1.0 PURPOSE AND SCOPE OF THE STUDY

The maintenance, rehabilitation, and improvement of the County's rural road network have been guided by the County's Rural Roads Master Plan (RRMP) 1995 (Strathcona County, 1995), as updated by the various administrative reviews prepared by County staff, the latest of which was the Rural Roads Master Plan Extension Report, June 2003 (Strathcona County, 2003).

In June 2009, the County retained the services of EBA Engineering Consultants Ltd. (EBA) to update the 1995 and 2003 RRMPs, and to develop the Sustainable Rural Roads Master Plan 2010 (SRRMP 2010).

The rural road network of Strathcona County totals 1,302 km; and is functionally classified as follows (the classification and other terminology is defined in the next section):

- Grid (range and township) roads (938 km) which are functionally classified into the following four classes:
  - Class I (79 km)
  - Class II (491 km)
  - Class III (135 km)
  - Class IV (233 km)
- Country Residential Subdivision (CRS) Roads (334 km)
- Rural Hamlet Roads (31 km)

Rural roads have one of the following four surface types:

- Paved (hotmix asphalt)
- Paved (coldmix asphalt)
- Gravel
- Dust-suppressed Gravel

By definition, the rural road network excludes the roads and streets within the boundaries of the urban Hamlet of Sherwood Park.

Nine Provincial Highways (No. 14, 15, 16, 21, 38, 216, 628, 630 and 830) traverse the County; these are under the jurisdiction of Alberta Transportation (AT). Of these, Highway No. 628, 630 and 830, previously known as Secondary Highways, were in the County's jurisdiction under a cost-shared arrangement with AT until 2001, at which time AT took them into the provincial highway system.

The map in Figure 1 shows the range and township roads, as well as the provincial highways in Strathcona County. This and the other County maps, including country residential subdivision plans and hamlet plans, are available on the County's web site.

Under the study's Terms of Reference (TOR) for the SRRMP 2010, EBA's main tasks were to conduct consultation with rural residents, carry out the required technical analyses, and make recommendations to update the current Rural Roads Master Plan with respect to, among other items, the following major elements:

- Classification criteria and road standards for the range and township (grid) roads;
- Rehabilitation practices and frequencies for grid roads, country residential subdivision roads and rural hamlet roads;
- Funding allocations for various program elements: maintenance, overlays, upgrading and reconstruction;
- Funding allocations for various road classes;
- Priorities for upgrades to Class I (paved hotmix) roads which carry high traffic volumes;
- Progression of Class IV (dust-suppressed) to a Class II (paved coldmix) standard;
- Review of the road safety program, including recommendations for line marking on narrow roads; and
- An overarching imperative and governing concept for EBA's work was the "sustainability" of the County's road network from environmental and budget viewpoints. Early in the study, EBA established a "sustainability framework" (described in Section 3) which guided the technical analyses and the resulting recommendations.

It should be noted that the analyses and recommendations are presented in the context of the existing functional rural road classifications and design standards. The review and recommendations related to functional rural road classifications (and any resulting class upgrades or downgrades) and design standards are presented in a separate section at the end of the report.

2.0 REPORT ORGANIZATION, TERMINOLOGY AND DATA SOURCES

2.1 REPORT ORGANIZATION

The report is organized as follows:

Section 3 describes the "sustainability framework" which guided the technical analyses and the resulting recommendations of the study.

Section 4 describes and summarizes, under appropriate headings, the background information and data regarding the relevant aspects of the County's rural road network and current practices, and sets the context for the report's analyses, conclusions and recommendations that are presented in the subsequent parts of the report.

Section 5 describes the methodology, content and results of the three phases of the public consultation process undertaken for the SRRMP 2010 study:

- A mail out questionnaire survey (in September 2009) to all rural residents in the County;
- Three open houses (on October 13, 14 and 15, 2009) to present the results of the questionnaire survey and obtain additional feedback; and
- A workshop with the County Council (on November 12, 2009) to present and discuss the preliminary findings and recommendations of the study.

Section 6 is a brief introduction to the analyses and recommendations regarding the various discrete or inter-related items in the TOR, which are in turn presented in Sections 7 through 14.

Section 15 deals with the recommended budget allocations based on the findings of the analyses in Sections 7 to 14.

Section 16 presents the results and recommendations of the review of the County's rural road functional classification and design standards.

All tables and figures are placed under their respective separate tabs at the end of the report. A few tables are also included in the text where their inclusion was considered necessary for the points being made.

The appendices, appropriately referenced throughout the text, provide background information and data deemed to be too detailed for the main body of the report.

2.2 DATA SOURCES

The main source of data for this study was the County's comprehensive rural road inventory system (COTRIS) which contains detailed historical information on almost all aspects of the road network. In terms of improving the utility of COTRIS, the only recommendation EBA suggests is better integration of traffic counts data in the road inventory. The invaluable assistance provided by the County staff in tapping COTRIS's capabilities and in providing additional information is gratefully acknowledged.

Other published and unpublished sources utilized are referenced in the text and listed in alphabetical order in the References Section at the end of this report.

2.3 TERMINOLOGY

Most of the technical and other terms used in road planning and engineering are commonly understood. However, certain terms can have peculiar or specific local meaning. The list below is an attempt to define selective terms for the purposes of this report in the context of the Strathcona County's rural road network.

Rural Road Functional Classification: Listed below are the definitions of the County's functional rural road classifications and the main geometric and surfacing standards associated with them:

Class I Grid Roads: typically carry over 1,000 vehicles per day (vpd); 9.0 m top width; current surface standard is hotmix; ROW 40.0 m.

Class II Grid Roads: typically carry between 250 vpd and 1,000 vpd; 7.5 m top width; current surface standard is coldmix; ROW 40.0 m (minimum 30.0 m).

Class III and Class IV Grid Roads: typically carry less than 250 vpd; 7.5 m top width; ROW 30.0 m.

Class III Grid Roads: typically carry less than 100 vpd; and a have gravel surface.

Class IV Grid Roads: typically carry between 100 and 250 vpd; and receive dust suppression for a complete section between intersections (referred to as "I to I"), or spot dust control based on the following criteria.

Intersection-to-Intersection dust treatment:

- At least 100 vehicles per day, or
- Between 65-100 vehicles per day with four or more occupied approaches per mile;

Spot Dust Control (153 m in front of occupied residences):

- Less than 100 vehicles per day with less than four occupied approaches per mile.

Rural Hamlet Roads: located within the boundaries of rural hamlets, are subdivided into two categories: roads in "high density parcel development" have 9.0 m gutter-to-gutter width, and 18.0 m ROW; while roads in "low density parcel development" (also described as country residential or rural density) have 8.5 m top width, and a 30.0 m ROW. There is no typical traffic volume requirement for rural hamlet roads, and the current surface standard is hotmix.

Country Residential Subdivision (CRS) Roads: have a top width of 8.5 m, and 30.0 m ROW. There is no typical traffic volume requirement for CRS roads, and the current surface standard is hotmix.

Hotmix Surface: Mix of asphalt and aggregate mixed hot in an asphalt plant, and laid hot on a prepared road base with a paving machine, and compacted with a roller.

Coldmix Surface: Layer of asphalt and aggregate mixed cold in an asphalt plant or on the road, and laid cold on the road subgrade normally with a grader, and compacted with a roller.

Gravel Surface: A layer of graded gravel placed on the road subgrade.

Dust-treated Gravel Surface: A mixture of gravel and an oil-based dust suppressant spread on the road subgrade with a grader and compacted with a roller.

Functional Class Reclassification: Reclassification of a County rural road to a higher functional classification (e.g. functional Class II to functional Class I), or reclassification of a County rural road to a lower functional classification (e.g. functional Class II to functional Class IV).

Improvement: Refers to bringing a road up to the required geometric (including width) and surface standards; it can involve reconstruction or widening of the subgrade, a new or stabilized base, and a new or recycled surface with coldmix or hotmix.

Improved Road: An improved road is one that meets the current geometric (including width) and surface type standards of its functional road classification. For example, a Class I road that has a 9.0 m road top, meets other geometric standards and has a hotmix surface is an "improved" road.

Un-improved Road: An un-improved road is one that does not meet the current geometric (including width) and surface type standards of its functional road classification. For example, a Class I road that is narrower than 9.0 m and/or has a coldmix surface is an "un-improved" road.

Overlay: This generally applies to coldmix or hotmix paved road surfaces only, and consists of a new or recycled road surface layer.

Base Stabilization: Consists of mixing the existing road base or the top layer of the subgrade with Portland cement or other suitable binder material, and shaping and compacting the base material before placing the paved surface.

3.0 ENVIRONMENTAL, ECONOMIC/FISCAL, AND SOCIAL SUSTAINABILITY FRAMEWORK

3.1 INTRODUCTION

Good rural roads improve community interconnectivity and social interaction; and they provide the necessary access to recreational, medical, educational, shopping, employment and other services and activities for the County's rural residents.

An overarching imperative and governing concept for EBA's work for the SRRMP 2010 was the "sustainability" of the County's road network from environmental and budget viewpoints. To achieve that objective, this section describes the "sustainability framework" which guided the technical analyses and the resulting recommendations throughout the entire study.

Strathcona County's Strategic Plan commits the County to consciously move toward creating a sustainable community. The Strategic Plan emphasizes a balanced, triple-bottom-line approach to encourage a balance of social, environmental and economic elements to sustain a health and vibrant community.

To realize the goals of the Strategic Plan, the County has developed three frameworks:

- The Social Sustainability Framework was approved by Council in March 2007 as the first step in endorsing a sustainable community that balances social, economic and environmental components.
- The Environmental Sustainability Framework, a guide to assess environmental factors and impacts in the County's planning and decision making, was approved in June 2009.
- The Economic Sustainability Framework, a guide to decision making toward fostering a healthy economy that benefits residents, business and industry, is currently being developed.

In a practical sense, Strathcona County's Municipal Development Plan, Bylaw 1-2007 (MDP), makes sustainability a cornerstone of the County's future growth management. Section 4 of the MDP titled "Sustainability and Growth", sets down the principles, objectives and policies that will govern the County's practices in 12 sustainable development themes, including "transport". In terms of encouraging its residents to practice environmentally sustainable lifestyles, the County is already actively promoting green living through its various initiatives.

According to the Transportation Association of Canada (http://www.tac-atc.ca/english/index.cfm), a "sustainable transportation network":

- Allows individuals and societies to meet their access needs safely and in a manner consistent with human and ecosystem health, and with equity within and between generations;
- Is affordable, operates efficiently, offers choices of transportation mode, and supports a vibrant economy, and;
- Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources to the sustainable yield level, re-uses and recycles its components, and minimizes the use of land and the production of noise.

Transportation infrastructure (e.g. roads, railways, airports, sea ports) and services are a derived demand, in that they are never built for their own sake but rather to serve the needs of land use and economic developments, which in turn determine the scope, standards and level of service and safety that the transportation infrastructure is expected to provide. In other words, it's the land use and development policies and practices that govern the demand and supply for transportation.

In terms of environmental impacts of transportation, the greatest attention has been paid to the emission of greenhouse gases by vehicles (cars, trucks, railway trains, airplanes and ships, road construction equipment). This is understandable because the transportation sector is the largest emitter of greenhouse gases in Canada, accounting for over 26% of all greenhouse gases emitted Canada in 2006 (Environment Canada web site).

However, other aspects of the transportation sector also contribute to its environmental foot print; these include consumption of land for roads, lanes and parking lots; use of

building materials like gravel, cement and asphalt; disturbance of natural habitats by roads and railways; noise; smog; visual intrusion.

Much literature is available on the subject of transportation vis a vis the environment, spanning a very broad range of environmental adaptation, mitigation and reduction measures. In terms of road infrastructure, these cover the entire spectrum of road planning, design, construction, reconstruction, rehabilitation/overlays and maintenance activities. Selected recent references about the road mode include: Haichert, 2009; Sloan 2009.

3.2 SUSTAINABILITY CONSIDERATIONS

Certain means of reducing the environmental footprint of road transportation, such as mandating better fuel efficiency of road vehicles, and better thermal efficiency of fuels are in the purview of the federal government, which indeed has issued recent directives in both respects.

Municipal jurisdictions like the Strathcona County do have many other means of lessening the negative environmental impacts of transportation infrastructure and use. In the urban Hamlet of Sherwood Park, the County has implemented measures of reducing the environmental footprint of roads and travel, such as transit, walking, biking, traffic signal coordination, and other demand-management and traffic engineering techniques.

Because of the low population density in rural areas of the County, the high car ownership and nearly complete reliance on private cars, it is not practicable to implement on rural roads the above mentioned "urban" measures of reducing the environmental footprint of roads and travel. Fortunately, however, there are many other measures that the County can utilize in the construction, rehabilitation and maintenance of the rural road network.

The following are some of the considerations and guidelines that were employed in EBA's analyses of the various elements of this study with a view to achieving the twin goals of environmental and fiscal sustainability of the County's rural road network:

1. Base spending decisions on objective criteria, such as surface condition, rather than on a fixed annual number of kilometres of overlays.
2. Utilize design standards that will satisfy the level of service and safety requirements while minimizing the environmental footprint of the transportation infrastructure.
3. Recycle existing hotmix and coldmix pavement surfaces; this may help postpone the need for widening. Other environmental benefits of recycling include conservation of non-renewable resources.
4. Utilize techniques that use less material (e.g. crack filling, seal coats and other maintenance measures rather than overlays).
5. If cost is not significantly different, use pavement types with a longer life (e.g. hotmix instead of coldmix).

6. Find efficiencies in the existing rural road budget levels to fund un-met high priority needs.

To validate EBA's sustainability concepts and to obtain feedback from the County's rural residents, the respondents to the public consultation survey questionnaire were asked to rate the four budget and environmental sustainability measures, which they rated in the following order of priority (details are discussed in Section 5):

1. Schedule maintenance and overlay decisions based on annual road condition assessments rather than overlaying a fixed annual number of kilometres.
2. Establish road surface type and/or width based on safety and type of use.
3. Increase the recycling of existing pavements to reduce the narrowing effect of successive overlays.
4. Increase spot repairs (e.g. crack filling, seal coats) rather than full road resurfacing.

All of these measures have been incorporated in the appropriate discussions and recommendations in the report.

There may be some practical difficulties and impediments in implementing some of the above measures, including the following:

1. We understand that the County uses its own work force for coldmix overlays and other road work activities. Some of the above measures (e.g. more recycling, which is specialized private sector work) or substitution of maintenance for overlays, would mean less work for the County's own work forces.
2. Recycling is a specialized type of work and several technologies are available in Alberta. Economies of scale may require a certain contract size (in terms of no. of kilometres), which may not be available on County roads at a given location because of the potentially scattered distribution of relatively small recycling candidate projects. The County may want to undertake a pilot recycling project to assess its costs and benefits of the most promising of these technologies.
3. Attempts to apply the minimum standards (e.g. gravel instead of dust-treatment), may not sit well with the affected County residents.

Reduction in the amount of travel (vehicle-kilometres) is a proven method of reducing greenhouse gas reductions without unduly affecting the public's lifestyle. It is recommended that the County include this angle in its promotions. Thus, if rural residents reduce their estimated 12 one-way trips (24 two-way trips) per household per day to ten one-way trips (20 two-way trips) per day, by, for example combining shopping trips or other errands with the trip to or from work, they can reduce their greenhouse gas emissions by 16%.

Overall, EBA believes that, as explained in the appropriate parts of the report, the study's recommendations have achieved the stated goal of budget and environmental sustainability.

4.0 DESCRIPTION OF THE COUNTY'S RURAL ROAD NETWORK AND CURRENT PRACTICES

This section describes and summarizes, under appropriate headings, the background information and data regarding the various aspects of the County's rural road network and current practices. Based on this information, the last subsection summarizes the current state of the County's rural road network, highlights the issues, and sets the context for the report's analyses, conclusions and recommendations that are presented in the subsequent sections of the report.

4.1 EXISTING FUNCTIONAL CLASSIFICATION CRITERIA AND GEOMETRIC & SURFACING STANDARDS

This section describes the current functional classification, and geometric and surfacing standards for the County's rural road network. The recommended changes to the functional classification and standards are discussed in Section 16 below.

The County's current functional classification, design standards and detailed drawings for rural roads are described in the Strathcona County Engineering Services Standards – Rural Service Area (June 2007); these are accessible at the following web site:

http://www.strathcona.ca/departments/Engineering_and_Environmental_Planning/Guidelines_Standards/rural-engineering-servicing-st.aspx

The Strathcona County Urban Eng. Servicing Standards – 2005 apply to certain high-density hamlet roads; these are accessible at the following web site:

http://www.strathcona.ca/departments/Engineering_and_Environmental_Planning/Guidelines_Standards/urban-engineering-servicing-st.aspx

These documents provide the necessary details of the design standards for each functional road classification, and for the most part prescribe right-of-way, cross-section, structure (embankment, pavement, etc.), and certain other elements. The Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads is referred to for horizontal and vertical alignment requirements on rural grid roads. In some cases design speeds are provided (i.e. rural grid roads); in other cases, only minor reference is made to the posted speed limit.

The design standards are supplemented with a collection of typical details that include cross-sections for specific road types and typical details for culvert installation, cul de sac development, pipeline crossings, etc. The County's standard cross-sections for Class I, II, III/IV and CRS roads are included in Appendix A.

The definitions of functional rural road classifications and surface types were provided in Section 2 above. Table 1 provides a summary of the selected key elements contained in the County's above-mentioned publications for the various functional road classifications, such as traffic volume criteria for functional classification, design speed, posted speed, road width, design life, surface type and right-of-way requirements, etc. Photos showing the

typical Class I, II, III and IV roads that meet the geometric and surface standards of their respective functional classification are shown in the Photographs Section of the report.

It should be noted that, as discussed below, a significant proportion of the County's rural road network does not meet the current geometric (e.g. top width) and/or surface standards.

4.2 TRAFFIC VOLUMES STATUS

Traffic volume in terms of vehicles per day (vpd) is the most important determinant of the functional classification, design and surfacing standards, and related elements of a road. The County regularly updates the traffic counts on its roads. Figure 1 shows the two-way vpd counts taken during the last few years at various points on the rural road network. Table 2 shows the overall averages and ranges of traffic volumes for each of the six road classifications: Grid road Classes I, II, III and IV; CRS roads and Hamlet roads. Table 3 is a more detailed picture of traffic volumes on the grid roads; it shows the number of kilometres in Classes I to IV roads that carry a certain range of traffic volumes.

The main conclusion regarding traffic volumes on the County's rural road network is that, not surprisingly, Class I roads carry the highest traffic volumes because they funnel rural traffic to and from Sherwood Park, Fort Saskatchewan, Edmonton, the Heartland area, and major provincial highways. Most rural residents in the County, regardless of where they live, end up using Class I roads in their daily travels. Indeed, Class I roads carry five times the average traffic volumes of Class II roads: 2,180 vpd compared to 440 vpd.

4.3 SURFACE TYPE STATUS

Table 2 shows the kilometres by surface type for each of the six functional road classifications in 2008. In terms of improvement needed in comparison to the current surface standards as described above, the following conclusions can be drawn from Table 2.

1. 46 % of Class I roads (36 of 79 km) need improvement in surface type; they have coldmix pavement rather than hotmix called for in the current design standard. The County currently does not have a program for improving the un-improved Class I roads to the hotmix surface standard. It should be noted, as shown in the next section, that most of the Class I roads that need improvement in surface type are also substandard in width, and in many cases in other geometric aspects. Therefore, improving the un-improved Class I roads will require reconstruction.
2. There are virtually no surface standard improvement needs on Class II roads; less than 1 % (6 of 491 km) need improvement in surface type.
3. By definition, no Class III (gravel) roads or Class IV (dust-suppressed) roads need improvement in surface type.
4. 56 % of country residential roads (186 of 334 km) need improvement in surface type; they have coldmix pavement rather than hotmix called for in the current design

standard. However, the County has a program in place to bring the substandard CRS roads to the hotmix surface standard.

5. 26 % of hamlet roads (8 of 31 km) need improvement in surface type; they have coldmix pavement rather than hotmix called for in the current design standard. However, the County has a program in place to bring the substandard hamlet roads to the hotmix surface standard.

4.4 ROAD-TOP WIDTH STATUS

Table 4 summarizes the road width statistics as of November 2008; for each road classification it shows the number of kilometres in various road width bands.

The second column in Table 4 indicates the current design road-top width per the County's design standards discussed above. The shaded part of the rows for each road class indicates the number of kilometres below the current design road-top width.

Many rural roads were originally constructed to a previous narrower road width standard. In addition, a main reason for narrow road widths, particularly for Class II coldmix roads, is that repeated overlays have narrowed the road width. The result is that currently large proportions of the County's rural roads in the various functional road classes are narrower than the current design road-top width for their design class. The overall narrow width statistics, as shown for each functional road class below, may sound alarming; but when we look at how many kilometres are narrower by how much when compared to the current width standards, the conclusion is that the picture is not as bad as it looks at first glance.

When discussing the narrow road widths, it should be kept in mind that an analysis conducted by EBA of a sample of Strathcona County rural road crashes found no evidence that narrow width is directly correlated with higher crash frequencies. A reason for this may be that narrow roads generally carry low traffic volumes. Generally speaking, narrow road width is a risk factor when combined with other factors such as high traffic volumes and poor road alignment and driver behaviour. Section 8.2 below recommends various methods to deal with road width loss, and Section 6.2 provides general guidelines for prioritizing budget expenditures with a view to reconstructing/widening narrow roads which carry high traffic volumes.

1. Of the 79 km in the Class I network, 65% are narrower than the current width standard of 9.0 m, but only 47% are narrower by more than 1.0 m than the current width standard, and only 12% are narrower by more than 2.0 m than the current width standard. Since these roads by definition carry relatively high volumes, widening to current standards should be the highest priority for the County.

2. Of the 491 km in the Class II network, 91% are narrower than the current width standard of 7.5 m, but only 31% are narrower by more than 1.0 m than the current width standard, and only 0.3% are narrower by more than 2.0 m than the current width standard. Some roads within the Class II network carry relatively high volumes for the Class and widening to current standards should be a higher priority. Other roads within

the Class II network carry moderate to low volumes of traffic. If no significant safety or operational issues exist then widening of these low to moderate volume roads should be a lower priority.

3. Of the 135 km in the Class III network, 84% are narrower than the current width standard of 7.5 m, but only 48% are narrower by more than 1.0 m than the current width standard, and only 13% are narrower by more than 2.0 m than the current width standard. The Class III roads which are narrower than the current standard were most likely built to the "standard of the day". Widening of these roads should only be necessary if safety or functional issues are identified on a specific section of roadway.

4. Of the 233 km in the Class IV network, 91% are narrower than the current width standard of 7.5 m, but only 29% are narrower by more than 1.0 m than the current width standard, and only 0.5% are narrower by more than 2.0 m than the current width standard. The Class IV roads which are narrower than the current standard were most likely built to the "standard of the day". Widening of these roads should only be necessary if safety or functional issues are identified on a specific section of roadway.

5. Of the 334 km of Country Residential roads, 91% are narrower than the current width standard of 8.5 m, and 85% are narrower by more than 1.0 m than the current width standard, and only 7% are narrower by more than 2.0 m than the current width standard. The Country Residential roads which are narrower than the current standard were most likely built to the "standard of the day". Widening of these roads should only be necessary if safety or functional issues are identified on a specific section of roadway.

6. Of the 31 km of Hamlet roads, 94% are narrower than the current width standard of 9.0 m, and 93% are narrower by more than 1.0 m than the current width standard, and 62% are narrower by more than 2.0 m than the current width standard. The Hamlet roads which are narrower than the current standard were most likely built to the "standard of the day". Widening of these roads should only be necessary if safety or functional issues are identified on a specific section of roadway.

4.5 COUNTY'S HISTORICAL EXPENDITURES ON RURAL ROADS

To build a picture of the County's historical and current budgets and expenditures on rural roads, several summary tables were developed.

4.5.1 Historical Rural Roads Budgets as a Percentage of the County's Total Budgets

For each of the five years 2005 to 2009, Table 5 shows the County's annual capital and operating (maintenance) budget allocations for rural roads, and compares these with the County's total capital and operating (maintenance) budgets. The table shows that in 2009 the rural roads were allocated 5.8% ($13.5 million) of the County's total budget of $232.0 million. The comparable rural roads allocations for previous years were: 5.7% ($13.67 million out of the County's total budget of $239.3 million) in 2008; 4.0% ($10.36 million out of the County's total budget of $258.3 million) in 2007; 4.2% ($8.05 million out of the

County's total budget of $190.8 million) in 2006; and 3.6% ($7.09 million out of the County's total budget of $194.6 million) in 2005. Budgets have gone up or down partly in relation to increase or decrease in inflation.

It should be noted that the actual expenditure in a given year can be somewhat less than the budgeted amount. Thus, in 2008 the total rural roads expenditure was $12.95 million compared to the allocated budget of $13.67 million.

4.5.2 Current County Expenditures by Functional Classification and Work Type

To establish the pattern of the County's expenditures on rural roads, detailed data were obtained for the four years 2006 to 2009. Table 6 shows the average annual expenditure on the various expenditure categories (capital overlays, capital reconstruction, and maintenance) for each of the functional rural road classes in the four years 2006 to 2009. Note that the four year annual average is a better indicator than a single year such as 2008 or 2009. The table shows the dollar allocations as well as the percentage allocations to various road classes and work types.

The main observations from the County's current and recent expenditure allocations on rural roads, shown in Table 6, are:

1. Nearly 80% of the County's rural roads expenditure goes to Class II and CRS roads. Class II roads are been allocated 43.6% of the County's annual rural roads expenditure; and CRS roads are being allocated 35.6% of the County's annual rural roads expenditure.
2. In contrast, Class I roads have been severely under-funded. There is no allocation for improvement of Class I roads in the current rural roads budget. The following points regarding budget allocations to the Class I network are worth noting:
    a. In the four years 2006-2009, the annual average expenditure on Class I roads has been only 3.1% of the total rural roads budget.
    b. The last Class I road improved with 100% County funding was in 1994 (two miles of Twp Rd 522 were upgraded in 1997, and were then turned over to the Province as Highway 628).
    c. The Provincial Secondary Highway network part of the Class I roads (then under County's jurisdiction) was improved from 1995 to 2001 with 25% County funding. After the Provincial Secondary Highway network was turned over to the Province, the County's previously 25% allocation for what were Class I roads was not allocated to the improvement of the un-improved Class I roads. It appears that a significant portion of these funds was instead allocated to Class II and CRS roads. The result is that nearly half of the Class I road network is substandard in width as well as surface standards.

3. Comparing the per km expenditure confirms the under-funding of Class I roads. Table 6 shows that the County is spending $11,400 per km on CRS roads, $9,500 per km on Class II roads, $5,700 per km on hamlet roads, $5,500 on Class IV (dust-suppressed) roads, and $4,200 per km on Class I roads.

4. Table 6 shows that in terms of budget allocations for various work categories, 31% is spent on maintenance (operating budget) and 69% on capital works. It should be noted that virtually all capital budget is spent on overlays of Class II and CRS roads, and there is no budget allocation for improvement or reconstruction of Class I roads.

4.5.3 Current County Expenditure Allocations in Comparison to the 1995 RRMP Recommendations

It would be useful to compare the County's current budget allocation among functional road classes with the allocation recommended in the 1995 RRMP. For that purpose two tables were prepared. Table 7 shows the details of the budget allocations recommended in the 1995 RRMP (it should be noted that Class III and IV roads were dealt with as a combined item in the 1995 RRMP). Table 8 (reproduced below) compares the 1995 recommended percentage allocations to the actual four-year (2006-2009) expenditure allocations.

TABLE 8. AVERAGE 4-YEAR (2006-2009) EXPENDITURES BY ROAD CLASS COMPARED TO 1995 RRMP RECOMMENDATIONS

Design Classification	Average Annual 2006-2009 Expenditure Allocation ($)	Average Annual 2006-2009 Expenditure Allocation (%)	1995 RRMP Suggested Expenditure Allocation ($)	1995 RRMP Suggested Expenditure Allocation (%)
Class I Network	329,126	3.1 %	1,353,000	25.3 %
Class II Network	4,655,292	43.6 %	1,950,000	36.5 %
Class III and IV Combined	1,722,995	16.1 %	777,000	14.6 %
Total Grid Roads	**6,883,000**	**62.5 %**	**4,080,000**	**76.4 %**
Country Residential Roads	3,799,476	35.6 %	1,190,000	22.3%
Hamlet Roads *	171,319	1.6 %	70,000	1.3 %
Total Rural Roads	**10,678,209**	**100 %**	**5,340,000**	**100 %**

*Provincial funding included.

Source: Strathcona County

The main points to note from Table 8 are:

1. Compared to the 1995 RRMP recommendations, Class II and CRS roads are receiving a much bigger share of the County's rural roads budget. Thus, in the four years 2006-2009, Class II roads received 43.6% of the rural roads budget compared to 36.5% recommended in the 1995 RRMP. CRS roads received 35.6% of the rural roads budget in the four years 2006-2009 compared to 22.3% recommended in the 1995 RRMP. It should be noted that additional funding for base stabilization was added in 1997.
2. In contrast, Class I roads received 3.1% of the rural roads budget compared to 25.3% recommended in the 1995 RRMP. This reinforces the point made in the section above that Class I roads are being severely under-funded.
3. The allocations for Class III and IV roads and Hamlet roads have stayed in approximately the same proportions that were recommended in the 1995 RRMP.

4.5.4 Comment on Budget Allocation among Functional Classes

An obvious conclusion from the above discussion of the distribution of the County's rural roads budget among functional road classes is that Class I roads are severely under-funded. As demonstrated in the next section, County's practice of overlaying a fixed number of kilometres a year of Class II roads and CRS roads appears to be resulting in unnecessary overlays on these roads. There is room within the existing budget levels to re-allocate some funds from Class II and CRS overlays to the improvement of Class I roads.

4.6 OVERVIEW OF THE COUNTY'S HISTORICAL REHABILITATION / OVERLAY PRACTICES

This section presents a brief overview of the County's historical and current practices regarding rehabilitation and maintenance of rural roads and their consequences on the road surface condition.

4.6.1 Historical Practices and their Consequences – Class I Roads

The relative lack of budget allocation to Class I roads discussed above appears to be based on the County's curious, but apparently conscious, approach to the management of the Class I network. As mentioned above, the last Class I road improved by the County was in 1994; it was the northern one mile of Range Road 231 from Township Road 520 to 522.

Class I Coldmix Un-improved Roads

The un-improved Class I roads (which make up 36 km of the 79 km Class I road network and have a coldmix surface and are also substandard in width) are in a catch-22 situation: by County policy, they do not receive overlays until they are reconstructed to proper width, but there is no budget allocation for their reconstruction and improvement to proper width. These roads are provided minimum maintenance by spot blade patching. Some roads have 100% of their surface patched over many years.

The result is that the surface condition of the un-improved, coldmix Class I roads is very poor, as shown in Figure 2 which depicts the surface condition history of Class I coldmix roads from 1995 to 2008.

It should be noted that from a lifecycle cost viewpoint, the reactive patching maintenance costs on Class I coldmix roads may exceed the cost of overlay or other surface rehabilitation, and provides less than desirable serviceability to the travelling public.

Class I Hotmix Improved Roads

The improved Class I hotmix roads make up 43 km of the 79 km Class I road network. They receive regular maintenance such as crack filling, spray patching, seal coats; but the funding allocation for their preservation (overlay) appears to be limited: only 4.8 km (about 11%) were overlaid in the three years 2006 to 2008.

The surface condition of the improved, hotmix Class I roads is very good, as shown in Figure 3 which depicts the surface condition history of Class I hotmix roads from 1995 to 2008.

4.6.2 Historical Practices and their Consequences – Class II Coldmix Roads

The 1995 RRMP had recommended that the 491 km Class II coldmix network should be rehabilitated (overlaid) on a 7.5 year cycle. Under this guideline approximately 65 km per year were coldmix overlaid. The 2003 RRMP Extension Report changed the overlay cycles from 7.5 years to 10 years (or 65 km to 49 km per year). Starting in 2009, a 12 year overlay cycle (i.e. 40 km per year) has been implemented; and the full Class II network was opened to prioritization; prior to that, only roads eligible in the cycle were considered.

The result is that the surface condition of the Class II coldmix network has steadily improved over the years and is now excellent, as shown in Figure 4 which depicts the surface condition history of Class II coldmix roads from 1995 to 2008.

However, this improvement in surface condition has created some other problems, as explained below:

- Although the overlay projects are prioritized annually based on condition (worst first) by utilizing a formula that gives weights to the percentages of base failure, surface failure, surface patching and riding quality, the inevitable consequence of a "mandated" minimum number of kilometres per year based on a fixed overlay cycle is that some roads in good condition are being overlaid.
- For example, EBA's examination (details are in Appendix E) of the Class II coldmix roads overlaid in 2008 and 2009 showed that:
    a. The average age of the coldmix surface on Class II coldmix roads overlaid in 2008 was 9 years (compared to the theoretical fixed cycle of 10 years), and in 2009 was 6.6 years (compared to the theoretical fixed cycle of 12 years) ; and

b. Several of the roads overlaid in 2008 and 2009 were in good to excellent condition; some had less than 2% surface failure or base failure, and less than 3% surface patching.

- Repeated overlays may improve the road surface condition, but they create or exacerbate the narrow road-top width problems discussed earlier, because they produce a permanent loss in width. That in turn gives rise not only to safety risks but also to much more expensive future widening/reconstruction required to restore the road to proper width standards. It should be noted that each 50 mm coldmix overlay causes a road-top width loss of about 0.2 m, assuming a 2:1 sideslope of the overlay layer.
- Repeated overlays on a fixed cycle are not an optimum allocation of resources. The Class II coldmix network is in an excellent condition, and therefore EBA recommends that the practice of a fixed overlay cycle should be discontinued, and overlay needs should be based on annual condition ratings. In other words, roads should not be overlaid unless warranted when based on condition.
- Various ways of preventing and mitigating road-top width loss are discussed below in the report.

Several additional observations regarding the Class II coldmix network are provided below:

- Coldmix is supplied by others (under a yearly contract) and all road construction is carried out by County forces. Some quality issues with the supplied coldmix experienced in the past have been addressed.
- Selective base strengthening is carried out prior to coldmix overlay based on judgment and experience; if the area requiring treatment is >60%, then 100% of the project is base stabilized. Base stabilization involves scarification to 150 mm depth of existing coldmix, gravel and subgrade and treatment with 5% Portland cement. This base strengthening program, which is considered a good approach to improve the properties of weak subgrades characteristic to the County, is likely a significant factor in improving the performance of coldmix overlays.
- Surface seals (50:50 SS1: water) are applied the year following coldmix placement and then every 4^{th} or 5^{th} year following. Surfaces that are "sweating" are not sealed. The other primary maintenance treatment is blade patching at localized failure locations. These are considered good practices to extend the life of coldmix surfaces.
- A trial project to evaluate Cold In-Place Recycling technology (on Range Road 224, 534-540) was carried out in 2006 where about 75 mm of an existing 150 mm coldmix pavement structure was recycled. The trial was not considered successful, primarily due to the recycling train being wider than one half the roadway width, resulting in double treatment of the centre portion of the roadway and improper crown construction. However, the County should consider other construction technologies to recycle coldmix surfaces in-place.

- To improve the ride quality of the coldmix overlay, two trial projects to evaluate paver laid coldmix were constructed in 2009: Rge Rd 220; Highway 14-510; Rge Rd 224; Twp Rd 510-512). Some mix design modifications were required. Limited observations indicated an acceptable ride quality, some variations in sideslopes, and early wheel path "sweating". This "sweating" should be investigated and necessary updates to specifications and QC/QA procedures implemented.
- Grade widening is not considered feasible by the County staff (no funding availability) to accommodate width loss from continued overlays.
- To preserve roadway width, a modified construction process was evaluated on Range Road 224 (510-512) in 2009. The process involved ripping and pulverizing the existing coldmix, windrowing it to one side, carrying out base stabilization and modest flattening of one half of the roadway, re-windrowing the pulverized coldmix, base stabilization and flattening of the other half of the roadway, spreading of the pulverized coldmix, followed by a new coldmix overlay. The project was considered successful in maintaining the existing width, and this process should be considered for other projects.
- To reduce costs, the thickness of coldmix overlays was reduced to 40 mm from 50 mm in 2009. The effects of the thinner overlays on performance, if any, should be monitored.
- The County's rural roads are subject to a year round 90% truck weight limit (road bans). To help preserve the integrity of the road surface and subgrade, and to reduce maintenance costs, the weight limit is reduced to 75% for six weeks in spring. EBA considers this a good practice.
- Limited observations by EBA indicated that some recent coldmix overlays were experiencing "sweating" following construction, which limits future maintenance sealing treatments and may result in a hazard to the travelling public. This should be investigated and necessary updates to specifications and QC/QA procedures implemented.
- Standards for reconstruction of Class II roads consist of a minimum structure of 150 mm GBC and 50 mm coldmix with a 7.5 m finished top (two 3.75 m lanes) and a 10 m subgrade which allows for 2 future 50 mm overlays. Based on the current 12 year design life, the width of a reconstructed Class II road will be adequate for a 36 year period.

4.6.3 Historical Practices and their Consequences – Class III Gravel Roads

Current width standard for the 135 km Class III gravel network is 7.5 m finished top; the subgrade is built 10.0 m wide so as to facilitate a potential future upgrade to Class II coldmix standard.

The current County policy for re-gravelling of Class III gravel roads stipulates a 7 year re-gravel cycle. Projects are prioritized for re-gravelling based on worst first condition.

In EBA's opinion, the current re-gravelling policy on these low volume roads is adequate.

4.6.4 Historical Practices and their Consequences – Class IV Dust-Suppressed Roads

The 233 km of dust-suppressed Class IV roads in the County's rural road network are gravel roads on which asphalt-based products are used for dust-suppression. It takes several years to transition from the first treatment on loose gravel to a "three-track" surface and finally to a fully bonded surface. Calcium Chloride is not used due to public concerns with potential corrosion damage to vehicles and "slippery when wet" conditions.

Some dust-suppressed Class IV roads can appear to be in better condition than some Class II roads.

Current standards consist of a 7.5 m finished top and 10.0 m subgrade (to facilitate future upgrade to Class II coldmix standard).

Although dust-suppressed Class IV roads can be difficult to maintain, and they can be "sticky" to drive on, EBA agrees with the current County practice for the Class IV dust-suppressed roads network, which carries relatively low traffic volumes. As discussed in the functional classification review later in the report, the higher volume Class IV roads can be considered for reclassification to Class II coldmix classification.

4.6.5 Historical Practices and their Consequences – Country Residential Roads

Of the 334 km CRS road network, 148 km have a hotmix surface and 186 have a coldmix surface. The traffic volumes on these local roads are relatively low. The County has a program to improve the coldmix CRS roads to the hotmix standard by carrying out 100% base stabilization and paving with hotmix. This is done on a fixed 15 year cycle from 2005 onwards; the previous cycle was 10 years.

Figure 5, which depicts the surface condition history of CRS cold mix roads from 1995 to 2008, shows that the surface condition of the CRS coldmix network has steadily improved over the years and is now very good. No coldmix has been placed since 2003.

As in the case of Class II coldmix overlays, the inevitable consequence of a "mandated" minimum number of kilometres per year based on a fixed improvement/overlay cycle is that some roads in good condition are being overlaid.

For example, EBA's examination (details are in Appendix F) of the CRS roads overlaid in 2008 and 2009 showed that:

a. The average age of the CRS coldmix roads improved to hotmix in 2008 was 10.9 years, and in 2009 was 11.8 years (compared to the theoretical fixed cycle of 15 years); and

b. Several of the CRS coldmix roads improved to hotmix in 2009 were in good to excellent condition; some had base failure, surface failure, and surface patching percentages less than 3%.

As in the case of Class II coldmix road overlays, EBA believes that continuing the improvement of CRS coldmix roads to hotmix on a fixed cycle is not an optimum allocation of resources. The CRS coldmix network is in good condition (see Figure 5), and

therefore, EBA recommends that the practice of a fixed cycle for improving CRS coldmix roads to hotmix should be discontinued, and the needs should be based on annual condition ratings. In other words, CRS coldmix roads should not be improved to hotmix unless warranted when based on condition.

Figure 6, which depicts the surface condition history of CRS hotmix roads from 1995 to 2008, shows that the surface condition of the CRS hotmix network is, as expected, excellent.

Some additional observations regarding the CRS road network are provided below:

- Water hauling is a problem on coldmix surfaces and causes failures.
- Limited observations indicate cracking and distresses of the hotmix surface (at longitudinal construction joints, centre-of-paver cracks, and segregation).
- Current maintenance practices appear adequate. There may be a requirement for increased maintenance expenditures for crack sealing and spot surface sealing of hotmix surfaces.

4.6.6 Current Practices and their Consequences – Rural Hamlet Roads

Of the 31 km rural hamlet road network, 20 km have a hotmix surface, 8 km have a coldmix surface, and 2 km are gravel. The traffic volumes on these local roads are relatively low.

With provincial funding, topped up by County allocations as necessary, the County has a program to improve the remaining coldmix hamlet roads to hotmix standard within 5 to 10 years (roads are rehabilitated with hotmix overlays without improving the width). After that, the network will only require ongoing maintenance; overlays will be programmed only if required based on an engineering evaluation.

Figure 7, which depicts the average surface condition history of hamlet roads from 1995 to 2008, shows that the surface condition of hamlet roads has steadily improved over the years and is now excellent.

EBA agrees that the County's Current practices regarding hamlet roads are adequate.

5.0 PUBLIC CONSULTATION WITH RURAL RESIDENTS

5.1 INTRODUCTION

Public consultation for the SRRMP 2010 study consisted of the following three phases:

- A mail out questionnaire survey of all rural residents in the County in September 2009, with a return deadline of September 21;
- Three open houses (October 13, 14 and 15, 2009) to present the results of the questionnaire survey and obtain additional feedback; and

- A workshop with the County Council (on November 12, 2009) to present and discuss the preliminary findings and recommendations of the study.

5.2 QUESTIONNAIRE SURVEY OF ALL RURAL RESIDENTS

5.2.1 The Mail Out Questionnaire

The purpose of the mail out questionnaire was to gauge the degree of satisfaction of the rural residents with the state of the various classes of the rural road network, and to obtain their priorities and suggestions regarding the major issues related to the network. The three-page questionnaire along with the two-page explanatory sheet sent with the questionnaire, as well as the summary of the responses, is contained in Appendix B. Note that the definitions of roads/factors/measures and of the rating scales are included in each question.

The respondents were given three options for returning the questionnaires:

Online: Complete the questionnaire online at the Strathcona County's website www.strathcona.ab.ca. Links on the website home page led the respondents to the questionnaire survey and also to representative pictures of the various classes of rural roads in the County. EBA has a subscription for the "SurveyMonkey" software, which was utilized for online questionnaire completion, and for analyzing the responses after the dropped-off and faxed responses were manually entered by EBA into SurveyMonkey's database.

Drop off at:

- County Hall at 2001 Sherwood Drive, Sherwood Park
- Heartland Hall Contact Office, 55305 – Range Road 213
- South Cooking Lake, #2 Fire Station, 22138 South Cooking Lake Road
- Ardrossan, #3 Fire Station, 8 Main Street, Ardrossan

Fax to: 780.454.5688, EBA Engineering Consultants Ltd. (24hrs)

A summary of the responses to each of the 11 questions in the questionnaire is presented below.

5.2.2 Questionnaire Return Statistics

Selected statistics regarding the questionnaire survey are provided below.

Questionnaires mailed out to (all) rural residents	= 8,803
Questionnaires undeliverable by Canada Post	= 25
Questionnaires delivered	= 8,778 (= 8,803 – 25)
Completed questionnaires returned by the Sep 21 deadline	= 737
Completed questionnaires returned after the Sep 21 deadline	= 18

Completed questionnaires returned and analyzed	= 755 (=737+18)
Response rate	**= 8.6 %** (= 755/8,778)

A response rate of 8.6% is considered high enough to be representative of the surveyed population, in this case the rural residents of the County.

Of the 755 questionnaires returned, the approximate breakdown of the method of return was: 50% online, 25% by fax, and 25% delivered to the three designated locations around the County.

Note that a few of the 755 respondents did not respond to all 11 questions. The number of respondents (out of 755) who answered and who did not answer a given question is indicated in the spreadsheets and charts for the various questions included in Appendix C.

The distribution of the 755 responses among the three rural Wards in the County (Question 10 in the questionnaire) is provided below:

Rural Ward	No. of Responses	Percent
Ward 5 (J. Fenske)	284	37.6%
Ward 6 (A. Dunn)	204	27.0%
Ward 7 (G. Lawrence)	197	26.1%
Ward not indicated	70	9.3%
TOTAL	**755**	**100%**

5.2.3 Results of the Questionnaire Survey and Discussion of the Major Issues Raised

The complete results of the questionnaire survey are reported in Appendix C. For each question, the details are presented in the form of excel tables and bar charts. The main findings for each question are summarized below with reference to the indicated Figure numbers which reproduce the appropriate bar charts from Appendix C.

Note that in all bar charts, the total response count is shown below the factor description on the X-axis, and the number and percentage of the respondents for each bar is shown immediately above the bar.

Questions 1 to 6: Rating of Rural Road Classes

The survey respondents were asked: "For questions 1 to 6, on a scale of zero to 10, indicate your rating of the overall state of the Strathcona County rural roads that you use on a daily basis (Indicate DO NOT USE if you do not use the road regularly)." The detailed rating results in table and chart forms are shown in Appendix C.

For ease of presentation at the public open houses and in this report, the rating scale of zero to 10 was condensed into a three point qualitative rating: Less than adequate (ratings of zero to 4), Adequate (rating of 5), and Good to Excellent (ratings of 6 to 10).

Figure 8 shows the respondents' ratings of the state of each rural road class. The main points to note are:

1. The degree of satisfaction with the state of rural roads among rural residents who regularly use certain classes of roads is relatively high except for Class III (gravel) and Class IV (dust-suppressed) roads. The percentage with satisfaction rating of adequate to excellent with the surface state of roads by frequent users is summarized below:
   - 88% for improved hotmix (Class I) roads. The satisfaction with un-improved coldmix Class I roads is low, based on review of comments from Question 11; see point 2 below.
   - 88% for CRS roads;
   - 80% for Hamlet roads;
   - 68% for coldmix (Class II) roads;
   - 56% for dust-suppressed gravel (Class IV) roads; and
   - 51% for gravel (Class III) roads.
2. Note that, given the high importance expressed for improving Class I roads in the answers to Questions 8 and 11, the high satisfaction rating above with Class I (hotmix) roads appears to be for the "improved" Class I roads that have been built to the proper geometric standards and have a hotmix surface.
3. It is interesting to note that, although the daily users of Class III (gravel) roads rate them relatively low, in answers to Question 8 (see below) the overall respondents rated the need to "convert gravel roads to dust-suppressed surface" as the least important of the six improvement strategies rated in Question 8.

Question 7: Importance of Priority Setting Factors

The survey respondents were asked: "For roads that you drive often, circle the degree of importance [from 1 being "not important" to 5 being "very important"] that should be given to each of the following [nine factors] in setting priorities)." The detailed rating results in table and chart forms are shown in Appendix C.

For ease of presentation at the public open houses and in this report, the rating scale of 1 to 5 was condensed into a three point qualitative rating: Low importance (ratings of 1 to 2), Medium importance (rating of 3), and High importance (ratings of 4 to 5).

Figure 9 shows the respondents' ratings of the importance of each of the nine priority setting factors. Note that the factor bars are arranged in descending order of the magnitude of the "high importance" rating. The main points to note are:

1. The top two factors: the factor that received the highest (92%) rating of high importance was "Condition of the road (e.g. bumps, cracks, potholes)", followed by a 79% rating of High importance for "Amount of traffic".
2. A cluster of four factors (Number of traffic collisions; Retaining the existing surface condition; the road as a link in the overall road/highway network; and Road width) received high importance ratings ranging from 74% to 69%.
3. The remaining three factors (Number of bad curves and hills; Number of public complaints; and Number of accesses) received high importance ratings ranging from 54% to 38%.

Question 8: Importance of Road Improvement Types

The survey respondents were asked: "For roads that you drive often, circle the degree of importance [from 1 being "not important" to 5 being "very important"] that should be given to each of the following [six] types of road improvement in rural Strathcona County)." The detailed rating results in table and chart forms are shown in Appendix C.

For ease of presentation at the public open houses and in this report, the rating scale of 1 to 5 was condensed into a three point qualitative rating: Low importance (ratings of 1 to 2), Medium importance (rating of 3), and High importance (ratings of 4 to 5).

Figure 10 shows the respondents' ratings of the importance of each of the six types of road improvement in rural Strathcona County. Note that the factor bars are arranged in descending order of the magnitude of the "high importance" rating. The main points to note are:

1. The top three types of road improvement (Widen narrow roads carrying high traffic volumes; Sight lines around corners at intersections; and Completion of improvements to the Class I network) received high importance ratings of 86%, 80% and 70%, respectively.
2. A cluster of two factors (Sight lines around curves; and Sight lines overtop hills) was next with high importance ratings of 64% and 63%, respectively.
3. "Convert gravel roads to dust-suppressed surfaces" received the lowest high importance ratings of 46%.

Question 9: Importance of Measures to Sustain Budgets and Help the Environment

The survey respondents were asked: "To help keep road budgets sustainable and reduce environmental impacts, circle the degree of importance [from 1 being "not important" to 5 being "very important"] that should be given to each of the following [four] measures." The detailed rating results in table and chart forms are shown in Appendix C.

For ease of presentation at the public open houses and in this report, the rating scale of 1 to 5 was condensed into a three point qualitative rating: Low importance (ratings of 1 to 2), Medium importance (rating of 3), and High importance (ratings of 4 to 5).

Figure 11 shows the respondents' ratings of the importance of each of the four measures to help keep road budgets sustainable and reduce environmental impacts. Note that the factor bars are arranged in descending order of the magnitude of the "high importance" rating, which are shown below:

90% Schedule maintenance and overlay decisions based on annual road condition assessments rather than overlaying a fixed annual number of kilometres

85% Establish road surface type and/or width based on safety and type of use

77% Increase the recycling of existing pavements to reduce the narrowing effect of successive overlays

55% Increase spot repairs (e.g. crack filling, seal coats) rather than full road resurfacing

Question 10: Response Rate by Electoral Ward

The distribution of the 755 responses among the three rural Wards in the County has already been reported above in Section 5.2.2.

Question 11: General Comments

The survey respondents were asked: "Please use the space below to add any other comments and suggestions regarding the County's rural roads."

Of the 755 respondents, 487 (64.5%) answered this question and provided nearly one thousand comments, which are included in Appendix C. It should be noted that, to the extent practicable, personal or other information (e.g. name, address, etc.) included in the general comments by some respondents, which could be used to identify people with particular comments, has been removed from the listed comments.

The approximate number (%) of respondents, along with the main themes/issues noted in the comments is summarized below.

SUMMARY OF GENERAL COMMENTS IN ANSWER TO QUESTION 11 OF THE SURVEY	
Themes/Issues Raised	**No. (%) of Respondents**
Complaints and criticism about narrow road widths covering all classes of rural roads.	105 (21.6%)
Expressed satisfaction and positive comments regarding the state of existing rural roads.	67 (13.8%)
Spoke to the importance of the Class I network (improving the un-improved and further improvements to the existing improved).	63 (12.9%)
Comments and suggestions regarding the Provincial (two-digit and three-digit) highway network in the County.	56 (11.5%)
Questioned the money being spent (e.g. needless overlays, etc.).	36 (7.4%)
Suggested the need for right-of-way brushing.	13 (2.7%)
Miscellaneous comments, mostly regarding specific rural roads and particular locations.	Various

5.3 PUBLIC OPEN HOUSES

Three public open houses were held on October 13, 14 and 15, 2009 (see details below) to present the results of the questionnaire survey and to get additional feedback and input from the rural residents. The open houses were advertised by the County in *SP-SC News* on October 2 and October 9; and in the *Fort Record* on October 8.

The Open House feedback and comments received are included in Appendix D.

Staff from EBA and the County were present at the open houses to answer questions.

PUBLIC OPEN HOUSES: LOCATION AND ATTENDANCE INFORMATION			
Date and Time	**Location**	**No. of Attendees**	**No. of Feedback Forms Completed**
Tuesday, October 13, 2009 5:00 to 8:00 pm	Josephburg	18	14
Wednesday, October 14, 2009 5:00 to 8:00 pm	Ardrossan	16	10
Thursday, October 15, 2009 5:00 to 8:00 pm	South Cooking Lake	8	8
	Totals	42	32

The gist of the feedback comments at the open houses is presented below. The percentage comparisons indicated below are with respect to the responses in the questionnaire survey.

- 88% of the Open House respondents confirmed the factors to consider when setting priorities.
- 79% of the Open House respondents confirmed the priorities for determining road improvement.
- 92% of the Open House respondents confirmed the importance of budget and environment sustainability measures.
- The general comments in the Open House feedback form were generally similar to the questionnaire survey responses (e.g. narrow road widths, safety, the need to improve high traffic volume roads).

5.4 MAJOR OBSERVATIONS FROM THE PUBLIC CONSULTATION

Among the many issues identified in the analysis of the ratings provided in answers to specific items in Questions 1 to 9 of the survey questionnaire, the more than one thousand narrative comments and suggestions in Question 11, and the feedback received at the three public open houses, the following four issues are considered to be the top priorities for the rural residents who use the County's rural roads.

The public's ratings of the sustainability measures in the questionnaire, their narrative comments, and their top priority issues all indicate recognition of the importance of managing the County's rural roads within a sustainable budget and in an environmentally responsible manner.

It is interesting to note that the public's priorities are in line with the conclusions reached by EBA in Section 4 based on a technical analysis of the rural road network's characteristics.

1. Widen narrow roads

Narrow road-top width is the top concern of Strathcona County rural residents. While the rural residents like the smooth riding quality provided by frequent overlays, they are very concerned with the narrowing effect of the overlays on road width. In the narrative comments, there were many that alluded to: the roads becoming narrow pyramids if we keep overlaying them without widening; money "being wasted on overlaying roads that are in good condition"; etc.

2. Complete improvements to the Class I network

The public's high priority for completing the improvements to the Class I network is not surprising because most rural residents end up on the high traffic volume Class I roads as they travel to and from Sherwood Park, Fort Saskatchewan and Edmonton, or connect to the provincial highways.

3. Make roads with high traffic volumes and/or safety issues a priority

This reflects the public's priority for safety, which is rightly perceived to be more of a problem on high traffic volume roads (and, per the width issue raised above, also with narrow roads).

4. Keep maintenance levels high

In terms of sustainable budgets, the public is aware that capital investments (reconstructions, overlays) are expensive, and that a high level of maintenance is a cost-effective alternative. Also, in general the public wants the County to keep up with the routine maintenance, such as crack filling, pothole repairs, snow clearing, etc.

5.5 WORKSHOP WITH COUNTY COUNCIL

The third element in public consultation for this study was the workshop was held with the County Council on November 12, 2009, to present EBA's analyses of the current state of the County's rural road network, the results of the public consultation process, and EBA's preliminary recommendations regarding the major issues in the study TOR. The comments received at the workshop have been incorporated in this report.

6.0 FRAMEWORK FOR NEED PRIORITIZATION AND SUSTAINABLE BUDGET ALLOCATION

This section discusses the framework and assumptions utilized to estimate savings within the current overall rural roads budget levels, re-allocation of the savings on the basis of need, and the general principles and guidelines to prioritize the needs.

The analyses and recommendations pertaining to issues that apply to the rural road network as a whole, as well as issues pertaining to specific functional classes are dealt with in the following sections. The generic issues that affect more than one road class, such as road safety, overlay cycles and narrow road widths, are dealt with first, followed by items pertaining to specific functional road classes.

6.1 SCENARIO FOR ESTIMATED INTERNAL BUDGET SAVINGS AND THEIR RE-ALLOCATION

A main recommendation of this report is that the fixed cycles for overlaying coldmix Class II roads and CRS roads, which result in overlaying of a fixed number of kilometres per year, regardless of actual need based on road conditions be discontinued. This recommendation is based on an analysis of historical and current budget allocation, overlay practices, and condition of the concerned roads. EBA estimates that discontinuing the fixed overlay cycles for coldmix Class II roads and CRS roads, and instead determining the number of kilometres requiring overlay in a given year based on annual road condition assessment, can produce estimated *net savings* of about $1.2 million/year ($400,000/year from coldmix Class II overlay program, and $800,000/year from the CRS overlay program). EBA is recommending that these savings be redirected into improving the un-improved Class I network.

It should be noted, however, that the actual savings achievable in a given future year could vary up or down from the $1.2 million/year estimate, depending upon factors such as future traffic volumes and types, unforeseen climatic conditions, unexpected road failures, development of heavy traffic generators, annual road conditions, and public expectations. The "current scenario" *net savings* of about $1.2 million/year should therefore be considered as a plausible but only one among several possible scenarios.

EBA recommends that, over the next few years, the County should track the condition-based overlay needs, and refine the magnitude of potential net savings.

6.2 FRAMEWORK FOR PRIORITIZATION OF NEEDS

Roads and other transportation infrastructure are built to serve the needs of the road users. Those needs must be met at acceptable levels of service and safety, which must be incorporated into prescribed "engineering" standards and requirements. It should be noted that public acceptance/satisfaction should be considered an important factor in road planning and engineering decisions. Thus, Strathcona County's experience shows that the level of public complaints about rural roads tend to increase when the road surface failure rating reaches about 7%, which, upon further analysis and confirmation, could be used as a possible threshold value in determining overlay needs discussed in the above section.

Since budgets are normally limited and are not sufficient to meet all needs in a given year, prioritization of needs is necessary. EBA recommends the following scheme to prioritize the needs and expenditures for Strathcona County rural roads. It should be noted that this prioritization scheme is a logical general guideline. The Council and County staff will of course consider and respond to other factors, such as public complaints, unexpected urgent or important non-urgent events, industry's emerging requirements, in determining priorities in a given year. Indeed, a side benefit of doing away with fixed overlay cycles (which result in a fixed number of kilometres of overlays each year) is to give the Council and County staff the flexibility to respond to emerging needs.

1. Preservation of Investment

This is done in two ways:

i) Maintenance according to the County's maintenance standards and practices for the various functional classes. It should be noted that proper maintenance can help delay the more expensive overlays or reconstruction, and therefore are the backbone of an environmentally and fiscally sustainable road management system. It is recommended that adequate maintenance should be kept up even on the road sections that may appear to be candidates for overlays.

ii) Overlays as needed on the basis of condition ratings help to preserve the road surface, and thus delay more costly reconstruction.

2. Safety Improvements

Road safety improvements in conjunction with rehabilitation, reconstruction and widening projects are an obvious and effective means of implementing the needed safety improvements. In addition, the County should give a high priority to redressing localized safety problems as discrete projects.

3. Re-allocation of Budget Savings to Address the Narrow Width Problem

EBA recommends that the net budget savings discussed above should be utilized in the following rough priority order. The recommendations assign the highest priority to Class I roads that are narrow and/or need surface improvement, followed by Class II roads that need width improvement. It is understood that the County already has programs for dealing with the Country Residential Roads and Hamlet roads.

This study is at the overall strategic Master Plan level and therefore cannot produce a prioritized list of specific road projects. Provided below are general guidelines that the County can apply to determine project priorities for the annual capital programs. In general, to determine priorities of individual projects within each category, consideration should be given to the road width, volume and type of traffic, safety issues (collision history), and other emerging needs as discussed above.

<u>Priority 1</u>: Reconstruct un-improved Class I roads requiring improvement in both width and surface type

It is recommended that, other things being equal, first priority in this category should be given to Class I road sections that do not have a hotmix surface, which are:

- Narrower than 7.0 m (that is, more than 2 m narrower than the current design standard of 9.0 m).
- Carry relatively high traffic volumes among un-improved Class I roads.
- With due consideration given to crash history.

Second priority in this category should be given to, other things being equal, Class I road sections that do not have a hotmix surface, which are:

- Between 7.0 and 8.0 m in width (that is, more than 1 m narrower than the current design standard of 9.0 m).
- Carry relatively high traffic volumes among un-improved Class I roads.
- With due consideration given to crash history.

Third priority in this category should be given to, other things being equal, Class I road sections that do not have a hotmix surface, which are:

- Between 8.0 m and 9.0 m in width (that is, narrower than the current design standard of 9.0 m).

- Carry relatively high traffic volumes among un-improved Class I roads.
- With due consideration given to crash history.

Priority 2: Reconstruct Class I roads requiring improvement in width

It is recommended that, other things being equal, priority in this category should be given to narrow Class I road sections requiring width improvement, which are:

- Narrower than 7.0 m (that is, more than 2 m narrower than the current design standard of 9.0 m).
- Carry relatively high traffic volumes among un-improved Class I roads.
- With due consideration given to crash history.

Second priority in this category should be given to, other things being equal, Class I road sections requiring width improvement, which are:

- Narrower than 8.0 m (that is, more than 1 m narrower than the current design standard of 9.0 m).
- Carry relatively high traffic volumes among un-improved Class I roads.
- With due consideration given to crash history.

Third priority in this category should be given, other things being equal, to Class I road sections requiring width improvement, which are:

- Between 8.0 m and 9.0 m in width (that is, narrower than the current design standard of 9.0 m).
- Carry relatively high traffic volumes among un-improved Class I roads.
- With due consideration given to crash history.

Priority 3: Reconstruct Class II roads requiring improvement in width

It is recommended that, other things being equal, first priority in this category should be given to narrow Class II road sections requiring width improvement, which are:

- Narrower than 5.5 m (that is, more than 2 m narrower than the current design standard of 7.5 m).
- Carry relatively high traffic volumes among narrow Class II roads.
- With due consideration given to crash history.

Second priority in this category should be given to, other things being equal, Class II road sections requiring width improvement, which are:

- Narrower than 6.5 m (that is, more than 1 m narrower than the current design standard of 7.5 m).

- Carry relatively high traffic volumes among narrow Class II roads.
- With due consideration given to crash history.

Third priority in this category should be given to, other things being equal, Class II road sections requiring width improvement, which are:

- Between 6.5 m and 7.5 m in width (that is, narrower than the current design standard of 7.5 m).
- Carry relatively high traffic volumes among narrow Class II roads.
- With due consideration given to crash history.

It is anticipated that the County will have the flexibility to decide, for example, whether the highest rated Class II road under Priority 3 above has for other reasons a better case than the lowest rated Class I road under Priority 2 above. EBA believes that a prioritization scheme should not be so rigid as to restrict the discretion and flexibility of the County Staff or Council to decide on the basis of emerging factors that cannot be captured in a rigid prioritization scheme.

7.0 ROAD SAFETY

This section presents EBA's analyses and recommendations with respect to two aspects of road safety in the TOR that EBA was asked to review and evaluate: a general evaluation of the County's road safety program and, more specifically, an evaluation of line marking on narrow rural roads.

7.1 GENERAL EVALUATION OF THE COUNTY'S RURAL ROAD SAFETY PROGRAM

The County maintains a listing of *"Rural Road Safety Upgrades"* which contains a ranking of the top 10 Grid/Grid and top 10 Grid/CRS intersections based on traffic control, widths, traffic volumes and sight impairments for select Grid/Grid intersections. A separate document maintained by the County, *"CRS/Grid Road Intersection Safety Assessment",* is a risk ranking for Grid/CRS intersections based on sight distances (horizontal and vertical) and traffic volumes. Although ranking of intersections for improvement based on physical characteristics is a good starting point, improvements that are focused on mitigation of collision trends are likely to provide greater benefit. A sample of a desktop review of selected intersections with respect to safety performance and recommendations for improvement is presented in Appendix G.

The width of existing roads in Strathcona County has been identified as an area of concern. Road links in the County, which were identified as having the higher collision frequencies, were reviewed relative to road width and design classification. A discussion of this review is included in Appendix G. The review found that none of the roads identified were in the narrowest ranges observed, and many of the roads met or exceeded the width defined by the road classification. One would expect that the roads identified as having the highest collision frequencies would also be among the narrowest roads; this is not the case. It is

important to note; however, that although the width of the roads is not currently an urgent safety issue it may be in the future and it is advisable to take proactive steps to maintain or improve pavement width.

The following points provide a summary of the safety considerations for the rural road network in Strathcona County:

1. Some specific intersections (see Appendix G) were found to experience "right angle" and "crossing" collisions, although the collision numbers are relatively low. Recommended improvements for these locations will range from intersection upgrades to improvements in sight lines.
2. An analysis of rural road collisions found no direct correlation between narrow width and collision frequency. However, narrow road width is a risk factor, particularly when combined with other factors such as driver behaviour, high traffic volumes, poor road alignment, winter road conditions, etc.
3. As many roads are currently narrower than their classification's design width, priorities for widening should be based on safety performance and traffic volumes.
4. Improving roadway and intersection geometry helps prevent future collisions.
5. The County has an existing Traffic Safety Improvement reserve program for Urban and Rural roads; under this program the County plans to undertake rural safety project(s) in 2010. It is recommended that priorities, particularly for intersections, should be based on collision numbers and severity, and traffic volumes. The nature of improvements (e.g. enhancements to STOP control, improvements to sight lines, road widening, or even rural roundabouts) should be based on the types of collisions at the selected location.
6. Good data collection and analysis is of crucial importance in the design and implementation of effective road safety programs. It is recommended that the County should ensure it has the latest safety data collection and analysis systems, including appropriate software tools.

7.2 EVALUATION OF LINE MARKING ON NARROW ROADS

The County's Municipal Policy SER-009-017 "Traffic Control Devices" was reviewed with particular attention to those sections that apply to or refer directly to line marking on Class I and II rural roads in the Rural Service Area. EBA conducted an exhaustive research of the literature, reviewed the guidelines and practices of other rural municipal and provincial jurisdictions in Canada, and consulted with selected jurisdictions and transportation professionals. A detailed technical memo dated June 30, 2009, describing the results of EBA's review and EBA's recommendations was submitted to the County; it is included as Appendix H of this report.

Based on the wide ranging review of the line marking aspects of traffic control and design guidelines, practices in other jurisdictions, and professional opinions discussed above, EBA

recommends that the County's current policy regarding line marking as contained in the Municipal Policy SER-009-017, "Traffic Control Devices" should be retained, with the following amendments:

1. In Section E, Traffic Control Device Placement, an additional note should be added that reflects the importance of roadway geometry, driver expectation and increased risk in the addition of placement of traffic control devices of any kind. An example of such wording is:

   "The introduction of any traffic control device must consider classification, operation, width, traffic volume, posted speed and other practical considerations for the specific area to ensure that drivers do not develop false expectations of the physical conditions or the actions of other drivers."

2. For greater emphasis, the statement "Roads with less than 7.5 m width should not normally receive centre-line or shoulder markings" could be added at the end of Section O.1 as shown below:

   O. Pavement Line Marking

   1) In the Rural Service Area, line marking decisions will consider:

   - *Road width*
   - *Posted speed*
   - *Site specific conditions*

   Rural roads with posted speeds of 80 km/hr or more and widths of less than 8.0 m are not normally good candidates for centre-line pavement marking. Under special circumstances centre-line marking may be considered without shoulder marking where the surface width is a minimum 7.5 m. Roads with less than 7.5 m width should not normally receive center-line or shoulder markings.

Traffic control devices other than line marking are utilized on narrow rural roads. Warning signs in advance of critical areas or in advance of where the roadway conditions change (i.e. curve ahead, intersection ahead, narrow road ahead) are recommended where there is a need. Warning signs such as Chevron alignment signs, speed reduction advisory signs, and reflective delineator posts along the edge of pavement through curves on narrow roads are also recommended.

8.0 OVERLAY CYCLES AND NARROWING ROAD WIDTHS

The County's historical and current overlay practices and the resulting width reductions caused by successive overlays have been discussed above. This section presents some overall ideas regarding overlay cycle lengths and how to deal with width reductions. Specific issues regarding overlay cycles, widths and related issues for individual functional design classes are dealt with below.

8.1 RECOMMENDATIONS REGARDING OVERLAY CYCLES

EBA's recommendations regarding pavement overlay cycles on the County's rural roads are listed below. Note that these recommendations apply to hotmix and coldmix overlays and, in the case of CRS roads, their improvement from a coldmix surface to a hotmix surface.

1. The practice of overlaying a fixed number of kilometres (based on a fixed cycle) each year (of Class II coldmix pavements and of CRS coldmix road improvement to hotmix) should be discontinued. As discussed earlier, this practice is undesirable from both budget and environmental viewpoints. Moreover, in the case of Class II coldmix overlays, it results in unnecessary narrowing of roads, which in turn leads to future widening/reconstruction requirements at higher cost.

   Instead, overlay priorities should be based on annual condition ratings. In other words, pavements should be overlaid only when required; this revised strategy is expected to save on budgets, in addition to being more environmentally friendly. It is expected that in many cases, maintenance would suffice instead of overlay, thus extending the pavement life.

2. Basing overlay priorities on need (annual condition ratings) is expected to produce significant savings, as quantified below, which should be allocated to the improvement of un-improved Class I roads.

3. To obtain the optimum balance between deferred overlays and increased maintenance costs, it is recommended that the County should undertake a Life Cycle Cost Analysis of the paved rural road network, and apply pavement management principles to identify the most cost-effective treatments and the schedule of their application.

4. Alternative rehabilitation strategies, as discussed below under width loss preservation, should be explored and implemented. Pilot projects for the more promising of these strategies should be implemented to assess their feasibility and cost.

5. Extending the overlay cycle by overlaying as needed, or implementing in-place recycling technologies contributes to sustainability and provides other benefits and indirect cost savings due to (1) maintaining the width, or reducing width loss, and delaying future widening, (2) reducing quantities of non renewable aggregate and asphalt materials incorporated into County roads, and (3) reducing damage to other grid roads used to haul materials.

8.2 HOW TO PRESERVE WIDTH OR DELAY WIDTH LOSS

As discussed earlier, an overlay of an existing road reduces the pavement surface because of the constructed sideslope of the overlay. For a Class II road based on a 50 mm coldmix overlay and 2:1 overlay sideslope, each overlay will result in a pavement width loss of about 0.2 m. For a Class I road based on a 50 mm hotmix overlay and 4:1 overlay sideslope, each overlay will result in a pavement width loss of about 0.4 m.

Some comments regarding preservation of road width in various road operations are provided below:

Reconstruction

As a matter of course, any new construction or reconstruction of an existing road should be to the current road width standards. It should be noted that the County's design standards for new road construction/reconstruction provide road-top width sufficient for two overlays. For example, the road-top width standard for Class I hotmix roads is 9.0 m; and therefore a new or reconstructed Class I hotmix road is built with a 10 m road-top width so that the top width would be greater than 9.0 m even after two overlays.

Overlays

Preservation of road width should be a prime objective during pavement overlays. Several strategies for width preservation when designing and placing overlays are included in Table 9 discussed below.

Safety Improvement Projects

Implementation of spot safety improvement projects offers a good opportunity to address the width issue, at least within the limits of the safety improvement project. Widening the road to current standards as part of safety improvements should normally be a cost-effective proposition.

Routine Maintenance

All attempts should be made to retain the existing road width when carrying out routine maintenance operations.

Table 9 lists several various strategies that can help preserve or delay pavement width loss, or at least slow down the rate of width reduction. Definitions of certain technical terms used in Table 9 are provided below.

Full Depth In-Place Reclamation (FDR): Where the total asphalt bound pavement structure (hotmix or coldmix) and a portion of the underlying granular base is uniformly pulverized and blended in-place, with or without the addition of additional granular material; the reclaimed material can be stabilized mechanically with water or with foamed or emulsified asphalt. An asphalt bound wearing surface is required to be placed on top of the reclaimed and stabilized pavement structure.

Cold In-Place Recycling (CIR): CIR is partial depth recycling of the asphalt pavement layer (hotmix or coldmix) stabilized in-place without heat; the process is carried out with a train of multi-functional recycling equipment. An asphalt bound wearing surface is required to be placed on top of the reclaimed and stabilized pavement structure.

Base Stabilization: Base stabilization involves scarification to 150 mm depth of existing coldmix, granular material (if existing) and subgrade, treatment with 5% Portland cement and moisture conditioning. An asphalt bound wearing surface is required.

It is recommended that pilot projects for the more promising of these strategies should be implemented to assess their feasibility and cost. It is recognized that these strategies may need some modifications to successfully address specific conditions that may be unique to the County's rural road network.

9.0 RECOMMENDATIONS REGARDING CLASS I ROAD NETWORK

9.1 RECOMMENDED REGIME FOR COLDMIX (UN-IMPROVED) CLASS I ROADS

The Class I road network is the most important part of the County's rural road system; it carries the highest traffic volumes, and serves as the link to the provincial highway system and to/from Sherwood Park, Edmonton, and Fort Saskatchewan. However, as discussed earlier, the Class I network has not received its due share of the County's road budget and has consequently not kept up with the traffic demands. For example, of the 79 km of Class I roads, 36 km (46%) need improvement in surface type in that they still surfaced with coldmix.

Recommendations

- Improve/reconstruct the 35.7 km of un-improved coldmix Class I roads to meet the width and surface standards.
- Per the County's standards, build the design cross-section for reconstructed roads to achieve a road top width of 10.0 m after reconstruction to allow for 2 future overlays of 60 mm (0.060 m x 2 x 4 x 2) at about year 20 and year 40 to provide a sufficient road top width for a 60 year period.
- Prioritize the reconstruction of un-improved Class I roads based on:
  - Safety Performance
  - Traffic Volumes
  - Emerging Needs
- Until reconstruction, develop and implement a preservation program for all un-improved Class I roads to preserve the existing coldmix surfacing and subgrade, and ensure an adequate level of serviceability. This program should be road specific and needs to consider the required service period until reconstruction and road condition, and should include the following treatments:
  - Ongoing Maintenance (localized patching, pot hole repair)
  - Coldmix Overlay Patch (blade laid)
  - Coldmix Overlay

Cost Implications

- The cost of constructing/reconstructing an un-improved Class I road to the current standards is estimated at $1.25 million/km in 2008 dollars based on County estimates, exclusive of land (right-of-way) cost if required. The total estimated cost to reconstruct/widen (grading, base and paving) the 36 km un-improved Class I roads is

estimated at 35.7 x $1.25 million/km = $44.6 million in 2008 dollars, excluding right-of-way costs if any.

- Nominal yearly maintenance cost for un-improved 35.7 km is estimated at $65,000 in 2008 dollars (based on $1,800/km).
- The yearly cost of the coldmix overlay patch, based on an assumed treatment of 10% of the area per year (without base stabilization), is estimated at $270,000 in 2008 dollars (based on $10.50/m^2).

9.2 RECOMMENDED REGIME FOR IMPROVED HOTMIX CLASS I ROADS

There are 43.3 km of improved Class I roads with hotmix surfaces, of which 15.8 km have pavement widths between 7.8 m and 8.7 m (i.e. less than the 9.0 m current standard). It is understood that the County's practice is to design the reconstruction pavement structure, or overlays of a reconstruction pavement structure, for a 20 year service life.

Recommendations

- Develop a program to widen 15.8 km of roads with substandard widths to meet Class I standards.
- Per the County's standards, build the design cross-section for reconstructed roads to achieve a road top width of 10.0 m after reconstruction to allow for 2 future overlays of 60 mm (0.060 m x 2 x 4 x 2) at about year 20 and year 40 to provide a sufficient road top width for a 60 year period.
- Prioritize the widening of Class I roads with substandard widths based on:
  - Safety Performance
  - Traffic Volumes
  - Emerging Needs
- Prioritize roads for hotmix rehabilitation overlays based on pavement condition.
- Continue to follow current maintenance practices to preserve and maximize the service life of hotmix pavements based on condition (i.e. crack filling and sealing, and spray patching of surface deficiencies).
- Use chip seals as a preservation treatment to treat pavement surface deficiencies (i.e. premature ravelling). Prioritize roads for chip seals based on condition criteria (to be established), not "worst first".

Cost Implications

- The cost to widen existing narrow Class I hotmix roads to the current standards is estimated at $0.6 million/km in 2008 dollars, exclusive of land (right-of-way) cost if required. The total estimated cost to widen (grading, base and paving) the 15.8 km narrow Class I roads is estimated at 15.8 x $0.6 million/km = 9.5 million in 2008 dollars, excluding right-of-way costs if any.

- Nominal yearly maintenance cost for 15.8 km is estimated at $18,000 in 2008 dollars (based on $1,100/km).
- The cost of the hotmix overlay (based on an assumed 20 year cycle) is estimated at 15.8 x $205,000/km = $3.2 million in 2008 dollars. This is only for the improved Class I roads. As the un-improved roads are improved, they will need to be overlaid, albeit not for 20 years from now.

10.0 RECOMMENDATIONS REGARDING CLASS II ROAD NETWORK

The recommendations in this section are based on the discussion in Section 7 above.

10.1 RECOMMENDED OVERLAY REGIME FOR COLDMIX CLASS II ROADS

The current practice is to overlay coldmix Class II roads on a fixed 12 year cycle (with partial base stabilization).

Recommendations

- Discontinue the fixed 12 year overlay cycle and determine annual needs based on condition assessment.
- Follow the current maintenance practices to preserve and maximize the service life of coldmix pavements based on condition (i.e. crack filling, surface patching of localized failures). See related comments in Section 6.
- Evaluate graded aggregate seal coat as a preservation treatment to extend the life of coldmix surfaces.

Cost Implications

- For the purposes of estimating the cost savings, this revised overlay strategy is assumed to be equivalent to increasing the overlay cycle from 12 to 14 years. Note the comments in Section 6 that this scenario is only one of several potential future scenarios.
- This strategy is estimated to reduce the capital (overlay) expenditure for the coldmix Class II network by about $430,000 per year (based on coldmix overlay cost of $75,000/km). However, there will be some increase in maintenance expenditures, estimated to be about $25,000/year for the coldmix Class II network (based on $1,800/km). The net savings are therefore estimated at about $400,000/year that can be redirected into improving the Class I network. Note the comments in Section 6 that this scenario is only one of several potential future scenarios.
- Extending the overlay cycle by overlaying as needed, or implementing in-place recycling technologies contributes to sustainability and provides other benefits and indirect cost savings due to (1) maintaining the width, or reducing width loss, and delaying future widening, (2) reducing quantities of non renewable aggregate and asphalt materials

incorporated into County roads, and (3) reducing damage to other grid roads used to haul materials.

10.2 RECOMMENDATIONS FOR OVERLAYING IMPROVED CLASS II ROADS WITH HOTMIX

An improved Class II road is defined by the pavement width meeting or exceeding the minimum desirable width of 7.5 m. Table 10 list the comparative characteristics of hotmix and coldmix overlays. This section discusses whether and under what conditions it might make sense to overlay an improved coldmix Class II with a hotmix overlay. Applied to the right existing coldmix surface, a hotmix overlay would be expected to have a longer service life than a coldmix surface.

Recommendations

Placing a hotmix overlay over an existing coldmix surface can be considered on improved Class II roads subject to the following guidelines:

- The improved road has a granular base layer, or has received 100% base stabilization.
- The subgrade can be considered stable, with good drainage and no significant frost heaving conditions.
- Specifications and design requirements for hotmix for these applications will need to be developed based on the City of Edmonton ACR specifications.

Cost Implications

- No cost implications are provided because comparative costs of in-place hotmix and coldmix for equivalent width and thickness are not available.
- Somewhat higher maintenance costs are anticipated for the hotmix overlay due to potentially increased extent of thermal, construction-related and random cracking.

10.3 RECOMMENDATIONS REGARDING WIDENING OF NARROW CLASS II ROADS

Of the total of 490.5 km of Class II roads, 45.9 km (9%) have widths greater than 7.5 m and 444.6 km (91%) have widths below the desirable width of 7.5 m. Of these roads with widths less than 7.5 m, there are 362 km (74%) with widths less than 7.0 m.

Recommendations

- Develop a program to widen 444.6 km of roads with substandard widths to meet Class II standards.
- Modify the design cross-section for widened roads to achieve a subgrade top width after widening to allow for 2 future overlays of 50 mm at about year 14 and year 28 to provide a sufficient road top width for a 36 year period. Maintain the desirable standard of a 7.5 m surface top width over the 36 year period.
- Prioritize the widening of Class II roads with substandard widths based on:

- Safety Performance
- Traffic Volumes
- Emerging Needs

- The cost of reconstructing/widening a Class II coldmix road to the current standards is estimated at $465,000/km in 2008 dollars (based on EBA estimates), exclusive of land (right-of-way) cost if required. The total estimated cost to reconstruct/widen (grading, base and paving) the 444.6 km un-improved Class II roads is estimated at 444.6 x $465,000/km = $207 million in 2008 dollars, excluding right-of-way costs if any.

  This level of expenditure on widening narrow Class II roads is obviously very unrealistic. In any case, not all narrow Class II roads would need widening. A more practical scenario would be to widen only those narrow Class II roads which have relatively high traffic volume and/or exhibit known safety related improvement needs.

- Nominal yearly maintenance cost for 444.6 km is estimated at $800,000 in 2008 dollars (based on $1,800/km).

- The cost of the coldmix overlay is estimated at $75,000/km in 2008 dollars.

11.0 RECOMMENDATION REGARDING RE-GRAVELLING FREQUENCY ON CLASS III AND IV GRAVEL ROADS

The current County policy for re-gravelling of Class III and Class IV gravel roads stipulates a 7 year re-gravel cycle.

Based on a survey of re-gravelling practices of selected Alberta rural municipalities, EBA recommends that the County assess a 5 year average re-gravel cycle based on needs determined on the basis of annual condition surveys and recommendations by maintenance staff. The cycle length of 5 years would apply to the gravel road networks as a whole, with an allowance for re-gravelling higher volume roads more frequently and lower volume roads less frequently.

12.0 RECOMMENDATION REGARDING COUNTRY RESIDENTIAL ROADS

Recommendations

There are 186 km of CRS roads that currently have a coldmix surface. The current practice is to surface rehabilitate coldmix CRS roads at a fixed cycle of 15 years (with full base stabilization and hotmix overlay).

- Discontinue the fixed 15 year practice and determine annual needs based on condition assessment.

- Follow the current maintenance practices (i.e. crack filling, sealing, spray patching of surface deficiencies, and localized patching of coldmix and hotmix surfaces) to maximize life.

Cost Implications

- For the purposes of estimating the cost savings, this revised overlay strategy is assumed to be equivalent to increasing the overlay cycle from 15 to 17 years.
- The cost saving by basing overlay on condition is estimated to reduce the capital (overlay) expenditure for the coldmix Class II network by $880,000 per year (based on $235,000/km which includes base stabilization cost). However, there will be some increase in maintenance expenditures, estimated to total $60,000/year for the coldmix Class II network (based on $1,600/km). The net savings are therefore estimated at about $800,000/year that can be redirected into improving the Class I network. Note the comments in Section 6 that this scenario is only one of several potential future scenarios.

13.0 RECOMMENDATION REGARDING HAMLET ROADS

There are 8 km of Hamlet roads that currently have a coldmix surface. The current practice is to surface rehabilitate Hamlet roads with a hotmix overlay based on a fixed budget partially funded by the Province. The service life of a hotmix overlay may be 30 years or more in these applications.

- No change to the current overlay practice is recommended.
- Continue the current maintenance practices (i.e. crack filling, sealing, spray patching of surface deficiencies and localized patching of roadways) to maximize life.

14.0 RECOMMENDATIONS RE. OVERLAY CYCLES FOR ROADS IN SPECIALIZED AREAS

The study TOR asked EBA to assess whether the rural roads in specialized areas identified in the County's Municipal Development Plan (such as Alberta Industrial Heartland, Rural/Urban Transition Policy Area, Urban Reserve area, etc.) would require special overlay cycles specific to these areas. Condition-based overlays should in fact be more responsive to the needs of special areas, say Alberta's Industrial Heartland, in case the heavy traffic causes a particular road to deteriorate, and thus trigger an overlay or special maintenance efforts.

As discussed above, EBA is recommending that fixed or special overlay cycles should be discontinued on the County's rural roads, and that overlay needs and priorities be determined on the basis of road conditions. This recommendation would apply to special areas also.

15.0 RECOMMENDATIONS REGARDING SUSTAINABLE BUDGET ALLOCATIONS

This section deals with enhancing the sustainability of the County's existing rural roads budget by redistributing it in accordance with the long term needs and priorities of the County's rural road network by implementing the recommendations discussed above.

In the preceding sections it was recommended that no change be made in the management regimes for Class III (gravel), Class IV (dust-suppressed), and hamlet roads.

However, the spending decisions based on fixed overlay cycles for Class II and CRS roads are resulting in sub-optimal, and in some cases wasteful, expenditures; and at the cost of neglecting more urgent priorities, such as improving the narrow coldmix Class I roads.

Therefore, it is recommended that within existing budget levels the savings accruing from overlaying as-needed based on annual condition assessment, should be re-allocated to improvement of Class I roads. Based on the scenario discussed above, savings of $1.2 million per year ($400,000 from Class II overlays and $800,000 from CRS overlays) would be available for re-allocation to higher priority needs such as improvement of un-improved Class I roads. Note the comments in Section 6 that this scenario is only one of several potential future scenarios.

Table 11 shows the results of applying these recommended budget re-allocations to the 2006-2009 total rural roads budget level. The table shows three comparative allocations: the percent allocation to various functional road classes recommended in the 1995 RRMP; the current 2006-2009 annual average allocation; and the recommended future allocation based on shifting $1.2 million to Class I roads.

Table 12, reproduced below, compares the after re-allocation future percentage shares for various road classes with their percentage shares recommended in the 1995 RRMP, as well as with the average 2006-2009 percentage shares.

TABLE 12. RECOMMENDED BUDGET RE-ALLOCATION PERCENTAGES COMPARED TO THE 1995 RECOMMENDATIONS AND THE 2006-2009 ACTUAL EXPENDITURE ALLOCATIONS

Design Classification	1995 RRMP Suggested Allocation (%)	2006-2009 4-year Average Annual Expenditure Allocation (%)	Recommended Future Allocation (%)	% to % Change from 2006-2009 Allocation to Future Allocation
Class I Network	25.3 %	3.1 %	14.3%	+ 11.2 %
Class II Network	36.5 %	43.6 %	39.8%	- 3.8 %
Class III and IV Combined	14.6 %	16.1 %	16.1%	0 %
Total Grid Roads	**76.4 %**	**62.8 %**	**70.2%**	**+ 7.4 %**
Country Residential Roads	22.3%	35.6 %	28.2%	-7.4 %
Hamlet Roads *	1.3 %	1.6 %	1.6%	0 %
Total Rural Roads	**100 %**	**100 %**	**100 %**	**0 %**

* Provincial funding included

Thus, after re-allocation:

- Class I roads will be allocated 14.3% of the total rural roads budget compared to 25.3% recommended in the 1995 RRMP; meaning that they will still remain comparatively under-funded.
- Class II roads will be allocated 39.8% of the total rural roads budget compared to 36.5% recommended in the 1995 RRMP.
- Class III and IV roads (which were dealt with as a combined item in the 1995 RRMP) will be allocated 16.1% of the total rural roads budget compared to 14.6% recommended in the 1995 RRMP.
- CRS roads will be allocated 28.2% of the total rural roads budget compared to 22.3% recommended in the 1995 RRMP.
- Hamlet roads will be allocated 1.6% of the total rural roads budget compared to 1.3% recommended in the 1995 RRMP.

These re-allocations will help bring the rural roads budget distribution closer to the current needs, although Class I roads will stay comparatively under-funded.

Timing of Implementing the Recommended Budget Re-distribution

If it is too late to formally incorporate the recommended changes in the County's practices and budgets in the official 2010 budget documents, then EBA recommends that:

1. The recommended changes in the Class II and CRS road overlay practices (from a "fixed overlay cycle/fixed no. of kilometres overlaid " to "condition-based, as-needed overlays" be formally implemented in the 2010 construction season, and the estimated 1.2 million savings be placed in a reserve fund for investment in improvement of un-improved Class I roads; and
2. The recommended changes should be formally incorporated in the official 2011 budget.

16.0 REVIEW OF RURAL ROAD FUNCTIONAL CLASSIFICATION AND DESIGN STANDARDS

16.1 INTRODUCTION

Section 4.1 presented the definitions and general descriptions of the County's existing road classification system and the associated design standards. An overview of selected key elements contained in the County's classification system and design standards (traffic volume by classification, design speed, posted speed, road width, design life, surface type and right-of-way requirements) is provided in Table 1.

EBA was asked to review and evaluate the County's functional road classification criteria and design standards, and make recommendations regarding any changes required. In particular, EBA was asked to propose suitable functional road classification system/criteria that could be applied by County staff to update functional classification designations of

particular rural roads if and when warranted by future changes in factors such traffic volumes, road functions, etc.

Appendix I presents the detailed results of EBA's review of Strathcona County's rural road functional classification and design criteria. The main recommendations for revisions to the County's classification system and design standards are summarized below.

16.2 REVIEW OF THE FUNCTIONAL ROAD CLASSIFICATION SYSTEM / CRITERIA

The County's current system for functional road classification was described in Section 4.1. EBA's recommendations regarding future functional classification of the County's rural roads are summarized below:

1. Adopt the proposed functional road classification system criteria presented in Table 13. The County's current system for functional road classification, discussed in Section 4.1, relies almost exclusively on traffic volumes as the classification criterion. EBA proposes that additional factors (in addition to traffic volume) should be utilized to determine the functional classification of County's rural roads in future. Below is the list of suggested classification factors:

    a. Traffic volume and type

    b. Function of the road

    c. Connection to the Provincial Highway Network

    d. Spatial hierarchical system

    e. Continuity

    Table 13 shows the system of factors/criteria for a proposed functional classification system for Strathcona County rural roads, and applies the proposed criteria/factors with respect to the various rural road classifications. Further definition is provided in the table for each proposed class of road in terms of traffic volume and type, function, connection to the provincial highway network, spatial hierarchical characteristics and continuity.

    It is recommended that the County adopt the proposed system/criteria for future reviews of the functional classification of the County's rural roads.

    At the present time, EBA does not propose reclassification of any specific roads.

    In the future, as and when substantial changes in one or more of the five classification factors a to e in the above list indicate that the functional classification of specific rural roads needs reviewing, the County can apply the proposed classification system/criteria to determine whether functional classification of the affected roads warrants a change. For example, the traffic volume on a road may increase because of industrial, residential or other developments. Another example is a "subdivision application" that may trigger a quick functional classification check for the affected road(s). It is recommended that

traffic volumes on the affected roads be double checked by special counts to ensure accuracy and to avoid misclassification. It is understood that any future functional classification revisions will be brought before Council for review and approval.

2. Keep the current six functional classifications (Class I, II, III, and IV roads; CRS roads; and Hamlet roads).

3. Create a new Industrial Roads classification to deal with special heavy industrial (truck) traffic in the Industrial Heartland area, and elsewhere as applicable. Table 13 suggests classification criteria for Industrial Roads. It should be noted that any proposed changes in the functional classification and/or design standards of the roads in the Industrial Heartland area should be considered in light of other relevant studies such as the "Strathcona Area Industrial Heartland Transportation Study Update, November 2007 (Stantec 2007), and the current Heartland Transportation Study by ISL Engineering and Land Services Ltd.

4. Consider reversing Class III and Class IV names to de-confuse the current situation in which the inferior surface standard of "gravel" is numbered Class III and the superior surface standard of "dust-suppressed" is numbered Class IV.

5. For classification of roads in Special Areas, apply the suggested requirements in the proposed classification criteria.

EBA believes that the proposed classification system provides greater depth of definition in the criteria (beyond traffic volume) to better represent the system needs. In addition, it specifically defines "Industrial Roads" as a separate functional classification. Also, it proposes to removing the confusion of the current Class III versus Class IV definition (in which Class IV - Dust-Suppressed is superior to Class III - Gravel) by referring to Class III as dust-suppressed and Class IV as gravel.

16.3 REVIEW OF THE RURAL ROAD DESIGN STANDARDS

The County's current design standards for rural roads were described in Section 4.1, and summarized in Table 1. The details of EBA's research and review of functional classification and design standards are provided in Appendix I, and the main recommendations for revisions to the rural road design standards are summarized below.

1. EBA's evaluation shows that, for all functional road classifications except the ones listed in point 2 below, the County's geometric and surfacing design standards (road-top width and other geometric and structural features) are expected to well serve the County's needs for the foreseeable future, and therefore EBA recommends that no changes are required.

2. For industrial roads and very high traffic volume Class I roads, conduct individual engineering analyses to determine appropriate geometric and structural dimensions in accordance with the Transportation Association of Canada guidelines.

17.0 CONCLUDING COMMENTS

In conclusion, EBA believes that the analyses, findings and recommendations provided in the report meet the requirements of the Terms of Reference, and would help the Strathcona County manage its rural roads network in a manner compatible with environmental and budget sustainability.

Respectfully Submitted,
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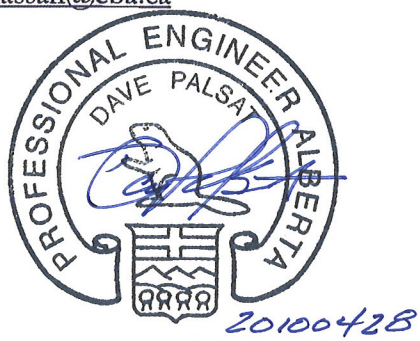

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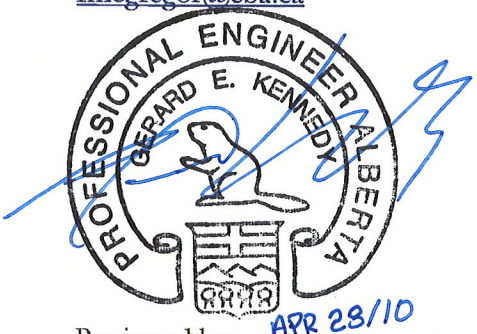

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PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature: McGregor
Date: April 28, 2010
PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

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