Performance of Recycled Asphalt Pavement in Gravel Roads

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ABSTRACT

As more Recycled Asphalt Pavement (RAP) becomes available to use in roadways, The Wyoming T2/LTAP Center and two Wyoming Counties investigated the use of RAP in gravel roads. The Wyoming DOT and the Mountain-Plains Consortium funded this study. The investigation explored the use RAP as a means of dust suppression on gravel roads while considering road serviceability.

Several test sections were constructed in two Wyoming Counties and were monitored for dust loss using the Colorado State University Dustometer. Surface distress evaluations of the test sections were performed following a technique developed by the U.S. Army Corps of Engineers in *Special Report 92-26: Unsurfaced Road Maintenance Management.* The data collected were summarized and statistically analyzed.

The performance of RAP sections was compared with the performance of gravel control sections. This comparison allowed for fundamental conclusions and recommendations to be made for RAP and its ability for dust abatement. It was found that RAP-incorporated gravel roads can reduce dust loss without adversely affecting the road's serviceability. Other counties and agencies can expand on this research to add another tool to their toolbox for dust control on gravel roads.

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1. INTRODUCTION

1.1 Background

With the influx of oil and gas drilling in the Rocky Mountain region, local jurisdictions are seeing substantial increases in traffic, particularly trucks, on their road networks. Often this results in increased maintenance costs that are out of reach of many local jurisdiction budgets.

Gravel loss, primarily in the form of dust, is a common problem on Wyoming's gravel roads. This loss both degrades the road surface and creates environmental problems. For both engineering and environmental reasons, it is in the best interests of the roads' owners and users to minimize dust loss and provide good road surfaces. As vehicles kick up dust that blows away, the gravel surfacing loses the binding effects of fine particles. Then, surface distresses such as washboards – rhythmic corrugations – develop on the road surface. When the loss of fine material makes the surface more permeable, more water is trapped on the surface, leading to more surface distresses.

As dust enters the air, it increases the risk of violating federal air quality standards. Dust is considered a particulate matter made up of particles that are 10 micrometers (microns) or less, denoted as PM-10. Figure 1.1 shows the national distribution of non-attainment areas for PM-10. Sheridan County, Wyoming, is one of these non-attainment areas. As more users travel Wyoming's gravel roads, the risk posed by fugitive dust will only increase unless steps are taken to reduce this air quality problem and the associated health problems.

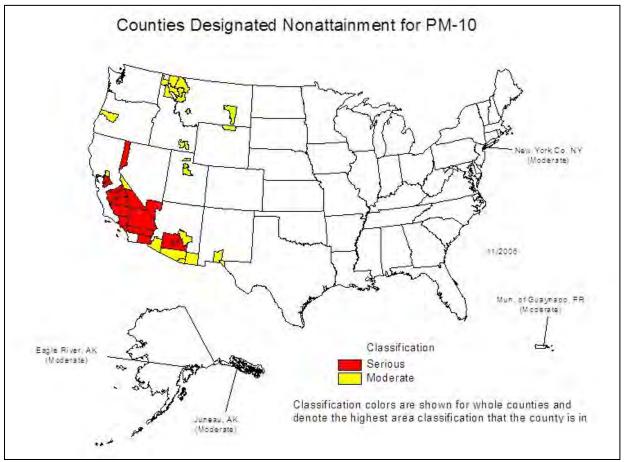


Figure 1.1 USEPA non-attainment areas for PM-10 particulate matter, November 2006.

Many unpaved county roads throughout Wyoming carry in excess of 500 vehicles per day (vpd), yet typical recommendations for when to pave an unpaved road range from 150 to 400 vpd. For financial reasons, many counties are unable to pave roads even though they know that in the long run paving is the most economical solution. Complicating the issue further is the knowledge that on many of these roads, traffic volumes will drop when drilling activities slow. Unfortunately, no one has a crystal ball that tells them just how much drilling activity will take place over the next decades. Considering these factors, it is important to know the most effective ways of managing unpaved roads, especially at higher traffic volumes.

1.2 Problem Statement

As the volume of traffic on unpaved roads in Wyoming increases with increased drilling activities, dust loss and surface distresses will continue to rise. It would make sense to pave some of these roads but many counties cannot afford these expensive operations, especially when the future volume on these roads is unknown. An alternative option needs to be explored that will reduce dust loss and associated surface distresses.

Recycled Asphalt Pavement (RAP) has been used as a surfacing additive on Wyoming's unpaved roads, streets, and alleys for several years. Recent state legislation compensates the Wyoming Department of Transportation (WYDOT) for RAP donated to Wyoming counties. WYDOT and local agencies need to evaluate the performance of blended RAP and virgin aggregate as a surfacing material for unpaved roads. Therefore, it is the intent of this research project to determine the feasibility of using RAP blends as surfacing material with a particular emphasis on its ability to reduce dust loss while maintaining road serviceability.

1.3 Research Objectives

The main objectives of this research project are as follows:

- Determine the effect of adding RAP to gravel roads in terms of reducing dust loss.
- Determine if the addition of RAP to gravel roads will maintain or improve roadway serviceability. That is, reduce surface distresses and not create any new distresses.
- Make recommendations to agencies who feel RAP-blended roadways would be beneficial to their operation.
- Make recommendations for further research into the use of RAP on gravel roads.

1.4 Report Organization

Section 2 of this report is a literature review of RAP, gravel roads, dust control, and the cost effectiveness of RAP utilization. Section 3 discusses the design of this experiment and explains the testing and data collection procedures used during the research project. Section 4 contains data collection from the field and laboratory evaluations. The raw data collected can be found in Appendix A through Appendix C. Section 5 contains the statistical analyses of the collected data. Finally, Section 6 summarizes the research project, presents conclusions, and offers recommendations to agencies and ideas for further research.

2. LITERATURE REVIEW

2.1 Introduction

Asphalt pavement is the most recycled product in America today (Davio 1999). As a result, recycled asphalt pavement (RAP) is being used more widely throughout the world in various applications. Most of the RAP is put back into the roadways of America as a base or surface material. RAP is also used in embankment and fill applications throughout the industry. Another possible use is to utilize RAP in gravel roads.

Gravel roads are abundant in America and especially in Wyoming. These roads are used by industry, farming, ranching, and tourism. The majority of problems that exist on gravel roads are the result of dust loss and the associated distresses. A possible additive to gravel roads is RAP. The addition of RAP may address dust loss and the associated problems. Whether used alone or in conjunction with other dust suppressants, RAP may provide an economical treatment for agencies fighting to keep dust loss at a minimum.

2.2 Recycled Asphalt Pavement

Reclaimed or recycled asphalt pavement (RAP) is the term given to removed and/or reprocessed pavement materials containing asphalt and aggregates. These materials are obtained when asphalt pavements are removed for reconstruction, resurfacing, or to gain access to buried utilities. When properly crushed and screened, RAP consists of high-quality, well-graded aggregates coated by asphalt cement (FHWA 1998).

2.2.1 Perspective on Recycling Asphalt

Highways are a leading recycler—with more asphalt pavement recycled than any other product in America. Few people realize that highways are among the nation's top recyclers. Around 80% of asphalt pavement is being reused in the highway environment. That is compared with only 28% of recycled post-consumer goods in the municipal solid waste stream. In the transportation field, recycling is a win-win proposition. RAP saves the taxpayers' dollars while maintaining high quality in the roadways of America. Recycling asphalt pavements also shows a healthy respect to the valuable materials used in asphalt pavements (AASHTO Center for Environmental Excellence 2003).

According to industry experts, the asphalt pavement industry is the nation's leader in recycling. Each year, 73 million tons of reclaimed asphalt pavements are reused. That is almost twice as much as paper, glass, plastic, and aluminum combined, which is saving taxpayers almost \$300 million annually. The volume of recycled asphalt pavement is 13 times greater than recycling of newsprint, 27 times greater than recycling of glass bottles, 89 times greater than recycling of aluminum cans, and 267 times greater than recycling of plastic containers. Recycled asphalt is used not only for new roads, but also for roadbeds, shoulders and embankments (AASHTO Center for Environmental Excellence 2003).

Ownership of RAP can be broken down by contractor, agency, or a combination of the two. Wyoming's RAP is owned and controlled by an agency, most likely WYDOT. Colorado's RAP is owned by both agencies and contractors. The sources of RAP include pavement milling, asphalt pavement removal, and plant waste material. RAP can either be stockpiled in isolated single source piles or as a blend of multiple sources. RAP can be processed in a number of ways, including screening, crushing, or fractioning (combination of both screening and crushing). RAP can also be processed into fine aggregate, minus ¹/₂ inch, or into coarse aggregate, greater than one-half inch (Huber 2008).

Asphalt pavement recycling has many advantages, including:

- reduced cost of construction
- conservation of aggregate and binders
- preservation of existing pavement geometrics
- preservation of the environment
- conservation of energy

The use of hot-mix, hot in-place and cold in-place recycling achieves material and construction savings of up to 40, 50 and 67%, respectively. In addition, significant user-cost savings are realized due to reduced interruption in traffic flow when compared with conventional rehabilitation techniques (Davio 1999).

2.2.2 Obtaining RAP

Asphalt pavement is generally removed either by milling or full-depth removal. Milling involves the removal of the pavement surface using a milling machine, which can remove up to 2 inch (50 mm) thickness in a single pass. Full-depth removal involves ripping and breaking the pavement using a rhino horn on a bulldozer and/or pneumatic pavement breakers. In most instances, the broken material is picked up by front-end loaders and loaded into haul trucks. The material is then hauled to a central facility for processing. At this facility, the RAP is processed using a series of operations, including crushing, screening, conveying, and stacking (FHWA 1998).

Although the majority of old asphalt pavements are recycled at central processing plants, asphalt pavements may also be pulverized in place and incorporated into granular or stabilized base courses using a self-propelled pulverizing machine. Hot in-place and cold in-place recycling processes have evolved into continuous train operations that include partial depth removal of the pavement surface, mixing the reclaimed material with beneficiating additives (such as virgin aggregate, binder, and/or softening or rejuvenating agents to improve binder properties), and placing and compacting the resultant mix in a single pass (FHWA 1998).

2.2.3 Uses of RAP

The majority of the RAP produced is recycled and used, although not always in the same year it is produced. RAP is almost always returned back into the roadway structure in some form, usually incorporated into asphalt paving by means of hot or cold recycling, but it is also sometimes used as an aggregate in base or sub-base construction (FHWA 1998).

It has been estimated that as much as approximately 33 million metric tons (36 million tons), or 80 to 85% of the excess asphalt concrete presently generated, is reportedly being used as a portion of recycled hot mix asphalt, in cold mixes, or as aggregate in granular or stabilized base materials. Some of the RAP that is not recycled or used during the same construction season in which it is generated is stockpiled and is eventually reused (FHWA 1998).

Milled or crushed RAP can be used in a number of highway construction applications. These include its use as an aggregate substitute and asphalt cement supplement in recycled asphalt paving (hot mix or cold mix), as a granular base or sub-base, as a stabilized base aggregate; or as an embankment or fill material. Recycled asphalt pavement can be used as an aggregate substitute material, but in this application it also provides additional asphalt cement binder, thereby reducing the demand for asphalt cement in new or recycled asphalt mixes containing RAP. When used in asphalt paving applications (hot mix or cold mix), RAP can be processed at either a central processing facility or on the job site (in-place processing). The

introduction of RAP into asphalt paving mixtures is accomplished by either hot or cold recycling (FHWA 1998).

Stockpiled RAP material can also be used as a granular fill or base for embankment or backfill construction. The use of RAP as an embankment base may be a practical alternative for material that has been stockpiled for a considerable time period, or may be a mixture from several different project sources. Use as an embankment base or fill material within the same right of way may also be a suitable alternative to the disposal of excess asphalt concrete that is generated on a particular highway project (FHWA, 1998).

According to FHWA, the majority of RAP is used in construction and maintenance applications, including:

- hot in-place recycling
- cold in-place recycling
- full-depth reclamation
- road base aggregate
- shoulder surfacing and widening
- various maintenance uses (Sullivan 1996).

The use of RAP as a maintenance tool in low-volume roads has not been investigated thoroughly and more research is needed in this field.

2.2.4 In-Place Recycling, Hot Mix Asphalt, Cold Mix Asphalt, Embankment, Fill, and MSE Walls

In-Place Recycling:

In-place recycling is an attractive method to rehabilitate deteriorated flexible pavements due to lower costs relative to new construction. It also supplies long-term societal benefits associated with sustainable construction methods. One approach is to pulverize and blend the existing hot-mix asphalt, base, and some of the subgrade to form a broadly graded granular material referred to as recycled pavement material (RPM). RPM can in turn be used in place as a base course for a new pavement. Blending is typically conducted to a depth of approximately 12 inches (300 mm). The RPM is compacted to form the new base course and is overlain with new hot-mix asphalt (HMA) (Li, Benson, Edil, and Hatipoglu 2007).

For cold in-place recycling, the pavement is removed by cold planing to a depth of 3 to 4 inches (75-100 mm). The material is then pulverized, sized, and mixed with an additive. Virgin aggregate may be added to modify RAP characteristics. An asphalt emulsion or a recycling agent is added. Once the gradation and asphalt content meet specifications, the material is placed and compacted. An additional layer is optional, such as a chip seal or 1 to 3 inches (75-100 mm) of hot-mix asphalt on top.

A 3-piece "train" may be used. This consists of a cold-planing machine, a screening and crushing unit, a mixing device, and conventional lay down and rolling equipment. This train occupies only one lane, thus maximizing traffic flow. Cost savings range from 20 to 40% more than conventional techniques. Since heat is not used, energy savings can be from 40 to 50% (Davio 1999).

For hot in-place recycling, the asphalt pavement is softened by heating, and is scarified or hot milled and mixed to a depth of ³/₄ to 1¹/₂ inches (18.75-37.5 mm). New hot-mix material (virgin aggregate and new binder) and/or a recycling agent is added in a single pass of a specialized machine in the train. A new wearing course may also be added with an additional pass after compaction (Davio 1999).

Hot-Mix Asphalt and RAP:

At a central processing plant, RAP is combined with new hot aggregate and asphalt to produce asphalt concrete, using a batch or drum plant. The RAP is usually obtained from a cold-planing machine, but could also be from a ripping or crushing operation (Davio 1999). The result is Hot-Mix Asphalt or HMA. The HMA is hauled from the plant to the project and compacted.

Cold-Mix Asphalt (Central Processing Facility):

RAP processing requirements for cold-mix recycling are similar to those for recycled hot mix. However, the graded RAP produced is incorporated into cold-mix asphalt paving mixtures as an aggregate substitute (Davio 1999). The mix is then hauled to the project site and compacted.

Full-Depth Reclamation:

In the full-depth reclamation process, all of the asphalt pavement section and a portion of the underlying materials are processed to produce a stabilized base course. The materials are crushed and additives are introduced. The materials are then shaped and compacted with the addition of a surface or wearing course that is applied on top (Davio 1999).

Embankment or Fill:

FHWA's "User Guidelines for Waste and By-product Materials in Pavement Construction" allows stockpiled RAP material to be used as a granular fill or base for embankment or backfill construction. RAP as an embankment base may be a practical alternative for material stockpiled for a considerable time period or that is a mixture from several project sources (Davio, 1999) (FHWA 1998).

Research by the Florida Institute of Technology has found a new application for RAP material. RAP may be utilized as a stabilizing material for sub-base below rigid pavements which will lead to increase use of RAP. RAP can also be used in embankment construction (Cosentino, Kalajian, & Shieh 2003).

Mechanically Stabilized Earth Walls

Mechanically stabilized earth (MSE) walls have been used throughout the United States since the 1970s. The popularity of MSE systems is based on their low cost, aesthetic appeal, simple construction, and reliability. To ensure long-term integrity of MSE walls, select backfills consisting of predominantly granular soils have been used. However, with increasing environmental and sustainability concerns, interest in using recycled materials for MSE walls has grown. Some of the most commonly available recycled materials are crushed concrete (CC) and RAP, and these materials are being considered for use as backfill in MSE walls in Texas (Rathje, et al. 2006).

2.3 Gravel Roads

The definition of *gravel* by the South Dakota LTAP and the FHWA is "a mix of stone, sand, and finesized particles used as a subbase, base or surfacing on a road. In some regions, it may be defined as aggregate" (Skorseth and Selim 2005). In the United States, 53% of all the roads are unpaved. That translates into over 1.6 million miles of unpaved roadways, most of which are gravel roads. In other nations throughout the world, unpaved roads, generally gravel, make up most of the road network. Gravel roads are considered to provide the lowest service to the user and are usually considered inferior to paved roads. But paving and maintaining a paved road where the volume traffic is low is not economically feasible. For the most part, gravel roads exist to provide access or service. They are used by farmers and ranchers to get their product in and out of their fields; by the timber industry to get equipment in and product out of the forests; and by the mining and oil industries to get to and from their sites with equipment and product. Gravel roads are also used to access remote areas like lakes or campgrounds as well as providing rural residents access to their homes. In many cases, gravel roads will not be paved due to the very low traffic volumes and/or not having the funds to adequately improve the subbase and base and then pave the road (Skorseth & Selim 2005).

Two basic principles can make or break a gravel road. The grading device(s) and the surface gravel are the most important elements in a well maintained or rehabilitated gravel road. The grader is used to properly shape to road to provide for adequate drainage of water. The volume and quality of the gravel aggregate is most likely more important to the roadway than the grader. For instance, corrugations or "washboarding" is more likely caused by the material itself and less likely by the grader, although this is generally perceived by the public in an opposite fashion (Skorseth & Selim 2005).

The change in the vehicles and equipment using low volume gravel roads is another matter of importance. The size of trucks and agricultural equipment are increasing and the effect of the larger and heavier loads on gravel roads is just as serious as the effect on paved roads.

2.3.1 Distresses

There are seven types of distresses that can be characterized by a surface evaluation on a gravel road. The seven distresses are:

- Improper cross section
- Inadequate roadside drainage
- Corrugations
- Dust
- Potholes
- Ruts
- Loose aggregate

These distresses are established by the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (Eaton and Beaucham 1992).

Another methodology that involves the same distresses in a different fashion is the Gravel PASER Manual. PASER stands for Pavement Surface Evaluation and Rating. This publication by the Transportation Information Center at the University of Wisconsin-Madison assesses gravel roadway conditions based on five roadway conditions. These five conditions involve the same distress as the U.S. Army Corps of Engineers approach but group them differently. The five conditions include:

• Crown

The height and condition of the crown, and an unrestricted slope of roadway from the center across the shoulders to the ditches

• Drainage

The ability of roadside ditches and under-road culverts to carry water away from the road

- Gravel Layer Adequate thickness and quality of gravel to carry the traffic loads
- Surface Deformation Washboarding, potholes, ruts
 Surface Defects

Dust and loose aggregate (Walker, Entine, and Kummer 2002)

In whatever methodology used to evaluate gravel roads, the underlying distresses are the keys to the chosen procedure. Either approach is considered viable and is in the choice of the agency maintaining the roadway. Both methodologies have their own individual rating system based on the distresses present in the roadway. In any case, it is the distresses that will convey the quality of the gravel road. Keep in mind, the surface conditions of gravel roads can literally change overnight by means of heavy precipitation and local traffic. The aforementioned distresses will be described in more detail in the following subsections.

2.3.1.1 Cross Section and Crown

The shape of the entire roadway must be understood in order to properly maintain gravel roads. To properly maintain these roads, three basic roadway characteristics must be understood: a crowned driving surface, a shoulder area that slopes away from the driving surface, and a ditch. Generally, these three items must be correct in the road's cross section or a gravel road will not perform well, even under very low traffic. The shape of the roadway is the responsibility of the agency and equipment operators who are in charge of the road. The shape of the road surface and shoulders is classified as routine maintenance.

The cross section of a gravel road is designed to drain all water away from the roadway. Gravel roads tend to rut in wet weather. In fact, standing water at any place in the cross section is one of the major reasons for surface distresses and the failure of a gravel road. The agency in charge of maintaining the road must do everything possible in their routine maintenance to take care of the roadway's shape or else extra equipment and manpower may be needed to rehabilitate the road, which generally is not in the budget. Also, a well maintained roadway shape will serve low volume traffic well, but when heavy loads are introduced, the roadway may fail due to weak subgrade strengths and low gravel depths (Skorseth and Selim 2005).

2.3.1.2 Drainage

Roadside ditches and culverts must be able to handle surface water flow. When water is ponding, it is the result of poor roadside drainage. Sitting water on the roadway will seep to the layers below and soften the road base. Ditches need to be wide and deep enough to accommodate all of the surface water. When ditches and culverts are not in good enough condition due to improper shape or maintenance, water will not be directed properly, resulting in ponding and water backup. The shape of the ditch may be affected by erosion and repairs may be necessary. Erosion control efforts may be needed to help maintain ditches. Also, buildups of debris in the ditches or culverts need to removed as part of routine maintenance. Any roadway material in the ditch may be placed back on the roadway or hauled away (Eaton and Beaucham 1992) (Walker, Entine, and Kummer 2002).

2.3.1.3 Gravel Layer

There is a need for an adequate layer of gravel based traffic loads. Traffic loads are carried in the gravel layer and distributed to the subsoils. The thickness of the gravel layer is dependent on the amount of heavy traffic and the stability of the soils below. Generally a minimum of 6 inches (150 mm) is required.

Layers used for heavier loads or poor subsoils can be as much as 10 inches (250 mm) or more. Not only does the volume of the gravel layer matter but the quality of the gravel being used. It is in the quality in which good, long term service will be prevalent. The use of the word quality in this context refers to the gradation and durability of the gravel. These are measured by hardness and soundness testing. In general, the proper gradation has a good mix of larger aggregate, sand-sized aggregate and fines. Gradation and quality of the gravel is based on agency specifications and can widely vary (Walker, Entine, & Kummer, 2002).

2.3.1.4 Surface Deformations

Surface deformations include corrugations, potholes, and ruts. Washboarding or corrugations are closely spaced ridges and valleys or ripples at fairly regular intervals. Corrugation is the result of traffic dislodging aggregate from the roadway surface. These ripples develop perpendicular to the traveled way. Where heavy traffic and loose aggregate are present, corrugations tend to occur. They also usually form on hills and curves, at intersections, where accelerating and decelerating by the traffic is present and around areas where the surface is soft or potholed. Soft subsoils and improper grading can also result in washboarding. When washboarding is severe, water can become trapped in the valleys and more problems can occur.

Potholes are bowl-shaped depressions that can develop in the gravel or on the surface. Potholes are created when traffic wears away small pieces of the surface or where soft spots are developing in the underlying layers. Pothole growth is accelerated when water collects in the hole. As a result of the sitting water, the roadway continues to get worse because of more material becoming loose and/or more soft spots in the subbase form. Small isolated potholes can be fixed by hand. Moderate and severe potholes need the use of a grader and more aggregate to be fixed.

Ruts are a surface depression that usually forms in the wheel path of the road. Rutting develops parallel to the road's centerline and can occur anywhere along the width of the driven road surface. Some ruts may be caused by the dislodging of the surface gravel while others occur with the permanent deformation in any of the road layers or subgrade. Repeated vehicle passes over soft spots in the road results in rutting. Poor crown and drainage can weaken the underlying soils and help accelerate the formation of ruts. Significant rutting can destroy a road (Eaton and Beaucham 1992) (Walker, Entine, and Kummer 2002).

2.3.1.5 Surface Defects

Surface defects include dust and loose aggregate. When the road is dry, traffic can create dust. The wear and tear on the gravel roads by the traffic loads will eventually loosen the larger aggregate from the soil binder or the fines. These fines are then picked up by the traffic and become airborne. Dust can create poor visibility for trailing vehicles and is considered an air pollutant. It is important to the replace these fines to maintain the roadway. Most of the time fines can be reclaimed from the shoulder and re-mixed into the existing surface.

Loose aggregate is the result of the wear and tear on the roadway that causes the fines to be lost in the form of dust. When the fines are lost, loose aggregate develops on the surface and/or the shoulder. Generally, the action of the traffic will move the loose gravel to the center or edges of the roadway. Loose aggregate can also form where vehicles tend to turn around or stop. The loose aggregate on the road and the fines from the road's edge may be able to be remixed by a grader to recreate a well graded gravel and be reused (Eaton and Beaucham 1992).

2.4 Dust Control

There are strong reasons to control dust from unpaved roads. The top problem associated with unpaved roads is fugitive dust created by traffic and the loss of fines. Dust is considered as a type of particulate matter air pollution. It can contaminate houses and barns, it settles on vegetation and can reduce visibility over long distances. Dust is usually kicked up into the air by vehicles or blown off the road by wind. Not only is dust present on gravel roads, it is also generated by road construction and is a given at quarries and gravel pits. Also, the more dust that leaves the road surface, the less road surface that will remain. When dust is blown away, aggregates in the road surface loosen which can lead to many types of distresses and costly maintenance or rehabilitation efforts for the road departments as well as higher road user costs in the form of vehicle maintenance (Kuennen 2006) (Addo, Sanders, and Chenard 2004).

Dust is considered a coarse particle (PM-10), that is, dust is made up of particles that are 10 micrometers (microns) or less. Another way look at it is dust particles are about one-seventh of the diameter of a human hair. The EPA has had national air quality standards for PM-10 since 1987. These standards consist of a 24-hour standard not to exceed 150 micrograms per cubic meter of air, and an average standard of 50 micrograms per cubic meter annually (Kuennen 2006).

Scientific studies have linked particulate matter pollution with significant health problems such as:

- Increased respiratory symptoms like irritation of airways, coughing, and difficulty breathing
- Decreased lung function
- Aggravated asthma
- Development of chronic bronchitis
- Irregular heartbeat
- Premature death of people with heart or lung disease

Coughing, wheezing and decreased lung function in healthy individuals can be caused by particle pollution (Kuennen 2006).

The standards for dust exclude dust that occurs due to natural kick-up by the wind. It is not practical or feasible to place regulation on dust caused by the wind. On the other hand, it is possible to manage fugitive dust with dust control measures (Kuennen 2006).

2.4.1 Types of Dust Suppressants

Dust control methods range from spraying the road with chemicals to using geotextiles in the reconstruction of a road. Other efforts may include reduction in vehicular speed and the application of water. The use of dust suppressants is justifiable when traffic is low and paving is not a feasible option financially, the cost of the suppressants and application are low, and when stage construction is planned. The commonly used dust suppressants are water, chloride compounds, lignin derivatives, and resinous adhesives. Performance characteristics as well as the type and volume of traffic, climate, roadway conditions and product cost all play a significant role in selecting a dust suppressant (Addo, Sanders, and Chenard 2004) (Sanders and Addo 1993).

The main idea behind dust suppression is to keep moisture in the surface of the roadway. Moisture keeps the dust particles wet which in turn increases their mass and cohesion. The moisture allows fines in the gravel to adhere to other fines as well as other aggregate in the mix. When the moisture content is sufficient, optimum compaction under the traffic load is achieved (Kuennen 2006).

2.4.1.1 Water

Fresh water or sea water is the oldest dust suppressant used. It is readily available, although in the semiarid West it is a commodity, and applied by spraying onto the road surface. The service capacity of water is limited and temporary due to evaporation. Excess watering may create undesirable runoff, being the cause for potential erosion and excessive mud. Several light applications of water are preferred over one heavy application. Although water may be less expensive as a product, the money saved will be consumed by the frequency of applications and labor costs (Addo, Sanders, and Chenard 2004) (Kuennen 2006).

2.4.1.2 Chloride Compounds

Road managers should consider chloride stabilization as a cost-effective method of dust control and other maintenance applications on gravel roads. Calcium chloride (CaCl) and magnesium chloride (MgCl) are the most commonly used chloride compounds. Sodium chloride (NaCl) is also sparingly used and is the least effective (Addo, Sanders, and Chenard 2004). These chlorides can be used by themselves or combined with other additives to create various types of product.

The desired effect of chloride compounds lies in their physical properties. Chlorides are hydroscopic, which means they can attract and absorb moisture from the atmosphere and retain it for extended periods of time. The result is a road surface that is constantly damp. The chloride properties are closely related to relative humidity and air temperature. A relative humidity of 30 to 40% is the point where calcium chloride and magnesium chloride stop attracting and absorbing moisture from the atmosphere. Also, another characteristic contained in chloride compounds is their low freezing points depending on concentration in a liquid solution. This results in reduced effects from the freeze-thaw cycles and minimized frost heaves, which can cause gravel roads to weaken (Monlux and Mitchell 2006).

Chloride compounds are reasonably simple to use and have additional benefits, such as improved ride, reduced sedimentation in streams, reduced aggregate loss, reduced inhalation hazards, reduced vehicle maintenance, and increased safety. These compounds are water soluble and can be washed out during wet weather cycles (Skorseth and Selim 2005).

2.4.1.3 Lignin Derivatives

Industrial waste products, animal fats, and vegetable oils make up these suppressants. The most common lignin derivative used is ligninsulfonate. Ligninsulfonate is a waste byproduct from the paper milling industry. Some personnel in the field refer to it as "tree sap." It is said that lignin is the natural cement that holds the wood fibers of plants together. When the pulping process occurs, lignin polymers and wood sugars are released into the processing wastewater. The wastewater is referred to as ligninsulfonate. When used as a suppressant, the lignin polymers act as a binder for the soil particles. This keeps the dust particles glued together and they become harder to get airborne. Ligninsulfonate is water soluble and can be washed away during wet weather conditions (Addo, Sanders, and Chenard 2004) (Skorseth and Selim 2005).

2.4.1.4 Resinous Adhesives

These dust suppressants include byproducts from the plastic industry, waste oils, tars, and bitumen. The most widely used products are cutback asphalt and asphalt emulsions. Cutback asphalts are the result of a solvent added to asphalt cement. Different cutbacks are produced based on the type of solvent used. Rapid-curing cutback is the result of using highly volatile solvents such as gasoline or napthal. Medium

and slow-curing cutbacks are created when lighter solvents such as kerosene are used. Asphalt emulsions are created by dispersing asphalts as small droplets of water. This is achieved by adding an emulsifying agent during the process. When resinous adhesives are used as dust suppressants, they create the most durable, dust free surfaces. This is due to their high cohesive properties and their insolubility to water. The use of these products was once popular but the amounts of fuel oil or kerosene in these products along with rising fuel costs has resulted in declined use and is being banned in many places. These products need to be applied by special asphalt application equipment (Addo, Sanders, and Chenard 2004).

Clays have also been used a dust suppressants. Clays have high plasticity and strong cohesion and work well when added to gravel in the right proportions. It is hard to haul and mix clay with gravel due to its high plasticity. For tars and bitumens, the structure and composition of the aggregates is the major factor that affects their cohesion in aggregate-asphalt mixes. A byproduct of soybean oil refining is also used as a dust suppressant. It is biodegradable and has many characteristics of light petroleum based oils. This product will penetrate the surface and create a light bond that reduces dust. There are also many other commercial products that may be used and should be tested on small sections of roadway before full use is decided upon (Skorseth and Selim 2005).

2.5 Dust Collection and Measurement

A majority of the research done with dust measurements has been focused in atmospheric pollution. Within the study of atmospheric pollution, dust measurements focus on two areas: 1) atmospheric modeling and prediction and 2) field measurement and quantification. The three main methods of air sampling techniques used by atmospheric pollution scientists are classified as sedimentation techniques, filtration techniques, and photometric techniques (Sanders and Addo 2000).

The sedimentation technique is a sampling method used for dust particle fallout from the atmosphere. These techniques follow ASTM D 1739 standards. Open-top containers, such as glass, metal, or plastic jars are used in this method. These containers have a height that is two to three times the diameter of the jar. Particulates are collected over an exposure period that is typically a month. The collected amount of particulate is expressed in terms of weight per unit area per 30 days. This technique depends on the forces of gravity and limits the particle size to about $2 \mu m$ or greater. There are a number of disadvantages to this technique as it requires an extended collection period for one sample, contaminated samples caused by foreign matter mixing with the collected dust, and the effect of winds on the samples (Sanders and Addo 2000).

The filtration technique employs the use of a suction source under a filter. The type of filter and the sampling equipment is dependent on the desired data and type of test being performed. An example of device that uses the filtration technique is the high volumetric sampler. The major drawback of this technique is that it requires the use of electric power to run the suction pump (Sanders and Addo 2000).

The photometric technique is based on the absorption properties of particulates passing though a light source. Basically, this technique looks at the light scattering as a sample passes through a light source. The amount of light scattered is dependent on the concentration, size, refractive index, shape, and color of the suspended particles.

The devices and techniques developed to measure road dust employ one or more of these particulate sampling techniques. In 1972, Wellman and Barraclough used the photometric technique to measure dust concentrations at a point along an unpaved road. Research performed by Hoover et al. in 1973 used the sedimentation technique by installing cups on the roadside of unpaved roads to gain data on the nature of dust generation and distribution. In 1984, Langon built a portable cyclone dust collector and mounted it on the rear of dust generating vehicle. The goal of this research was to use the filtration technique over a

section of the road versus one point on the road. In 1986, the USDA Forest Service, in a cooperative study with Irwin et al. at Cornell University, developed a device that measured the road dust in terms of air opacity using photometric techniques. This device was called the Road Dust Monitor (RDM).

Between 1992 and 1995, a Mountain-Plains Consortium and department of transportation sponsored research project was undertaken by Thomas Sander and Jonathan Addo at Colorado State University. One objective of this project was to develop an inexpensive dust measuring device. Due to problems associated with the roadside bucket method of dust collection, a decision was made to develop a device to measure dust production from test sections that mounted on a vehicle and took real-time measurements. Modeling a device similar to the Langdon (1984) device, the Colorado State University Dustometer was created. The device and method were developed to generate quantitative and reproducible measurements that could be used to directly measure the dust mass in the field (Sanders and Addo 2000).

2.6 Cost Effectiveness of RAP Utilization

Recycled asphalt pavement (RAP) has been widely used in the United States since the 1970s and is a major benefit to the asphalt paving industry. The use of RAP allows for a lower mix material cost, elimination of the RAP disposal costs, and removal of a waste product from landfills. There are many additional benefits of using RAP including:

- Recycling material that would otherwise be disposed of at the taxpayers' expense, with a risk of harming the environment if disposed of improperly
- Maintaining original roadway geometrics
- Lowering the initial cost of the pavement by utilizing recycled binder and aggregate, which have a lower cost
- No sacrifice in the mix performance when the RAP is handled and incorporated into the mixture using the proper methods

Recycling asphalt pavements is currently the largest single recycling practice in the United States. In 2002, 30 million tons of RAP were used in hot mix asphalt (HMA) with a savings of over \$300 million, accomplished by lowering material costs for the newly placed asphalt and eliminating the disposal cost of the RAP (Putnam, Aune, and Amirkhanian 2002).

2.7 Section Summary

Recycled asphalt pavement plays a significant role in the recycling world and the highway environment, yet, productive use of this material on gravel roads has remained limited. There is no significant research into the use of RAP on gravel roads, but it has the potential to provide an option in the fight to reduce dust loss and maintain roadway serviceability. Given the large amounts of RAP that is produced in Wyoming and the quantity of gravel roads, there is justification for further research into the use of RAP on gravel roads.

3. DESIGN OF STUDY AND TESTING PROCEDURES

3.1 Introduction

The objective of this research project was to explore the use of Recycled Asphalt Pavement (RAP) in gravel roads to help reduce dust loss while maintaining roadway serviceability. To accomplish this objective, field experiments were constructed in two counties in the state of Wyoming. Laramie County and Johnson County obtained RAP from WYDOT to use on some sections in their unpaved road network. The design of the sections utilizing RAP was developed by the individual county's road and bridge department in conjunction with the WYT² center.

Each section had three monitoring activities performed on them during the summer of 2008. Dust collection was taken using the Colorado State University (CSU) Dustometer. Surface distresses were observed following an established United States Army Corps of Engineers method. Roadway moisture content and wind characteristics were also collected on all sections. Laboratory testing was also performed by WYDOT on the materials used in the test sections. From these activities, the performance of RAP in gravel roads was evaluated.

3.2 Data Collection and Laboratory Testing

3.2.1 CSU Dustometer

Dust monitoring was accomplished using the CSU Dustometer. The Dustometer is a dust collection device that attaches behind the driver side rear wheel of the test vehicle. The Dustometer is an inexpensive moving dust sampler that was developed at CSU by Thomas Sanders and Jonathan Addo. It has been proven to be a quantitative, reproducible, and precise device for dust measurement (Sanders and Addo 1993).

The device consists of a fabricated steel filter box that contains glass microfiber filters; a standard high volumetric suction pump; a steel mounting bracket attached to the bumper of the test vehicle; a flexible hose for connecting the suction pump to the filter box; a gas-powered generator; an on/off switchbox for the suction pump; and a 2001 Chevy Suburban used as a testing vehicle. The steel filter box has an opening facing the rear wheel covered with a 200 μ m mesh sieve screen that prevents large particles from entering the box during collection. The bottom of the filter box opens to allow access to the filter paper, which rests on another 200 μ m mesh sieve screen that is mounted horizontally in the filter box (Morgan, Schaefer, and Sharma 2005). Figure 3.1 shows the CSU Dustometer with the clam shell open. Figures 3.2 and 3.3 show the University of Wyoming test vehicle setup.

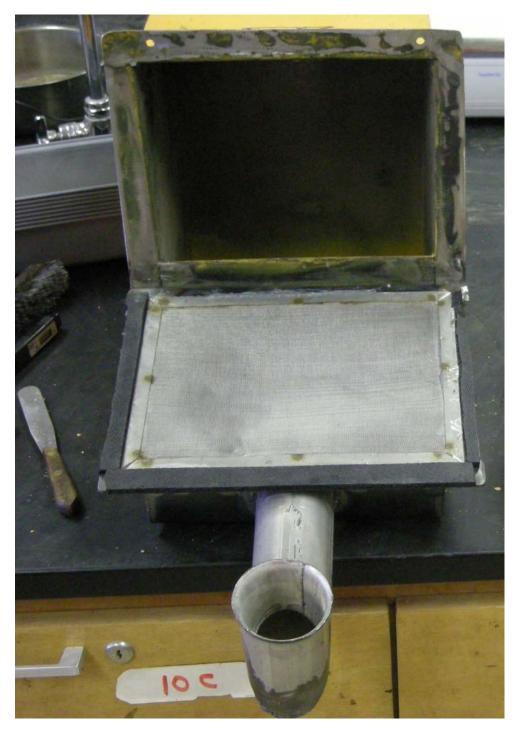


Figure 3.1 CSU Dustometer with Open Filter Box.



Figure 3.2 UW Test Vehicle: 2001 1/2 Ton Chevy Suburban.



Figure 3.3 Complete CSU Dustometer Setup On Test Vehicle.

For each test, the 2001 half-ton Chevy Suburban was run at a test speed of 40 mph (64 km/hr) with a tire pressure of 50 psi (345 kPA) over one-half mile of the test section. Whatman EPM 2000 glass Microfibre filters were used. Dust data were collected by (1) weighing inside a gallon Baggie and recording; (2) setting up the Dustometer and making a run at 40 mph; (3) collecting the filter and sample in original gallon Baggie; and (4) re-weighing the Baggie with sample to find the dust sample weight in grams. All test sections had one dust measurement taken from each direction.

3.2.2 Environmental Factors

Environmental factors were collected on each section every time a dust measurement was taken. These factors include wind speed, wind direction, and surface moisture content. The wind characteristics were collected on site using a hand held compass and wind vane. The WindMate 200 by Speedtech Industries was used to collect this data. Road surface moisture content was collected by scraping off a sample of the road surface using a pick. A depth of no more than one inch (25 mm) was scraped off the surface and collected in a tin can. The tin can was taped off to seal in the moisture and returned to the lab. Each sample was weighed before and after drying, and the moisture content was calculated. Moisture content, wind speed, and wind direction were collected every time a dust measurement was performed.

3.2.3 Distress Survey

Surface distresses of each section were found using the methods presented in *Unsurfaced Road Maintenance Management* by Robert A. Eaton and Ronald E. Beaucham, USACE-CRREL Special Report 92-26, December 1992. A representative subsection of each test section (usually 100 feet) was determined and marked for monitoring. Each subsection was walked and all distresses were record every time field data were collected. The individual distresses were ranked according to the USACE methods, and a total unsurfaced road condition index (URCI) was established. The surface distresses were recorded on a field sheet that was developed by the USACE.

3.2.4 Material Characteristics

Samples of the materials used were collected. These samples were taken to the WYDOT Materials Testing Lab to be properly tested. Various tests were performed on the materials to determine the desired characteristics of a given material. The laboratory testing results were used to describe the materials and their relation to dust loss and surface distresses as described in Section 5.

Samples of RAP and RAP blends from the individual counties were collected from stockpiles using proper sample collection techniques. These samples were bagged, tagged and transferred to the WYDOT Materials Testing Lab in Cheyenne, WY. Lab technicians performed the necessary tests on the RAP and RAP blend materials to find the following characteristics of the material: gradation, R-value, oil percentage, and gradation after extraction of oil.

Samples of virgin aggregate from the individual counties were collected from stockpiles or the pit using proper sample collection techniques. These samples were transferred to the WYDOT Materials Testing Lab. Lab technicians performed the necessary tests on the virgin aggregate to find the following characteristics of the material: gradation, Atterburg Limits, cohesion value, fractured faces, R-value, along with the percentage of gravel, sand silt and clay.

The most important characteristic of the materials used in this research is the gradation of the materials. The percentage of material passing the #200 (0.075 mm) sieve is vital as it is this material that will become the airborne dust that is monitored. The material passing the #200 (0.075 mm) sieve also plays an important role in the binding component of gravel roads, especially when looking at surface distresses.

3.2.5 Traffic Counts

Traffic counts were collected from the individual county's Road and Bridge Department or by the WYT^2 center. Volume, speed, and vehicle classification on the three roads observed in this research project were collected. Traffic counters were in the field for a minimum of 10 days to provide adequate sampling. Traffic counts were taken during the summer months as it is during this time in which drilling, farming, and ranching activities are the most active.

3.3 Laramie County Experiment

The Laramie County Road and Bridge Department and the WYT² Center developed plans to use RAP on two county roads approximately 20 miles north of Cheyenne. Figure 3.4 shows a map of Wyoming with the Laramie County test site marked by a diamond in the southeast corner of the state. A total of five test sections were constructed in April 2008. Three of the sections were on County Road 224, also known as Atlas Road. The other two sections were on County Road 124 also known as Pry Road. The RAP used came from a stockpile near Atlas Road that was milled from nearby I-25. The aggregate used in the existing 100% gravel roadway came from a pit near Atlas Road. An overview of the area for the Laramie County test sites can be found in Figure 3.5.



Figure 3.4 Test Site Locations on State Map of Wyoming.



Figure 3.5 Overview of Laramie County Test Site.

Of the five total test sections in Laramie County, three consisted of blended RAP and gravel while the other two contained 100% gravel to be used as control sections. The RAP blend sections were all blended on site. The construction process consisted of (1) scarifying the existing 100% gravel roadway with a motor grader, (2) hauling and dumping a calculated volumetric depth of pure RAP onto the scarified roadway, (3) blending the RAP and aggregate using the blade on a motor grader, (4) shaping the road with the newly created RAP blend, and (5) letting traffic compact the roadway. No additional dust abatement measures were taken on the test sections.

The results of construction on Atlas Road consisted of three sections: two different RAP blends and one 100% gravel control. One RAP blend section consisted of a volumetric depth of 2½ inches (62.5 mm) of RAP blended with the existing surface. The total length of the section was 0.6 miles, and it was named A2. The other RAP blend section consisted of a volumetric depth of 1½ inches (37.5 mm) of RAP blended with the existing surface. The total length of the section was 0.7 miles, and it was named A1.

Finally, the remaining 0.7 miles of Atlas Road consisted of 100% gravel. This control section was named A0. Figure 3.6 shows the test sections on Atlas Road.



Figure 3.6 Atlas Road Test Sections.

The results of construction on Pry Road consisted of two sections: one RAP blend and one 100% gravel control. The RAP blend section consisted of a volumetric depth of 1½ inches (37.5 mm) of RAP blended with the existing surface. The total length of the section was 0.8 miles, and it was named P1. The 100% gravel control section had a length of 1.2 miles, and was named P0. Figure 3.7 shows the test sections on Pry Road.

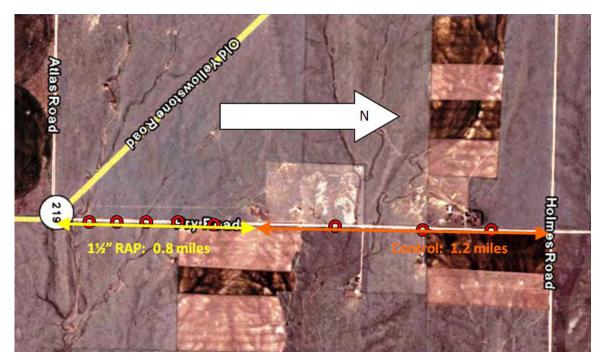


Figure 3.7 Test Sections on Pry Road.

Although each test section in Laramie County was longer than one-half mile, only one-half of a mile was used for testing. The beginning and end of each half mile test section was clearly marked using painted wood stakes in the ditch and brightly colored tape on the fence line. Field data were collected and monitored on each section independently.

3.4 Johnson County Experiment

The Johnson County Road and Bridge Department and the WYT² Center developed plans to use RAP on Schoonover Road approximately 20 miles east of Buffalo, WY. Figure 3.4 above shows a map of the State of Wyoming with the Johnson County test site marked by a star in the northern part of the state. A total of three sections were constructed in June 2008. All three sections were constructed back to back. Two contained RAP blends and the third was a 100% gravel control. The addition of calcium chloride (CaCl) was used on two of the test sections.

The construction process in Johnson County was much different than that in Laramie County. The construction process on Schoonover Road consisted of (1) mixing RAP with virgin aggregate off-site in a pugmill with a 1 to 1 ratio resulting in 50% RAP and 50% virgin aggregate blend; (2) hauling the RAP blend onto site and dumping on the existing roadway; (3) using the blade on a motor grader to spread the RAP blend and shape the roadway; and (4) using a vibratory drum roller to compact the roadway surface.

Two weeks after construction, CaCl was applied to the appropriate sections. This process consisted of (1) wetting the roadway surface using a water truck; (2) spreading CaCl flakes on the wet roadway; (3) making another pass with the water truck; and (4) letting the CaCl leach into the roadway surface as the water dries off. CaCl was applied to one RAP blend section and the rest of the existing 100% gravel road.

The result of construction was three test sections. All the sections had a length of one-half mile. One section was a RAP blend section with no CaCl applied, and it was named S2. Another section was a RAP blend section with CaCl, and it was named S1. Finally, the third section was the 100% gravel with CaCl control section, and it was named S0. A section of 100% gravel without CaCl was not constructed due the heavy traffic experienced on Schoonover Road, especially truck traffic. Field data were collected and monitored on each section independently. Figure 3.8 gives a visual overview of the Johnson County test sections on Schoonover Road.

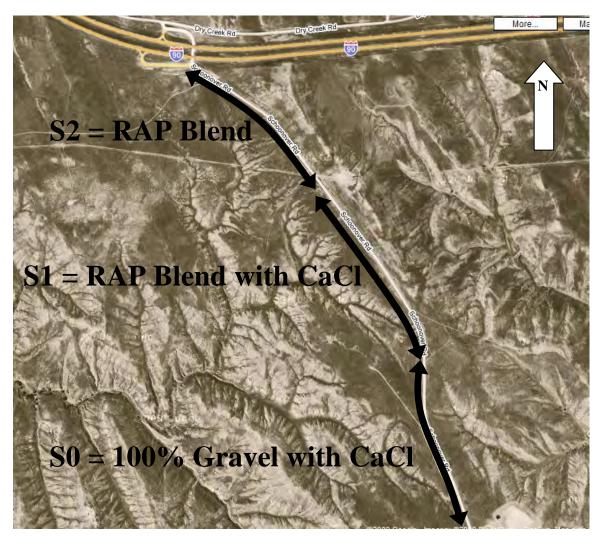


Figure 3.8 Test Sections on Schoonover Road.

3.5 Section Summary

This chapter described the strategies and construction techniques used to evaluate the use of RAP in gravel roads. Each section in this study was monitored independently. The CSU Dustometer was used to collect dust data. A method developed by the USACE was used to evaluate surface distresses. A handheld instrument was used to collect environmental conditions. Surface samples were taken to calculate the moisture content of the roadway. Traffic data were collected by the local agencies and the WYT² Center. Several test sections in two counties in Wyoming were constructed using different techniques for utilizing RAP in gravel roads. These techniques were used to collect the necessary data on each section in order to evaluate the use of RAP in gravel roads.

4. DATA COLLECTION

4.1 Introduction

Field and laboratory data were collected in this research project to evaluate the performance of RAP in gravel roads. The field evaluation was accomplished by observing and collecting data on the test sections constructed in Laramie and Johnson Counties. Traffic data were provided by the individual county or the WYT² Center. Dust measurements, surface surveys, and environmental factors were collected by the WYT² Center.

The laboratory testing of material was conducted by the WYDOT Materials Testing Lab in Cheyenne, WY. Lab technicians performed the necessary tests on the materials to provide the desired characteristics of the material. One of the main purposes of this testing was to provide the gradations of the various materials. The tests performed followed the appropriate AASHTO and ASTM testing procedures. Wyoming modified AASHTO and ASTM testing procedures were used where applicable.

4.2 Material Characteristics

To determine the characteristics of the materials used in this project, lab testing performed by WYDOT was utilized. All materials had a sieve analysis performed to determine the gradation of the material. Materials that contained RAP had different tests than the virgin aggregates due to the nature of the material and the testing. The following sections will break down the results of the lab testing.

4.2.1 Recycled Asphalt Pavement

RAP samples were collected for both Laramie and Johnson Counties. Gradation before and after extraction of the oil was desired, along with the R-value for strength of the material and the percentage of oil in the RAP. Table 4.1 summarizes the laboratory results for the RAP used in Laramie County. Figure 4.1 shows the gradation of the RAP used in Laramie County. No samples of the RAP used in Johnson County were taken as all of the material used was already blended with 100% virgin aggregate. Please refer to Appendix C for the complete data set.

From the laboratory results and gradation, it can be seen that the RAP material has less than 1% of the total material passing the #200 (0.075mm) sieve. Therefore, the amount of fines found in the RAP material is very small. Also, from Figure 4.1 it can be seen that the RAP is well graded. These characteristics make the RAP a suitable addition to gravel roads for reducing dust loss.

Laramie County - Atlas and Pry Roads							
Percent Passing							
Sieve Size	RAP Windrow						
	A2	A1	P1	Average			
2 in. (50.8 mm)	100.0	100.0	100.0	100.0			
1 1/2 in. (38.1 mm)	97.9	99.5	100.0	99.1			
1 in. (25.4 mm)	94.7	97.4	98.3	96.8			
3/4 in. (19.0 mm)	92.3	94.5	95.8	94.2			
1/2 in. (12.7 mm)	80.0	82.3	83.5	81.9			
3/8 in. (9.5 mm)	72.1	74.4	75.8	74.1			
No. 4 (4.75 mm)	44.2	48.0	49.8	47.3			
No. 8 (2.38 mm)	32.5	33.3	29.6	31.8			
No. 16 (1.19 mm)	22.1	21.9	16.9	20.3			
No. 30 (0.595 mm)	13.3	13.3	8.5	11.7			
No. 50 (0.297 mm)	5.9	6.8	3.0	5.2			
No. 100 (0.149 mm)	2.2	2.8	1.0	2.0			
No. 200 (0.075 mm)	0.8	0.9	0.4	0.7			
	Sample A	Sample B	Sample C	Average			
R - Value	76.0	77.0	79.0	77.3			
% Oil	5.85	5.59	5.88	5.77			
	Perce	nt Passing A	fter Oil Extra	action			
Sieve Size	RAP Windrow						
	Sample A	Sample B	Sample C	Average			
3/4 in. (19.0 mm)	100.0	100.0	100.0	100.0			
1/2 in. (12.7 mm)	93.3	91.7	92.3	92.4			
3/8 in. (9.5 mm)	88.4	84.4	88.0	86.9			
No. 4 (4.75 mm)	63.5	60.3	63.9	62.6			
	63.5 47.5	60.3 44.6	63.9 48.3	62.6 46.8			
No. 4 (4.75 mm)							
No. 4 (4.75 mm) No. 8 (2.38 mm)	47.5	44.6	48.3	46.8			
No. 4 (4.75 mm) No. 8 (2.38 mm) No. 16 (1.19 mm)	47.5 36.3	44.6 33.9	48.3 36.5	46.8 35.6			
No. 4 (4.75 mm) No. 8 (2.38 mm) No. 16 (1.19 mm) No. 30 (0.595 mm)	47.5 36.3 27.8	44.6 33.9 25.9	48.3 36.5 27.6	46.8 35.6 27.1			

 Table 4.1 Laramie County Recycled Asphalt Pavement Lab Results

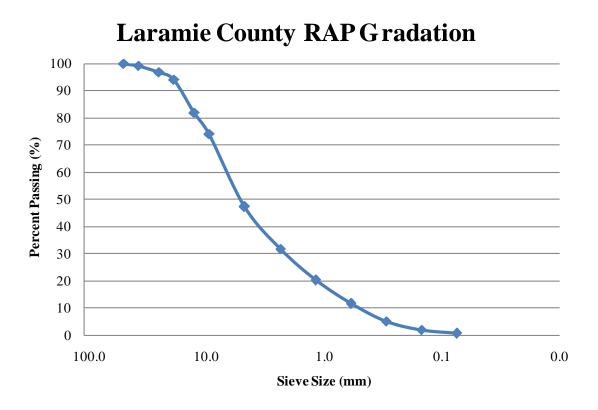


Figure 4.1 Gradation of RAP Material Used in Laramie County.

4.2.2 Virgin Aggregate

Virgin aggregate samples were collected for both Laramie County and Johnson County. Gradation, Atterburg Limits, cohesion value, fractured faces, R-value, percentage of gravel, sand, silt, and clay were determined. Table 4.2 summarizes the lab results for the virgin aggregate used in Laramie County and Table 4.3 summarizes the lab results for the virgin aggregate used in Johnson County. Figure 4.2 contains the gradations of the gravel used in Laramie and Johnson Counties. Please refer to Appendix C for the complete data set.

Laramie County - Atlas and Pry Roads							
	Percent Passing						
Sieve Size	100 % Gravel Control						
	Atlas	Pry	Average				
1 1/2 in. (38.1 mm)	100.0	100.0	100.0				
1 in. (25.4 mm)	99.8	99.4	99.6				
3/4 in. (19.0 mm)	99.4	98.6	99.0				
1/2 in. (12.7 mm)	97.6	96.4	97.0				
3/8 in. (9.5 mm)	95.3	93.7	94.5				
No. 4 (4.75 mm)	78.1	76.1	77.1				
No. 8 (2.38 mm)	65.1	65.1	65.1				
No. 16 (1.19 mm)	54.8	57.7	56.2				
No. 30 (0.595 mm)	45.2	49.7	47.4				
No. 50 (0.297 mm)	35.4	40.1	37.7				
No. 100 (0.149 mm)	29.3	32.7	31.0				
No. 200 (0.075 mm)	22.4	23.6	23.0				
	Atlas	Pry	Average				
Liquid Limit (LL)	26.5	27.0	26.8				
Plasticity Index (PI)	11.5	11.0	11.3				
Cohesion Value (CV) psi	340.5	164.0	252.3				
Fractured Faces (FF) %	-	Insuffcient Materi	al				
R - Value	30.0	26.0	28.0				
% Gravel	0.3	0.0	0.2				
% Sand	62.4	60.2	61.3				
% Silt	23.2	26.5	24.9				
% Clay	14.2	13.8	14.0				

 Table 4.2
 Laramie County 100%
 Gravel Laboratory Results

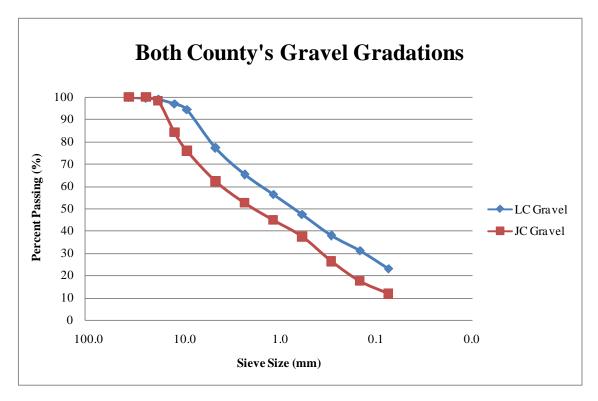


Figure 4.2 Gradations of Gravel Used in Laramie and Johnson Counties.

The gravel used in Laramie County has two times more material passing the #200 (0.075mm) sieve than the gravel in Johnson County. This would imply that the Laramie County test sections were expected to have more dust loss than Johnson County test sections as there was more available material to become airborne. Also, the percentage of fine material in the gravel used in Laramie County is much greater than the percentage of fine material in the RAP used in Laramie County by almost 200%.

Johnson County - Schoonover Road								
Percent Passing								
Sieve Size	S	Stockpiled Virgin Aggregate						
	Sample A	Sample B	Sample C	Average				
1 1/2 in. (38.1 mm)	100.0	100.0	100.0	100.0				
1 in. (25.4 mm)	100.0	100.0	99.8	99.9				
3/4 in. (19.0 mm)	98.0	98.4	98.0	98.1				
1/2 in. (12.7 mm)	83.5	86.0	82.5	84.0				
3/8 in. (9.5 mm)	75.7	77.7	73.8	75.7				
No. 4 (4.75 mm)	62.1	63.7	60.6	62.1				
No. 8 (2.38 mm)	50.5	53.9	52.8	52.4				
No. 16 (1.19 mm)	42.8	46.0	45.5	44.8				
No. 30 (0.595 mm)	35.8	38.2	38.0	37.3				
No. 50 (0.297 mm)	25.7	26.4	26.3	26.1				
No. 100 (0.149 mm)	17.0	17.4	17.4	17.3				
No. 200 (0.075 mm)	11.5	11.3	12.0	11.6				
	Sample A	Sample B	Sample C	Average				
Liquid Limit (LL)	NV	NV	NV	NV				
Plasticity Index (PI)	NP	NP	NP	NP				
Cohesion Value (CV) psi	517.0	400.0	420.0	445.7				
Fractured Faces (FF) %	89.1	91.6	90.2	90.3				
R - Value	74.0	79.0	71.0	74.7				
% Gravel	0.0	0.3	0.4	0.2				
% Sand	75.3	72.1	78.8	75.4				
% Silt	18.7	21.4	14.9	18.3				
% Clay	6.0	6.2	5.9	6.0				

 Table 4.3 Johnson County 100% Virgin Aggregate Laboratory Results

4.2.3 RAP Blend

RAP blend samples were collected for both Laramie County and Johnson County. Gradation before and after extraction of the oil were desired along with the R-value for strength of the material and the percentage of oil in the RAP blend. Table 4.4 summarizes the lab results for the RAP blend used in Laramie County and Table 4.5 summarizes the lab results for the RAP blend used in Johnson County. Figure 4.3 contains the gradations of the RAP blends used in Laramie and Johnson Counties. Please refer to Appendix C for the complete data set.

Laramie	e County -	Atlas and F	Pry Roads				
Percent Passing							
Sieve Size	RAP Blended Surface						
	A2	A1	P1	Average			
3 in. (76.2 mm)	100.0	100.0	100.0	100.0			
2 in. (50.8 mm)	100.0	99.5	100.0	99.8			
1 1/2 in. (38.1 mm)	100.0	99.5	100.0	99.8			
1 in. (25.4 mm)	98.4	98.8	99.2	98.8			
3/4 in. (19.0 mm)	96.8	97.7	98.2	97.6			
1/2 in. (12.7 mm)	88.1	88.3	91.8	89.4			
3/8 in. (9.5 mm)	81.6	81.7	86.5	83.3			
No. 4 (4.75 mm)	54.8	56.3	62.9	58.0			
No. 8 (2.38 mm)	33.8	42.5	50.2	42.2			
No. 16 (1.19 mm)	19.7	31.5	38.7	30.0			
No. 30 (0.595 mm)	10.9	21.8	27.0	19.9			
No. 50 (0.297 mm)	5.1	13.1	15.4	11.2			
No. 100 (0.149 mm)	2.3	7.0	7.4	5.6			
No. 200 (0.075 mm)	1.0	2.9	2.7	2.2			
	A2	A1	P1	Average			
R - Value	78.0	73.0	78.0	76.3			
% Oil	4.18	4.61	4.07	4.29			
	Perce	Percent Passing After Oil Extraction					
Sieve Size		RAP Blend	led Surface				
	A2	A1	P1	Average			
1 in. (25.4 mm)	100.0	100.0	100.0	100.0			
3/4 in. (19.0 mm)	99.4	99.7	100.0	99.7			
1/2 in. (12.7 mm)	92.4	92.8	97.4	94.2			
3/8 in. (9.5 mm)	89.1	87.0	92.7	89.6			
No. 4 (4.75 mm)	67.9	65.4	74.3	69.2			
No. 8 (2.38 mm)	53.9	51.3	58.7	54.6			
No. 16 (1.19 mm)	42.6	40.5	45.8	43.0			
No. 30 (0.595 mm)	33.6	31.7	34.9	33.4			
No. 50 (0.297 mm)	24.8	23.3	25.0	24.4			
No. 100 (0.149 mm)	17.4	16.1	17.6	17.0			
No. 200 (0.075 mm)	11.3	10.4	12.0	11.2			

 Table 4.4
 Laramie County RAP Blend Lab Results

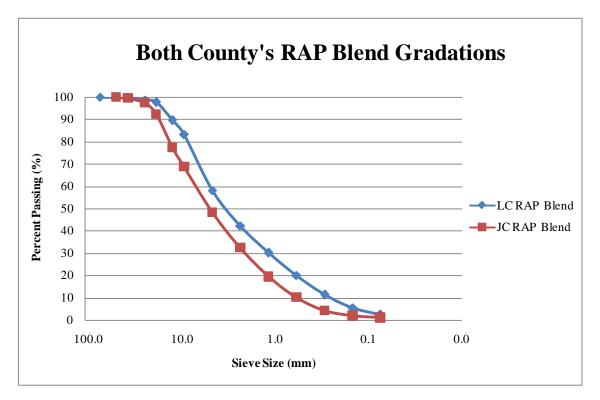


Figure 4.3 Gradations of RAP Blend Used in Laramie and Johnson Counties.

The percentage of RAP blend material that passed the #200 (0.075mm) sieve was greater for Laramie County compared with Johnson County by 220%. This suggests that the RAP blended sections in Laramie County should have more dust loss than those in Johnson County.

Johnso	on County	- Schoonov	er Road				
	Percent Passing						
Sieve Size	RAP Virgin Blend						
	Sample A	Sample B	Sample C	Average			
2 in. (50.8 mm)	100	100	100	100			
1 1/2 in. (38.1 mm)	99.5	100.0	99.4	99.6			
1 in. (25.4 mm)	97.0	98.5	96.5	97.3			
3/4 in. (19.0 mm)	91.8	94.4	90.8	92.3			
1/2 in. (12.7 mm)	76.6	80.2	74.7	77.2			
3/8 in. (9.5 mm)	68.1	71.6	66.1	68.6			
No. 4 (4.75 mm)	48.4	48.9	47.4	48.2			
No. 8 (2.38 mm)	36.0	28.2	33.1	32.4			
No. 16 (1.19 mm)	23.3	14.0	20.9	19.4			
No. 30 (0.595 mm)	12.5	6.8	11.0	10.1			
No. 50 (0.297 mm)	4.8	3.5	4.5	4.3			
No. 100 (0.149 mm)	1.8	1.9	1.8	1.8			
No. 200 (0.075 mm)	0.7	1.5	0.8	1.0			
	Sample A	Sample B	Sample C	Average			
R - Value	78.0	79.0	80.0	79.0			
R - Value % Oil	78.0 2		80.0 2.15	79.0 2.2			
	2	79.0 2.4		2.2			
	2	79.0 2.4	2.15 fter Oil Extra	2.2			
% Oil	2	79.0 2.4 nt Passing A	2.15 fter Oil Extra	2.2			
% Oil	2 Perce	79.0 2.4 nt Passing A <i>RAP Virg</i>	2.15 fter Oil Extra gin Blend	2.2 action			
% Oil Sieve Size	2 Perce Sample A	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B	2.15 fter Oil Extra gin Blend Sample C	2.2 action Average			
% Oil Sieve Size 1 in. (25.4 mm)	2 Perce Sample A 100.0	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0	2.15 fter Oil Extra gin Blend Sample C 100.0	2.2 action Average 100.0			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm)	2 Perce Sample A 100.0 100.0	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0 98.2	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3	2.2 action Average 100.0 98.5			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm) 1/2 in. (12.7 mm)	2 Perce Sample A 100.0 100.0 83.7	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0 98.2 80.6	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3 78.7	2.2 action Average 100.0 98.5 81.0			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm) 1/2 in. (12.7 mm) 3/8 in. (9.5 mm)	2 Perce Sample A 100.0 100.0 83.7 76.5	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0 98.2 80.6 73.3	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3 78.7 78.7	2.2 action Average 100.0 98.5 81.0 76.2			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm) 1/2 in. (12.7 mm) 3/8 in. (9.5 mm) No. 4 (4.75 mm)	2 Perce Sample A 100.0 100.0 83.7 76.5 56.9	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0 98.2 80.6 73.3 55.9	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3 78.7 78.7 53.3	2.2 action Average 100.0 98.5 81.0 76.2 55.4			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm) 1/2 in. (12.7 mm) 3/8 in. (9.5 mm) No. 4 (4.75 mm) No. 8 (2.38 mm)	2 Perce Sample A 100.0 100.0 83.7 76.5 56.9 46.7	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0 98.2 80.6 73.3 55.9 47.9	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3 78.7 78.7 53.3 45.2	2.2 action Average 100.0 98.5 81.0 76.2 55.4 46.6			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm) 1/2 in. (12.7 mm) 3/8 in. (9.5 mm) No. 4 (4.75 mm) No. 8 (2.38 mm) No. 16 (1.19 mm)	2 Perce Sample A 100.0 100.0 83.7 76.5 56.9 46.7 34.7	79.0 2.4 nt Passing A <i>RAP Virg</i> Sample B 100.0 98.2 80.6 73.3 55.9 47.9 38.5	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3 78.7 78.7 53.3 45.2 35.5	2.2 action Average 100.0 98.5 81.0 76.2 55.4 46.6 36.2			
% Oil Sieve Size 1 in. (25.4 mm) 3/4 in. (19.0 mm) 1/2 in. (12.7 mm) 3/8 in. (9.5 mm) No. 4 (4.75 mm) No. 8 (2.38 mm) No. 16 (1.19 mm) No. 30 (0.595 mm)	2 Perce Sample A 100.0 100.0 83.7 76.5 56.9 46.7 34.7 24.6	79.0 2.4 nt Passing A RAP Virg Sample B 100.0 98.2 80.6 73.3 55.9 47.9 38.5 29.0	2.15 fter Oil Extra gin Blend Sample C 100.0 97.3 78.7 78.7 53.3 45.2 35.5 25.6	2.2 action Average 100.0 98.5 81.0 76.2 55.4 46.6 36.2 26.4			

 Table 4.5
 Johnson County RAP Blend Lab Results

4.2.4 Material Comparison to WYDOT Gradation Requirements

Table 4.6 contains a summary of the materials used in the test sections. Table 4.6 also contains the gradation requirements for gravel roads (Grading GR) from the WYDOT *Standard Specifications for Road and Bridge Construction, 2003 Edition.* The gradations of the RAP blends consist of the materials after the oil was chemically extracted. The RAP blends after chemical extraction in both counties are within specifications for WYDOT Grading GR, except that the one-half inch (12.7mm) material in Laramie County is a little high. This has no particular influence on dust loss or road serviceability as it the material smaller than the #4 (4.75 mm) sieve that is important. The gravel used in Johnson County meets the Grading GR specifications with the exception of the #30 (0.595mm) material having 37.3%, passing while the high end of the specifications with the majority of the materials not falling within the specification range. This is important when looking at the fines, especially the #200 (0.075mm) sieve, because there is more material available to be lost as dust. This will lead to more dust loss in Laramie County compared with Johnson County.

·		Р	ercent Passin	g	
Sieve Size	Laramie County Gravel	Laramie County RAP Blend After Extraction	Johnson County Gravel	Johnson County RAP Blend After Extraction	WYDOT Grading GR
1 1/2 in. (38.1 mm)	100.0	100.0	100.0	100.0	
1 in. (25.4 mm)	99.6	100.0	99.9	100.0	100.0
3/4 in. (19.0 mm)	99.0	99.7	98.1	98.5	90 to 100
1/2 in. (12.7 mm)	97.0	94.2	84.0	81.0	65 to 85
3/8 in. (9.5 mm)	94.5	89.6	75.7	76.2	
No. 4 (4.75 mm)	77.1	69.2	62.1	55.4	50 to 78
No. 8 (2.38 mm)	65.1	54.6	52.4	46.6	37 to 67
No. 16 (1.19 mm)	56.2	43.0	44.8	36.2	
No. 30 (0.595 mm)	47.4	33.4	37.3	26.4	13 to 35
No. 50 (0.297 mm)	37.7	24.4	26.1	17.3	
No. 100 (0.149 mm)	31.0	17.0	17.3	10.6	
No. 200 (0.075 mm)	23.0	11.2	11.6	6.7	4 to 15

Table 4.6 Summary of Gradations and WYDOT Grading GR Specifications

4.2.5 Materials on the Test Sections

Table 4.7 gives the gradations of the roadway surfaces that were used in both counties. Both Laramie and Johnson County had test sections with 100% gravel and RAP blends. The gradations of the RAP blended material are before chemical extraction of the oil was performed. The amount of material passing the #200 (0.075mm) sieve for the gravel used in Laramie County is twice as much as that in Johnson County. This also holds true for the RAP blended sections. The result will be more material available to be lost as dust in Laramie County than in Johnson County. Also, the amount of fines in the RAP blends is minimal as there is asphalt cement within the blend that is binding the materials together and making the blend suitable for application on gravel roads.

		Passing			
Sieve Size	Laramie County Gravel	Laramie County RAP Blend	Johnson County Gravel	Johnson County RAP Blend	
3 in. (76.2 mm)	100.0	100.0	100.0	100.0	
2 in. (50.8 mm)	100.0	99.8	100.0	100.0	
1 1/2 in. (38.1 mm)	100.0	99.8	100.0	99.6	
1 in. (25.4 mm)	99.6	98.8	99.9	97.3	
3/4 in. (19.0 mm)	99.0	97.6	98.1	92.3	
1/2 in. (12.7 mm)	97.0	89.4	84.0	77.2	
3/8 in. (9.5 mm)	94.5	83.3	75.7	68.6	
No. 4 (4.75 mm)	77.1	58.0	62.1	48.2	
No. 8 (2.38 mm)	65.1	42.2	52.4	32.4	
No. 16 (1.19 mm)	56.2	30.0	44.8	19.4	
No. 30 (0.595 mm)	47.4	19.9	37.3	10.1	
No. 50 (0.297 mm)	37.7	11.2	26.1	4.3	
No. 100 (0.149 mm)	31.0	5.6	17.3	1.8	
No. 200 (0.075 mm)	23.0	2.2	11.6	1.0	

Table 4.7 Comparison of the Materials on the Test Sections

4.3 Dust Measurement, Moisture Content, Wind Speed, Wind Direction

Dust measurements were collected using the CSU Dustometer. Every time a dust measurement was taken the moisture content of the road surface was collected. Wind speed and direction were also collected with each run of the Dustometer using a hand held wind vane and compass. Table 4.8 gives a sample of the dust, moisture content, and wind data collected for the Laramie County test sections.

Table 4.9 presents a sample of the dust, moisture content, and wind data collected for the Johnson County test sections. Please refer to Appendix A for the complete set of collected data.

	Laramie County Dust, Moisture, and Wind Data								
#	Test Section	Date of Sample	Time of Sample	Wind (mph)	1 mi. Dust Wt. (g)	Moisture Content (%)			
1	Atlas Road - A2 (2 1/2" RAP)	6/9/2008	7:55 AM	20 W	1.82	2.044			
2	Atlas Road - A1 (1 1/2" RAP)	6/9/2008	8:10 AM	20 W	6.20	0.991			
3	Atlas Road - A0 (100% Gravel)	6/9/2008	8:25 AM	20 W	5.78	2.591			
4	Pry Road - P1 (1 1/2" RAP)	6/9/2008	8:30 AM	20 W	0.64	2.105			
5	Pry Road - P0 (100% Gravel)	6/9/2008	8:35 AM	20 W	0.38	2.549			
6	Atlas Road - A2 (2 1/2" RAP)	6/17/2008	7:25 AM	10 W	3.86	0.477			
7	Atlas Road - A1 (1 1/2" RAP)	6/17/2008	7:30 AM	10 W	6.52	0.645			
8	Atlas Road - A0 (100% Gravel)	6/17/2008	7:40 AM	10 W	3.76	1.029			
9	Pry Road - P1 (1 1/2" RAP)	6/17/2008	7:45 AM	10 W	0.88	0.767			
10	Pry Road - P0 (100% Gravel)	6/17/2008	7:50 AM	10 W	0.92	1.314			
11	Atlas Road - A2 (2 1/2" RAP)	6/24/2008	7:10 AM	10 WNW	2.40	6.362			
12	Atlas Road - A1 (1 1/2" RAP)	6/24/2008	7:20 AM	10 WNW	1.58	3.385			
13	Atlas Road - A0 (100% Gravel)	6/24/2008	7:30 AM	10 WNW	2.40	5.044			
14	Pry Road - P1 (1 1/2" RAP)	6/24/2008	7:35 AM	10 WNW	2.34	4.936			
15	Pry Road - P0 (100% Gravel)	6/24/2008	7:40 AM	10 WNW	5.84	5.523			
16	Atlas Road - A2 (2 1/2" RAP)	7/11/2008	7:40 AM	15 W	2.20	0.736			
17	Atlas Road - A2 (2 1/2" RAP)	7/28/2008	8:45 AM	16 WNW	0.76	0.662			
18	Atlas Road - A1 (1 1/2" RAP)	7/28/2008	8:40 AM	20 W	0.42	0.777			
19	Atlas Road - A0 (100% Gravel)	7/28/2008	8:30 AM	20 WNW	0.96	1.193			
20	Pry Road - P1 (1 1/2" RAP)	7/28/2008	9:15 AM	11 WNW	0.64	0.605			

 Table 4.8
 Sample of Dust, Wind, and Moisture Data Collected in Laramie County

Table 4.9 Sample of Dust, Wind, and Moisture Data Collected in Johnson County

	Johnson County Dust, Moisture Content, and Wind Data							
#	Test Section	Date of Sample	Time of Sample	Wind (mph)	1 mi. Dust Wt. (g)	Moisture Content (%)		
1	Section 1 & 2 of RAP (no dust abatement)	6/9/2008	2:15 PM	10 NNW	1.50	2.117		
2	Section 1 & 2 of RAP (no dust abatement)	6/11/2008	9:05 AM	10 NNW	0.77	1.904		
3	Section 1 & 2 of RAP (no dust abatement)	6/17/2008	12:45 PM	10 NNW	1.84	0.316		
4	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/14/2008	12:45 PM	15 NNW	1.08	1.657		
5	Schoonover Road - S2 (RAP Blend)	7/28/2008	4:00 PM	5 N	0.54	0.348		
6	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/28/2008	4:10 PM	5 N	0.26	1.692		
7	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/28/2008	4:20 PM	5 N	0.46	1.282		
8	Schoonover Road - S2 (RAP Blend)	7/28/2008	4:35 PM	5 N	0.54	0.348		
9	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/28/2008	4:30 PM	5 N	0.48	1.692		
10	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/28/2008	4:25 PM	5 N	1.04	1.282		
11	Schoonover Road - S2 (RAP Blend)	7/29/2008	9:45 AM	0	0.86	0.504		
12	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/29/2008	9:50 AM	0	0.48	1.569		
13	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/29/2008	9:55 AM	0	1.52	1.741		
14	Schoonover Road - S2 (RAP Blend)	7/29/2008	9:40 AM	0	0.50	0.504		
15	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/29/2008	9:30 AM	0	0.50	1.569		
16	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/29/2008	9:20 AM	0	1.36	1.741		
17	Schoonover Road - S2 (RAP Blend)	8/6/2008	3:20 PM	3 N	0.64	0.331		
18	Schoonover Road - S1 (RAP Blend w/ CaCl)	8/6/2008	3:15 PM	4 NE	0.28	1.297		
19	Schoonover Road - S0 (100% Gravel w/ CaCl)	8/6/2008	3:10 PM	3 NE	0.98	0.698		
20	Schoonover Road - S2 (RAP Blend)	8/6/2008	2:40 PM	6 NE	0.36	0.331		

4.4 Surface Distresses

Surface distresses of each section were recorded following the USACE methods. A distress survey for each section was completed every day in which dust measurements were collected. If dust was being collected on two consecutive days, then only one surface distress survey was performed as the conditions would not drastically change overnight unless thunderstorms passed through during the night. The individual distresses on a given section were used to create an Unsurfaced Road Condition Index (URCI). The URCI gave an overall condition of the roadway. Figure 4.4 summarizes the URCI of the Laramie County test sections throughout the summer of 2008. Figure 4.5 shows the URCI of the Johnson County test sections throughout the summer of 2008.

Notice that a threshold value of 50 was used to determine if a given section was failing or not. By the end of the summer, section S0 in Johnson County was failing due to large amounts of loose aggregate and rutting. Please refer to Appendix B for the complete data set of condition indices and distresses.

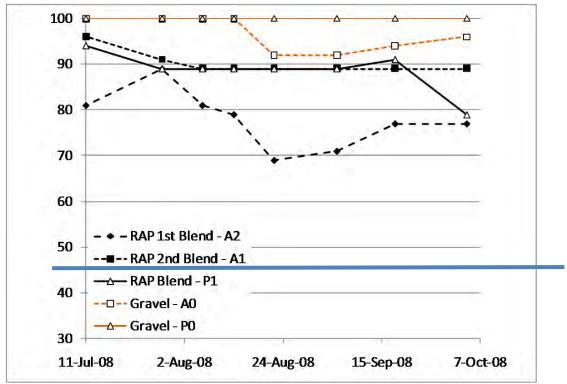


Figure 4.4 Laramie County Overall URCI

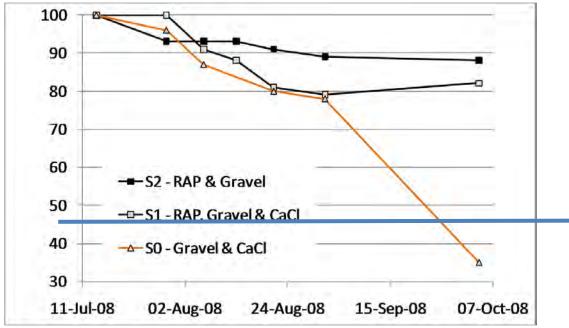


Figure 4.5 Johnson County Overall URCI69

4.5 Traffic Counts

Traffic data was collected on all of the roads used in this study. Traffic volume, speed, and class were collected using road tubes. This data were collected by the individual county's road and bridge department or by the WYT² center. Traffic data were collected for at least 10 days to get a representative sample. Tables 4.10 and 4.11 summarize the traffic data for Atlas and Pry Roads in Laramie County. Table 4.12 summarizes the traffic data for Schoonover Road in Johnson County.

The traffic on Atlas and Pry Roads in Laramie County was very similar. Speeds, volumes, and vehicle classifications were essentially the same for both of these roads. Since the difference in traffic is negligible, the test sections on Atlas and Pry Roads can be compared without worrying about the effect of traffic being different on the two roads.

The traffic data in Laramie County are significantly different than the traffic data collected in Johnson County. Traffic volumes and vehicle classifications are highly varied between the two counties. The test sections in Johnson County experienced more traffic volume than the test sections in Laramie County. An average of 25 vehicles per day drove on the test sections in Laramie County and an average of 237 vehicles per day drove on the test sections in Johnson County. Furthermore, the traffic in Johnson County had significantly more trucks compared with the traffic in Laramie County. Schoonover Road in Johnson County experienced 74% trucks compared with an average of 3% on Atlas Road and 12% on Pry Road in Laramie County. The majority of the trucks on Schoonover Road were classed as either 2-Axle Long or 2-Axle 6 Tire. The difference in traffic among the counties would play a role in the condition indices of the test sections within the two counties.

	Traffic	Volume		Vehicle Cla	assification	85th percentile Speed (MPH)		
	Direction 1	Direction 2	Direc	Direction 1 D		tion 2	Direction 1	Direction 2
	Cars & Trucks	Cars & Trucks	Cars	Trucks	Cars	Trucks	Cars & Trucks	Cars & Trucks
Fri 9/5/2008	23	25	23	0	25	0	52	58
Sat 9/6/2008	21	22	19	2	21	1	54	60
Sun 9/7/2008	26	22	26	0	21	1	56	55
Mon 9/8/2008	22	21	22	0	21	0	59	57
Tue 9/9/2008	34	32	33	1	31	1	54	52
Wed 9/10/2008	20	19	19	1	19	0	53	61
Thu 9/11/2008	28	24	28	0	24	0	53	59
Fri 9/12/2008	21	19	21	0	19	0	50	50
Sat 9/13/2008	26	23	26	0	23	0	51	54
Sun 9/14/2008	26	25	23	3	24	1	55	56
Mon 9/15/2008	32	30	30	2	28	2	55	58
Tue 9/16/2008	34	33	33	1	32	1	55	55
Wed 9/17/2008	23	25	23	0	24	1	56	59
Thu 9/18/2008	37	27	35	2	25	2	51	58
Fri 9/19/2008	26	30	25	1	28	2	55	55
Sat 9/20/2008	26	25	24	2	23	2	54	57
Sun 9/21/2008	26	19	26	0	19	0	54	53
Mon 9/22/2008	25	22	25	0	22	0	51	56
Average	26.4	24.6	25.6	0.8	23.8	0.8	53.8	56.3
	Directional Di	stribution (%)		Percent of V	Vehicles (%)		
52		48	97	3	97	3		

 Table 4.10
 Laramie County Atlas Road Traffic Data

	Traffic	Traffic Volume			assification	85th percentile Speed (MPH)		
	Direction 1	Direction 2	Direc	ction 1	Direc	tion 2	Direction 1 Direction 2	
	Cars & Trucks	Cars & Trucks	Cars	Trucks	Cars	Trucks	Cars & Trucks	Cars & Trucks
Fri 9/5/2008	25	42	23	2	20	22	55	47
Sat 9/6/2008	21	16	19	2	15	1	61	57
Sun 9/7/2008	16	13	16	0	13	0	56	61
Mon 9/8/2008	24	19	22	2	18	1	55	54
Tue 9/9/2008	31	19	30	1	19	0	59	51
Wed 9/10/2008	35	51	31	4	34	17	55	55
Thu 9/11/2008	32	44	32	0	31	13	56	58
Fri 9/12/2008	21	15	21	0	15	0	55	56
Sat 9/13/2008	21	17	20	1	17	0	53	54
Sun 9/14/2008	27	16	27	0	16	0	57	58
Mon 9/15/2008	27	24	26	1	24	0	57	56
Tue 9/16/2008	28	23	26	2	22	1	58	54
Wed 9/17/2008	24	19	21	3	17	2	59	58
Average	25.5	24.5	24.1	1.4	20.1	4.4	56.6	55.3
	Directional Di	istribution (%)		Percent of V	Vehicles (%	5)		
	51	49	94.5	5.5	82	18		

 Table 4.11
 Laramie County Pry Road Traffic Data

Date	24-Hour Combined
Date	Traffic Volume
Tue, 6/10/2008	275
Wed, 6/11/2008	261
Thu, 6/12/2008	240
Fri, 6/13/2008	275
Mon, 6/16/2008	266
Tue, 6/17/2008	270
Wed, 6/18/2008	276
Thu, 6/19/2008	247
Fri, 6/20/2008	151
Mon, 6/23/2008	225
Tue, 6/24/2008	230
Wed, 6/25/2008	264
Thu, 6/26/2008	176
Fri, 6/27/2008	136
Mon, 6/30/2008	262
Average	236.93
Standard Deviation	46.21
85th Percentile	51.4
Speed (MPH)	J1.4
Maximum Speed	05 1
(MPH)	85.1

 Table 4.12
 Johnson County Schoonover Road Traffic Data

Vehicle Classification					
Class Count Percent					
Cars	114	2.9%			
Pickups	914	23.0%			
Trucks	2944	74.1%			
Overall ADT	188.0				

Vehicle Classification Breakdown				
Class	Count	Percent		
Cars & Trailer	114	2.9%		
2 Axle Long	914	23.0%		
Buses	49	1.2%		
2 Axle 6 Tire	1857	46.8%		
3 Axle Single	301	7.6%		
4 Axle Single	9	0.2%		
< 5 Axle	285	7.2%		
5 Axle Double	337	8.5%		
>6 Axle	95	2.4%		
<6 Axle Multi	0	0.0%		
6 Axle Multi	2	0.1%		

4.6 Section Summary

In this section, the collected field data as well as the laboratory results were presented. Dust, moisture content, wind speed, and wind direction were collected on every test section. The URCI produced from surface distress surveys on each test section was used to evaluate the performance of the test sections throughout the testing period. None of the test sections in Laramie County were considered as failing. One test section in Johnson County, gravel with CaCl, was considered failing by the end of the 2008 summer due to a URCI below 50. Traffic data were also collected on the three roads used in this study. The volumes of traffic between the two counties were significantly different. Schoonover Road in Johnson County experienced much heavier traffic volumes than two roads in Laramie County and it saw 74% trucks.

Samples of the materials used in this research were tested by the WYDOT Materials Testing Laboratory to determine the material characteristics. It was found that the gravel used in Laramie County had much more material passing the #200 (0.075mm) sieve compared with the gravel used in Johnson County. This trend also held true for the RAP blends used in each county. In the following chapter, a statistical analysis on the collected data is presented

5. DATA ANALYSIS

5.1 Introduction

Following the data collection described in the previous chapter, preliminary and statistical analyses were performed on the data. The preliminary analysis involved visually inspecting plots of data to identify relationships that may be present in the data. Dust data were plotted against age, moisture content, and wind speed to detect possible relationships among the variables. These preliminary analyses were performed to gain an understanding of the behavior of data.

Statistical software was used to analyze the collected data. This analysis used statements within the general linear model (GLM) procedures to contrast groups of data. Using the contrast values, it could be determined what group of data was dominating the contrast. This technique allowed for more than one section to be in a given group allowing for comparisons to be made on more than a one-to-one basis. The groupings included sections containing the following characteristics: Laramie County, Johnson County, RAP, no RAP, calcium chloride (CaCl), and no CaCl.

A second statistical analysis was performed where the data was broken down by county as the test sections in both counties were constructed using different techniques. This analysis involved a sectional analysis of the test sections where individual test sections were compared with each other on a one-to-one basis. The test sections were compared using dust, Unsurfaced Road Condition Index (URCI), and surface distress data. Attempts at creating a model for predicting dust loss based on the collected data were made. This chapter describes the preliminary and statistical analyses used to evaluate the collected data. The analyses performed used Microsoft Excel and SAS 9.2 for Windows. The SAS code and results can be found Appendix D.

A general cost comparison analysis was also performed. The goal of this analysis was to evaluate the costs of using RAP and other dust suppressants in gravel roads. Furthermore, this analysis was performed to give agencies an idea of the cost effectiveness of using RAP in gravel roads.

5.2 Preliminary Analysis

Visual inspection of the collected data was performed to detect any relationships found in the data. Dust was plotted against age, moisture content, and wind speed to help understand the behavior of the data. The data was broken down by county and test section to perform this analysis.

5.2.1 Dust vs. Age

One relationship that was desired to analyze data behavior was dust loss versus age. In general, as a test section aged the dust loss decreased. As more dust is lost, there is less dust available to be removed from the section. When all of the dust data from Johnson County is plotted against the age of the test sections, there is a general decline in dust loss with time. The same general decrease holds true for the Laramie County data. Figures 5.1 and 5.2 show the dust versus age plots for Johnson and Laramie Counties, respectively. The decrease in dust with age also holds true for all of the individual sections within the counties. The plots for the individual sections can be found in Appendix A. Although this relationship can be visually seen, further research will be needed to quantitatively define the relationship.

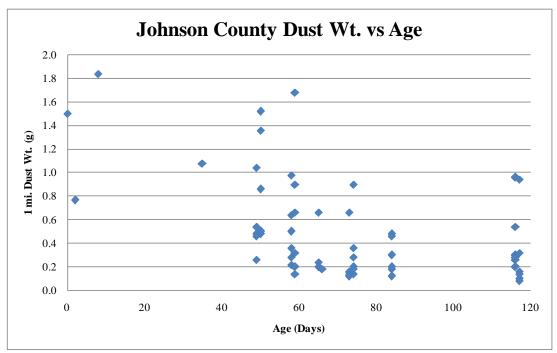


Figure 5.1 Johnson County Dust vs. Age

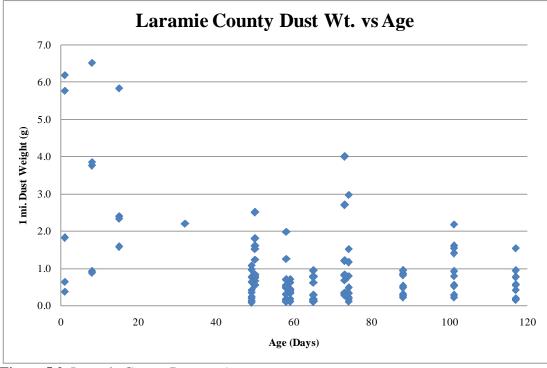


Figure 5.2 Laramie County Dust vs. Age

5.2.2 Dust vs Moisture Content

The dust loss and moisture content relationship was also investigated. It was concluded that no particular relationship between dust loss and moisture content in the individual sections can be established. This is because dust data were not collected when the roadway surface was wet. This resulted in a small range of moisture contents in which dust was collected. Also, within the small range of moisture contents there are no big variations in the collected dust weights. These conclusions hold true for both Johnson and Laramie Counties. Figures 5.3 and 5.4 give examples of dust loss versus moisture content in Johnson and Laramie Counties, respectively. The rest of the plotted data for dust loss versus moisture content can be found in Appendix A.

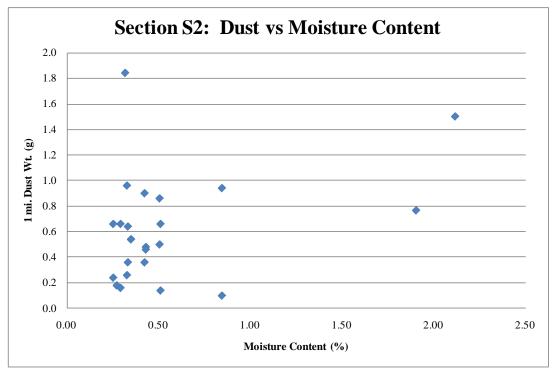


Figure 5.3 Example from Johnson County Dust vs. Moisture Content

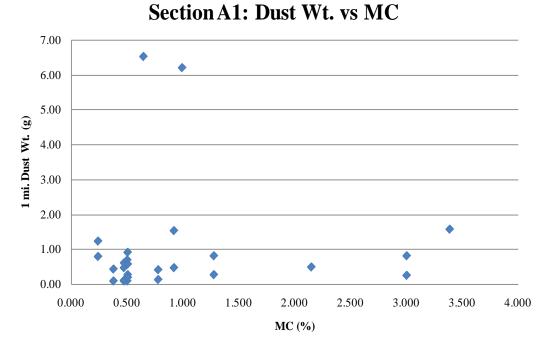


Figure 5.4 Example from Laramie County Dust vs. Moisture Content

5.2.3 Dust vs Wind Speed

The relationship between dust loss and wind speed was also desired. It was suggested from visual inspection that a general trend between dust loss and wind speed could be inferred. The higher the wind speed, the lower the collected dust weight. Examples of this can be seen in Figures 5.5 and 5.6 for Johnson and Laramie Counties, respectively. It should also be noted that the variability in the dust weights is most likely attributed to the wind direction with respect to the direction of travel. That is, a strong headwind would force more dust into the collection box while a strong tailwind would prevent dust from reaching the box. It is suggested that dust collection should not be performed in high winds in order to ensure fair sampling.

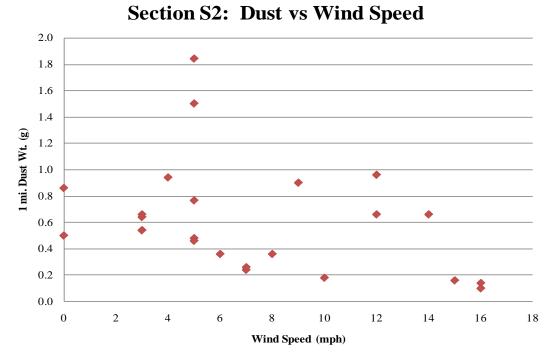


Figure 5.5 Example from Johnson County Dust vs. Wind Speed

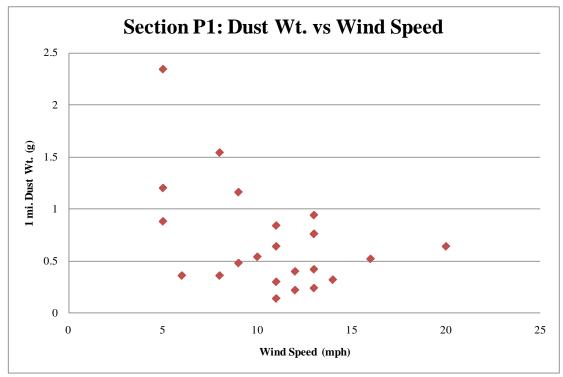


Figure 5.6 Example from Laramie County Dust vs Wind Speed

5.3 Statistical Contrast Analysis

Statistical software was used to analyze the collected data. This analysis used statements within the general linear model (GLM) procedures to contrast groups of data. The contrast values were used to determine what group of data was dominating the contrast. This technique allowed for more than one section to be in a given group, allowing for comparison to be made on more than a one-to-one basis. The groupings included sections containing the following comparisons: Laramie versus Johnson County, RAP versus no RAP, and calcium chloride (CaCl) versus no CaCl.

Contrasts were made on the basis of dust and URCI. All eight sections in the study were used in this analysis. An alpha value of 0.10 was chosen due to the inherent variability of unpaved roads. P-values were measured against the 0.10 value to determine if the groups were significantly different from one another. P-values less than 0.10 were considered significantly different and conclusions could be drawn. A contrast with a p-value greater than 0.10 was said to have no proof of the groups being significantly different and the results would not be considered. All contrasts in this analysis were found to be significantly different, therefore conclusions could be made.

In this analysis, a wind factor was established to help describe the effect of the wind on sampling. The wind speed, wind direction, and the angle in which the wind blew with respect to the roadway were used to establish the wind factor. Each direction of wind was given a degree value based on where it fell on a circle. A circle was broken up into sixteen segments to help describe the wind direction. North was given a value of zero. Moving in the clockwise direction each segment was 22.5 degrees larger than the last. A summary of the wind direction degree values can be found in Figure 5.7.

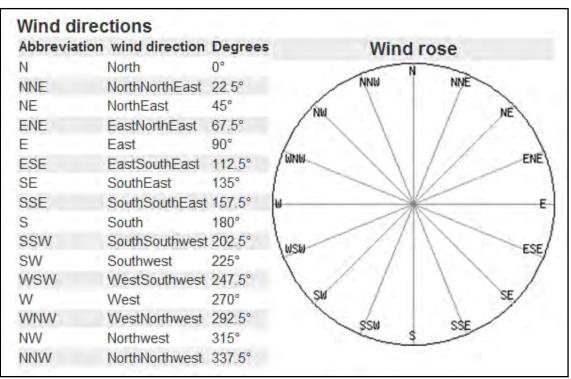


Figure 5.7 Wind Direction and Degree Values

Atlas Road in Laramie County runs east and west. Pry Road in Laramie County runs north and south. Schoonover Road in Johnson County runs NNW and SSE. The angle of the wind direction perpendicular to the bearing of the roads was calculated for each dust weight calculated. This angle was designated as θ (theta). The following equation was used to determine the wind factor.

Wind Factor = Wind Speed $* \cos(\theta)$

Data was collected on each section from both directions of travel. For example, data were collected on Atlas Road driving west and east. The average of the data collected in each direction on any given section was determined. This was done in order to not violate assumptions associated with the variance of populations used in statistical analysis. Therefore, all of the variables used in this analysis were the average of the two collections taken in opposite directions.

The variables available for use in the contrast analysis model included dust, moisture content, age, wind factor, and URCI. A residual analysis of the data was performed. From the residual analysis it was confirmed that the linear model assumptions were met. Therefore, the model was considered to be suitable for the contrast analyses.

5.3.1 Contrast Analysis Based on Dust

A contrast analysis was performed on the basis of dust. The dependent variable used was the log of the average dust weights. The log function was chosen to improve the necessary assumptions of linearity, equal variance, and normality needed to trust the statistical results. The independent variables included the averages of age, moisture content, and the wind factor.

Three contrasts were made using the following parameters: Laramie County versus Johnson County; sections with no RAP versus sections with RAP, and sections with no CaCl versus sections with CaCl. The results of these contrasts can be found in Table 5.1. Since the contrast was based on X vs. Y, a positive estimate value means that X is dominating and a negative estimate value means Y is dominating the contrast.

Parameter	Estimate	Standard Error	t value	p value
Laramie vs. Johnson	1.05741117	0.13723690	7.71	<.0001
noRAP vs. RAP	0.38804705	0.13641207	2.84	0.0056
noCaCl vs. CaCl	1.26457298	0.16427895	7.70	<.0001

 Table 5.1 Log Dust Contrast Results

From the results found in Table 5.1, it can be seen that there is more dust loss associated with the Laramie County test sections compared with the Johnson County test sections. Sections without RAP produced more dust than those with RAP. Also, sections without CaCl had more dust loss than sections with CaCl. The difference in the two groups was calculated using the following equation:

$$e^{\text{ estimate value}} = \left[\frac{dust \text{ in } X}{dust \text{ in } Y}\right]$$

By using this equation, the amount of difference in the two groups was calculated. It was found that the Laramie County test sections had 288% more dust than the Johnson County test sections. Sections

without RAP exhibited 147% more dust than sections utilizing RAP. Finally, sections without CaCl had 354% the amount of dust loss of sections with CaCl.

These results are linked to the laboratory results on the materials used in this research. From the gradations found in Chapter 4, it was found that the test sections in Laramie County exhibited more

material passing the #200 sieve than the Johnson County test sections. The gravel and RAP blend used in Laramie County had 23% and 2.2% material passing the #200 (0.075mm) sieve, respectively. In Johnson County, 11.6% of the gravel material and 1.0% of the RAP blend material passed the #200 (0.075mm) sieve. Therefore, more dust was available to be captured in Laramie County. Also, the roadways in the Laramie County were not compacted using a drum roller as they were in Johnson County.

The percentage of RAP blended material passing the #200 (0.075mm) sieve in Laramie County was 20% less than the percentage of gravel material passing the #200 (0.075mm) sieve. In Johnson County, the RAP blend had 10% less material passing the #200 (0.075mm) sieve than gravel. Therefore, any test sections that contained RAP would have less material available for capture as dust. Finally, the use of CaCl significantly reduced the amount of dust loss. This was expected as it is the nature of CaCl to capture moisture from the air surrounding the roadway surface and keep dust size materials from becoming airborne.

5.3.2 Contrast Analysis Based on URCI

A contrast analysis was performed on the basis of the URCI. The dependent variable used was URCI, with dust, age, moisture content, and wind factor being the independent variables. Three contrasts were made using the following parameters: Laramie County versus Johnson County, sections with no RAP versus sections with RAP, and sections with no CaCl versus sections with CaCl. The results of these contrasts can be found in Table 5.2. Since the contrast was based on X vs. Y, a positive estimate value means that X is dominating and a negative estimate value means Y is dominating the contrast. The resulting contrast values only indicate which group is dominating the contrast and quantitative comparisons of the two values cannot be adequately developed due to the nature of the URCI being composed of multiple factors that are not necessarily the same in each group.

Parameter	Estimate	Standard Error	t Value	p value
Laramie vs. Johnson	5.26596165	1.28732118	4.09	0.0001
noRAP vs. RAP	4.80737817	1.18336694	4.06	0.0001
noCaCl vs. CaCl	8.67047145	1.60173674	5.41	<.0001

 Table 5.2
 URCI Contrast Results

Based the results found in Table 5.2, it can be seen that the URCI of the Laramie County test sections had better URCI scores compared with the Johnson County test sections. This is most likely due to a couple of factors. First, the volume of traffic on the Johnson County test sections (237 vpd) was much heavier than the traffic in Laramie County (25 vpd). Also, the number of trucks using the Johnson County test sections (74% trucks) was much more than the trucks using the Laramie County test sections (3-12% trucks). Secondly, CaCl was used on the Johnson County test sections. This presented the opportunity for rutting to occur on the sections with CaCl.

Sections without RAP had better URCI scores compared with sections with RAP. This is most likely due to the RAP sections having more loose aggregate. The amounts of loose aggregate on the RAP sections can be found in the URCI data sheets in Appendix B. This is further described in the following subsections that utilize sectional analysis methods. Sections without CaCl had better URCI scores than sections with CaCl. This is mainly due to the presence of rutting in the CaCl, which is described in more detail in the sectional analysis results in the following subsections.

5.4 Sectional Analysis of the Laramie County Test Sections

A sectional analysis was performed based on the collected data in Laramie County. The analysis consisted of comparing a RAP section to its control counterpart or another RAP section. Comparisons were made based on dust loss, URCI, and surface distresses found in both sections. The analysis was based on subtracting the values for a RAP section from those of the corresponding control/RAP section. The data were sorted by county, date, and direction of travel in order to make a fair comparison. Environmental elements such as wind speed, wind direction, and moisture content were not included in the analysis.

The comparisons based on dust loss, URCI, and surface distresses each contained: (1) a mean difference between the two sections being compared and a corresponding standard deviation, (2) a mean percentage difference between the two sections being compared and a corresponding percent standard deviation, and (3) a paired T-test p-value for the two sections being compared. An alpha level of 0.10 was chosen due to inherent variability of unpaved roads.

The p-values were measured against the 0.10 alpha level to see if the two sections' samples were significantly different. Any p-values less than 0.10 were considered significantly different and conclusions could be drawn. A set of sections with a p-value greater than 0.10 was said to have no proof of significant difference and were not considered.

5.4.1 Sectional Analysis Based on Dust

The collected dust data on each section in Laramie County were analyzed using the sectional data analysis methods previously mentioned. Table 5.3 summarizes the analysis of the dust data for Laramie County. From Table 5.3 it can be seen that the control section on Pry Road in Laramie County had 41% more dust than the section with 1.5 inches of RAP. The control section on Atlas Road had 20% more dust than the section with 1.5 inches of RAP. Therefore, the RAP sections were producing significantly less dust loss in Laramie County. This is due to the control sections having more bonding because more gravel material is passing the #200 (0.075mm) sieve compared with the RAP sections. It should also be noted that there was no difference between the control section and the section with 2.5 inches of RAP in terms of dust. This is most likely due to poor construction on section A2 and less likely the material itself as this section was the first section to be blended. Section A2 was re-blended shortly after initial construction.

		Atlas Road - A1 (1 1/2" RAP) vs Atlas Road - A0 (100 % Gravel)	
Analysis based on :	A0 - A2	A0 - A1	P0 - P1
DUST MEAN DIFFERENCE (g)		0.27	0.77
DUST DIFFERENCE STD. DEV. (g)	0.39	0.52	0.92
DUST MEAN % DIFFERENCE		<u>20%</u>	<u>41%</u>
DUST % DIFFERENCE STD. DEV.	51%	40%	33%
DUST T-TEST P-VALUE	7E-02	3E-02	4E-03

Table 5.3	Laramie	County	Sectional	Data A	Analysis	Results	Based on Dus	st

5.4.2 Sectional Analysis Based on URCI

The overall URCI data on each section in Laramie County was analyzed using the sectional data analysis methods previously mentioned. Table 5.4 summarizes the analysis of the URCI data for Laramie County. From Table 5.4 it can be seen that the control sections in Laramie County are performing slightly better than the RAP sections. The control section on Atlas Road compared with the 1.5 inch and 2.5 inch RAP sections had 16% and 5% better URCI values, respectively. On Pry Road, the control section had URCI values that were 9% better than those of the 1.5 inch RAP section. The reason for this is found within the comparison of the surface distresses, particularly the loose aggregate, which is discussed in the next subsection.

Labie ett Baram	able 5.4 Earanne County Sectional Data Analysis Results Dased on ORCI				
		Atlas Road - A1 (1 1/2" RAP) vs			
	Atlas Road - A0 (100 % Gravel)	Atlas Road - A0 (100 % Gravel)	Pry Road - P0 (100 % Gravel)		
Analysis based on :	A0 - A2	A0 - A1	P0 - P1		
URCI MEAN	15.44	5.33	9.33		
DIFFERENCE	13.44	5.55	9.33		
URCI					
DIFFERENCE	2.19	3.54	3.00		
STD. DEV.					
URCI MEAN %	160/	59/	00/		
DIFFERENCE	<u>16%</u>	<u>5%</u>	<u>9%</u>		
URCI %					
DIFFERENCE	2%	4%	3%		
STD. DEV.					
URCI T-TEST	3E-08	2E-03	1E-05		
P-VALUE	3E-00	2E-03	1E-05		

 Table 5.4
 Laramie County Sectional Data Analysis Results Based on URCI

5.4.3 Sectional Analysis Based on Surface Distresses

The surface distress data on each section in Laramie County were analyzed using the sectional data analysis methods previously mentioned. Table 5.5 summarizes the analysis of the distress data for Laramie County. Loose aggregate was the only surface distress that could be compared in this analysis. This is because no other sections in Laramie County, except for the 2.5 inch RAP section on Atlas Road, displayed any other surface distresses.

From Table 5.5 it can be seen that the RAP sections in Laramie County tend to have more loose aggregate. The 2.5 inch RAP section on Atlas Road had 132% more loose aggregate than the control section on Atlas Road that it was being compared with. When the control sections on Atlas and Pry Roads were compared with the 1.5 inch RAP sections on each road, there was 81% and 100% more loose aggregate, respectively, on the 1.5 inch RAP sections on Atlas and Pry Roads. This is an expected characteristic when using RAP in the road surface as the larger aggregates will tend to work to the outside of the roadway.

Lusie ene Datanne County Sectional Data Analysis Results Dased on Doose Algeregate				
		•		
Atlas Road - A0 (100 % Gravel)	Atlas Road - A0 (100 % Gravel)	Pry Road - P0 (100 % Gravel)		
A0 - A2	A0 - A1	P0 - P1		
-11.44	-5.89	-9.67		
3.09	3.86	2.18		
-132%	-81%	-100%		
54%	51%	0%		
4E-06	2E-03	1E-06		
	Atlas Road - A2 (2 1/2" RAP) vs Atlas Road - A0 (100 % Gravel) A0 - A2 -11.44 3.09 -132% 54% 4E-06	Atlas Road - A2 (2 1/2" RAP) vs Atlas Road - A1 (1 1/2" RAP) vs Atlas Road - A0 (100 % Gravel) Atlas Road - A0 (100 % Gravel) A0 - A2 A0 - A1 -11.44 -5.89 3.09 3.86 -132% -81% 54% 51% 4E-06 2E-03		

Table 5.5 Laramie County Sectional Data Analysis Results Based on Loose Aggregate

5.5 Sectional Analysis of the Johnson County Test Sections

A sectional data analysis was performed based on the collected data in Johnson County. The analysis consisted of comparing the three test sections on Schoonover Road. Comparisons were made based on dust loss, URCI, and surface distresses found in both sections. The analysis was based on subtracting the values for one section from those of the comparative section. The data were sorted by date and direction of travel in order to make a fair comparison. Environmental elements such as wind speed, wind direction, and moisture content were not included in the analysis.

The comparisons based on dust loss, URCI, and surface distresses each contained: (1) a mean difference between the two sections being compared and a corresponding standard deviation, (2) a mean percentage difference between the two sections being compared and a corresponding percent standard deviation, and (3) a paired T-test p-value for the two sections being compared. An alpha level of 0.10 was chosen due to inherent variability of unpaved roads.

The p-values were measured against the 0.10 alpha level to see if the two sections' samples were significantly different. Any p-values less than 0.10 were considered significantly different and conclusions could be drawn. A set of sections with a p-value greater than 0.10 was said to have no proof of significant difference and were not considered.

5.5.1 Sectional Analysis Based on Dust

The collected dust data on each section in Johnson County were analyzed using the sectional data analysis methods previously mentioned. Table 5.6 summarizes the analysis of the dust data for Johnson County. From Table 5.6 it can be seen that the RAP blend with CaCl performed much better than the gravel with CaCl in terms of dust. The control section had nearly 40% more dust than the RAP section. This is most likely due to the control section having greater amounts of material passing the #200 (0.075mm) sieve compared with the RAP sections. When the RAP blend with CaCl is compared with the RAP blend without CaCl had 42% more dust. This result is typical as it is the nature of

roadways with CaCl to exhibit less dust loss than those without CaCl. Results could not be drawn from the RAP blend compared with the gravel with CaCl because the p-value of 0.70 is greater than the alpha value of 0.10, which suggests that the two sections are not significantly different in terms of dust.

	S1 (RAP Blend w/ CaCl) vs S0 (Gravel w/ CaCl)	S2 (RAP Blend) vs S0 (Gravel w/ CaCl)	S1 (RAP Blend w/ CaCl) vs S2 (RAP Blend)
Analysis based on :	S0 - S1	S0 - S2	S2 - S1
DUST MEAN DIFFERENCE (g)	035	0.07	0.28
DUST DIFFERENCE STD. DEV. (g)	0.42	0.51	0.26
DUST MEAN % DIFFERENCE	40%	-50%	<u>42%</u>
DUST % DIFFERENCE STD. DEV.	33%	124%	32%
DUST T-TEST P-VALUE	3F-02	<u>7E-01</u>	7E-05

 Table 5.6
 Johnson County Sectional Data Analysis Results Based on Dust

5.5.2 Sectional Analysis Based on URCI

The overall URCI data on each section in Johnson County were analyzed using the sectional data analysis methods previously mentioned. Table 5.7 summarizes the analysis of the URCI data for Johnson County. From Table 5.7 it can be seen that there was no significant difference in the Johnson County sections in terms of URCI due to the p-values being greater than 0.10. But there are specific findings for individual distresses as seen in the next subsection.

Table 5.7 Johnson County Sectional Data Analysi	s Results Based on URCI
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	S1 (RAP Blend w/ CaCl) vs S0 (Gravel w/ CaCl)	S2 (RAP Blend) vs S0 (Gravel w/ CaCl)	S1 (RAP Blend w/ CaCl) vs S2 (RAP Blend)
Analysis based on :	· · · · /	S0 - S2	S2 - S1
URCI MEAN DIFFERENCE	-4 83	-6.67	1.83
URCI DIFFERENCE STD. DEV.	8.98	8.82	4.26
URCI MEAN % DIFFERENCE	-7%	-9%	2%
URCI % DIFFERENCE STD. DEV.	14%	14%	5%
URCI T-TEST P-VALUE	<u>2E-01</u>	<u>1.2E-01</u>	<u>3E-01</u>

5.5.3 Sectional Analysis Based on Surface Distresses

The surface distress data on each section in Johnson County was analyzed using the sectional data analysis methods previously mentioned. Table 5.8 summarizes the analysis of the distress data for Johnson County. From Table 5.8 it can be seen that rutting and loose aggregate had significant findings. The S_0 - S_2 set has no viable comparison for loose aggregate due to a p-value greater than 0.10. The gravel with CaCl section showed almost 26% more loose aggregate than the RAP blend with CaCl section. The RAP blend section also showed 39.5% more loose aggregate than the RAP blend with CaCl section. In terms of rutting, the RAP blend with CaCl showed 67% more rutting than the RAP blend by itself. The gravel with CaCl showed 83% more rutting than the RAP blend without CaCl. This is not surprising due to the nature of CaCl and its effect on the moisture content of the road surface.

	S1 (RAP Blend w/ CaCl) vs S0 (Gravel w/ CaCl)	S2 (RAP Blend) vs S0 (Gravel w/ CaCl)	S1 (RAP Blend w/ CaCl) vs S2 (RAP Blend)
Analysis based on :	S0 - S1	S0 - S2	S2 - S1
LOOSE AGG. MEAN DIFFERENCE	2.50	-0.67	3.17
LOOSE AGG. DIFFERENCE STD.	2.26	3.14	2.48
LOOSE AGG. MEAN % DIFFERENCE	<u>26%</u>	-12%	<u>39%</u>
LOOSE AGG. % DIFFERENCE STD.	27%	44%	38%
LOOSE AGG. T-TEST P-VALUE	/F 02	<u>6E-01</u>	3E-02
			·
RUT MEAN DIFFERENCE	3 00	9.67	-6.67
RUT DIFFERENCE STD. DEV.	8.65	10.21	5.50
RUT MEAN % DIFFERENCE	180/-	<u>83%</u>	<u>-67%</u>
RUT % DIFFERENCE STD.	56%	41%	52%
RUT T-TEST P-VALUE	/ F_01	7E-02	3E-02

5.6 Cost Comparison Analysis

A general cost analysis was performed to evaluate the cost effectiveness of utilizing RAP in gravel roads. This analysis only takes into account material costs and does not account for construction, maintenance, labor, or user cost. It is suggested that these costs should be collected for Phase II of this project in order to adequately develop a benefit-cost analysis.

The main component of a gravel road is the aggregate. The 2009 WYDOT weighted average price for crusher run aggregate was \$6.90/ton. A density of 150 pcf was assumed for the crusher run aggregate. Additional cost on a gravel road is the cost of dust suppressants. For this analysis, Magnesium Chloride (MgCl) was used as this product will be utilized in Phase II of this project. As quoted by the Desert Mountain Corporation, the cost to deliver and apply MgCl is \$0.53/gallon with an application rate of 0.5 gallons/yd². Also, the 2009 WYDOT weighted average price for RAP was \$12.77/yd³. A density value of 140 pcf was assumed for the RAP. Therefore, the cost of RAP was calculated to be \$6.75/ton.

The basic design of Phase II of this project has developed one-mile test sections that will consist of 6 inches of RAP or aggregate blended with three inches of native soils. The width of the roadway is 27 feet. This data were utilized to perform the cost comparison. The comparison made was between the material cost of a one-mile RAP blended section and a one-mile section of crusher run aggregate with MgCl.

To cover a roadway that is 27 feet wide with 6 inches of material for one mile will take 71,280 feet³ of material. It would take 4,990 tons of RAP or 5,346 tons of crusher run aggregate to cover the one-mile roadway at a depth of 6 inches. Therefore, the material cost for the RAP is \$33,683.50. The material cost for the aggregate is \$36,887.40. A one-mile long road that is 27 feet wide has 142,560 square yards in it. A total of 71,280 gallons of MgCl would be needed to cover the road at a delivery and application cost of \$37,778.40. Therefore, the total cost for the RAP section is \$33,683.50, and the total cost of the aggregate with the MgCl section is \$74,665.80. If MgCl was added to the RAP section, the total cost would be \$71,460.90.

In terms of cost effectiveness, this general materials cost comparison shows that RAP is a cost effective material for use in gravel roads; and, as prior analyses show, RAP blends reduce dust loss. These are only general comparisons, and it is suggested for Phase II of this project to confirm this analysis. Initial construction and material costs need to collected. Application costs associated with dust suppressants as well as long-term maintenance costs will also be needed to perform the actual cost analysis.

5.7 Section Summary

Multiple analyses were performed on the collected data from the test sections. These analyses included a preliminary analysis where visual inspection of the collected data was performed to detect any relationships found in the data. Dust was plotted against age, moisture content, and wind speed to help understand the behavior of the data.

From the preliminary analysis it appears that dust loss decreased with age. When dust loss was compared with moisture content, it was implied that moisture content did not have any effect on dust loss at low moisture contents. It was implied from the dust loss and wind speed comparison that dust measurements were affected by wind speed, and collection should not be attempted during high winds in order to ensure fair data collection.

A contrast analysis was also performed on the collected data. In this analysis, groups of data were compared with one another. Contrasts were made on the basis of dust loss as well as URCI. Three contrasts for dust loss and three contrasts for URCI were made using the following parameters: Laramie County versus Johnson County, sections with no RAP versus sections with RAP, and sections with no CaCl versus sections with CaCl.

The contrast analysis based on dust found that the Laramie County test sections had 288% more dust than the Johnson County test sections. Sections without RAP produced 147% more dust than those with RAP. Test sections without CaCl exhibited 354% more dust than sections with CaCl. The reason for these large differences in dust can be found in the materials used within each section with particular emphasis on the percentage of material passing the #200 sieve.

The contrast analysis based on URCI values found that the Laramie County test sections had higher URCI scores compared with the Johnson County test sections. Sections without RAP were found to have higher scores than those with RAP, mostly due to larger amounts of loose aggregate on the RAP sections. Test sections without CaCl were found to have higher URCI scores than sections with CaCl due to the rutting present in the sections utilizing CaCl.

Finally, a sectional statistical analysis was performed on the collected data from the test sections. The purpose of this analysis was to compare the test sections within a given county based on dust, URCI, and surface distresses. The analysis was based on subtracting the values for a RAP section from those of the comparative section.

The sectional analysis performed on the dust data found that the RAP sections in Laramie County had significantly less dust loss than the control sections. In Johnson County, the RAP blend with CaCl performed much better than the gravel with CaCl in terms of dust. When CaCl was not used with the RAP blend section, the gravel with CaCl had less dust loss. When the RAP blend with CaCl was compared with the RAP blend without CaCl, the RAP blend without CaCl created 42% more dust.

The sectional analysis performed on the basis of URCI found that the gravel control sections in Laramie County performed slightly better than the RAP sections. The result from the analysis performed on the Johnson County URCI data revealed no significant difference in the three sections on Schoonover Road. This was due to the resulting p-values being larger than the set value of 0.10.

The sectional analysis performed on the surface distress found that the RAP sections in Laramie County experienced more loose aggregate than the RAP sections. In Johnson County, the RAP blend with CaCl had the least amount of loose aggregate followed by gravel with CaCl. The RAP blend without CaCl had the most loose aggregate. In terms of rutting, the sections with CaCl showed more rutting. The gravel with CaCl exhibited the worst rutting of the three sections.

A general cost analysis showed that RAP is a cost effective material for use in gravel roads. It is suggested that Phase II of this project collect construction and maintenance cost data in order to perform a thorough cost analysis of the actual test sections and confirm that RAP is a cost effective material in gravel roads.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

This research project utilized field and laboratory evaluations to study the performance of using Recycled Asphalt Pavement (RAP) in gravel roads by focusing on its ability to reduce dust loss and maintain roadway stability. The field evaluations involved observing eight test sections constructed in two Wyoming counties. Dust collection was accomplished using the Colorado State University Dustometer. Surface distresses were monitored following methods developed by the United States Army Corps of Engineers. Conditions related to wind were collected using a handheld wind vane and digital compass. Roadway moisture content was determined from surface samples. Laboratory evaluations involved material testing performed by WYDOT. All of this data were collected in a database to allow for statistical analyses to be performed in order to evaluate the effectiveness of RAP in gravel roads.

6.2 Conclusions

From the preliminary analysis of the collected data it was observed that dust loss decreased with age. It was also concluded that dust collection should not be taken when wind speeds are high. Dust measurements were taken when the roadway was dry and the moisture content was low. Therefore, at low moisture contents it was determined that moisture content did not appear to affect dust loss.

From the contrast analysis based on dust, sections without RAP generated 147% more dust loss than sections with RAP. The asphalt within the RAP provided better binding for the materials. Test sections without CaCl generated 354% more dust than sections with CaCl. The amount of dust loss in the Laramie County test sections was greater than those in Johnson County by 288% because the materials used in Laramie County had significantly higher percentages of material passing the #200 (0.075mm) sieve.

From the contrast analysis based on URCI, the URCI values in Laramie County were better than the URCI values in Johnson County due to the differences in traffic volumes, particularly when comparing truck traffic (3-12% versus 74% trucks). Sections without RAP had URCI values that were better than sections with RAP due to larger amounts of loose aggregate associated with RAP sections. Sections without CaCl had URCI values that were better than sections with CaCl had URCI values that were better than sections with CaCl due to the rutting associated with the use of CaCl. Conclusions drawn from sectional analyses of the data are broken down by county and found in the following two subsections.

From the general cost analysis it was observed that RAP is a cost effective material for use in gravel roads. It is suggested that Phase II of this project collect construction and maintenance cost data in order to perform a thorough cost analysis of the actual test sections and confirm that RAP is a cost effective material in gravel roads.

6.2.1 Laramie County Conclusions

Based on the observations and testing performed on the Laramie County test sections, the following conclusions were drawn:

- 1. The use of RAP in gravel roads reduced dust loss from 0 to 41%.
- 2. Overall road serviceability, based on the URCI, was slightly better for the 100% gravel sections. This was due to more loose aggregate seen on the RAP sections.

- 3. The sections with RAP exhibited significantly more amounts of loose aggregate than the 100% gravel sections.
- 4. The construction technique blending the RAP and gravel on site by means of a blade led to segregation of the material, resulting in large amount of loose aggregate.
- 5. Loose aggregate was the main surface distress that was apparent in the Laramie County test sections, especially in the RAP sections.
- 6. The overall conclusion was that RAP significantly reduced dust loss with no improvement in road condition.

6.2.1 Johnson County Conclusions

Based on the observations and testing performed on the Johnson County test sections, the following conclusions were drawn:

- 1. The RAP blend section and the gravel with CaCl section were not significantly different in terms of dust, URCI, or loose aggregate.
- 2. There was no statistical significant difference in the URCI among the three test sections. That is, the RAP sections did not make any improvements in the overall serviceability of the roadway compared with the control section.
- 3. The gravel with CaCl section showed more loose aggregate than the RAP blend with CaCl section. The RAP blend section without CaCl displayed more loose aggregate than the RAP blend with CaCl. The use of CaCl helped in stabilizing the road surface and reducing the amount of loose aggregate.
- 4. The sections with CaCl had more rutting than the section without CaCl.
- 5. The use of RAP in the roadway reduced dust loss. RAP with CaCl reduced dust loss even more.
- 6. The overall conclusion was that RAP significantly reduced dust loss with no adverse effects to the road serviceability. In addition, using CaCl with the RAP blend further reduced dust loss.

6.3 Recommendations to Agencies

This project thoroughly investigated the use of RAP in gravel roads in two Wyoming counties. From this investigation it has been concluded that the use of RAP is an effective tool for reducing dust loss without compromising road serviceability. For any agency that has a desire to reduce the amount of dust loss on their gravel roads, it is suggested that they follow these recommendations:

- 1. Blend RAP into the existing gravel road surface or blend RAP with virgin aggregate in a pugmill and place on the existing unsurfaced road to reduce dust loss. If applicable, RAP and gravel should be blended in a pugmill rather than in place to avoid segregation of materials from blade mixing.
- 2. Compact the RAP blend with a roller if at all possible. This will help in maintaining the long-term road serviceability.

- 3. Combine CaCl with the RAP blend to further reduce dust loss as well as reduce loose aggregate.
- 4. Attention should be directed to traffic volumes as there are trade-offs between using RAP and CaCl in gravel roads. Reduced dust loss is most likely more important than minor amounts of loose aggregate and rutting.
- 5. Attention should be directed to the initial gradations of the materials being used in order to help reduce loss and provide adequate binding. Materials with large amounts of fines (>15% passing the #200 [0.075 mm] sieve) will have more dust available to be lost.

6.4 Recommendations for Phase II

- 1. Additional field evaluations should be performed to determine the optimum design and construction technique of incorporating RAP into gravel roads.
- 2. Dust measurements should not be performed on test sections when wind speeds are high and/or when the roadway is wet.
- 3. Further research should be performed to quantitatively describe the effects of the wind on dust loss. This should be done by developing laboratory techniques to analyze the relationship between dust and wind
- 4. Laboratory tests should be developed to help correlate field data to lab data. The test(s) should simulate field data in order to make sound statistical analyses. Once verified, the test(s) could be used to make conclusions about a material's dust loss and serviceability.
- 5. Further research should be performed to study the effects of traffic, especially trucks, on the performance of gravel roads using RAP and other dust suppressants.
- 6. This research project has determined that RAP used in gravel roads reduces dust loss without adversely affecting road serviceability. Given the benefits that may be utilized by using RAP, further investigations into its use are justified.
- 7. Construction and maintenance cost data should be collected in order to perform a thorough cost analysis of the actual test sections and confirm that RAP is a cost effective material in gravel roads.

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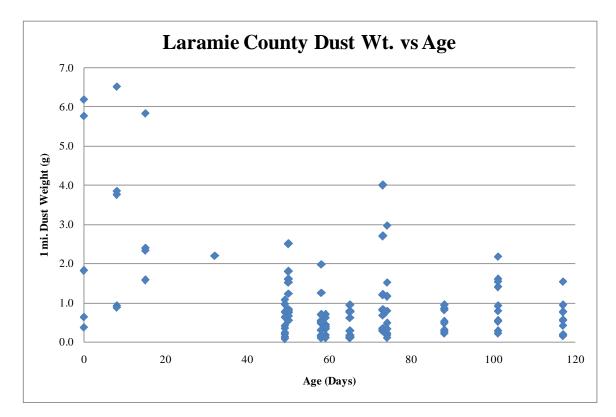
WYDOT. (2010, January 04). 2009 Weighted Average Bid Prices. Retrieved August 2010, from http://www.dot.state.wy.us/webdav/site/wydot/shared/Contracts%20and%20Estimates/2009%20English.p df

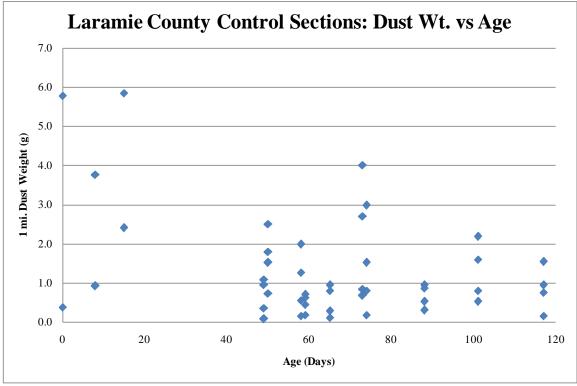
APPENDIX A DUST COLLECTION, MOISTURE CONTENT, AND WIND DATA

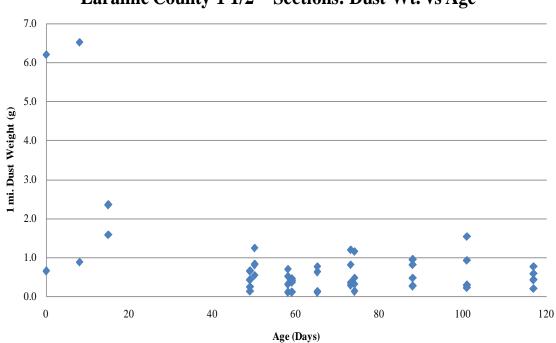
	Laramie C	ounty Dust,	Moisture, a	and Wind Da	ita	
#	Test Section	Date of	Time of	Wind (mph)	1 mi. Dust	Moisture
#	Test Section	Sample	Sample	wina (mpn)	Wt. (g)	Content (%)
1	Atlas Road - A2 (2 1/2" RAP)	6/9/2008	7:55 AM	20 W	1.82	2.044
2	Atlas Road - A1 (1 1/2" RAP)	6/9/2008	8:10 AM	20 W	6.20	0.991
3	Atlas Road - A0 (100% Gravel)	6/9/2008	8:25 AM	20 W	5.78	2.591
4	Pry Road - P1 (1 1/2" RAP)	6/9/2008	8:30 AM	20 W	0.64	2.105
5	Pry Road - P0 (100% Gravel)	6/9/2008	8:35 AM	20 W	0.38	2.549
6	Atlas Road - A2 (2 1/2" RAP)	6/17/2008	7:25 AM	10 W	3.86	0.477
7	Atlas Road - A1 (1 1/2" RAP)	6/17/2008	7:30 AM	10 W	6.52	0.645
8	Atlas Road - A0 (100% Gravel)	6/17/2008	7:40 AM	10 W	3.76	1.029
9	Pry Road - P1 (1 1/2" RAP)	6/17/2008	7:45 AM	10 W	0.88	0.767
10	Pry Road - P0 (100% Gravel)	6/17/2008	7:50 AM	10 W	0.92	1.314
11	Atlas Road - A2 (2 1/2" RAP)	6/24/2008	7:10 AM	10 WNW	2.40	6.362
12	Atlas Road - A1 (1 1/2" RAP)	6/24/2008	7:20 AM	10 WNW	1.58	3.385
13	Atlas Road - A0 (100% Gravel)	6/24/2008	7:30 AM	10 WNW	2.40	5.044
14	Pry Road - P1 (1 1/2" RAP)	6/24/2008	7:35 AM	10 WNW	2.34	4.936
15	Pry Road - P0 (100% Gravel)	6/24/2008	7:40 AM	10 WNW	5.84	5.523
16	Atlas Road - A2 (2 1/2" RAP)	7/11/2008	7:40 AM	15 W	2.20	0.736
17	Atlas Road - A2 (2 1/2" RAP)	7/28/2008	8:45 AM	16 WNW	0.76	0.662
18	Atlas Road - A1 (1 1/2" RAP)	7/28/2008	8:40 AM	20 W	0.42	0.777
19	Atlas Road - A0 (100% Gravel)	7/28/2008	8:30 AM	20 WNW	0.96	1.193
20	Pry Road - P1 (1 1/2" RAP)	7/28/2008	9:15 AM	11 WNW	0.64	0.605
21	Pry Road - P0 (100% Gravel)	7/28/2008	9:05 AM	12 WNW	1.08	1.185
22	Atlas Road - A2 (2 1/2" RAP)	7/28/2008	7:30 AM	11 W	0.20	0.662
23	Atlas Road - A1 (1 1/2" RAP)	7/28/2008	7:50 AM	10 W	0.14	0.777
24	Atlas Road - A0 (100% Gravel)	7/28/2008	8:10 AM	17 WNW	0.08	1.193
25	Pry Road - P1 (1 1/2" RAP)	7/28/2008	9:30 AM	13 WNW	0.24	0.605
26	Pry Road - P0 (100% Gravel)	7/28/2008	9:35 AM	14 WNW	0.36	1.185
27	Atlas Road - A2 (2 1/2" RAP)	7/29/2008	3:50 PM	5 W	0.66	0.399
28	Atlas Road - A1 (1 1/2" RAP)	7/29/2008	4:00 PM	7 W	0.80	0.239
29	Atlas Road - A0 (100% Gravel)	7/29/2008	4:15 PM	6 W	0.74	0.732
30	Pry Road - P1 (1 1/2" RAP)	7/29/2008	4:25 PM	10 W	0.54	0.316
31	Pry Road - P0 (100% Gravel)	7/29/2008	4:35 PM	8 W	1.52	0.594
32	Atlas Road - A2 (2 1/2" RAP)	7/29/2008	4:55 PM	10 W	1.60	0.399
33	Atlas Road - A1 (1 1/2" RAP)	7/29/2008	4:50 PM	8 W	1.24	0.239
34	Atlas Road - A0 (100% Gravel)	7/29/2008	4:45 PM	12 W	2.50	0.732
35	Pry Road - P1 (1 1/2" RAP)	7/29/2008	4:40 PM	11 W	0.84	0.316
36	Pry Road - P0 (100% Gravel)	7/29/2008	4:30 PM	9 W	1.80	0.594
37	Atlas Road - A2 (2 1/2" RAP)	8/6/2008	8:00 AM	10 WNW	0.18	0.457
38	Atlas Road - A1 (1 1/2" RAP)	8/6/2008	8:10 AM	14 WNW	0.10	0.500
39	Atlas Road - A0 (100% Gravel)	8/6/2008	8:15 AM	15 NW	0.16	0.892
40	Pry Road - P1 (1 1/2" RAP)	8/6/2008	8:20 AM	16 NW	0.52	0.696
41	Pry Road - P0 (100% Gravel)	8/6/2008	8:30 AM	10 NW	1.98	0.845
42	Atlas Road - A2 (2 1/2" RAP)	8/6/2008	7:55 AM	12 NW	0.48	0.457
43	Atlas Road - A1 (1 1/2" RAP)	8/6/2008	7:45 AM	16 NW	0.70	0.500
44	Atlas Road - A0 (100% Gravel)	8/6/2008	7:35 AM	15 NW	0.56	0.892
45	Pry Road - P1 (1 1/2" RAP)	8/6/2008	8:45 AM	11 NW	0.30	0.696

	Laramie C	ounty Dust,	Moisture, a	and Wind Da	ita	
#	Test Section	Date of	Time of	Wind (mph)	1 mi. Dust	Moisture
16		Sample	Sample	0.000	Wt. (g)	Content (%)
46	Pry Road - P0 (100% Gravel)	8/6/2008	8:40 AM	9 NW	1.26	0.845
47	Atlas Road - A2 (2 1/2" RAP)	8/7/2008	3:00 PM	11 S	0.40	0.425
48	Atlas Road - A1 (1 1/2" RAP)	8/7/2008	3:10 PM	10 S	0.44	0.377
49	Atlas Road - A0 (100% Gravel)	8/7/2008	3:25 PM	7 SE	0.70	0.722
50	Pry Road - P1 (1 1/2" RAP)	8/7/2008	3:30 PM	8 SE	0.36	0.291
51	Pry Road - P0 (100% Gravel)	8/7/2008	3:40 PM	10 S	0.62	0.599
52	Atlas Road - A2 (2 1/2" RAP)	8/7/2008	4:05 PM	8 S	0.34	0.425
53	Atlas Road - A1 (1 1/2" RAP)	8/7/2008	4:00 PM	9 S	0.10	0.377
54	Atlas Road - A0 (100% Gravel)	8/7/2008	3:55 PM	9 S	0.18	0.722
55	Pry Road - P1 (1 1/2" RAP)	8/7/2008	3:50 PM	12 S	0.40	0.291
56	Pry Road - P0 (100% Gravel)	8/7/2008	3:45 PM	15 S	0.44	0.599
57	Atlas Road - A2 (2 1/2" RAP)	8/13/2008	8:05 AM	15 NW	0.18	0.619
58	Atlas Road - A1 (1 1/2" RAP)	8/13/2008	8:15 AM	7 WNW	0.10	0.472
59	Atlas Road - A0 (100% Gravel)	8/13/2008	8:30 AM	12 NW	0.12	0.869
60	Pry Road - P1 (1 1/2" RAP)	8/13/2008	8:35 AM	11 NW	0.14	0.424
61	Pry Road - P0 (100% Gravel)	8/13/2008	8:45 AM	12 W	0.28	0.787
62	Atlas Road - A2 (2 1/2" RAP)	8/13/2008	9:15 AM	15 WNW	0.78	0.619
63	Atlas Road - A1 (1 1/2" RAP)	8/13/2008	9:10 AM	14 WNW	0.62	0.472
64	Atlas Road - A0 (100% Gravel)	8/13/2008	9:05 AM	16 WNW	0.94	0.869
65	Pry Road - P1 (1 1/2" RAP)	8/13/2008	9:00 AM	13 WNW	0.76	0.424
66	Pry Road - P0 (100% Gravel)	8/13/2008	8:55 AM	10 NW	0.80	0.787
67	Atlas Road - A2 (2 1/2" RAP)	8/21/2008	7:10 AM	3 NW	1.20	1.576
68	Atlas Road - A1 (1 1/2" RAP)	8/21/2008	7:20 AM	4 NW	0.82	1.275
69	Atlas Road - A0 (100% Gravel)	8/21/2008	7:30 AM	5 NW	2.70	2.061
70	Pry Road - P1 (1 1/2" RAP)	8/21/2008	7:35 AM	6NW	0.36	0.948
71	Pry Road - P0 (100% Gravel)	8/21/2008	7:45 AM	5 WNW	0.84	1.874
72	Atlas Road - A2 (2 1/2" RAP)	8/21/2008	8:15 AM	5 NW	0.32	1.576
73	Atlas Road - A1 $(1 1/2" RAP)$	8/21/2008	8:10 AM	3 NW	0.28	1.275
74	Atlas Road - A0 (100% Gravel)	8/21/2008	8:05 AM	4 WNW	0.68	2.061
75	Pry Road - P1 (1 1/2" RAP)	8/21/2008	8:00 AM	5 NW	1.20	0.948
76	Pry Road - P0 (100% Gravel)	8/21/2008	7:55 AM	4 NW	4.00	1.874
77	Atlas Road - A2 (2 1/2" RAP)	8/22/2008	12:25 PM	12 NE	0.22	0.550
78	Atlas Road - A1 $(1 \frac{1}{2} \text{ RAP})$	8/22/2008	12:25 PM	12 NE 10 NE	0.12	0.330
79	Atlas Road - A0 (100% Gravel)	8/22/2008	12:35 PM	10 NE	0.12	2.625
80	Pry Road - P1 (1 1/2" RAP)	8/22/2008	1:15 PM	11 NE 14 NE	0.18	0.615
81	Pry Road - P0 (100% Gravel)	8/22/2008	1:10 PM	8 NE	1.52	0.013
82	Atlas Road - A2 (2 1/2" RAP)	8/22/2008	2:05 PM	8 NE	0.34	0.704
83	Atlas Road - A2 ($2 \frac{1}{2}$ RAP) Atlas Road - A1 ($1 \frac{1}{2}$ RAP)			9 NE	0.34	0.330
83 84	Atlas Road - A1 (11/2 RAP) Atlas Road - A0 (100% Gravel)	8/22/2008	1:40 PM	9 NE 11 NE	0.48	2.625
	· · · · · · · · · · · · · · · · · · ·	8/22/2008	1:30 PM			
85	Pry Road - P1 (1 1/2" RAP)	8/22/2008	12:50 PM	9 NE 13 NE	1.16	0.615
86	Pry Road - P0 (100% Gravel)	8/22/2008	12:55 PM		2.98	0.704
87	Atlas Road - A2 (2 1/2" RAP)	9/5/2008	3:40 PM	11 S	0.86	3.998
88	Atlas Road - A1 (1 1/2" RAP)	9/5/2008	3:50 PM	8 S	0.82	3.000
89	Atlas Road - A0 (100% Gravel)	9/5/2008	4:00 PM	10 S	0.52	2.891
90	Pry Road - P1 (1 1/2" RAP)	9/5/2008	4:05 PM	13 S	0.94	1.935

	Laramie County Dust, Moisture, and Wind Data											
#	Test Section	Date of Sample	Time of Sample	Wind (mph)	1 mi. Dust Wt. (g)	Moisture Content (%)						
91	Pry Road - P0 (100% Gravel)	9/5/2008	4:15 PM	12 S	0.94	2.675						
92	Atlas Road - A2 (2 1/2" RAP)	9/5/2008	5:30 PM	12 S	0.22	3.998						
93	Atlas Road - A1 (1 1/2" RAP)	9/5/2008	5:05 PM	7 S	0.26	3.000						
94	Atlas Road - A0 (100% Gravel)	9/5/2008	4:55 PM	8 S	0.30	2.891						
95	Pry Road - P1 (1 1/2" RAP)	9/5/2008	4:40 PM	9 S	0.48	1.935						
96	Pry Road - P0 (100% Gravel)	9/5/2008	4:30 PM	15 S	0.86	2.675						
97	Atlas Road - A2 (2 1/2" RAP)	9/18/2008	3:15 PM	12 SSW	1.40	0.305						
98	Atlas Road - A1 (1 1/2" RAP)	9/18/2008	3:20 PM	11 SSW	0.92	0.504						
99	Atlas Road - A0 (100% Gravel)	9/18/2008	3:25 PM	13 SSW	1.60	1.229						
100	Pry Road - P1 (1 1/2" RAP)	9/18/2008	3:30 PM	12 SSW	0.22	0.715						
101	Pry Road - P0 (100% Gravel)	9/18/2008	3:35 PM	10 SSW	0.52	1.312						
102	Atlas Road - A2 (2 1/2" RAP)	9/18/2008	3:10 PM	10 SSW	0.54	0.305						
103	Atlas Road - A1 (1 1/2" RAP)	9/18/2008	3:00 PM	9 S	0.28	0.504						
104	Atlas Road - A0 (100% Gravel)	9/18/2008	2:55 PM	9 S	0.80	1.229						
105	Pry Road - P1 (1 1/2" RAP)	9/18/2008	2:45 PM	8 S	1.54	0.715						
106	Pry Road - P0 (100% Gravel)	9/18/2008	2:40 PM	7 S	2.18	1.312						
107	Atlas Road - A2 (2 1/2" RAP)	10/4/2008	2:55 PM	10 S	0.18	0.985						
108	Atlas Road - A1 (1 1/2" RAP)	10/4/2008	2:50 PM	8 S	0.20	0.505						
109	Atlas Road - A0 (100% Gravel)	10/4/2008	2:45 PM	9 S	0.16	1.404						
110	Pry Road - P1 (1 1/2" RAP)	10/4/2008	2:15 PM	13 S	0.76	0.480						
111	Pry Road - P0 (100% Gravel)	10/4/2008	2:20 PM	11 S	1.54	0.757						
112	Atlas Road - A2 (2 1/2" RAP)	10/4/2008	1:50 PM	11 S	0.56	0.985						
112	Atlas Road - A1 (1 1/2" RAP)	10/4/2008	2:00 PM	10 S	0.58	0.505						
114	Atlas Road - A0 (100% Gravel)	10/4/2008	2:10 PM	10 S	0.76	1.404						
115	Pry Road - P1 (1 1/2" RAP)	10/4/2008	2:35 PM	10 S	0.42	0.480						
116	Pry Road - P0 (100% Gravel)	10/4/2008	2:30 PM	13 S	0.94	0.757						
117	Atlas Road - A2 (2 1/2" RAP)	2/17/2009	12:25 PM	8 NW	0.60	0.722						
118	Atlas Road - A1 $(1 1/2" RAP)$	2/17/2009	12:20 PM	9 NW	0.50	2.147						
119	Atlas Road - A0 (100% Gravel)	2/17/2009	12:20 PM	11 NW	0.98	2.305						
120	Pry Road - P1 (1 1/2" RAP)	2/17/2009	12:15 PM	10 NW	0.54	2.098						
120	Pry Road - P0 (100% Gravel)	2/17/2009	12:00 PM	10 NW	0.36	2.050						
121	Atlas Road - A2 (2 1/2" RAP)	6/25/2009	9:00 AM	10 S	2.10	0.739						
122	Atlas Road - A1 (1 1/2" RAP)	6/25/2009	9:10 AM	5 S	1.54	0.918						
123	Atlas Road - A0 (100% Gravel)	6/25/2009	9:18 AM	7 S	1.04	0.615						
124	Pry Road - P1 (1 1/2" RAP)	6/25/2009	9:23 AM	6 S	2.06	0.209						
125	Pry Road - P0 (100% Gravel)	6/25/2009	9:30 AM	9 S	1.44	0.209						
120	Atlas Road - A2 (2 1/2" RAP)	6/25/2009	9:52 AM	8 S	0.62	0.739						
127	Atlas Road - A1 $(1 \frac{1}{2} \text{ RAP})$	6/25/2009	9:48 AM	8 S	0.48	0.918						
120	Atlas Road - A0 (100% Gravel)	6/25/2009	9:43 AM	6 S	0.52	0.615						
129	Pry Road - P1 (1 1/2" RAP)	6/25/2009	9:38 AM	8 S	1.98	0.013						
130	Pry Road - P0 (100% Gravel)	6/25/2009	9:35 AM	9 S	1.38	0.209						

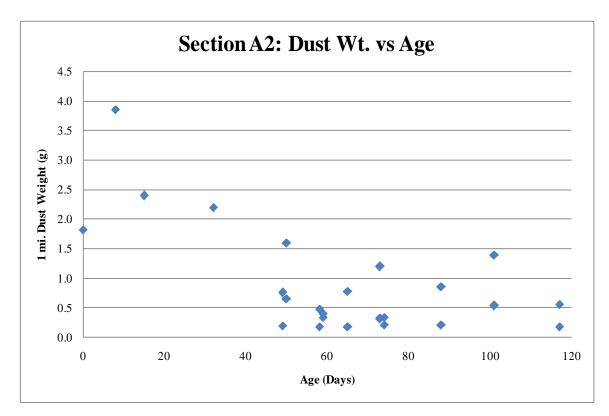


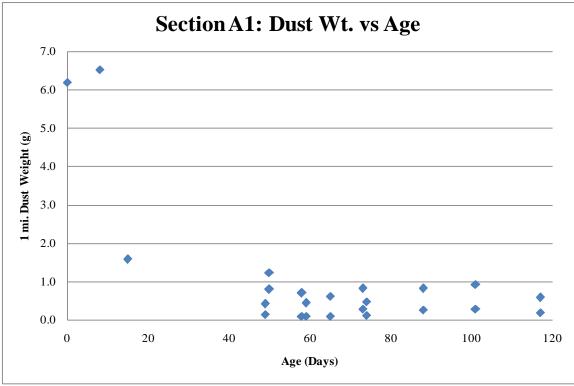


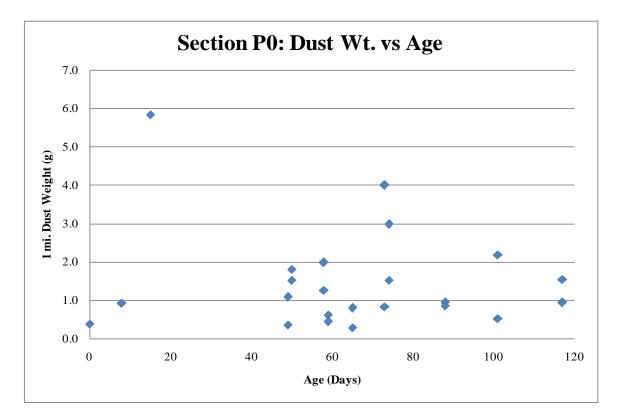


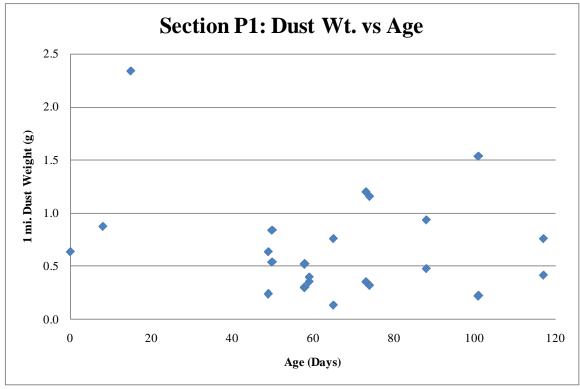
Section A0: Dust Wt. vs Age 7.0 6.0 5.0 1 mi. Dust Weight (g) 4.0 ٠ 3.0 ٠ • ۵ 2.0 ٠ 1.0 ٠ \$ 0.0 20 40 60 100 0 80 120 Age (Days)

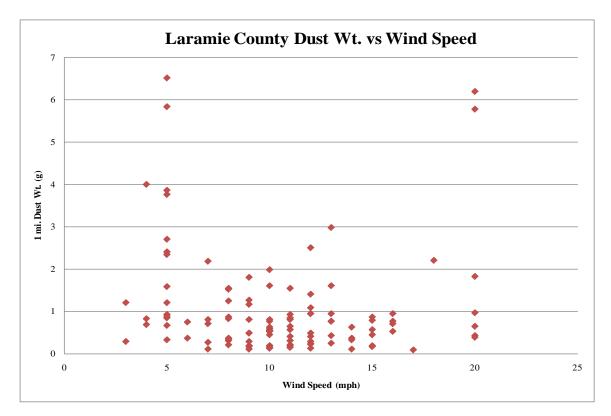
Laramie County 1 1/2" Sections: Dust Wt. vs Age

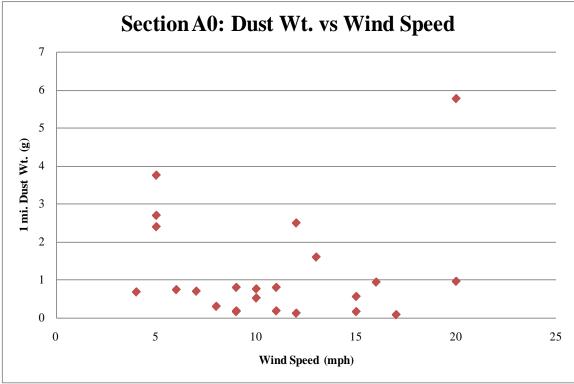


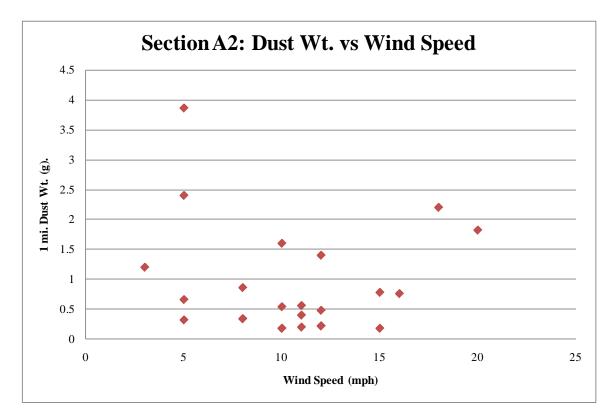


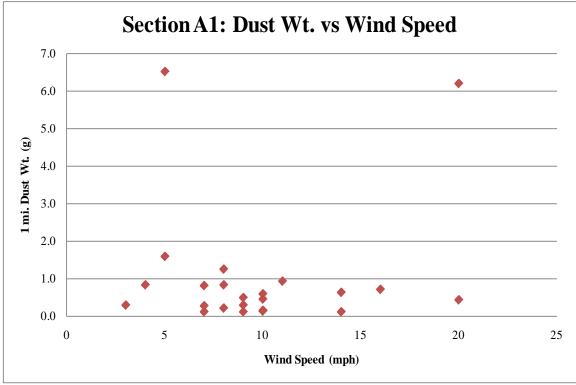


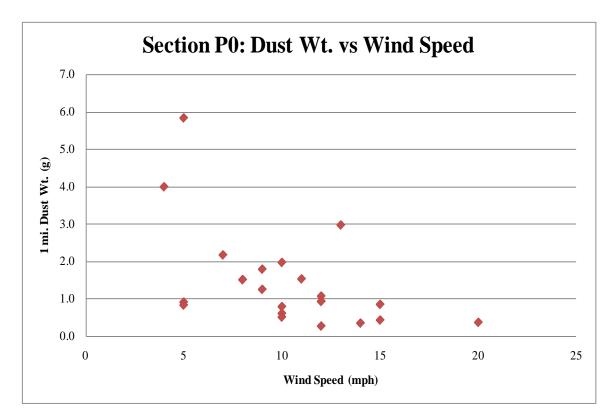


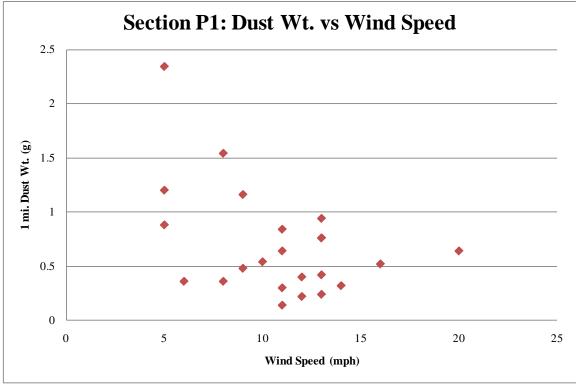


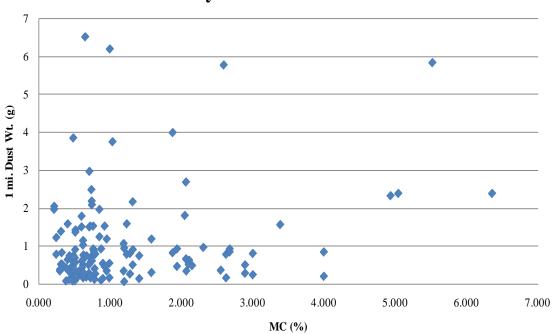






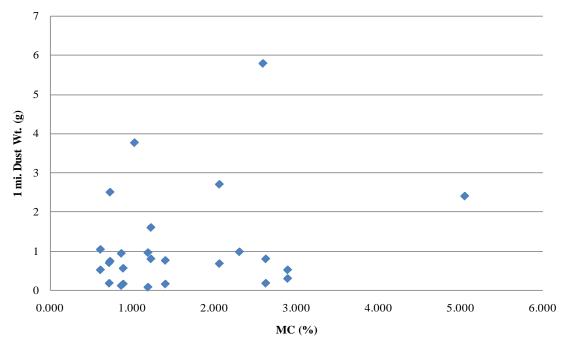


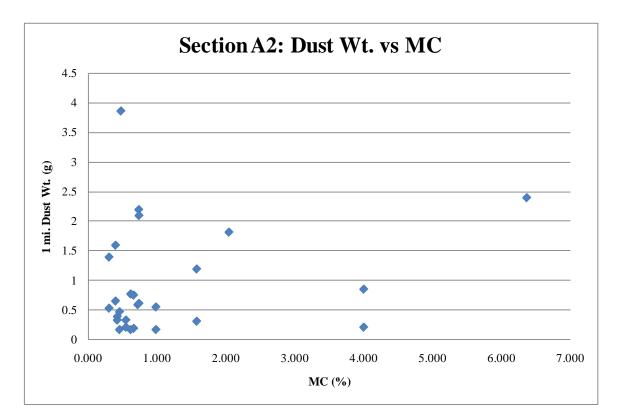


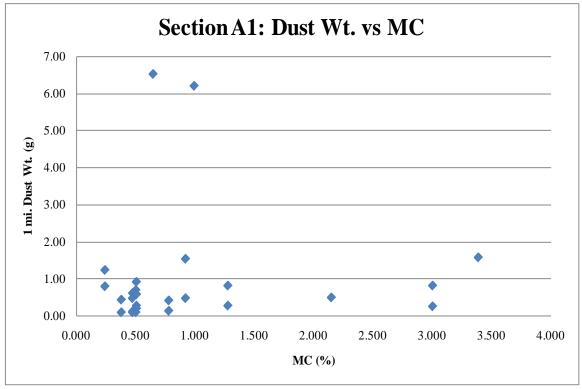


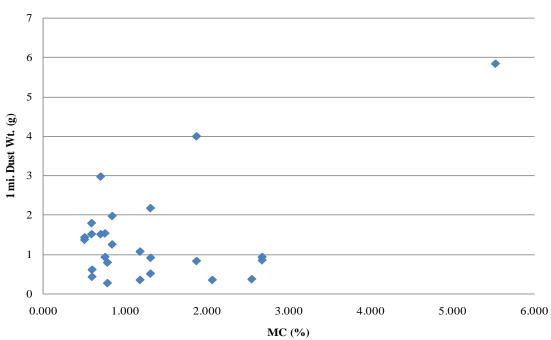
Laramie County Dust Wt. vs Moisture Content

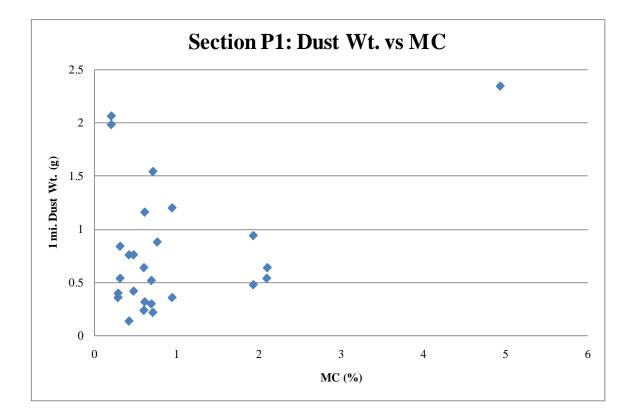
Section A0: Dust Wt. vs MC







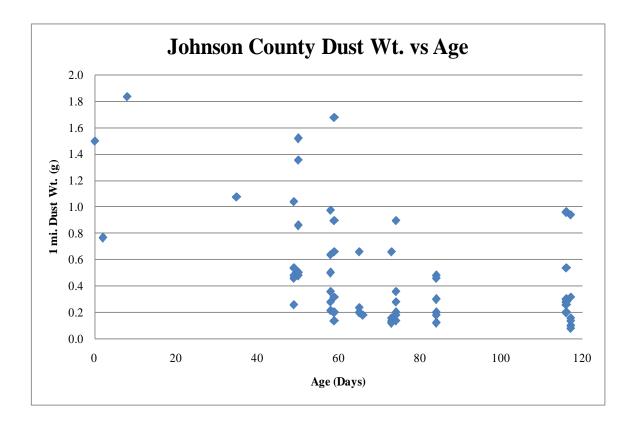


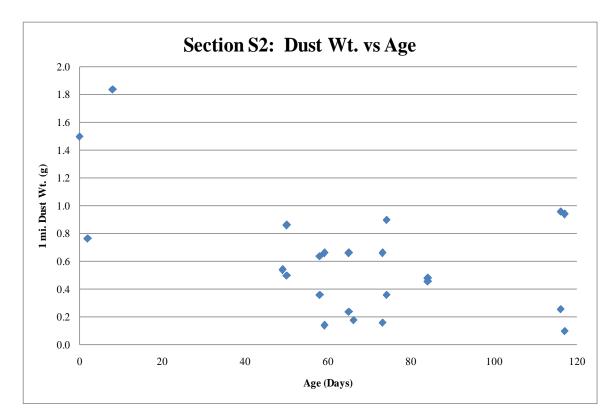


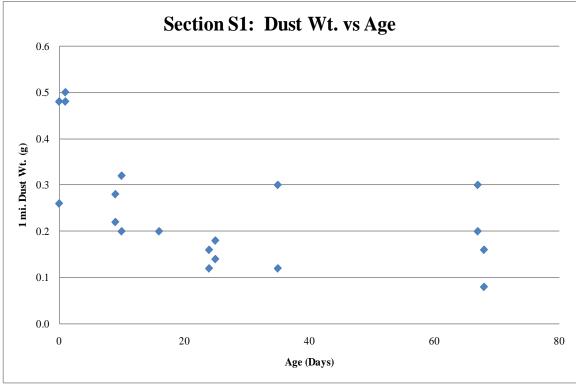
Section P0: Dust Wt. vs MC

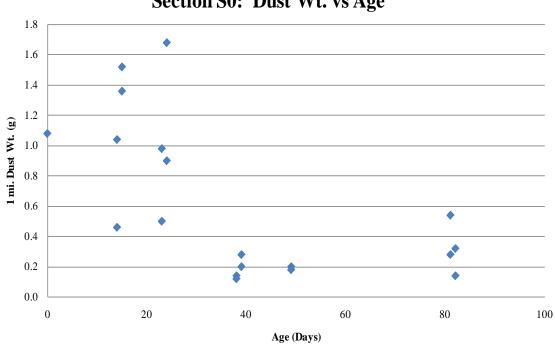
	Johnson County Dus	t, Moisture	Content, an	d Wind Data	a	
#	Test Section	Date of Sample	Time of Sample	Wind (mph)	1 mi. Dust Wt. (g)	Moisture Content (%)
1	Section 1 & 2 of RAP (no dust abatement)	6/9/2008	2:15 PM	10 NNW	1.50	2.117
2	Section 1 & 2 of RAP (no dust abatement)	6/11/2008	9:05 AM	10 NNW	0.77	1.904
3	Section 1 & 2 of RAP (no dust abatement)	6/17/2008	12:45 PM	10 NNW	1.84	0.316
4	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/14/2008	12:45 PM	15 NNW	1.08	1.657
5	Schoonover Road - S2 (RAP Blend)	7/28/2008	4:00 PM	5 N	0.54	0.348
6	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/28/2008	4:10 PM	5 N	0.26	1.692
7	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/28/2008	4:20 PM	5 N	0.46	1.282
8	Schoonover Road - S2 (RAP Blend)	7/28/2008	4:35 PM	5 N	0.54	0.348
9	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/28/2008	4:30 PM	5 N	0.48	1.692
10	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/28/2008	4:25 PM	5 N	1.04	1.282
11	Schoonover Road - S2 (RAP Blend)	7/29/2008	9:45 AM	0	0.86	0.504
12	Schoonover Road - S1 (RAP Blend w/ CaCl)	7/29/2008	9:50 AM	0	0.48	1.569
13		7/29/2008	9:55 AM	0	1.52	1.741
	Schoonover Road - S2 (RAP Blend)	7/29/2008	9:40 AM	0	0.50	0.504
15	Schoonover Road - S2 (RAP Blend w/ CaCl)	7/29/2008	9:30 AM	0	0.50	1.569
-	Schoonover Road - S0 (100% Gravel w/ CaCl)	7/29/2008	9:20 AM	0	1.36	1.741
17	Schoonover Road - S0 (RAP Blend)	8/6/2008	3:20 PM	3 N	0.64	0.331
18		8/6/2008	3:15 PM	4 NE	0.28	1.297
19		8/6/2008	3:10 PM	3 NE	0.28	0.698
20	Schoonover Road - S0 (100% Glaver w/ CaCl) Schoonover Road - S2 (RAP Blend)	8/6/2008	2:40 PM	6 NE	0.36	0.331
20	Schoonover Road - S1 (RAP Blend w/ CaCl)	8/6/2008	2:55 PM	2 N	0.30	1.297
21	Schoonover Road - S0 (100% Gravel w/ CaCl)	8/6/2008	3:05 PM	0	0.22	0.698
22		8/7/2008	10:35 AM	14 SSE	0.50	0.509
	Schoonover Road - S2 (RAP Blend w/ CaCl)				0.00	
24	Schoonover Road - S1 (RAP Blend W/ CaCl) Schoonover Road - S0 (100% Gravel w/ CaCl)	8/7/2008 8/7/2008	9:55 AM 10:10 AM	15 SSE 12 SSE	1.68	1.118
	Schoonover Road - S0 (100% Glaver w/ CaCl) Schoonover Road - S2 (RAP Blend)	8/7/2008	10:10 AM 10:30 AM	12 SSE 16 SSE	0.14	0.509
20	Schoonover Road - S2 (RAP Blend w/ CaCl)		10:25 AM		0.14	
	Schoonover Road - S1 (RAP Blend W/ CaCl) Schoonover Road - S0 (100% Gravel w/ CaCl)	8/7/2008 8/7/2008	10:23 AM 10:20 AM	18 SSE 17 SSE	0.20	1.118
28	Schoonover Road - S0 (100% Glaver w/ CaCl) Schoonover Road - S2 (RAP Blend)	8/13/2008	3:35 PM	7 ESE	0.30	0.251
	Schoonover Road - S2 (RAP Blend)	8/13/2008	3:30 PM	3 ESE	0.24	0.251
	Schoonover Road - S2 (RAP Blend w/ CaCl)		3:15 PM	5 ESE 5 SE		
31 32		8/13/2008			0.20	0.743 0.270
	Schoonover Road - S2 (RAP Blend) Schoonover Road - S2 (RAP Blend)	8/14/2008 8/21/2008	10:10 AM 12:30 PM	10 WNW 12 S	0.18	0.270
	· · · · · · · · · · · · · · · · · · ·					
34		8/21/2008	12:45 PM	18 S	0.16	1.280
35	Schoonover Road - SO (100% Gravel w/ CaCl)	8/21/2008	12:55 PM 1:10 PM	10 S 15 S	0.14	1.301 0.291
	Schoonover Road - S2 (RAP Blend)	8/21/2008			0.16	
37	Schoonover Road - S1 (RAP Blend w/ CaCl) Schoonover Road - S0 (100% Gravel w/ CaCl)	8/21/2008	1:05 PM 1:00 PM	13 S 11 S	0.12	1.280 1.301
	Schoonover Road - S0 (100% Gravel w/ CaCl) Schoonover Road - S2 (RAP Blend)	8/21/2008				
		8/22/2008	7:45 AM	8 NNW	0.36	0.422
40	Schoonover Road - S1 (RAP Blend w/ CaCl)	8/22/2008	8:00 AM	6 NW	0.14	1.311
41	Schoonover Road - SO (100% Gravel w/ CaCl)	8/22/2008	8:05 AM	9 WNW	0.20	1.789
42	Schoonover Road - S2 (RAP Blend)	8/22/2008	8:20 AM	9 NW	0.90	0.422
43	Schoonover Road - S1 (RAP Blend w/ CaCl)	8/22/2008 8/22/2008	8:15 AM	7 NW 10 NNW	0.18	1.311
44 45	Schoonover Road - SO (100% Gravel w/ CaCl)		8:10 AM		0.28	1.789
	Schoonover Road - S2 (RAP Blend)	9/1/2008	10:25 AM	5 NW	0.48	0.429
46		9/1/2008	10:20 AM	2 NW	0.30	2.102
47	Schoonover Road - SO (100% Gravel w/ CaCl)	9/1/2008	10:10 AM	3 NW	0.20	2.584
48	Schoonover Road - S2 (RAP Blend)	9/1/2008	10:30 AM	5 NW	0.46	0.429
49	Schoonover Road - S1 (RAP Blend w/ CaCl)	9/1/2008	10:35 AM	5 NW	0.12	2.102
50	Schoonover Road - S0 (100% Gravel w/ CaCl)	9/1/2008	10:40 AM	4 NW	0.18	2.584

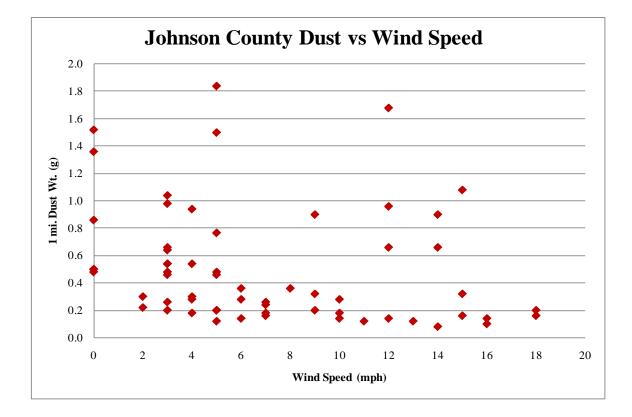
	Johnson County Dust, Moisture Content, and Wind Data									
#	Test Section	Date of Sample	Time of Sample	Wind (mph)	1 mi. Dust Wt. (g)	Moisture Content (%)				
51	Schoonover Road - S2 (RAP Blend)	10/3/2008	6:50 PM	12 SSE	0.96	0.326				
52	Schoonover Road - S1 (RAP Blend w/ CaCl)	10/3/2008	7:05 PM	4 S	0.30	0.939				
53	Schoonover Road - S0 (100% Gravel w/ CaCl)	10/3/2008	7:10 PM	4 S	0.54	1.980				
54	Schoonover Road - S2 (RAP Blend)	10/3/2008	7:25 PM	7 S	0.26	0.326				
55	Schoonover Road - S1 (RAP Blend w/ CaCl)	10/3/2008	7:20 PM	6 S	0.20	0.939				
56	Schoonover Road - S0 (100% Gravel w/ CaCl)	10/3/2008	7:15 PM	5 S	0.28	1.980				
57	Schoonover Road - S2 (RAP Blend)	10/4/2008	8:00 AM	4 S	0.94	0.844				
58	Schoonover Road - S1 (RAP Blend w/ CaCl)	10/4/2008	8:20 AM	7 SSE	0.16	0.376				
59	Schoonover Road - S0 (100% Gravel w/ CaCl)	10/4/2008	8:25 AM	9 S	0.32	1.713				
60	Schoonover Road - S2 (RAP Blend)	10/4/2008	9:20 AM	16 S	0.10	0.844				
61	Schoonover Road - S1 (RAP Blend w/ CaCl)	10/4/2008	9:10 AM	14 S	0.08	0.376				
62	Schoonover Road - S0 (100% Gravel w/ CaCl)	10/4/2008	8:50 AM	12 S	0.14	1.713				



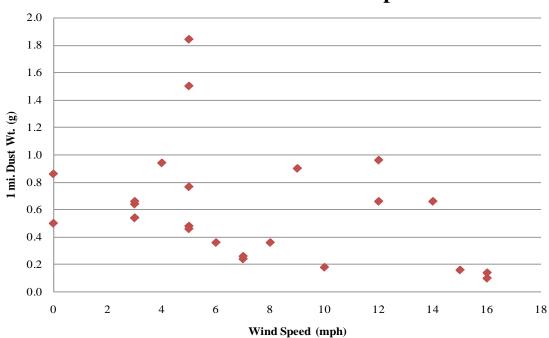


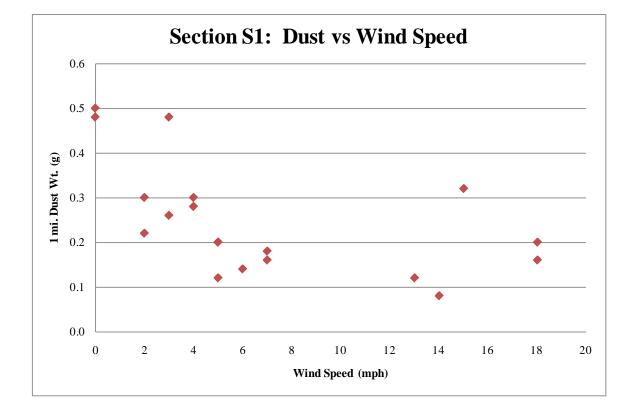




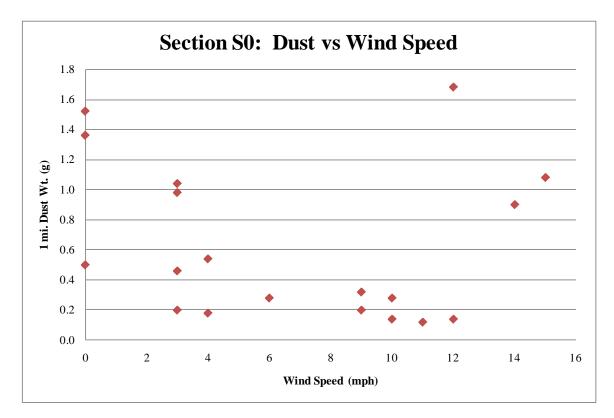


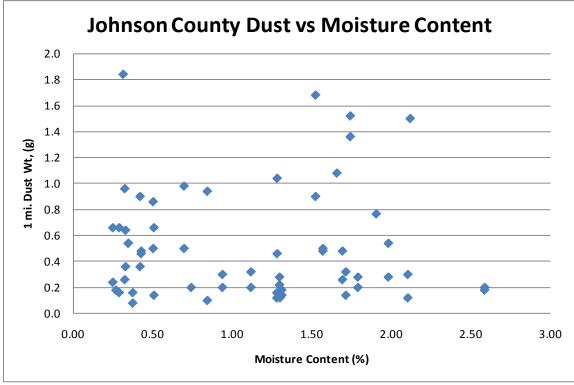
Section S0: Dust Wt. vs Age

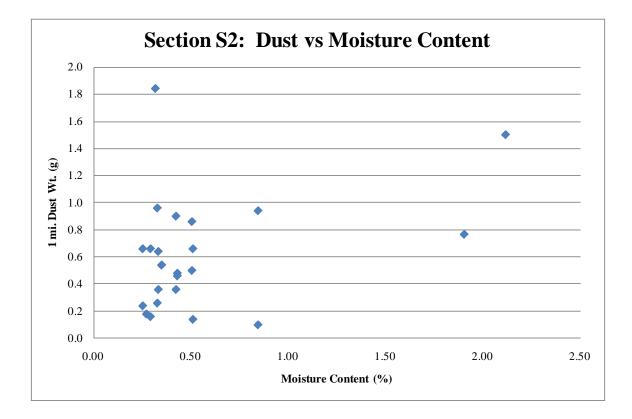




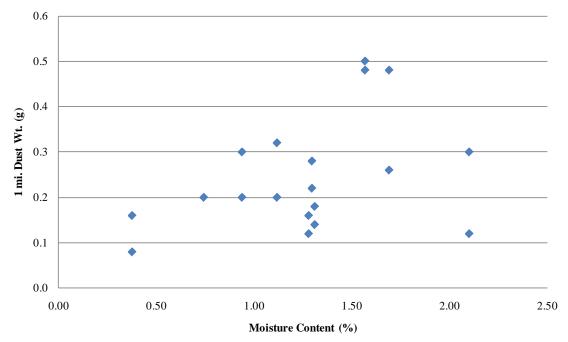
Section S2: Dust vs Wind Speed

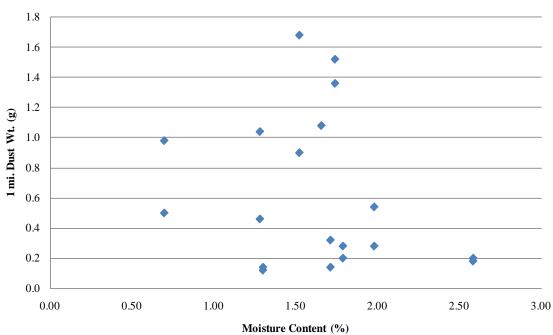






Section S1: Dust vs Moisture Content





Section S0: Dust vs Moisture Content

APPENDIX B

UNSURFACED ROAD CONDITION INDEX INSPECTION SHEETS

DateURCI $6/24/2008$ 86 $7/11/2008$ 84 $7/11/2008$ 89 $8/6/2008$ 82 $8/6/2008$ 82 $8/6/2008$ 82 $8/6/2008$ 82 $8/6/2008$ 84 $8/13/2008$ 84 $8/22/2008$ 77 $9/5/2008$ 77 $9/5/2008$ 76 $10/4/2008$ 83Pry RoDateURCI $6/24/2008$ 100 $6/24/2008$ 90 $8/6/2008$ 90 $8/6/2008$ 90 $8/6/2008$ 90 $8/6/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 90 $9/18/2008$ 100 $7/11/2008$ 100 $7/28/2008$ 100 $8/6/2008$ 100 $8/6/2008$ 100 $8/6/2008$ 100 $8/6/2008$ 100 $8/6/2008$ 100 $8/22/2008$ 93		Laramie	e County URCI
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8/22/2008 93			
			1
	9/5/2008	93	1
9/18/2008 94			1
10/4/2008 97			1

Pry Road - P	1 (1 1/2" RAP)
Date	URCI
6/24/2008	95
7/11/2008	95
7/28/2008	90
8/6/2008	90
8/13/2008	90
8/22/2008	90
9/5/2008	90
9/18/2008	91
10/4/2008	85
Pry Road - P0	(100% Gravel)
Date	URCI
6/24/2008	100
7/11/2008	100

100

100

100

100

100

100

100

7/28/2008

8/6/2008

8/13/2008

8/22/2008

9/5/2008

9/18/2008

10/4/2008

Johnson County URCI							
Schoonover Road - S2 (RAP Blend)							
Date	URCI						
7/14/2008	100						
7/29/2008	95						
8/6/2008	95						
8/13/2008	95						
8/21/2008	92						
9/1/2008	90						
10/4/2008	88						
Schoonover Road - S	l (RAP Blend w/ CaCl)						
Date	URCI						
7/14/2008	100						
7/29/2008	100						
8/6/2008	90						
8/13/2008	87						
8/21/2008	87						
9/1/2008	84						
10/4/2008	88						
Schoonover Road - S0	(100% Gravel w/ CaCl)						
Date	URCI						
7/14/2008	100						
7/29/2008	97						
8/6/2008	90						
8/21/2008	85						
9/1/2008	83						
10/4/2008	65						

		ι	JNSURFAC	ED ROAD	INSPECTION	N SHEET			
Branch		Atlas Roa	id - A2		Date		6/24/2008		
Section		2 1/2"			Inspector SK & GH				
Sample Unit				Α	rea of Sample	mple 29' x 517 ' = 14993 sf			
DISTR 1. Improper C		TYPES	par feet)						
2. Inadequate		•	•	+)					
3. Corrugation				.)					
4. Dust		, ,							
5. Potholes (r		•							
6. Ruts (squar									
7. Loose Aggr	ega	te (linear feet	z)						
			DISTRESS	QUANTIT	Y AND SEV	ERITY			
Туре		1	2	3	4	5	6	7	
Quantitu and	L		130'				280 sf	727'	
Quantity and Severity	м							30'	
-	н								
			L		ULATION		-	-	
Distress Type		Density	Severity	Deduct Value	REMARKS	:			
2		1.0%	L	2	• 1-2 % Cros	s Slope, peak	not on cente	rline	
6		1.9%	L	3					
7		4.8%	L	8	• 8' x 35' = 2	80 sf of low r	utting		
7		0.2%	М	1					
					• 100' of low	severity drai	nage on north	n side	
30' of low severity drainage on south side							side		
	Total of 727' of low loose aggregate								
		Total De	educt Value =	14	• Total of 30	' of medium l	oose aggrega	te	
			q =	1					
URCI = 86			Rating =	EXC.					

			UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Ro	ad - A2		Date		7/11/2008	
Section		2 1/2"	RAP	Inspector SK				
Sample Unit				Α	rea of Sample	29'	x 517 ' = 1499	3 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s num	adside Drain square feet) ber) eet)	age (linear fee t)		Y AND SEV	FRITY		
Туре		1	2			5	6	7
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	L		170'				440 sf	460'
Quantity and	м		170				440 si 450 sf	70'
Severity	н							40'
Distress Type		Density	L Severity	JRCI CALC Deduct Value	ULATION REMARKS	:		
2		1.1%	L	2	• 1-2 % Cros	s Slone neak	not on cente	rline
6		2.9%	L	4				
6		3.0%	М	5	 secondary 	shoulders sta	rting to form i	in some
7		3.1%	L	6	spots			Joine
7		0.5%	М	2	• 6" berm or	n south side 5	0' long with ru	ıtting
7		0.3%	Н	2				
					• 170 total' o	of low severit	y drainage	
Total of 460' of low loose aggregate								
					• Total of 70	' of medium l	oose aggregat	e
		Total D	educt Value =	21	• Total of 40	' of high loose	e aggregate	
			q =	2	Low and N	ledium severi	ty rutting also	present
URCI = 84			Rating =	Very Good				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Atlas Roa	id - A2		Date		7/28/2008		
Section					Inspector SK				
Sample Unit				Α	rea of Sample	29'	x 517 ' = 1499	93 sf	
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ross Roa ns (s iuml re fe	s Section (line adside Draina quare feet) ber) et)	nge (linear fee		ΓY AND SEV	FRITY			
Туре					4	5	6	7	
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	L			3	-		60 sf	755'	
Quantity and	м						00 51	15	
Sevenity	н								
Distress Type		Density	L Severity	JRCI CALC Deduct Value		:			
7		5.0%	L	9	• 1-2 % Cros	s Slope, flat o	enter		
7		0.1%	М	1					
6		0.4%	L	1	• 755 ' of lov	v loose aggre	gate		
					1/2" - 1 3/4"				
		Total De	educt Value =	11	 15' of medium loose aggregate 2" 3' x 20' = 60 sf low rutting on south side 				
			q =	1	Seems roa	dway has bee	n reworked si	ince last	
URCI = 89			Rating =	EXC.	evaluation				

		I	UNSURFAC	ED ROAD	INSPECTIO	N SHEET				
Branch					Date		8/6/2008			
Section				•	Inspector		SK			
Sample Unit				A	rea of Sample	29'	x 517 ' = 1499	93 sf		
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros: Ro ns (s ium re fe	adside Draina square feet) ber) eet)	age (linear fee							
	<u> </u>		1	-	Y AND SEV		-			
Туре		1	2	3	4	5	6	7		
Quantity and	L						220 sf	1059'		
Severity	м						200 sf	50'		
	н									
			ι	JRCI CALCI	JLATION REMARKS					
Distress Type		Density	Severity	Value	IL MARKS	•				
7		7.1%	L	12	• 1-2 % Cros	s Slope, peak	not on cente	rline		
7		0.3%	М	3	flat center					
6		1.5%	L	2	• Medium ru	itting on sout	h side			
6		1.3%	М	2	4' x 50' = 200	sf				
					Low rutting	g on south sid	le			
					4' x 30' = 120 sf					
					Low rutting on north side					
					2' x 50' = 100 sf					
					• Total of 10	59' of low loc	ose aggregate			
		Total De	educt Value =	19						
			q =	1	• 50' of med	ium loose agg	gregate on sou	uth side		
URCI = 82			Rating =	Very Good						

			UNSURFAC	ED ROAD	NSPECTIO	N SHEET				
Branch Atlas Road -			ad - A2		Date		8/13/2008			
Section			RAP		Inspector SK					
Sample Unit	Sample Unit			Ar	Area of Sample 29' x 517 ' = 14993 sf			93 sf		
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s ium	adside Draina square feet) ber) eet)	age (linear fee t)							
DISTRESS QUANTITY AND SEVERITY										
Туре		1	2	3	4	5	6	7		
Quantity and	L						220 sf	1064'		
Severity	м						200 sf	100'		
_	н									
Distress Type		Density	L Severity	JRCI CALCU Deduct Value	JLATION REMARKS	:				
6		1.5%	L	2	 1% Cross Slope not on centerline. Flat center 					
6		1.3%	М	2						
7		7.1%	L	12	Total of 1064' low loose aggregate					
7		0.7%	М	5]					
					• 100' of medium loose aggregate on south side					
					200 sf of medium rutting on south side					
					• 120 sf of low rutting on south side					
		Total D	educt Value =	21	 100 sf of low rutting on north side 					
	q =									
URCI = 84	URCI = 84 Rating =			Very Good						

		l	UNSURFAC	ED ROAD	INSPECTIO	N SHEET				
Branch Atlas Roa		ad - A2		Date		8/22/2008	8/22/2008			
Section		2 1/2"	RAP		Inspector		SK			
Sample Unit		<u> </u>		A	Area of Sample 29' x 517 ' = 14993 s			93 sf		
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (r 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s num	adside Draina square feet) ber) eet)	age (linear fee t)			EDITY				
Tupo	DISTRESS QUANTITY AND SEVERITY									
Туре		1	2	3	4	5	6	7		
Quantity and	L					10	250 sf	1064'		
Severity	М						400 sf	130'		
	Η									
			L	JRCI CALCI						
Distress Type		Density	Severity	Value	REMARKS:					
6		1.7%	L	2	• 1% Cross Slope not on centerline. Flat center					
6		2.7%	М	3						
7		7.1%	L	12	 Total of 1064' low loose aggregate 					
7		0.9%	М	4	80' of medium loose aggregate on south side					
5		0.07%	L	10	(east)					
					 50' of medium loose aggregate on south side (west) Low and medium rutting on south side (east and 					
					west)					
		-	<u> </u>							
Total Deduct Value =				23	 >1' diameter potholes on west end 					
q = URCI = 77				1 Vary Cood	10 at 1" deep)				
			Rating =	Very Good						

			UNSURFAC	ED ROAD	INSPECTION	SHEET				
Branch	Branch Atlas Roa		1 - A2		Date 9/5/2008					
		2 1/2"	RAP		Inspector SK					
Sample Unit				A	Area of Sample 29' x 517 ' = 14993 sf			93 sf		
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	Cros Ro ns (s num	adside Draina square feet) ber) eet)	age (linear fee t)		Y AND SEV	DITY				
Туре		1	2	3		5	6	7		
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	L		_			10	250 sf	1034'		
Quantity and						10	400 sf	300'		
Severity	н						100 01			
Distress Type		Density	L Severity	JRCI CALCI Deduct Value	ULATION REMARKS:					
5		0.07%	L	2	 1% Cross Slope not on centerline. Flat center 1034' low loose aggregate from both sides 300' med loose aggregate on south side 					
6		1.7%	L	2						
6		2.7%	М	3						
7		7.1%	L	12						
7		2.0%	М	10	• 80' x 4' = 320sf of medium rutting on south side					
					 30' x 3' = 90sf of low rutting (middle) (west) 40' x 4' = 160 sf low rutting south (east) 					
					• 20' x 4' = 80	20' x 4' = 80 sf medium rutting north (west)				
					4					
Total Deduct Value =				29	 >1' diameter potholes on west end 					
q =				2 Mary Cood	10 at 1" deep					
URCI = 77			Kating =	Very Good						

			UNSURFAC	ED ROAD	NSPECTION	N SHEET				
Branch		Atlas Roa	ad - A2		Date		9/18/2008			
Section		2 1/2"	RAP							
Sample Unit				Aı	ea of Sample	29'	x 517 ' = 1499	93 sf		
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s ium	adside Draina square feet) ber) eet)	age (linear fee t)							
			1		Y AND SEV			-		
Туре	Type 1		2	3	4	5	6	7		
Quantity and	L					10	320 sf	1264'		
Severity	М						300 sf	45'		
	Н							30'		
Distress Type		Density	L Severity	JRCI CALCU Deduct Value	JLATION REMARKS	:				
5		0.07%	L	2	• 1% Cross S	lone not on a	enterline. Fla	at center		
6		1.7%	L	2	1		e from both s			
6		2.7%	М	3	1		middle (west)			
7		7.1%	L	12	1		e middle(eas			
7		0.3%	М	2	• 45' med lo	ose aggregate	e south (east)			
7		0.2%	Н	2	• 30' high loo	ose aggregate	south (east)			
		Total D	educt Value =	22	 35' x 4' = 140 sf low rutting middle (west) 60' x 3' = 180 sf low rutting middle (east) 50' x 6' = 300 sf med rutting middle (east) 22 >1' diameter potholes on west end 					
URCI = 79			q = Rating =	1 Very Good	10 at 1" deep					

			UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	ad - A2		Date		10/4/2008	
Section		2 1/2"	RAP		Inspector		SK	
Sample Unit				Α	rea of Sample	29'	x 517 ' = 1499	3 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros: Ro ns (s ium re fe	adside Drain square feet) ber) eet)	age (linear fee t)					
		-		-	Y AND SEV		-	_
Туре	_	1	2	3	4	5	6	7
Quantity and	L					10	625 sf	1134'
Severity	м							
Н	н							30'
Distress Type		Density	L Severity	JRCI CALCI Deduct Value	ULATION REMARKS	:		
5		0.07%	L	2	• 1% Cross \$	Slope not on (centerline. Fla	t center
6		4.2%	L	7	1		te from both s	
7		7.6%	L	12	< 2"	00 0		
7		0.2%	н	2	• 100' low le	oose aggregat	te middle(eas	t)
		0.2,0						-,
					• 30' high lo	nse aggregate	south (east)	
					• 30' x2' = 60) sf low ruttin	g middle	
					4		ing middle (ea	ast)
	-				1		ting middle (ea	-
	<u> </u>	Total D	educt Value =	23	 >1' diamet 			
			q =	2	10 at 1" deep	-		
URCI = 83			•	Zery Good				
			- Guine -	, 6000	1			

		ι	JNSURFAC	ED ROAD I	NSPECTIO	N SHEET		
Branch		Atlas Roa	id - A1		Date		6/24/2008	
Section		1 1/2"						
Sample Unit		•		Ar	ea of Sample	30'	x 100 ' = 300	0 sf
DISTR 1. Improper C 2. Inadequate	ros			t)				
3. Corrugation			0-(- /				
4. Dust		,						
5. Potholes (n	um	ber)						
6. Ruts (squar		•						
7. Loose Aggr			:)					
	-							
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
Quantity and								
	м							
Severity	н							
			ι	JRCI CALCI	JLATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 3 % Cross	Slope		
					No Distress	ses		
					t			
<u> </u>					ł			
					1			
	I	Total De	educt Value =	0				
	q =							
URCI = 100	•							

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Atlas Roa	id - A1		Date		7/11/2008		
Section		1 1/2"	RAP						
Sample Unit				A	rea of Sample				
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n	ros Ro ns (s	adside Draina square feet)		t)					
6. Ruts (squar	e fe	eet)							
7. Loose Aggr	ega	te (linear feet	:)						
			DISTRESS	QUANTIT	Y AND SEV	ERITY			
Туре		1	2	3	4	5	6	7	
	L							65'	
Quantity and	м								
Severity	н								
			U	JRCI CALCI	JLATION				
Distress Type		Density	Severity	Deduct Value	REMARKS	:			
7		2.2%	L	4	• 3 % Cross	Slope			
					• 40' of low	oose aggrega	te on north si	de	
					• 25' of low	oose aggrega	te on south si	de	
					1/2" - 3/4"				
]				
		Total De	educt Value =	4]				
	q =								
URCI = 97			Rating =	EXC.					

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A1		Date		7/28/2008	
Section		1 1/2"	RAP					
Sample Unit				A	rea of Sample			
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar	ros Ro ns (s	adside Draina square feet) ber)		t)				
7. Loose Aggr	ega	te (linear feet		QUANTIT	Y AND SEV	ERITY		
Туре	DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6							7
	L							150'
Quantity and	м							100
Severity	н							
			U	JRCI CALCI	JLATION REMARKS			
Distress Type		Density	Severity	Value	REIVIARNS	i da la companya da l		
7		5.0%	L	9	• 2 % Cross	Slope		
					• 100' of low	loose aggreg	ate on north	side
					ο ΓΩ' of low			
					• 30 01 10w 1/2" - 1"	loose aggrega	te on south si	lue
					1/2 -1			
					4			
					1			
					1			
		Total De	educt Value =	9]			
	q =							
URCI = 92			Rating =	EXC.				

5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity L Image:			ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Section 11/2" RAP Inspector SK Sample Unit 3000 sf 3000 sf DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 3. Corrugations (square feet) 6. Ruts (square feet) 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) 23 VERESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and H	Branch		Atlas Roa	ad - A1		Date		8/6/2008		
Sample Unit Area of Sample 3000 sf DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 3. Corrugations (square feet) 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity 1 2 3 4 5 6 7 Quantity and H 1 1 1 200' 200' 200' White H 1 1 1 200' 200' 200' DISTRESS QUANTITY AND SEVERITY Quantity and H M 1 1 1 200' WEIC CALCULATION Distress Type Density Severity Deduct REMARKS: 2 % Cross Slope 100' of low loose aggregate on north side 1/2" - 1" 100' of low loose aggregate on south side 1/2" - 1" 100' of low loose aggregate on sou			1 1/2"	RAP						
1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 4. Dust 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) 1 2 3 4 5 6 7 1 2 3 4 5 6 7 Quantity and Severity 1 2 3 4 5 6 7 Quantity and Severity 1 2 3 4 5 6 7 Quantity and Severity 1 2 3 4 5 6 7 0 1 1 1 1 200' 200' 200' Quantity and L 1 <td< td=""><td></td><td></td><td>· ·</td><td></td><td>А</td><td></td><td></td><td></td><td></td></td<>			· ·		А					
Type 1 2 3 4 5 6 7 Quantity and Severity L M 200' M <th> Improper C Inadequate Corrugation Dust Potholes (n Ruts (squar </th> <th>ros Ro ns (s um e fe</th> <th>s Section (line adside Draina square feet) ber) eet)</th> <th>age (linear feet</th> <th></th> <th>TY AND SEV</th> <th>FRITY</th> <th></th> <th></th>	 Improper C Inadequate Corrugation Dust Potholes (n Ruts (squar 	ros Ro ns (s um e fe	s Section (line adside Draina square feet) ber) eet)	age (linear feet		TY AND SEV	FRITY			
Quantity and Severity L Image: Construction of the second	Туре									
Quantity and Severity M Image: Construction of the second					_					
Severity H Image: Constraint of the second constraint of the	-	-							200	
URCI CALCULATION Distress Type Density Severity Deduct Value REMARKS: 7 6.7% L 11 • 2 % Cross Slope 1 1 - • 100' of low loose aggregate on north side 1 1 - • 100' of low loose aggregate on south side 1/2" - 1" • 100' of low loose aggregate on south side 1/2" - 1" • 100' of low loose aggregate on south side 1/2" - 1 "/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 100' of low loose aggregate on south side 1/2" - 1 1/4" • 11	Severity									
Image: style sty	Distress Type		Density		Deduct	1	:			
Image: style sty	7		6.7%			• 2 % Cross	Slone			
Image: state of the state	,		0.770	L		2 /0 01035	Siope			
q = 1						1/2" - 1"100' of low loose aggregate on south side				
q = 1						4				
•			Total De							
	URCI = 90	•								

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Atlas Roa	nd - A1		Date		8/13/2008		
Section		1 1/2"	RAP						
Sample Unit		,		А	rea of Sample				
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n	ros: Ro ns (s um	s Section (line adside Draina square feet) ber)		t)					
6. Ruts (squar									
7. Loose Aggr	ega	te (linear feet	:)						
			DISTRESS	QUANTI	TY AND SEV	ERITY			
Туре	rpe <u>1</u> 2			3	4	5	6	7	
	L							200'	
Quantity and	м								
Severity	н								
			U	IRCI CALC	1				
Distress Type		Density	Severity	Deduct Value	REMARKS	:			
7		6.7%	L	11	• 2 % Cross	Slope			
					• 100' of low	loose aggreg	ate on north	side	
					1/2" - 1 1/4"				
					• 100' of low	loose aggreg	ate on south	side	
					1/2" - 1 1/4"				
		Total De	educt Value =	11	1				
	q =								
URCI = 90			Rating =	EXC.					

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET				
Branch		Atlas Roa	id - A1		Date		8/22/2008			
Section		1 1/2"	RAP							
Sample Unit				А	rea of Sample					
DISTRE 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (square 7. Loose Aggre	ross Roa ns (s uml e fe	Section (line adside Draina quare feet) ber) et)	ge (linear fee	t)						
			DISTRESS	QUANTI	Y AND SEV	ERITY				
Туре	1 2			3	4	5	6	7		
	L							200'		
Quantity and	м									
Severity	н									
			U	IRCI CALC	Ī					
Distress Type		Density	Severity	Deduct Value	REMARKS	:				
7		6.7%	L	11	• 2% Cross 9	Slope				
					• 100' of low	/ loose aggreg	ate on north	side		
					1/2" - 1 1/4"					
					• 100' of low	/ loose aggreg	ate on south	side		
					1/2" - 1 1/4"					
					• no rutting	but rough sur	face			
]	5				
		Total De	educt Value =	11						
			= p	1						
URCI = 90			Rating =	EXC.						

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Atlas Roa	ad - A1		Date		9/5/2008		
Section		1 1/2"	RAP						
Sample Unit				Α	rea of Sample		3000 sf		
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggro	ross Ro ns (s um e fe	s Section (line adside Draina quare feet) ber) eet)	age (linear feet		TY AND SEV	ERITY			
Type	Type 1 2 3 4 5 6 7								
	L			-				200'	
Quantity and								200	
Severity	м н								
Distress Type		Density	U Severity	IRCI CALC	ULATION REMARKS	:			
			-	Value	-				
7		6.7%	L	11	• 2% Cross S	Slope			
					 100' of low loose aggregate on north side 3/4" - 1 1/4" 100' of low loose aggregate on south side 1/2" - 1 1/4" 				
		Total De	educt Value =	11	-				
			q =	1					
URCI = 90			Rating =	EXC.					

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Atlas Roa	id - A1		Date		9/18/2008		
Section		1 1/2"	RAP						
Sample Unit				А	rea of Sample				
DISTR 1. Improper C 2. Inadequate	ros			t)					
3. Corrugation	าร (ร	square feet)							
4. Dust									
5. Potholes (n	um	ber)							
6. Ruts (squar	e fe	et)							
7. Loose Aggr	ega	te (linear feet	:)						
					Y AND SEV	EDITV			
Туре		1	2	3	4	5	6	7	
туре			2	3	4	5	0		
Quantity and								200'	
Severity	м								
	Η								
			U	IRCI CALC	ULATION				
Distress Type		Density	Severity	Deduct Value	REMARKS:				
7		6.7%	L	11	• 2% Cross S	Slope			
					• 100' of low	loose aggreg	gate on both s	ides	
					3/4" - 1 1/2"	00 0			
					-				
					-				
					-				
					4				
					1				
		Total De	educt Value =	11					
	q =								
URCI = 90	RCI = 90 Rating =								

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A1		Date		10/4/2008	
Section		1 1/2"	RAP					
Sample Unit				A	rea of Sample			
 Improper C Inadequate 	ros Ro	adside Draina		t)				
3. Corrugation	าร (ร	square feet)						
4. Dust								
5. Potholes (n								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	.)					
			DISTRESS	QUANTI	Y AND SEV	ERITY		
Туре	1 2			3	4	5	6	7
	L							200'
Quantity and	м							
Severity	н							
			U	JRCI CALC	ULATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
7		6.7%	L	11	• 2% Cross \$	Slope		
					• 100' of low	/ loose aggreg	ate on both s	ides
					3/4" - 1 1/2"	00 0	,	
					-			
					-			
					-			
ļ					4			
					4			
		Total De	educt Value =	11				
	q =							
URCI = 90			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A0		Date		6/24/2008	
		100 % G		i	Inspector		SK & GH	
Sample Unit				A	Inspector rea of Sample	27'	x 100 ' = 270	0 sf
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ar feet)					
2. Inadequate	Ro	adside Draina	ge (linear fee	t)				
3. Corrugation	าร (ร	square feet)						
4. Dust								
5. Potholes (n	um	ber)						
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	:)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре	Type 1 2				4	5	6	7
Quantity and								
-	м							
Severity	н							
	н							
			ι	JRCI CALCI	JLATION			
				Deduct	REMARKS	:		
Distress Type		Density	Severity	Value	_			
					• 2 % Cross	Slone		
					2 /0 01033	Slope		
					4			
					 No Distress 	ses		
					1			
					1			
	-				4			
ļ					ł			
L					ļ			
Total Deduct Value =				0]			
	q =							
URCI = 100	RCI = 100 Rating							

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	ad - A0		Date		7/11/2008	
Section		100 % G						
Sample Unit				A	Inspector rea of Sample	27	' x 100 ' = 270	0 sf
				•	-			
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ear feet)					
2. Inadequate	Ro	adside Draina	ige (linear fee	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (r								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	:)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
Quantity and	L							
	м							
Severity	н							
			ι		JLATION			
Distress Type		Density	Severity	Deduct	REMARKS	:		
Distress Type		Density	Seventy	Value				
					• 2 % Cross	Slope		
					No Distres	202		
						563		
					4			
					4			
					ļ			
					ļ			
					1			
					1			
		Total De	educt Value =	0	1			
			q =	0				
URCI = 100			Rating =					

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A0		Date		7/28/2008	
Section		100 % G		•				
Sample Unit				A	Inspector ea of Sample	27	x 100 ' = 270	0 sf
-								
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ar feet)					
2. Inadequate	Ro	adside Draina	ge (linear fee	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (r	um	ber)						
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	:)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and								
Severity	M							
	Η							
			L	JRCI CALCI	Π ΑΤΙΟΝ			
				Deduct	REMARKS	•		
Distress Type		Density	Severity	Value	_			
					• 2 % Cross	Slone		
					• 2 /0 Closs	Siope		
					4			
					 No Distress 	ses		
					1			
					t			
					ł			
					-			
					ł			
		Total De	educt Value =	0				
			q =	0				
URCI = 100			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	NSPECTIO	N SHEET		
Branch		Atlas Roa	id - A0		Date		8/6/2008	
Section		100 % G		i i i i i i i i i i i i i i i i i i i				
Sample Unit				Aı	Inspector ea of Sample	27	x 100 ' = 270	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (r 6. Ruts (squar	ESS Prose Roa ns (s ns (s num	adside Draina square feet) ber) eet)	ge (linear fee					
7. Loose Aggr	ega [.]	te (linear feet		QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and	м							
Severity	н							
			L	JRCI CALCU	JLATION REMARKS			
Distress Type		Density	Severity	Value	ILIVIAIIIS	•		
					• 2 % Cross	Slope		
					No Distres	ses		
		Total Da	educt Value =	0	{			
			q =	0				
URCI = 100			۹ Rating =					

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	ad - A0		Date		8/13/2008	
Section	-	100 % G						
Sample Unit				A	Inspector rea of Sample	27	x 100 ' = 270	0 sf
					-			
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ear feet)					
2. Inadequate	e Ro	adside Draina	ige (linear fee	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (r								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	:)					
			DICTORCO					
		-		-	Y AND SEV			_
Туре	_	1	2	3	4	5	6	7
Quantity and	L							
Severity	м							
	н							
								•
			ι	JRCI CALCI	JLATION			
Distress Type		Density	Severity	Deduct	REMARKS	:		
Distress Type		Density	Seventy	Value				
					• 2 % Cross	Slope		
					No Distres	202		
						563		
					4			
	<u> </u>				ł			
					ļ			
					ļ			
]			
					1			
		Total De	educt Value =	0	1			
			q =	0				
URCI = 100			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Atlas Roa	d - A0		Date		8/22/2008		
Section		100 % G							
Sample Unit				A	Inspector rea of Sample	27	x 100 ' = 270	0 sf	
-	E SS rose Ro ns (s	TYPES s Section (line adside Draina square feet) ber)	ar feet)						
7. Loose Aggr					Y AND SEV	EDITY			
Туре		1	2	3	FAND SEV	5	6	7	
туре		-	2		-		0		
Quantity and	L							100'	
Severity	M								
	Η		L		JLATION		<u> </u>	<u>.</u>	
Distress Type		Density	Severity	Deduct Value	REMARKS	:			
7		3.7%	L	8	• 2 % Cross	Slope			
				100' of low loose aggregate on south side 1/2" - 1"					
		i otal De	educt Value = q =	8 1					
URCI = 93			ч – Rating =	EXC.					

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A0		Date		9/5/2008	
Section		100 % G						
Sample Unit				A	Inspector ea of Sample	27	x 100 ' = 270	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s um	adside Draina square feet) ber) eet)	ge (linear fee	t)				
				QUANTIT 3	Y AND SEV			
Туре	Type 1 2				4	5	6	7
Quantity and	L							100'
Severity	м							
,	н							
			L		1			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
7		3.7%	L	8	• 2 % Cross	Slope		
					• 100' of low 1/2" - 1"	v loose aggreg	ate on south	side
					-			
					1			
					1			
					1			
		Total De	educt Value =	8	1			
			q =	1				
URCI = 93			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A0		Date		9/18/2008	
Section	-	100 % G						
Sample Unit	-			А	Inspector rea of Sample	27	' x 100 ' = 270	0 sf
-	ESS rose Roa ns (s um re fe	TYPES s Section (line adside Draina square feet) ber) set)	ar feet) ge (linear fee					
	- 0 -			QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							80'
Quantity and Severity	м							
Seventy	н							
			U	IRCI CALCI	1			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
7		3.0%	L	6	• 2 % Cross	Slope		
					• 80' of low 1/2" - 1"	loose aggrega	ite on south s	ide
					1			
					1			
		Total De	educt Value =	6	1			
			q =	1				
URCI = 94			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Atlas Roa	id - A0		Date		10/4/2008	
Section	-	100 % G						
Sample Unit				A	Inspector rea of Sample	27	' x 100 ' = 270	0 sf
-	ESS Frose Roa ns (s num re fe	TYPES s Section (line adside Draina square feet) ber) set)	ar feet) ge (linear fee					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							55'
Quantity and	м							
Severity	н							
			U	JRCI CALCI	JLATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
7		2.0%	L	4	• 2 % Cross	Slope		
					1			
					• 55' of low 1/2" - 1"	oose aggrega	ite on south s	de
					ļ			
					ļ			
		Total De	educt Value =	4				
			= p	1				
URCI = 97			Rating =	EXC.				

Branch Pry Road - P1 Date 6/24/2008 Section 11/2" RAP Inspector SK & GH Sample Unit 29' x 100' = 2900 sf SK & GH DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 3. Loose Aggregate (linear feet) 0 100' 6. Ruts (square feet) 0 100' 7. Loose Aggregate (linear feet) 100' URCI CALCULATION URCI CALCULATION Distress Type Density Severity Deduct 7 3.5% L 6 100' low loose aggregate on west side 1/2" - 3/4"			ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Section 1 1/2" RAP Inspector SK & GH Sample Unit	Branch		Prv Road	d - P1		Date		6/24/2008	
DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 4. Dust 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) 7. Loose Aggregate (linear feet)			1 1/2"	RAP	i i	Inspector			
DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 4. Dust 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) 7. Loose Aggregate (linear feet)			,		A	rea of Sample	29'	x 100 ' = 290	0 sf
5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and L 0 100' M 0 100 000 Severity H 0 0 0 000 URCI CALCULATION Distress Type Density Severity Deduct Value 7 3.5% L 6 • 3 % Cross Slope • 100' low loose aggregate on west side 1/2" - 3/4" • 102' a du 1/2" - 3/4"	 Improper C Inadequate Corrugation 	ros Ro	s Section (line adside Draina						
6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and L 0 100' M 0 100 00' Severity H 0 100 00' URCI CALCULATION Distress Type Density Severity Deduct 7 3.5% L 6 7 3.5% L 6 1/2" - 3/4" 1/2" - 3/4"	5. Potholes (n	um	ber)						
Type 1 2 3 4 5 6 7 Quantity and Severity L I <thi< th=""> I I I</thi<>									
DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity L Image: Colspan="4">Image: Colspan="4" Output Density Severity Deduct Value REMARKS: - 3 % Cross Slope - 3 % Cross Slope - 100' low loose aggregate on west side - 1/2" - 3/4" - 1/2" - 3/4" - 1/2" - 3/4" - 1/2" - 3/4" - 1/4" </td <td></td> <td></td> <td></td> <td>:)</td> <td></td> <td></td> <td></td> <td></td> <td></td>				:)					
Type 1 2 3 4 5 6 7 Quantity and Severity L 100' 100' M 100' M		-94		.)					
Quantity and Severity L Image: Construction of the second				DISTRESS	QUANTIT	Y AND SEV	ERITY		
Quantity and Severity M Image: Construct of the second secon	Туре		1	2	3	4	5	6	7
Severity M Image: Construct of the second s	Quantity and								100'
Jevenny H URCI CALCULATION Distress Type Density Severity Deduct Value REMARKS: 7 3.5% L 6 • 3 % Cross Slope	-								
Distress Type Density Severity Deduct Value REMARKS: 7 3.5% L 6 • 3 % Cross Slope	Seventy								
Distress Type Density Severity Value 7 3.5% L 6 • 3 % Cross Slope - - - - • 100' low loose aggregate on west side - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - <td< td=""><td></td><td></td><td></td><td>U</td><td>JRCI CALCI</td><td>JLATION</td><td></td><td>-</td><td>-</td></td<>				U	JRCI CALCI	JLATION		-	-
 	Distress Type		Density	Severity		REMARKS	:		
1/2" - 3/4"	7		3.5%	L	6	• 3 % Cross	Slope		
1/2" - 3/4"									
1/2" - 3/4"						• 100' low lo	ose aggregate	e on west side	
Total Deduct Value = 6 q = 1							00 0		
q = 1									
q = 1						1			
q = 1						ł			
q = 1		-				4			
q = 1						ł			
q = 1						ł			
q = 1			T 1 . 5	alvest Males		4			
			i otal De						
	URCI = 95			q = Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Road	d - P1		Date		7/11/2008	
Section		1 1/2"	RAP					
Sample Unit		,		Α	rea of Sample			
		TYPES						
1. Improper C	ros	s Section (line	ar feet)					
2. Inadequate				t)				
3. Corrugation								
4. Dust		. ,						
5. Potholes (n	um	ber)						
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	.)					
			DISTRESS	QUANTI	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							100'
Quantity and	м							
Severity	н							
			U	IRCI CALC	ULATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
7		3.5%	L	6	• 3 % Cross	Slope		
					1			
					• 100' low lo	nse aggregate	on west side	
					1/2" - 3/4"		on west side	
				-	1/2 - 3/4			
					_			
					1			
					1			
		Total De	educt Value =	6	4			
			q =	0				
URCI = 95			ې ج Rating =	EXC.				

		I	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Roa	d - P1		Date		7/28/2008	
Section		1 1/2"	RAP		Inspector		SK	
Sample Unit				Α	rea of Sample		2900 sf	
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggro	ros Ro ns (s um	adside Draina square feet) ber) eet)	age (linear fee		TY AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							200'
Quantity and	м							
Severity	н							
Distress Type		Donsitu	L Severity	JRCI CALC	ULATION REMARKS	:		
Distress Type		Density	Seventy	Value				
7		6.9%	L	11	• 3 % Cross	Slope		
					• 100' low lo	ose aggregate	e on west side	
					3/4" - 1 1/4"			
					_			
					-	ose aggregate	e on east side	
					1/2" - 1"			
					4			
					4			
					4			
		Total De	educt Value =	11 1				
	q =							
URCI = 90			Rating =	EXC.				

		I	UNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Pry Roa	d - P1		Date		8/6/2008		
Section		1 1/2"	RAP		Inspector		SK		
Sample Unit				Α	rea of Sample		2900 sf		
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggro	ros: Ro ns (s um e fe	s Section (line adside Draina square feet) ber) set)	age (linear fee t)		ΓY AND SEV	ERITY			
Туре		1	2	3	4	5	6	7	
	L							200'	
Quantity and	- M								
Severity	н								
Distress Type		Density	L Severity	IRCI CALC		:			
Distress Type		Density	Seventy	Value					
7		6.9%	L	11	• 3 % Cross	Slope			
					 100' low loose aggregate on west side 3/4" - 1" 				
					• 100' low loose aggregate on east side				
	-				1/2" - 1"				
					4				
					4				
		Tatal D		11	4				
		i otal De	educt Value =	11 1					
URCI = 90			q = Rating =	EXC.					

		I	UNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Pry Roa	d - P1		Date		8/13/2008		
Section		1 1/2"	RAP		Inspector		SK		
Sample Unit				Α	rea of Sample		2900 sf		
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggro	ross Ro ns (s um e fe	s Section (line adside Draina square feet) ber) set)	age (linear fee t)		ΓY AND SEV	ERITY			
Туре		5	6	7					
	L							200'	
Quantity and									
Severity M H									
Distress Type		Density	L Severity	IRCI CALC		:			
Distress Type		Density	Seventy	Value					
7		6.9%	L	11	• 3 % Cross	Slope			
• 100' low loose aggregate on west side 1/2" - 1"									
					• 100' low loose aggregate on east side				
					1/2" - 1"				
					4				
					4				
		Tatal D		11	4				
		i otal De	educt Value = q =	11 1					
URCI = 90	· · · · ·								

		I	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Roa	d - P1		Date		8/22/2008	
Section		1 1/2"	RAP		Inspector		SK	
Sample Unit				Α	rea of Sample		2900 sf	
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggro	ros Ro ns (s um	adside Draina square feet) ber) eet)	age (linear fee		TY AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							200'
Quantity and	м							
Severity	н							
Distance Turns		Density		JRCI CALC		:		
Distress Type		Density	Severity	Value				
7		6.9%	L	11	• 3 % Cross	Slope		
						ose aggregate	e on west side	
					3/4" - 1"			
					_			
					-	ose aggregate	e on east side	
					3/4" - 1"			
					-			
					4			
					4			
		Total De	educt Value =	11 1				
URCI = 90	q =							
UNCI - 90			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Pry Road	d - P1		Date	_	9/5/2008		
Section		, 1 1/2"	RAP						
Sample Unit				А	rea of Sample		2900 sf		
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggro	ros Ro ns (s um	adside Draina square feet) ber) eet)	age (linear feet		TY AND SEV	ERITY			
DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7									
<u> </u>	L			-				200'	
Quantity and								200	
Severity	м н								
				JRCI CALC					
Distress Type		Density	Severity	Value					
7		6.9%	L	11	• 3 % Cross	Slope			
					• 100' low lo	ose aggregate	e on west side		
					• 100' low lo	ose aggregate	e on east side		
					1/2" - 1 1/4"				
					1				
					1				
		Total De	educt Value =	11	1				
	q =								
URCI = 90	CI = 90 Rating =								

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET				
Branch		Pry Road	d - P1		Date		9/18/2008			
Section		1 1/2"	RAP							
Sample Unit				Α	rea of Sample					
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s um	s Section (line adside Draina quare feet) ber) et)	nge (linear fee		ጉ AND SEV	ERITY				
Туре	DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7									
	L							140'		
Quantity and								140		
Severity	м н									
Distress Type		Density	U Severity	IRCI CALCI Deduct Value		:				
7		4.8%	L	9	• 3 % Cross	Slone				
,		4.070		5		Siope				
					 100' low loose aggregate on west side 1/2" - 1 1/4" 40' low loose aggregate on east side 					
					1/2" - 3/4 "	של מצבו בצמובי				
					<u>-</u> ,					
					-					
					1					
		Total De	educt Value =	9	1					
			q =	1						
URCI = 91	RCI = 91 Rating =			EXC.						

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET				
Branch Section Sample Unit		Pry Road 1 1/2"		Date 10/4/2008 Inspector SK Area of Sample 2900 sf						
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ross Roa ns (s uml re fe	s Section (line adside Draina equare feet) ber) et)	ge (linear fee							
Turne	1	1			TY AND SEV		6			
Туре		1	2	3	4	5	6 200 sf	7 200'		
Quantity and	м						200 SI	200		
Severity	н									
		D		JRCI CALC Deduct		:	-			
Distress Type		Density	Severity	Value						
6		6.9%	L	10	• 3 % Cross	Slope				
7		6.9%	L	11	4					
					-	ose aggregate	e on both side	S		
					1/2" - 1 1/4"					
					• 100' x 2' lo	w rutting on v	vest side			
					• 100' x 2' low rutting on west side 3/4 " deep					
]					
					4					
					4					
		Total De	educt Value = q =	21 2						
URCI = 85			ч – Rating =	EXC.						

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Road	d - P0		Date		6/24/2008	
Section	-	100% G						
Sample Unit				A	rea of Sample	25	x 100 ' = 250	0 sf
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ear feet)					
2. Inadequate	Ro	adside Draina	ige (linear feet	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (n								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	:)					
			DISTRESS	OUANTIT	Y AND SEV	FRITY		
Туре		1	2	3	4	5	6	7
Type		-	-	5	· ·	5		,
Quantity and L								
Severity	м							
	н							
				RCI CALCI	1			
Distress Type		Density	Severity	Deduct Value	REMARKS			
				value	4			
					• 2 % Cross	Slope		
					1			
					No Distress	ses		
					1			
					1			
					4			
					4			
					4			
L					ļ			
]			
		Total De	educt Value =	0	1			
			q =	0				
URCI = 100			Rating =	EXC.				

		l	UNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Branch		Pry Roa	d - P0		Date		7/11/2008		
Section	-	100% G			Inspector		SK		
Sample Unit				A	rea of Sample		2500 sf		
1. Improper C	ros								
2. Inadequate			age (linear fee	t)					
3. Corrugation	ns (s	square feet)							
4. Dust									
5. Potholes (r									
6. Ruts (squar									
7. Loose Aggr	ega	te (linear feet	t)						
			DISTRESS	QUANTIT	Y AND SEV	ERITY			
Туре	Type 1 2 3 4 5 6 7								
Quantity and L Severity M									
	н								
			L	JRCI CALCI	JLATION				
Distress Type		Density	Severity	Deduct Value	REMARKS	:			
					• 2 % Cross	Slope			
					No Distres	ses			
					-				
					1				
					4				
					4				
					4				
		Total D	educt Value =	0	┫				
		TOLAT DE	q =	0					
URCI = 100			ч – Rating =	EXC.					

		ι	UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Road	d - P0		Date		7/28/2008	
Section		100% G						
Sample Unit				A	rea of Sample			
1. Improper C	ros							
2. Inadequate			age (linear fee	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (n								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	t)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
Quantity and Severity	L M							
Seventy	н							
				JRCI CALCI	JLATION			1
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 2 % Cross	Slope		
					No Distres	ses		
					ļ			
					1			
					1			
	-				1			
		Total De	educt Value =	0	1			
			q =	0				
URCI = 100			Rating =	EXC.				

		l	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Roa	d - P0		Date		8/6/2008	
Section		100% G				Inspector SK		
Sample Unit				A	rea of Sample		2500 sf	
				1	-			
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ear feet)					
2. Inadequate			age (linear fee	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (n								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	t)					
	-		DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре	Type 1 2 3 4 5 6 7							
	L							
Quantity and	м							
Severity	н							
	н							
			ι		JLATION			
Distress Type		Density	Severity	Deduct Value	REMARKS			
					• 2 % Cross	Slope		
					1			
					No Distres			
					• NO DISTIES	563		
					ł			
					ł			
					_			
	L							
]			
					1			
 					1			
		Total De	educt Value =	0	1			
			q =	0				
URCI = 100			Rating =	EXC.				

Branch Pry Road - P0 Date 8/13/2008 Sample Unit 100% Gravel Inspector SK Jampoper Cross Section (linear feet) Area of Sample 2500 sf 1 ingroper Cross Section (linear feet) . . . 2 corrugations (square feet) 3. Corrugations (square feet) 4. Dust 5. Potholes (number) 7. Loose Aggregate (linear feet) 9. Outo 1 2 3 4 5 6 7 Quantity and 1 2 3 4 5 6 7 9. Outo 1 			ι	UNSURFAC	ED ROAD	INSPECTIO	N SHEET			
Section 100% Gravel Inspector SK Sample Unit	Branch		Prv Roa	d - P0		Date		8/13/2008		
Area of Sample 2500 sf DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 3. Dothles (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity Image:					i i					
DISTRESS TYPES 1. Improper Cross Section (linear feet) 2. Inadequate Roadside Drainage (linear feet) 3. Corrugations (square feet) 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) 9. Loose Aggrega	Sample Unit				Α	rea of Sample				
3. Corrugations (square feet) 4. Dust 5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity L	1. Improper C	ros	s Section (line		+)					
 4. Dust S. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity I <lii< li=""> I <lii< li=""> I I</lii<></lii<>				.80 (- /					
5. Potholes (number) 6. Ruts (square feet) 7. Loose Aggregate (linear feet) DISTRESS QUANTITY AND SEVERITY Type 1 2 3 4 5 6 7 Quantity and Severity L Image:		10 (1	iquare reet,							
6. Ruts (square feet) 7. Loose Aggregate (linear feet)		um	ber)							
Image: Severity of the second sec										
Type 1 2 3 4 5 6 7 Quantity and Severity L M M M M <t< td=""><td></td><td></td><td></td><td>t)</td><td></td><td></td><td></td><td></td><td></td></t<>				t)						
Type 1 2 3 4 5 6 7 Quantity and Severity L M Image: Construction of the second of										
Quantity and Severity L M Image: Construction of the second seco				DISTRESS	QUANTIT	Y AND SEV	ERITY			
Jevenny H Image: Constraint of the second s	Туре	Type 1 2 3 4 5 6 7								
Jevenny H Image: Constraint of the second s		L								
Jevenny H Image: Constraint of the second s	Quantity and	м								
URCI CALCULATION Distress Type Density Severity Deduct Value REMARKS: Image: Imag	Severity									
Distress TypeDensitySeverityDeduct ValueREMARKS:Image: Construct of the second sec		н								
Distress Type Density Severity Value Image: Severity Value • 2 % Cross Slope Image: Severity Image: Severity • 2 % Cross Slope Image: Severity Image: Severity • No Distresses Image: Severity Image: Severity Image: Severity Image: Severity Image: Severity • 2 % Cross Slope Image: Severity Image: Severity • No Distresses Image: Severity Image: Severity Image: Severity				ι		JLATION				
Image: Second	Distress Type		Density	Severity		REMARKS	:			
Image: state of the state						• 2 % Cross	Slope			
Image: state of the state										
q = 0						No Distres	ses			
q = 0										
q = 0										
q = 0										
q = 0		-				1				
q = 0		-				4				
q = 0		-				4				
q = 0						-				
q = 0			Tatal D	duat Maluri	0	4				
			i otal De		-					
	URCI = 100			q = Rating =	U EXC.					

		ι	UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Road	d - P0		Date		8/22/2008	
Section		100% G						
Sample Unit				A	rea of Sample			
					•			
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ear feet)					
2. Inadequate	Ro	adside Draina	age (linear feet	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (n	um	ber)						
6. Ruts (squar	e fe	et)						
7. Loose Aggr	ega	te (linear feet	t)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and	Quantity and L Severity M							
Severity								
	Η							
			U		ULATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 2 % Cross	Slope		
						·		
					 No Distres 	ses		
						0/04/2000		
					Re-bladed	8/21/2008		
					-			
L								
	I	Total De	educt Value =	0	-			
			q =	0				
URCI = 100			Rating =	EXC.				

		l	UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Roa	d - P0		Date		9/5/2008	
Section		100% G						
Sample Unit				A	rea of Sample			
DISTR	ESS	TYPES						
1. Improper C								
2. Inadequate			age (linear fee	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (n								
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet	t)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
Quantity and								
Quantity and	м							
Severity								
	Η							
			ι		ULATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 2 % Cross	Slope		
					1			
					No Distres	ses		
					-			
					-			
					_			
					1			
					1			
	I	Total De	educt Value =	0	1			
			q =	0				
URCI = 100			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch		Pry Road	d - P0		Date		9/18/2008	
Section		100% G						
Sample Unit				A	rea of Sample			
					•			
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ear feet)					
2. Inadequate	Ro	adside Draina	age (linear feet	t)				
3. Corrugation	ns (s	square feet)						
4. Dust								
5. Potholes (n	um	ber)						
6. Ruts (squar	e fe	et)						
7. Loose Aggr	ega	te (linear feet	t)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and	м							
Severity								
	Η							
			U		ULATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 2 % Cross	Slope		
					1	·		
					 No Distres 	505		
					• NO DISTIES	353		
					-			
					_			
]			
					1			
	-				-			
		Total D	educt Value =	0	-			
		i otal De		0 0				
URCI = 100			q = Rating =	EXC.				
- 100			Nating -	LAC.				

			l	UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
	Branch		Pry Roa	d - P0		Date		10/4/2008	
	Section		100% G						
Sa	ample Unit				Α	rea of Sample		2500 sf	
	-					-			
	DISTR	ESS	TYPES						
1.	Improper C	ros	s Section (line	ear feet)					
				age (linear fee	t)				
		ns (s	quare feet)						
	Dust								
	Potholes (n								
	Ruts (squar								
7.	Loose Aggr	ega	te (linear feet	t)					
					_	_			
				DISTRESS	QUANTIT	Y AND SEV	ERITY	-	-
	Туре		1	2	3	4	5	6	7
		L							
Qu	antity and	м							
	Severity								
		Η							
				U		ULATION			
Dis	tress Type		Density	Severity	Deduct Value	REMARKS	:		
						• 2 % Cross	Slope		
						- No Distros			
						No Distres	ses		
┣						4			
L						4			
1									
]			
						1			
\vdash						-			
\vdash			Total D	educt Value =	0	4			
				Suuce value –	0	1			
				q =	0				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	noonover - S2	(RAP Blend)		Date		7/14/2008	
		RAP Mix r			Inspector		SK	
Sample Unit				A	rea of Sample	26	x 100 ' = 260	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	cros Ro ns (: ium	adside Draina square feet) ber) eet)	age (linear fee	t)				
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and Severity	м							
Sevency	н							
	1		ι					
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 2 - 3 % Cro	oss Slope		
					No Distress	ses		
					-			
					• Loose Aggr	egate may be	ecome a distre	ess soon but
					it is not enou	gh to be one	now.	
					_			
					_			
					4			
					4			
		Total De	educt Value =	0				
			q =	0				
URCI = 100			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	100nover - S2	(RAP Blend)		Date		7/29/2008	
		RAP Mix r			Inspector		SK	
	-			A	ea of Sample	26	x 100 ' = 260	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (r	cros e Ro ns (s	adside Draina square feet)	•	t)				
6. Ruts (squar								
7. Loose Aggr			:)					
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре					4	5	6	7
	L							100 '
Quantity and Severity M	м							
Sevency	н							
		<u> </u>	L	JRCI CALCI	JLATION		<u>.</u>	
Distress Type		Density	Severity	Deduct	REMARKS			
				Value	-			
7		3.8%	L	7	• 2 1/2 % Cr	oss Slope		
					+			
					1		on North Side	9
					(Pic. 971).			
					1/2" - 1"			
					-			
					-			
	ļ	Total De	educt Value =	7				
			q =	1				
URCI = 95			Rating =	EXC.				

		l	JNSURFAC	ED ROAD	INSPECTION	N SHEET		
Branch	Scł	100nover - S2	(RAP Blend)		Date		8/6/2008	
		RAP Mix r			Inspector		SK	
				Α	rea of Sample	26'	x 100 ' = 260	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (r 6. Ruts (squar 7. Loose Aggr	cros e Ro ns (s num re fe	adside Draina square feet) ber) eet)	age (linear fee	t)				
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре					4	5	6	7
	L							100 '
Quantity and Severity	м							
Sevency	н							
Distress Type		Density	L Severity	JRCI CALC		:		
		-	-	Value				
7		3.8%	L	7	• 2 % Cross	Slope		
					1001-01-0			
					• 100 Of LOO	ise Aggregate	on North Side	2
					3/4" - 1"			
					3/4 - 1			
					4			
					-			
		Total De	educt Value =	7]			
			q =	1				
URCI = 95			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	100nover - S2	(RAP Blend)		Date		8/13/2008	
		RAP Mix r			Inspector		SK	
Sample Unit				A	rea of Sample	26	x 100 ' = 260	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s num	adside Draina square feet) ber) eet)	age (linear fee	t)				
			DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре				3	4	5	6	7
	L							100 '
Quantity and Severity	м							
Sevency	н							
Distress Type		Density	L Severity	JRCI CALCI Deduct	JLATION REMARKS	:		
		Denoity	ocremy	Value	-			
7		3.8%	L	7	• 2 % Cross	Slope		
					4			
					• 100' of Loc	se Aggregate	on North Side	9
					4			
					-			
					4			
					1			
					-			
	I	Total De	educt Value =	7	1			
			q =	1				
URCI = 95			Rating =	EXC.				

		ı	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	100nover - S2	(RAP Blend)		Date		8/21/2008	
		RAP Mix r			Inspector		SK	
Sample Unit	-			А	rea of Sample	26	x 100 ' = 260) sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros Ro ns (s um	adside Draina square feet) ber) eet)	ege (linear fee					
		1	DISTRESS	QUANTI	TY AND SEV	ERITY		
Туре					4	5	6	7
Overtity and	L							140'
Quantity and Severity	м							
ocremy	н							
				JRCI CALC		:		
Distress Type		Density	Severity	Value				
7		5.4%	L	9	• 2 % Cross	Slope		
					• 100' of Loc	ose Aggregate	on North Side	9
					3/4" - 1 1/4"			
					• 40 ' of Loo	se Aggregate	on South Side	
					1/2 " - 1"			
					_			
					4			
		Total De	educt Value =	9				
			q =	1				
URCI = 92			Rating =	EXC.				

		ı	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	100nover - S2	(RAP Blend)		Date		9/1/2008	
		RAP Mix r		•	Inspector		SK	
Sample Unit				Α	rea of Sample	26	x 100 ' = 260	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (r 6. Ruts (squar 7. Loose Aggr	cros Ro ns (: ium	adside Draina square feet) ber) eet)	age (linear fee					
			DISTRESS	QUANTI	TY AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							160'
Quantity and Severity	м							
Seventy	н							
Distress Type		Density	L Severity	JRCI CALC	ULATION REMARKS	:		
		_	_	Value	-			
7		6.2%	L	11	• 2 % Cross	Slope		
					-			
					-	ose Aggregate	on North Side	5
					3/4" - 1 1/4"			
					-	se Aggregate	on South Side	
					1/2 " - 1"			
					-			
					-			
		.			-			
		Total De	educt Value =	11				
			= p	1				
URCI = 90			Rating =	EXC.				

		ı	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Sch	100nover - S2	(RAP Blend)		Date		10/4/2008	
		RAP Mix r						
Sample Unit				A	rea of Sample	26	x 100 ' = 260	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggr	ros: Ro ns (s ium re fe	adside Draina square feet) ber) eet)	age (linear fee					
		1	DISTRESS	QUANTI	TY AND SEV	ERITY	1	
Туре	Type 1 2		2	3	4	5	6	7
Out with a set of	L							200'
Quantity and Severity	м							
Sevency	н							
Distress Type		Density	L Severity	JRCI CALC Deduct Value	ULATION REMARKS	:		
7		7.7%	L	12	• 2 % Cross	Slone		
/		1.170	L	12	• 2 % Closs	Slobe		
					• 100' of Loc	so Aggrogato	on North Side	0
					3/4" - 1 1/4"			-
					5/4 - 1 1/4			
					• 100 ' of Lo	ose Aggregat	e on South Sid	0
					1/2 " - 1 1/2"			C
					1/2 -11/2			
					4			
					4			
	L	Total De	educt Value =	12	4			
			q =	1				
URCI = 88			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	100nover - S1	(RAP Blend w	/ CaCl)	Date		7/14/2008	
Section		RAP Mix w		,,	Inspector		SK	
Sample Unit					Inspector Area of Sample	27	x 100 ' = 270	0 sf
DISTR 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (r 6. Ruts (squar 7. Loose Aggr	cros e Ro ns (s num re fe	adside Draina square feet) ber) eet)	ge (linear fee					
				-	TY AND SEV			-
Туре	_	1	2	3	4	5	6	7
Quantity and	L							
Severity	м							
,	н							
	1		ι		ULATION			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
					• 2 % Cross	Slope		
					No Distres	ses		
					Potential f	or rutting		
					4			
					4			
					4			
					4			
		Total De	educt Value =	0				
			q =	0				
URCI = 100			Rating =	EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Sch	100nover - S1	(RAP Blend w	/ CaCl)	Date	e	7/29/2008	
		RAP Mix w			Inspecto	r	SK	
Sample Unit					Inspecto Area of Sample	e 27	' x 100 ' = 270	0 sf
 Improper C Inadequate Corrugatio Dust Potholes (r 	Eros: e Ro ns (s	adside Draina square feet) ber)	•					
6. Ruts (squai								
7. Loose Aggr	ega	te (linear feet	:)					
			DISTRESS	QUANT	TY AND SEV	/ERITY		
Туре 1 2				3	4	5	6	7
	L							
Quantity and Severity	м							
Seventy	н							
			L	JRCI CALO	CULATION			
Distress Type		Density	Severity	Deduct Value	REMARK	S:		
					• 2 % Cross	s Slope		
					No Distres	sses		
					Potential	for rutting in f	uture	
					_			
					Potential	Loose Aggrega	ate on South S	ide in future
ļ								
		Total De	educt Value =	0				
URCI = 100			q = Poting =	0 EXC.				
UNCI - 100			Rating =	EXU.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET					
Section Sample Unit		RAP Mix w	(RAP Blend w ith CaCl		Date Inspector area of Sample	27	8/6/2008 SK ' x 100 ' = 2700	D sf			
DISTRE 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (square 7. Loose Aggre	ross Roa ns (so umb e fee	Section (line dside Draina quare feet) er) et)	ge (linear fee			FDITY					
Туре	T	1	2	3	TY AND SEV	5	6	7			
Quantity and Severity	L M H						150 sf	30 '			
			U	JRCI CALC	ULATION						
Distress Type		Density	Severity	Deduct Value	REMARKS	:					
7		1.1%	L	2	• 2 % Cross	Slope					
6		5.5%	L	8							
					• 30' of Loos 1/2" - 3/4 "	e Aggregate (on south side				
					1						
URCI = 90		Total De	educt Value = q = Rating =	10 1 EXC.							

		I	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch Section Sample Unit		oonover - S1 RAP Mix w	(RAP Blend w ith CaCl		Date Inspector rea of Sample		8/13/2008 SK ' x 100 ' = 2700) sf
DISTRI 1. Improper C 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (squar 7. Loose Aggre	ross Roa ns (se umb e fee	Section (line adside Draina quare feet) per) et)	ge (linear fee)					
Туре	-1	1	DISTRESS 2	QUANTI 3	TY AND SEV	ERITY 5	6	7
Quantity and Severity	L M H						150 sf	50'
			L	JRCI CALC	ΠΑΤΙΟΝ			
Distress Type		Density	Severity	Deduct Value	REMARKS	:		
6		5.5%	L	8	• 2 % Cross	Slope		
7		1.8%	L	4	• 50 ' of Low 50' x 3' = 150	-	outh side	
					• 50' of Loos 1/2" - 3/4 "	e Aggregate (on south side	
		Total De	educt Value = q =	12 1	-			
URCI = 87			q = Rating =	EXC.				

		UNSURFAC	ED ROAD	INSPECTION	N SHEET		
Branch Section Sample Unit		r - S1 (RAP Blend w ⁄lix with CaCl		Date Inspector Irea of Sample	27	8/21/2008 SK ' x 100 ' = 270	D sf
1. Improper C	Roadside D Is (square fe umber) e feet)	rainage (linear fee eet) r feet)					
Туре	1	DISTRESS 2	3 QUANTI	TY AND SEV	ERITY 5	6	7
Quantity and Severity	L					225 sf	100'
	н		JRCI CALC				
Distress Type	Density	y Severity	Deduct Value	REMARKS			
6	8.3%	L	12	• 2 % Cross	Slope		
7	3.7%		7	• 75 ' of Low 75' x 3' = 225	-	outh side	
				• 100' of Loo 1/2" - 1"	se Aggregate	on south side	2
				-			
URCI = 87	Tot	al Deduct Value = q = Rating =	19 2 EXC.				

		UNSURFAC	ED ROAD	INSPECTION	N SHEET		
Section Sample Unit	RAP Mix	1 (RAP Blend w with CaCl		Date Inspector Irea of Sample		9/1/2008 SK ' x 100 ' = 2700	D sf
 Improper C Inadequate Corrugation Dust Potholes (n Ruts (square) 	ns (square feet) umber)	nage (linear fee et)					
Туре	1		3 QUANTI	TY AND SEV	5 EKIIY	6	7
Quantity and Severity	L M H					225 sf	125'
			JRCI CALC	ΠΑΤΙΟΝ			
Distress Type	Density	Severity	Deduct Value	REMARKS	:		
6	8.3%	L	12	• 2 % Cross	Slope		
7	4.6%		9	• 75 ' of Low 75' x 3' = 225	-	outh side	
				• 100' of Loc 1/2" - 1"	ose Aggregate	on south side	2
	Total I	Deduct Value =	21	• 25' of Loos 1/2" - 3/4"	e Aggregate (on north side	
URCI = 84		q = Rating =	2				

		UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Section Sample Unit		S1 (RAP Blend w x with CaCl		Date Inspector Area of Sample		10/4/2008 SK ' x 100 ' = 2700	D sf
 Improper C Inadequate Corrugation Dust Potholes (n Ruts (squar Loose Aggree 	Roadside Dra ns (square fee umber) e feet)	ainage (linear fee t) Teet)					
Туре	1	DISTRESS	S QUANTI 3	TY AND SEV	ERITY 5	6	7
Quantity and Severity	L					135 sf	140'
			JRCI CALC	Ι ΙΙ ΔΤΙΟΝ			
Distress Type	Density	Severity	Deduct Value	REMARKS	:		
6	5.0%	L	9	• 2 % Cross	Slope		
7	5.2%		9	• 45 ' of Low 75' x 3' = 135	-	outh side	
				• 100' of Loc 1/2" - 1"	ose Aggregate	e on south side	2
	Tota	Deduct Value =	17	• 40' of Loos 1/2" - 3/4"	e Aggregate	on north side	
URCI = 88		q = Rating =	2 EXC.				

		ι	JNSURFAC	ED ROAD		N SHEET		
Branch	Sch	noonover - SO	(100% Gravel	w/ CaCl)	Date		7/14/2008	
		Gravel wit						
				i i	Inspector Area of Sample	27	x 100 ' = 270	0 sf
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ar feet)					
2. Inadequate	Ro	adside Draina	ge (linear fee	t)				
3. Corrugation	าร (ร	square feet)						
4. Dust								
5. Potholes (n	um	ber)						
6. Ruts (squar	e fe	et)						
7. Loose Aggr			:)					
			DISTRESS	QUANT	ITY AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and								
Severity	Μ							
	Н							
			L	JRCI CAL	CULATION			
Distress Type		Density	Severity	Deduct	REMARKS	:		
Distress Type		Density	Sevency	Value				
					• 2 % Cross	Slope		
					No Distres	505		
						505		
					 Potential f 	or rutting		
					1			
					-1			
		Tatal D	al at Males :	0				
		i otal De	educt Value =	0				
URCI = 100			q =	0				
UKCI = 100			Rating =	EXC.				

			ι	JNSURFAC	ED ROAD		N SHEET		
	Branch	Sch	oonover - SO	(100% Grave	w/ CaCl)	Date		7/29/2008	
			Gravel wit						
Sa	mple Unit	-				Area of Sample	27	' x 100 ' = 270	0 sf
	-				1				
	DISTRI	ESS	TYPES						
1. I	mproper C	ross	s Section (line	ar feet)					
2. I	nadequate	Ro	adside Draina	ge (linear fee	t)				
3. (Corrugatior	ns (s	quare feet)						
4. C	Dust								
5. F	Potholes (n	um	ber)						
	Ruts (squar								
7. L	oose Aggre	egat	te (linear feet)					
				DISTRESS	QUANT	ITY AND SEV	ERITY		
	Туре		1	2	3	4	5	6	7
		L						100 sf	
	antity and	м							
S	Severity								
		Η							
				ι		CULATION			
D:			Density	Severity	Deduct	REMARKS			
DIS	tress Type		Density	Seventy	Value				
	6		3.7%	L	4	• 2 % Cross	Slope		
						• 1' v 100' Pi	utting Small	but noticeable	0
							-	but noticeable	e
						(Pic. 967, 96	8)		
						7			
╞──						-1			
⊢			Total De	duct Value =	4				
				q =	4				
URC	CI = 97			Rating =	EXC.				

		UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Section Sample Unit DISTRI 1. Improper C 2. Inadequate 3. Corrugatior 4. Dust 5. Potholes (n 6. Ruts (squar	E SS TYPES ross Section (lin Roadside Drain ns (square feet) umber)	ith CaCl ear feet) age (linear fee			27	SK	0 sf
		DISTRESS	QUANTI	TY AND SEV	ERITY		
Туре	1	2	3	4	5	6	7
Quantity and Severity	L М Н					100 sf	120'
	1		JRCI CALC			•	
Distress Type	Density	Severity	Deduct Value	REMARKS	:		
6	3.7%	L	5	• 2 % Cross	Slope		
7	4.4%	L	8	• 1' x 100' Ru 1 " deep	utting down c	enterline	
				• 100' of Loc 3/4" - 1 1/2 "		on south side	2
				• 20' of Loos 1/2" - 1"	e Aggregate o	on north side	
URCI = 90	Total D	educt Value = q = Rating =	13 2 EXC.				

		ι	JNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Branch	Scł	1000 nover - SO	(100% Grave	l w/ CaCl)	Date		8/13/2008	
		Gravel wit			Inspector		SK	
Sample Unit				-	Inspector Area of Sample	27	x 100 ' = 270	0 sf
-				•	-			
DISTR	ESS	TYPES						
1. Improper C	ros	s Section (line	ar feet)					
2. Inadequate	Ro	adside Draina	ge (linear fee	t)				
3. Corrugation	าร (ร	square feet)						
4. Dust								
5. Potholes (n	um	ber)						
6. Ruts (squar								
7. Loose Aggr	ega	te (linear feet)					
			DISTRESS	6 QUANTI	TY AND SEV	ERITY		
Туре		1	2	3	4	5	6	7
	L							
Quantity and								
Severity	М				-			
	Н							
			(JRCI CALO				
Distress Type		Density	Severity	Deduct	REMARKS	:		
Distress Type		Density	Sevency	Value				
					no inspect	ion recorded		
					-			
					_			
					_			
 					-			
	-				-			
 		Tatal D-	aluat Value -		_			
		i otal De	duct Value =					
			q = Bating =					
URCI =			Rating =					

		UNSURFAC	ED ROAD	INSPECTION	I SHEET		
Section Sample Unit DISTRI 1. Improper C 2. Inadequate 3. Corrugatior 4. Dust 5. Potholes (n 6. Ruts (squar	E SS TYPES ross Section (lin Roadside Drain ns (square feet) umber)	ith CaCl ear feet) age (linear fee	μ	Date Inspector		8/21/2008 SK ' x 100 ' = 2700	O sf
		DISTRESS	QUANTI	TY AND SEV	ERITY		
Туре	1	2	3	4	5	6	7
Quantity and Severity	L М Н					200 sf	150'
						•	
Distress Type	Density	Severity	Deduct Value	REMARKS:			
6	7.4%	L	10	• 2 % Cross S	Slope		
7	5.6%	L	10	• 2' x 100' Lo 1 " deep	ow Rutting do	own centerline	2
				• 50' of Loos 1/2" - 3/4"	e Aggregate o	on south side	
	Tatal D		20	• 100' of Loo 1/2" - 1"	se Aggregate	e on north side	
URCI = 85	i otal D	educt Value = q = Rating =	20 2 EXC.				

		UNSURFAC	ED ROAD	INSPECTIO	N SHEET		
Section Sample Unit DISTRI 1. Improper C	Gravel v ESS TYPES ross Section (li Roadside Drai ns (square feet umber) e feet)	near feet) nage (linear fee	A	Date Inspector rea of Sample		SK	<u>0 sf</u>
		DISTRESS	QUANTIT	Y AND SEV	ERITY		
Туре	1	2	3	4	5	6	7
Quantity and Severity	L M H					200 sf	200'
		l	JRCI CALCI	ULATION			
Distress Type	Density	Severity	Deduct Value	REMARKS	:		
6	7.4%	L	10	• 2 % Cross	Slope		
7	7.4%		12	• 2' x 100' L 1 " deep	ow Rutting do	own centerline	2
				• 100' of Loo 1/2" - 1"	ose Aggregate	on Both side:	5
	Total	Deduct Value =	22	-			
URCI = 83		q = Rating =	2 Very good				

		ι	JNSURFAC	ED ROAD	INSPECTION	N SHEET		
	Gra		(100% Gravel th CaCl		Date Inspector Area of Sample		10/4/2008 SK ' x 100 ' = 270	D sf
DISTRE 1. Improper Cl 2. Inadequate 3. Corrugation 4. Dust 5. Potholes (n 6. Ruts (square 7. Loose Aggre	Roadside as (square umber) e feet)	Draina feet)	ge (linear fee)		TY AND SEV	ERITY		
Туре	1		2	3	4	5	6	7
Quantity and Severity	L М			1400 sf			300 sf 200 sf	200'
	11		U	IRCI CALC	ULATION		<u>.</u>	
Distress Type	Densi	ty	Severity	Deduct Value	REMARKS:			
3	51.99	%	L	24	• 2 % Cross \$	Slope		
6	11.19	%	L	15				
6	7.4		М	14	• 2' x 100' M	edium Ruttin	g down cente	rline
7	7.4		L	12	1 1/2 " deep			
					• 100' of Loo	se Aggregate	on Both sides	5
					1/2" - 1"			
					• 100' x 3' lo	w rutting on s	south side	
					1/2" - 1" deer)		
	Тс	otal De	educt Value =	65				
URCI = 65			q = Rating =	4 good	• < 1" corruga 100' x 14'	ations center	ed on centerli	ne

APPENDIX C MATERIAL TESTING DATA SHEETS

	Mater	RTMENT OF TRANS rials Testing Laborator IPLE TRANSMITTAI	ry Reviseo
	🗋 Metric 🔯 English	D Prelimin	uction
Project Number	4-30-08 UW RESEA HUNTINGTON ATLAS	Date Received RCH Road Section	ATLAS ROAD UW LARAMIE
Soils	Aggregate	Sample Distribution	ernistry 🔲 Geology
Location (Belt, Stockpil	e, etc.) SURFAC	₩ŢĠs# €at: (Sta., kp., M.P to : to ;	., etc.)
		For Use As :	
Profile	BSE	PMP Grd.	Conc. Coarse Aggregate
Borrow	CB, Grd		Conc. Med. Aggregate
Topping	РМВ	PMWC, Type	Conc. Fine Aggregate
Alkali	СТВ	CCA, Type	Conc. Cylinders
Check Curve	Filler	Maint. Type	Conc. Beams
Final Emb	Drain Gravel	Check Design	Port. Cement, Type
A Other SU	RFACINC	and the second s	Туре
	Geosynth	netics (Geogrid/Geote	ctile)
Product Name		Manufacturer	
temarks: WASH FRACTURED	GRADATION: P FACES; HYL	L', LL; COHESIO DROMETER (NVALUEI R-UALUE GEOLOGY)
naterialsísharedVormsisoil & sum 120.		Submitted By	For

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY REPORT OF TEST ON SURFACING MATERIALS

Form T-103B Rev. 9-06

5

										English			
LABORATOR	N YS	10. 2	008-	- 02	158		DATE RE	C'D	4-28-	08	3	_	
SUBMITTED	BA	G.	Hun	tin	ston		_AT	U.	W.				2
I.D. MARKS	-					_	DATE SCREENED						
SOURCE		17. VA 5. 4				DATE SAMPLED							
QUANTITY R	EPP	RESENT	ED	-									
FOR USE AS	-4	1.00	Kes	ear	ch		PROJEC	T			CO		
	-	-			1	EST RE	ESULTS						
		-		_									
		RET.	RET.		Contractor	RET.	RET.	her."	Sec. 1.	RET.	RET.		
SIEVE SIZ		WT. LBS.	WT. GRAMS	RET		WT.	WT.	RET.		WT.	WT.	RET	PASSING
		LBS.	334.4	%	%	LBS.	GRAMS	%	%	LBS.	GRAMS	%	%/
MAX			248.9		1			1.11			1.1		RValu
3" (75 mm)	-										1		
2" (50 mm)		1						(<u></u>			1	-	
1 1/2 (3.75 m	m)		· · · · · ·							l arr			
1" (25 mm)					100.0							-	
3/4" (19 mm	1)	O.d.		0.4	91.6					1			
1/2" (12.5 mr	-	1,8		1.7	17.9							-	11
3/8" (9.50 mr	-	2.5		2.4	95.5		-	-			-	-	24
#4 (4.75 mm	-	17.9		17.1	78							-	
	-	81.3	-								-		260
#8 (2.36 mm	-	191.5	62-7	14.6	63-8		-			_		-	1200
#16 (1.18 mn			46.3	10.8	53.0							1.00	1
#30 (600 um	1)		40-8	9.6	43.4								
#50 (300 um	1)	1	40.4	9.5	33-9		· · · · · · · · · · · · · · · · · · ·	1.1 - 1		1.000			
#100 (150 un	n)	1000	23-3	5.5	28.4	1.00	11.000						
#200 (75 um)		26.4	6.2	22-2		11.	100		1.1			
PAN	-	8.8	94.3			1.1.1	12.000	11.11		-		1	1
		104.7				11.11					-		(4)
LIQUID LIMIT		27					-			-			1171
PLASTICITY INE	-												
		16											
SAND EQUIVALE	-	-				-	1	-		-			
	Tec		te REM	MARKS	uw	- M	1-00	211-	F (G, 1	H, I	1 Co	omb	
	CS A.C		9				/		• /	'	/		
	GE				Grad	4		-		-		_	_
Wash	MA	-		TIL									
Gradation	MA	5 5-	19 (20	1	392							
Crush Wash	-	-	6			19		~					
CR LL PI	-	-		Frac	TURE F	6.C.C.	S = Tr	suff	-icient 1	Mat.	to Perto	Tes -	rest
LAR	-	-	<u> </u>	YDr	omety	er:	See	WON	teshere	t ins	id e	_	-
SE	-	1											

WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/96 MATERIALS TESTING LABORATORY h:Vorms\scil&sur\T-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.	, DATE
PROJECT NUMBER	UW-AL-CONTIGHILLOMD SOURCE
ENGINEER	FOR USE AS

TEST RESULTS

F + H ² 0 =		O.D.	BULK
F + M + H20 =	TARE PAN	F + H20 + 500 - F,M,H20	
MATERIAL + TARE =	g,	0.D	APPARENT
0.D. =		F + H ² 0 + O.D F.M.H ² 0	

1.2	FLASK	F+M	F + H ² O
1	183.3	683.3	683.0
2	170.2	670.2	668,4
3	184.8	684.8	682,6

MOISTURE SAMPLE FROM 4 S/G TARE WEIGHT WET WEIGHT WT. OF MOISTURE - DRY WEIGHT + DRY WEIGHT - DRY WEIGHT + DRY WEIGHT = WT. OF MOISTURE MOISTURE % @	
WET WEIGHT WT. OF MOISTURE - DRY WEIGHT + DRY WEIGHT = WT. OF MOISTURE MOISTURE @ S.S.D + 5% FOR COMPACTION MOISTURE @ COMPACTION MOISTURE @ COMPACTION MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
- DRY WEIGHT + DRY WEIGHT = WT. OF MOISTURE MOISTURE @ S.S.D. MOISTURE @ S.S.D. S.D. MOISTURE @ S.S.D + 5% FOR COMPACTION MOISTURE @ COMPACTION MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
= WT. OF MOISTURE MOISTURE & MOISTURE @ S.S.D. + 5% FOR COMPACTION MOISTURE @ COMPACTION MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
WT. OF MOISTURE S.S.D. + 5% FOR COMPACTION MOISTURE @ COMPACTION MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
MOISTURE @ S.S.D + 5% FOR COMPACTION MOISTURE @ COMPACTION MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
MOISTURE @ COMPACTION MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
MOISTURE SAMPLE FROM EXCESS MATERIAL AFTER COMPACTION TARE WEIGHT WET WEIGHT 560 WT. OF MOISTURE 52	
TARE WEIGHT SLO WT. OF MOISTURE 52	
WET WEIGHT 560 WT. OF MOISTURE 52	
	1.1
= WT. OF MOISTURE 52. MOIST. % @ COMPACTION	
MACHINE LOAD PSI	
1 1595 ÷ 4 = 396.3 MOLD	1
2 1320 + 4 = 330,0 OILED	1
3 1200 ÷ 4 = 450.0 UNOILED	7
AVG. 1568,3 AVG. 342-1	-
APPARENT S/G 2.577 BULK S/G 2.30	5
MOISTURE @ S.S.D ABSORBTION % 4.58	ŝ1
MOISTURE @ COMPACTION 10, 2	
TES:30ml=2% moisture	

	GRAI	N SIZE DIST	TRIBUTION TEST DATA	
Project: U.W.	Research			
Project Number			Client: G. Huntington	
		Sam	ple Data	
Source: UW-A1-	CONT-(G,H,I)			
Sample No.: 80				
Elev. or Depth	1:		Sample Length (in./cm.):	
Location:				
Description: C	layey sand			
		Mechanical	Analysis Data	
	Initial			
Dry sample and	tare= 1084.2	8		
Tare	= 0.0	0		
	ght = 1084.2	8		
	n number 10 si			
Split sample d				
		re = .00 Sa	ample weight = 54.54	
	weight retained			
Tare for cumul	ative weight r	etained= .(00	
Sieve	Cumul. Wt.	Percent	(N)	
	retained	finer		
3 inch	0.00	100.0		
1.5 inch	0.00	100.0		
.75 inch	0.00	100.0		
.375 inch	0.00	100.0		
# 4	3.83	99.6		
# 10	137.85	87.3		
# 20	6.54	76.8		
# 40	14.64	63.9		
# 100	23.71	49.3		
# 200	29.07	40.8		
		Hydrometer	Analysis Data	
Separation sie	ve is #10			
	based upon comp	lete sample	e= 87.3	
	cometer sample:			
	sture correct			
	& tare = 168.			
Dry weight &				
Tare	= 107.			
	moisture= 2.0			
	ased weight= 62			
	erature correc			
the same of the second s	prrection at 20		6.7	
Meniscus corre	ction only= 0			
	ty of solids=	2.672		
	ty correction		995	
Hydrometer typ		and the second		
	lepth L= 16.294	964 - 0.16	4 x Rm	
arround a				

WYDOT GEOLOGY

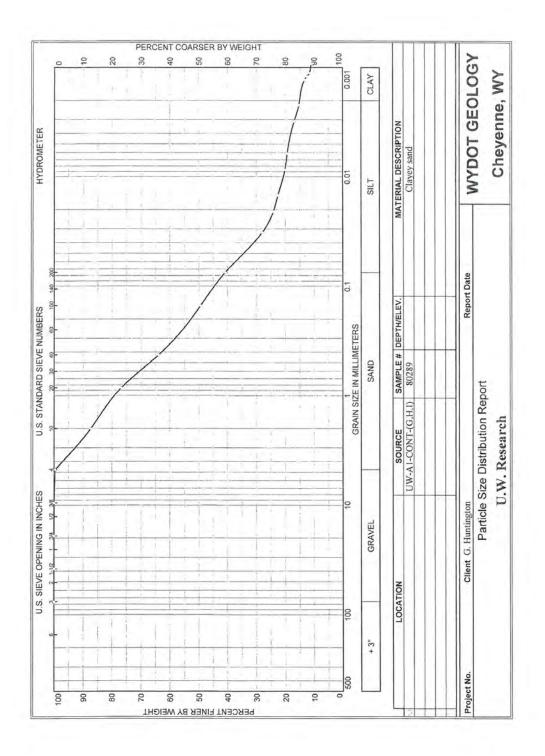
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	ĸ	Rm	Eff. depth	Diameter mm	Percent
2.00	23.5	23.5	17.6	0.0130	23,5	12.4	0.0324	28.0
5.00	23.5	21.0	15.1	0.0130	21.0	12.9	0.0208	24.1
10.00	23.5	20.0	14.1	0.0130	20.0	13.0	0.0148	22.5
30.00	23.5	18.5	12.6	0.0130	18.5	13.3	0.0086	20.1
60.00	23.5	18.0	12.1	0.0130	18.0	13.3	0.0061	19.3
240.00	23.5	16.5	10.6	0.0130	16.5	13.6	0.0031	16.9
480.00	23.5	15.5	9.6	0.0130	15.5	13.8	0.0022	15.3
1440.00	22.5	14.5	8.3	0.0131	14.5	13.9	0.0013	13.3
1680.00	22.5	14.0	7.8	0.0131	14.0	14.0	0.0012	12.5
1945.00	22.0	13.5	7.2	0.0132	13.5	14.1	0.0011	11.5
2880.00	22.5	13.0	6.8	0.0131	13.0	14.2	0.0009	10.9

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 % + 3" = 0.0 % GRAVEL = 0.4 % SAND = 58.8 % SILT = 25.8 % CLAY = 15.0 (% CLAY COLLOIDS = 11.1)

D85= 1.64 D60= 0.34 D50= 0.16 D30= 0.04 D15= 0.00

WYDOT GEOLOGY =



Form T-115 Rev. 5/91

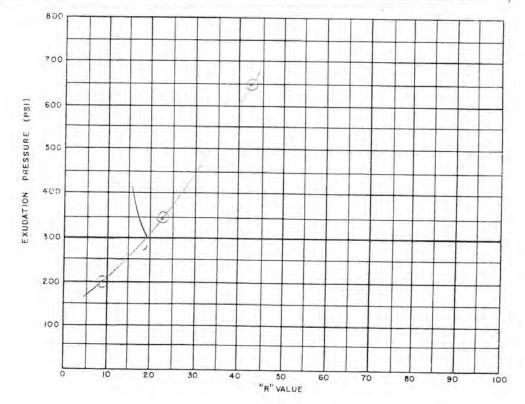
WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

SOILS STABILOMETER WORK SHEET

ATLAS ROAD

TEST SPECIMEN	A	B	C	D	LL	PL	PI	LAB. N					
MOLD NO	26	32	4A		08- 258								
COMPACTOR AIR PRES-PSI	250	150	100	1	SOIL	CLASS &	GROUP	INDEX	P	ROJEC	T		
INITIAL MOIST %													
WATER ADDED-ML	00	12.0	143		FIELD IDENT				STA	STATION			
WATER ADDED-%	-					INITIAL	MOISTU	RE	1"	_			
MOIST AT COMPACTION %	23	911	11.7		WET		DRY		3/4	1			
WET WEIGHT OF PAT-GMS	141	1072	146		DRY TARE		3/8"						
HEIGHT OF PAT-INCHES	2.47	2.40	2.60	1	WT) (DRY	· · · · · · ·	NO.	4			
DENSITY-LB. PER CU. FT.	129.3	123.)	119.6		EXP	ANSION	SPECIN	EN	A	В	c	D	
STAB. Ph AT 1000 LBS	12	34	51	-	D	AL RE	ADING		1.6-	1.8-1	15	-	
2000 LBS.	71	01.	1401		cov	ER REQ	UIRED -	INCHES	1				
DISPLACEMENT	3.49	5.27	3.94	1.00	TIN NO.	REMAR	RKST	-			T-115A	-	
"R" VALUE	47	23	3/1			Â.	Inwe	12 11	~1		"R" VA	LUE	
EXUDATION PRESS. PSI	630	380	2.00		AI CONT (G, H, I) LEAD				19				



XXX Y	Materi	RTMENT OF TRAN als Testing Laborato PLE TRANSMITTA	bry	Form T-3. REVISED 8/
TAANSPORTUTION	Metric English	Prelim Const	ruction	AD/QA
Date Sampled	4.28.08		08-21	
Project Number	UN. Research	Road Section	Atlas Road	
Resident Engineer	Huntington	at :	UW	
Pit or Source	Atlas Stockpile	County	Lavamip	
		Sample Distribution		
Soils	Aggregate	Concrete	Chemistry 📮 Geo	logý
		20s# /at: (Sta., kp., M to:to:		
		For Use As :		
Profile	BSE	PMP, Type	Conc. Coarse Agg	regate
D Borrow	CB, Grd.		Conc. Med. Aggres	gate
Topping	PMB	PMWC, Type	Conc. Fine Aggreg	ate
Alkali	СТВ	CCA, Type	Conc. Cylinders	
Check Curve	Filler	Maint. Type	Conc. Beams	
Final Emb.	Drain Gravel	Check Design	Port. Cement, Typ	e
Other	Surfacing		Туре	
	Geosynth	netics (Geogrid/Geot	extile)	
Product Name	er and er a	Manufacturer		
Remarks: <u>Asphi</u> <u>Cohesion Vi</u> <u>2503.6</u> 1068.6 2423.4		chemical extrac	tion; screened	grada bion,
materialististrarediformstsori & surrivi 2	Q.15	Submitted By	George Huntin	Autor Aborder # FR-8042

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY REPORT OF TEST ON SURFACING MATERIALS

Form T-103B Rev. 9-06

REPORT OF TEST OF	REPORT OF TEST ON SURFACING MATERIALS							
LABORATORY NO. 2008 - 0253 SUBMITTED BY <u>G. Huntington</u> I.D. MARKS SOURCE QUANTITY REPRESENTED FOR USE AS 11. W Research	DATE REC'D <u>4-28-08</u> AT <u>1, W.</u> DATE SCREENED DATE SAMPLED LOCATION PROJECT	Metric						
FOR USE AS U.W. Research	LOCATION CO CO	_						

J

T

_	LOCATION
	PROJECT
TEST RE	SULTS
11	1.11
RET.	RET

	1			-								
SIEVE SIZE PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET. %	PASSING	RET. WT.	RET. WT. GRAMS	RET	PASSING
MAX	1	5-11-7				1000		1	200.	GIGINO	70	101/1
3" (75 mm)		A				11000						~ vmu
2" (50 mm)				100.00	1		< 1			-	1	
1 1/2 (3.75 mm)	0.6	1	0,5	99.5							-	-
1" (25 mm)	2.5		2.1	97.4			-					
3/4" (19 mm)	3.4		2.9	94.5	1						-	
1/2" (12.5 mm)	14.5		12.2	82.3	-						1.	
3/8" (9.50 mm)	9,4		7.9	74.4	-						-	212
#4 (4.75 mm)	31.3	-	26.4	48.0	1							304
#8 (2.36 mm)	56-1.10	114.2	14.7	33.3					-	-	-	624
#16 (1.18 mm)		88.3	11.4	21.9					-			1200
#30 (600 um)		66.7	8.6	13.3							-	
#50 (300 um)		50 .1	6.5	6.8					-		-	
#100 (150 um)		31.0	4.0	2.3							-	
#200 (75 um)		14.4	1-9	0.9								
PAN	4.5	1.0					-				-	
·	118.8	2 119			-				-			(11)
LIQUID LIMIT	-	Dealis	4	Sample	-		-					(4)
PLASTICITY INDEX	1	11	- 10	-th					-			
AND EQUIVALENT	_		10	12			-					
Tests Te	ch Da		ADVE	100.0		-					_	
Screen C.S		a KEI	WARNS-	UW-AI	-RAI	ND.C.)					
LL - PI			T. 14	EM+ S	20.0			1				
Wash			RAD.	6	JEE .	work	2 51		visid			
Gradation MA	5 5.		1 =	Ala-	4 Per	built			nsla			
Crush		_	" MAL		77	LUCE + U.S.	- (Asphalt	in	Samply		
rush Wash							-					
CR LL PI	1.1											-
LAR	1											
CE	1											

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY EXTRACTION WORKSHEET

LABORATORY NO: ENGINEER: DATE RECEIVED: SAMPLED ID: FOR USE:		08-00021 HUNTINGT 5/19/2008			DATE TES	ATLAS STOCKPILE
		UW-AL-RA	PD		SOILS & S	NO: UW RESEARCH URFACING LAB NO:
(1) WT. OF OII (2) TARE OF F (3) WT. OF OII (7) WT. OF OII	PAN AND FILT LED SAMPLE _ (3 - 6)	TER: :: (1 - 2) ING A VACUUM EX	FILTER:	2503.6 1068.6 1435.0 80.2	(5) TARE O (6) WT. OF (8) % OIL: (THEO. OIL	UNOILED SAMPLE, PAN, AND FILTER: 2423. 25 PAN AND FILTER: UNOILED SAMPLE: (4 - 5) 13 67 1 1068. 1059. 1059.
	WT. RET.	% RET.	% PA	SSING	SPEC'S	ABSON EXTRACTION
37.5mm(1 1/2")		1. 2. 18				KINEMATIC VISCOSITY;
				1		ABSOLUTE VISCOSITY:
25mm (1")				1	1.1.1.1	PENETRATION:
				(
19mm (3/4")			100.0	1.0.000		CHEMICAL: METHODB OVEN:
12.6mm (1/2")	14.6	8.3	71.7		1	CALCULATIONS
9.5mm (3/8")	99.1	7.5	\$4.4	-		
4.75mm (#4)	326.4	2411	60.3			-
2.36mm (#8)	212.0	15.7	446		1	1
1.18mm (#16)	144.9	10.7	53.9		1	1
600µm (#30)	107.7	6.0	25.7			1
300µm (#50)	93.7	7.3	18.6			1
150µm (#100)	82.5	6.1	12.5			
75µm (#200)	.57.2	4.2	8.3			
PAN	113.4		10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	11]
25.4					1	
TOTAL						
	114.7	0.10	15 m U			
ERUN: REMARKS:			-			
_		_			TESTED BY:	: KMM

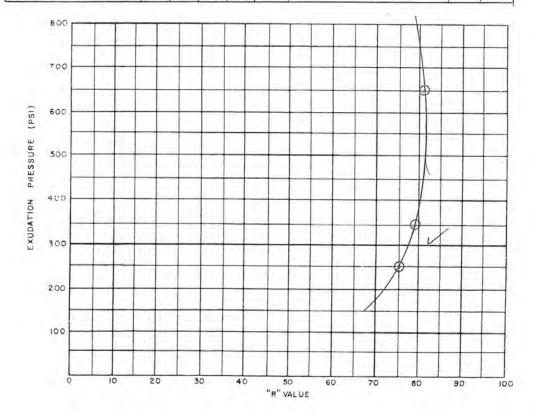
FORM T-215 REV. 4/95 Form T-115 Rev. 5/91

WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

ATLAS ROAD

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO					
MOLD NO.	30	54	55				08-	- 2,58					
COMPACTOR AIR PRES-PSI	300	350	350		SOIL CLASS & GROUP INDEX			INDEX	PROJECT				
INITIAL MOIST - %		-											
WATER ADDED-ML	100	90	50	_	FIELD IDENT				STATION				
WATER ADDED-%	-			1.1	INITIAL MOISTURE) ^{<i>u</i>}				
MOIST AT COMPACTION %	8.3	6.7	4.2		WET DRY				3/4"				
WET WEIGHT OF PAT-GMS	1:63	1095	1040		DRY TARE				3/8"				
HEIGHT OF PAT-INCHES	2,43	2.55	2.45		WT WT WATER DRY				ND. 4				
DENSITY-LB. PER CU. FT	124.7	121.9	1244		EXPANSION SPECIMEN			IEN	Α	в	C	D	
STAB. Ph AT 1000 LBS	10	8	6		DIAL READING				1.11	1			
2000 L BS.	24	22	14		COVER REQUIRED-INCHES								
DISPLACEMENT	9.75	4,22	4,63		TIN NO. REMARKS: AI - RAP (D.E					T-115A			
"R" VALUE	75	79	81				(D, E.	.F) "R" VALUE					
EXUDATION PRESS. PSI	250	150	650	1.1					77				



×	Materi	RTMENT OF TRA als Testing Laborat PLE TRANSMITT	ory	ON Form 7- REVISED (
	Metric English	D Preli	truction	0 QC/QA
Date Sampled Project Number Resident Engineer Pit or Source_	4.28.08 UM: Research It untington A Has Road	Road Section at :	5-19-08 Atlan	3 Road
		Sample Distribution		5.000
Soils		Concrete	Chemistry	Geology
1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1	0 s#at: (Sta., kp., N faceat: (Sta., kp., N to: to:		
1		For Use As :		
Profile	BSE.	PMP, Type	Conc. C	oarse Aggregate
Borrow	CB; Grd.		Conc. M	ed. Aggregate
Topping	РМВ	PMWC, Type	Conc. F	ine Aggregate
Alkali	СТВ	ССА, Туре	Conc. C	ylinders
Check Curve	Filler	Maint. Type	Conc. B	eams
Final Emb.	Drain Gravel	Check Design	Port. Ce	ment, Type
Other	Surfacing		Туре	
	Constant	ation (Constid/Con	toxtila	
	Geosynti	netics (Geogrid/Geo Manufacturer	iexule)	
Product Name				
Remarks: <u>Afash</u> <u>SCVEPNED</u> gr <u>2683.4</u> <u>1069.8</u> <u>2609.0</u>		sphalt contrut sion value; R	· by cheim · Value	ical extraction
				,
		Submitted By	beorge He	TET
			world M	In lingator

Form T-103B Rev. 9-06

REPORT OF TEST ON SURFACING MATERIALS	English
LABORATORY NO. 2008 - 0258 DATE REC'D 4-28-08 SUBMITTED BY G. Huntington AT U.W. I.D. MARKS DATE SCREENED DATE SCREENED SOURCE DATE SAMPLED DATE SAMPLED QUANTITY REPRESENTED LOCATION FOR USE AS U.W. Research	Metric

	1	-	_		EST R	ESULTS	_					-
SIEVE SIZE PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING
MAX	1	380.1	1.00		1			1-27		- Cround	70	R Value
3" (75 mm)				10505.05		1		1.1.1.1	-			K Vanue
2" (50 mm)	16.6		0.5	99.5		10.000		1	1		-	-
1 1/2 (3.75 mm)	B.B	1	0	94.5				1.1	-	-		
1" (25 mm)	0.8		0.7	98.8				1	-			-
3/4" (19 mm)	1.0.		1.1	97.7								
1/2" (12.5 mm)	10.7		9.4	88.3	-		-		-			
3/8" (9.50 mm)	7.5		6.6	81.7						-	1.000	140
#4 (4.75 mm)	28.8	-	25.4	56.3					1		-	220
#8 (2.36 mm)	63.8	93.6	13.8	42.5	1				-		-	524
#16 (1.18 mm)		74.1	11.0	31.5			-					1200
#30 (600 um)		65.4	9.7	21-8					-		-	
#50 (300 um)	1	58.4	8.7	13.1	-					1.1	_	
#100 (150 um)		41.2	6 -1	7.0							-	
#200 (75 um)	-	28.0	4.1	2.9			-					
PAN	19-0	/		2.1								
	173.3	19.4					-			-	1.1	
LIQUID LIMIT	-	est 14									1.11	(4)
PLASTICITY INDEX	- FI	11	10.2	ample								
AND EQUIVALENT				**		_						
	LID	-					-					
Tests Tec Screen << 1			IARKS	UW-AL	-RS	D.E.F	5					
LL - PI	13 1214			-			_					
Wash		EX	CHE	Me' De	ee w	orksh	eat	inside				
Gradation MAS	5-2		PAC+		P 40	orte sl	ret	insidie	-	_		
Crush			VAL	NO	T Pe	reprove	ed 1	ASPHEL	+ in	SAMP	1el	
rush Wash				15 -	10					1.1.1.1	1	_
CR LL PI	1	-11	place	e illai	+45 -	. = 3		(D)				
LAR							5%	(E)		-		_
PF.	-				_	2	.8%	(F)				

SE

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY EXTRACTION WORKSHEET

ENGINEER:	DATE RECEIVED: 5/19/2008 GAMPLED ID: UW-AL-RSD				DATE TES LOCATION SOURCE: PROJECT SOILS & SI	LARAMIE ATLAS STOCKPILE		
(1) WT. OF OII (2) TARE OF F (3) WT. OF OII (7) WT. OF OII	PAN AND FIL LED SAMPLE L (3 - 6)	TER: : (1 - 2) ING A VACUUM EX	TILTER:	2683.4 1069.8 1613.6 74.4 GRAMS	(4) WT. OF UNOILED SAMPLE, PAN, AND FILTER: (5) TARE OF PAN AND FILTER: (6) WT. OF UNOILED SAMPLE: (4 - 5) (8) % OIL: (7 / 3)*100 THEO. OIL CONTENT: WT. DRY AGG. AFTER WASH:			
	WT. RET. % RET. %1				SPEC'S	ABSON EXTRACTION		
37.5mm(1 1/2")			Maria Sal		100	KINEMATIC VISCOSITY:		
		H	1	1		ABSOLUTE VISCOSITY:		
25mm (1")			100.0		-	PENETRATION:		
19mm (3/4")	5.9	0.3	199.7			CHEMICAL: METHODB OVEN:		
12.6mm (1/2")	106,4	la . T	92 8			CALCULATIONS		
9.5mm (3/8")	85.8	5.8	820		1			
4.75mm (#4)	332.0	21.4	65.4		-	-		
2.36mm (#8)	216.6	14.1	513	-		1		
1.18mm (#16)	166.4	8.01	40.5	1.000				
600µm (#30)	134.9	8.8	31-7		1	1		
300µm (#50)	129.9	8.4	23.3		I	1		
150µm (#100)	11012	7.2	16.1			1		
75µm (#200)	87.4	5.7	10.4			1		
PAN	159.6		1		1	1		
32.9	1		1.00					
TOTAL						1		
	160.7	0.07	1000					
ERUN: REMARKS:								
					TESTED BY	KMM		

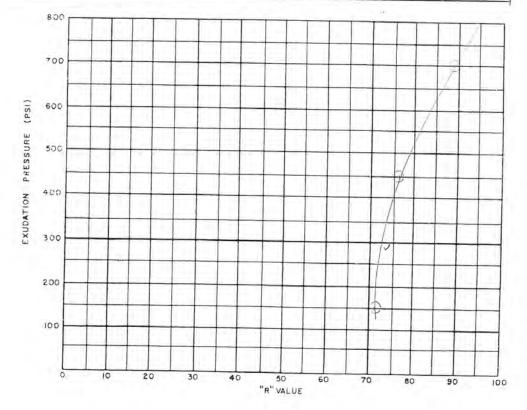
FORM T-215 REV 4/95 Form T-115 Rev. 5/91

WYOMING DEPARTMENT OF TRANSPORTATION SOILS STABILOMETER WORK SHEET

UW RESEARCH

ATWAS ROAD

TEST SPECIMEN	A		C	D	LL	PL	PI	LAB. NO)			
MOLD NO	14A	74	1114		1		1.1.1.1	08-	2.5	8		
COMPACTOR AIR PRES-PSI	350	35>	150		SOIL CLASS & GROUP INDEX			INDEX	1 Pi	ROJEC	т	
INITIAL MOIST %	-	-										
WATER ADDED-ML	80	60	70		FIELD	IDENT	-	-	STAT	TION		-
WATER ADDED-%		1		1.1	INITIAL MOISTURE			RE	1"			
MOIST AT COMPACTION %	6.7	4,7	55		WET DRY		3/4"					
WET WEIGHT OF PAT-GMS	1144	1017	REN	-	DRY TARE		3/8"					
HEIGHT OF PAT-INCHES	2.47	3,63	Artic		WATER	10.000	DRY		NO. 4			
DENSITY-LB.PER CU.FT.	151.5	124.4	1.48			ANSION	SPECIN	EN	A	в	C	D
STAB. Ph AT 1000 LBS	18	6	10		DI	AL RE	ADING	-	1			-
2000 LBS.	31	16	23	1.000	COVE	R REO	UIRED -	INCHES				-
DISPLACEMENT	4.27	4.44	4.21		TIN NO. REMARKS				1	T-115A	-	
"R" VALUE	71	84	76		AI-RS(D,E,F)			"R" VA				
EXUDATION PRESS. PSI	150	200	230			HI -	ies (u,	6,1-)			7	-



w w	Materia	TMENT OF TRANS	Y REVISED was
ATA	SAMP	LE TRANSMITTAL	
ТААКИЧСКЕНТОК	Metric X English	D Prelimin	nary 🔲 QC/QA uction
Date Sampled Project Number Resident Engineer Pit or Source	Huntington	at:	Atlas Road LIW Daramie
Pit or Source		Sample Distribution	<i>p</i> · <i>upw</i>
Solis			nemistry 🖸 Geology
			Multiple Samples
	MI-AL-VIA	10	TH # of
Sample Number(s)	atc) Mindraw	at: (Sta., kp., M.I	P., etc.)
Vartical Limits	ero.)	to :	
Vertical Limits		to :	
Quantity Represented			
uantity Represented		For Use As :	
-	BSE	Туре	Sonc
Profile	CB, Grd.		Cane Mes Appreses
Borrow			Conc. Fine Aggregate
Topping	PMB		Conc. Cylinders
Alkali	СТВ	CCA, Type	Conc. Beams
Check Curve	Filler	Maint Type	
Final Emb.	Drain Gravel	Check Design	Port. Cement, Type
The Other	arfacing		Туре
	Geosynt	hetics (Geogrid/Geot	extile)
1	Geosynt	Manufacturer	1 KO 1990 K.
Product Name			
A 7 1	gradation; Pl ace; hydrou		on Value; R-Value;

Form T-103B Rev. 9-06

LABORATO	DV	10			OF TEST OF					~	2		English
SUBMITTE	DRY	G	11	14:00			DATE RE	C'D_	4-28-	- 08	5	_	-
SUBMITTE	ы	_0	Har	11/11	STON			(A)	ED				e
SOURCE								-					
QUANTITY		RESEN	TED				LOCATIO						EC.
FOR USE A	s /	I.W	Res	Pah	ch						00		-
1 611 2021			1100				SULTS					-	-
							DOLTO			-			
SIEVE SI PASSIN		RET. WT. LBS.	WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING
MA	х		413-7		-					LUG.	GRAMS	70	"R'Value
3" (75 mr	n)						1		21.0		1	-	~ vaule
2" (50 mr	n)						1.1		1.000				-
1 1/2 (3.75	mm)		-	11	100.0								-
1" (25 mr	n)	Ø.4		0.4.	94.6								
3/4" (19 m	m)	0.5	12.	0.5	99.1				1.1.2.				
1/2" (12.5 r	nm)	1.9	11	1.8	97.3	1			1	-		-	32
3/8" (9.50 n	nm)	2.4		2.2	95.1						1	11	58
#4 (4.75 m	im)	18.7		17.4	77.7					-	1		268
#8 (2.36 m	m)	81.5	\$ 59-6	11.3	66.4	1							1200
#16 (1.18 п	nm)		\$2.7	9-9	56.5				1	1.1	1		120
#30 (600 u	im)		51:3	9-6	46.9			-	11.22		1.1.1		
#50 (300 u	ım)		54 -D	10-1	34.8				1				1
#100 (150)	um)		35-1	6.6	30.2				11000			1	
#200 (75 u	m)		40.5	7.0	22.6				1			0	
PAN		10.7	120.0	1				_	1.2.2.4				
		107.7		1		1.00							(4)
LIQUID LIN	IT	26			100 C								
PLASTICITY I	NDEX	11	A-:	2-4	(0)					1			
SAND EQUIVA	LENT			-0						11			
Tests	Te	ch D	ate RE	MARKS	A1- C	ont	DEF	10	anab				
Screen	-						C. 54	2					
LL - PI				Wish	Grad	VI							
Wash	MAS	5 5-	14		LL:	/							
Gradation	MA	5 5	- 19	(V		289 1	2						
Crush	-	-			alup =						_	_	_
Crush Wash CR LL PI	-	-		Fractu	re Face	c = I	nsutfi	Cievy	+ Mat. +	o Pe	rformer	1 Te	5+.
LAR	-	-		1-1 7 0.12	moter =	Se	e won	rk s	heet ;	nsicl	-P .	-	
SE	1.1	-				AIT	Work	SI	eets ;	Insid			
	-	-				111	NON		6133	Insla	P		

WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/96 MATERIALS TESTING LABORATORY h:Vorms/soil&surlT-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.	DATE # 9/5/05	
PROJECT NUMBER	SOURCE	
ENGINEER	 FOR USE AS	

TEST RESULTS

F + H ² 0 =		0.D.	BULK
F+M+H*0=	TARE PAN	F + H20 + 500 - F,M,H20	
MATERIAL + TARE =	g.	0.0	APPARENT
O.D. =		F + H20 + O.D F.M.H20	

-	FLASK	F+M	F + H*0
	183.3	683,3	683,0
2	170.2	670.2	668.4
3	184.8	684.B	682.6

				Moistu	re @ S.S.E.	
		M	OISTL	RE SA	MPLE FROM -4 S/G	
	TARE WEIGHT	_	-	-		10 m l
	WET WEIGHT		_		WT. OF MOISTURE	· · · · · · · · · · · · · · · · · · ·
- 14	- DRY WEIGHT	-			+ DRY WEIGHT	· · · · · · · · · · · · · · · · · · ·
	A. T. T. T. C. C. C.				MOISTURE % g	
L	= WT. OF MOISTURE				\$.S.D	A second s
Г		MOISTI			+ 6% FOR COMPACTION	
	and the second second				@ COMPACTION	
		AMPLE	FROM	MEXCI	ESS MATERIAL AFTER C	COMPACTION
	TARE WEIGHT	12-	~	-	-	80.8
	WET WEIGHT_	62	-		WT, OF MOISTURE	
- 11	- DRY WEIGHT	575	2		+ DRY WEIGHT	
1.1	= WT, OF MOISTURE	52	161		MOIST. % @	
		-		-		-
	MACHINE LOAD				PSI	
1	980	÷	4	=	245	MOLD
2	1120	×	4	÷	280	OILED
3	1370	÷	4	÷	343	UNOILED
AVG.				AV	G. 289	
		_			-	
	APPARENT S/G	2.	58	9	BULK S/C	
	MOISTURE @ S.S.D		_		ABSORBTION	3.500
MOIST	JRE @ COMPACTION	9	101			
moistur	e					

ENGINEER

TESTED BY

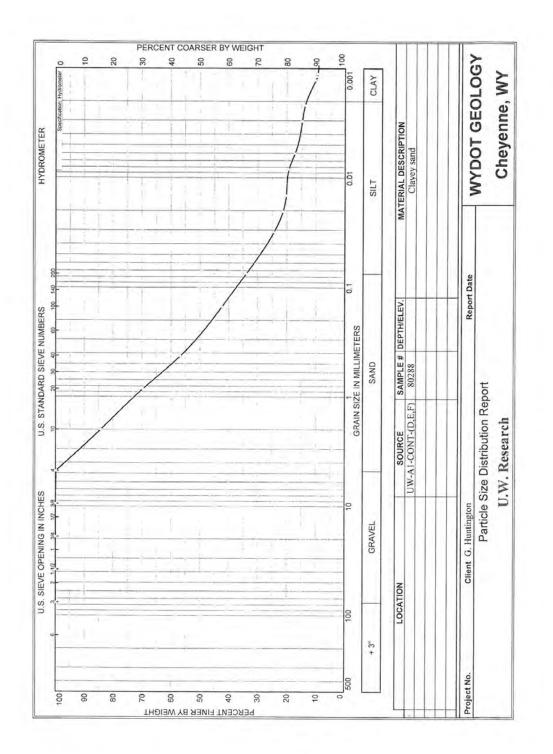
	and a second						
Project: U.W. R Project Number:			Client: G. H	lunting	gton		
		Samp	le Data				
Source: UW-A1-C	ONT-(D,E,E)						
Sample No.: 802	88						
Elev. or Depth:			Sample Lengt	h(in./	(cm.):		
Location:							
Description: Cl	ayey sand						
		Mechanical	Analysis Data	ı.			
	Initia	L					
Dry sample and	tare= 1504.3	31					
Tare		00					
Dry sample weig							
Sample split on							
Split sample da							
		are = $.00$ Sa	mple weight =	81.95			
Cumulative we							
Tare for cumula			0				
Sieve	Cumul. Wt.		Specificat:			iation,	
	retained	finer	Limits, per			cent	
3 inch	0.00	100.0	0.0 to	0.0	+	100.0	
1.5 inch	0.00	100.0	0.0 to	0.0	+	100.0	
.75 inch	0.00	100.0	0.0 to	0.0	+	100.0	
.375 inch	0.00	100.0	0.0 to	0.0	+	100.0	
# 4	3.73	99.8	0.0 to	0.0	+	99.8	
# 10	235.74	84.3					
# 20	14.18	69.7	0.0 to	0.0	+	69.7	
# 40	26.80	56.7	0.0 to	0.0	÷	56.7	
# 100	40.69	42.4	0.0 to	0.0	+	42.4	
# 200	48.98	33.9	0.0 to	0.0	+	33.9	
		Hydrometer	Analysis Data	1			
and the second	#10	- S					
Separation siev Percent -#10 ba		olete sample	= 84.3				
Weight of hydro							
Hygroscopic moi							
Moist weight							
Dry weight &							
Tare	= 105						
Hygroscopic m							
Calculated bias							
Automatic tempe							
Composite cor	rection at 20	deg C = -6	. 7				
water and the							
Meniscus correc		0.000					
Specific gravit			inc.				
Specific gravit		Tactor= U.9	30				
Hydrometer type		1064 - 0 104	an Des				
Effective de	pcn L= 16.29	4904 - U.164	x Km				
			-				
		WYDOT	GEOLOGY				

Elapsed time, min		Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent
2,00	22.5	30.0	23.8	0.0132	30.0	11.4	0.0314	24.4
5.00	22.5	27.0	20.8	0.0132	27.0	11.9	0.0203	21.3
10.00	22.0	26.0	19.7	0.0132	26.0	12.0	0.0145	20.2
30.00	22.5	25.0	18.8	0.0132	25.0	12.2	0.0084	19.3
60.00	22.5	23.0	16.8	0.0132	23.0	12.5	0.0060	17.2
240.00	22.5	20.5	14.3	0.0132	20.5	12.9	0.0031	14.7
480.00	22.5	19.5	13.3	0.0132	19.5	13.1	0.0022	13.7
1440.00	22.5	16.0	9.8	0.0132	16.0	13.7	0.0013	10.1
1680.00	22.5	15.5	9.3	0.0132	15.5	13.8	0.0012	9.6
1920.00	22.0	15.5	9.2	0.0132	15.5	13.8	0.0011	9.4
2880.00	22.5	15.0	8.8	0.0132	15.0	13.8	0.0009	9.1

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 % + 3" = 0.0 % GRAVEL = 0.2 % SAND = 65.9 % SILT = 20.6 % CLAY = 13.3 (% CLAY COLLOIDS = 9.2) $D_{85}= 2.08 D_{60}= 0.51 D_{50}= 0.27 D_{30}= 0.05 D_{15}= 0.00 D_{10}= 0.00 C_c= 4.5094 C_u= 403.6618$

WYDOT GEOLOGY



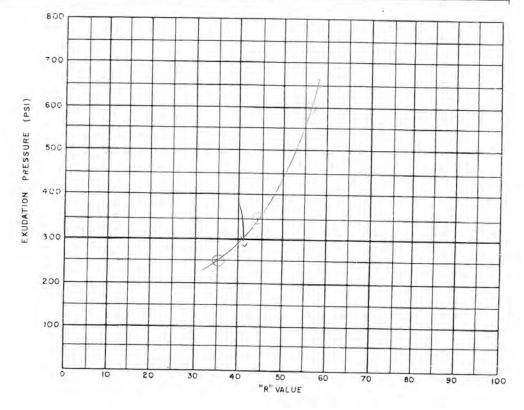
Form T-115 Rev. 5/81

WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

ATLAS ROAD SOILS STABILOMETER WORK SHEET

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO)			
MOLD NO	SA	37	Hug					08-	25	8		
COMPACTOR AIR PRES-PSI	350	300	100		SOIL	CLASS 8	GROUP	INDEX	P	ROJEC	T	
INITIAL MOIST - %			-						12			
WATER ADDED-ML	100	120	110		FIELD	IDENT.			STA	TION		
WATER ADDED-%						INITIAL	MOISTU	RE	10	~		
MOIST AT COMPACTION %	23	3.1	1.2	111.4	WET		DRY		3/4		~	
WET WEIGHT OF PAT-GMS	1140	1147	1172		DRY		TARE		3/8			_
HEIGHT OF PAT-INCHES	2.57	2.50	2.46		WT		DRY		NO.			1
DENSITY-LB.PER CU.FT.	124.1	126.5	132.2			ANSION	SPECIM	IEN	A	в	C	T p
STAB. Ph AT 1000 LBS	24	36	29	1.1.1	D	AL RE	ADING		16	6	15	
2000 LBS.	(5)	89	75		COV	ER REQ	UIRED -	INCHES	-	-	1	1
DISPLACEMENT	3,21	1.21	2.44		TIN NO. REMARKS			T-115A		1		
"R" VALUE	54	35	44			0.					"R" V	-
EXUDATION PRESS PSI	600	250	350		2	141	-ONT	(D, E P	F) H/			



V V	Mater	RTMENT OF TRAN	PEVISED P
TANSFORTEN	SAM Metric	PLE TRANSMITTA	inary 🖸 QC/QA
Date Sampled Project Number Resident Engineer	4.28.08 UW-Research Huntington	Road Section	08-23 5-19-08 Atlas Road UW
Pit or Source_		ochpile County	Laramie
1.2.2.1		Sample Distribution	
Soils	Aggregate	Concrete C	Chemistry Geology
ocation (Belt, Stockpile Vertical Limits	e, etc.)		P., etc.)
		For Use As :	
Profile	BSE	PMP. Type	Gonc. Coarse Aggregate
Borrow	CB, Grd.		Conc. Med. Aggregate
Topping	PMB	PMWC, Type	Conc. Fine Aggregate
Alkali	СТВ	ССА, Туре	Conc. Cylinders
Check Curve	Filler	Maint. Type	Conc. Beams
Final Emb.	Drain Gravel	Check Design	Port. Cement, Type
Diher	Surfacing		Туре
	Googunt	hetics (Geogrid/Geot	ovtile)
Product Name	Geosynu	Manufacturer	
Remarks: Asphal	t content by che. ne; R-value	mical extraction;	screened gradation;
materialstaharedVormstacil & surti-120	Sate	Submitted By	Seorge Huntington george # FR-0042

Form T-103B Rev. 9-06

LABORATOR	RY N	0 2	008-	02	58		DATE DE		4-28-	00			L Metric
SUBMITTED							AT	11.	120	00			
.D. MARKS				5	7101				D				-
SOURCE)				
DUANTITY F	REPE	RESENT	ED	-									
FOR USE AS	5 14	I.W	Resi	ear	ch		PROJEC	T			00		
1-(0	-00					EST RE		-					-
			-										
SIEVE SIZ PASSING	1.1.1	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET. %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING
MAX	<	1	364.7									5	Rillalue
3" (75 mm	1)		1				1200						1 Clann
2" (50 mm	1.000		·	1.1	1005.05			1			1	-	
1 1/2 (3.75 m		2.3		2.1	97.9	1111	1.	-		-		-	
1" (25 mm		3.6		3.2	94.7	1							
3/4" (19 mm	-	2.7		2.4	92.3			-				-	
1/2" (12.5 m		13.6	-	12.3	80			-			-	1	1740
3/8" (9.50 m		8.8		7.9	72.1							-	240
#4 (4.75 mm		31.0		27.9	44.2				-			-	334
		110 1 1	56.8	11.7	32.5			-			-	-	1270
#8 (2.36 mm		191.0		-	32.5			-				-	1200
#16 (1.18 m			84-1	10-4		-	-					-	
#30 (600 un		-	72.3		13-3	-	-					-	
#50 (300 ur	m)		61.1	7-4	5.9		-					_	
#100 (150 u	im)		30.4	3.7	2.2						-	-	
#200 (75 ur	m)	_	11.7	1.4	0-8		-			1		-	
PAN	-	0.0	1.3				-			1.1		·	1.
_	-	111.0	1								1.	1.1	(4)
LIQUID LIMI	π	- p	sphalt	in	sample								
PLASTICITY IN	IDEX	-		14.	11					1			_
AND EQUIVAL	ENT	-	-										
Tests	Te	ch Da	te RE	MARKS	UW-A	7 - D/	ion (A	27					-
Screen		11 5-			A		ir varn,	0,0)					_
LL - PI			6	Extic	HEMI	See	Wor	K 5	heet i	nside	2.4		
Wash			6	RAD		See	wor	te s	heret 1	neid	e.		
Gradation	MA	5 5-		U		Not	port	Orwit	ed (As	01=14	in Sa	male	1_
Crush	-	-	11A	VA VA	LUE	= 70	1	_					
Crush Wash		-		_		-							
CR LL PI	-	-									- L.		
SE	-	-											

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY EXTRACTION WORKSHEET

LABORATORY ENGINEER: DATE RECEIVI SAMPLED ID: FOR USE:	ED:	08-00023 HUNTINGTO 5/19/2008 UW-A2-RAP RAP			DATE TEST LOCATION: SOURCE: PROJECT M SOILS & SU	LARAMIE ATLAS STOCKPILE
(1) WT. OF OIL (2) TARE OF P (3) WT. OF OIL (7) WT. OF OIL	AN AND FILT ED SAMPLE (3 - 6)	ER: : (1 - 2) NG A VACUUM EX	ILTER:	1116.8 1473.0 86.2	(5) TARE O (6) WT. OF (8) % OIL: (THEO. OIL	Charles the second s
	WT. RET.	% RET.	% PA	SSING	SPEC'S	ABSON EXTRACTION
37.5mm(1 1/2")		1.000		1.	1	KINEMATIC VISCOSITY:
-						ABSOLUTE VISCOSITY:
25mm (1")						PENETRATION:
19mm (3/4")					-	CHEMICAL: METHODB OVEN:
12.6mm (1/2")	11.5	6.7	121.3			CALCULATIONS
9,5mm (3/8**)	67.1	4. 1	28.4			
4.75mm (#4)	345.8	24.9	45.5			
2.36mm (#8)	222.3	16.0	49.5			7
1.18mm (#16)	155.5	11.2	34.3	1		1
600µm (#30)	118.2	8.5	27.8			1
300µm (#50)	108.6	7.8	20.0			7
150µm (#100)	91.4	6.6	13.4			7
75µm (#200)	62.4	4.5	8.9			1
PAN	123.0	1994 - Car		1		1
25.6	27 272.4		11 TH 11	11		
TOTAL				1		
	124.0	0.08				
RERUN: REMARKS:						
_				_	TESTED BY	/: KMM

FORM T-215 REV. 4/95 Form T-115 Rev. 5/91

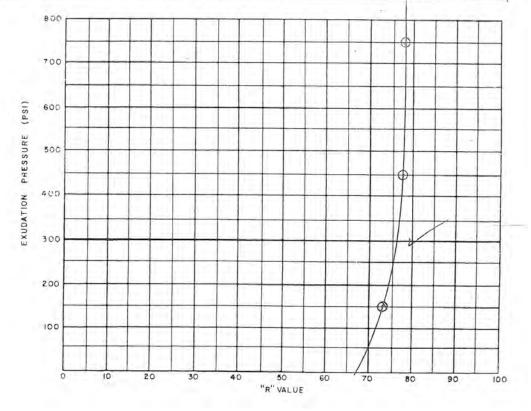
WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

SOILS STABILOMETER WORK SHEET

ROAD

TEST SPECIMEN	A	8	¢	D	LL	PL	PL	LAB. NO		-		
MOLD NO	10	10	314					08-	255	3		
COMPACTOR AIR PRES-PSI	300	350	350	-	SOIL	CLASS 8	GROUP	INDEX	Pi	OJEC	τ	
INITIAL MOIST - %			-	-					1			
WATER ADDED-ML	100	70	50		FIELD	IDENT.			STAT	ION		
WATER ADDED-%					1	NITIAL	MOISTU	RE	1 ⁿ			
MOIST AT COMPACTION %	8.3	5.8	4.2		WET		DRY	-	3/4"			
WET WEIGHT OF PAT-GMS	1022	1025	1077		DRY		TARE		3/8			-
HEIGHT OF PAT-INCHES	2.41	252	2,47		WATER		WT. DRY	1	NO.	4		
DENSITY-LB.PER CU.FT.	125.7	117.8	129.1		EXP	ANSION	SPECIA	AEN	A	в	С	D
STAB, Ph AT 1000 LBS	11	9	8		DI	AL RE	ADING					
2000 LBS.	24	22	20		COVE	ER REQ	UIRED -	INCHES				
DISPLACEMENT	5.22	4.78	5.31		TIN NO.	REMA	RKS:				T-115A	
"R" VALUE	73	77	77			0.5	. 000	W LA	en		"R" VA	LUE
EXUDATION PRESS. PSI	150	4220	755			196		The Car	3,6)		70	1



$\frac{\text{Metric}}{28.08}$	D Prelimir D Constru Lab #	Iction
28.08	Lab #	
Kesearch ytsnyton as Road	Date Received Road Section at :	08-25 5-19-08 Atlas Road UW Laramie
A second s		emistry 📮 Geology
Road Simtace	at: (Sta., kp., M.P to :	., etc.)
Ea		
BSE	PMP, Type	Conc. Coarse Aggregate
	1993 - Carlos - Carlo	Conc. Fine Aggregate
		Conc. Cylinders
		- Conc. Beams
		Port. Cement, Type
	Check Design	Type
	(Congrid/Conto	vtila)
Geosynthetics	Manufacturer	Autoj
ent by chemica 2. value	al extraction; Combin	
	Aggregate Sample Aggregate Aggregate	As Road County Sample Distribution Aggregate Concrete Aggregate S# Aggregate State BSE PMP, Grd, Grd PMB PMVC, Type CTB CCA, Type Drain Gravel Check Design Cing Geosynthetics (Geogrid/Geote Manufacturer State Aggregate State Aggregate State

Form T-103B Rev. 9-06

	DRY N	NO 2			OF TEST OF					. 09	3		English
SUBMITTE	DBY	G	Hur	tin	ston		AT	11.	11)				-
I.D. MARKS	5		1.0.	1.1.1), and		DATE SC	PEEN	ED			-	
SOURCE							DATE SA	MPIER	D				-
QUANTITY		RESEN	TED				LOCATIC	ON LEL					-
FOR USE A	s /	1.W	Res	ear							00		•
		-					SULTS			_			-
										-			
SIEVE SI PASSIN		RET. WT. LBS.	WT.	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING
MA	X		251-6	1.0		1				200.	GIUNIO	70	"R"Valu
3" (75 m	m)			1		-	1.		1.			-	IN Vacu
2" (50 mr	-			1			-			-	1		-
1 1/2 (3.75			1		100.0					-	-		
1" (25 mr		1.6		1.6	98.4								-
3/4" (19 m		1.6		1.10	96.8	1	1		1			-	
1/2" (12.5 r		8=9,		8.7	88.1	2	1		-		-		142
3/8" (9.50 r	-	6.7		6.5	81.6	-							
#4 (4.75 m		27.4	1	26.8					1			-	220
#8 (2.36 m		55.1	134.5	21.0	33.8		(-		-	-		542
#16 (1.18 m		70	46.0	14.1	19.7		1	-					1200
#30 (600 u		1	56.7	8.8	15.9		-	-					
#50 (300 u	-	-	37.5	5.8	5+1	1	-				1	-	
#100 (150	-		17.9	-	2.3					-		-	
#200 (75 u		1	8.5	1.3	1-0					-			
PAN		4.1								-	-	-	
		102.3						-					(4)
LIQUID LIN	лг	-						-		-			
PLASTICITY I		-							0				
SAND EQUIVA						17	E 11	-		-			
Tests	Гте	ch I D	ate RE	MARKS	Uw-A		o Snypii			-			
Screen	15	_	19		UWFA	2-11 3	(A, P, C	-)					_
LL - PI	1-5			TX+	Then		20.0	1 -1	eet in	1.15			_
Wash				and	5 5	5.00	e wo	Les.	1-2- 1-	5104	2		_
Gradation	MA	5 5.	20 /	11 =	nb	t p:	er for.	ne Si	(asphal	510 4		-1	
Crush			"R	Va	lue -		78		(aspect	14	samp	C.M	
Crush Wash					ace 1			3.4	1% (4	2)		-	
CR LL PI				1				4.3					
LAR	_	1						4.2	· /. (C				
SE													

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY EXTRACTION WORKSHEET

LABORATORY ENGINEER: DATE RECEIV		08-00025 HUNTINGTO 5/19/2008	DN	_	DATE TEST LOCATION SOURCE:	
SAMPLED ID:		UW-A2-RSA	1		PROJECT	
FOR USE:		RAP			SOILS & SI	URFACING LAB NO:
1) WT. OF OIL			ILTER:	2505.2	- • • • • • • • • • • • • • • •	UNOILED SAMPLE, PAN, AND FILTER: 2443
2) TARE OF P 3) WT. OF OIL				1018.2	(5) TARE O	OF PAN AND FILTER:
7) WT. OF OIL		. (1 - 4)		62.2	(8) % OIL: (
		ING A VACUUM EX TER AID.	TRACTION, ADD 50	GRAMS	THEO, OIL	CONTENT:
	WT. RET.	% RET.	% PA	SSING	SPEC'S	ABSON EXTRACTION
37.5mm(1 1/2")						KINEMATIC VISCOSITY:
				1		ABSOLUTE VISCOSITY:
25mm (1")	-	-	100 0			PENETRATION:
19mm (3/4")	7.4	0.4	1. A. C.			CHEMICAL: METHODB OVEN:
12.6mm (1/2")	39.2	7.0	92.4			CALCULATIONS
		-		1		
9.5mm (3/8")	46.7	5.3	89.1			-
4.75mm (#4)	302.4	=1.2	47.7	1.5	1	1
2.36mm (#8)	203.2	14.3	53.1.	1		-
1.18mm (#16)	156.7	11.0	42.6	J		1
600µm (#30)	128.2	9.0	33.6			1
300µm (#50)	125.7	8.8	24.8	1		
150µm (#100)	105.5	7.4	17.4	1		1
75µm (#200)	87.2	lo. 1	11-3	1		
PAN	161.0			11 m.		
28.3				1		
TOTAL						
	162.6	0.12				
REMARKS:						
			_	-	_	
	-				TESTED BY	KMM

FORM T-215 REV, 4/95 Form T-115 Rev. 5/91

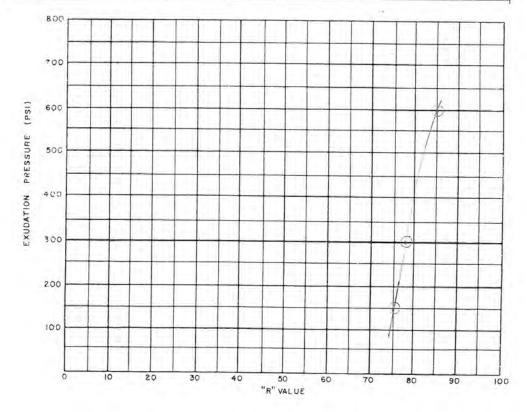
WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

SOILS STABILOMETER WORK SHEET

ATLAS ROAD

TEST SPECIMEN	A		C	D	LL	PL	PI	LAB. NO				
MOLD NO	1514	44	111					08-	2.55	3		
COMPACTOR AIR PRES-PSI	355	10	350		SOIL	CLASS &	GROUP	INDEX	P	OJEC	т	
INITIAL MOIST - %												
WATER ADDED-ML	20	100	<i>a</i> [FIELD	IDENT.			STAT	ION		-
WATER ADDED-%	-		·			NITIAL	MOISTU	RE	1.			
MOIST AT COMPACTION %	6.7	8.3	75		WET		DRY		3/4"			
WET WEIGHT OF PAT-GMS	1147	1152	198		DRY		TARE		3/8			
HEIGHT OF PAT-INCHES	2,45	2.93	142		WATER		DRY		NO.	4		
DENSITY-LB.PER CU.FT.	152.9	133.3	1325	17.1		ANSION	SPECIA	EN	A	в	C	D
STAB. Ph AT 1000 LBS	6	12	10		DI	AL RE	ADING					1
2000 LBS.	15	25	22	177	COVI	COVER REQUIRED - INCHES						
DISPLACEMENT	4.35	4.41	1.101	1.1	TIN NO. REMARKS		-		T-115A			
"R" VALUE	0.5	75	75		AZ-25 (A.B.C)			0 3			"R" VA	LUE
EXUDATION PRESS PSI	600	150	500	1.00	1	14 L-	25 CA	15,5-)			78	2



SOILS INPLACE MOISTURE SHEET

U.W RESCARCH HUNDERGERM 4-27-07

LAB. # PROJECT # GEOLOGIST DATE TECH:

1

SAMPLE I.D.	WET WT.	DRY WT.	WT.OF MOIST.	MOIST. %
MAL-AZ-REA	209.9	203.0	6.9	3.4
	211.6	202.9	87	43
1W-A7-RSC		180.0	7.4	4.2
UW - AI-ESD	186.5	7. 95	6.8	3.8
UW - AI - RSE	217.7	210.9	3.2	1.5
JW-A1-SSF	221.3	215.3	6.0	2.3
JIN - PI- RSI5	165.8	160.00	5.3	3.4
IN - PI-RSK	196-8	189-4	7.4	3.9
W-PI-RSL	214.4	210 - 8	3.6	1.7
	1	1 - 1 - 1 - 1		
	1	1		
		-	1	
				-
			-	
		-		
			N	
			1.	
		1	1	
			R	
				1
-				

Wet wt. - Dry wt. = wt. of moisture Wt. of Moisture / Dry wt. = moisture %

MAT/SOILS/SURF/FORMS/SOILS INPLACE MOISTURE SHEET

	Mater	RTMENT OF TRA ials Testing Laborat PLE TRANSMITT	tory	Form T-1 REVISED &
	Metric MEnglish	Preli Cons		QC/QA
Date Sampled	4.28.08	Date Received		
		Road Section	Atlas Road	
		h at:		
	Atlas Pit		x Laramie	
		Sample Distribution		
🛄 Sails	Aggregate	Concrete	Chemistry	Geology
				Multiple Samples
		S#		of1
		at: (Sta., kp., M		
Vertical Limits		to :		
Horizontal Limits		to :		
Quantity Represented				
10.00 TO 1		For Use As :		
Profile	BSE	PMP. Type	Conc. Coarse A	ggregate
Borrow	CB, Grd.		Conc. Med. Ag	gregate
Topping	PMB	PMWC, Type	Conc. Fine Agg	regate
Atkali	СТВ	CCA, Type	Conc. Cylinders	
Check Curve	Filler	Maint. Type	Conc. Beams	
Final Emb.	Drain Gravel	Check Design	Port. Cement, 1	Vpe
D Other Su	and the second se		Туре	
	Geosynth	etics (Geogrid/Geo	extile)	_
Draduct Nama	Geosynth	Manufacturer	lextile)	_
Product Name				
Remarks: Wash g fractured fa	radation; PL; ces; hydromete	LL; cohesiou ~ (beology)	value; R-v	alue j
		Submitted By	eorge Hunti	1

Form T-103B Rev. 9-06

LABORATO SUBMITTEI	RYN	10.	2008.	- 02	58		DATE RE	C'D .	4-28-	05	3		L Metric
SUBMITTE	DBY	G	. Hur	tin	ston		AT	U.	W.				
D. MARKS	ii			-			DATE SC	REEN	ED				S
SOURCE													-
QUANTITY	REPI	RESEM	TED						_				
FOR USE A	s_L	1.W	Res	ear	ch	_	PROJEC	T		-	CO		
	-	-			1	EST RE		-					
		-				1.0	1.1	-			100		
SIEVE SI PASSIN		RET WT LBS	WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING
MA	x		372 - 2	1	-		1						"R"Ilat.
3" (75 mr	m)		1						· · · · · ·				1 Van
2" (50 mr	m)						1.200		1			1	
1 1/2 (3.75)	mm)				11000				11111			-	
1" (25 mr	m)				100.0						-		
3/4" (19 m	nm)	15.6	2	0.5	99,6				1.0				
1/2" (12.5 m	mm)	2.1	-	1.7	97.8		1.1		11	11.2	-		24
3/8" (9.50 m	nm)	2.8	- 0	2.3	95,5				1.00			1	54
#4 (4.75 m	ım)	21.4		17.5	78.0	1.2.1				1.000			264
#8 (2.36 m	nm)	11:95	3 45.6	9-5	68-5						-		1200
#16 (1.18 m	nm)	-	39.2	8.2	60-3							1.1	1
#30 (600 u	Im)		37.7	7-9	52.4					1.00			1
#50 (300 u	(mu		41.4	8 - 7	43.7		·			-		0	
#100 (150)	um)		35-8	7.5	36.2				1				
#200 (75 u	Jm)		46.2	9.7	26.5				Y				
PAN		H-	6 126.3	1					1	124	12		·
		12	2		(T								(4)
LIQUID LIN	AIT.	25		-	1								
PLASTICITY I	NDEX	9	A	-2-4	1(0)	-			******	1	-		
SAND EQUIVA	LENT						-			1			
Tests	Te	ch 1	Date RE	MARKS	11.10.	- A	7-17	ut	(A.E	0	1		
Screen	cs .	13 4	5-14		- 12-23-1		6- V	10	111-	10,	}		
LL + PI	GE	1		ogh									
Wash	MA	_		LL	V	_							
Gradation	MA	5 5			= 340			_					
Crush Crush Wash	-	-			ie =		00	11 +1				_	-
CR LL PI	-	+			re Faci				Kshee	1	21.		
LAR	1			Yar	UNTER		SEE	0001	Th Shee	T 11	iside.		
SE								-	_				

Wt Of sample	_			Ī	LOCATION		PR	PROJECT					
	_	% F & E Particiae	% retained	Weighted		Wt. Of One or more fractured	% ane or more F.F.	% retained weights	Weighted %	Wt. Of Two or more fractured	% Two or more F.F.	% retained weights	WI 14
Coarse -3/4"+1/2" -1/12"+3/8" -3/8"+#4 -3/8"+#4 Medium -3/4"+1/2"	_			T		faces				faces			
Coarse 3/4*1/2* 1/2*43/8* 3/8*+#4 3/8*+#4 Medium Medium Ar*+1/2*	-			Ī									
1/2"+3/8" 3/8"+#4 Aedium 3/4"+1/2" -^^*_1/2"	T				15-20-51	64/23	1.1	001:0	0				
0/8*+#44 Medium 8/4*+1/2"					graduat	2 5 2 10 1	55	0.105	1.1				
1edium 3/4"+1/2"	1			1	20.11	0.45	36:2	566.0	76 6				
3/4"+1/2" 1/2"													
1.6/CT.G.													
-3/8"+#4													2
				1									1
Fines													
-1/2"+3/8" -3/8"+#4													
-1/2"+3/8"	T												
-3/8"+#4													
							n.,						
Weighted Total %									95-4				
Flat & Elongated Formula							Note:						
(B / A) X 100 = %							Flat test = width to livicioness Elongaled test = length to width	dth to livicion st = length to	ess b width				
To calculate the weighted %, the +#4 needs to be adjusted	needs to be a	diusted					Flat & Elo	ngated =	Hat & Elongated = length to thickness	ess			
so when all the new retained weights of the +## are added torother than solution that when	s of						WI % = weighted %	% pa					
we we are access operator, usy equal routs, monopy the multiply that times % of fills operator. The set the set of that sizes. Then multiply that times each bin split if there are multiple stockples if necessary. Add the weighted %'s on the various sieve sizes and report.	ed of that sieve ockpiles If neo	e. Then multi essary. Add	ply that times the weighted	%'s on the			Note: The as the sie	sieve sij ve above	Note: The sieve size containing le as the sieve above it or befow it.	Note: The sieve size containing less than 10% will use the same % of flat & elongated as the sieve above it or below it.	l use the sa	me % of fla	8
							Fractured Face Formula: P=[F/(F+N)] X 100	ice Formula:)] X 100					
4							F= Fractured Faces N= No fractured faces P= Permont of fracturer	F= Fractured Faces N= No fractured faces P= Perrent of fractured faces					

six grotelet

WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/86 MATERIALS TESTING LABORATORY h:Vorms/soil&surt-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.					DATE	9/5/08	
PROJECT NUMBER	UN	H2	VW (A.G.	2	SOURCE		_
ENGINEER				1	FOR USE AS		

TEST RESULTS

F + H ^z 0 =		0.D.	BULK
F + M + H ² 0 =	TARE PAN	F + H*0 + 500 - F.M,H*0	
MATERIAL + TARE =	g	O.D	APPARENT
0,D. =		F + H20 + O.D F,M,H20	

	FLASK	F+M	F + H*0
1	183.3	683.3	683.0
2	170.2	670.2	668,4
3	184.8	684.8	682.6

			re @ S.S.E.	
MC	DISTU	RESA	MPLE FROM -4 S/G	
			-	
_	_	_	WT. OF MOISTURE	1
		-		
MOISTL	IRE @	S.S.D	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	· · · · · · · · · · · · · · · · · · ·
	MOIS	TURE	COMPACTION	
AMPLE	FROM	MEXCE	SS MATERIAL AFTER C	OMPACTION
600	9.0		WT. OF MOISTURE	53.7
555	1,8		* DRY WEIGHT	- 355.5
53	.7			
_			PSI	
÷	4	=	ищи	MOLD
÷	4	=	296	OILED
÷	4	-	761	
		AV	3. 360 %	1
		_	1	1707
2.	49	3.	-	
_		_	ABSORBTION V	3.604%
	MOISTL 40° 555 53 ÷ ÷ 24	MOISTURE @ MOIS CAMPLE FROM 609.0 555.8 53.7 $\div 4$ $\div 4$ $\div 4$	MOISTURE @ S.S.D MOISTURE (AMPLE FROM EXCE $\frac{409.0}{555.8}$ 53.7 $\div 4 =$ $\div 4 =$ $\div 4 =$ $\div 4 =$	$555.8 \rightarrow DRY WEIGHT MOIST. % @ COMPACTION PSI \dot{x} \ 4 = 4444 \dot{x} \ 4 = 2.966 \dot{x} \ 4 = 3501 AVG. 560 %$

NOTES:30ml=2% maisture

TESTED BY

ENGINEER

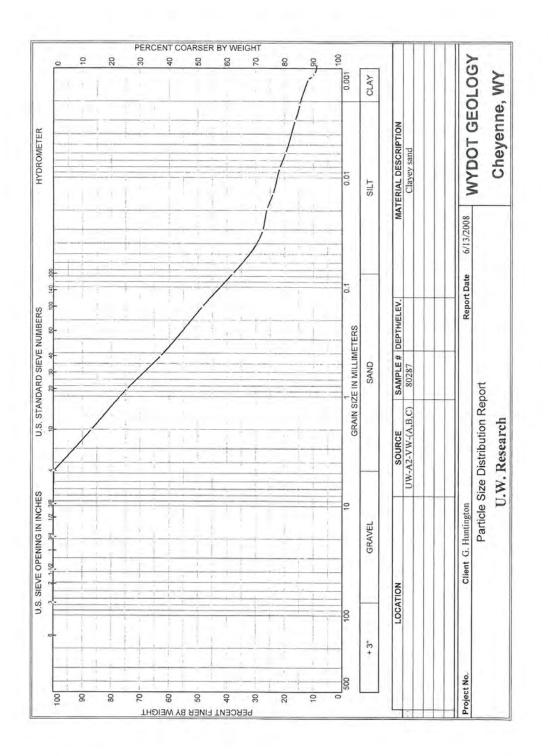
Project: U.W. I Project Number				
Project Number				
	£.		Client: G. Huntington	
		Samp	le Data	
Source: UW-A2-V	W- (A. B. C)			
Sample No.: 802				
Elev. or Depth			Sample Length(in./cm.):	
Location:	7		sampus sangen (anti) out / :	
Description: C	layey sand			
		Machanical	Analysis Data	
	÷		Marysis Data	
Dry sample and	Initial tare= 1586.0			
Tare	= 0.0			
Dry sample weig				
Sample split or				
Split sample da		1 Sec. 1		
		re = .00 Sa	mple weight = 87.07	
	eight retained		and an and show a second	
Tare for cumula	ative weight r	etained= .0	0	
Sieve	Cumul. Wt.	Percent		
	retained	finer		
3 inch	0.00	100.0		
1.5 inch	0.00	100.0		
.75 inch	0.00	100.0		
.375 inch	0.00	100.0		
# 4	3.83	99.8		
# 10	210.10	86.8		
# 20	12.40	74.4		
# 40	23.99	62.9		
# 100	38.64	48.3		
# 200	49.07	37.9		
		Hydrometer	Analysis Data	
Separation siev				
Percent -#10 ba			= 86.8	
Weight of hydro				
Hygroscopic moi				
	& tare = 191.			
	tare = 189.			
Tare	= 105. noisture= 1.8			
Calculated bias	the second s			
Automatic tempe	[14] A. K. M. M. M. W. W. W. M. M. M. W.			
	crection at 20		.7	
Meniscus correc	tion only= 0			
Specific gravit		2.685		
Specific gravit	y correction :	Eactor= 0.9	92	
Aydrometer type Effective de	a: 152H apth L= 16.294	964 - 0.164	x Rm	
		WYDOT	GEOLOGY	

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	ĸ	Rm	Eff. depth	Diameter mm	Percent
2.00	22.5	34.0	27.8	0.0131	34.0	10.7	0.0303	27.5
5.00	22.5	32.5	26.3	0.0131	32.5	11.0	0.0194	26.0
10.00	22.0	30.5	24.2	0.0132	30.5	11.3	0.0140	23.9
30.00	22.5	28.0	21.8	0.0131	28.0	11.7	0.0082	21.6
60.00	22.0	26.0	19.7	0.0132	26.0	12.0	0.0059	19.5
240.00	22.5	22.5	16.3	0.0131	22.5	12.6	0.0030	16.2
480.00	22.5	21.0	14.8	0.0131	21.0	12.9	0.0021	14.7
1440.00	22.5	18.0	11.8	0.0131	18.0	13.3	0.0013	11.7
1680.00	22.5	16.5	10.3	0.0131	16.5	13.6	0.0012	10.2
1920.00	21.5	16.0	9.6	0.0133	16.0	13.7	0.0011	9.5
2880.00	22.5	15.0	8.8	0.0131	15.0	13.8	0.0009	8.7

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 % + 3" = 0.0 % GRAVEL = 0.2 % SAND = 61.9 % SILT = 23.5 % CLAY = 14.4 (% CLAY COLLOIDS = 8.8) D85= 1.76 D60= 0.35 D50= 0.17 D30= 0.04 D15= 0.00 D10= 0.00 C_c= 4.2485 C_u= 301.4911

WYDOT GEOLOGY =



Form T-115 P.ev. 5/91

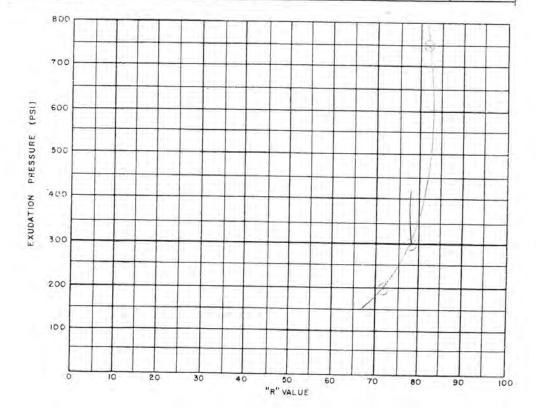
WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

ATLAS ROAD

SOILS STABILOMETER WORK SHEET

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO				
MOLD NO	55	.9	NCI	1				08-	25	8		
COMPACTOR AIR PRES-PSI	352	250	320		SOIL	CLASS E	GROUP	INDEX	P	NOJEC	T	-
INITIAL MOIST - %												
WATER ADDED-ML	20	10	65		FIELD	IDENT.			STA	TION	1	
WATER ADDED-%			-		1	NITIAL	MOISTU	RE	11			-
MOIST AT COMPACTION %	6.7	7.5	5.9		WET		DRY		3/4			-
WET WEIGHT OF PAT-GMS	1112	3801	138		DRY		TARE		3/8			
HEIGHT OF PAT-INCHES	2.45	2.47	1.12		WT		WT DRY		NO.	4		
DENSITY-LB.PER CU.FT.	1-291 B	D.5.]	124.8			ANSION	SPECIN	AEN.	Α	в	C	D
STAB. Ph AT 1000 LBS	12	15	inger til	11.1	DI	AL RE	ADING	-	-			-
2000 LBS.	26	35	19		COVE	ER REQ	UIRED -	INCHES				
DISPLACEMENT	3.63	3.49	4.00		TIN NO.	REMA	RKS:			-	T-115A	
"R" VALUE	7.2	72	82	1.1.1		AZ	ww (A, B, C)			"R" V	
EXUDATION PRESS PSI	300	200	52	1.0							78	



LIQUID LIMIT AND PLASTIC INDEX TEST U, W, KESCATCH Labt 09-0258

LAB#	# NIL	WEIGHT	DRY WEIGHT	TIN TARE	# OF BLOWS	WEIGHT H20	WEIGHT DRY SOIL	% H20	CORR. % H20	PLASTIC	L.L. & P.I.	# OF BLOWS CORR. FACTOR
ABC	563	34.00	31.12	T D	Ē	2.33	11.12	25.9	L.42	-	25	14 = 0.933
W92-WC	550	33.43	31.560	R O		1.87	11560		16.2	8.5	0	15 = 0.940
N.N.O	570	79.97	31.61	1 - U.	14	3.36	11.61	28.9	27.0		27	16 = 0.947
1102-1-1-00	594	34.71	32.63	P. B.		2.08	12.63		16.5	10.5	II	17 = 0.954
C,H,T	L19	360.73	33.14	Ŀ E	23	3.59	13.14	27.3	27.0		12	18 = 0.961
jw-A1-CONT	508	30.16	28.52	E : E		1.34	8.82		16.2	11.8	21	19 = 0.967
12.20	145	35.95	32.26		19	3.68	1225	30.02	290		GN	20 = 0.973
Uch M. wall	509	36.03	34.13	D D		1.90	1 2		1. 10-	15.6	14	21 = 0.979
1.0.0	505	37.53	33.86	の一般の日	19	547	13.86	26.48	52 4		26	22 = 0.985
UNAN STATE	22.3	35.32	33.42	9 9		190	0 - 21		14.2	11.4	11	23 = 0.990
												24 = 0.995
				T T								25 = 1.000
				A State of the second								26 = 1.005
				Τ T								27 = 1.009
												28 = 1.014
				N N								29 = 1.018
				S. S.								30 = 1.022
												31 = 1.026
				(三) (三)						-		32 = 1.030
				And the second s								33 = 1.034
				209 309				100				34 = 1.038
								-				35 = 1.042
				A Contraction of the second								36 = 1.045
				御話したい								

DOUBLE DIGIT TINS = 30g % H20 = (WT. H20)/(WT. D.S.) X 100 LIQUID LIMIT - PLASTIC LIMIT = PLASTIC INDEX TIN TARE TRIPLE DIGIT TINS = 20g

LAB#	PROJECT#UW-PI-VW (JKL)SG. PIT NAME_	
	FINE AGGREGATE	COARSE AGGREGATE
FLASK & H2O #1	678,1	A =
FLASK, MAT & H2O	975.1	B = C =
MAT & TARE	770.4	BULK
TARE #10	287.7	APP
OVEN DRY	482.7	% ABS
BULK S.G. =	<u>4827</u> (=) <u>4977</u> (=) <u>2.378</u> (673.1 +500.0- 975.1 <u>208</u>	
APP S.G. =	678144927=9751 (=) <u>4827</u> (=) <u>1.597</u>	
ABSORBTION =	500.0- <u></u>	

- 11-		mu	
- 40	4	Lint.	

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PROJECT# DWAL CONT S.S PIT NAME

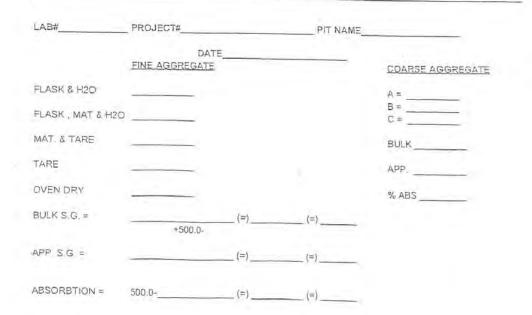
DATE 8-8-08	COARSE AGGREGATE					
FLASK & H20 #1 678.1	Α =					
FLASK, MAT & H20 970.7	B = C =					
MAT & TARE TIL.T	BULK					
TARE #3 338.6	APP					
OVEN DRY 478.1	% ABS					
BULK S.G. = $\frac{478.1}{2.78.1 + 500.0-978.7}$ (=) $\frac{278.1}{200.1}$ (=) 2.305						
APP. S.G. = <u>478.1</u> 678.1 - 970.7 (=) <u>478.1</u> (=) <u>2.577</u>						
ABSORPTION = 500.0- $\frac{477.1}{478.1}$ (=) $\frac{21.9}{478.1}$ (=) $\frac{4.581}{478.1}$						

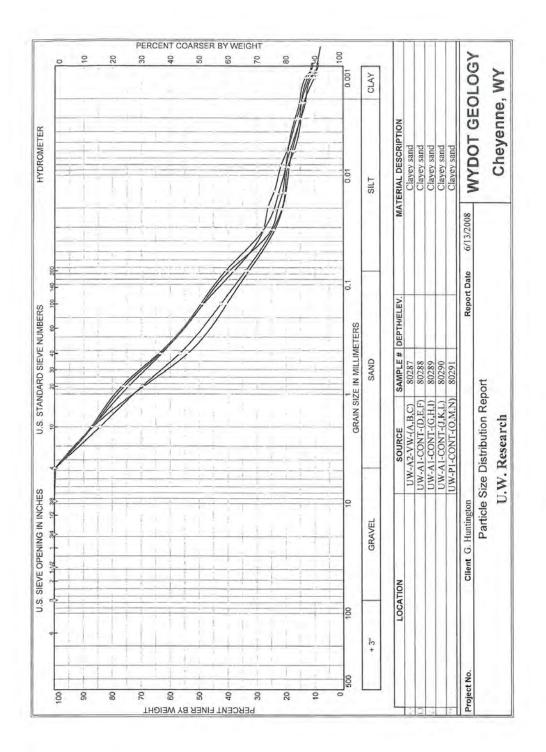
LAB#	PROJECT# <u>UW-A2- I/W</u> PIT NAME (ABC) DATE <u>8-19-08</u>	
	EINE AGGREGATE	COARSE AGGREGATE
FLASK & H2O	1.78.1 Moist. Somple 200.0 g. SEL 967.1 192.9 2.0	A =
FLASK , MAT & H2O		C =
MAT. & TARE	762.1 7.1= 3.681%	BULK
TARE	279,5	APP
OVEN DRY	482.6	% ABS
BULK S.G. =	678.1 +500.0-967.1 =) 40,5 1 (=) 2287	
APP, S.G. =	(=) <u>487.6</u> (=) <u>487.6</u> (=) <u>749</u> 3	
ABSORBTION =	500.0- <u>482.6</u> (=) <u>17.4</u> (=) <u>3.60</u> 6	

RSE AGGREGATE
к
BS
-00

-

LAB#	PROJECT# <u>MW-A1-VW</u> PIT NAME (D_c 5. f) DATE_8-15-08	
	FINE AGGREGATE	COARSE AGGREGATE
FLASK & H2O	678.1 METET. Surger	A =
FLASK, MAT & H2O		B = C =
MAT & TARE	819.6	BULK
TARE	336.3	APP
OVEN DRY	483.3	% ABS
BULK S.G. =	(=) <u></u>	
APP, S.G. =	$\frac{1}{678.1 + 483.2 + 9.74.7} (=) \frac{1/823.3}{186.7} (=) \underline{\Im, S, 8.9}$	
ABSORBTION =	500.0- <u>483.3</u> (=) <u>16.7</u> (=) <u>3.455</u>	





TANEFORTUNI		rials Testing Laborat		ATION	REVIS
	Metric English	Prelin	ninary	0 00/0)A
	4-30-08 HUNTINGTON VW RESEAR	1.11		ROAD	_
Pit or Source	ATLAS	Count	LAR	AMIE	
		Sample Distribution			
Soils	Aggregate	Concrete	Chemistry	Geolog	У
Location (Belt, Stockpile,	etc.) SUKFAC	ONTM S# Eat: (Sta., kp., M to :	.P., etc.)		Aultiple Samp
Horizontal Limits					
Quantity Represented		to :		1	
		Post of a			
Profile	BSE	For Use As :		onc. Coarse Aggrega	te
Borrow	CB, Grd.	G/d		inc. Med. Aggregate	
Topping	РМВ	PMWC, Type		nc. Fine Aggregate	
Alkali	СТВ	CCA, Type		inc. Cylinders	
Check Curve	Filler	Maint. Type		inc. Beams	
Final Emb.	Drain Gravel	Check Design		nt. Cement, Type	
A other 50%	REACING		Type		
	Geosynth	netics (Geogrid/Geot	extile)		
Product Name		Manufacturer			

Form T-103B Rev. 9-06

1

LABORATORY NO. 2008 - 0258 DATE REC'D 4-28-08								English				
SUBMITTED BY				cton		AT	11.	120	00	,		
I.D. MARKS		/		1100		DATE SC	REEN	ED				-
SOURCE						DATE SA	MPLEI	D			-	-
QUANTITY REP	RESENT	ED				LOCATIC	N CL					-
FOR USE AS	FOR USE AS U.W Res					LOCATION CO						-
						SULTS						-
			-		1				-		-	_
SIEVE SIZE PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING
MAX	1	320.1			1 ··· · · · · · · · · · · · · · · · · ·			14	LDC,	BICAND	70	ET alux
3" (75 mm)								1				Flance
2" (50 mm)	0.01	1	100	-			1		1			
1 1/2 (3.75 mm)	1.11		12	100.0	1	1	1		1			
1" (25 mm)	6.7	1	0.6	99.4							-	
3/4" (19 mm)	0.9		6.6	98.6								
1/2" (12.5 mm)	2.5		2.2	96.4	1 12 11	1						42
3/8" (9.50 mm)	31	1	2.7	93.7	6 (T 1)	1.0		-4				74
#4 (4.75 mm)	20,2		17,6	76.1	1.0.0	1						284
#8 (2.36 mm)	86.0	44.3	11-0	65.1								1200
#16 (1.18 mm)		31.3	7-4	57.7	1.001						_	1000
#30 (600 um)		33.5	8.0	49.7		11 1	1.1					-
#50 (300 um)		40.5	9.6	40.1								
#100 (150 um)		31-0	7.4	32.7				17 A.S. 7.			-	1
#200 (75 um)	1	38.1	9-1	23.6		1	1			1		
PAN	13.0	19.4				11	1000				1	
	114.5		1									(4)
LIQUID LIMIT	27											
PLASTICITY INDEX	11				1		_					
SAND EQUIVALENT	1								2			
Tests Te	ch Da	te RE	MARKS	U.W	PI.	- CON	T-	(0, n	1 1	1		
Screen (5		1			-			2011	; ,,	/		
LL-PI GE			Vash		/							
Wash MA	_								224			
Gradation MA	5 5-		V	= 1 lue= 2	64 P3	T					_	
Crush Wash							~			-	-	
CR LL PI	-	Fr	Lidi	anotal	: * S =	Spisul	ficie	nt mat ksheet	. +0	perfor	m t	est.
LAR			yar	UNTEICH	E	Jee	mor	k shept	India	le.	-	
SE												_

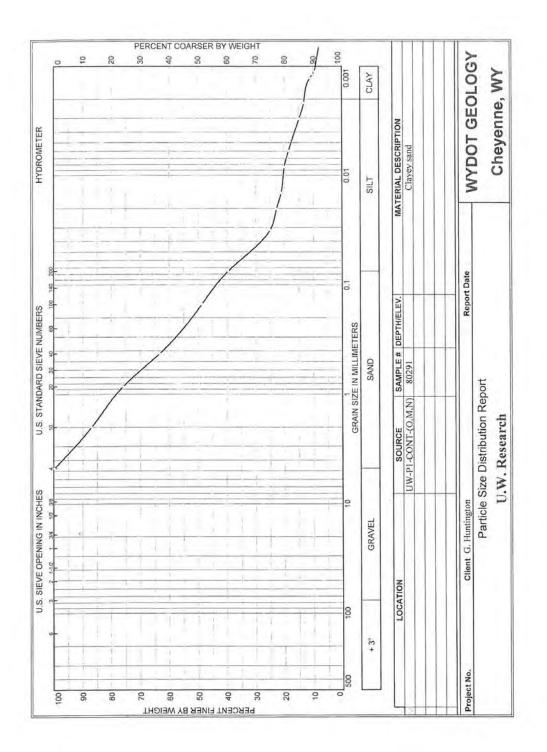
GRAIN SIZE DISTRIBUTION TEST DATA Project: U.W. Research Project Number: Client: G. Huntington Sample Data Source: UW-P1-CONT-(0,M,N) Sample No.: 80291 Elev. or Depth: Sample Length (in./cm.): Location: Description: Clayey sand Mechanical Analysis Data Initial Dry sample and tare= 1371.54 Tare 0.00 = Dry sample weight = 1371.54 Sample split on number 10 sieve Split sample data: Sample and tare = 78.98 Tare = .00 Sample weight = 78.98 Cumulative weight retained tare= .00 Tare for cumulative weight retained= .00 Cumul. Wt. Sieve Percent retained finer # 4 4.23 99.7 179.41 # 10 86.9 # 20 10.02 75.9 # 40 21.44 63.3 # 100 34.84 48.6 # 200 43.11 39.5 Hydrometer Analysis Data Separation sieve is #10 Percent -#10 based upon complete sample= 86.9 Weight of hydrometer sample: 80.54 Hygroscopic moisture correction: Moist weight & tare = 184.16 Dry weight & tare = 182.63 = 105.38 Tare Hygroscopic moisture= 2.0 % Calculated biased weight= 90.88 Automatic temperature correction Composite correction at 20 deg C = -6.7Meniscus correction only= 0 Specific gravity of solids= 2.685 Specific gravity correction factor= 0.992 Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm Elapsed Temp, Actual Corrected K Eff. Rm Diameter Percent reading time, min deg C reading depth mm finer 2.00 22.5 29.0 22.8 0.0131 29.0 11.5 0.0315 24.9 5.00 22.5 27.0 20.8 27.0 0.0131 11.9 0.0202 22.7 10.00 22.5 25.5 19.3 0.0131 25.5 12.1 0.0144 21.1 WYDOT GEOLOGY

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	ĸ	Rm	Eff. depth	Diameter mm	Percent
30.00	22.5	24.5	18.3	0.0131	24.5	12.3	0.0084	20.0
60.00	23.0	23.0	17.0	0.0130	23.0	12.5	0.0059	18.5
240.00	23.5	19.5	13.6	0.0129	19.5	13.1	0.0030	14.8
480.00	23.5	18.0	12.1	0.0129	18.0	13.3	0.0022	13.2
1440.00	22.0	16.5	10.2	0.0132	16.5	13.6	0.0013	11.1
1680.00	22.5	15.5	9.3	0.0131	15.5	13.8	0.0012	10.2
1920.00	22.0	15.0	8.7	0.0132	15.0	13.8	0.0011	9.5
5760.00	22.0	13.5	7.2	0.0132	13.5	14.1	0.0007	7.9

Fractional Components

% SAND = 60.2
(% CLAY COLLOIDS = 9.2)

WYDOT GEOLOGY =



WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/96 MATERIALS TESTING LABORATORY h:\forms\solitSsur\t-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.		DATE	8/23	02	
PROJECT NUMBER	UN-PI- CONF (O, M, N)	SOURCE	1.00		
ENGINEER		FOR USE AS	VW	Research	

TEST RESULTS

F + H ² 0 =		0.D.	BULK
F + M + H ² 0 =	TARE PAN	F + H20 + 500 - F,M,H20	
MATERIAL + TARE =	9.	O,D	APPARENT
O.D. =		F + H*0 + O.D F,M,H*0	

1	FLASK	F+M	F + H*0
	183.3	683.3	683.0
	170.2	670.2	668.4
	184.8	684.8	682.6

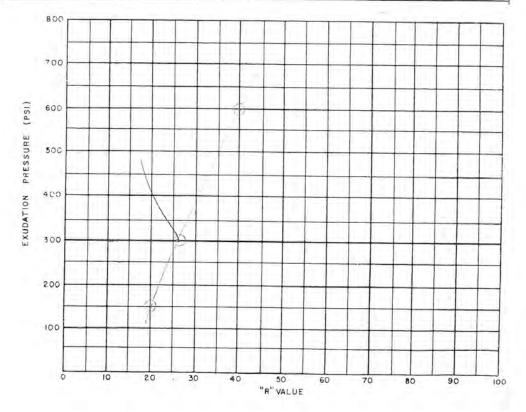
1			Moisture	@ S.S.E.	
		MOIST	JRE SAM	PLE FROM -4 S/G	
	TARE WEIGHT		-		
	WET WEIGHT			WT. OF MOISTURE	-
	- DRY WEIGHT			+ DRY WEIGHT	
	= WT. OF MOISTURE		•====	MOISTURE % @ S.S.D.	
	N	IOISTURE @) S.S.D +	5% FOR COMPACTION	
1		MOIS	STURE @	COMPACTION	
	MOISTURE SA	MPLE FRO	M EXCES	S MATERIAL AFTER CO	OMPAGTION
	TARE WEIGHT	_		Contract States	10.4
	WET WEIGHT	723.	0	WT, OF MOISTURE	67.6
	- DRY WEIGHT	655.	4	+ DRY WEIGHT	655.4
	= WT. OF MOISTURE	67,	6	MOIST, % @ COMPACTION	10.3
	MACHINE LOAD			PSI	
1	820	+ 4	7	205	MOLD
2	540	÷ 4	=	135	OILED D
3	607	÷ 4	÷	152	
AVG.			AVG.	164 PSI	
	APPARENT S/G	2.52	3	BULK S/G	2.292
	MOISTURE @ S.S.D	1		ABSORBTION %	4.080
MOIST	URE @ COMPACTION	10.3			
TES:30ml=2% moistu	ire				

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SOILS STABILOMETER WORK SHEET

ATLAS ROAD

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO				
MOLD NO	(Ort	新民	39	-				08-	25	8		
COMPACTOR AIR PRES-PSI	300	00	30		SOIL	CLASS 8	GROUP	INDE'X	P	ROJEC	T	
INITIAL MOIST - %												
WATER ADDED-ML	100	140	120	0.01	FIELD	IDENT			STA	TION		
WATER ADDED-%				1.31		NITIAL	MOISTU	RE	1"	_		
MOIST AT COMPACTION %	8.3	11.7	1.9	-	WET		DRY		3/4			
WET WEIGHT OF PAT-GMS	1161	1161	1094		DRY		TARE		3/8	n .		
HEIGHT OF PAT-INCHES	2.49	2.60	2.49		WATER		DRY		NO.	4		
DENSITY-LB.PER CU.FT.	130.5	15111	121,1		EXP.	ANSION	SPECIN	IEN	A	B	C	D
STAB, Ph AT 1000 LBS	26	49	33		DI	AL RE	ADING		6	15	92	
2000 LBS.	76	119	37		COVE	ER REQ	UIRED -	INCHES	-			
DISPLACEMENT	10.14	4,02	4.22		TIN NO.	REMA	RKS		-		T-115A	
"R" VALUE	40	1/20	26		1			12. 2	×		"R" VA	LUE
EXUDATION PRESS. PSI	600	150	300			PI-	-LONT	LO,M,	N)		20	9



		ials Tes	NT OF TRA sting Labora RANSMITT	tory	For REVIS
	Metric V English		Preli		QC/QA
Date Sampled	4-29-08			5-19-0	
Project Number	UWRESEAK				
	HUNTIPETOD			4	
	ATCAS PLT			y LARAMI	5
		Sample	Distribution		
C Solis	Aggregate		Concrete	Chemistry	Geology
	UW-PI-RAPI				
The second s	le, etc.) WIND RO		a state of the second se		
			to :		
Horizontal Limits			to :		_
Quantity Represented					
			Jse As : Type	and an of some	
Profile	BSE	Q P	MP Grd,	Conc. Coarse	Aggregate
Borrow	CB, Grd.		PMP	Conc. Med. A	ggregate
Topping	РМВ	D P	MWC, Type	Conc. Fine Ag	gregate
Alkali	СТВ.		CA, Type	Conc. Cylinde	rs
Check Curve	Filler		taint. Type	Conc. Beams	
Final Emb.	Drain Gravel		heck Design	Port. Cement,	Туре
other 50	RFACING			Туре	
	Geosynth	etics (C	Geogrid/Geot	textile)	
Product Name		N	Manufacturer		
Remarks: <u>AJ/HA</u> <u>SCREEWED G/</u> <u>2541.2</u> <u>1105.8</u> 2456.8	LT CONTENT RADATION, CON	BY	CHEM ICH KI UALUS	AL EXTRACT	-101 DE
			nitted By	1.0 4	
				1h Sam	

Form T-103B Rev. 9-06

2

ABODATODY	10 2			OF TEST O					~			English
LABORATORY SUBMITTED B	NO. C	11.	L' Z	- 4		DATE RE	C'D_	4-28-	08	5	_	
I.D. MARKS	0.	Har	17/110	FON	-	AI	U.	u.				-
SOURCE						_ DAIL OC	IL CIN	-D				-
QUANTITY RE	DDECENT	ED				DATE SA	WPLEL					-
FOR USE AS_	11 111	Por	enh	-1		LOCATIC	N					
FOR USE AS_	u.w	VED	care		FEOT DI	PROJEC				CO		
	1				ESIRE	ESULTS						
SIEVE SIZE PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING
MAX		312-8			-	1.2-2-1		18	LDU.	Ground	70	"2" Value
3" (75 mm)		1				11						RVALL
2" (50 mm)	-					1.	11	1				-
1 1/2 (3.75 mm			1	100.0	1111	11.00		1				
1" (25 mm)	1.4		1.7	98.3		1			-	1		
3/4" (19 mm)	2.7		2,5	95.8		11					-	i
1/2" (12.5 mm)	13.5	1	12.3	83.5		1		1	1.0			198
3/8" (9.50 mm)	8,5	1	7.7	75.8			1					290
#4 (4.75 mm)	28.5		26.0	49.6					-			602
#8 (2.36 mm)	54.2	126.3	20.2	29.6				1.1		1		1200
#16 (1.18 mm)	1000	79-9	10000		5 1			1			1	120
#30 (600 um)		\$2.9	8.4	8-5	1			1	1	· · · · · · · ·		
#50 (300 um)	Sec. 1	34.6	5.5	3.0		1		1				12
#100 (150 um)		12.6	2.0	1.0		1						·
#200 (75 um)	1000	3.9	0.4	0.4		1			1		10.01	
PAN	2.5	12.6	1			1	1					
	109.7		1000	1.00	1.			1				(4)
LIQUID LIMIT	-	Aspha	It in	Sample					10.00			
PLASTICITY INDE		,	17.		1							
SAND EQUIVALEN	т							1				
Tests T	ech Da	te RE	MARKS	UW-P	I-RA	PWITS	271		-			
Screen CS	13 5-1	9				1 10 0 0	1 - aller)				
LL - PI		E	KT. CH	IEM. (Sec	work	she	et ins	idy.			
Wash		0	RAD	. (Ser	work	she	et ins	ide			
	15 5-	20 0	CV =	n	ot e	evetur.	med	(Asp)	nalt	In sau	nole	1
Crush	_	- 10	RUVA	LVE =	79						-	
Crush Wash	-		-									
CR LL PI					_				_			_
LAR												

LABORATORY ENGINEER: DATE RECEIV SAMPLED ID: FOR USE:		HUNTINGTON LOCATION: LAF D: 5/19/2008 SOURCE: ATI			5/21/2008 LARAMIE ATLAS STOCKPILE JW RESEARCH 8 NO:				
(1) WT. OF OIL (2) TARE OF P (3) WT. OF OIL (7) WT. OF OIL	AN AND FILT ED SAMPLE . (3 - 6)	FER: : (1 - 2)	ILTER:	2541.2 1105.8 1435.4 84.4 GRAMS	(5) TARE O (6) WT. OF (8) % OIL: (THEO. OIL	F PAN AND FIL UNOILED SAM 7 / 3)*100	PLE: (4 - 5)	417)	2456.8 1105.8 1351.0 5.88
	WT. RET.	% RET.	% PAS	SSING	SPEC'S		ABSON EXTRA	CTION	
37.5mm(1 1/2")	1 1			1.		KINEMATIC V	ISCOSITY:		
				1			SCOSITY:		
25mm (1")		1		1		PENETRATIC			
		1		(
19mm (3/4")			10015			CHEMICAL:	METHODB O	VEN:	
12.6mm (1/2")	104.1	7:7	105-34				CALCULATIO	ONS	
9.5mm (3/8")	57.6	4.3	58.0						
4,75mm (#4)	325.4	24.1	45.9		-	-			
2.36mm (#8)	210.1	15.6	48.3		1				
1.18mm (#16)	157.7	11.8	34.5		_				
600µm (#30)	120.5	8.9	27.6	11.		1			
300µm (#50)	104.9	7,8	19.8		1.				
150µm (#100)	84.5	4.3	13.5						
75µm (#200)	56.3	4.2	9.3		1				
PAN	126.0				1				
25.2									
TOTAL	1		1	1					
	127.9	0.15				12			
RERUN: REMARKS:									
					TESTED BY	KMM			

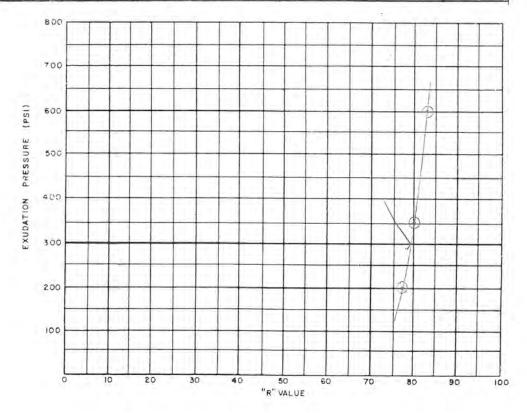
WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

SOILS STABILOMETER WORK SHEET

ATLAS ROAD

TEST SPECIMEN C D LL PL PI LAB. NO A 8 08- 258 MOLD NO. 26 37 44 COMPACTOR AIR PRES-PSI 577 350 350 SOIL CLASS & GROUP INDEX PROJECT INITIAL MOIST - % 70 90 70 WATER ADDED-ML FIELD IDENT. STATION ~ INITIAL MOISTURE 1" WATER ADDED-% 3/4" MOIST AT COMPACTION % 35 5.2 6.7 DRY WET 1078 1009 WET WEIGHT OF PAT-GMS DRY TARE 3/8" 1001 WT WT 2.45 2.46 HEIGHT OF PAT-INCHES 2.49 NO. 4 WATER DRY DENSITY-LB. PER CU. FT. 78.2 EXPANSION SPECIMEN Α The S в С D STAB. Ph AT 1000 LBS 9 12 7 DIAL READING COVER REQUIRED - INCHES 2000 LBS. 21 23 18 4.14 410 DISPLACEMENT TIN NO. REMARKS 4,20 T-115A 83 PI-RAPVI (J, E, L) "R" VALUE 20 78 "R" VALUE 79 350 100 EXUDATION PRESS. PSI 200



	Mater	RTMENT OF TRAN ials Testing Laborato	nry REVISED
TRANSPORTEN	Metric English	D Prelim	ninary D QC/QA
Project Number	HUNTING TOI	Date Received RCH Road Section	ับเป
	10-1/	Sample Distribution	
G Soils		and the second sec	Chemistry 🔲 Geology
Location (Belt, Stockpil	e, etc.) ROAD 50 7		
		For Use As :	
Profile	BSE	PMP Type	Conc. Coarse Aggregate
Borrow	CB, Grd.		Conc. Med. Aggregate
Topping	РМВ	PMWC, Type	Conc. Fine Aggregate
Alkali	СТВ	CCA, Type	Conc. Cylinders
Check Curve	Filler	Maint. Type	Conc. Beams
Final Emb.	Drain Gravel	Check Design	Port. Cement, Type
Other 50	DRFACING		Туре
	Geosynt	hetics (Geogrid/Geot	extile)
Product Name		Manufacturer	
Remarks: <u>ASPHR</u> <u>5CR EENED G</u> 2466.B 1018.6 2407.8	ACT CONSTENT RADATION: CO	T BY CHEM, KAN HESION VALUE	LEXTRACTION:
naterials/shared/torms/soli & su/t-12/	0.xs	Submitted By	B Soa

Form T-103B Rev. 9-05 English

3

LABORATORY N	10. 2	008.	- 02	58			C'D .	4-28-	05	2		L Metric
SUBMITTED BY	G.	Hur	tin	ston		AT	11.	W.				-
LD. MARKS		1.201	-	//		DATE SC	REEN	ED				
SOURCE												
QUANTITY REP	RESENT	ED										-
FOR USE AS	I.W	Res	earc	ch						CO.		5
	(1.00	1	EST RE	SULTS						
		1.1										
SIEVE SIZE PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET. %	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING
MAX		373-5	10	-		1.000	1	1 7		1		"R'late
3" (75 mm)								1.000				1 Dates
2" (50 mm)		L.				1		11 10 10				1
1 1/2 (3.75 mm)	1.000	1.	1.00	1605.65	-	1			100			
1" (25 mm)	05.8		0,8	99.2							-	
3/4" (19 mm)	1,05		1.0	98.2	-	1					-	1
1/2" (12.5 mm)	6.2		6.4	91.8	1	1						98
3/8" (9.50 mm)	5,1		5.3	86.5		1				-	-	162
#4 (4.75 mm)	22.7	/	23.6		1							444
#8 (2.36 mm)	60.2	75-6			-				1			1200
#16 (1.18 mm)		48.1	11.5		-			1				1200
#30 (600 um)	1.1	49.5	11-7	27.0	1	1.					_	
#50 (300 um)		68.9	11.40	15.4		1.						
#100 (150 um)		47.7	8.0	7.4	1	1		1				
#200 (75 um)		27.8		2.7	70.00				11			1
PAN	15.2	15.9	1								1	1
	96.4				1.1				-			(4)
LIQUID LIMIT	- 1	Asplialt	· Vis	Samole	1				5			1. (1)
PLASTICITY INDEX		N	31		1							
SAND EQUIVALENT			-		1				-			
Tests Te	ch Da	te RE	MARKS	11W-P	I - R	SAVI	1-	-				
Screen C5	11 5-2			1/18		-1-2010						
LL - PI	212	E	KT. C	HEM.	See	Wor	KS	heeti	insid	p		
Wash		G	RADE		See	work	< 5	heet 1	nsid	e.	-	
Gradation MA	5 5-2	2D CV	1		NOT	perfor	rme	d As	phal	tin	Sami	ole i
Crush	-				78							
Crush Wash	-	I	nplac	e Mois	ture			(J)			_	_
CRLLPI	-						9:1.	(K)				_
LAR						1.	7%	(L)				

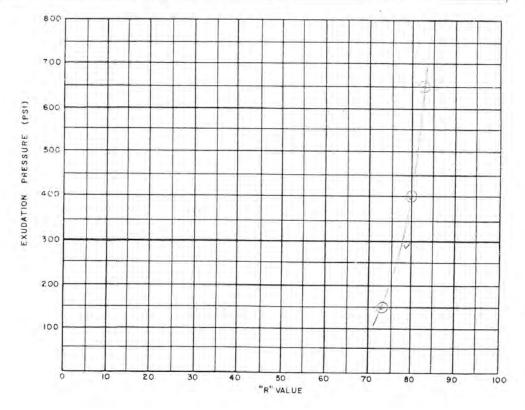
ENGINEER:	TE RECEIVED: 5/19/2008 MPLED ID: UW-PL-RSK R USE: RAP				DATE TEST LOCATION: SOURCE: PROJECT N SOILS & SU	LARAMIE ATLAS ROAD
2) TARE OF PA 3) WT. OF OIL 7) WT. OF OIL					(5) TARE O (6) WT. OF (8) % OIL: (THEO. OIL	
	WT. RET.	% RET.	% PA	SSING	SPEC'S	ABSON EXTRACTION
37.5mm(1 1/2")			1	12.00	1	KINEMATIC VISCOSITY:
		-				ABSOLUTE VISCOSITY:
25mm (1")						PENETRATION:
19mm (3/4")				-		CHEMICAL: METHODB OVEN:
12.6mm (1/2")	37.9	2.6	47.4			CALCULATIONS
9.5mm (3/8")	66.1	4.7	92.7		-	
4.75mm (#4)	255.2	18.4	74.3			
2.36mm (#8)	216.4	15.6	58.7			
1.18mm (#16)	179.4	12.9	45.8	1000		
600µm (#30)	150.9	10,9	34.9		1	
300µm (#50)	136.9	9.9	25.0			
150µm (#100)	102.1	7.4	17.6			
75µm (#200)	77.8	5.6	12.0	1.1		
PAN	166.6					
31.4	14		12.2710		1	
TOTAL						
	166.5	0.01			1.111	
RERUN: REMARKS:						
					TESTED B	Y: KMM

WYOMING DEPARTMENT OF TRANSPORTATION

UW RESEARCH

ATLAS ROAD

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO				
MOLD NO.	33	21	44	-				08-	255	3		
COMPACTOR AIR PRES-PSI	250	350	150		SOIL	CLASS 8	GROUP	INDEX	Ph	OJEC	т	
INITIAL MOIST - %	-								100			
WATER ADDED-ML	80	90	70		FIELD IDENT			STATION				
WATER ADDED-%			-		INITIAL MOISTURE		1"					
MOIST AT COMPACTION %	6.7	75	3.2	1.1	WET		DRY		3/4"			
WET WEIGHT OF PAT-GMS	1127	1135	141		DRY		TARE		3/8			
HEIGHT OF PAT-INCHES	2.34	3,51	i é - É		WT. WATER	- 11	WT. DRY		NO.	4		
DENSITY-LB.PER CU.FT	136.1	27.5	130.2	1.5		ANSION	SPECIN	AEN	Α	в	C	D
STAB. Ph AT 1000 LBS	19	21	9		D	AL REA	DING					
2000 LBS.	22	37	19		COV	ER REQ	JIRED -	INCHES	111			
DISPLACEMENT	3.98	3.10	3.6%		TIN NO.	REMAR	KS:				T-115A	
"R" VALUE	03	73	\$3			Di	05	(J.K.)	5		"R" VA	LUE
EXUDATION PRESS PSI	45.7	150	26.27		1	1-1	-123	Caroli	-)		7	8



		RTMENT OF TRAN als Testing Laborat PLE TRANSMITT	ory	Form T- REVISED B
TRANSPORTETION	Metric M English	Prelir Cons	minary 🖸 QC/QA	
Project Number Resident Engineer	4-29-08 UW-RESEAR HUNTING TON ATLAS PLT	Road Section	(AM)	Þ
C Soits		Sample Distribution	Chemistry 🔲 Geology	
Location (Belt, Stockpi Vertical Limits		2at: (Sta., kp., Mto :	TH #	ple Samples
Profile	🕞 BSE	For Use As :	Conc. Coarse Aggregate	
Borrow	CB, Grd		Conc. Med. Aggregate	
Topping	PMB	PMWC, Type	Conc. Fine Aggregate	
Alkali	СТВ	CCA, Type	Conc. Cylinders	
Check Curve	Filler	Maint Type	Conc: Beams	
Final Emb.	Drain Gravel	Check Design	Port. Cement, Type	2 8
Other 30	REACING		Туре	
	Geosynthe	etics (Geogrid/Geot	extile)	
Product Name		Manufacturer		
Remarks: WASH R-VALUE;	GRADATION; FRA CTURE	PL; LL; CO D FACES; HY	HESION VALUE PROMETER (GEB	606Y)
		Submitted By	BErons	

Form T-103B Rev. 9-06

			R	EPORT	OF TEST C	ON SUR	FACING N	ATERI	ALS				English
LABORATOR SUBMITTED	RYN	0. 2	008-	02	158		DATE RE	C'D	4-28-	08	3		Metric
SUBMITTED	BY	G.	Hun	tin	ston		AT	U.	W.				5
D. MARKS				~	/		DATE SC	REEN	ED				
SOURCE													
QUANTITY F	REPF	RESENT	ED				LOCATIO	N					
FOR USE AS	5 4	w	Res	ear	ch						CO.		
		(-			SULTS	-					
		5											1
SIEVE SIZ		RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASSING
MAX			360.9				Ciculto	~	10	LDJ.	GRAMS	70	10 Uster
3" (75 mm	1)					1000	1		1	-	-		1- mar
2" (50 mm	-	S	·				1.1		1				
1 1/2 (3.75 m	-		1		100.0	2 1 1						-	1
1" (25 mm		0.5		0.5	99.5					1			1
3/4" (19 mr		Ø.7		0.6	98.9	2.000	1		1.000		1	1	
1/2" (12.5 m	im)	1.6	(j	1.5	97.4	1						-	32
3/8" (9.50 m	im)	2.3		2.1	95.3	1							58
#4 (4.75 mr	m)	85.2		78.9	16.11		11						1004
#8 (2.36 mr	m)	17: 17.7	57.7	2.6	13.8		1.						1200
#16 (1.18 m	m)	2	51:5	2.3	11-5		1		1.1			-	1
#30 (600 ur	m)		45.6	2.1	9.4		1						
#50 (300 ur	m)		41-1	1.9	7.5								
#100 (150 u	m)		27.2	1.3	4.2								
#200 (75 ur	m)		34-8	1-6	4.6	1.1						1	
PAN		10-4	100.7	17			1						1
	_	108.0				1.2.		-		-		-	(4)
LIQUID LIM	П	29				1				6 . e			
PLASTICITY IN	DEX	14						-		1			
AND EQUIVAL	ENT												
Tests	Tec	h Da	te RE	MARKS	UW	1 - 1	P17	ON	T(J	KD	- C		
Screen	CS:	15 5-1	Fire .			1			2 4	7-1			
LL - PI		-	V	VASH	Grad	1	_					_	
Wash	MAS	_		PI :			-		_				
Gradation	MA	\$ 5-		<u>(v</u>	e	22	7 PSI	1 0					
Crush Crush Wash		-		KI	lalie =	68	(al	1 Ro	et)	1	6		-
CR LL PI	-	-	1	HACTU	meter =	2= 1	n Sutfi	CIENT	+ Mut.	to Pe	rtonm	+ = 3	<u>t.</u>
LAR	-	-		rivato	m1.+0/ =	0	ee u	Dork	= sheet	Ins	ide.		
SE	-	-		-									

WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/96 MATERIALS TESTING LABORATORY h:Vorms/solid/sur/T-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.	DATE 09/2/08
ROJECT NUMBER UN-PI VW (J.K.L)	SOURCE
ENGINEER	FOR USE AS UN Research

TEST RESULTS

F + H ² 0 =		0.D.	BULK
F + M + H ² 0 =	TARE PAN	F + H20 + 500 - F,M,H20	
MATERIAL + TARE =	g.	O.D	APPARENT
O.D. =		F + H40 + O.D F,M,H40	

1	FLASK	F+M	F + H20
1	183.3	683.3	683.0
2	170.2	670.2	668.4
3	184.8	684.8	682.6

1		Moisture	@ S.S.E.	
		MOISTURE SAME	PLE FROM 4 S/G	
	TARE WEIGHT			
	WET WEIGHT		WT. OF MOISTURE	
	- DRY WEIGHT		+ DRY WEIGHT	
	= WT. OF MOISTURE		MOISTURE % @ S.S.D.	
.1		MOISTURE @ S.S.D +	5% FOR COMPACTION	
1			COMPACTION	
	MOISTURE S		S MATERIAL AFTER C	OMPACTION
	TARE WEIGHT			
	WET WEIGHT	676.1	WT. OF MOISTURE	52.6
	· DRY WEIGHT	623.5	+ DRY WEIGHT	623.5
	= WT. OF MOISTURE	52.6	MOIST. % @ COMPACTION	8.4
	cutation at a tax		PSI	
	MACHINE LOAD	÷ 4 =	281	MOLD
1	485	+ 4 =	246	OILED T
2	610	÷ 4 =	153	
3 AVG.	907	AVG.	1.10-	
AVG.		400.	1 1 2 2	1
	APPARENT SIG	2.599	BULK S/G	2.378
	MOISTURE @ S.S.D	P	ABSORBTION %	
MOIST	TURE @ COMPACTION	8.4		
VOTES:30ml=2% moist	lre			
	TESTE	DBY		ENGINEER

	GRAI	N SIZE DISTRIBUTION TEST DATA
Project: U.W. Res	earch	Advances of all a second second second
Project Number:		Client: G. Huntington
		Sample Data
Source: UW-A1-CON	T-(J,K,L)	
Sample No.: 80290		
Elev. or Depth:		Sample Length (in./cm.):
Location:		
Description: Clay	ey sand	
		Mechanical Analysis Data
	Initial	
Dry sample and ta:	re= 1363.2	8
Tare	= 0.0	0
Dry sample weight		
Sample split on n	umber 10 si	eve
Split sample data		
		re = .00 Sample weight = 71.56
Cumulative weigh	ht retained	tare= .00
Tare for cumulati	ve weight r	etained= .00
Sieve	Cumul. Wt.	Percent
	retained	finer
3 inch	0.00	100.0
1.5 inch	0.00	100.0
.75 inch	0.00	100.0
.375 inch	0.00	100.0
# 4	3.48	99.7
# 10	181.42	86.7
# 20	14.54	69.1
# 40	27.08	53.9
# 100	38.23	40.4
# 200	44.52	32.8
		Hydrometer Analysis Data
Separation sieve		plete sample= 86.7
Weight of hydrome		
Hygroscopic moist		
Moist weight &		
Dry weight & ta		
Tare	= 104	
Hygroscopic moi		
Calculated biased		
Automatic tempera		
Composite corre	ction at 20	deg C = -6.7
Meniscus correcti	on only= 0	
Specific gravity		2.678
	correction	factor= 0.994
Specific gravity		101012 N.C.S.
	owned that it is	
Hydrometer type:	h L= 16.294	$1964 - 0.164 \times Rm$
	h L= 16.294	1964 - 0.164 x Rm
Hydrometer type:	h L= 16.294	1964 - 0.164 x Rm

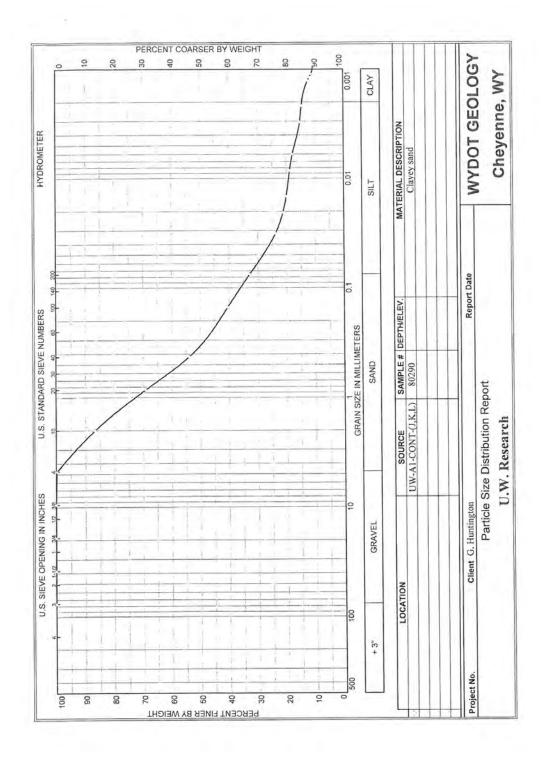
Elapsed time, min	Temp, deg C	Actual reading	Corrected	K	Rm	Eff. depth	Diameter mm	Percent
2.00	24.0	25.5	19.8	0.0129	25.5	12.1	0.0317	23.8
5.00	23.5	23.5	17.6	0.0130	23.5	12.4	0.0205	21.2
10.00	23.5	22.5	16.6	0.0130	22.5	12.6	0.0146	20.0
30.00	23.5	21.5	15.6	0.0130	21.5	12.8	0.0085	18,8
60.00	24.0	20.5	14.8	0.0129	20.5	12.9	0.0060	17.8
240.00	23.5	18.5	12.6	0.0130	18.5	13.3	0.0030	15.2
480.00	23.5	18.0	12.1	0.0130	18.0	13.3	0.0022	14.6
1440.00	22.5	16.5	10.3	0.0131	16.5	13.6	0.0013	12.4
1680.00	22.5	16.0	9.8	0.0131	16.0	13.7	0,0012	11.8
1935.00	22.5	15.5	9.3	0.0131	15.5	13.8	0.0011	11.2
2880.00	22.5	15.0	8.8	0.0131	15.0	13.8	0.0009	10.6

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 % + 3" = 0.0 % GRAVEL = 0.3 % SAND = 66.9 % SILT = 18.4 % CLAY = 14.4 (% CLAY COLLOIDS = 10.7)

D₈₅= 1.82 D₆₀= 0.57 D₅₀= 0.34 D₃₀= 0.06 D₁₅= 0.00

WYDOT GEOLOGY

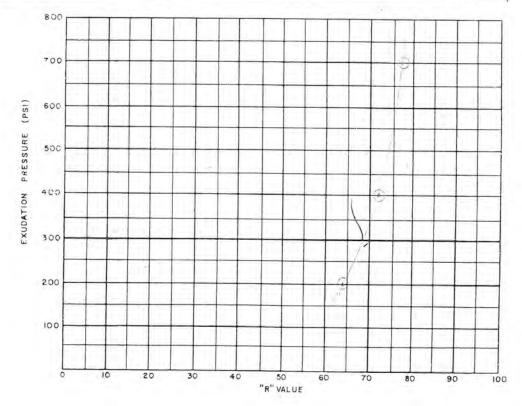


WYOMING DEPARTMENT OF TRANSPORTATION

SPORTATION RESEARCH

ATLAS	KOND

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO				
MOLD NO	22	44	612	10.00				08-	2.5	3		
COMPACTOR AIR PRES-PSI	350	350	350	1	SOIL	CLASS 8	GROUP	INDEX	P	OJEC	T	
INITIAL MOIST - %	-											
WATER ADDED-ML	100	120	140		FIELD IDENT. STATION							
WATER ADDED-%					INITIAL MOISTURE			m ×				
MOIST AT COMPACTION %	2.3	24	1.7		WET DRY		3/4"					
WET WEIGHT OF PAT-GMS	1105	1126	1178		DRY		TARE		3/8		-	-
HEIGHT OF PAT-INCHES	2.45	2.48	2.47		WATER		DRY	120	NO.	4		1
DENSITY-LB.PER CU.FT.	126.2	124.1	29.4		EXP	ANSION	SPECIN	IEN	A	В	C.	D
STAB. Ph AT 1000 LBS	7	٩	13		D	AL RE	ADING		1	2	7	
2000 L BS.	18	15	30		cov	ER REQ	UIRED -	INCHES	FD	Fa	FO	
DISPLACEMENT	6.63	5-14	3.82	-	TIN NO.	REMA	RKS!				T-115A	
"R" VALUE	77	72	24			D1./	auri	F.K. L)			"R" VA	LUE
EXUDATION PRESS, PSI	700	400	100	1		FILL	Succ	2, -, -)			6	8



W NOR	Mater	RTMENT OF TRAN rials Testing Laborate	ory	Form T REVISED
Талартопатан	Metric English	🍎 Prelim		C/QA
		Lab # Date Received		0
Resident Engineer	HUNTINGTON			
Pit or Source 7	0.01	100 M	DEHNSON	
		Sample Distribution	- Sennoon	
C Soils	Aggregate	Concrete C C	hemistry 🔲 Ge	ology
Location (Belt, Stockpile, Vertical Limits Horizontal Limits	etc.) <u>StockPil</u>	<u>B-A</u> s#at: (Sta., kp., M.) to:to:to:	P., etc.) 30-00	Multiple Samples
Quantity Represented				
		For Use As :		
Profile	BSE	PMP Type Grd	Conc. Coarse Age	gregate
Borrow	CB, Grd		Conc. Med. Aggre	gate
Topping	рмв	PMWC, Type	Conc. Fine Aggre	gate
Alkali	СТВ	ССА, Туре	Conc. Cylinders	
Check Curve	Filler	Maint Type	Conc. Beams	
Final Emb.	Drain Gravel	Check Design	Port. Cement, Typ	e
Other	rfacing	and the second second	Туре	
	Geosynth	netics (Geogrid/Geote	xtile)	
Product Name		Manufacturer		
Remarks: Asphu Screened Virgin Aygrey	gradutio	by chemical e by cohesion va Blend	1 10 11	e
materiaişisinatedilormistsoli & suril-120.vks		Submitted By	ott Koch	Reorger # FR-6042

	it office berrathingit	or manufor on remon		FORT 1=
	MATERIALS LA	BORATORY		Rev B-C
	REPORT OF TEST ON SU	REACING MATERIALS		En En
LABORATOPY NO	08 1020	DATE REC'D		🗆 Me
SUBMITTED BY Huntin	gton	TA		
1.D MARKS UW- Resum	ch - VW.S-RVB-A	DATE SCREENED 10-25		
SOURCE COMES H P.	+ (Stockpied)	DATE SAMPLED 7-14		
QUANTITY REPRESENTE	D ISK	LOCATION		
FOR USE AS Surface	4	PROJECT	00	
	TEST F	RESULTS		

					LOIN							
ZE G	RET. WT. L'BS.	RET. WT. GRAMS	RET	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LES.	RET. WT. GRAMS	RET %	PAS
X		334.9					-			RUlalue	2.671	1.0
ר)				1.5. 11								
nj -	1.1				1.							1
nm)	6.2		0.5	99.5	1	1					A	
1)	1.0		2.5	97.0					1.71			
TI)	2.1		5,2	91,5					1.11			
(חור	6.1		15.2	76.6					0.121	280		
im)	34		8.5	68.1						382		
т)	7.9		19.7	43.4	1.1					1	1	
п)	19.1	36-1	12.4	36-5	10 m (
m)		87-9	12-7	23-3								
m)		74.7	10.8	12.5								
m)	120.00	\$3.3	ד- ר	4.8	12							
im)		21.1	3.0	1-8								
חד)		7.3	1-1	0.7	1.201	1	1					
	4.1	4.1							1.1			
	40.1								100	(4)		
т	-									(//		
DEX.												
ENT												
-	h Dat	REN	ARKS	1111 - 4	- Pil	10 10						
Ċm		8	1.1.1	<u> </u>	J- KV	6 M					-	-
11.5		C	hem.	EX+ V	/							-
MAS	10.43	18 "K	2" 1/1	lue =	78				_			
1	1		- 44									
-		_					_					
	-											
1000	- 11	_					_					
	3 X X 1) 1) 1) 1) 1) 1) 1) 11 11 11	ZE WT. G LIBS. X	ZE WT. WT. G LES. GRAMS X 334.9 n) <	ZE WT. WT. RET G LES. GRAMS % X 334.9 n) x n) n) n) n) n) n) n)<	RET. RET. RET. WT. RET PASSING 334.9 334.9 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1) 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1) 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1) 1 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1) 1 1 1 1 1 1 1) 1 1 1 1 1 1 1) 1 </td <td>RET. RET. RET. RET. PASSING RET. $GRAMS$ $WT.$ RET $WT.$ LES. $WT.$ LES. X 334.9 $V.$ $W.$ LES. $WT.$ LES. X 334.9 $V.$ $V.$ LES. $WT.$ LES. X 334.9 $V.$ $V.$ $WT.$ LES. X 334.9 $V.$ $V.$ LES. X 334.9 $V.$ $V.$ LES. $Y.$ $V.$ $V.$ $V.$ $V.$ $Y.$ $V.$ $V.$<td>ZE WT. WT. RET PASSING WT. WT. WT. G LES. GRAMS % % LES. GRAMS X 334.9 </td><td>RET. RET. WT. RET. PASSING WT. WT. WT. RET. GRAMS $%$ $%$ $%$ $%$ $WT.$ WT. WT. RET. N. 334.9 $%$ $%$ $%$ K $GRAMS$ $%$ X 334.9 $%$ $%$ K $GRAMS$ $%$ X 334.9 $%$ $%$ $%$ $%$ K N (10.0) (2.5) 97.0 (10.0) (2.5) 97.0 (10.0) (10.0)</td><td>RET. RET. WT. RET. PASSING WT. RET. RET. RET. RET. WT. RET. PASSING 334.9 334.9 </td><td>RET. RET. RET. PASSING RET. WT. RET. WT. RET. WT. RET. WT. RET. WT. RET. WT. RET. LES. GRAMS % MT. LES. MT. LES. GRAMS % MT. LES. MT. MT. LES. MT. LES. MT. MT.</td><td>RET. RET. RET. RET. RET. RET. RET. RET. WT. WT. RET. WT. Les. GRAMS % Z <thz< th=""> <thz< th=""> <thz< th=""></thz<></thz<></thz<></td><td>RET. RET. RET. RET. RET. RET. RET. RET. RET. WT. WT. RET. WT. WT. RET. WT. WT. RET. WT. WT. RET. WT. RET. WT. RET. WT. RET. WT. WT. RET. WT. WT. RET. WT. WT. WT. WT. WT. WT. RET. WT. WT.</td></td>	RET. RET. RET. RET. PASSING RET. $GRAMS$ $WT.$ RET $WT.$ LES. $WT.$ LES. X 334.9 $V.$ $W.$ LES. $WT.$ LES. X 334.9 $V.$ $V.$ LES. $WT.$ LES. X 334.9 $V.$ $V.$ $WT.$ LES. X 334.9 $V.$ $V.$ LES. X 334.9 $V.$ $V.$ LES. $Y.$ $V.$ $V.$ $V.$ $V.$ $Y.$ $V.$ $V.$ <td>ZE WT. WT. RET PASSING WT. WT. WT. G LES. GRAMS % % LES. GRAMS X 334.9 </td> <td>RET. RET. WT. RET. PASSING WT. WT. WT. RET. GRAMS $%$ $%$ $%$ $%$ $WT.$ WT. WT. RET. N. 334.9 $%$ $%$ $%$ K $GRAMS$ $%$ X 334.9 $%$ $%$ K $GRAMS$ $%$ X 334.9 $%$ $%$ $%$ $%$ K N (10.0) (2.5) 97.0 (10.0) (2.5) 97.0 (10.0) (10.0)</td> <td>RET. RET. WT. RET. PASSING WT. RET. RET. RET. RET. WT. RET. PASSING 334.9 334.9 </td> <td>RET. RET. RET. PASSING RET. WT. RET. WT. RET. WT. RET. WT. RET. WT. RET. WT. RET. LES. GRAMS % MT. LES. MT. LES. GRAMS % MT. LES. MT. MT. LES. MT. LES. MT. MT.</td> <td>RET. RET. RET. RET. RET. RET. RET. RET. WT. WT. RET. WT. Les. GRAMS % Z <thz< th=""> <thz< th=""> <thz< th=""></thz<></thz<></thz<></td> <td>RET. RET. RET. RET. RET. RET. RET. RET. RET. WT. WT. RET. WT. WT. RET. WT. WT. RET. WT. WT. RET. WT. RET. WT. RET. WT. RET. WT. WT. RET. WT. WT. RET. WT. WT. WT. WT. WT. WT. RET. WT. WT.</td>	ZE WT. WT. RET PASSING WT. WT. WT. G LES. GRAMS % % LES. GRAMS X 334.9	RET. RET. WT. RET. PASSING WT. WT. WT. RET. GRAMS $%$ $%$ $%$ $%$ $WT.$ WT. WT. RET. N. 334.9 $%$ $%$ $%$ K $GRAMS$ $%$ X 334.9 $%$ $%$ K $GRAMS$ $%$ X 334.9 $%$ $%$ $%$ $%$ K N (10.0) (2.5) 97.0 (10.0) (2.5) 97.0 (10.0)	RET. RET. WT. RET. PASSING WT. RET. RET. RET. RET. WT. RET. PASSING 334.9 334.9	RET. RET. RET. PASSING RET. WT. RET. WT. RET. WT. RET. WT. RET. WT. RET. WT. RET. LES. GRAMS % MT. LES. MT. LES. GRAMS % MT. LES. MT. MT. LES. MT. LES. MT. MT.	RET. RET. RET. RET. RET. RET. RET. RET. WT. WT. RET. WT. Les. GRAMS % Z <thz< th=""> <thz< th=""> <thz< th=""></thz<></thz<></thz<>	RET. RET. RET. RET. RET. RET. RET. RET. RET. WT. WT. RET. WT. WT. RET. WT. WT. RET. WT. WT. RET. WT. RET. WT. RET. WT. RET. WT. WT. RET. WT. WT. RET. WT. WT. WT. WT. WT. WT. RET. WT. WT.

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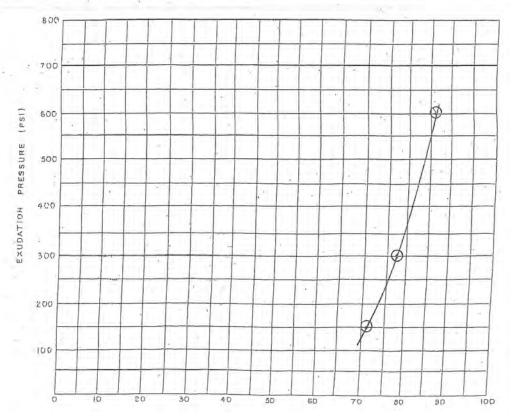
Forn 1-

UW Research

Form T-115 Rev. 5/91

WYOMING DEPARTMENT OF TRANSPORTATION

TEST SPECIMEN	A	Ð	G	D	LL	PL	PI	LAB, N	Ű.			
MOLD NO.	54	DA	2014					08-	1020	2		
COMPACTOR AIR PRES-PSI	350	350	350		SOIL	CLASS B	GROUP	NDEX	P	ROJEC	T	
INITIAL MOIST - %	-					- 4						
WATER ADDED-ML	00	100	90	-	FIELD	DENT			STAT	LION		
WATER ADDED-%	-					INITIAL	MOISTL	JRE	1 ⁱⁿ			
MOIST AT COMPACTION %	6.7	8.3	7.5		WET	320.0	DRY		3/4"			
WET WEIGHT OF PAT-GMS	1145	1190	1192		DRY	1	TARE	80,0	3/8			
HEIGHT OF PAT-INCHES	2,47	2.35	2.42	1.11	WT. WATER		WT. DRY		ND	1		
DENSITY-LE.PER GU.FT.	131.6	191.7	138.8		EXF	PANSION	SPECI	MEN	А	Ð	C	C
STAB. Ph AT 1000 LBS	7	10	9	1	L	MAL, REA	DING	100		11		
2000 LBS.	12	22	18	1 1 1	COV	ER REOL	JIRED -	INCHES				
DISPLACEMENT	5.22	5.51	5.58		TIN NO.	REMAR	K'S :				T-115A	2
"R" VALUE	26	14/71	75			UL	J-5-	RUB-A			"R" VA	LUE
EXUDATION PRESS. PSI	600	150	300								78	



LABORATOR		08-00170 HUNTINGTO	DN	_	DATE TEST		11/5/2008 UW	
DATE RECEIV		11/4/2008			SOURCE:		TXT PIT I-90 UW-RESEAR	
SAMPLED ID: FOR USE:		UW-S-RVB-	A		PROJECT			
TON USE.		har			_ SUILS & SI	SOILS & SURFACING LAB NO: 08-		
(1) WT. OF OIL (2) TARE OF P (3) WT. OF OIL (7) WT. OF OIL	AN AND FIL LED SAMPLE . (3 - 6)	TER:		1117.6 1200.2 24.0	(5) TARE O (6) WT. OF (8) % OIL: (THEO. OIL	F PAN AND F UNOILED SA	ND FILTER: 2293.8 1117.6 1175. <u>5</u> 1176.2 2.00	
_	-	TER AID:			1	-		
	WT. RET.	% RET.	% PA	SSING	SPEC'S	in the second	ABSON EXT	
37.5mm(1 1/2*)				-		1	VISCOSITY:	
25mm (1*)				1	-	PENETRAT	VISCOSITY:	
				1	1	- CHETRAL	-	
19mm (3/4")		1	100.0			CHEMICAL	METHODB	OVEN:
12.6mm (1/2")	192,3	163	R3.7				CALCUL	ATIONS
	95.2		541		-	-		
9.5mm (3/8*)	2.2	3.1	75.6		-			
4.75mm (#4)	21916	18.7	54.9	V		1		
2.36mm (#8)	119,5	10.2	46.7	D		1		
1.18mm (#16)	1414/4	12.0	34.7	h]		
800µm (#30)	119.2	10.12	24.6					
300µm (#50)	96.5	8.2	16.4	-				
150µm (#100)	71.5	6-1	10.3		1000			
75µm (#200)	3615	3,1	7.2					
PAN	8215 541					-		
TOTAL	-			·				
		I i						
RERUN: REMARKS:								
					TESTED BY	: KMM		

A V	Mater	RTMENT OF TRAI rials Testing Laborat IPLE TRANSMITT	ory Revised
TRANSPORTETION	Metric English	- and	truction
Date Sampled Project Number Resident Engineer Pit or Source	HUNTINGTON	at :	
		Sample Distribution	
Soils	Aggregate	Concrete	Chemistry 🛄 Geology
Location (Belt, Stockpile Vertical Limits	etc.) STOUKPIL		I.P., etc.) JO CO. YARD
		For Use As :	
Profile	BSE	PMP, Type Grd	Conc. Coarse Aggregate
Borrow	CB, Grd	RPMP	Conc. Med. Aggregate
Topping		PMWC, Type	Conc. Fine Aggregate
🗋 Alkali	СТВ	CCA, Type	Conc. Cylinders
Check Curve	Filler	Maint. Type	Conc. Beams
Gener S	Drain Gravel	Check Design	Port. Cement, Type
	1		
	Geosynt	hetics (Geogrid/Geot	textile)
Product Name		Manufacturer	
Remarks: Asphi Screen Virgin Ayge	ed grudatio	by chemical bin; cohesian v Blend	
		Submitted By	Scott Kectt

× '	Mater	RTMENT OF TRAI	огу	Form T- REVISED (
TRANSPORTETION	Metric Metric English	Const	ninary 🔲 QC truction	/QA
Date Sampled Project Number		Lab # Date Received	-	_
Resident Engineer	1112 10 40 10			
Pit or Source	TXT PIT 1:	I-90 County	JOHNSON	
201		Sample Distribution		
Soils	Aggregate	Concrete	Chemistry 🔲 Geol	ogy
Location (Belt, Stockpile	e, etc.) Stucke	<u>S-B</u> S# <u>ILE</u> at: (Sta., kp., M to : to :	.P., etc.)	
		For Use As :		
Profile	BSE	PMP, Type	Conc. Coarse Aggre	egate
Borrow	CB, Grd.		Conc. Med. Aggrega	ate
Topping	РМВ	PMWC, Type	Conc. Fine Aggrega	te
Alkali	СТВ	CCA, Type	Conc. Cylinders	
Check Curve	Filler	Maint. Type	Conc. Beams	
Final Emb.	Drain Gravel	Check Design	Port Cement, Type	
Other 5	URFACING		Туре	
	Geosynth	netics (Geogrid/Geot	oxtilo)	
Product Name	Geosynti	Manufacturer	extile)	
Froduct Name _				
Remarks: <u>Aspid</u> Screeven		BY CHEMICA : CONFISION UN		U LUE
VIRGIN A	SURECATE / 6	RAP BLEND		
		Submitted By	Scott Koitt	2

	MATERIALS LA REPORT OF TEST ON SL	BORATORY		Rev B-C
LABORATORY NO.	08 1020	DATE REC'D		Пие
SUBMITTED BY Hunting	nton	T		
1.D MARKS UW- Reserve	ch - UW-S-RUB-B	DATE SCREENED 10-28		
SOURCE CAPIS H.P.	+ (Stockalte)	DATE SAMPLED 7- 14		
QUANTITY REPRESENTED	D Isk	LOCATION		
FOR USE AS Surfacing	1	PROJECT	co	
	TEST	RESULTS		

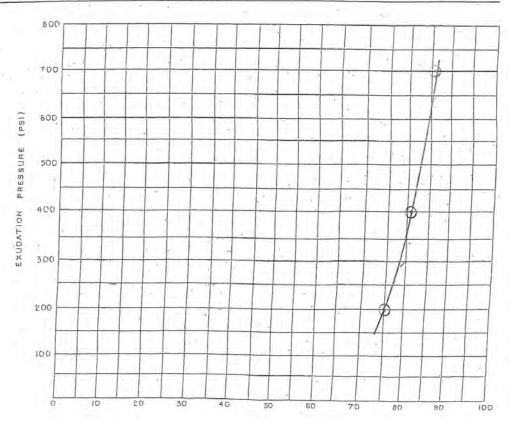
		-				Large C 7 11				-			
SIEVE SU PASSING		RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET.	PASSING	RET. WT. LES.	RET. WT. GRAMS	RET	PAS
MA	Х		422 - 4								Elalue		
3" (75 mm	n)			1	1			1-0					
2" (50 mm	n)		1										1
1 1/2 (3.75 r	nm)	1.1			100.0								
1" (25 mm	1)	0.5		1.5	98.5								
3/4" (19 mi	(11	1.1		4.1	94.4			1					Ì
1/2" (12.5 m		4.8		14.2	\$0.2			·		1	238	1.24	
3/8" (9.50 m		2.9		8.6	71.6			1	1	1.1	342		
#4 (4.75 m	m)	77		22.7	48.9	1.			1		614	12.17	
#8 (2.36 mr	m)	16:36.6	178.7	20.7	28-2		1	Sec. 1	1		1200	1	
#16 (1.18 m			122-9	14-2	14.0			-			100		
#30 (600 ur	m)	1	42.4	7-2	6.8								
#50 (300 u	m)		28.9	3.3	3.5	1	· · · · · · · · · · · · · · · · · · ·						
#100 (150 u	(m)		13.5	1-6	1-9					1.1.1			
#200 (75 ur			3.3	0.4	1-5		1					-	
PAN		12.7	13.2									1	
		33.9	2 13.2								(4)		1
LIQUID LIM	т										(1)		-
PLASTICITY IN													
SAND EQUIVAL													
Tests	Tec	h Da	PEN	ANDER	Tint &	DIR	107				_		
	Cm	10-2		MARINA -	111-5-	- RVD	-(D)						-
LL - PI		10-2	P n	6.0.00	EVA	~							-
Wash				2" 1/2	EXT.	79							-
Gradation	-	-		ya									-
Crush	1		11										
Crush Wash			-										-
CR LL PI													-
LAR													-

3

Forn T-

WYOMING DEPARTMENT OF TRANSPORTATION

TEST SPECIMEN	. Þ.	0	G	b	LL	PL	PI	LAB. N	0.			
MOLD NO.	114	12A	3A					08	1020	C		
COMPACTOR AIR PRES-PSI	350	350	350		BOIL	CLASS B	GROUP	INDEX	P	CONEC	T	
INITIAL MOIST - %	-											
WATER ADDED-ML	80	60	70		FIELD	IDENT:			STAT	TON		_
WATER ADDED-%						INITIAL	HOIS T L	IRE	1"			
MOIST AT COMPACTION %	6.7	4.9	5.9		WET	320.0	DRY		3/4"	-		
WET WEIGHT OF PAT-GM5	1162	1153	1177		DRY		TARE	80,0	3/8			_
HEIGHT OF PAT-INGHES	2.40	2.48	2.47	-	WI. WATER		WT. DRY		ND.	1		_
DENSITY-LE.PER CU.FT.	137.5	134.3	136.5		EXF	ANSION	SPECIA	AEN	A	В	C	D
STAR. Ph AT 1000 LBS	11	7	9		U	IAL, REA	DING					
2000 LBS.	23	12	17		COV	ER REOL	IRED -	INCHES				
DISPLACEMENT	4.93	5.17	5.04		TIN NO.	REMAR	KS!				T-115A	
'R" VALUE	75	96	81	. I		uw-	5- 12	UB-B			"R" VA	LUE
EXUDATION PRESS. PSI	300	700	400		1						79	



LABORATORY ENGINEER: DATE RECEIVE SAMPLED ID: FOR USE:		08-00171 HUNTINGTO 11/4/2008 UW-S-RVB- RAP			DATE TEST LOCATION: SOURCE: PROJECT N SOILS & SU	UW TXT PIT I-90
1) WT. OF OILED SAMPLE, PAN AND FILTER: 2) TARE OF PAN AND FILTER: 3) WT. OF OILED SAMPLE: (1 - 2) 7) WT. OF OIL (3 - 6) NOTE: WHEN DOING A VACUUM EXTRACTION. ADD FOR FILTER AID.				1114.4 1200.4 28.8	(5) TARE O (6) WT. OF (8) % OIL: (THEO. OIL	UNOILED SAMPLE, PAN, AND FILTER: 2286 F PAN AND FILTER: 1114.4 UNOILED SAMPLE: (4 - 5) 170 7 1171.6 7 / 3)*100 2.40 CONTENT: GG. AFTER WASH: 1000 0
	WT. BET.	% RET.	% PA	SSING	SPEC'S	ABSON EXTRACTION
37.5mm(1 1/2")		1 million	1.1.1		1	KINEMATIC VISCOSITY:
		_		1		ABSOLUTE VISCOSITY:
25mm (1")			70 0		-	PENETRATION:
19mm (3/4")	20.7	<u>4×</u>	. é c.	1		CHEMICAL: METHODB OVEN:
12.6mm (1/2*)	265,0	7.6	28.8			CALCULATIONS
9.5mm (3/8")	86.3	7.1	73.3			
4.75mm (#4)	201.8	18.4	15.9	-		-
2.36mm (#8)	93,2	8.5	17.9			
1.18mm (#16)	105	2.1	351			
600µm (#30)	11019	9,5	29,0	i		
300µm (#50)	116.5	10.0	12.0	11		
150µm (#100)	84.5	2.2	11.2	11		
75µm (#200)	5319	4.6	7.2			
PAN (9)	5316 F9.8.	0.1	-			
TOTAL						
RERUN: REMARKS:		1			1	1
					TESTED B	Y: KMM

Non Y	Mater	RTMENT OF TRAN rials Testing Laborate IPLE TRANSMITTA	ory REVISED
	Metric.	Prelim	ninary 🔲 QC/QA truction
Date Sampled Project Number Resident Engineer Pit or Source	HUNTINGTON	Date Received <u>COH</u> Road Section)at :	
Solls	Aggregate	Sample Distribution	Chemistry 🔲 Geology
Location (Belt, Stockpile	etc.) Stockp		TH #Of
		For Use As :	
Profile	BSE	PMP. Type	Conc. Coarse Aggregate
Borrow	CB, Grd.		Conc. Med. Aggregate
Topping	рмв	PMWG, Type	Conc. Fine Aggregate
Alkali	СТВ	CCA, Type	Conc. Cylinders
Check Curve	Filler	Maint. Type	Conc. Beams
Final Emb.	Drain Gravel	Check Design	Port. Cement, Type
other 5	URFACING		Туре
	Geosynt	hetics (Geogrid/Geot	extile)
Product Name		Manufacturer	5
SCREEVED	G. BADATION	BY CHEMICA CONTESION DA	2314.E 1114.4

		ials Testing Laborat		
Тамерентала	Metric		truction	QC/QA
Project Number	UW- RESEAR HUNTINGTON	Date Received	and the second se	
Pit or Source	TXT PAT /	E-90 County	JOHNSC .	~
		Sample Distribution		
Soils	Aggregate	Concrete	Chemistry	Geology
Location (Belt, Stockpile	e, etc.) <u>STOCIA</u>	<u>IB-C</u> s# <u>PiLE</u> at: (Sta., kp., M to: to:	.P., etc.)	
Quantity Represented				
		For Use As :		
Profile	BSE	PMP: Type Grd.	Conc. Coars	se Aggregate
Borrow	CB, Grd.		Conc. Med.	Aggregate
Topping	PMB	PMWC, Type	Conc. Fine	Aggregate
Alkali	СТВ	CCA, Type	Conc. Cyline	ters
Check Curve	Filler	Maint. Type	Conc. Beam	5
Final Emb.	Drain Gravel	Check Design	Port. Cerner	nt, Type
Other 5	DRFACING		Туре	
	Consumt	natice (Geogrid/Cost	ovtilo)	
Droduct Name		netics (Geogrid/Geot Manufacturer	extile)	
Product Name				
Remarks: ASPHA SCREENED		T BY CHE I, COHESION		- VALUE
	N/-			
VIDENIN A	GUREGATE/	RAP BLEN	10	
VIGAN	MUREWILE	DAL PLOA		

LABORATORY NO ______ G3 1020 ____ DATE REC'D___ SUBMITTED BY Huntington 1.D MARKS UW-Research - UW-S-RVB-C SOURCE Cross HPit (Stackpiled) DATE SAMPLED 7-14 QUANTITY REPRESENTED /3K

FOR USE AS Surfacing

PROJECT TEST RESULTS

AT____

DATE SCREENED 10-2%

LOCATION

	1				COTIN	LUDEID			-			
SIEVE SIZE PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET	PASSING	RET. WT. LBS.	RET. WT GRAMS	RET	PASSING	RET. WT. LBS.	RET. WT. GRAMS	RET %	PASS
MAX		351-2								Elalue		
3" (75 mm)		1		1.11	1	1.			-			
2" (50 mm)				100.0								
1 1/2 (3.75 mm)	6.2		0.6	99.4								
1" (25 mm)	1.0		2.9	96.5		-		1	1.1.1			
3/4" (19 mm)	2.0	1 1.7	5.7	90.8								
1/2" (12.5 mm)	5.6		16.1	74.7			1			304		
3/8" (9.50 mm)	3.0		8.6	66.1		1.				408		
#4 (4.75 mm)	6.5		18.7	47.4				1.1.1.1		632		
#8 (2.36 mm)	16.3	105.8	14.3	33-1			1			1200		
#16 (1.18 mm)		90.4	12.2	20.9						1000		
#30 (600 um)		73.1	9.9	11.0	1.00						1.11	2
#50 (300 um)		48-4	6.5	4-5			1			1		
#100 (150 um)		20.2	2.7	1.8								
#200 (75 um)		7.6	1.0	6.8			I	1	1000			
PAN	5.4	5.7							1.1			-
	34.8								1.1	(4)		12.77
LIQUID LIMIT					1							
PLASTICITY INDEX	-											
AND EQUIVALENT												
Tests Te	ch Dat	REN	ARKS	IN.S	- 01	POS		-				
Screen Cm	10-2	8	-	110-2	RV	a <u>c</u>						-
LL - PI		PI PI	honi.	EXT.	/							-
Wash MA	5 10-2		"VA	lue =	80							-
Gradation	1											
Crush							-					
Crush Wash												-
CP. LL PI												_
LAR												

5

Form T+

Rev H-C

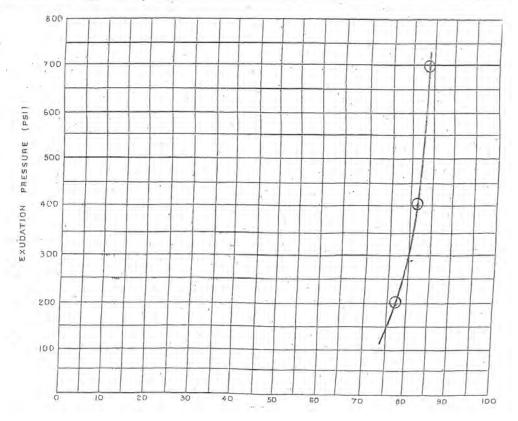
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CO_

Form T-115 Rav. 6/91

WYOMING DEPARTMENT OF TRANSPORTATION

TEST SPECIMEN	A	Ð	G	D	LL	PL	PI	LAB. N	0.			
MOLD NO.	614	1164	1514	1				08	1	060		
COMPACTOR AIR PRES-PSI	350	350	350		SOIL CLASS & GROUP INDEX				PROJECT			
INITIAL MOIST %												
WATER ADDED-ML	80	60	70		FIELD	IDENT.			STATION			
WATER ADDED-%					INITIAL MOISTURE					("		
NOIST AT COMPACTION %	6.7	4.9	5.8		WET	WET 320.0 DRY		3/4 ⁸				
WET WEIGHT OF PAT-GMS	1189	1136	1178		DRY TARE 80,0				8/8"			
HEIGHT OF PAT-INCHES			2.45	- 1	WT. WT. WATER DRY					ND, 1		
DENSITY-LB. PER CU. FT.	139.5	129.0	137.7		EXPANSION SPECIMEN				A	В	C	þ
STAB, Ph AT 1000 LBS	9	7	8		D	IAL, REA	DING					
2000 LBS.	18	13	15		COVER REQUIRED - INCHES					1	-	
DISPLACEMENT	5.47	5.27	5.33		TIN NO. REMARKS:					-	T-115A	-
R" VALUE	72	84	22								"R" VA	LUE
EXUDATION PRESS. PSI	200	700	400								20	



LABORATORY ENGINEER: DATE RECEIVI		08-00172 HUNTINGTO 11/4/2008	DN		DATE TEST LOCATION SOURCE:		11/5/2008 UW TXT PIT I-90				
SAMPLED ID:		UW-S-RVB-	0		PROJECT	NO:	UW-RESEAR				
FOR USE:		RAP			SOILS & SU	URFACING L	08-1041				
(1) WT. OF OIL	ED SAMPLE	, PAN AND F	LTER:	2277.6	(4) WT. OF	UNOILED S	AMPLE, PAN, A	ND FILTER: 2251.8			
2) TARE OF P.		Contraction of the second s		1077.4		F PAN AND		1077.4			
3) WT. OF OIL		: (1 - 2)		1200.2							
7) WT. OF OIL	. (3 - 6)			25.8	_(8) % OIL: (2.15			
		ING A VACUUM EX TER AID.	THACTION, ADD 50	GRAMS		CONTENT: GG. AFTER	WASH:	11291			
	WT. RET.	% RET.	% PA	SSING	SPEC'S		ABSON EX	TRACTION			
37.5mm(1 1/2")		1-1-1-1				KINEMATI	C VISCOSITY:				
	1					The second second	E VISCOSITY:				
25mm (1")		1	166.4			PENETRAT					
		10,000			1						
19mm (3/4")	33-8	2.5	10 in 19			CHEMICAL	.: METHODB	OVEN:			
12.5mm (1/2")	210.0	19.4	72.7		-	-	CALCUL	ATIONS			
		1		11							
9.5mm (3/8")	113.2	9.7	67.6	11	1.1						
4.75mm (#4)	152.3	5.7	53.3		-	-					
2.36mm (#8)	95.0	9.7	115.2	-		-					
1.18mm (#16)	116.2	7.9	the second second			1					
600µm (#30) 300µm (#50)	107.7	9.2	25.6		-	-					
150µm (#100)	78.5	66	9.0		-	÷					
75µm (#200)	42.6	4.1	5.7		-	-					
	65.9 57.1	0.1	3.1			-					
PAN 1213						1					
TOTAL	4	1	1								
12102				11.1							
RERUN:					ļ	1					
REMARKS:											
CENTRAL .											
	_										
					TESTED BY	KMM					

	Mater	RTMENT OF TRA rials Testing Laborat	огу	Form TA REVISED (
	Metric		truction	ac/da
Date Sampled Project Number Resident Engineer Pit or Source_	HUNTINGTON	Date Received		IER
Soils	Aggregate	Sample Distribution	Chamleton Die o	a allanati
Location (Belt, Stockpil Vertical Limits	e, etc.) <u>STOC</u> U	<u>IB-C</u> s# <u>PiLE</u> at: (Sta., kp., M 	.P., etc.)	
		For Use As :		*****
Profile	BSE	PMP, Type	Conc. Coarse A	ggregate
Borrow	CB, Grd	RPMP	Conc. Med. Agg	regate
Topping	PMB	PMWC, Type	Conc. Fine Aggr	egate
Alkali	СТВ	CCA, Type	Conc. Cylinders	
Check Curve	Filler	Maint, Type	Conc. Beams	
Final Emb.	Drain Gravel	Check Design	Port. Cement, T	/pe
Other 5	URFACING		Туре	
1.9	Geosynti	netics (Geogrid/Geot	extile)	
Product Name		Manufacturer		
SCREENEC	ALT CONTEN GRADATION AGGREGATE /			RACTION VALUE 177.6 17.4 51.8
nztenalstaharedVormstadil & su/k.120	ale	Submitted By	Scott Ke	Reader # FR-6042

N N	Mater	RTMENT OF TRAI rials Testing Laborat	ory	ATION	Form T- REVISED B
TRANSPORTETION	Metric English	Prelin Cons	truction		
Date Sampled _ Project Number _ Resident Engineer _ Pit or Source_	7.14.0 IW-Resea Huntington TXTP	Date Received <u>rch</u> Road Section at: <u>Cross HP</u> +County	Schol UW John	onover	
		Sample Distribution		1000	
Solls	Aggregate	Concrete	Chemistry	Geology	
Location (Belt, Stockpile,	etc.) <u>Stactipil</u>	<u>SPA</u> s# eat: (Sta., kp., M to; to;	.P., etc.)	JOGY	⊥of_l ≢ ¤rd
		For Use As ;			
Profile	BSE	PMP, Type	- Co	nc. Coarse Aggregate	
Borrow	CB, Grd.		Co Co	nc. Med. Aggregate	
Topping	PMB	PMWC, Type	Co	nc. Fine Aggregate	
Alkali	СТВ	CCA. Type	C0	nc. Cylinders	
Check Curve	Filler	Maint. Type	Q Co	nc. Beams	
Final Emb.	Drain Gravel	Check Design	D Po	nt. Cement, Type	
🛱 Other	urfacing		Туре	1.11	
	Concurt	hetics (Geogrid/Geot	ortila		
Droduct Name	Geosynt	Manufacturer	extile		
Product Name					
Remarks: Wash fractured Virgin Aggi	aradation; faces; hy c mate	A IIIr	hesions logy)	ralue; R.	valnej
	- Jeur		Scott,	1.	
		Submitted By	1 5 11	1.1	

LABORATORY	NC)		00	1020	DATE REC'D							
SUBMITTED B							AT						
I.D MARKS	UW	- RESE	arch - 1	1-5	- VSPA		DATE SC	CREEN	ED 10-2	5			
SOURCE	1153	H	Ort	(Sto	ckpiles	()			0 7-14				
QUANTITY RE	PRE	ESENT	ED 13	R		-	LOCATIO	DN				_	
FOR USE AS	5.	er fac	.24 (V	ingin		PROJECTCO							
	-					EST RE	ESULTS						
SIEVE SIZE	1	RET. WT	RET. WT	RET	PASSING	RET. WT	RET. WT	RET	PASSING	RET. WT.	RET WT.	RET	PAS
PASSING	+	LBS.	GRAMS	"/"	1/4	LES.	GRAMS	%	1/10	LBS.	RAMS Relatur	%	-
MAX	-		421.5	-			-				RValue		
3" (75 mm)	+		1		-		-		-				
2" (50 mm)	1		-						-	_	1		-
1 1/2 (3.75 mm)	-	-		100.0		1	-					
1" (25 mm)	+				100.0		-				-		-
3/4" (19 mm)	-	0.7	-	2.0	18.0	-				12.22		-	-
1/2" (12.5 mm)		10		14.5	23.5					-	198		-
3/6" (9.50 mm)	1	2.7		7.8	75-7		1				292		-
#4 (4.75 mm)		1.7		13.6	62.1						456		-
#8 (2.36 mm)	F	1.1	92.40	11-6	50.5			-			1200		
#16 (1.18 mm)	-		62.2	7.7	42-8								
#30 (600 um)	-		SLA. 8	7.0	35-8	1							
#50 (300 um)	-		81.8	10-1	25.7								
#100 (150 um)	-	_	70.5	8.7	17.0								
#200 (75 um)	-	_	44.3	5.5	11.5	-				-			1
PAN		12.8	92-2 92-7	1.1		11.53						-	
	3	4.6				111					(4)		
LIQUID LIMIT		NY		1.1		1	_		- L				
PLASTICITY INDE	x I	NP											
SAND EQUIVALEN	т		-										
Tests T	ech	Da	te REP	ARKS	UW-S-	-1/SF	(A)		() () () () () () () () () ()				
Screen Cr	2	10-2			tiene ,	Vel	(11)						-
LL - PI			Gr	ada-	Jon V	/							
	15	10-3		1 =									
Gradation	1	10-	_	E: -									_
Crush Crush Wash	-				517 PS		_						_
CR LL PI	-		FI		89.1 %								-
LAR					vieter		eo I	lar	k Shee	+			-

Forn. 7-

Rev 9-(

242

(M) - S - USP (M)

		T	OCATIO	LOCATION				PR	PROJECT	UW Researc	Resporch			
	A	В												
5:1 Ratio	Wt. Of sample	Weight of Flat & Elong. Particles	% F & E Particles	% retained weights	Weighted		Wt. Of One or more fractured	% one or more F.F.	% retained weights	Weighted %	WL Of Two or more fractored	% Two or more F.F.	% retained weights	Wt %
SIEVE SIZE							Inces				10 CG			
Coarse								•						
-3/4"+1/2"						(20.0.2)	528.2	88.1	0:435	38.3				
-3/8"+#4						0.05	70.7	33:4	0.359	31.7				
Medium	7					ä				1				
-3/4"+1/2"														
-1/2 +3/8														
Finan														
-1/2"+3/8"										5				
-3/8"+#4														
Filler														
-1/2 +3/8														
								59.7						
Weighted Total %	°								Ĩ	89.1			Γ	
Flat & Elongated Formula	Formula	m						Note:						
(B1A) X100=%								Flat test = w Elongated le	Flat test = width to thickness Elongated test = length to width	i width				
To calculate the weighted %, the +#4 nee so when all the new retained weighte of	ghted %,	To calculate the weighted %, the +#4 needs to he adjusted so when all the new retained weighte of	adjusted						- naiphil	i ar or monifiated - terrifitt to thickness	ess			
+#4 are added to	ogether, U	the ##4 are added together, they equal 100%. Multiply the	Wiply the					WL% = weighted %	led %					
% of flat & elong. times the % each bin split if there are multi various sieve sizes and report.	e are mul and repor	% of flat & elong. Himes the % retained of that sleve. Then multiply flat times teach bin split: If there are multiple stockpiles if necessary. Add the weighted %'s on the various sleve steas and report.	eve. Then mult cessary. Add	liply that times the weighted	%'s on the			Note: Thu as the sie	e sieve siz ve above i	Note: The sieve size containing le. as the sieve above it or below it.	Note: The sieve size containing less than 10% will use the same % of flat & elongated as the sieve above it or below it.	Il use the sar	ne % of flat	& elong
								Fractured Face Formula: P=[F/(F+N)] X 100	sce Formuts:)] X 100					
								F= Fractured Faces N= No fractured fact P= Percent of fractu	F= Fractured Faces N= No fractured faces P= Percent of fractured faces	580				

Satefong 245

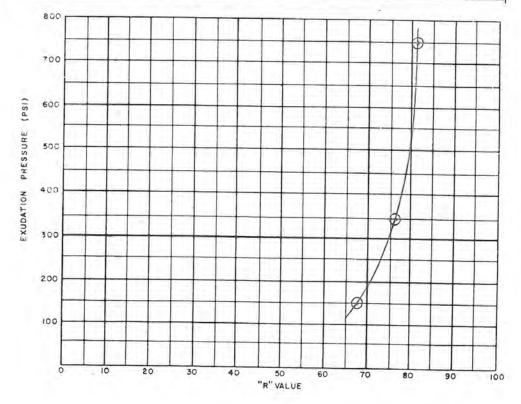
UN Reserve

Form T-115 Rev. 5/91

WYOMING DEPARTMENT OF TRANSPORTATION

SOILS STABILOMETER WORK SHEET

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO)			
MOLD NO.	19	55	26	100	1			0%	10	20		
COMPACTOR AIR PRES-PSI	350	350	350	-	SOIL	CLASS &	GROUP	INDEX	P	ROJEC	T	
INITIAL MOIST %	-		-	-								
WATER ADDED-ML	80	100	90		FIELD	IDENT.	-		STA	TION		
WATER ADDED-%			-			INITIAL	MOISTU	RE	$1_{\mathbf{n}}$			
MOIST AT COMPACTION %	1.7	8.3	25		WET		DRY		3/4			-
WET WEIGHT OF PAT-GMS	1214	1256	1203		DRY		TARE		3/8			-
HEIGHT OF PAT-INCHES	2.51	2.62	3.68		WATER		DRY		NO.	4		-
DENSITY-LB. PER CU. FT.	137.3	134.1	126.5			ANSION		AEN	A	в	c	D
STAB. Ph AT 1000 LBS	7	16	10		D	AL RE	ADING		0	0	6	1
2000 LBS.	15	35	25		COVER REQUIRED - INCHES		INCHES			1	1	
DISPLACEMENT	5.21	4.74	5.00		TIN NO.	REMA	RKS	12		-	T-1154	
"R" VALUE	82	6569	73/16			(11.)-	5 - VSP	101			"R" V	1
EXUDATION PRESS. PSI	750	150	350		1	000-	2 131	(1)				4



WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/96 MATERIALS TESTING LABORATORY h:Vorms\soli8.sur/T-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.	08-1020	VSP-A	DATE			
PROJECT NUMBER			SOURCE	UW-	Research	
ENGINEER			FOR USE AS	_		_

TEST RESULTS

F + H*0 =	6831			O.D.	BULK= 2.429
F + M + H20 =		TARE P	AN	F + H20 + 500 - F,M,H20	
MATERIAL + TARE =	773.5	283.4	9.	0.0	APPARENT: 2.55
O.D. =	490.1			F + H20 + O.D F,M,H20	

	FLASK	F+M	F + H20
1	183.3	683.3	683.0
2	170.2	670.2	668,4
3	184.8	684.8	682.6

					@ S.S.E.		1
	and the second			IRE SAM	PLE FROM -4 S/G		
	TARE WEIGHT					5. J.	
	WET WEIGHT				WT. OF MOISTURE		75 - 6
	- DRY WEIGHT	190.1	-		+ DRY WEIGHT		
	= WT. OF MOISTURE	9.9	11		MOISTURE % @ S.S.D.	2.0	
	Ň	IOISTI	JRE @	S.S.D +	5% FOR COMPACTION		
			MOIS	TURE @	COMPACTION		
	MOISTURE S	MPLE	FROM	M EXCES	S MATERIAL AFTER C	OMPACTION	
	TARE WEIGHT		-		Contract Address		
	WET WEIGHT	41	4.4		WT. OF MOISTURE	27.9	
	- DRY WEIGHT	38	6.5	5	+ DRY WEIGHT		
	= WT. OF MOISTURE	2	7.9		MOIST. % @ COMPACTION		
	- the meter start		1				1
	MACHINE LOAD				PSI		
1	2147	÷	4	=	537	MOLD	
2	1962	÷	4	=	491	OILED	
3	2094	÷	4	=	524	UNOILED	
AVG.	2068		1	AVG.	517]	
	APPARENT SIG	-	-	-	BULK S/G	· · · · · ·	T.
	MOISTURE @ S.S.D				ABSORBTION %		
MOIST	TURE @ COMPACTION				ABSORBTION		1
incra					1		
	100						
5:30ml=2% moist							

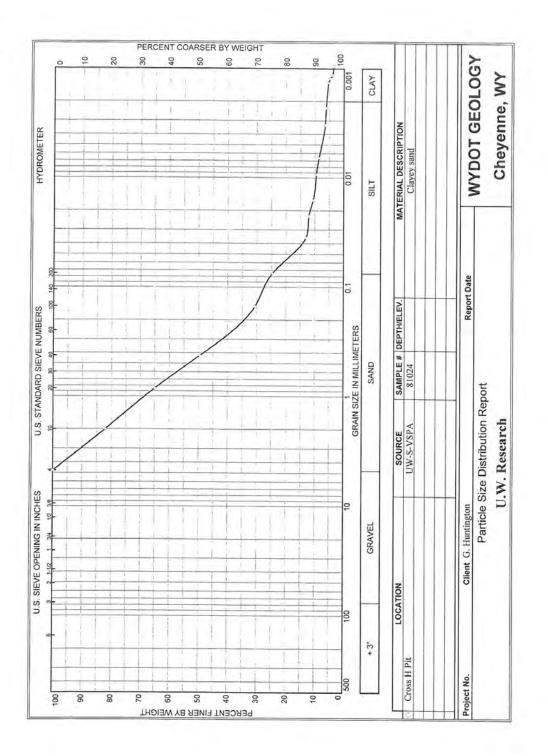
and March 1999		510	AIN SIZE DI	STRIBUTI	ON TES	I DATA		
Project: U. Project Numi		arch		Clier	at: G.	Hunting	iton	
			Sau	mple Dat	a			
Source: UW-	S-VSPA							
Sample No.:								
Elev. or Dep				Samol	e Leno	th (in. /	cm 1 -	
location: C	ross H	Pit						
Description	: Claye	y sand						
			Mechanica	1 Analys	is Dat	a		
		Inítia	1					
ory sample a	and tar		1.1.1					
lare			00					
Dry sample w								
Sample split		mber 10 s	ieve					
Split sample								
Sample and	1 tare =	= 71.81 1	are = .00 s	Sample we	eight =	= 71.81		
Cumulative	e weight	t retaine	d tare= .00					
fare for cur Sieve								
Sleve		umul. Wt. etained	Percent					
# 4	Te	0.69						
# 10		124.69	99.9 82.1					
# 20		14.96	65.0					
# 40		28.53						
# 100		45.01	30.6					
# 200		50.31	24.6					
		MARKS.	11					
		-	Hydromete	r Analys	is Dat	a		
Separation s								
Percent -#10 Weight of hy	/ based	upon com	plete sampl	e= 82.1				
Hygroscopic				51				
Moist weig								
Dry weight	and the second second second							
Tare		= 61.						
Hygroscopi	c moist							
Calculated b								
intomatic to	mperatu	ire corre	ction					
LUCOMACIC LE	correct	tion at 2	0 deg C = -	6.7				
	COTTECT							
Composite		only= 0						
Composite Meniscus cor	rection		2 673					
Composite Meniscus cor Specific gra	rection wity of	solids=	2.673	995				
Composite Meniscus cor Specific gra Specific gra	rection wity of wity co	solids=	2.673 factor= 0.	995				
Composite Meniscus cor Specific gra Specific gra	rection wity of wity co ype: 15	solids= prrection	2.673 factor= 0. 4964 - 0.16					
Composite Meniscus cor Specific gra Specific gra	vity of vity co vity co vpe: 15 depth	solids= prrection	factor= 0.	4 x Rm	Bm	Eff	Diameter	Percent
Composite Meniscus cor Specific gra Specific gra Vydrometer t Effective	rection wity of wity co ype: 15 depth Temp,	solids= prrection 2H L= 16.29	factor= 0. 4964 - 0.16	4 x Rm	Rm	Eff. depth	Diameter	Percent
Composite Meniscus cor Specific gra Specific gra Vydrometer t Effective Elapsed	rection wity of wity co ype: 15 depth Temp,	solids= prrection 2H L= 16.29 Actual reading	factor= 0. 4964 - 0.16 Corrected reading	4 x Rm		depth	mm	finer
Composite eniscus cor pecific gra pecific gra ydrometer t Effective Elapsed time, min	rrection wity of wity co ype: 15 a depth Temp, deg C 18.0	solids= prrection 2H L= 16.29 Actual reading	factor= 0. 4964 - 0.16 Corrected reading 12.8	4 x Rm K	20.0	depth 13.0	mm 0.0355	finer 13.1
Composite Meniscus cor pecific gra pecific gra ydrometer t Effective Elapsed time, min 2.00	rection avity of avity co cype: 15 a depth Temp, deg C 18.0 18.0	solids= prrection 2H L= 16.29 Actual reading 20.0	factor= 0. 4964 - 0.16 Corrected reading 12.8	4 x Rm K 0.0139	20.0	depth	mm	finer
Composite Meniscus con Specific gra Specific gra Vydrometer t Effective Elapsed time, min 2.00 5.00	rection avity of avity co cype: 15 a depth Temp, deg C 18.0 18.0	solids= prection 2H L= 16.29 Actual reading 20.0 19.0	<pre>factor= 0. 4964 - 0.16 Corrected reading 12.8 11.8</pre>	K 0.0139 0.0139	20.0	depth 13.0 13.2	mm 0.0355 0.0226	finer 13.1 12.1

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	ĸ	Rm	Eff. depth	Diameter mm	Percent
30.00	18.0	16.5	9.3	0.0139	16.5	13.6	0.0094	9.5
60.00	18.5	15.5	8.4	0.0138	15.5	13.8	0.0066	8.6
240.00	20.0	13.0	6.3	0.0136	13.0	14.2	0.0033	6.4
480.00	21.0	12.5	6.0	0.0134	12.5	14.2	0.0023	6.1
1440.00	20.0	12.0	5.3	0.0136	12.0	14.3	0.0014	5.4
1680.00	21.5	11.0	4.6	0.0133	11.0	14.5	0.0012	4.7
1920.00	22.5	10.0	3.8	0.0131	10.0	14.7	0.0011	3.9
2880.00	21.0	10.0	3.5	0.0134	10.0	14.7	0.0010	3.5

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 $+ 3" = & GRAVEL = \\ SILT = 18.7 & CLAY = 6.0$ D85= 2.31 D60= 0.68 D50= 0.43 D30= 0.14 D15= 0.04 D10= 0.01 C_c= 2.2358 Cu= 51.5095

% SAND = 75.3
(% CLAY COLLOIDS = 3.6)



W ARA	Mater	RTMENT OF TRA ials Testing Laborat PLE TRANSMITT	ory	ATION FORM T-I REVISED &
TRANSPORTED	Metric A English	Prelir	ninary truction	
Date Sampled Project Number Resident Engineer	7 14-08 UW - KESEAR HUNTINGTON	Road Section	Scio Lab	DNOVE &
Pit or Source	Proper H f	Count	y_ Sci	INSON
	1.6	Sample Distribution		
Soils	Aggregate	Concrete	Chemistry	Geology
Location (Belt, Stockpile,	etc.) <u>Stockpil</u>	E S# E at: (Sta., kp., N to : to :	1.P., etc.)	So. Co YARD
		For Use As :		*
Profile	BSE	PMP. Type	- 0.	onc. Coarse Aggregale
Borrow	CB, Grd.	014.		onc. Med. Aggregate
Topping		PMWC, Type		onc. Fine Aggregate
Alkali	СТВ	ССА, Туре	00	onc. Cylinders
Check Curve	Filler	Maint, Type		onc. Beams
Final Emb.	Drain Gravel	Check Design		ort. Cement, Type
Other Sc	AFACINES		Туре	
an and the American	Geosynt	hetics (Geogrid/Geo	textile)	
Product Name		Manufacturer		
Remarks: 14/4-H R 1/4645 F	-			CON MUS (GEOLOGY)
UARZENIN F	AGGREGATE			
			Scott.	FacH

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY REPORT OF TEST ON SURFACING MATERIALS

				MATERIA	LS LAB	ORATORY	Y					Ray B-C
LABORATORY	10		08.	1020	_	DATE RE	EC'D_					🗆 Me
SUBMITTED BY						TA						
D MARKS U	W- Rosa	arch - J	W-5-	VERB		DATE SC	CREEN	ED 10-2	6			
SOURCE	53 H 1	0,+	(St	ockpile	1)	DATE SA	MPLE	0 7-14			_	
QUANTITY REP						LOCATIO	DIN		_			
FOR USE AS	Surta	12 (V	ireir	1 Agg.)	PROJEC	1			00		
		P	~		EST R	ESULTS						
SIEVE SIZE	RET. WT.	RET WT.	RET	PASSING	RET. WT	RET. WT. GRAMS	RET.	PASSING			RET	PASS
PASSING	L'BS.	GRAMS	74	70	LDS.	GRANS	70	1%	LBS.	ERAMS Plalue	%	"/0
3" (75 mm)		390-1		+		1				Kvaa		
2" (50 mm)												1
1 1/2 /2 75 mm						1		1	1000			1

MA	Ni l	1	1390.1	1			-	-	-		RValue	
3" (75 m	m)	1		-	+					·	_	
2" (50 mi	mi)				1			211			1	
1 1/2 (3.75	mm)											
1" (25 mi	m)				100.0					-		
3/4" (19 m	m)	0.6		1.6	98.4							
1/2" (12.5 r	mm)	4.6		12.4	36.0	1			1		168	
3/8" (9.50 r	mm)	3.1		8.3	77.7						268	
#4 (4.75 m	nm)	5.2		14.0	637		1				436	
#8 (2.36 m	im)	23.11	70.9	9.8	53.9						1200	1
#16 (1.18 n	nm)		\$7.0	7.9	46.0							
#30 (600 L	im)		56 -9	7.8	38-Z					111		
#50 (300 L	(m)		85.5	11-8	26-4			1				
#100 (150	um)		45.2	9.0	17.4							
#200 (75 u	IIII)		44-3	6.1	11-3		1			101-1		
PAN		10.3	\$2.0					1				
		37.2									(4)	
LIQUIDLIN		NV		_					-1			-
PLASTICITY I	NDEX	NP										
SAND EQUIVA										-		
Tests	Tec	h Da	te REI	ARKS	WW-S	1/0	DED		-			
Screen	Cm	10-2	8	en a a co	40-5	- 15	PIP	1				
LL - PI		100		adat	ion v	/						
Wash	MAS	10.	6.1	. =	NV							
Gradation	1	10 -	28 PI	1=	NP							_
Crush			CV	1 =	401 1	OSI						
Crush Wash			"P"	Walue	-= 79	7						
CR LL PI		12-1	FF		91.69	1.						
LAR			Hy	draw	reter		Seo	Wor	KSI	heet	-	

-T mai

(1) -5 - VSP (E)

ML Of Ote Tractured W. LOT Nor Tractured W. LOT Nor W. Lot Nor 0.00 57757 9.4.2 0.3 £ £ 3.7.8 0.4.2 3.5.7.7 9.4.2 0.3 £ 5.7 0.4.2			-	LOCATION	z	-			PR	PROJECT	(n h	UW Recearth	1	t		
WL Of One armore fractured faces <i>BDO</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i> <i>B</i>		A	в											-		
600.0 5772 H00.0 365.7 80.0 69.8	5:1 Ratio	WL OF sample		% F & E Particles	% retained weights	Weighted		Wt. Of One or more fractured	% ane ar more F.F.	% retained weights		Wt O or o fract		-0	% retained weights	We st
31 600.0 5737 30.0 36.7 36.7 30.0 36.7 36.7 31 90.0 36.7 32 30.0 36.7 33 30.0 36.7 34 30.0 36.7 35 30.0 36.7 36 30.0 36.7 37 31 30.0 36 31 30.0 37 31 30.0 36 31 30.0 37 31 30.0 38 31 30.0 39 31 30.0 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 <td>SIEVE SIZE Coarse</td> <td></td> <td>ž</td> <td>8</td> <td></td> <td></td> <td></td>	SIEVE SIZE Coarse											ž	8			
400.0 <u>365.7</u> 90.0 <u>6</u> 3.8	-3/4"+1/2"						600.0	577:2		0.386	1.0	-	1	T		
80.0	8/5+ 7/1-						400.0	365.7		0.228			-			
	+#+ 0/C-						80.0	69 8	87.3	0.386	33.7					
	Medium -3/4"+1/2" -1/2"+3/8"															
	5#1 0/C-															11
	Fines -1/2"+3/8" -3/8"+#4															
	Filler															
	-3/8"+#4															11
				Í					916							
	Veighted Total %	.0									91.6					
	lat & Elongated	Formula							Note:							
	31 A) X 100 = %								Flat test = wi Elongated ter	dth to livickne si = length to	width					
	o calculate the weig	ghled %, I	the +#4 needs to be	adjusted					Flat & Elo.	ngaleo = H	ength to thick	ness				
	e +#4 are added too	gether, th	veignts of tey equal 100%. Mul	ltiply the					WI % = weight.	% pa						
Fractured Face Formula: P=[Ft/[F+N]] X 100 F≡ Fractured Faces N= No fractured faces	of flat & elong. tim ch bin split if there rious sieve sizes al	nes the % s are mult nd report	relained of that ste- liple stockpiles if neu L	ve. Then mul cessary. Ado	liply that time 1 the weighter	as %'s on the			Note: The as the siev	e sieve siz ve above it	e containing l or below it.	less than 10	% will use	the same	s of flat	& elo
F≡ Fractured Faces N= No fractured faces									Fractured Fa	ce Formula:)] X.100						
In a Preparation of Instantial Action									F= Fractured N= No fracture P= Percent o	Faces red faces f fractured far	and a state of the					

faleorgxis

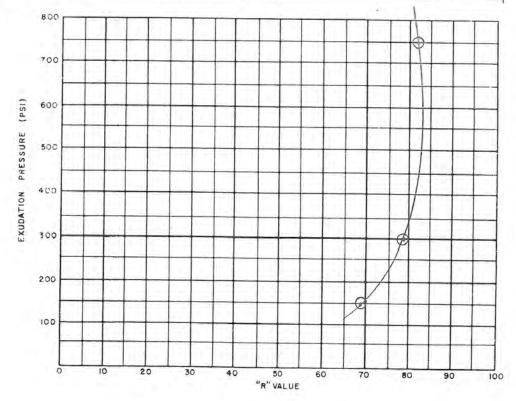
UN Research

Form T-115 Rev. 5/91

WYOMING DEPARTMENT OF TRANSPORTATION

SOILS STABILOMETER WORK SHEET

TEST SPECIMEN	A	B	C	D	LL	PL	PI	LAB. NO)			
MOLD NO.	37	47	13		1			08-	102	0		
COMPACTOR AIR PRES-PSI	350	350	350		SOIL	CLASS &	GROUP	INDEX	PH	OJEC	T	
INITIAL MOIST - %	-											
WATER ADDED-ML	80	100	90		FIELD	IDENT			STAT	ION	-	
WATER ADDED-%	-	-	-		11	NITIAL	MOISTU	RE	1 ^{ic}			
MOIST AT COMPACTION %	6.7	8.3	7.5		WET		DRY		3/4"			-
WET WEIGHT OF PAT-GMS	-1213		1234		DRY		TARE		3/B			-
HEIGHT OF PAT-INCHES	2.57	2,59	2.61		WATER		DRY		NO.	4		
DENSITY-LB. PER CU. FT.	134.0	134.)	133.3			ANSION		AEN	A	в	C	D
STAB. Ph AT 1000 LBS	8	15	12	-	D	AL RE	ADING	-	0	0	0	
2000 L 85.	16	30	23	1	cov	ER REG	UIRED -	INCHES				
DISPLACEMENT	4.91	4.79	4.66		TIN NO.	REMA	RKS:				T-115A	
"R" VALUE	182	69	76 79		1		1	USP (B			"R" VA	LUE
EXUDATION PRESS. PSI	250	1 10 10	300	-	1	U	1 2 - 1	USI CA)		7	9



WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/96 MATERIALS TESTING LABORATORY https://www.solitesurit-daveg.xls

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO.	08-1020	VSP-B	DATE	
PROJECT NUMBER			SOURCE	Uw-Research
ENGINEER			FOR USE AS	

TEST RESULTS

F+H= 6772		O.D.	BULK= 2.45 6
F+M+H=0 = 977.8	TARE PAN	F + H20 + 500 - F,M,H20	
MATERIAL + TARE = 825.2	335.5 g.	0.D	APPARENT : 2.590
O.D. = 489.7		F + H20 + O.D F,M,H20	

	FLASK	F + M	F + H*0
1	183.3	683.3	683.0
2	170.2	670.2	668.4
3	184.8	684.8	682.6

[Moisture	@ S.S.E.		
		MOISTURE SAM	PLE FROM -4 S/G		
	TARE WEIGHT	3355			
	WET WEIGHT		WT. OF MOISTURE	10.3	1.12
	- DRY WEIGHT	489.7	+ DRY WEIGHT	489.7	95 ~ 6
	= WT. OF MOISTURE	10.3	MOISTURE % @ S.S.D.		
		MOISTURE @ S.S.D +	5% FOR COMPACTION		
		MOISTURE @	COMPACTION		
		AMPLE FROM EXCES	S MATERIAL AFTER C	OMPACTION	
	TARE WEIGHT			25.0	
	WET WEIGHT	514.0	WT. OF MOISTURE		
	- DRY WEIGHT	479.0	+ DRY WEIGHT		
	= WT. OF MOISTURE	35.0	MOIST. % @ COMPACTION		
-0	MACHINE LOAD		PSI		
1	1703	÷ 4 =	426	MOLD	
2	1270	÷ 4 =	318	OILED	
3	1839	÷ 4 =	460	UNOILED	
AVG.	1604	AVG.	401		
	APPARENT S/G		BULK S/G		
	MOISTURE @ S.S.D		ABSORBTION %		
MOIST	URE @ COMPACTION				
IOTES:30ml=2% moistu	ire				
	TESTE	DBY		ENGINE	ER

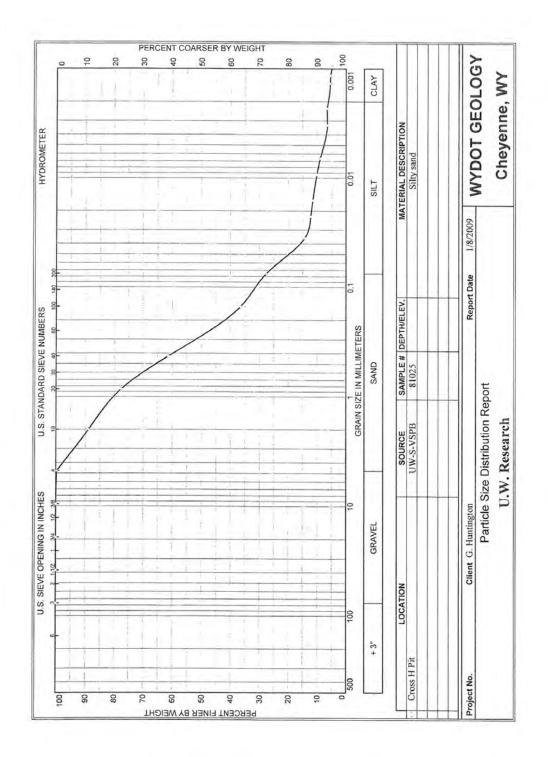
	GRAI	IN SIZE DISTRIBUTION TEST DATA
Project: U.W.	Research	
Project Number	1	Client: G. Huntington
		Sample Data
Source: UW-S-V		
Sample No.: 81		
Elev. or Depth		Sample Length (in./cm.):
Location: Cros		
Description: S	ilty sand	
		Mechanical Analysis Data
	Initial	
Dry sample and	tare= 623.2	0
Tare	= 0.0	
Dry sample wei		
Sample split of		eve
Split sample da		
		re = .00 Sample weight = 64.57
	eight retained	
Tare for cumula		
Sieve	Cumul. Wt.	
a desta	retained	finer
3 inch	0.00	100.0
1.5 inch	0.00	100.0
.75 inch	0.00	100.0
.375 inch	0.00	100.0
# 4	2.15	99.7
# 10	69.11	88.9
# 20	8.28	77.5
# 40	20.08 38.06	61.3
# 100		36.5
# 200	44.52	27.6
		Hydrometer Analysis Data
Separation siev	ve is #10	
Percent -#10 ba	ased upon comp	lete sample= 88.9
Weight of hydro	ometer sample:	65.01
Hygroscopic mo:		
	& tare = 124.	
Dry weight &	tare = 124.	
Tare	= 60.3	
	moisture= 0.7	
Calculated bias	and the second	
Automatic tempe Composite con	erature correc rrection at 20	
	antes esters 0	
Maniscus correc		
		2 71
Meniscus correc Specific gravit	ty of solids=	
Specific gravit Specific gravit	ty of solids=	
Specific gravit Specific gravit Hydrometer type	ty of solids= ty correction s: 152H	

	reading	reading	K	Rm	Eff. depth	Diameter mm	Percent finer	
18.5	17.5	10.4	0.0137	17.5	13.4	0.0354	14.2	
18.5	16.0	8.9	0.0137	16.0	13.7	0.0226	12.2	
18.5	15.5	8.4	0.0137	15.5	13.8	0.0160		
18.5	14.5	7.4	0.0137	14.5	13.9	0.0093		
19.0	13.5	6.6	0.0136	13.5	14.1	0.0066		
20.0	11.5	4.8	0.0134	11.5	14.4	0.0033	1	
20.5	11,5	4.9	0.0133	11.5	14.4	0.0023		
19.0	11.0	4.1	0.0136	11.0	14.5	0.0014		
21.0	10.5	4.0	0.0132	10.5	14.6	1 3 3 G G G	200 P 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
19.0	10.5	3.6	0.0136	10.5	14.6	0.0010	4.8	
	18.5 18.5 19.0 20.0 20.5 19.0 21.0	18.5 16.0 18.5 15.5 18.5 14.5 19.0 13.5 20.0 11.5 20.5 11.5 19.0 11.0 21.0 10.5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 \$ + 3" = 0.0 \$ GRAVEL = 0.3\$ SILT = 21.4 \$ CLAY = 6.2D85= 1.42 D60= 0.40 D50= 0.28 D30= 0.09 D15= 0.04 D10= 0.01 Cc= 2.1606 Cu= 44.9912

% SAND = 72.1
(% CLAY COLLOIDS = 4.9)



ARA	Mater	RTMENT OF TRA ials Testing Labora	tory	twine Mr.	Form T-17 REVISED 84
TAANPORTING	Metric English	Prel	iminary struction		λA
Date Sampled	7-14-08	Date Received			
Project Number					
Contraction of the second	HUNTINGTON				
Pit or Source	CROSS H		ty_JOH	NJON	
Soils	Aggregate	Sample Distribution	Chemistry	Geolog	
	Sal magnagine		onemiory	GEORG	,
		<u>FC</u> s# LEat: (Sta., kp., 1			Aultiple Samples
		to :			
		to .			
Quantity Represented					
		For Use As :			
Profile	BSE	търма Туре		onc. Coarse Aggreg	ate
Borrow	CB, Grd	Grd		onc. Med. Aggregate	
Topping		PMWC, Type		onc. Fine Aggregate	
	СТВ	CCA, Type		onc. Cylinders	
Check Curve		Maint Type		onc, Beams	
Final Emb.	Drain Gravel	Check Design		ort. Cement, Type _	
	IRFACING	Crieck Design	-	ort. Cement, Type_	
Da Other(IRFACING		Туре		
100 p	Geosynth	netics (Geogrid/Geo	textile)		
Product Name		Manufacturer	and a state of the		
	GRADATION ; FACES	PL; LL, COH HYDROMETER		ue ; R. 264)	VALUE
Virean	AGGREGATE				
		Submitted By	Scott.	Hoch	

WYOMING DEPARTMENT OF TRANSPORTATION MATERIALS LABORATORY REPORT OF TEST ON SURFACING MATERIALS

LABORATORY NO.	60 1020	DATE REC'D	
SUBMITTED BY HUATIAN	n .	TA	
I.D MARKS UW-Research -	UW- S-USPC	DATE SCREENED 10-24	2
SOURCE Cross H Pir	(Stockpiled)	DATE SAMPLED 7-14	
QUANTITY REPRESENTED	1 sk	LOCATION	
FOR USE AS Surfacing	Unin Ave.	PROJECT	CO
	TEST R	ESULTS	

PASSING LBS. GRAMS % % LBS. GRAMS % % LBS. GRAMS % % MAX 328.7<		T				Earne				_	_		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		WT.	WT. GRAMS		1.	WT.	WT.	1.		WT.	WT. GRAMS		PAS
3" (75 mm) //00.0 11/2 (3.75 mm) //00.0 11/2 (3.75 mm) //00.0 11/2 (3.75 mm) 0.1 11/2 (3.75 mm) 0.1 11/2 (3.75 mm) 0.1 3/4" (19 mm) 0.1 3/4" (19 mm) 0.1 1/2" (12.5 mm) 2.1 1/2" (12.5 mm) 2.1 1/2" (12.5 mm) 2.2 1/2" (12.5 mm) 1/2" (12.5 mm) 1/2" (12.5 mm) 1/2" (12.5 mm) 1/2" (12.5 mm) 2.2 1/2" (12.5 mm) 2.2 1/2" (12.5 mm) 2.2 1/2" (12.5 mm) 2.2 1/2" (12.5 mm) 2.1 1/2" (12.5 mm)	MAX						-1				""Value	1	
1 1/2 (3.75 mm) 100.0 100.0 1' (25 mm) 0.1 5.2 97.8 1 3/4' (19 mm) 0.1 15.9 92.5 2/0 1/2" (12.5 mm) 6.1 15.9 92.5 2/0 3/8" (9.50 mm) 3.4 8.7 73.8 3/4' 4/4 (4.75 mm) 5.2 13.2 60.6 4/72_ #8 (2.36 mm) 2.3.4 52.0 7.8 52.2 //200 #8 (2.36 mm) 2.3.4 52.0 7.8 52.2 //200 #16 (1.16 mm) 49.2 7.3 45.5 1 1 #30 (600 um) 49.9 7.5 39.0 1 1 1 #200 (75 um) 57.5 5.4 12.0 1<	3" (75 mm)		12125							-			
1* (25 mm) $D-1$ $5 \cdot 2$ $9? \cdot 3$ 1 3/4* (19 mm) $6 \cdot 7$ $1/8$ 78_0 $21/0$ 1/2* (12.5 mm) $6 \cdot 1$ $15 \cdot 9$ $82 \cdot 5$ $21/0$ 3/8* (9.50 mm) 3.4 $8 \cdot 7$ $73 \cdot 8$ $31'4'$ #4 (4.75 mm) $5 \cdot 2$ $13 \cdot 2$ $60 \cdot 6$ $4'72_{-}$ #8 (2.36 mm) $2^{-2} \cdot 3$ $52 \cdot 6$ 1200 $4'72_{-}$ #8 (2.36 mm) $49 \cdot 2$ $7 \cdot 3$ $45 \cdot 5$ 1200 #16 (1.18 mm) $49 \cdot 2$ $7 \cdot 3$ $45 \cdot 5$ 1200 #430 (600 um) $49 \cdot 9$ $7 \cdot 5$ $39 \cdot 0$ 10^{-1} #30 (500 um) $77 \cdot 2$ 11.7 $24 \cdot 3$ 10^{-1} #400 (150 um) $57 \cdot 6$ $8 \cdot 9$ $17 \cdot 9$ 10^{-1} #200 (75 um) $35 \cdot 5$ 5.4^{-1} $12 \cdot 0$ 10^{-1} PAN $6 \cdot 5$ $7^{-1} \cdot 7 \cdot 9$ 10^{-1} 10^{-1} Juquip Linift NV $10^{-1} \cdot 5$ $10^{-1} \cdot 5$ $10^{-1} \cdot 5$ Uquip 1 = 1	2" (50 mm)	1		1			1						
1* (25 mm) $D-1$ $5 \cdot 2$ $9? \cdot 3$ 1 3/4* (19 mm) $6 \cdot 7$ $1/8$ 78_0 $21/0$ 1/2* (12.5 mm) $6 \cdot 1$ $15 \cdot 9$ $82 \cdot 5$ $21/0$ 3/8* (9.50 mm) 3.4 $8 \cdot 7$ $73 \cdot 8$ $31'4'$ #4 (4.75 mm) $5 \cdot 2$ $13 \cdot 2$ $60 \cdot 6$ $4'72_{-}$ #8 (2.36 mm) $2^{-2} \cdot 3$ $52 \cdot 6$ 1200 $4'72_{-}$ #8 (2.36 mm) $49 \cdot 2$ $7 \cdot 3$ $45 \cdot 5$ 1200 #16 (1.18 mm) $49 \cdot 2$ $7 \cdot 3$ $45 \cdot 5$ 1200 #430 (600 um) $49 \cdot 9$ $7 \cdot 5$ $39 \cdot 0$ 10^{-1} #30 (500 um) $77 \cdot 2$ 11.7 $24 \cdot 3$ 10^{-1} #400 (150 um) $57 \cdot 6$ $8 \cdot 9$ $17 \cdot 9$ 10^{-1} #200 (75 um) $35 \cdot 5$ 5.4^{-1} $12 \cdot 0$ 10^{-1} PAN $6 \cdot 5$ $7^{-1} \cdot 7 \cdot 9$ 10^{-1} 10^{-1} Juquip Linift NV $10^{-1} \cdot 5$ $10^{-1} \cdot 5$ $10^{-1} \cdot 5$ Uquip 1 = 1	1 1/2 (3.75 mm)				100.0								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1" (25 mm)	D-1	1	5.2					1				
$1/2^{n}$ (12.5 mm) G_{0} · · · · · · · · · · · · · · · · · · ·		0.7	1.0					-					1
$3/6"$ (e.50 mm) 3.4 9.7 73.6 $3/4'$ #4 (4.75 mm) 5.2 13.2 60.6 $4/72$ #8 (2.36 mm) $2^{2}x_{2}$ 52.6 7.8 52.2 $1/72$ #8 (2.36 mm) $2^{2}x_{2}$ 52.6 7.8 52.2 $1/72$ #16 (1.18 mm) 49.2 7.3 45.5 $1/200$ #16 (300 um) 49.9 7.5 39.0 $1/200$ #30 (600 um) 49.9 7.5 39.0 $1/200$ #30 (500 um) 77.2 11.7 26.3 $1/200$ #100 (150 um) 59.6 8.9 17.4 $1/200$ #100 (150 um) 59.6 8.9 17.4 $1/2.0$ PAN 6.5 $7^{3.7}$ $1/2.0$ $1/2.0$ H200 (75 um) 35.5 5.4 $1/2.0$ $1/2.0$ PAN 6.5 $7^{3.7}$ $1/2.0$ $1/2.0$ Liquib Limit NV $1/2.0$ $1/2.0$ $1/2.0$ Screen 2.1 $1/2.24$ $1/2.24$							1				1710	-	
#4 (4.75 mm) 5-2 13.2 60.6 972 #8 (2.36 mm) 23.8 52.0 7.8 52.2 1200 #8 (2.36 mm) 23.8 52.0 7.8 52.2 1200 #16 (1.18 mm) 48.2 7.3 45.5 1200 #30 (600 um) 49.9 7.5 39.0 1 1 #30 (600 um) 49.9 7.5 39.0 1 1 #30 (600 um) 77.2 11.7 26.3 1 1 #100 (150 um) 59.0 8.9 17.4 1 1 #200 (75 um) 35.5 5.4 12.0 1 1 PAN 6.5 71.7.3 1 1 1 1 UQUID LIMIT NV 1 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1 1</td><td>1.1.1</td><td>1</td></t<>											1 1	1.1.1	1
#8 (2.36 mm) 223.8 52.0 7.8 52.2 //200 #16 (1.18 mm) 48.2 7.3 45.5 //200 #30 (600 um) 49.9 7.5 39.0 //200 #30 (600 um) 49.9 7.5 39.0 //200 #50 (300 um) 77.2 11.7 24.3 //200 #100 (150 um) 59.0 8.9 17.4 //200 #200 (75 um) 35.5 5.4 12.0 //200 PAN 6.5 79.3 //200 //200 PAN 6.5 71.3 //200 //200 PAN 6.5 5.4 12.0 //200 PAN 6.5 5.4 12.0 //200 PLAN 6.5 79.3 //200 //200 Screen 2.4 10.24 //200 //200 LL-PI ///200 2.4 //200 //200 Wash $axcs$ 10.24 //200 //200 Wash $axcs$ 10.24 <t< td=""><td></td><td>1</td><td>1.</td><td>13.7</td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>1 1</td><td>100</td><td></td></t<>		1	1.	13.7			1				1 1	100	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			52.0										
#30 (600 um) 49.9 7.5 39.0		2.3.0				-					1200		
#50 (300 um) 77.2 11.7 24.3 #100 (150 um) 57.6 8.9 17.4 #200 (75 um) 35.5 5.4 12.0 PAN 6.5 77.7 17.3 39.3								1		-			-
#100 (150 um) 57.6 3.9 17.4													
#200 (75 um) 35.5 5.4 12.0 PAN 6.5 73.7 (4) 39,3 (4) (4) LIQUID LIMIT NV (4) PLASTICITY INDEX NP SAND EQUIVALENT REMARKS $UW.S - VSP(C)$ Tests Tech Date Screen 2.1 $IP-2\delta$ LL-PI (07.8 $IP-2\delta$ Vash ARS 10-2 δ Crush $IP = NP$ $IP = NP$ Crush $IP = PP$ $IP = T/I$ CR LL PI $FF = 90.2 V^{2}$													
PAN $4 \cdot 5$ $72 \cdot 7 \cdot 3$ (4) 39, 3 (4) (4) LIQUID LIMIT NY PLASTICITY INDEX NP SAND EQUIVALENT REMARKS Tests Tech Date REMARKS Screen $2 \cdot 1$ $4 \cdot 5$ $10 \cdot 26$ LL - Pi $(6r \cdot 16 \cdot 10)$ Wash $ARS = 10 \cdot 26$ Crush $21 \cdot 5 \cdot NP$ Crush $QV = 420 \cdot P5T$ Screen $R^* VAlut = 71$ F.F. = 90.2.7-								-		-		-	
39.3 (4) LIQUID LIMIT NY PLASTICITY INDEX NP SAND EQUIVALENT REMARKS $(U, W) - S - V S P(C)$ Tests Tech Date REMARKS $(U, W) - S - V S P(C)$ Screen Cm Wash In-28 LL - Pi (Gradiation V) Wash In-28 Crush CV = 420 PSI Crush REVARKS = 71 CR LL Pi FE = 90.2 %			78-2	2.4	12.0		-					-	
LIQUID LIMIT NY PLASTICITY INDEX NP SAND EQUIVALENT REMARKS Tests Tech Date REMARKS Screen $2m$ $10-2\delta$ Intervention LL-Pi Intervention Wash ABS $10-2\delta$ Intervention $V = 100$ Intervention $V = 1000$ Intervention $V = 1000$ Intervention $V = 10000$ Intervention $V = 10000$ Intervention $V = 10000$ Intervention $V = 100000$ Intervention $V = 1000000$ Intervention $V = 100000000000000000000000000000000000$	PAN		19.3	-							60		
PLASTICITY INDEX NP SAND EQUIVALENT REMARKS $UW - S - VSP(C)$ Tests Tech Date REMARKS $UW - S - VSP(C)$ Screen L_{11} $I0 - 2\delta$ $I0 - 2\delta$ $I0 - 2\delta$ LL - Pi $I0 - 2\delta$ $I1 - 2\delta$ $I1 - 2\delta$ $I1 - 2\delta$ Gradation I	Vision and the second										(4)	-	
SAND EQUIVALENT Tests Tech Date REMARKS UW -S - VSP(C) Screen Cn 10-28 (Gredition V) LL-Pi (Gredition V) (Line V) Wash ARS 10-28 (Gredition V) Gradation 1 1 (CV = 420 PSI Crush CV = 420 PSI (CV = 71) CR LL PI FF = 90.2%													
TestsTechDateREMARKS UW -S-VSP(C)Screen2m10-28LL-PI(or a dationWash ARS 10-29Gradation11Crush $QV = 420$ PSIGrush Wash $REV = 71$ CRUL PIFF = 90.2%		NP											
Screen $2 m$ $10 - 28$ LL - Pi(or n dottors V Wash AKS Gradation11 $PI := NP$ Crush $CV = 420 P5I$ Grush Wash $R^* Value = 71$ CR LL Pi $FF = 90.2 \%$								-					
Screen $2 m$ $10 - 28$ LL - Pi (or n dottion V Wash $AB \leq 10 - 28$ Gradation 1 Dirush $2V = 420 P5I$ Crush $R^{-1} V A lat = 71$ CR LL PI FF = 90.2 ½			te REN	ARKS	UW-S	- VS	PIC.	they betree the					
WashARS10-27 $L = NV$ Gradation L $L = NV$ Crush $CV = 420 PSI$ Grush Wash $R^{T}VAlue = 7I$ CR LL PI $FF = 90.24$		10-2	8		-			-					
GradationII $PI = NP$ Crush $CV = 420 PSI$ Grush Wash $R^{*}V_{A} _{UP} = 71$ CR LL PI $FF = 90.2\%$	LL-PI		0	10 10	tion V								
Crush $CV = 420 PSI$ Crush Wash $R^{*}V_{A} _{UP} = 71$ CR LL PI $FF = 90.2\%$	Wash	5 10-2	2 21	= NU	/								_
Crush $CV = 420 P5I$ Crush Wash $R^{*}V_{A} _{UP} = 7/$ CR LL PI $FF = 90.2\%$	Gradation	11	21	1 = A	JP								-
Crush Wash $\frac{R' V_A u P = 7/}{FF = 90.2\%}$	Crush					OST		_		-			-
CRLLPI FF = 90.2%	Crush Wash			1									-
						/							-
LAR Hydrometer= See Work Sheet		-					1.2	1					_

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Form T-

Rev 9-0

(I I T T - MM

A B M. Of One Variation Water Variation Water Variation Water Variation Water Variation Water Variation Variati				LOCATION	z				PRC	PROJECT	UW R	Scerc	HUH	PROJECT UN RESERVENT	rcH
Contract % refained % relating % relating % relating % relating		A	B									-			
Model is housing Model Sign (2000) Sign	5:1 Ratio	Wt. Of sample		% F & E Particles	% retained weights	Weighted		Wt. Of One or more fractured faces		% retained weights	Weighted %	Nt. 0 or n fract	Wt. Of Two or more fractured	f Two Tore % Two or ured more F.F.	
80.00 335.2 700.0 342.3 80.0 23.0 79.4	SIEVE SIZE														2
600.0 535.2 700.0 35.2.3 700.0 35.2.3 70.0 35.2.3 70.1 73.0 70.1 73.0	Coarse				1.1							-			
70.0 362.3 73.0 73.0 73.0	-3/4"+1/2"						600.0	535.2	1-1	424.0	39.6				
	+#+8/E-						0.00	78.0		12210	20.0	1			
									L	1000	Dior				
1 1 1 1 1 1 1 1 20.4	Medium	r												-	
70.4	-3/4"+1/2"														
70.4	-3/8"+#4													_	
20.1	Tines	1													
70. Y	-1/2"+3/8"											-		-	
90.Y	-3/8"+#4														
70.4	Filler				-										
90.4	-1/2"+3/8"					a									
Treads in the artifuctor	t#+ 0/2-						1	90.4							
treads in the adjusted	Weighted Total 9										90.2				
treads in the additional	Flat & Florented	Formula													
Dould to the addicated	(B / A) X 100 = %	Luillion							Note: Flat test = wid Elongated tes	dth to thickne st = length to	ass width				
	To calculate the weil	ahted %.	the +#4 needs to he	adiuetad					Flat & Elon	ngated = I	ength to thickn	SSa			
so when all the new retained weights? W1X=weighted 5	so when all the new	retained	weights of	natesting					WI % = welghie	2° D					

To calculate the weighted %, the +#4 needs to be adjusted so when all the new retained weights of the +#4 are added together. Uney agual 100%, Multipy the % of flat & elong, times the % retained of that sieve. Then multiply that times % of flat in there are multiple stockpiles if necessary. Add the weighted %'s on the various sieve sizes and report.

Note: The size containing less than 10% will use the same % of flat & elongated as the sleve above it or below it.

Fractured Face Formula: P=[F/(F+N)] X 100

F= Fractured Faces N= No fractured faces P= Percent of fractured faces

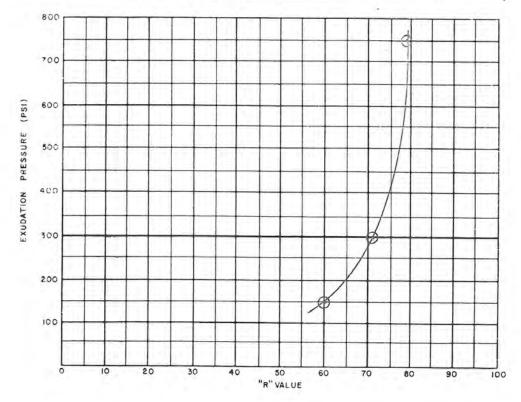
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Form T-115 Rev. 5/91

WYOMING DEPARTMENT OF TRANSPORTATION

SOILS STABILOMETER WORK SHEET

TEST SPECIMEN	A	8	C	D	LL	PL	PI	LAB. NO				
MOLD NO	1	10	21		1			07	100	06		
COMPACTOR AIR PRES-PSI	350	350	350		SOIL	CLASS 8	GROUP	INDEX	PH	OJEC	т	
INITIAL MOIST - %		-	-									
WATER ADDED-ML	80	100	90		FIELD	IDENT			STAT	ION		
WATER ADDED-%					1	NITIAL	MOISTU	RE	1_0			
MOIST AT COMPACTION %	6.7	8.3	7.5		WET		DRY	1.00	3/4"	-		
WET WEIGHT OF PAT-GMS	1218	1223	1209		DRY		TARE		3/8			
HEIGHT OF PAT-INCHES	2.61	2.49	2.51		WATER		DRY		NO.	4		_
DENSITY-LB.PER CU.FT.	132.5	138.5	135.8	-	EXPANSION SPECIMEN				А	B	C	D
STAB. Ph AT 1000 LBS	11	18	14		DIAL READING				0	0	0	
2000 L 85.	23	41	29		COV	ER REC	UIRED -	INCHES		1		
DISPLACEMENT	4,37	4.77	4.71		TIN NO.	REMA	RKS:				T-115A	
"R" VALUE	77 79	60	71		1	(Jun	- 5 - VS	015			"R" VA	LUE
EXUDATION PRESS. PSI	750	150	100		1	000	2.03	· (L)			1 7	71



WYOMING DEPARTMENT OF TRANSPORTATION REV. 5/86 MATERIALS TESTING LABORATORY h: Vorms/soil&sunt-DAVEG.XLS

REPORT OF NATURAL CEMENTATION OF AGGREGATE FINES

REPORT NO. 102	0-VSP-C	DATE	
PROJECT NUMBER		SOURCE	UW-Research
ENGINEER		FOR USE AS	

TEST RESULTS

F + H*0 =	GT7.2		O,D.	BULK= 2.488
F + M + H20 =		TARE PAN	F + H ^z 0 + 500 - F,M,H ^z 0	
MATERIAL + TARE =		289.9 9.	0.D	APPARENT: 2 45
O.D. =	- TA +		F + H20 + O.D F.M.H20	

	FLASK	F+M	F + H*0
1	183.3	683.3	683.0
2	170,2	670.2	668.4
3	184.8	684.8	682,6

1			Moisture (a s.s.e.		
		MOISTU	RE SAMP	LE FROM -4 S/G		
	TARE WEIGHT	289.9	_		A	
	WET WEIGHT	500.0	-	WT, OF MOISTURE		
	- DRY WEIGHT	490.4		+ DRY WEIGHT		
	= WT. OF MOISTURE	9.6	-	MOISTURE % @ S.S.D.	2.0%	95 ML
		MOISTURE @	S.S.D + 5	% FOR COMPACTION		
	 I = 1 	MOIS	TURE @ C	OMPACTION		
	MOISTURE S	AMPLE FROM	A EXCESS	MATERIAL AFTER CO	OMPACTION	
	TARE WEIGHT		_			
	WET WEIGHT	503.4		WT, OF MOISTURE	33.9	
	- DRY WEIGHT	469.5		+ DRY WEIGHT	469.5	
	= WT. OF MOISTURE	33.9	-	MOIST. % @ COMPACTION	6.7	
	MACHINE LOAD	÷ 4		PSI		
1	1805	÷ 4 ÷ 4	=	451	MOLD	
2	1588	÷ 4	-	397		
3	1644	7 4		411 420		
AVG.	1679		AVG.	720		
	APPARENT S/G		1	BULK S/G	1	
	MOISTURE @ S.S.D			ABSORBTION %		
MOIST	TURE @ COMPACTION				· · · · · · · · · · · · · · · · · · ·	
IOTES:30ml=2% moistu	ire .					
	TESTE	DBY			ENGIN	IEER

	GRAI	IN SIZE DISTRIBUTION TEST DATA	
Project: U.W.		international and an and a second	
Project Number		Client: G. Huntington	
		Sample Data	
Source: UW-S-V	SPC		
Sample No.: 81	.026		
Elev. or Depth	12.	Sample Length (in./cm.):	
Location: Cros	s H Pit		
Description: S	ilty sand		
		Mechanical Analysis Data	
	Initial		
Dry sample and	l tare= 769.4	12	
Tare	= 0.0	0	
Dry sample wei	ght = 769.4	12	
	n number 10 si		
Split sample d	the second s		
		are = $.00$ Sample weight = 76.41	
	eight retained		
and the second	ative weight r		
Sieve	Cumul. Wt.	Contraction and a second se	
	retained	finer	
3 inch	0.00	100.0	
1.5 inch	0.00	100.0	
.75 inch	0.00	100.0	
.375 inch	0.00	100.0	
# 4	2.93	99.6	
# 10	122.45	84.1	
# 20	14.79	67.8	
# 40	30.33	50.7	
# 100	50.70	28.3	
# 200	57.48	20.3	
1 200	- (1.0.9		
		Hydrometer Analysis Data	
Separation sie			
		olete sample= 84.1	
그 같은 아이들은 이렇게 이야지 않는 것이 많이 많이 많다.	ometer sample:		
	isture correct		
	& tare = 139.		
Dry weight &	tare = 138.	.90	
Tare	= 61.6	58	
Hygroscopic	moisture= 0.7	8	
Calculated bia	sed weight= 90	0.85	
Automatic temp	erature correc	tion	
Charles and the second s		deg C = -6.7	
Meniscus corre	ction only= 0		
	ty of solids=	2,663	
	ty correction		
Hydrometer typ			
		1964 - 0 164 - Pm	
Effective d	epch L= 10.294	1964 - 0.164 x Rm	

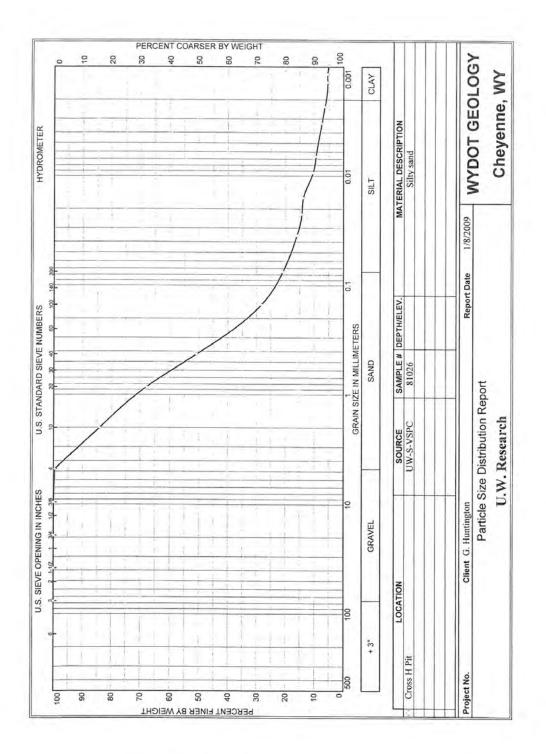
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8.5	21.5	14.4	0.0139	01 E				
	20.0			21.5	12.8	0.0350	15.9	
a 6		12.9	0.0139	20.0	13.0	0.0223	14.2	
8.5	19.5	12.4	0.0139	19.5	13.1	0.0159	13.7	
8.5	16.5	9.4	0.0139	16.5	13.6	0.0093		
9.0	15.5	8.6	0.0138	15.5	13.8	0.0066	9.4	
0.0	13.5	6.8	0.0136	13.5	14.1	0.0033	7.4	
0.5	12.5	5.9	0.0135	12.5	14.2	0.0023		
8.5	12.0	4.9	0.0139	12.0	14.3	0.0014		
1.0	11.5	5.0	0.0134	11.5	14.4	0.0012		
9.0	11.5	4.6	0.0138	11.5	14.4	0.0010	5.0	
	8.5 9.0 0.0 0.5 8.5 1.0	8.5 16.5 9.0 15.5 0.0 13.5 0.5 12.5 8.5 12.0 1.0 11.5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8.5 16.5 9.4 0.0139 9.0 15.5 8.6 0.0138 0.0 13.5 6.8 0.0136 0.5 12.5 5.9 0.0135 8.5 12.0 4.9 0.0139 1.0 11.5 5.0 0.0134	8.5 16.5 9.4 0.0139 16.5 9.0 15.5 8.6 0.0138 15.5 0.0 13.5 6.8 0.0136 13.5 0.5 12.5 5.9 0.0135 12.5 8.5 12.0 4.9 0.0139 12.0 1.0 11.5 5.0 0.0134 11.5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8.5 16.5 9.4 0.0139 16.5 13.6 0.0093 9.0 15.5 8.6 0.0138 15.5 13.8 0.0066 0.0 13.5 6.8 0.0136 13.5 14.1 0.0033 0.5 12.5 5.9 0.0135 12.5 14.2 0.0023 8.5 12.0 4.9 0.0139 12.0 14.3 0.0014 1.0 11.5 5.0 0.0134 11.5 14.4 0.0012	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$

Fractional Components

Gravel/Sand based on #4 Sand/Fines based on #200 * + 3" = 0.0 * GRAVEL = 0.4 * SAND = 78.8 * SILT = 14.9 * CLAY = 5.9 (* CLAY COLLOIDS = 5.1) D₈₅= 2.10 D₆₀= 0.61 D₅₀= 0.41 D₃₀= 0.17 D₁₅= 0.03 D₁₀= 0.01 C_c= 5.3697 C_u= 72.4827

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APPENDIX D SAS CODE AND RESULTS

SAS Code for Dust Contrasts

DM LOG 'CLEAR'; DM OUTPUT 'CLEAR';

DATA Both_Counties_Average;

INFILE 'R:\RAP Writings & Data\DATA\Statistical Analysis\Both Counties SAS\Average.csv' DLM = ',' DSD MISSOVER; INPUT Section \$ Dust Moisture Age Wind Pass; Log_Dust=log(Dust);

PROC PRINT DATA = Both_Counties_Average; TITLE 'Estimate No Pass Both Counties Average';

RUN;

ODS RTF FILE = 'R:\RAP Writings & Data\DATA\Statistical Analysis\Both Counties SAS\Estimate No Pass Both Counties Average.rtf' BODYTITLE;

PROC GLM alpha = 0.10
DATA=Both_Counties_Average;
CLASS Section;
MODEL Log_Dust = Section Moisture Age Wind /solution;
ESTIMATE 'Average Laramie vs Johnson' section 3 3 3 3 3 -5 -5 -5/ DIVISOR=15;
ESTIMATE 'Average noRAP vs RAP' section 5 -3 -3 5 -3 5 -3 -3/ DIVISOR=15;
ESTIMATE 'Average noCaCl vs CaCl' section 1 1 1 1 1 -3 -3 1/ DIVISOR=6;
output p=fit r=res out=datsec;
RUN;

ODS RTF CLOSE;

SAS Code for URCI Contrasts

DM LOG 'CLEAR'; DM OUTPUT 'CLEAR';

DATA Both_Counties_Average_URCI; INFILE 'R:\RAP Writings & Data\DATA\Statistical Analysis\Both Counties SAS\AverageWithURCI.csv' DLM = ',' DSD MISSOVER; INPUT Section \$ URCI Dust Moisture Age Wind Pass;

PROC PRINT DATA = Both_Counties_Average_URCI; TITLE 'Estimate No Pass Both Counties Average URCI'; RUN;

ODS RTF FILE = 'R:\RAP Writings & Data\DATA\Statistical Analysis\Both Counties SAS\Estimate No Pass Both Counties Average URCI.rtf' BODYTITLE;

PROC GLM alpha = 0.10

DATA=Both_Counties_Average_URCI; CLASS Section; MODEL URCI = Section Dust Moisture Age Wind /solution; ESTIMATE 'Average URCI Laramie vs Johnson' section 3 3 3 3 3 -5 -5 -5/ DIVISOR=15; ESTIMATE 'Average URCI noRAP vs RAP' section 5 -3 -3 5 -3 5 -3 -3/ DIVISOR=15; ESTIMATE 'Average URCI noCaCl vs CaCl' section 1 1 1 1 1 -3 -3 1/ DIVISOR=6; output p=fit r=res out=datsec; **RUN**;

ODS RTF CLOSE;

SAS Results for Average Contrasts

Estimate Both Counties Average

The GLM Procedure

Class Level Information				
Class	Levels	Values		
Section	8	A0 A1 A2 P0 P1 S0 S1 S2		

Number of Observations Read	96	
Number of Observations Used	95	

The GLM Procedure

Dependent Variable: Log_Dust

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	35.96941872	3.59694187	10.34	<.0001
Error	84	29.22510617	0.34791793		
Corrected Total	94	65.19452489			

R-Square	Coeff Var	Root MSE	Log_Dust Mean
0.551725	-123.8379	0.589846	-0.476305

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Section	7	16.40863705	2.34409101	6.74	<.0001
Moisture	1	0.18007628	0.18007628	0.52	0.4739
Age	1	10.56048849	10.56048849	30.35	<.0001
Wind	1	8.82021690	8.82021690	25.35	<.0001

Source	DF	Type III SS	Mean Square	F Value	$\mathbf{Pr} > \mathbf{F}$
Section	7	28.53127923	4.07589703	11.72	<.0001
Moisture	1	0.10082701	0.10082701	0.29	0.5918
Age	1	7.93235049	7.93235049	22.80	<.0001
Wind	1	8.82021690	8.82021690	25.35	<.0001

Parameter	Estimate	Standard Error	t Value	$\mathbf{Pr} > \mathbf{t} $
Average Laramie vs Johnson	1.05741117	0.13723690	7.71	<.0001
Average noRAP vs RAP	0.38804705	0.13641207	2.84	0.0056
Average noCaCl vs CaCl	1.26457298	0.16427895	7.70	<.0001

Parameter	Estimate		Standard Error	t Value	$\Pr > t $
Intercept	0.218606698	В	0.20751041	1.05	0.2951
Section A0	0.615692996	В	0.24718199	2.49	0.0147
Section A1	0.284570246	В	0.23352320	1.22	0.2264
Section A2	0.374399685	В	0.23112192	1.62	0.1090
Section P0	0.800149550	В	0.24199452	3.31	0.0014
Section P1	0.336765895	В	0.23837916	1.41	0.1614
Section S0	-0.430894872	В	0.26174894	-1.65	0.1035
Section S1	-1.294391623	В	0.25694116	-5.04	<.0001
Section S2	0.000000000	В		•	
Moisture	0.047883216		0.08894740	0.54	0.5918
Age	-0.009349600		0.00195808	-4.77	<.0001
Wind	-0.074204682		0.01473771	-5.04	<.0001

SAS Results for URCI Contrasts

Estimate No Pass Both Counties Average URCI

The GLM Procedure

Class Level Information				
Class Levels Values				
Section	8	A0 A1 A2 P0 P1 S0 S1 S2		

Number of Observations Read	83
Number of Observations Used	82

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

The GLM Procedure

Dependent Variable: URCI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	3286.317073	298.756098	16.90	<.0001
Error	70	1237.207317	17.674390		
Corrected Total	81	4523.524390			

R-Square	Coeff Var	Root MSE	URCI Mean
0.726495	4.626702	4.204092	90.86585

Source	DF	Type I SS	Mean Square	F Value	$\mathbf{Pr} > \mathbf{F}$
Section	7	2452.088027	350.298290	19.82	<.0001
Dust	1	128.604882	128.604882	7.28	0.0087

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Moisture	1	83.787327	83.787327	4.74	0.0328
Age	1	612.437535	612.437535	34.65	<.0001
Wind	1	9.399302	9.399302	0.53	0.4683

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Section	7	2486.419342	355.202763	20.10	<.0001
Dust	1	26.705805	26.705805	1.51	0.2231
Moisture	1	16.169123	16.169123	0.91	0.3421
Age	1	591.089166	591.089166	33.44	<.0001
Wind	1	9.399302	9.399302	0.53	0.4683

Parameter	Estimate	Standard Error	t Value	$\Pr > t $
Average URCI Laramie vs Johnson	5.26596165	1.28732118	4.09	0.0001
Average URCI noRAP vs RAP	4.80737817	1.18336694	4.06	0.0001
Average URCI noCaCl vs CaCl	8.67047145	1.60173674	5.41	<.0001

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Parameter	Estimate		Standard Error	t Value	$\mathbf{Pr} > \mathbf{t} $
Intercept	102.0479995	В	2.22689771	45.83	<.0001
Section A0	4.6065644	В	2.11742462	2.18	0.0330
Section A1	-2.1220789	В	1.88501433	-1.13	0.2641
Section A2	-11.3945134	В	1.92136966	-5.93	<.0001
Section P0	6.3220059	В	2.21834442	2.85	0.0057
Section P1	-3.1984453	В	1.88878748	-1.69	0.0948
Section S0	-11.3108234	В	2.26424636	-5.00	<.0001

Parameter	Estimate		Standard Error	t Value	$\mathbf{Pr} > \mathbf{t} $
Section S1	-7.9589419	В	2.29688627	-3.47	0.0009
Section S2	0.0000000	В			
Dust	1.5379255		1.25113650	1.23	0.2231
Moisture	-0.7106810		0.74302542	-0.96	0.3421
Age	-0.1239219		0.02142860	-5.78	<.0001
Wind	-0.1010580		0.13857820	-0.73	0.4683

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. estimates are followed by the letter 'B' are not uniquely estimable.

Terms whose