorate more quickly than gravel roads, thus requiring higher levels of maintenance.

What are the components of a good gravel road?

A good gravel road is constructed of three different layers. The *subgrade* or roadbed is the bottom layer made up of the native material (clay, silt or sand) found along the roadway alignment or fill brought in to level a depression. The *aggregate base* is placed on top of the *subgrade* and is ideally 18 to 24 inches in depth, constructed of a free draining and easily compacted *aggregate* material (gravel or crushed stone) that produces a strong and stable layer. Such *aggregate* base materials should contain a minimal amount of *fines* (materials with a very small particle size such as clay or silt) since they tend to inhibit the free drainage of water, which in turn reduces the strength of the *aggregate base*. Finally, the *surface layer* (uniformly graded gravel or crushed stone) is placed on top of the *aggregate base* and is at least 8 inches in depth. The Vermont Agency of Transportation (VAOT), that has produced an extensive publication on gravel roads, recommends that this layer be uniformly graded from course to fine materials[1]. The fines in this layer fill the voids among the courser particles and act as a binder to hold together the *aggregate* mixture in a tight, dense layer. Additionally, *fines* form a hard crust that allows for the efficient shedding of water from the surface and allows the roadway to bear the traffic load. Often stabilizing agents such as calcium chloride are used to maintain a certain moisture content in the fine materials that allows them to maintain a strong bond with the *aggregates*.

Figure 2 shows the desired gravel road structure. In practice many existing gravel roads have only a *subgrade* and *surface layer* that, combined, is about one foot in thickness.

Figure 2: Ideal Cross Section and Structure of a Gravel Road

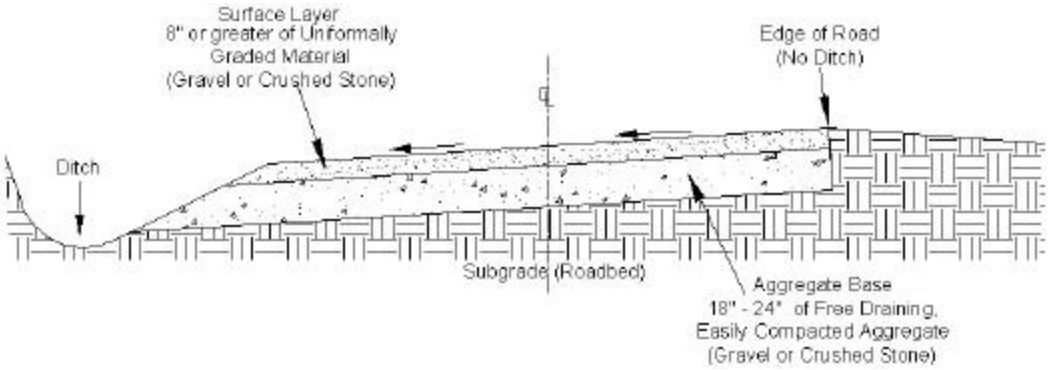


[1] Vermont Better Backroads Pocket Guide, Vermont Local Roads Program

What is the ideal cross section for a gravel road?

The traveled way (area of roadway where vehicles drive) of a gravel road should be crowned (elevated) in the middle. The proper crown has a "modified 'A' cross section"[2], as shown in Figure 2, on the previous page. The crown should slope from the center of the road dropping ½ to ¾ inches for every foot of road width to the edge of the traveled way[3]. Such a crown permits efficient shedding of surface water without excessively washing away the *fines* and *aggregate* materials in the *surface layer*. It is easily created with a *grader blade*. A crown in excess of this slope is undesirable mainly from a safety standpoint as it is easier for vehicles to slide off of the roadway and forces drivers to travel in the middle of the road. Where the road curves to the left or right, the modified 'A' crown should gradually be eliminated, and the entire road surface banked (built-up) towards the outside of the curve. Tighter curves require greater elevation of the banking. Figure 3 shows a typical cross section of a gravel road on a curve.

Figure 3: Typical Cross Section of a Gravel Road on a Curve



Can you construct a gravel road so it will not erode?

The nature of gravel roads means that you can never completely prevent erosion of the materials, but using good design and materials in conjunction with good roadside drainage can control the amount of erosion. Generally the worst erosion occurs on steep grades. It is important that in these situations the surface and the profile of the roadway allow the water to drain to the sides into well-designed drainage ditches or structures. Water cannot be allowed to run down the traveled way of the road since the force of the running water can quickly cause severe erosion of the *surface layer* and then the *aggregate base*. Vehicle traffic also contributes to the erosion of the *surface layer*. The extent of this erosion is dependant on the volumes and size of the vehicles.

What methods can be used to stabilize soft sections of a gravel road?

Sections of gravel roads that are continually wet, producing soft weak areas that erode and rut, are often the result of underground springs, poor *subgrade* soils that produce boggy conditions, or severe drainage problems caused by the surrounding topography. Under these conditions the *subgrade* soils (clay or silt) are saturated producing a *mud-slurry* (paste-like watery mixture of insoluble fines). As traffic passes over the softened *subgrade* this slurry is pumped upwards into the *aggregate base* and *surface layer*s, while the *aggregate* sinks down into the *subgrade*, reducing the strength and stability

[2] Problems Associated with Gravel Roads, Federal Highway Administration
[3] Vermont Better Backroads Pocket Guide, Vermont Local Roads Program

of these layers. Under these circumstances, the weight of passing vehicles results in the formation of deep wheel ruts in the travel way.

One way to stabilize soft sections on a gravel road is by installing *geotextiles*. *Geotextiles* are blanket-like products manufactured from plastic fibers (synthetic polyethylene) in a woven or non-woven pattern, have a well-documented history of success in stabilizing and strengthening *subgrade* soils and reducing erosion. The *geotextile* is placed on top of the *subgrade* and covered with the *aggregate base* and *surface layers*. The *geotextile* prevents the *mud-slurry* in the *subgrade* from rising into the *aggregate base*, while allowing the water to pass through, thus aiding drainage of the area. Essentially, in this scenario the *geotextile* provides separation of the adjacent *subgrade* and *aggregate base* layers, preventing contamination of the *aggregate base* layers with *fines* and turning it into a gravelly mud.

There are numerous types and manufacturers of *geotextiles* available, so it is important to use the correct *geotextile* for the specific type of problem. A recommended resource related to *geotextiles* is the "Geotextile Selection and Installation Manual for Rural Unpaved Roads"[4]. This manual contains details about problem identification, *geotextile* selection and installation, and gravel selection, spreading and finish blading.

What causes "mud season" and is it inevitable with gravel roads?
Mud Season occurs during the spring months of the year and is a result of excessive water content in the road structure that freezes during the winter months. As the warmer temperatures of spring arrive the water in the roadway begins to melt from the top. Since the lower layers are still frozen there is nowhere for this water to drain. Since the *surface layer* contains a large proportion of *fines*, the presence of water results in the formation of a *mud-slurry*. The action of passing vehicles pumps this slurry to the surface as the *aggregate*s sink, destabilizing the roadway structure and resulting in potholes, rutting and erosion. Mud season is inevitable with gravel roads, but the extent of impact can be minimized considerably by constructing an *aggregate base* of free draining (gravel mixture with a minimal amount of *fines*) materials that limit the water content and hence will not freeze during the winter months.

How important is the proximity of drainage ditches to the edge of roadway?
Drainage ditches should be constructed as far away from the edge of the roadway as the available right of way allows. There are three reasons for this. First, it is very important that water be drained away from the *subgrade* and *aggregate base* layers of a gravel road. The further the ditch is away from the edge of the roadway the less chance there is of water being retained in these layers during prolonged periods of wet weather. Secondly, for drainage ditches to operate efficiently they should be clean. Providing a grassy buffer between the roadway surface and the drainage ditch allows for the filtering of materials contained in the water before it enters the drainage ditch, reducing the buildup of materials that could eventually block and back up the water. Thirdly, the further the drainage ditches are away from the traveled portion of the road, the less likely vehicles are to drop into them, thus increasing roadway safety. Drainage ditches should be deep enough to intercept surface and adjacent ground water at the level of the *subgrade* layer. If this is not practical, an underdrain should be considered.

[4] Geotextile Selection and Installation Manual for Rural Unpaved Roads, Oklahoma State University/Federal Highway Administration, report No. FHWA-RT-89-050, April 1989

What is an Underdrain?
An underdrain is a drainage structure buried to the *subgrade* level along the edge of the roadway. Underdrain components usually include *geotextiles*, uniform coarse stone (free draining material), and a pipe. The underdrain works by providing an opportunity for excess water in the adjacent *subgrade* layer to drain away, while keeping the soil particles in place. Underdrains can be used under or near drainage ditches on almost any cut slope sections, especially where water seeps to the surface or other evidence of excess water is present.

Can catch basins be used along gravel roads?
Catch basins are buried drainage structures that are often placed at regular intervals along the edge of the roadway and can be used on gravel roads. Proper placement of catch basins can reduce roadside hazards associated with deep drainage ditches near cross *culverts.* Catch basins should be deep to allow for the collection of gravel and debris and should be inspected and cleaned regularly to prevent the collected materials from being washed into connecting *culvert*s or water bodies. Catch basin covers should be selected based on ability to pass debris and not pose a safety hazard to vehicles, bicycles or pedestrians.

What is "RAP (Reclaimed Asphalt Pavement) Mix" and how effective is it?
RAP is the term given to removed and/or reprocessed pavement materials containing asphalt and *aggregate.* These materials are most commonly produced when asphalt pavements materials are removed for resurfacing or reconstruction. When crushed and graded, RAP provides a high quality *aggregate* coated in asphalt that can be blended with conventional *aggregate*s to create *aggregate base* and *surface layer* materials that produce roadways with good drainage characteristics and durability. Care must be taken when blending the RAP material with conventional *aggregate*s as it has been found that above 20% to 25% RAP content decreases the strength of the roadway because less compaction of the blended material can be achieved[5]. It should be noted that there are some unresolved environmental concerns regarding the leachability characteristics of RAP in situations where there may be groundwater contact. The town of Becket in Berkshire County has had recent success in utilizing RAP in the *surface layer* of a gravel roadway while maintaining the look and feel of gravel[6]. Use of RAP in Franklin County has been limited due a lack of local road projects producing RAP.

Maintenance

How important is it to keep drainage structures clean?
Regular cleaning of drainage structures is one of the most important ways to maintain a good gravel roadway. Water is a gravel road's enemy and it needs to be conveyed efficiently away from the roadway. Sediment, leaves, tree branches and other debris commonly build-up in drainage ditches, clogging them and causing a buildup of water in the *subgrade* and *aggregate base*. Clogging can also lead to overflows during heavy rain, leading to washouts of the roadway. The same can be said for blocked *culvert*s and catch basins. Drainage structures should be inspected and cleaned regularly. Deferment of such activities could result in thousands of dollars in repairs due to the erosion or failure of the roadway structure, and thus have a major impact on the surrounding environment.

[5] Reclaimed Asphalt Pavement, User Guideline – http://www.tfhrc.gov/hnr20/recycle/waste/rap134.htm
[6] Unpaved Roads BMP Manual, Berkshire Regional Planning Commission, 2001

Can materials cleaned from ditches be reused?
Decomposing leaves, tree branches and gravel washed from the roadway commonly accumulate in roadside ditches. Currently there are no regulations limiting the reuse or disposal of materials cleaned from ditches. In practice, ditch cleanings have little value, being limited to reuse as general fill and sometimes as topsoil.

Can materials cleaned from catch basins be reused?
Catch basin cleanings are classified as a solid waste[7] that must be handled and disposed of in accordance with all DEP (Department of Environmental Protection) regulations, polices and guidance at a landfill that is permitted by the Commonwealth of Massachusetts to accept solid waste. Catch basin cleanings cannot be used for any purpose, such as road grading material or as fill for any project without the special "beneficial use determination" from DEP.

What causes washboarding of the road surface and how can it be prevented from reoccurring?
Washboarding describes the rhythmic undulations (bumps) that normally extend across the full width of the traveled way and run perpendicular to the direction of traffic. It is so named because of its similarity to the old-fashioned laundry washboard. Washboarding forms on roadways where the crust on the *surface layer* is dry and crumbly and is caused by the loss of the *fines* (primarily in the form of dust) that are displaced by passing vehicles. Washboarding is amplified in areas experiencing high vehicle speeds or areas where vehicles are constantly braking and accelerating. Washboarding cannot be completely prevented, but using well-graded surface materials mixed with calcium chloride can minimize its reoccurrence. Empty pickup trucks with light rear ends traveling at higher speeds appear to increase washboarding more so than other vehicles.

What causes potholes and how can they be prevented from reoccurring?
Potholes are bowl-shaped depressions in the road surface which can develop singularly or in clusters and often develop in conjunction with other surface distresses, especially washboarding. Potholes predominantly form in areas where the *subgrade* is wet, and the action of passing vehicles causes a failure in the *subgrade* producing a series of deformations in the road surface. Isolated potholes can form when oversized stones are dislodged at or near the road surface, leaving voids. In both cases the deformations and voids fill with water and increase in size rapidly under the action of traffic. Isolated potholes can be repaired by removing the water and cleaning out the loose materials, then refilling with properly graded *aggregate* mixed with calcium chloride, that is compacted by tamping or using a truck wheel. In locations where there are a number of potholes, a more extensive repair is required since filling each individual hole is impractical. The affected roadway section should be ripped up using a scarifier attachment on a motor grader, new *aggregate* materials mixed with calcium chloride added, and the surface regraded to the appropriate crown. Finally it should be compacted using a roller to form a new hard crust.

Why is Calcium Chloride spread on gravel roads?
Just as too much moisture is detrimental to the structural integrity of a gravel road, not enough moisture is also detrimental. When there is insufficient moisture in the *surface layer* of the roadway, the *fines* no longer act as a binder with the *aggregate*s and this leads to a degeneration of the road surface and washboarding. These *fines* are removed from the road surface by the action of traffic and wind in the form of dust. This dust is not only a costly nuisance, since these lost materials must be

[7] Summary of Regulations Governing Catch Basin Cleanings, DEP, October 28, 1997

replaced, but also a health and environmental hazard. Dust kicked up by traffic can travel several hundred feet into nearby homes where it is one of the most common causes of allergies and hay fever. This dust can also contaminate local waterways and vegetation. Calcium Chloride ($CaCl_2$) has been used for over 50 years to stabilize gravel road materials. Calcium Chloride is classified as a salt that has the ability to absorb moisture from the air. This moisture binds the *fines* and *aggregates* together creating a harder and more durable road *surface layer*. Calcium Chloride also resists evaporation giving it a prolonged life in the roadway. Over time the chemical penetrates the surface several inches, adding a stabilization while reducing the effects of frost.

What impact does Calcium Chloride have on surrounding water bodies and wells?
Calcium Chloride is seen as an environmentally safe product when applied properly. The State of Maine conducted a study[8] on the migration of Calcium Chloride in groundwater and found that concentrations were directly related to the distance from the roadway. Calcium Chloride tends to stay where it is placed when used for roadway stabilization and there is no indication that negative environmental impacts have occurred from its use for dust control. However it is suggested that Calcium Chloride should not be used in areas that often contain high, receding ground water tables. A simple rule to follow to prevent the migration of Calcium Chloride is not to apply it when heavy rain is forecast in the following 36 hours. The presence of Calcium Chloride in drinking water is not seen as a health hazard, but can affect the aesthetics of taste and palatability.

Are there other substances that can be used in place of Calcium Chloride?
Presently, Calcium Chloride has proven to be the most cost effective material used for dust suppression. However, there are numerous alternatives available including: Lignin Derivatives (byproduct of paper industry), *Geotextiles*, Sodium Chloride, Sodium Chloride and Calcium Chloride Mix, Magnesium Chloride, water, and Soybean Oil. The Vermont Local Roads Program produced Fact Sheet T-215 "Road Dust Suppressants" which provides an assessment of the different dust suppressant chemicals and materials. Copies of this fact sheet can be obtained by contacting the Baystate Roads Program at 413-545-2604. Additionally, conducting a search of the internet using the keywords "Dust Control" produces a number of links to producers of the above products.

Why is it important to use a grader rather than a bucket loader when regrading a gravel road?
The correct cross section (See "What is the ideal cross section for a gravel road?" on page 4) of the roadway is critical to retain road structure stability and efficiently shed water away to the drainage structures. Such a cross section cannot be developed using a bucket loader since it does not have the ability to angle the bucket to create the crown. Roadways regraded with a bucket loader will have a flat cross section that will not shed, but rather retain water. A grader on the other hand has been specifically designed to be able to produce the desired crown.

Traffic

Can a speed limit be posted on a gravel road?
In the Commonwealth of Massachusetts speed limits are established through the Massachusetts Highway Department and the Registry of Motor Vehicles after an engineering and traffic investigation has been conducted in compliance with established traffic engineering practices. "The

[8] Road Business, Vol 8 1993 – Technology Transfer Center, University of New Hampshire

ideal speed limit is both acceptable to the prudent driver and enforceable by police departments. Gravel roadways are not typically speed zoned due to the fact that it is impossible to establish a consistent road surface and the conditions on such roads tend to change over a relatively short period of time"[9]. Chapter 90, Section 17 of the Massachusetts General Law governs the speed of motor vehicles on unposted roadways. It states that "No person, operating a motor vehicle on any way shall run it at a rate of speed greater than is reasonable and proper, having regard to traffic and the use of the way and the safety of the public" and provides "prima facie" speed limits of 40 mph on undivided roadways outside thickly settled districts and 30 mph in thickly settled districts. Interpretation of "reasonable and proper" speeds supersedes the above limits, but due to its subjectivity, it is difficult to enforce.

At what traffic volume does it become impractical to continue to maintain a gravel road?
When average daily traffic volumes on gravel roads reach 400 to 500 vehicles per day[10], serious consideration should be given to paving the roadway. However, these traffic volumes are merely guides. The type of traffic using the road should also be a consideration. If there is a high volume of truck traffic, paving a road with lower overall traffic might be considered since truck traffic has a significantly greater detrimental impact on a gravel road. The Vermont Local Roads program produced Fact Sheet T-110, "When to Pave a Gravel Road" which provides a ten part answer to the question "Should we pave this Gravel Road?". Copies of this fact sheet (code: UNS-13) can be obtained by contacting the Baystate Roads Program at 413-545-2604.

Regulatory

Are there statewide standards for the design of gravel roads?
Since the Massachusetts Highway Department does not maintain any gravel roads, statewide standards have not been developed for gravel roads.

Can Chapter 90 money be used for gravel road repairs and reconstruction?
Each municipality in the Commonwealth receives "Chapter 90" funding through the State Transportation Bond for road repair and reconstruction. Funding levels are based on a formula that takes into account the number of miles of maintained roadways, population, and level of employment in the town. "Chapter 90" funding can be used on gravel roads for full reconstruction or when projects involve the upgrading of the gravel road in the following ways: substantial addition of gravel replacement, or the addition of *culvert*s or drainage. Routine maintenance activities such as pothole patching and reshaping are not eligible. Towns must submit a project request to their MassHighway District Office, outlining the scope of the project and receive approval from the MassHighway District Director before work can commence and reimbursement can be sought. For more information contact the State Aid Engineer with the MassHighway District responsible for your Town. If you are unsure of which District is responsible for your town, contact your Regional Planning Agency for assistance. See pages 14 and 15 for a listing of Massachusetts Regional Planning Agencies.

[9] Procedures for Speed Zoning on State and Municipal Roadways, Massachusetts Highway Department ,1998
[10] When to Pave a Gravel Road, Fact Sheet T-110, Vermont Local Roads Program

Are there other sources of funding that can be used for gravel road repair and reconstruction?
The Small Town Road Assistance Program (STRAP) is a potential source of funds that could be used to repair or reconstruct gravel roads. STRAP was established through, and is funded by the Transportation Bond. It provides funding of up to $500,000 to towns with populations less than 3,500 for transportation improvement projects. Eligible STRAP projects are transportation projects that improve public safety or emphasize economic development. Right-of-way takings cannot be funded with STRAP monies. Towns approved to receive STRAP funds receive 70% of the total cost of the project as a reimbursement grant. The remaining 30% of the project cost is given to the town in the form of a loan, which the town must repay within ten years of the project's completion. The Massachusetts Department of Revenue arranges the repayment plan. The loan payment is deducted from the town's Local Aid Cherry Sheet (their listing of state funds for transportation in a given year) over the ten year period. A town may receive a STRAP grant once every five years. STRAP grants are allocated on a first come-first served basis. Applications for STRAP funding are available at the MassHighway District Offices (see page 15). However, STRAP application submittals should be sent directly to Secretary Kevin Sullivan of the Executive Office of Transportation and Construction at the State Transportation Building, 10 Park Plaza, Suite 3170, Boston, MA 02116.

Environmental

Are there environmental regulations governing construction and maintenance projects on gravel roads?
There are a variety of local, state and federal laws and regulations, primarily related to impacts on wetlands and water bodies, which local Highway Departments must adhere to before commencement of any construction or maintenance work. In general, any project that is located within 100 feet of wetlands, brooks, streams, creeks, rivers and "wetland resource areas" are regulated by the federal Clean Waters Act, the Massachusetts Wetlands Protection Act, the Massachusetts Stormwater Policy, and possibly local municipal wetland protection bylaws if they exist. Depending on the nature and complexity of the work to be undertaken, permits and approvals may be required by the federal, state and local agencies, boards and commissions prior to beginning construction. Highway Departments should work closely with their towns' conservation commission to ensure that all construction and maintenance projects on gravel roads conform to all the applicable laws and regulations.

What is the Massachusetts Wetlands Protection Act?
"The Wetlands Protection Act (Massachusetts General Law (MGL) Chapter 131, Section 40) protects wetlands and the public interests they serve, including flood control, prevention of pollution and storm damage, and protection of public and private water supplies, ground water supply, fisheries, land containing shellfish, and wildlife habitat."[11] This is achieved by requiring a careful review of any proposed work that may alter wetlands. The municipal conservation commission administers this law at the local level, while the Department of Environmental Management (DEP) administers the law at the State level, and also can provide written comment and guidance to the conservation commission of the project applicant.

[11] Protecting Wetlands in Massachusetts, http://state.ma.us/dep/consumer/protwet.htm

What is the Massachusetts Stormwater Policy[12]?
The goal of the Stormwater Policy is to improve water quality and address water quantity problems by the implementation of clear and consistent guidelines and standards for stormwater management. These standards are intended to be applied during routine project review by issuing authorities (conservation commissions and/or DEP) under the Wetlands Protection Act.

What is the Clean Water Act?
The Clean Water Act amended the Federal Water Pollution Act, which set the basic structure for regulating discharges of pollutants to waters of the United States. The law gives the EPA the authority to set effluent standards on an industry basis and continued the requirements to set water quality standards for all contaminants in surface waters. The law also delegates the permitting, administrative and enforcement aspects to state governments. Section 404 of the federal Clean Water Act is the section most relevant to gravel road projects and authorizes the Army Corps of Engineers to regulate these projects. The Corps have deferred the review and permitting of minor projects (most road projects) to the local authorities as it deems the review under the Wetlands Protection Act and Stormwater Policy is sufficient for those projects.

General

Are gravel roads really more of a financial drain on our Highway Department Budget than paved roads?
Gravel roads are relatively cheap to construct but require a high annual investment for maintenance. Conversely, paved roadways are expensive to construct, but have relatively low annual maintenance costs, especially in the early years of their life where little or no maintenance is required. It is not possible to generalize this answer since it is dependent on a number of factors, such as the existing conditions of the gravel roads.

Why don't towns pave the continually eroding gravel roads?
The major reason is the cost. Towns often cannot afford the large capital investment required to pave a roadway. To simply pave over an existing gravel road, especially one that is failing, is a complete waste of money. Often, the materials used in the *surface layer* of a gravel road are not suitable as a base layer for a paved roadway as there are too many *fines* that prevent suitable drainage of the layer once it has been capped with asphalt.

Why do paving designs of gravel roads require the widening of the roadway, the removal of trees and the installation of ugly guardrails?
Traffic speeds are generally much faster on paved roads than on gravel roads, primarily because of the smoother riding surface. Because of these faster speeds a larger cleared area off the edge of the roadway is required to allow errant vehicles to regain control. The width of this cleared area is dependent on the projected vehicle speeds and generally requires the clearing of swath of trees on either side of the roadway. In areas where the slope at the roadway edge is greater than 1:3 or where there is an immovable fixed object such as a bridge abutment, guardrails should be installed. Traffic volumes on existing gravel roads will allow for the use of the Massachusetts Highway Departments

[12] Stormwater Management Volume 1: Stormwater Policy Handbook, Massachusetts Department of Environmental Protection and Massachusetts Office of Coastal Zone Management

Low Speed/Low Volume design standards that allow for reduced roadway widths. For more details on the Low Speed/low Volume design standards refer to "Design Alternatives for Rural Roads" produced by the Franklin Regional Council of Governments.

Informational Resources

How can I find out more information about gravel roads?
The following list of reference materials offer more detailed information on different aspects of gravel roads. You may also contact your Regional Planning Agency or MassHighway District Office. Contact information for these agencies is included in the reference listing below.

References

The Massachusetts Unpaved Roads BMP (Best Management Practices) Manual
Berkshire Regional Planning Commission (BRPC), 2001
[Copies can be obtained from BRPC by calling 413-442-1521 or electronically at www.berkshireplanning.org]

Vermont Better Backroads Manual, Clean Water You Can Afford
Windham Regional Commission, November 1995
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Vermont Better Backroads Pocket Guide
Vermont Local Roads Program, June 1997
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

A Guideline for Maintenance and Service of Unpaved Roads
Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority, Alabama, Feb 2000
[Copies can be obtained from the Alabama Department of Environmental Management at 334-271-7700 or electronically at: http://www.adem.state.al.us/EnviroProtect/WatershedMan/watman/Documents/pdf/unpavedtxtonly.pdf]

Design Alternatives for Rural Roads
Franklin Regional Council of Governments, 2001
[Copies can be obtained from the Franklin Regional Council of Governments by calling 413-774-3167]

Problems Associated With Gravel Roads
Federal Highway Administration, Pub # FHWA-SA-98-045, May 1998
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Earth and Aggregate Surface Design for Low Volume Roads
Federal Highway Administration, Pub # FHWA-FLP-96-001, October 1995
[Copies (code UNS-17) can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Developing a Highway Access Policy – Guidelines and a Model Ordinance
Vermont Local Roads Program, May 1997
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Erosion and Sediment Control Manual
Environmental Quality Section, Division of Watershed Management, Metropolitan District Commission, December 1994

Vermont State Standards for the Design of Transportation Construction, Reconstruction and Rehabilitation of Freeways, Roads and Streets
State of Vermont Agency of Transportation, October 1997
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Blading Aggregate Surfaces
National Association of County Engineers Training Guide Series, 1990
[Copies (code UNS-02) can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Cost-Effective Solutions To Protect Water Quality Near Vermont Town Roads
Vermont Local Roads Program, May 1997
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Field Guide for Unpaved Rural Roads
Wyoming Technology Transfer Center, March 1997
[Copies (code UNS-18) can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Nonpoint Source Pollution: A Handbook for Local Governments, Planning Advisory Service Report Number 476
American Planning Association, December 1997

When to Pave a Gravel Road
Vermont Local Roads Program, Fact Sheet T-110
[Copies (code UNS-13) can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Maintaining Gravel Roads Surfaces
Vermont Local Roads Program, Fact Sheet T-225
[Copies (code UNS-14) can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Maintaining the Vermont Backroad
Vermont Local Roads Program, Fact Sheet
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Road Dust Control with Calcium Chloride
Vermont Local Roads Program, Fact Sheet
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Road Dust Suppressants
Vermont Local Roads Program, Fact Sheet T-215
[Copies can be obtained from the Baystate Roads Program by calling (413) 545-2604]

Procedures for Speed Zoning on State and Municipal Roadways
Massachusetts Highway Department, 1998
[Copies can be obtained from Franklin Regional Council of Governments, Transportation Planning Engineer at (413)-774-4352 or your MassHighway District Office]

Regional Planning Agencies

Berkshire Regional Planning Commission
33 Dunham Mall, Pittsfield, MA 01201
(413) 442-1521, www.berkshireplanning.org

Cape Cod Commission
3225 Main St. PO BOX 226, Barnstable, MA 02630-0226
(508) 362-3828, www.vsa.cape.com

Central Massachusetts Regional Planning Commission
35 Harvard Street, Worcester, MA 01609
(508) 756-7717, www.cmrpc.org

Franklin Regional Council of Governments
425 Main Street, Suite 20, Greenfield, MA 01301-3313
(413) 774-3167, www.frcog.org

Martha's Vineyard Commission
P.O. Box 1447, Oak Bluffs 02557
(508) 693-3453

Merimack Valley Planning Commission
160 Main Street, Haverhill MA 01830
(978) 374-0519, www.mvpc.org

Metropolitan Area Planning Council
60 Temple Place, Boston, MA 02111
(617) 451-2770. www.mapc.org

Montachusett Regional Planning Commission
1427 Water Street, Fitchburg, MA 01420
(978) 345-7376, www.mrpc.org

Nantucket Planning and Economic Development Commission
4 North Water Street, Nantucket, MA 02554
(508) 228-7237, www.town.nantucket.ma.us/departments/npedc.html

Northern Middlesex Council of Governments
Gallagher Terminal, Floor 3B, 115 Thorndike Street, Lowell, MA 01852-3308
(978) 454-8021, www.nmcog.org

Old Colony Planning Commission
70 School Street, Brockton, MA 02301-4097
(508) 583-1833, www.ocpcrpa.org

Pioneer Valley Planning Commission
26 Central Street, West Springfield, MA 01089
(413) 781-6045, www.pvpc.org

Southeastern Regional Planning and Economic Development District
88 Broadway, Taunton, MA 02780
(508) 824-1367, www.srpedd.org

Massachusetts Highway Department

Massachusetts Highway Department (MassHighway)
10 Park Plaza, Suite 3510, Boston, MA 02116
(617) 973-7800, www.state.ma.us/mhd/home.htm

MassHighway District 1
270 Main Street, Lenox, MA 01240
(413) 637-1750

MassHighway District 2
811 North King Street, Northampton, MA 01060
(413) 584-1611

MassHighway District 3
403 Belmont Street, Worcester, MA 01604
(508) 754-7204

MassHighway District 4
519 Appleton Street, Arlington, MA 02174
(781) 641-8300

MassHighway District 5
1000 County Street, Taunton, MA 02780
(508) 824-6633

Massachusetts Department of Environmental Protection (DEP)

State Office
One Winter Street, Boston, MA 02108
(617) 292-5500, www.state.ma.us/dep/

Western Regional Office
436 Dwight Street, Springfield, MA 01103
(413) 784-1100,

Central Regional Office
627 Main Street, Worcester, MA 01608
(508) 792-7683

Northeast Regional Office
205 Lowell Street, Wilmington, MA 01887
(978) 661-7600

Southeast Regional Office
20 Riverside Drive, Lakeville, MA 02347
(508) 946-2700

Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Fisheries and Wildlife

State Office
251 Causeway St, Suite 400, Boston, MA 02114-2152
(617) 626-1590, www.state.ma.us/dfwele/dptovrvw.htm

Western District
400 Hubbard Avenue, Pittsfield, MA 01201
(413) 447-9789

Connnecticut Valley District
East Street, Belchertown, MA 01007
(413) 323-7632

Central District
Temple Street, West Boylston, MA 01583
(508) 835-3607

Northeast District
68 Harris Street, Acton, MA 01720
(978) 263-4347

Southeast District
195 Bournedale Road, Buzzards Bay, MA 02532
(508) 759-3406

United States Department of Agriculture, Natural Resources Conservation Service

Massachusetts State Office
451 West Street, Amherst, MA 01002-2995
(413) 253-4350, http://ma.nrcs.usda.gov/

United States Army Corps of Engineers

New England District
696 Virginia Road, Concord, MA 01742
(978) 318-8111, www.nae.usace.army.mil

New York District
26 Federal Plaza, New York, NY 10278
(212) 264-0100, www.nan.usace.army.mil/index.htm

Glossary

Aggregate: Any of various loose, particulate materials such as sand, gravel or pebbles used in a road aggregate base or surface layer.

Aggregate Base: Middle layer of a gravel road, which ideally should be 18 to 24 inches in depth and consist of free draining, easily compacted aggregate materials such as gravel or crushed stone.

Conservation Commission: A volunteer board of three to seven members appointed by the selectboard or city council who administers the Wetlands Protection Act at the local level.

Culvert: Buried metal, plastic or concrete (rectangular or circular) pipes used to direct existing water bodies or stormwater from catch basins or ditches under roadways.

Fines: Finely crushed or powdered materials or very small particles in a mixture of various sizes.

Geotextiles: Synthetic polyethylene fibers manufactured in a woven or non-woven pattern to form a blanket-like product.

Grader Blade: (Moldboard) Long curved metal implement, generally attached to a Motor Grader used to cut, shape, mix and spread the aggregate materials used to construct a gravel road.

Mud-Slurry: Watery mixture of insoluble matter (such as silt or clay).

Subgrade: Bottom layer of a gravel road made up of the native material found along the roadway alignment or fill brought in to level a depression

Surface Layer: Top layer of a gravel road, which ideally should be 8 inches in depth and consist of uniformly graded aggregate materials, such as gravel or crushed stone.