Recommendations for Preservation of Dirt (Unpaved) Roads in Philipstown, NY

Submitted to:

Mr. Terry Zaleski
President, Old Road Society of Philipstown
Garrison, New York 10524

Submitted by:

Ken Skorseth
Retired Program Manager, SD Local Transportation Assistance Program
SD State University, Brookings, SD

Introduction:

This report covers a summary of work completed at the request of the Old Road Society of Philipstown, NY. Although the work was requested by them, it is my goal to make this useful to the Town of Philipstown Highway Department, the Town Board and all citizens of Philipstown.

The agreement for work to be done focused on these primary tasks: 1) Review the research and assessment data from the past to determine if additional information could be added, 2) Travel to the site(s) and make a careful assessment of overall road cross section with special attention to drainage, road profile such as crown on the surface, and overall surface condition, 3) Do some basic coring to determine how much surface gravel (sometimes called aggregate) is in place, 4) From the information derived from the assessments above, make recommendations on necessary improvements to the road cross section, specification for new surface gravel – both in quantity needed and the gradation along with a plasticity index requirement, 5) Make recommendations for a maintenance strategy after the road has been improved because how an unpaved road is reshaped and maintained along with the surface aggregate placed on it has huge impact on how the road performs, 6) Present the recommendations to decision makers and then facilitate a public meeting or meetings to explain and support the recommendations for road improvement and preservation.

The work has been completed and this report is intended to be as forthright, honest and as non-technical as possible to be understood by all who read it. Despite the emphasis on being non-technical, it should provide sound guidance for the preservation of unpaved roads in the Town of Philipstown. Some photos, tables and illustrations are included which should help all who read the report in understanding what was observed on the roads and what can be expected as shown on other roads in the US where recommended changes have been made and the results of those changes.

Recommendation for Preservation of Dirt Roads in the Town of Philipstown, NY

The first task was a review of previous dirt road assessments and recommendations done in the Town of Philipstown. The documents provided for review were: *Recommendations for the Maintenance of Old Albany Post Road* Compiled by Tim Ziegler, Field Operations Specialist, Penn State Center for Dirt and Gravel Road Studies (Center). It is my understanding this was completed in 2009. The next document was a PowerPoint presentation titled *The Old Roads* developed and presented in January, 2013 by Paul Crabtree, PE of Crabtree Group, Inc. The final document was titled *HISTORIC RESOURCE STUDY OF THE OLD ALBANY POST ROAD* prepared and compiled under a contract to the Federal Emergency Management Agency (FEMA) of the US Department of Homeland Security.

It would be good for everyone to review some recommendations from Mr. Ziegler. It would be redundant to repeat his work in this report, but two of his key recommendations are the importance of drainage and potential stabilization of surface aggregate to keep the material from eroding to the ditches and on to streams or creeks. He mentions using "as many ditch outlets as possible to create shorter ditch runs". I concur. There are areas where this could be done. This will be elaborated on later in this report.

There are some good recommendations to review from Paul Crabtree. However, his PowerPoint presentation was not entirely clear to me on some points. He has good guidance to consider on erosion and sediment control (slides 31 through 40) along with sample surface aggregate specifications to consider (slide 42). Again, this report will address this in more detail later.

The study done for FEMA does not have specific recommendations for preservation of the road, but has detailed information on the historic significance of Old Albany Post Road. One statement is interesting in the Executive Summary excerpted here: *"The Federal Emergency Management Agency --- has proposed providing assistance to the Town of Philipstown, Putnam County, New York, --- to mitigate damage to the National Register of Historic Places (NRHP)-listed Old Albany Post Road-Philipstown Section (Road), which occurred during storms of April 14-18, 2007".* I do not know if assistance was sought from FEMA or not. If not, it is likely too late now, but this would have been a good opportunity to get direction and financial support for road preservation. Either way, it is time to move ahead and work together for the future.

Task two was to travel to the town of Philipstown to get a first-hand look at the roads to make an assessment of overall roadway conditions in order to make useful recommendations. This was done on the 17th and 18th of this past March in 2016. This was a profitable trip. A few members of the Old Road Society were kind enough to meet me during breakfast the first day. Two of them took the time to take me to several roads in the Town of Philipstown which was extremely helpful in order to get acquainted with the area. I was able to visit with a few residents in the area and observe ten or more road sections. Spring maintenance was being done on one section of Old Albany Road and I was able to visit with the motor grader operator and one other crew member. They were congenial and answered several questions I had regarding the equipment and the surface aggregate being used on the road. This was much appreciated.

On the second morning, I was able to meet with the Highway Superintendent, Mr. Carl Frisenda, along with his assistant and with a town board member. While visiting the highway department, I was able to take samples from an aggregate (gravel) stockpile representative of the material being used as surfacing on the dirt roads in the town of Philipstown. Two key issues came from that discussion: the quality of the surface aggregate available and the problem of drainage and

erosion at the edge of the roads. Mr. Fresenda and I made arrangements to meet out on an unpaved road later that morning so that he could give me a better perspective on the department's needs in addressing the issues discussed in the office. Regrettably, he was called to an emergency meeting a short time later and had to cancel the meeting out on the road. I spent the rest of the day making observations on several road sections, taking many photos, obtaining samples of surface aggregate in two locations on Old Albany Post Rd along with random checks of roadway crown, drainage features, steepness of grade in a couple of locations and measurement of corrugation (washboard) in the road surface. The aggregate samples were tagged and left for shipment back to a certified soil/aggregate testing laboratory and field work was completed by late evening on March 18th.

Task three involved some basic coring to determine how much surface gravel (also called aggregate) is in place. In addition to coring on the road surface, it was good to be able to get samples of the virgin aggregate at the highway department stockpile site. The stockpile was sampled by digging into the face of the stockpile in nine areas, discarding the material from the outer surface, then carefully getting representative samples from the pile and place them in sealed bags.

Photo of one sample location at the stockpile site.

More samples were taken at two sites on Old Albany Road. These locations were approximately 490 feet south of the intersection with Chapman Road (Surface sample A in the appending test data sheet) and approximately 400 feet south of the intersection with Travis Corners Road (Surface sample B in appendices). The samples were labeled at the time of sampling to avoid confusion during testing.

Example of coring or digging a test pit to obtain a road surface aggregate sample

The surface samples were obtained from the top three inches of the surface at three locations at each site. Test pits were cut at the center of roadway, and two feet from the edge of the traveled way on each side of the road.

All samples were left with Mr. Terry Zaleski who agreed to arrange for shipment back to my residence in SD.

Field test site for Surface sample A on Old Albany Road

It was my preference to do my own initial analysis on the samples upon returning home and then to have more complete testing done at a certified soil and aggregate testing lab.

All samples arrived intact. A minimum composite of 30 pounds of material was thoroughly mixed and analyzed from each of the three sites. My initial testing was only to confirm the material met the specification for the percentage passing a No. 4 sieve. The specification used is from Table 4 in the *Gravel Roads Construction and Maintenance Guide* published by the Federal Highway Administration of US Department of Transportation (table shown below). The center column specification is used due to the average annual precipitation in Philipstown.

Table 4: Surface Aggregate Sample Specifications

Annual precipitation	> 20 inches	< 20 inches
Sieve	**Percent Passing**	**Percent Passing**
1" (25.0 mm)	100	
3/4" (19.0 mm)		100
No. 4 (4.75 mm)	45 - 70	50 - 78
No. 8 (2.36 mm)	27 - 55	37 - 67
No. 40 (425 mm)	10 - 28	13 - 35
No. 200 (75 mm)	3.0 - 12.0	8.0 - 15.0
Liquid Limit Max	25	30
Plasticity Index	3 - 10	8 - 15

My testing showed all samples met the requirement for the required percentage passing the No. 4 sieve. All material testing thereafter was performed by Geotek Engineering and Testing Services in Sioux Falls, SD. This firm is a pre-approved consulting firm in the state of SD and is a firm known for very accurate testing, particularly when the plasticity index (sometimes called the Atterberg limits test) of the fine material in the sample is needed. In simple terms, the plasticity index defines whether the fine material in the sample has a "plastic" or cohesive characteristic. This helps bind the coarse particles and sand sized particles together to provide a tightly bound driving surface on an unpaved road. It also indicates the material will resist

raveling from the surface under traffic. It will also stay in place during heavy rains and not erode nearly as easily to the edge of the roadway or be carried into the ditch or on to adjoining streams. If the lab tests show a plasticity index of 3 or greater, it is generally an indication the aggregate has some natural clay in it which provides the binding or cohesive characteristic. If the material is non-plastic, it indicates the fine material portion of the sample is primarily a silt type material along with very fine fragments of rock generated from the crushing process at the quarry.

In addition, complete gradation testing was done to insure the material has a good overall blend of coarse and fine aggregate. This might be explained simply by saying there has to be stone, sand and some true fine material in the overall mass of the material. The results of the testing are shown in the appending documents under the heading of Geotek Engineering and Testing Services along with "Sieve Analysis and Additional Testing Report".

Here is my assessment of the material tests. On the positive side, there is consistency in all of the samples – stockpile and road surface. This is good since it is extremely hard to make recommendations when there is great variability in the existing material, especially on the road surface. After analyzing the material tests, there are a few things to note. The stockpile sample has 2% retained on the 1 inch sieve. While this is not a great amount, the larger stone is not desirable for surface material. It is hard to keep larger stone embedded in the surface under traffic. Two other items in gradation should be noted. Both road samples A and B have a higher percentage of fine material (passing the No. 200 sieve) than the stockpile sample. Sample A is actually slightly out of specification at 12.9% passing and sample B is at the limit at 12% passing. This is not unusual when comparing road surface material in-place to the original material in a stockpile. It generally comes from native soil getting into the gravel during maintenance operations and/or from the breakdown of the coarser material under traffic.

The greatest deviation from the specification in the *Gravel Roads Construction and Maintenance Guide* is all samples show no plasticity index. The results are simply documented as "non-plastic". This means there is no cohesive characteristic in the surface aggregate. This will lead to excess raveling or loosening of the material under traffic. The problem will be worse in periods of dry weather. This leads to two problems: excess loss of material off of the roadway and potential erosion into streams and more maintenance required by the highway department. A more complete explanation of good surface gravel (or aggregate) can be found in Section III of the *Gravel Road Construction and Maintenance Guide.*

I have some concern about the quantity of material on the road. The layer thickness was adequate where the test pits were dug. However some areas of the roads show almost no material and traffic is essentially driving on the native soil.

Photo documentation of an area of the road with no surface aggregate indicated by native rock and soil showing at the surface.

The other part of this task three was to check roadway shape. Overall,

the traveled way was shaped to an acceptable standard. The most important things are to have adequate crown on the surface to drain water off of it, to have no high shoulder to obstruct drainage at the edge of the roadway and to have a surface free of potholes and corrugation (washboard). Overall, roadway crown was good when measured in random locations. Crown on the traveled way ranged from 4% to 6%. My preference is for crown at or near 4% as defined in the FHWA *Gravel Road Construction and Maintenance Guide*. A few locations have inadequate crown and potholes appear. That is a consequence of too little crown.

One area on the town road system that has less than 2% crown and potholes are present as a result.

The bigger problem appears to be drainage at the edge of the roadway in a number of locations.

There is a lot of erosion shown here in which fine material in the ditch is eroding away when water flows along the edge of the roadway carrying soil with it. This needs a remedy

Task four is to take information derived from the assessments in the previous two tasks and make recommendations on necessary improvements to the road cross section and specification for new surface gravel. As mentioned earlier, crown in the road surface is critical to drain water off of the road surface. This is important whether the road is paved or unpaved. On pavements, lack of drainage will lead to premature deterioration of the surface and will cause potholes to form on unpaved roads. With only a few exceptions, the crown is the roads

observed was adequate. (Crown was checked only on unpaved roads). The bigger issue is drainage at the edge of the roads. The challenges here are significant in Philipstown due to very confined right-of-ways (ROWs) on which the roads were built and being maintained. Again, this problem has to be addressed whether the road is paved or unpaved. Some photos will help define the problem and potential solutions.

This photo at left shows a significant problem with a "berm" along the road in an area where the water could be drained off the shoulder along the entire section along the left side of the road. It is good to eliminate a berm anywhere it is possible.

It is also possible to "single slope" a road section like this and drain all of the water to the open (left edge as viewed here) side. That does require some significant reshaping of the road surface.

This photo is in another region of the country which receives overall less rainfall, but tends to get catastrophic rain/storm events. Note there is no berm along either side of the road surface. There is good drainage to a small ditch. Steepness of grade on parts of this road section approach 20% - not a good situation - yet the road performs quite well. It is due to two things: excellent shape on the road cross section and high quality surface aggregate that remains tightly bound and resists erosion and loosening under traffic.

However, many roads sections in Philipstown have confining property and/or steep backslopes on both sides and drainage cannot simply be done by draining water directly off to the adjoining fields or forest. Two problems have to be addressed: keeping the ditches stable to prevent the erosion of native soil and working to prevent the erosion of surface material into the ditches and potentially on down to streams and creeks.

There are several ways to reduce erosion within the ditches themselves. Finding good native vegetation that will grow in the local ditch soil is one method. I am not familiar with vegetation

that grows well in the native soil in the Philipstown area. A good source to find this would be the US Agriculture Extension Office in the county. It is worth a contacting them at: http://putnam.cce.cornell.edu/agriculture If vegetative cover in ditches cannot be maintained, more aggressive means of erosion control is needed. Rock-lined ditches are one method of doing this. Quarry rock is best because it is fractured and can be purchased in uniform sizes that will stay in place in flowing water. Lining the ditch with a geotextile, often called filter fabric, prior to placing rock is a good practice. This may have to be done along some of the paved roads as well since I noticed some areas with quite a bit of erosion.

An example of a very simple rock-lined ditch to prevent erosion of soil along the edge of the roadway.

Here, native stone was used which is not crushed or processed in any way. It worked well here, but quarry stone that fractured will perform better in rugged terrain.

An example of a combination of a geotextile fabric being placed along with a drainage pipe and rock to be placed around it later.

Source: Figure 20. Geosynthetic capillary barrier drain (GCBD) installed on a test section over the subgrade/base interface in Vermont (Henry et al. 2005)

Some road sections in Philipstown have subdrainage installed somewhat like storm sewers on urban streets. My experience with this has not been very good. It will work reasonably well if the surface aggregate goes into a tightly bound state and does not loosen in prolonged dry weather or soften and erode in wet weather. The aggregate currently being used does not have that characteristic. Consequently, loose aggregate gets into the inlets and can plug the system.

An inlet shown here on an unpaved Philipstown road. These can work if the surface material stays bound and does not erode into the drop inlet or catch basin.

However, they are always a challenge for motor grader operators when doing surface maintenance. It is hard to shape the road surface and not disturb the grate or move material into the catch basin.

This is a better example of locating a catch basin outside of the traveled way and at a lower elevation allowing water to flow easily to it. It is also far easier for the motor grader operator to shape the road without disturbing the grate. Erosion control such as rock lining around the catch basin would be helpful to prevent soil from entering the basin.

This transitions to the importance of good quality surface aggregate and how that integrates into drainage management. The quality of the aggregate as sampled and tested from the Old Albany Post Road is mentioned earlier in this report. While gradations are reasonably good, all samples tested were non-plastic, meaning there is no cohesive characteristic to the material. This means it will not go into a tightly bound state to make a good driving surface even in dry weather. Some may be concerned that material with a cohesive characteristic will rut more easily in wet weather. In my experience, that is not the case. It actually sheds water and resists rutting and erosion. The only way to achieve this is to change the material specification. A good sample specification is shown in Table 3 on page 107 of the FHWA *Gravel Road Construction and Maintenance Guide* (See Appendix B for link to the Guide). This may be difficult to do if the local suppliers are unwilling to produce the material. However it is possible to modify it after purchasing the material. The Philipstown Highway Dept is currently experimenting with this by adding bentonite clay. I commend them for doing this.

To further address erosion, here is an example of using good quality surface aggregate along with a geocell system placed on a geosynthetic fabric. This is not a highly technical process and when done correctly, it is an excellent way to virtually eliminate erosion problems in both surface and edge drainage along with drastic reduction in loss of aggregate and reduced blade maintenance.

Source: Figure 21. Geocells placed over non-woven geotextile on a test section in Vermont (Henry et al. *2005)*

Quoting from Low-Cost Rural Surface Alternative, A draft study done by the Center for Earthworks Engineering Research at Iowa State University, pages 40 – 42: *Geocells are another relatively new type of geosynthetics. Geocells are three-dimensional, honeycomb-shaped soil-reinforcing geosynthetics composed of polymeric materials and are primarily used for confinement of granular material (Figure 21 shown above). Geocells are placed at grade, in-filled with granular material, and compacted. The cellular structures of the geocells provide lateral and vertical confinement and tensioned membrane effect, thereby increasing the bearing capacity and providing a wider stress distribution (Rea and Mitchell 1978). As a result, rutting or permanent deformations under traffic loading can be reduced. Typically, the geocell-base/subbase system is underlain by a geotextile to separate the infilled base/subbase material from the subgrade.*

Beyond the issue of using better surface aggregate and looking at a geosynthetic product, a good way to reduce dust, blade maintenance and preserve the aggregate layer is to use a stabilization treatment. The most common products used across the US are calcium chloride or magnesium chloride. These products are hygroscopic and work by simply drawing moisture from the atmosphere. This in turn tends to keep the surface in a damp state and the stone does not loosen from the surface. However, once again it must be emphasized these products perform far better when there is a cohesive characteristic to the material. Once again, quality surface material is the key to success. Getting the necessary cohesion can be achieved by adding some natural clay to the aggregate or by adding a processed clay – generally bentonite. Be very careful when adding bentonite. It is such a highly plastic or cohesive clay, it will become too sticky when it is in a moist condition. In my experience on several road sections around the country, two to three percent is all that is needed. It must be thoroughly mixed for good performance.

There can be some concern about the corrosive characteristic of chlorides. In my experience, this has never been an issue when the product is mixed and confined in the surface aggregate. Try to keep traffic at a minimum during the application as the chloride is being absorbed into the aggregate. Once absorption occurs, there is virtually no corrosive effect. Be aware, these are the same products used for a lot of deicing in the winter and corrosion can occur in that application because it is placed on the surface to melt ice. The flakes or brine will splash up on vehicles causing a problem is the vehicle isn't washed quickly. Dust control is different.

There are many other products available for stabilizing and/or controlling dust on unpaved roads. In fact there are so many types and trade names, it is beyond the scope of this report to try to give guidance on them. The list includes portland cement, fly ash, lime, organic oils, petroleum oils, polymers, enzymes, synthetic fluids, resins and many more. A study done by Dr. David Jones are UCal – Davis in 2013 identified over 200 named products being marketed in North America for stabilization and/or dust control. Be careful when trying a product for the first time. The best advice is to do a test section – generally no more than 1,000 feet. Ask the supplier for clear direction on the compatibility of the product with the surface aggregate in place, the correct process for road preparation, product application and finishing. Successful stabilization can really enhance the performance of an aggregate surfaced road and keep the aesthetics of an unpaved (dirt) road. It can also be cost effective if reduced blade maintenance and aggregate loss equals or exceeds the cost of paving.

An example of a chloride treated road in a mountainous region that carries >1,000 vehicles per day (vpd) in the summer season and never carries less than 600 vpd in the winter.

This performance comes from excellent surface aggregate, good roadway preparation prior to treatment and good application of the chloride.

An example of outstanding surface performance on another road that carries just under 700 vehicles per day throughout the year. This includes over 100 heavy trucks per day.

High traffic volume does not have to be a deterrent to preserving an unpaved road.

Again, this performance comes from excellent surface aggregate, a chloride treatment along with good roadway preparation and product application.

Task five is making recommendations for a maintenance strategy after the road has been improved. After surface aggregate quality, roadway shape and drainage are addressed, road

maintenance is actually reduced in nearly all of my experience in working with unpaved roads across the nation and even outside of the US. However, the need for maintenance is never eliminated. Some of the maintenance must continue whether the road is paved or unpaved. That includes keeping ditch drainage and underdrain systems (storm sewers) cleared of obstructions and erosion must be monitored. In addition surface condition must be monitored. Unpaved roads tend to require more frequent cycles of maintenance such as blading and aggregate replacement where needed. Surfaces paved with asphalt tend to have less cycles of maintenance, but maintenance such as chip seals, crack filling, dig-out and pavement repair are far more expensive.

This is an illustration of erosion control and pavement edge repair needed on a Philipstown paved road.

Paving will not eliminate all of the problems that have to be addressed on unpaved roads. The performance on the two surface types differs, but maintenance always has to be done.

Although the focus of this report is on preservation of unpaved (dirt) roads, all public agencies must look at management and preservation of all roads on their system.

While doing work in Philipstown, it was hard not to notice significant deterioration on several paved roads. This will have to be addressed in future budget and project planning. Paved road maintenance, repair and rehabilitation can be very expensive. In the past, I have often had to assist agencies in analyzing needs on the entire road or street system. It is often impossible to maintain all roads to an acceptable standard due to budget constraints. Thereafter, priorities have to be set and long-term planning has to be done. It is becoming common in many local agencies in the nation to have to revert some paved roads back to unpaved surfaces. This is an extremely difficult situation to address. In virtually every case, managers and elected officials conclude some of the roads that have to be reverted should have never been paved in the beginning. It is easy to pave when money is

available, but long-term costs have to be analyzed. Life-cycle cost should be done for at least 20 years for good planning. Accurate current and projected cost data needs to be used. Traffic type and volume needs to be considered as well. When accurate life-cycle cost analysis is done, unpaved roads are often the cheapest to rehabilitate and maintain. Traffic volume is sometimes used to demand paving, but traffic count data provided to me on several Philipstown roads does not justify paving.

Once more, the key to successful unpaved road management is to understand good surface aggregate and good maintenance methods. The unpaved road maintenance methods and equipment being used as observed in my March, 2016 visit appeared to be adequate and quite common to the industry. Visits with Mr. Frisenda and a few staff members at the highway department indicated to me that all want to do a good job. That is commendable. Continue to do blade maintenance when needed and watch aggregate loss. Continue to work on getting better aggregate surfacing material because it reduces both surface maintenance costs in the long run as well as reduced erosion of aggregate to the ditches and drains. That has already be discussed and I won't belabor the point.

Task six required a presentation of the recommendations to decision makers and then facilitate a public meeting or meetings to explain and support the recommendations for road improvement and preservation. This was done on June 15, 2016. The show of interest was good to see – both by the Town Board and Highway Superintendent and by the public. Good interaction occurred and it is my hope that the presentation was clear and understandable. This report should address most of the questions that came up.

It seems important to reiterate some of the concluding points in the PowerPoint presentation made back in June:

1. Current surface material has reasonably good gradation, but does not have a cohesive characteristic (non-plastic). Current modification (with crusher fines) should be monitored and continued if improved performance is observed. I have since provided some guidance to Mr. Frisenda on the use of bentonite for stabilizing the aggregate and providing a better binding characteristic. When the correct amount is used and the mixing process is done well, this should greatly improve the binding characteristic of the aggregate.

2. Dust control or stabilization should be further tested on improved surface material. The proprietary product currently being used appears to be primarily calcium chloride. This will work better with surface aggregate that has some plasticity or cohesiveness.

3. Drainage and erosion needs work – consider testing stone-lined ditches, but also consider testing a geosynthetic method on both unpaved and paved roads. Erosion never goes away, it's a matter of figuring out what works in Philipstown to reduce it. Geosynthetics (fabrics, grids and cells) have worked well in many, many places to combat erosion. Ask suppliers to provide help and guidance along with firm cost estimates on using these products in Philipstown.

4. Begin some life-cycle analysis of all surface types being used. Generally this is done on 20 year cycles. The current surface types would be aggregate surfacing, treated aggregates surfacing and asphalt pavement. To do a good job of this, accurate data has to be known specific to all costs of constructing and maintaining a road surface. I am willing to provide a very simple Excel™ Spreadsheet software to assist in beginning the process. There will be no charge for this.

5. Don't be afraid to look at and try new things, but when trying something new, do test sections only. Reduce risk – sometimes a 1,000 ft. trial section will tell you a lot about whether a product

or process works in Philipstown. On the other hand, don't reject a product or process if it appears to have merit, but the method of construction, product application or volume needs to be changed. Continue to experiment when something shows promise, but again to manage the risk, don't construct long sections.

6. Be sensitive to the historic significance of some of your roads – there are virtually none like them in the nation. It is amazing to many who visit to travel on a road(s) that were used by General Washington, Benjamin Franklin and other historic figures. Obviously, in their original condition, they were all unpaved. Preserving them in as close to original condition as possible is part of your legacy. Don't take it lightly. One suggestion: a few more signs indicating this could be helpful for public appreciation.

7. Keep communicating! Agency and citizen communication is critical for everyone to understand the issues. It can be difficult to reach a consensus on important matters like this, but keeping lines of communication open is critical to avoid gross misunderstanding of the reasons for decisions either being made or being considered.

Respectfully Submitted,

Ken Skorseth,

Retired Program Manager, SD LTAP, SD State University

Appendices Attached

Appendix A-1 Stockpile Test Data

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 East 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

SIEVE ANALYSIS WITH ADDITIONAL TESTING REPORT

REPORTED TO:
SDLTAP
Kenneth Skorseth Jr.
SDSU PO Box 2219, SCEH 312
Brookings, SD 57007

DATE: 4/20/2016

PROJECT: 16-375
Sieve Analysis & Atterberg Tests
Old Albany Rd
Phillipsetown, NY

COPIES TO:

Sample Data

Sample #:	1	Material Type:	Gravel Surfacing - Crushed Grani
Sampled By:	Ken Skorseth	Date Sampled:	3/18/2016
Tested By:	ALK	Date Tested:	4/18/2016
Location:	Stockpile		

Sieve Data (ASTM C136)

Sieve Size	% Passing	Specification
2"	100	-----
1 1/2"	99	-----
1"	98	100
3/4"	92	-----
1/2"	79	-----
3/8"	71	-----
#4	53	45 - 70
#8	40	27 - 55
#40	18	10 - 28
#200	8.4	3.0 - 12.0

Additional Materials Tests

Additional Tests	Result	Specification
Liquid Limit (ASTM: D4318)	Non-Controllable	25 Max
Plasticity Index (ASTM: D4318)	Non-Plastic	3 - 10

Remarks: The sample doesn't meet the sieve analysis, liquid limit, or plasticity index requirements of the FHWA Gravel Road Maintenance & Construction Guide - 2015.

By
Matthew Thompson, PE: Project Manager

#TR-204

Appendix A-2 Old Albany Road Sample Site A

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 East 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

SIEVE ANALYSIS WITH ADDITIONAL TESTING REPORT

REPORTED TO:
SDLTAP
Kenneth Skorseth Jr.
SDSU PO Box 2219, SCEH 312
Brookings, SD 57007

DATE: 4/20/2016

PROJECT: 16-375
Sieve Analysis & Atterberg Tests
Old Albany Rd
Phillipsetown, NY

COPIES TO:

Sample Data

Sample #:	3	Material Type:	Gravel Surfacing - Crushed Grani
Sampled By:	Ken Skorseth	Date Sampled:	3/17/2016
Tested By:	ALK	Date Tested:	4/18/2016
Location:	Surface sample A		

Sieve Data (ASTM C136)

Sieve Size	% Passing	Specification
1"	100	100
3/4"	96	-----
1/2"	80	-----
3/8"	73	-----
#4	59	45 - 70
#8	49	27 - 55
#40	29	10 - 28
#200	12.9	3.0 - 12.0

Additional Materials Tests

Additional Tests	Result	Specification
Liquid Limit (ASTM: D4318)	Non-Controllable	25 Max
Plasticity Index (ASTM: D4318)	Non-Plastic	3 - 10

Remarks: The sample doesn't meet the sieve analysis, liquid limit, or plasticity index requirements of the FHWA Gravel Road Maintenance & Construction Guide - 2015.

By
Matthew Thompson, PE: Project Manager

#TR-204

Appendix A-3 Old Albany Road Sample Site B

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 East 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

SIEVE ANALYSIS WITH ADDITIONAL TESTING REPORT

REPORTED TO:
SDLTAP
Kenneth Skorseth Jr.
SDSU PO Box 2219, SCEH 312
Brookings, SD 57007

DATE: 4/20/2016

PROJECT: 16-375
Sieve Analysis & Atterberg Tests
Old Albany Rd
Phillipsetown, NY

COPIES TO:

Sample Data

Sample #:	2	Material Type:	Gravel Surfacing - Crushed Grani
Sampled By:	Ken Skorseth	Date Sampled:	3/17/2016
Tested By:	ALK	Date Tested:	4/18/2016
Location:	Surface sample B		

Sieve Data (ASTM C136)

Sieve Size	% Passing	Specification
1"	100	100
3/4"	97	-----
1/2"	84	-----
3/8"	75	-----
#4	58	45 - 70
#8	45	27 - 55
#40	26	10 - 28
#200	12.0	3.0 - 12.0

Additional Materials Tests

Additional Tests	Result	Specification
Liquid Limit (ASTM: D4318)	Non-Controllable	25 Max
Plasticity Index (ASTM: D4318)	Non-Plastic	3 - 10

Remarks: The sample meets the sieve analysis requirements of the FHWA Gravel Road Maintenance & Construction Guide - 2015.

The sample doesn't meet the liquid limit or plasticity index requirements of the FHWA Gravel Road Maintenance & Construction Guide - 2015.

By
Matthew Thompson, PE; Project Manager

#TR-204

Appendix B – Some Recommended Sources for Further Information

Gravel Roads Construction and Maintenance Guide – Published by the US Dept of Transportation Federal Highway Administration in August 2015. This guide is has broad coverage of the entire arena of basic construction and maintenance of gravel (dirt) roads. It is easy to understand and is non-technical, yet has good information on surface material, use of equipment for building and maintaining roadway shape as well as basic information on stabilization. It is available at this link: https://www.fhwa.dot.gov/construction/pubs/ots15002.pdf (Please note: the recent link has errata info at the beginning instead of the title of the manual; continue to scroll down for the main document)

Low-Cost Rural Surface Alternatives: Demonstration Project – Final Report Published in June 2015 by the Institute for Transportation at Iowa State University. This document is lengthy, but has some excellent information that could provide help in determining options for drainage improvement and surface stabilization. Note especially the mention of bentonite, calcium chloride and the use of geotextiles and geogrids for stabilizing roads as well as making drainage improvement. The document is available at this link: http://www.intrans.iastate.edu/research/documents/research-reports/low-cost_rural_surface_alternatives_demo_w_cvr.pdf

Stabilization Selection Guide for Aggregate and Native-Surfaced Low Volume Roads – Published by the US Forest Service in March 2009. This document is also somewhat lengthy, but has information that could be helpful in evaluating methods of improving unpaved roads. It can be found at this link: http://www.fs.fed.us/t-d/pubs/pdf/08771805.pdf

Gravel Road Maintenance – Meeting the Challenge – A video presentation now uploaded to YouTube; originally produced by the University of Minnesota's Institute for Transportation Research in 2005. It covers the basics of gravel road maintenance very quickly and runs only 21 minutes. It can be viewed at this link: https://www.youtube.com/watch?v=1-AnMLGr41g

Problems Associated with Gravel Roads – Parts I, II, & III – These are YouTube Videos developed and produced by the Local Technical Assistance Program sponsored by the Federal Highway Administration. The videos are based on information in a document titled *Problems Associated with Gravel Roads* (now out of print). Although produced nearly 20 years ago, there is some good information in them. The links to the videos are: https://www.youtube.com/watch?v=S9Getd6WqNU (Part 1)
https://www.youtube.com/watch?v=9KoUmLXD4Ck (Part 2)
https://www.youtube.com/watch?v=MGcDuHmClrY (Part 3)

StabiliGrid™ Cabin Gravel Road Installation Video – A basic video on the use of a geocell product to improve an unpaved access road in a wet, mountainous region in an extremely confined right-of-way. Please note: This is not my endorsement of the product. However, it is a good basic video footage of the use of the product with limited resources in the way of personnel, equipment and material. I do recommend viewing this to understand the principles in installation and the performance you can expect. The video is at this link: https://www.youtube.com/watch?v=rY_UcEM7nNc

Appendix C – Technical Assistance Sheet from SDLTAP on Chloride Dust Control/Stabilization

KEYS TO SUCCESSFUL CHLORIDE DUST CONTROL/STABILIZATION

Magnesium chloride, calcium chloride, and sodium chloride (road salt – very short term dust control only) have all been used successfully for stabilizing and dust control on South Dakota's gravel roads. When chloride treatments are working well, they not only control dust which makes local residents happy, but the gravel surface remains tightly bound which reduces gravel loss and reduces blading frequency. In some cases, depending on traffic, chloride treatments will actually pay for themselves by reducing the need to regravel and blade the road frequently. However, we have also seen poor performance and even failures with chloride treatments as well. Here are three major points to consider:

Good subgrade and gravel are essential

If the road has a weak subgrade, the surface will constantly deflect under traffic and the surface gravel will never have a chance to form a crust. Subgrade improvement will need to be done before treatment in very weak conditions. Thereafter, quality of the existing surface gravel is critical. If the gravel does not have a good natural "binding" characteristic the chloride cannot do its job. Chloride is not a binder; but it will draw moisture from the air and keep the gravel surface damp and tightly bound when natural binder is present.

Gravel that has a good blend of stone, sand and fines is essential. Ideally, the gravel should have 8 to 15% of its total weight passing a #200 sieve. In addition to this, a minimum PI (plasticity index) of 5 is ideal with 12 as a maximum. The top size of stone should not exceed three quarters of an inch. [Comment: one inch top should work in NY where more rainfall is expected]

Proper surface preparation

The road surface needs to be properly prepared before treatment. When stabilizing, loosen the top one to two inches of gravel. An ideal way to do this is to use a "bit type" cutting edge on the grader. These bits will have a shallow scarifying effect on the gravel and do a nice job of loosening the surface and blending the stone, sand and fines.

Make sure the surface is crowned properly and shaped uniformly. Crown should be at or near 4%. Never exceed 6%. If the material is dry, it is best to pre-wet the road to near optimum moisture prior to chloride treatment. An ideal time to treat a road is right after fresh gravel is hauled and spread. Do not attempt to treat dry gravel.

Excellent example of application of liquid chloride shown here.

Proper Application

Liquid chloride should be applied through a pressurized spray bar that gives a uniform application across the road surface. Also the truck's travel speed in feet per minute and the output of the spray bar in gallons per minute should be carefully calibrated so that a uniform application rate is made on the entire length and width of the road. Unless the rate of application is less than .3 gal per square yard, the product should be applied in two shots with ample time for absorption in between.

Flake or pelleted chloride should be applied through a ground driven spreader (such as a broadcast fertilizer spreader) that can be precisely calibrated. Sand spreaders are often used, but they are not ideal.

One final point – don't be stingy on the application rate itself. A liquid treatment of less than .5 gal. per sq. yd. is seldom effective for the season. A flake treatment of under 1.5 pounds per sq. yd. is seldom enough. Follow these simple rules and chloride treatments will perform very well.

Originally authored by Ken Skorseth, SDLTAP Program Manager May, 2002