# Gravel Roads Study

Bob Moorhead, P.E.
CRAB Maintenance Manager
April 2016

**Contributors**

This report is the result of many county staff members who completed a “Survey Monkey” questionnaire; shared information in the course of sixteen scheduled county visits; and responded to various e-mail requests for specific information. The road system spreadsheet in Attachment F was developed by Don Zimmer, CRAB Road Log Manager. The report was compiled by Bob Moorhead, P.E., CRAB Maintenance Manager.

**Cover Photo**

Bateman Road Grading. Courtesy of Benton County.

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**Washington State**

**County Road Administration Board**

2404 Chandler Court SW, Ste 240, Olympia, WA 98504-0913

360/753.5989 – www.crab.wa.gov

April 14, 2016

The Honorable Dale Snyder, Chairman
County Road Administration Board
2404 Chandler Court SW
Olympia, WA 98904-0913

Mr. Chairman and Members of the Board:

There is possibly nothing more representatively iconic of rural Washington State or, perhaps, of rural America than is the simple line of an unstriped, unpaved road hugging the land contours as it stretches through large, open spaces and reaches toward a distant horizon. As the pages of this report will show, this kind of road is not just emblematic of the history of surface transportation in our state, but is very much a functioning part of the system as it exists today, and will remain an important part of it for many future years.

It should be kept in mind that of the nearly 40,000 miles of roads currently shown on the road log of the thirty-nine counties, over thirty-five percent of this total is made up of gravel/unpaved roads. Without regard to ADT or freight route classification, the sheer bulk of this road mileage is indicative of its importance to the system, and serves to remind us that its maintenance and preservation is deserving of our attention and resources. I say this for two reasons. When I first came to the CRABoard in the early 1990's, there were but a few voices advocating for this portion of the county system. There are fewer voices today. The second reason I put this before you is that among those responsible for transportation stewardship, the state, the cities and the counties, there is no other voice but yours to be raised to identify, quantify and advocate for this funding need. It cannot be glossed over, and we cannot let it be forgotten.

Finally, I would like extend my thanks to the CRAB staff and those from counties across the state who responded to our requests for information and assistance.

Mr. Chairman and members of the Board, I commend this study and report to your serious consideration and favorable review.

Sincerely,

Jay P. Weber
Executive Director

## EXECUTIVE SUMMARY

Gravel/unpaved roads are important components of the transportation system of Washington's 39 counties. While the mileage, terrain, weather conditions, uses, and public expectations vary widely, each county has developed methodologies to meet those local needs. With these wide variances, there is no need for uniform maintenance specifications, techniques, or funding scenarios addressing gravel roads. While this report highlights issues particular to gravel roads, what are needed are the resources to get the jobs done, not only on gravel roads, but throughout the counties' transportation systems. With adequate funding, the usual components of Maintenance Management (Personnel, Equipment, and Materials) are available to meet the locally-defined needs.

## RECOMMENDATIONS

The resulting recommendations address the four major components noted above (Personnel, Equipment, Materials, and Finance) and a fifth: Information Sharing. While each county's legislative authority is responsible for the financial resources, and county employees use those resources to achieve the desired results, the sharing of information among the counties about new equipment, materials and techniques (what works, what doesn't) broadens the body of knowledge, enabling those doing the work to be more effective and efficient.4

**Gibson Draw Road. Courtesy of Lincoln County**

## INTRODUCTION

Gravel roads are a fact of life in each of Washington's 39 counties, accounting for almost 13,600 centerline miles (35%) of the counties' road systems state-wide. Whether it be less than three centerline miles in Clallam County, or more than 1,500 in Lincoln County, challenges abound. The standard components of Maintenance Management are *Personnel*, *Equipment*, and *Materials*. The
maintenance and preservation of gravel roads obviously requires different equipment and materials from the maintenance of paved (typically chip seal) roads. It also requires a different skill set for the personnel.

This report explores many of the factors comprising gravel road maintenance, from those noted above to the widely variable issues of terrain, weather, local practices and preferences, and financial considerations.

## GRAVEL ROAD CLASSIFICATIONS

Of the 13,600 centerline miles of gravel road in the county systems, about 600 are classified as arterial truck routes, and almost 700 are classified as local access truck routes. The remaining 12,300 centerline miles are classified as local access, and include 3,800 miles further classified as primitive roads.

**Early Spring Grading on Euclid Road. Courtesy of Spokane County**

## BACKGROUND

In 1996, at the request of the Washington State Legislature, the County Road Administration Board (CRAB) prepared a report released in January 1997 entitled County Gravel Roads in Washington State, "A Status Report and Proposed Upgrade Program." Using statistical data for crop yields (primarily of wheat and potatoes), the report calculated estimated freight tonnages to identify three categories of gravel roads as "high priority" candidates for converting to bituminous surface treatment (or chip seal): Freight and Good Transportation System (FGTS) Routes; Arterial and Collector Routes; and Urban Roads. While the Arterials and Collectors were noted as being eligible for various state and federal grant funding programs, about 430 miles of the FGTS routes and virtually all of the unpaved urban roads were classified as "Local Access" and not eligible for the grant funding. Another concern at the time was air pollution, as the federal Environment Protection Agency (EPA) was performing studies related to identifying areas of "non-attainment" under the National Ambient Air Quality Standards for Particulate Matter (PM-10)." The majority of these sites were within the more densely populated urban areas, hence the inclusion of the urban county roads in the report. The funding shortfall in 1997 was estimated to be more than $825 million, and several courses of action were recommended to develop an on-going funding source to address the issues.

In the two decades since the original study was presented, no additional funding sources have been authorized, nor any existing sources increased to address the identified problems. In reviewing the report in 2016, several of the original assumptions now appear to be invalid, and many of the recommended actions, if undertaken today, would result in additional costs to address safety and environmental issues that have become routine in road improvement projects in Washington State.

Among the assumptions of the 1997 report that would need to be reviewed and revised are:

a. No significant roadway widening or horizontal and vertical alignment changes were considered in the cost estimate. By today's standards, a "paved road" would typically have at least 22 feet of hard surfacing, plus appropriate shoulder widths, based on traffic volumes.
b. No cost estimates for additional right-of-way were included in the 1997 report. These costs, while not quantified for this report, would not be insignificant.
c. There were no costs estimated for modifying or replacing existing drainage structures (various culverts types and short-span bridges).
d. Current environmental issues such as fish passage barriers were only starting to come to the public's attention in 1997.

In summary, the funding challenges of 1996 remain, and have increased. Issues of safety, protection and enhancement of the environment, and local residents' preferences have been added. The goal of "paving" most of the existing gravel roads in Washington's counties may be feasible no longer. The prudent emphasis for gravel roads in the 21st Century will be preservation and maintenance using proven techniques that provide the best results with the limited financial resources available.

## CURRENT OVERVIEW

In the vast majority of cases, gravel roads are a functional, effective, and economical option to provide access and appropriate levels of service in rural settings. This is not to say that land uses and expectations of the users of gravel roads have not changed in some locations over the years. While public works maintenance management typically identifies three primary components (personnel, equipment, and materials), there is really a fourth: finances. The funding available for maintenance functions is the defining factor for the end result.

### A. Financial

When it comes to county gravel roads, the local county Road Fund and the county direct distribution share of the state Motor Vehicle Fuel Tax are the primary (if not the only) financial resources available. Of the 13,557 miles of gravel county roads in the state, only about 4% (576 miles) are classified as arterials and eligible for various federal and state transportation grant programs (STP, RAP, CAPP, TIB). The remaining 12,981 miles of rural gravel roads, classified as Local Access, are not eligible for any of the grant programs.

The opportunities for additional funding for local access road maintenance, including most gravel roads, are limited. With the wide range of gravel road mileage among the counties, additional state funding focused only on gravel roads would not be equitable. An increased share from the Motor Vehicle Fuel Tax would benefit all counties and all county roads. Over the past 25 years, the state Motor Vehicle Fuel Tax has increased from 23 cents to 44.5 cents in July, 2015, and will increase to 49.4 cents in July, 2016. During that same time, counties' share of the MVFT has dropped from about 33% to 25% of the total collected, while the Washington State Department of Transportation share has increased from about 33% to 50%. So while the counties' share increased from about 7.6 to 12.4 cents, the WSDOT share increased from about 7.6 to 25.7 cents, even though the "cost of doing [road maintenance] business" increase was about the same for both road systems. Of course, it should be recognized that WSDOT has undertaken a very large series of capital improvements over that time period.

The maximum local property tax levy for county roads is statutorily set at $2.25 per $1,000 of assessed value on parcels in the unincorporated areas. Among the 39 counties, only four budgeted for the maximum levy rate in 2015, while five set levy rates at less than 50% of the maximum. Looking at a state-wide summary, the counties collectively collected about 76% of the maximum road property tax revenues. To be sure, in some counties with relatively high property values and relatively small road systems, imposition of the maximum rate is neither required nor desirable. And, in other areas, the maximum road levy may be limited by the 1% annual maximum increase in rates.

### B. Personnel

For the maintenance of gravel roads, the skill of the veteran equipment operator is perhaps the most important asset. Being well-versed in the local road usage, subbase and surface materials, terrain, and weather, the equipment operator performs the gravel road grading tasks with minimal or no direct supervision. Among the challenges facing many counties is the current wave of retirements among the "baby boomer" generation, those employees in their 50s and 60s. In many counties, especially those in the most rural (or even remote) areas, the

pool of potential applicants in the younger generations is limited. Add to this the time needed to train a new employee to become a seasoned operator, and wage scales that may not be competitive with the private sector and other career paths, recruitment and retainage of skilled employees may become and remain a long-term issue.

### C. Equipment

All of Washington's counties utilize Equipment Rental & Revolving (ER&R) Funds to manage the road department fleets of equipment and vehicles. This methodology has been successful in keeping most county maintenance equipment modern and in good working order. But, as equipment rental rates include allowances for replacing equipment on a regular schedule, and the cost of new equipment is generally higher, these costs are significant factors in road maintenance budgets and expenditures. On the other hand, the latest equipment may come with new features that improve productivity and reduce operating costs.

The most common road graders in use by Washington counties are Caterpillar and John Deere models. Among the accessories in use by several counties is a "Walk'n'Roll" compactor, which is attached to the rear hydraulic mounting system on the road graders.

Caterpillar M12 Grader

John Deere 770 Series Grader

Walk'n'Roll Compactor

**D. Materials**

Of course, the primary material needed for the maintenance of gravel roads is gravel. Some counties have access to their own sources or nearby commercial vendors, while others have long hauls to remote road locations. The quality of the materials can vary as well. The counties have generally developed their own preferences as far as material specifications with ½" to 5/8" to even 1-1/4" the common sizes. But here again, based on the local sources and conditions (weather patterns, terrain, traffic volumes and seasonal truck traffic), the desired percentage of "fines" (smaller particles and dust) in the gravel mixture can vary from county to county, or even within a county.

Some Washington counties have reported success with the use of asphalt grindings as part of the top course on a gravel road project. This material may be available from nearby city, county, or WSDOT overlay or chip seal projects at minimal cost.

Another gravel road maintenance material is decomposed granite. While it is available in some northern areas of the state, its use is somewhat limited. In some cases, the shape of the aggregate prevents optimum compaction and reduces traction.

Other materials in common (if not widespread) use on county gravel roads include Magnesium Chloride (a salt) and Lignin Sulfonate (an organic) to stabilize the road and reduce dust. Several counties even use a mixture of these products. The application of these materials is usually in liquid form and incorporated into the routine maintenance blading activity. Care is required in the use and application of these materials to achieve the optimum result and avoid negative environmental impacts to the adjacent private land uses and sensitive areas.

## BEST MANAGEMENT PRACTICES (BMPs)

There are many gravel road maintenance techniques that are common to counties in Washington State. Each county has developed its own standard methods to address the local conditions, uses, and public expectations with the available skilled personnel, well maintained equipment, and local materials. Among the gravel road basics are:

**Grading Frequency:** Virtually all gravel county roads in the state are graded at least twice a year. The most common schedule is once in the spring and once in the fall when seasonal rains provide the needed moisture to get the greatest benefit. Beyond that, each county knows which gravel roads need more attention, and when that additional effort is needed. Factors requiring additional grading include weather, seasonal truck traffic for crop harvests and logging activities, and seasonal recreational traffic. Depending on the agricultural commodity and the intensity of the hauling, some gravel roads may need blading several times a month or even weekly during the harvest season.

**Grading Techniques:** While there are commonly accepted three-pass and five-pass grading patterns, most of Washington's counties rely on the expertise, skill, and knowledge of the individual equipment operators to get the job done effectively and efficiently. There is just no substitute for experience!

**Sharing Information:** There are numerous avenues available for the counties to share information on maintenance techniques and materials.

- For the 20 counties east of the Cascades, the Eastern Washington Association of County Road Supervisors (EWACRS) usually meets three times a year to share information, hear vendor presentations, and get caught up on new equipment purchases.
- For the 19 counties west of the Cascades, the Western Washington Association of County Road Supervisors (WWACRS) also holds meetings with the same goal.
- Washington State University conducts the annual Road and Street Supervisors Conference in Yakima each October, bringing presentations, vendors, and networking opportunities.
- The Washington State Chapter of the American Public Works Association holds an annual Equipment ROADeo in the fall, with maintenance workers competing in the operation of loaders, backhoes, and snow plow trucks. In just three years, participation has doubled from about 25 to 50 participants.
- The County Road Administration Board gathers information on asphalt and chip seal oil bids, and distributes the updated tally weekly from January to May each year.

## MAINTENANCE COSTS FOR GRAVEL VS. PAVED ROADS

One of the goals of this report has been found to have no consistent answer. While it may be generally thought that gravel roads cost less per centerline mile to maintain than roads with chip seal or bituminous surface treatment (BST) hard surfacing, the anecdotal information from about one-third of Washington's counties is not consistent. Estimates of gravel road maintenance ranged from $1,528 to $23,651 per mile, while paved roads ranged from $3,892 to $26,374 per mile. The wide differences can be attributed to various factors, such as:

- The number of times per year a gravel road requires maintenance grading.
- The number of miles of gravel roads, and the proximity to equipment storage sites.
- The regional weather, terrain, and subgrade conditions.
- Seasonal traffic volumes and percentage of trucks.
- Historic maintenance patterns.
- Local users' expectations of road conditions.
- Levels of road maintenance budgets and financial resources.

## TRYING SOMETHING NEW

Washington's 39 county road departments are not creatures of habit that resist the opportunities to try new things. Some are finding success with equipment and techniques that other counties may have tried in the past and discarded. Only time will tell if the initial enthusiasm will be maintained over several seasons, or if other counties take the plunge of a new method or piece of equipment.

### A. Rock Rake

Columbia County has recently purchased a Rock Rake, manufactured by Poor Boy Graders of Tonasket, Washington. The unit is pulled behind a 4x4 pickup truck, and has adjustable settings for the angle of the rake and the depth of the tines. The settings are adjusted hydraulically using a hand-held controller. By moving larger rocks to the side and sifting the gravel through the rake teeth, the surface crown can be restored and the irregular wash boarding and rutting defects can be reduced.

It should also be noted that in several counties the use of a rock rake has been curtailed or discontinued as the results were found to be less than satisfactory for the local conditions and traffic volumes.

Poor Boys Grader

**B. Linear Crusher**

Ferry County has leased a Linear Crusher from Vanway International of Kingston, Idaho, for short periods of time for several summers. The device mounts on a large front-end loader, and excavates into the roadway surface and base courses and crushes the material into a uniform gradation that can be reused as base course or top course gravel. The primary advantages are that there is less need to haul in surface material from distant pits and stockpiles, and on-site material is re-used within the roadway template.

Vanway Roadtech V600H Linear Crusher

### C. Asphalt Grindings

Adams County is one of several in the northwest that has had success in using asphalt grindings as a surface course for gravel road maintenance. Working with the Washington State Department of Transportation (WSDOT), the grindings from an I-90 paving project were stockpiled at a county site at little or no cost. The county then utilized the grindings as maintenance rock on gravel county roads. The uniform gradation and residual asphalt oil in the materials blended well into the re-surfacing efforts. While the availability of asphalt grindings may be limited in many areas, they are an innovative and effective option for gravel road maintenance practices.

**Tokio Road with asphalt grindings (2012). Courtesy of Adams County.**

**Tokio Road re-grinding and mixing 2012 Asphalt grindings into roadway surface (2015). Courtesy of Adams County.** The original grindings were found to have large chunks that made routine maintenance grading difficult.

## CONCLUSIONS

The maintenance and operation of unpaved/gravel roads, while employing similar equipment, materials, and techniques across the state's counties, have significantly different budget and management impacts from region to region and even from county to county. However, each county has developed gravel road maintenance practices to meet the local conditions, available finances, and public expectations.

With the 19 counties west of the Cascade Divide maintaining 3 to 74 centerline miles of gravel road (average 29 miles), and the 20 counties east of the divide maintaining 29 to 1,541 centerline miles (average 650 miles), it is evident that gravel road maintenance costs are much more significant on the east side of the state. With this great imbalance, any suggestions to identify new state-wide funding options specifically for gravel roads could result in an inequitable distribution among the counties. However, additional resources at the state level distributed through the current formulae would assist all the counties in meeting the growing expenses of overall county road maintenance.

On the local level, with only four counties choosing to levy the maximum allowable Road Levy of $2.25 per $1,000 of assessed value on unincorporated areas, there may be opportunities for local action. In considering this option, the maximum 1% allowable increase in property tax levies, as well as the political realities within each county may be limiting factors.

Data from responding counties indicate maintenance costs per centerline mile of gravel roads are generally 50% to 60% of the costs for Bituminous Surface Treated (BST) roads. However, there are instances where the gravel road can cost as much, or even more, to maintain. This can be the case when one or more of these factors is present:

- The relatively few miles of gravel road require equipment, materials, and personnel skills that are not needed on the much larger paved system.
- The sections of gravel roads are in remote areas and/or some distance from the maintenance facilities where the equipment is stored and the materials are stockpiled.
- Climate, terrain, and ground conditions are such that extra equipment (water trucks, self-propelled roller/compactors, and material haulers) increase the maintenance costs.
- Gravel roads that need blading more than twice a year, during times of agricultural planting and harvest, timber harvest, seasonal recreation traffic, or industrial shipments.
- Established maintenance routines and practices and local road user expectations.

In light of the great variance in gravel road mileage and maintenance practices among the counties, the priorities for utilizing County Road Fund should remain the responsibility of each county's legislative authority.

## RECOMMENDATIONS

It is unlikely that any single gravel road maintenance technique will be applicable or practical in all of Washington's 39 counties. It is equally unlikely that any specific piece of equipment will gain universal acceptance. And, in matters of revenues and expenditures, no "one size fits all" uniform methodology will meet the needs of every county. What can be shared state-wide is information on all these topics.

**Funding/Finances:**

- Statewide: Continue on-going efforts to provide additional transportation funding to the counties from state collected revenues, with a goal of regaining parity with the Washington State Department of Transportation.
- County Road Levy: In 2015, only four of the 39 counties had imposed the maximum Road Levy rate of $2.25 per $1,000 of assessed value within the un-incorporated road district. While some counties may be limited by the maximum 1% annual increase in property tax rates, when identifying potential revenue increases, include this option.
- Transportation Benefit Districts: Within limits, and subject to action by the county legislative authority and/or a public vote, consider the several options for additional Road Fund revenues available through this tool.

**Personnel:**

- Continue and expand employee safety and equipment operation training in all areas of public works.
- Provide cross-training among employees for flexibility and efficiency.
- Initiate actions to retain experienced road maintenance crew members, recognizing that members of the "baby boomer" generation are reaching retirement age.
- Develop recruitment and training programs to provide opportunities for career ladders for the next generation of public works employees.

**Equipment:**

- Maintain equipment to insure availability and productivity.
- Establish reasonable replacement schedules for major equipment, based on usage, county finances, and advancements in equipment technology.

**Materials:**

- Maintain product quality in the purchase, production, stockpiling, storage, and delivery of road maintenance materials.

**Information Sharing:**

Often the best information on any task or process comes directly from the employees doing the task. The sharing of experiences in old and new methods, equipment, and materials, and the successes, or lack thereof, in those efforts are valuable tools in the overall learning experience. For that reason, opportunities to spread that knowledge to peers in other agencies are essential. Whether it be regular meetings of the Eastern and Western Associations of County Road Supervisors, the APWA ROADeo, Washington State University's Annual Road & Street Maintenance Conference, or a casual telephone call asking about something new in another county, keeping lines of communication open is valuable tools in getting the work done efficiently and effectively.

**ATTACHMENTS**

A. **“Survey Monkey” Questionnaire Response Summary**

B. **Summary of County Visits**

C. **WWACRS Meeting Summary**

D. **County Road Surfacing Summary Spreadsheet**

E. **Examples of County Gravel Road Maintenance**

F. **Example of Information Sharing**

G. **Reference Materials**

## Attachment A: ”Survey Monkey” Questionnaire Response Summary

**Gravel Roads Study** 
June 18, 2015
Summarized by Bob Moorhead

**Responses:** **35 of 39 counties responded** **87.2%**
32 were identified
3 were not identified
4 did not respond
**Observation:** ***Great response rate!***

**Do you have adequate resources for the desired level of gravel road maintenance?**

| Component | Yes | No | No Reply |
|---|---|---|---|
| Personnel | 18 | 16 | 1 |
| Equipment | 29 | 5 | 1 |
| Materials | 17 | 18 | 0 |
| Time | 15 | 20 | 0 |
| Funding | 14 | 21 | 0 |

**Observations:** More than half the counties are short of money, with about half short on personnel, materials, and time. Overall, equipment is considered adequate (probably because ER&R systems are in place and stable).
**Follow-up:** Identify how limited resources are prioritized, and quantify the results in terms of current and long-term gravel road conditions.

**Should the study make an effort to identify Gravel Road Maintenance Best Practices?**

| Component | Yes | No |
|---|---|---|
| Blading & Gravelling Frequencies | 27 | 8 |
| Number of Passes | 24 | 11 |
| Stabilization Treatments | 27 | 8 |
| Dust Treatments | 20 | 15 |
| Ditch & Culvert Maintenance | 25 | 10 |

**Observations:** Only a bit over half the counties see value in gathering information on Dust Treatments, but 2/3 to ¾ see value for blading, stabilization and ditch/culvert maintenance practices.
**Follow-up:** Focus data gathering on the four most important components.

**Should the study make an effort to identify equipment used in Gravel Road Maintenance?**

| Component | Yes | No | No Reply |
|---|---|---|---|
| Grader | 30 | 5 | 0 |
| Pickup/Service Truck | 19 | 15 | 1 |
| Water Tanker | 28 | 7 | 0 |
| Scarifier | 23 | 12 | 0 |
| Roller | 29 | 6 | 0 |

**Observations:** High interest in graders, water tankers, and rollers. Medium interest in scarifiers. Less interest in details about pickup/service trucks.
**Follow-up:** Focus on desirable features of graders, tankers, and rollers. Determine extent and role that scarifiers play in gravel road maintenance.

**Should the study attempt to quantify the resource shortfall for Gravel Road Maintenance?**

| Component | Yes | No | No Reply |
|---|---|---|---|
| Ranges of county-wide Gravel Road Maintenance Costs | 33 | 2 | 0 |
| Ranges of costs per mile for Gravel Road Maintenance | 32 | 2 | 1 |
| Ranges of comparison costs per mile For BST Maintenance | 30 | 5 | 0 |
| Ranges of Gravel Road Maintenance Production Rates (miles/day) | 29 | 6 | 0 |

**Observations:** Very high interest in gravel road maintenance costs. With wide variations in weather, terrain, subgrade, surfacing materials, traffic volumes, equipment and personnel, avoid direct comparisons.
**Follow-up:** Develop cost models that reflect varying conditions and local practices/preferences/ limitations/resources. Highlight cost effective techniques that can be easily implemented and widely used.

**Do your long range road maintenance plans include allowing some BST roads to revert to gravel?**

| Component | Yes | No | Not Applicable |
|---|---|---|---|
| Within 5 years? | 3 | 21 | 11 |
| In 5 to 10 years? | 4 | 18 | 13 |
| More than 10 years | 3 | 18 | 14 |
| Has this proposal been announced publicly? | 2 | 20 | 13 |

**Observations:** This topic is only being considered by four counties, and announced by only two.
**Follow-up:** Gather specifics from the four counties considering this option.

**Do you wish to have your staff participate in the next round of data collection?**

| Yes | No |
|---|---|
| 26 | 9 |

**If "Yes" to staff participation, what format is desirable?**

| Format | Yes | No | No Reply |
|---|---|---|---|
| In-person county visit | 15 | 8 | 3 |
| Regional multi-county meeting | 15 | 8 | 3 |
| Survey Monkey Questionnaire | 20 | 5 | 1 |

| | | | |
|---|---|---|---|
| EWACRS/WWACRS Meetings | 15 | 8 | 3 |



**Observations:** Survey Monkey is top option with 20 counties, and some sort of personal contact is also favored by 15 counties.

**Follow-up:**

1. Develop more specific/detailed Survey Monkey questionnaire and send it to County Engineers for distribution to county maintenance personnel of their choice.

2. Solicit invitations for on-site county visits among the 15 Eastside Counties with road systems with the highest percentage of gravel miles wishing to participate.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Adams | 63% | Asotin | 58% | Columbia | 71% | Douglas | 73% |
| Ferry | 73% | Franklin | 40% | Garfield | 71% | Grant | 42% |
| Klickitat | 48% | Lincoln | 77% | Okanogan | 49% | Pend Oreille | 47% |
| Spokane | 45% | Stevens | 55% | Whitman | 77% | | |

3. Solicit invitations from any of the 24 other counties with gravel roads under 40% of the system mileage who may wish to participate.

**Comments Offered (Optional):**

**Adams County:** Each county has adopted their gravel road maintenance differently with the funding available to perform the work. The increase in material costs has affected our ability to provide the gravel structure needed for the increased load of bigger farm equipment.

**Chelan County:** Actually fairly minor amount of gravel/unpaved roads that are not primitive. Should Primitive Road mileage be included in “gravel” roads study?

**Clark County:** We don’t have a lot of gravel roads that need to be converted to BST and the ones we have don’t have the width for converting or have lots of curves that would be dangerous if we did convert them a hard surface.

**Columbia County:** It is important that this help to illustrate the successes of the counties and their practices, but not become a study that could be used to benchmark one county against another. This is why cost items should not be included.

**Garfield County:** Interested in sponsoring a study on some our roads. We are prepared to develop test sections and try some different products. (Comment submitted via e-mail.)

**Jefferson County:** We have converted about a mile of BST back to gravel on a low volume logging road. We have made some gravel to BST conversions in recent years on very short urban segments.

**Skamania County:** When analyzing costs per miles, make sure it is lane miles and not necessarily center line miles for proper comparison.

**Spokane County:** Very interested in means/methods of surface stabilization.



**Wahkiakum County:** We have very few gravel road miles to maintain, so this is a relatively low interest issue here as compared to some other counties.

**Whatcom County:** We only have about 30 miles of gravel road.

**Observation:** Comments from 6 Eastside and 4 Westside counties.

## Attachment B: Summary of County Visits



Between July 14 and November 3, 2015, on-site visits were held with sixteen counties across the state. Brief summaries of those visits are included.

**Grader preferences**

An informal question on equipment purchases showed these results:
Caterpillar: Ferry, Mason, Yakima (joy stick), Skamania (1), Columbia, Garfield, Asotin, Adams (steering wheel), Lincoln (joy sticks), Whitman (most), Walla Walla
John Deere: Cowlitz, Skamania, Franklin, Adams (joy sticks), Whitman (few), Grant, Spokane
Volvo: Mason

**Adams County:** Blading now done on an as-needed basis.

Mixture of 80% Mag Chloride 20% Lignin Sulfate applied only 500 feet each way at intersections.
Asphalt grindings in replacement gravel (I-90 source)
4-pass blading (2 cut, 2 feather)
Dig out "dust holes" 8" deep
85 miles of BST identified for potential reversion to gravel. Some should never have been BST.
Reversion program has been slowed down by lower oil prices.

**Asotin County:** Mag Chloride used on Snake River Road. Two shots of 0.25 gal/sq yd

**Columbia County:** "Poor Boy Grader" rock rake works well for interim maintenance.

Using Lignin Sulfate (30%) mixed with Mag Chloride (70%), Lignin has had inconsistent quality.

**Cowlitz County:** Less than 7 miles of gravel road. Would like to convert gravel roads to BST.

**Ferry County:** Has been satisfied with the results of an on-site linear crusher (Vanway Roadtech model V600H) rented seasonally, production rate of about 3 miles per week.

**Franklin County:** Two bladings per year everywhere. As frequently as 1 or 2 per week on harvest route with 20-25% truck traffic.

Dust/stabilization products: Materials purchased by land owner, bladed & applied by County

**Garfield County:** Need more maintenance funding in lieu of construction funding.

Mag Chloride regularly used.
Keep berm off road edge, ditches and crowns dressed in fall blading

**Grant County:** Urban gravel roads graded 2-3 times per year. Truck routes as many as 5 times per year
Equipment Operators have assigned areas and use own judgement on blading schedule/routes.

**Lincoln County:** All gravel roads bladed twice a year. Some as many as 7-8 times.
More spot grading in the steeper areas.
More funding for BST would release funds for gravel maintenance.

**Mason County:** Operator choice on number of passes
Limited training opportunities for new operators
Self-propelled roller added to blading operators

**Skamania County:** Very limited budget. Will PM-10 Air Quality issue return?

**Spokane County:** 4-5 bladings/year on truck routes.
Equipment Operators typically pull some fines from slopes into template, then complete the routine blading several days later.
Typical 5/8" minus specification rock needs some #200 binder added
Reference: FHWA-WY-10/03F "Wyoming Gravel Roads Management Report" 2010

**Stevens County:** Roads are generally bladed twice a year
Water trucks not used—depend on seasonal rains
Mag Chloride and other products not used
Gut feeling: BST more expensive to maintain
Do not minimize costs or value of Primitive Roads
Grader operator skill more important than specifying 3- or 5-pass blading
Has re-gravelling program $300,000 annually for 4" to 6" every 7-8 years
Also budgets $350,000 annually for reconstructing 40-50 miles, at $7,000 to $9,000 per mile

**Walla Walla County:** Most gravel roads graded 3 times/year. Primitive roads graded twice/year

**Whitman County:** 15-year re-gravelling cycle with 3-year segments
Most roads graded three times/year. Signed Primitive Roads graded twice/year

**Yakima County:** Road Dept. has "Road Patrolmen" who report spot grading needs, as well as citizen phone calls. Mag Chloride used for "Gravel Road Annual Surface Stabilization" (GRASS) for 11,000 to 15,000 square yards

## Attachment C: WWACRS Meeting Summary

Western Washington Association of County Road Supervisors
Meeting of September 23, 2015
Poodle Dog Restaurant, Fife, WA

Summary of Comments
Prepared by Bob Moorhead
Counties attending were Clark, Cowlitz, Kitsap, Mason, Pierce, San Juan and Whatcom.

It was noted that gravel roads are less common in Westside counties, with only 4 counties having 12-18% (28 to 73 miles) of gravel, and 15 having 1-9% (3 to 51 miles) of gravel roads on the county system.

The most common gravel road grading frequency was 1 or 2 times per year. Pothole complaints was a primary driver of the schedule in one county. Traffic levels and trucks were the other common factors.

Snow removal occasionally results in the need for blading once the snow is gone, although very few gravel roads are high on the snow plowing priority.

None of the seven counties present need to impose seasonal weight limits on gravel roads.

Caterpillar and Deere graders are most common. A few Volvos are in the fleets. Joy stick control models are more difficult to back up. Five- and ten-yard dump trucks fitted with underbody blades are used in several counties. Rollers with front steel drums and rear rubber tires are used. Spring and Fall rains usually provide the needed moisture. The opportunities for newer employees to get training on graders are limited.

The most common blading pattern is 5-pass, with the operator having a choice depending on the conditions. Some narrow roads and cul-de-sacs only require a two-pass pattern. Grading is usually a one-person operation, with warning signs at each end of the one-mile segment.

Several counties use belt loaders for picking up leaves and debris to avoid blading these materials into the top course. The most common rock size is 5/8” minus. Some counties are using asphalt grindings for pothole repair. Mag-Chloride and Lignin-Sulfonate are used for base stabilization and dust control.

Pre-grading operations include ditch- and shoulder-pulling. One county sterilizes the surface before blading.

Without specific cost data available, the Westside counties present are of the opinion that BST roads are cheaper to maintain than gravel roads. While some regulators have expressed concern over BST water pollution problems, others have seen dust from gravel roads as a greater environmental hazard.

## Attachment D: County Road System Inventory Summary

The information on the following spreadsheet was compiled by Don Zimmer, CRAB Road Log Manager, from information provided bi-annually to CRAB by Washington's 39 counties.

## January 1, 2015 Total System Wide Centerline Miles and Truck Route Class by Paved or Gravel Miles

| Cty # | County Name | System C/L Total Miles | Total Paved | Total Gravel | Primitive Gravel | % Paved | % Gravel | TRC-1 Arterial Paved | TRC-1 Arterial Gravel | TRC-1 Local Paved | TRC-1 Local Gravel | TRC-2 Arterial Paved | TRC-2 Arterial Gravel | TRC-2 Local Paved | TRC-2 Local Gravel | TRC-3 Arterial Paved | TRC-3 Arterial Gravel | TRC-3 Local Paved | TRC-3 Local Gravel | TRC-4 Arterial Paved | TRC-4 Arterial Gravel | TRC-4 Local Paved | TRC-4 Local Gravel | TRC-5 Arterial Paved | TRC-5 Arterial Gravel | TRC-5 Local Paved | TRC-5 Local Gravel | County Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Adams | 1,775.73 | 649.57 | 1,126.15 | 0.00 | 37 | 63 | 0.00 | 0.00 | 0.00 | 0.00 | 0.53 | 0.00 | 0.00 | 0.00 | 86.30 | 0.00 | 1.55 | 0.00 | 164.81 | 22.70 | 9.58 | 0.09 | 185.46 | 36.62 | 21.93 | 83.33 | Adams |
| 2 | Asotin | 399.98 | 166.75 | 233.23 | 163.88 | 42 | 58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 22.95 | 0.00 | 0.00 | 0.00 | 15.65 | 4.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Asotin |
| 3 | Benton | 857.36 | 601.60 | 255.76 | 0.00 | 70 | 30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 108.10 | 0.00 | 9.34 | 0.50 | 101.31 | 12.47 | 4.50 | 2.55 | 41.69 | 19.39 | 20.29 | 8.50 | Benton |
| 4 | Chelan | 655.27 | 531.93 | 123.35 | 108.97 | 81 | 19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 51.21 | 0.00 | 0.00 | 0.00 | 85.85 | 0.00 | 9.55 | 0.00 | 24.64 | 0.00 | 14.70 | 0.00 | Chelan |
| 5 | Clallam | 484.94 | 481.98 | 2.96 | 0.00 | 99 | 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 34.40 | 0.00 | 0.00 | 0.00 | 56.42 | 0.00 | 42.02 | 0.00 | 0.79 | 0.00 | 9.20 | 0.00 | Clallam |
| 6 | Clark | 1,110.03 | 1,098.16 | 11.87 | 0.40 | 99 | 1 | 0.22 | 0.00 | 0.00 | 0.00 | 10.31 | 0.00 | 0.13 | 0.00 | 133.45 | 0.00 | 2.55 | 0.00 | 134.68 | 0.00 | 25.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Clark |
| 7 | Columbia | 502.41 | 147.96 | 354.45 | 208.39 | 29 | 71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.30 | 0.00 | 0.00 | 0.00 | 47.87 | 0.45 | 0.69 | 0.12 | 71.43 | 55.40 | 0.21 | 19.77 | Columbia |
| 8 | Cowlitz | 528.89 | 522.02 | 6.87 | 0.00 | 99 | 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 72.94 | 0.00 | 5.57 | 0.00 | 46.84 | 0.00 | 10.28 | 0.00 | 1.81 | 0.00 | 1.19 | 0.00 | Cowlitz |
| 9 | Douglas | 1,630.08 | 438.63 | 1,191.44 | 3.39 | 27 | 73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.89 | 0.00 | 0.00 | 0.00 | 79.93 | 3.43 | 0.09 | 0.08 | 126.55 | 29.37 | 9.12 | 6.11 | Douglas |
| 10 | Ferry | 737.68 | 201.50 | 536.19 | 400.09 | 27 | 73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 107.99 | 0.87 | 0.00 | 0.00 | 59.34 | 26.27 | 0.00 | 30.10 | 0.00 | 0.00 | 0.00 | 0.00 | Ferry |
| 11 | Franklin | 981.67 | 586.50 | 395.17 | 190.48 | 60 | 40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 107.91 | 0.00 | 3.48 | 0.00 | 126.09 | 0.00 | 23.84 | 4.12 | 97.46 | 0.00 | 95.15 | 59.90 | Franklin |
| 12 | Garfield | 447.10 | 129.32 | 317.78 | 71.52 | 29 | 71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.13 | 0.00 | 0.00 | 0.00 | 93.21 | 31.18 | 1.36 | 0.00 | Garfield |
| 13 | Grant | 2,508.24 | 1,447.20 | 1,061.04 | 660.47 | 58 | 42 | 0.00 | 0.00 | 0.00 | 0.00 | 10.19 | 0.00 | 0.00 | 0.00 | 262.53 | 0.00 | 6.61 | 0.49 | 210.07 | 4.25 | 34.40 | 13.16 | 169.77 | 4.01 | 99.79 | 32.43 | Grant |
| 14 | Grays Harbor | 564.74 | 524.95 | 39.79 | 25.53 | 93 | 7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 179.47 | 4.09 | 21.55 | 7.55 | 0.72 | 1.03 | 5.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Grays Harbor |
| 15 | Island | 582.49 | 577.41 | 5.07 | 0.36 | 99 | 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.05 | 0.00 | 0.00 | 0.00 | 26.29 | 0.00 | 3.13 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | Island |
| 16 | Jefferson | 398.47 | 324.86 | 73.61 | 0.00 | 82 | 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 38.04 | 0.00 | 1.59 | 0.00 | 27.51 | 0.00 | 5.50 | 0.00 | 47.43 | 0.00 | 11.65 | 6.67 | Jefferson |
| 17 | King | 1,492.16 | 1,440.87 | 51.29 | 0.01 | 97 | 3 | 5.13 | 0.00 | 0.00 | 0.00 | 21.38 | 0.00 | 0.00 | 0.00 | 235.40 | 0.00 | 17.55 | 0.98 | 94.84 | 0.00 | 5.41 | 6.17 | 0.00 | 0.00 | 0.00 | 0.00 | King |
| 18 | Kitsap | 915.45 | 906.16 | 9.29 | 0.00 | 99 | 1 | 0.00 | 0.00 | 0.00 | 0.00 | 2.14 | 0.00 | 0.00 | 0.00 | 189.51 | 0.00 | 12.95 | 0.00 | 68.96 | 0.00 | 33.17 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | Kitsap |
| 19 | Kittitas | 563.25 | 497.53 | 65.72 | 43.40 | 88 | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 7.38 | 0.00 | 0.00 | 0.00 | 190.63 | 0.00 | 3.04 | 0.55 | 89.70 | 0.00 | 7.54 | 0.00 | 7.86 | 0.25 | 0.00 | 0.08 | Kittitas |
| 20 | Klickitat | 1,084.40 | 561.88 | 522.52 | 296.75 | 52 | 48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 165.66 | 0.00 | 9.02 | 0.00 | 97.76 | 7.41 | 6.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Klickitat |
| 21 | Lewis | 1,044.46 | 999.90 | 44.56 | 7.63 | 96 | 4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 131.24 | 0.00 | 14.74 | 0.00 | 102.75 | 0.00 | 103.14 | 3.62 | 13.64 | 0.00 | 29.20 | 3.14 | Lewis |
| 22 | Lincoln | 1,997.14 | 456.02 | 1,541.12 | 48.28 | 23 | 77 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 125.79 | 4.69 | 0.38 | 1.04 | 191.20 | 46.02 | 6.87 | 37.69 | 46.46 | 116.15 | 15.59 | 185.70 | Lincoln |
| 23 | Mason | 617.20 | 569.63 | 47.58 | 28.90 | 92 | 8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 68.72 | 0.00 | 0.00 | 0.00 | 49.10 | 0.00 | 2.65 | 0.00 | 1.70 | 0.00 | 0.00 | 0.00 | Mason |
| 24 | Okanogan | 1,335.65 | 674.75 | 660.90 | 556.37 | 51 | 49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.25 | 0.00 | 0.18 | 0.00 | 81.62 | 27.49 | 7.36 | 0.00 | 107.36 | 19.05 | 27.02 | 28.26 | Okanogan |
| 25 | Pacific | 349.37 | 301.40 | 47.98 | 0.00 | 86 | 14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 76.89 | 8.81 | 30.14 | 19.58 | 0.00 | 0.00 | 0.00 | 0.00 | Pacific |
| 26 | Pend Oreille | 564.61 | 300.02 | 264.59 | 132.13 | 53 | 47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 38.00 | 0.00 | 0.39 | 0.00 | 99.86 | 9.06 | 11.31 | 5.17 | 26.50 | 0.00 | 26.71 | 9.00 | Pend Oreille |
| 27 | Pierce | 1,556.53 | 1,532.85 | 23.68 | 8.71 | 98 | 2 | 5.83 | 0.00 | 0.00 | 0.00 | 52.07 | 0.00 | 0.00 | 0.00 | 285.64 | 0.00 | 26.83 | 0.26 | 27.64 | 0.00 | 1.09 | 0.00 | 7.70 | 0.00 | 0.00 | 0.00 | Pierce |
| 28 | San Juan | 270.64 | 222.47 | 48.18 | 0.44 | 82 | 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 22.55 | 0.00 | 1.38 | 0.00 | 51.89 | 0.00 | 12.68 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | San Juan |
| 29 | Skagit | 801.06 | 760.81 | 40.25 | 34.55 | 95 | 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 | 124.11 | 0.00 | 2.72 | 0.00 | 110.42 | 0.00 | 2.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Skagit |
| 30 | Skamania | 239.64 | 210.84 | 28.80 | 1.10 | 88 | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 19.25 | 0.00 | 3.40 | 0.00 | 53.56 | 0.00 | 4.64 | 0.53 | 0.00 | 0.00 | 0.00 | 0.00 | Skamania |
| 31 | Snohomish | 1,570.91 | 1,560.82 | 10.09 | 1.85 | 99 | 1 | 4.31 | 0.00 | 0.00 | 0.00 | 9.47 | 0.00 | 0.00 | 0.00 | 293.48 | 0.00 | 33.91 | 0.00 | 60.27 | 0.00 | 48.63 | 0.00 | 55.08 | 3.06 | 0.72 | 1.84 | Snohomish |
| 32 | Spokane | 2,527.01 | 1,378.85 | 1,148.16 | 0.00 | 55 | 45 | 5.69 | 0.00 | 0.00 | 0.00 | 29.16 | 0.00 | 0.00 | 0.00 | 417.13 | 1.51 | 29.21 | 2.65 | 58.57 | 10.64 | 26.79 | 10.90 | 30.70 | 39.17 | 10.86 | 28.55 | Spokane |
| 33 | Stevens | 1,488.99 | 663.44 | 825.55 | 486.62 | 45 | 55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 80.46 | 0.00 | 0.71 | 0.12 | 168.18 | 0.00 | 1.53 | 5.43 | 72.29 | 3.25 | 3.32 | 0.00 | Stevens |
| 34 | Thurston | 1,035.85 | 1,012.79 | 23.06 | 1.26 | 98 | 2 | 2.93 | 0.00 | 0.00 | 0.00 | 9.20 | 0.00 | 0.49 | 0.00 | 188.11 | 0.00 | 18.64 | 0.00 | 47.77 | 0.00 | 29.30 | 0.00 | 0.00 | 0.00 | 1.37 | 2.76 | Thurston |
| 35 | Wahkiakum | 138.86 | 125.70 | 13.16 | 5.29 | 91 | 9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.88 | 0.00 | 0.00 | 0.00 | 10.90 | 0.00 | 1.49 | 0.00 | 7.58 | 0.56 | 0.00 | 0.00 | Wahkiakum |
| 36 | Walla Walla | 963.86 | 595.35 | 368.51 | 149.27 | 62 | 38 | 0.00 | 0.00 | 0.00 | 0.00 | 2.15 | 0.00 | 0.00 | 0.00 | 79.28 | 0.00 | 2.38 | 0.00 | 254.96 | 20.02 | 6.08 | 8.55 | 0.00 | 0.00 | 0.39 | 5.00 | Walla Walla |
| 37 | Whatcom | 939.75 | 908.60 | 31.15 | 5.75 | 97 | 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 103.65 | 0.00 | 3.75 | 0.00 | 79.67 | 0.00 | 12.21 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | Whatcom |
| 38 | Whitman | 1,899.28 | 437.58 | 1,461.70 | 157.60 | 23 | 77 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.92 | 0.84 | 37.97 | 0.00 | 0.00 | 0.00 | 236.63 | 5.26 | 1.33 | 5.50 | Whitman |
| 39 | Yakima | 1,646.32 | 1,101.64 | 544.68 | 0.00 | 67 | 33 | 0.00 | 0.00 | 0.00 | 0.00 | 8.45 | 0.00 | 0.00 | 0.00 | 366.91 | 0.00 | 16.63 | 1.24 | 93.53 | 8.19 | 28.14 | 4.04 | 32.82 | 0.31 | 18.98 | 13.45 | Yakima |
| | **Statewide** | **39,207.46** | **25,650.26** | **13,557.20** | **3,799.39** | **65** | **35** | **24.11** | **0.00** | **0.00** | **0.00** | **163.22** | **0.00** | **0.62** | **0.00** | **4,475.17** | **11.16** | **251.96** | **16.22** | **3,201.49** | **212.57** | **563.15** | **152.09** | **1,506.54** | **363.04** | **420.26** | **499.98** | **Statewide** |
| | Eastern | 24,566.03 | 11,568.05 | 12,997.98 | 3,678.71 | 47 | 53 | 5.69 | 0.00 | 0.00 | 0.00 | 58.01 | 0.00 | 0.00 | 0.00 | 2,328.30 | 7.07 | 84.84 | 7.43 | 2,074.39 | 202.73 | 184.47 | 122.00 | 1,370.82 | 359.42 | 366.75 | 485.56 | Eastern |
| | Western | 14,641.43 | 14,082.22 | 559.21 | 120.68 | 96 | 4 | 18.42 | 0.00 | 0.00 | 0.00 | 105.21 | 0.00 | 0.62 | 0.00 | 2,146.88 | 4.09 | 167.12 | 8.79 | 1,127.09 | 9.84 | 378.68 | 30.09 | 135.73 | 3.62 | 53.52 | 14.42 | Western |

## Attachment E: Examples of County Gravel Road Maintenance

## E-1: Rock Cut Road.  Courtesy of Ferry County

## E-2: McBee Road.  Courtesy of Benton County

## Attachment F: Example of Information Sharing

# OACES 2016
# ENHANCED GRAVEL ROAD TREATMENTS WORKSHOP

**Tuesday, March 15, 2016**

**9:30 AM to 3:00 PM**
(with a working lunch)

**Deschutes County Fairgrounds in Redmond, OR**

Focus will be on agencies sharing their successes and issues of using **alternate** treatments and products for:

1. Gravel Road Safety
2. Wash-boarding, Speed, Curves
3. Dust Abatement
4. Environmental Sensitive Areas
5. Soil Stabilization
6. Upgrades: converting to oil mat or asphalt hard surfaces

Many are using a wide assortment of both old and new products and tools with mixed results, which includes:

| | | | |
|---|---|---|---|
| Lignin | Earthbind | Enzymes | Asphalt Grindings |
| Coherex | Rhino Snot | High-Flow 150 | Various Rock Mixes |

*This is **not** a workshop for routine Gravel Road Maintenance, but rather the focus is in getting acquainted with the newer products and procedures agencies have been using to **enhance** public safety, quality of living and to reduce costs of gravel road maintenance.*

In the same format as the OACES Chipseal workshops, **agencies will share and present** their process and outcomes of using products to address the above issues. We want to learn first-hand from staff who have experimented with products and methods, as well as cost thereof. Sales representatives and contractors are not invited. **Short PowerPoint presentations will be greatly welcome!**

More workshop information can be found at http://www.co.marion.or.us/PW/Roads.

This workshop is sponsored by APWA, OACES and Oregon T2.

Cost is $12 (CASH ONLY) per attendee to be collected at the workshop for the working lunch and refreshments.

**Workshop Administrator:**
**Don Newell**
DNewell@co.marion.or.us
503-365-3129

Contact **Don** to **RSVP & register** your agency with group size **by March 8.**

If you or your agency wants to **share a presentation**, please **contact Don by March 1** *... the sooner, the better!*

The **2016 Cascade East Vegetation Management Conference (CEVMC)** follows on **March 16-17** at the same location (Deschutes County Fairgrounds). To obtain Oregon and Washington herbicide licenses CEU credits, visit www.CEVMC.com.

## 2016 OACES Enhanced Gravel Road (GR) Treatments workshop - Presenters List v5

**March 15, 2016 - Deschutes County Fair Grounds**

| Start | End | Minutes | Who | Agency | Topic |
|---|---|---|---|---|---|
| 9:30 AM | 9:40 AM | 10 | Todd Watkins | Washington Co | workshop host - Welcome / Intro |
| 9:40 AM | 9:50 AM | 10 | Don Newell | Marion Co | *By the Numbers* - OR Unpaved Roads systems mileage |
| 9:50 AM | 10:10 AM | 20 | Bob Moorhead | CRAB, WA | 1) Wash GR overview; 2) Rock Rake; 3) Linear Crusher; 4) BST-to-Gravel |
| 10:10 AM | 10:35 AM | 25 | John Vial | Jackson Co | Gravel Road Safety |
| 10:35 AM | 10:50 AM | 15 | BREAK | | |
| 10:50 AM | 11:10 AM | 20 | Carl Rhoton | Jackson Co | Various treatments/ Enzymes / **Rock Specs** |
| 11:10 AM | 11:30 AM | 20 | Jim Stouder | Benton Co | AC Grindings |
| 11:30 AM | 12:00 PM | 30 | Chris Doety | Deschutes Co | 1) AC Grindings; 2) Otta Seal |
| 12:00 PM | 12:40 PM | 40 | Working Lunch | | Todd may lead Discussion / Q/A |
| 12:40 PM | 1:00 PM | 20 | Dan Reijonen | Pend Oreille Co, WA | Calcium (Spring treatments) |
| 1:00 PM | 1:15 PM | 15 | Ryan Calhoun | Yakima Co, WA | MagCloride |
| 1:15 PM | 1:25 PM | 10 | Bud Simmons | Spoakane Co, WA | MagCloride w/ AC Grindings |
| 1:25 PM | 1:40 PM | 15 | Jim Ableman | Linn Co | 1) Enzymes: Perma-Zyme; 2) Grader Rollers use |
| 1:40 PM | 1:55 PM | 15 | Tom Beggs | City of Portland | 1) Enzymes: Perma-Zyme - no clay; 2) Zydex; 3) others |
| 1:55 PM | 2:10 PM | 15 | BREAK | | |
| 2:10 PM | 2:20 PM | 10 | Pete DeLapp | Marion Co | 1) Earthbind; 2) AC Grindings; 3) Grader Rollers use |
| 2:20 PM | 2:40 PM | 20 | Todd Watkins | Washington Co | GR management - PASER software |
| 2:40 PM | 3:00 PM | 20 | Todd Watkins | workshop host | Wrap-up / Lessons learned |

## Attachment G: Reference Materials

County Gravel Roads in Washington State. Washington State County Road Administration Board. January 1997.

Dust Control on Low Volume Roads. U.S. Department of Transportation, Federal Highway Administration. May 2001. FHWA Report No. FHWA-LT-01-002.

Environmentally Sensitive Maintenance for Dirt and Gravel Roads. U.S. Environmental Protection Agency and Pennsylvania Department of Transportation. March 2006.

Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads. U.S. Department of Agriculture Forest Service. National Technology & Development Program. April 2012. Publication No. 7700-Transportation Management 1177 1802-SDTDC.

Gravel Road Construction & Maintenance Guide. U.S. Department of Transportation, Federal Highway Administration. South Dakota Local Transportation Assistance Program. August 2015. FHWA Publication No. FHWA-OTS-15-0002.

Gravel Roads Maintenance and Design Manual. U.S. Department of Transportation, Federal Highway Administration. South Dakota Local Transportation Assistance Program. November 2000.

Maintenance of Aggregate and Earth Roads. Washington State Department of Transportation. June 1987. Publication No. WA-RD 144.1.

Pavement Surface Evaluation and Rating (PASER) Gravel Roads Manual, Wisconsin Transportation Information Center. 2002. On the web at http://epdfiles.engr.wisc.edu/pdf_web_files/tic/manuals/Gravel-PASER_02.pdf

Unsurfaced Road Maintenance Management. U.S. Army Corps of Engineers, Cold Regions Research & Engineering Laboratory. December 1992.

"Gravel Roads Maintenance: Meeting the Challenge." Video prepared by the Minnesota Local Transportation Assistance Program.