

ROADWAY GRAVEL IN MAINE

Updated Feb 2018

- It's more than just "dirt" -

MAINE

LOCAL ROADS

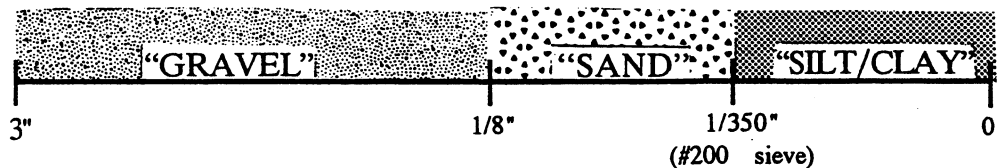
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The ultimate durability and life of your roads depends on the quality of materials used to build them. "Gravel" should be well defined by ordinance and be specific in wording.

Good road gravel needs "gravel", "sand", and "silt" in proper proportions to support traffic, shed water, resist abrasion, and allow compaction. That portion defined as gravel is any material over approximately 1/8" and those particles less than 1/8" are sand or silt. Particles small enough to pass through a No. 200 sieve (so fine that water doesn't readily pass through it) are called "fines" or silt. These "fines" are flour-like in consistency and can become airborne as dust when dry. The smaller clay and silt particles are used to fill the voids between the sand particles and the larger stones so that the mixture can be compacted into a dense condition. If the your material is mostly composed of sand particles or gravel-size stones of the same size, then it may tend to move around like ball-bearings. If the material is mostly fine particles, then this material will not drain freely and will be very frost-susceptible. Thus, a good "gravel" must have a mixture of all size particles.



Natural deposits of good-quality "gravel" are getting to be in short supply in Maine. These deposits of "pit run" or "bank-run gravel" are generally old streambeds or glacial deposits such as gravel pits. Years of road construction have depleted these pits to the point where good "gravel" has become a very valuable resource. This fact serves to emphasize the need for municipalities to ensure that their "gravel" is of suitable quality and will serve its intended purpose without earlier-than-anticipated maintenance costs.

The old adage "pay me now or pay me later" applies to road building. If inferior materials are used in the beginning, then this will be followed by excessive maintenance costs and, possibly, costly rehabilitation costs before paving. However, if good base materials are put down in the beginning, this will assure a town of a good foundation which will adequately support the intended traffic load.

PAVED ROADS

Maine DOT "Gravel" Specifications

It is common practice in Maine municipalities to specify that roads be built with a thin crushed gravel base course on top of a thicker subbase course. The practice of specifying an upper "base course" and a lower "subbase course" is fine, but a town may be spending more than is necessary for this type of design. The MaineDOT has not used this design for decades because of the higher quality and more expensive crushed material for the upper base course. MaineDOT routinely requires "aggregate subbase" gravel which meets MaineDOT Standard Specification 703.06(c) - Type D for the entire thickness. Pavement goes directly on the surface of this compacted subbase course in most cases.

The MaineDOT Spec for subbase gravel [703.06(c)] limits the sizes of particles and stones in a "gravel". However, the spec is fairly open and wide variations in material types can be found throughout the state. This gravel spec allows rocks which are 6" or less in diameter and there is a "sieve designation" for that portion which is less than 3" in size. These sieve sizes allow certain percentages of particle sizes from 3" to microscopic sizes. For instance, up to 7% by weight of "fines" (clay and silt) is allowed in the mix.

For that portion which is greater than 3", there are no limits on the amount of 3" to 6" stones. There could be many 3" to 6" stones which makes for a very unworkable "gravel" that cannot be fine-graded. On the other hand, if there is very little 3" to 6" material, then the

material may be a good "gravel" and compact well. If it is very sandy or composed predominantly of one size of particle, this can present compacting problems because it acts fairly "dead" and may not support construction traffic well.

So, if your "gravel" is not very workable or is subject to heavy rutting during construction, then it is recommended to specify a thin layer (3" to 4") of crushed base gravel (MaineDOT Standard Spec 703.06(a) - Type A) to go on top of the subbase gravel. This base gravel should be specified as an option to be used, if necessary, and not as a standard requirement

Gravel Depth

The final compacted thickness of "gravel" should be a minimum of 18" for local roads. This may mean that there is (a) 18" of subbase gravel or (b) 3" of base gravel over 15" of subbase. When considering the weight of heavy vehicles travelling Maine roads and streets today, this minimum amount of 18" is a practical compromise between available dollars for work, the structural integrity of the roadway base, and future maintenance costs.

Because the density of gravel directly affects the performance of the roadway, it is critical that gravel is properly compacted during construction. There are specific tests which can be formally done but the ultimate roadway should be stable and firm with little movement of the material. It is suggested that if 18" of gravel is to be placed, then it should be placed in two - 9" lifts and compacted.

UNPAVED ROADS

Gravel used for unpaved roads should meet the requirements for paved roads as described above, BUT, the 3" or 4" of surface gravel should be a "tighter" consistency. This means that there should be a higher percentage of "fines" in the surface gravel which will wick up moisture from below and allow it to evaporate. These "fines" will also provide better surface drainage and help keep the surface compacted and dust free. However, too many "fines" can easily turn a road into a muddy disaster with deep ruts.

In terms of gradation, a surface gravel should consist of material less than 2" in size and meet the following gradation:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
2"	95-100%
1/2"	30-65%
#200	7-12%

There is not one specific MaineDOT standard specification which can be referenced for surface gravel on unpaved roads. MaineDOT Spec 703.06 - Type A or B are satisfactory only if the maximum stone size is 2" and the percentage of "fines" passing the #200 sieve is increased to 7% to 12%. Types C and D are generally not recommended because they may not contain enough larger gravel particles which provide the structural support.

Another possible MaineDOT specification for "surface" gravel is Spec 703.10 - Aggregate for Leveling Course. Again, it is recommended to allow up to 2" stones and increase the amount of "fines" passing the #200 sieve to 7% to 12%.

Thinking About Paving an "Old" Gravel Road?

If a town finally decides to pave what has always been a gravel road, they should remember this. The surface of a gravel road which is to be paved should have far fewer "fines" than a road that is to remain a gravel road. Why? As mentioned before, without a paved surface, the moisture in the road that is drawn up due to the wicking action of the "fines" is free to evaporate. Once the road is paved, the moisture will continue to be drawn up but its evaporation will be blocked. This means that your gravel road has too much clay or silt ("fines") in it to make a good base. It will attract and retain water, and you will be wasting your money if you cover it with a paved surface.

Thus, it is recommended to scarify or loosen the surface and then add 3" to 4" of MaineDOT base gravel meeting MaineDOT Spec 703.06 - Type A.

Checking your Gravel

How does a local official check this "gravel" to see if it complies with the requirements in the specification. Here are several suggestions:

1. Stay in contact with the contractor to ensure that he is well aware of what the town is requiring. Schedule a preconstruction conference prior to the start of work to discuss material requirements, inspection points, etc.

2. Take samples from the gravel pit and send it to one of a half dozen testing labs in the State for gradation analysis. It will cost a few dollars but it is cheap insurance for such an expensive investment.
3. Hire someone with road building experience (i.e., retired MaineDOT engineer) to work part-time on inspection. Again, it will cost a few dollars but it will be well worth it in the long run. Dollars spent for inspection and compliance are small relative to the total construction project cost.
4. With some experience, you can inspect the gravel yourself. Are the stones different sizes or are they all one size? Does there seem to be an equal number of stones of each size? Are there lumps of clay, silt, or other contaminants (like dark, soft organic materials)? Do the fines (silt and clay) stick to your hands? If so, it's "dirty" gravel and may not be useful for roads because too many fines will give poor stability and drainage.

Gravel used for streets and roads represent a tremendous investment on the part of the citizens of the community. One of the important responsibilities of the road commissioner, selectmen, or public works official is to ensure that the taxpayers get their money's worth and that they get an acceptable end product.

MaineDOT Standard Specification for Base and Subbase Aggregate

(November 2014)

703.06 Aggregate for Base and Subbase The following shall apply to Sections (a.) and (c.) below. The material shall have a Micro-Deval...” and replace with “The material shall have a minimum degradation value of 25.0 or less as determined by AASHTO T 327. If the Micro-Deval value exceeds 25.0, the Washington State Degradation DOT Test Method T 113T113, Method of Test for Determination of Degradation Value (January 2009 version) shall be performed), except that the test shall be performed on the reported degradation value will be the result of testing a single specimen from that portion of the sample that passes the ½ in sieve and is retained on the No. 10 sieve. If the material has a Washington Degradation value of less than 15, the material shall be rejected.

The material, minus any reclaimed asphalt pavement used in Section (b.) below shall have a Micro-Deval value of 25.0 or less as determined by AASHTO T 327. If the Micro-Deval value exceeds 25.0 the material may be used if it does not exceed 25 percent loss on AASHTO T 96, Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine. If AASHTO T 96 is used for acceptance of the material, the material shall be retested at intervals of 25%, 50% and 75% completion of the course.

Recycled Asphalt Pavement (RAP) shall not be used for or blended with aggregate base or subbase.

- a. Aggregate for base, Type A and B shall be crushed ledge or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the part that passes a 3 inch sieve shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Type A	Type B
½ inch	45-70	35-75
¼ inch	30-55	25-60
No. 40	0-20	0-25
No. 200	0-6.0	0-6.0

At least 50 percent by weight of the material retained on the No. 4 sieve shall have at least one fractured face as tested by AASHTO T 335.

Type A aggregate for base shall only contain particles of rock that will pass the 2 inch square mesh sieve.

Type B aggregate for base shall only contain particles of rock that will pass the 4 inch square mesh sieve.

b. Aggregate for base, Type C shall be crushed ledge or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The material shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Type C	
4 inches	100	
3 inches	90-100	
2 inches	75-100	
1 inch	50-80	
½ inch	30-60	
No. 4	15-40	
No. 200	0-6.0	

At least 50 percent by weight of the material coarser than the No. 4 sieve shall have at least one fractured face as tested by AASHTO T 335.

c. Aggregate for subbase shall be sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the part that passes a 3 inch sieve shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Type D	Type E
½ in	35-80	
¼ inch	25-65	25-100
No. 40	0-30	0-50
No. 200	0-7.0	0-7.0

Type D aggregate for subbase gravel may contain up to 50 percent by weight Recycled Concrete Aggregate (RCA). When RCA is used, the portion of the resulting blend of gravel and RCA

retained on a ½” square mesh sieve shall contain a total of no more than 5 percent by weight of other recycled materials such as brick, concrete masonry block, or asphalt pavement as determined by visual inspection.

RCA shall be substantially free of wood, metal, plaster, and gypsum board as defined in Note 9 in Section 7.4 of AASHTO M 319. RCA shall also be free of all substances that fall under the category of solid waste or hazardous materials.

Aggregate for subbase shall not contain particles of rock which will not pass the 6 inch square mesh sieve.