PURPOSE:
This report has been prepared to provide City Council information on the City of Prince George Gravel Road Maintenance Program

BACKGROUND:
The City of Prince George has approximately 256 lane kilometers* of gravel roads within the road network inventory. These include industrial, residential and alley roadways and for the purposes of this report are referred to as “Gravel Roads.” Roads Division is responsible for the annual maintenance of gravel roads within an annual operating budget. Typical maintenance includes grading of the travel surface, dust control, shoulder vegetation control, culvert maintenance and ditch cleaning. Gravel road maintenance generally begins in late spring once vehicle weight restriction bans are removed. The City of Prince George mirrors weight restriction time-lines determined by the Ministry of Transportation and Infrastructure. The bans are set to limit damages to roadways which are soft due to frost melting and saturated soils experienced in spring.

[*Note: A lane kilometer is the number of lanes in one centerline kilometer of road. For example, for a four lane road, the four lanes in one kilometer equal 4 lane kilometers.]

Travel Surface Grading

Annual spring thaw and precipitation, in conjunction with local traffic, cause the travel surface of gravel roads to degrade. To remediate the travel surface, City graders work to smooth potholes, rutting, wash-board areas, frost heaves and reinstate the road crown to facilitate surface drainage. This work commences once weight restriction road bans are removed. Due to the weight of grading equipment, this work is ideally completed when the road structure is suitably dry. Performing this work during restrictions may cause more maintenance issues and a subsequent return to the site for further grading. For most gravel roads, grading operations occur two times annually; once in early summer and second in late summer. Gravel road surfaces that degrade rapidly or hilly areas may see more frequent visits to temporarily smooth the travel surface. At the completion of the initial grading, dust control products are applied.

RECOMMENDATION(S):
That Council receive this report for information.
**Dust Control**

Gravel roads within City limits are typically constructed of pit-run gravels for the sub-base course and finer crush gravels for the travel surface. Crushed gravels allow for work-ability and regrading during maintenance activities as the rock is only a maximum of 19mm in size. The “crushed” or angular fracture and granular fines allow for tighter compaction and a smoother travel surface initially. Dry weather and traffic volume cause surface conditions to degrade and the granular fines become loose and subsequently airborne. To control airborne dust, a liquid dust suppressing agent is applied after the first bi-annual maintenance grading is completed. The liquid consists of a solution of calcium chloride and water. The gravel road is pre-saturated with water first. Saturating the road allows the liquid dust suppressing agent to evenly migrate across each travel lane. A tanker truck applies the dust suppressing agent with a spreader bar applicator and covers one travel lane per pass. In 2015, 278,610 litres of suppressing agent and 14 days were required to complete one application cycle for all gravel roads within the City’s current inventory. Dust control processes are completed by a contractor secured through the annual tender process. For 2015, Tiger Calcium supplied the product and completed the application process.

**Millings**

Millings are a beneficial byproduct created within the capital paving program. Roadways that are candidates for the “mill and fill” paving process have the existing asphalt surface milled down a sufficient depth to accommodate the placement of new asphalt. The existing asphalt millings produced resemble crushed gravel but retain the asphaltic content of pavement. Millings consist of pure asphalt pavement. Since 2004, asphalt millings have been placed on gravel roads within city limits. Millings serve to control dust and improve the travel surface while minimizing grading maintenance activities. Millings are hauled to a previously identified gravel road and applied at minimum 150mm thickness. Millings are graded and compacted to create a dust free travel surface. With warm weather, traffic and the annual aging process, the millings can visibly turn into a product that resembles pavement. This transformation can cause local residents to assume their road is now a paved piece of City road network and expect service levels that a paved road would receive.

For inventory purposes, gravel roads with milling applications are still defined as a gravel road. Millings are only considered a surface treatment to improve dust mitigation and general travel surface conditions. To be considered a paved road, the gravel road would have a crushed base course added, hot-mix asphalt applied, materials testing and associated works completed by paving equipment. There are currently 59 lane kilometers of gravel roads treated with asphalt millings within the City’s inventory. Past experience indicates millings are better suited for low vehicle volume gravel roads.

**Recycled Asphalt Pavement**

Recycled Asphalt Pavement or “RAP” is a byproduct of excavation works within an existing roadway. It also has been utilized to improve existing gravel roads since 2004. Slabs and chunks of asphalt are removed from a job site and stockpiled. The stockpiled asphalt is crushed and a percentage of crush gravel is added. RAP reduces maintenance activities and improves dust mitigation but because of the crushed gravel content, roads with RAP are part of the dust suppression program. RAP is hauled to a previously identified gravel road and applied at minimum 150mm thickness. It is graded and compacted to improve the travel surface and lessen dust that accompanies a traditional gravel road. The workable nature of RAP allows for efficient regrading activities. For inventory purposes, gravel roads with RAP applications are still defined as a gravel road. There are currently 41 lane kilometers of gravel roads treated with RAP within the City’s inventory.

**Gravel Roadside Maintenance**

Storm drainage on gravel roads is controlled by open ditches adjacent to the roadway and cross culverts buried in the road structure. The travel surface is graded towards open shoulders and open ditch networks to allow surface water to exit the road. The integrity of the road relies on the ability of storm waters to enter the ditch
network. To ensure this, Roads Division performs annual maintenance activities along gravel roads. Open shoulders will begin to vegetate and impede storm waters from entering the ditch. A flail mower is employed to trim the annual shoulder growth. Ditches also experience vegetation growth and a build-up of sediment. Roads crews remove this material, taking into consideration possible impacts on water courses, with a backhoe and truck. Cross culverts are flushed of sediment with a flusher truck. Ditches and culverts free from debris and obstructions allow storm water to flow freely and limit potential flooding of the roadway and neighbouring properties.

Other Surface Treatments

Gravel roads outside of City limits are controlled and maintained by the Regional District of Fraser Fort George and the Ministry of Transportation and Infrastructure through contracted forces. Both organizations have improved some gravel roads through “seal coating” or “chip seal” processes. For this surface treatment, gravel roads are graded to remove low spots and irregularities. Using a truck mounted sprayer, a thin layer of hot liquefied asphalt emulsion is applied to the gravel surface. A layer of small crushed aggregate or “chips” are spread over the asphalt emulsion. The aggregate is rolled into the asphalt emulsion by a smooth drum roller and is allowed to set up prior to introducing vehicle traffic. The resulting hard surface improves the travel surface, assists in keeping water from penetrating the underlying road base and eliminates airborne dust. Research indicates the life span of a chip sealed road is 7-10 years depending on traffic loads and turning motions. Areas of stop/start, corners and hills generally degrade more rapidly than linear straight sections. Currently there are no roadways within the City’s road inventory that have received a chip seal surface treatment. Roads Division is investigating if potential exists to partner with the RDFFG or Ministry of Transportation and Infrastructure and utilize their contractors for a chip seal pilot project.

FINANCIAL CONSIDERATIONS:

The annual Gravel Road Maintenance Program is funded through separate operating accounts. The amounts presented below are the annual operating and maintenance expenditures over the last 5 years:

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<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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Temperature and precipitation duration and intensity affect the volume of maintenance required to keep gravel roads in satisfactory condition. Cool temperature and extended times of rain lead to super-saturation of the roadway. The resulting moisture content causes the road structure to soften and become more susceptible to potholes, rutting, wash-boarding and ultimately more grading time. Extended periods of hot, dry weather leave the travel surface intact but create conditions of airborne dust when vehicles or wind velocity pick up the fine particles. An additional application of dust suppressing agent or localized roadway watering serve to control dust issues. These additional weather influenced maintenance requests all require return visits outside of the normal maintenance schedules.

SUMMARY AND CONCLUSION:

This report has provided council with information regarding the City of Prince George annual Gravel Road Maintenance Program. Roads Division utilizes industry standard practice to maintain the travel surface and control dust. Localized grading and dust suppression techniques are adequate for surface maintenance and controlling airborne dust short term. Long term solutions include the continuing use of milling and recycled asphalt pavement (RAP) applications, possibly applying seal coating and investigating the potential conversion of gravel surfaces to asphalt pavement surfaces. Urban alleyways are prime candidates for hot mix asphalt paving while rural gravel roads are better suited to receive milling and RAP applications. A reduction in the gravel roads inventory would improve air quality and reduce maintenance activities.