Modified Surface Aggregate Stabilization with Calcium Chloride
A Test Project for Lethbridge County Haul Roads

Results from One Year Monitoring Period

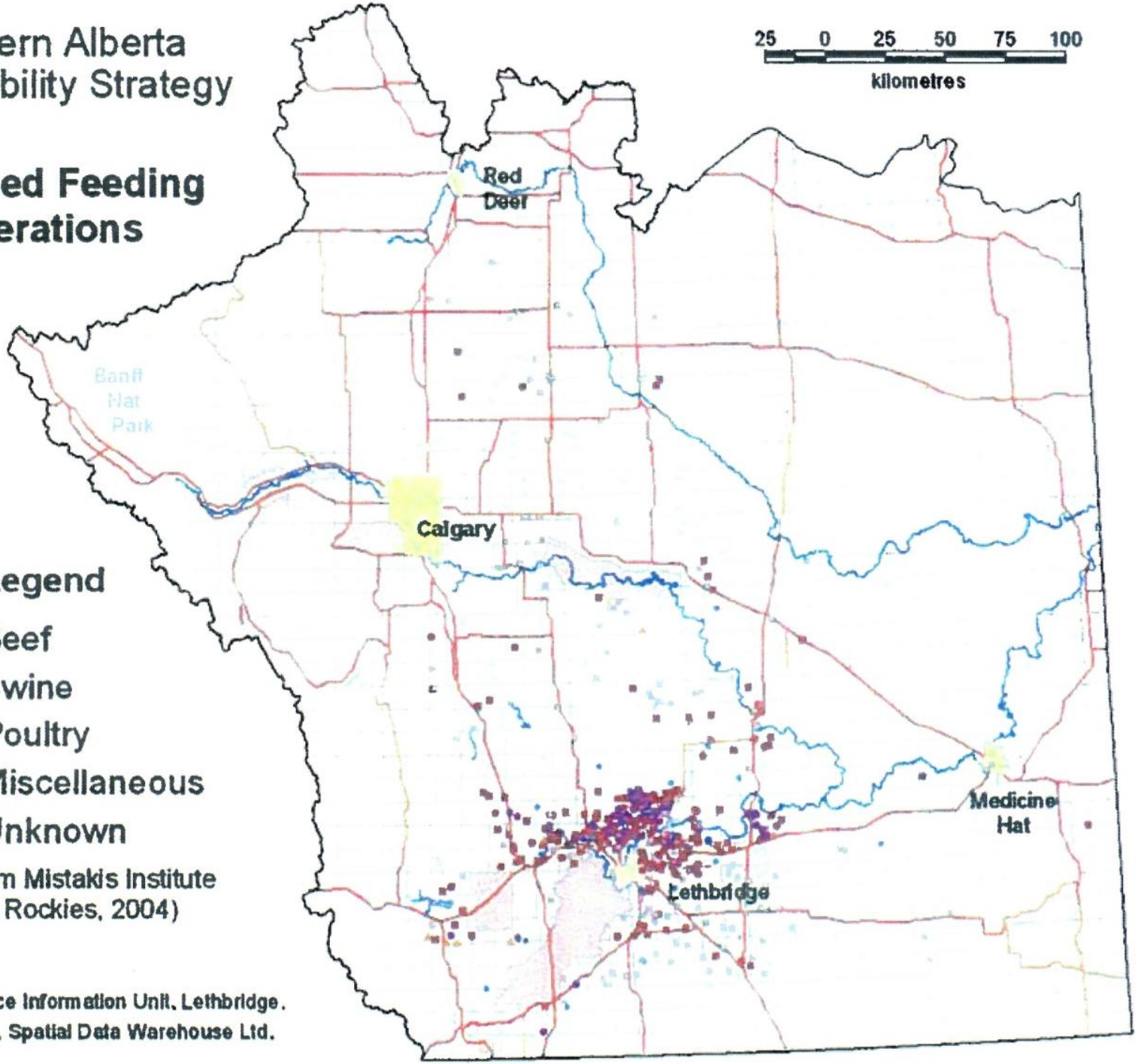
2016 AMSA Fall Convention
November 16, 2016 - Edmonton, AB

INTRODUCTION

- Located in Southern Alberta
- Semi Arid Climate
- Population 10,061
- Lowest Linear Taxes in the Area $3M Compared to Neighbors ($10M-$27M)
- Highest Concentration of Intensive Livestock in Alberta $1.12B GDP Annually
- High Concentration of Heavy Haul Routes

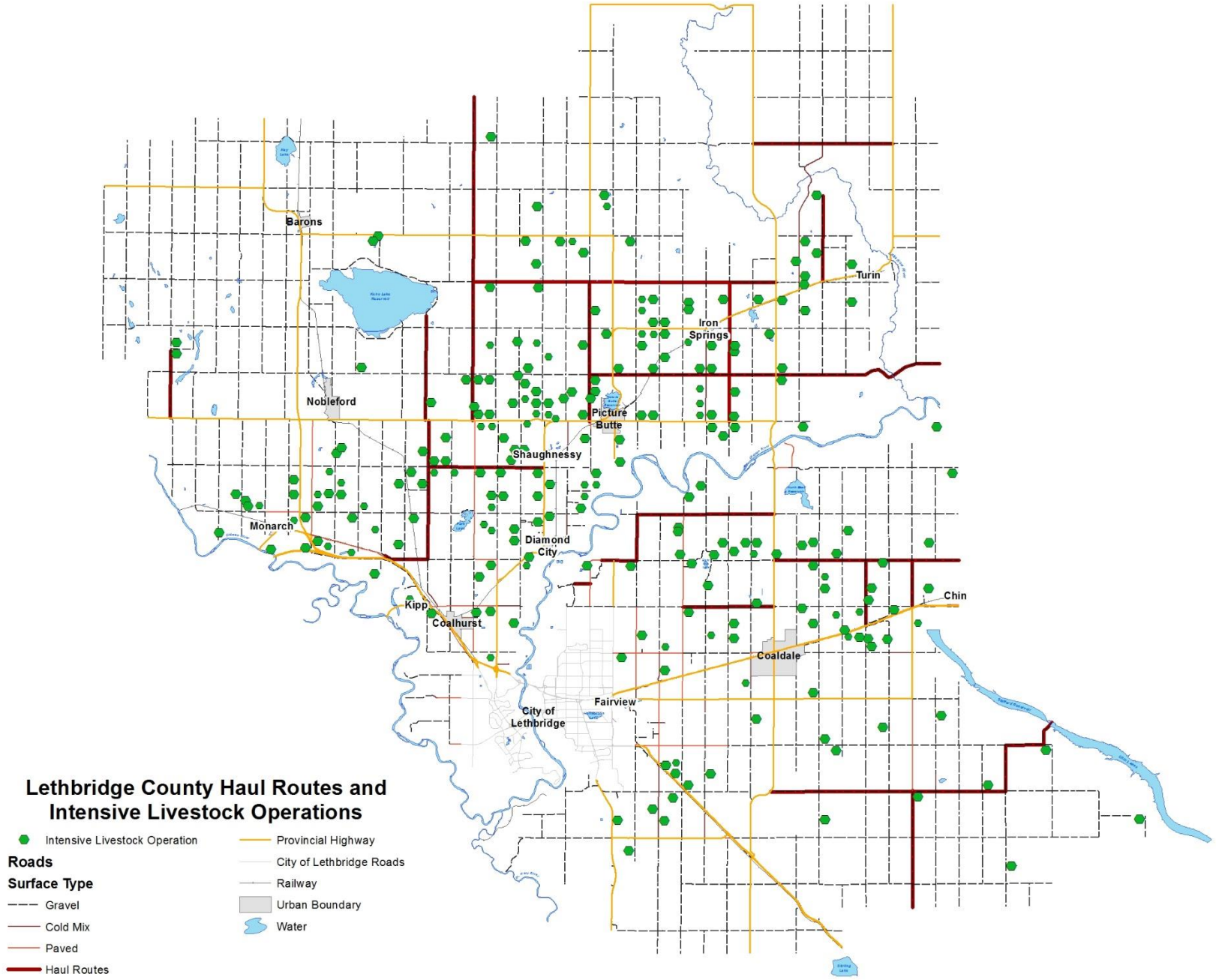
Southern Alberta Sustainability Strategy

Confined Feeding Operations

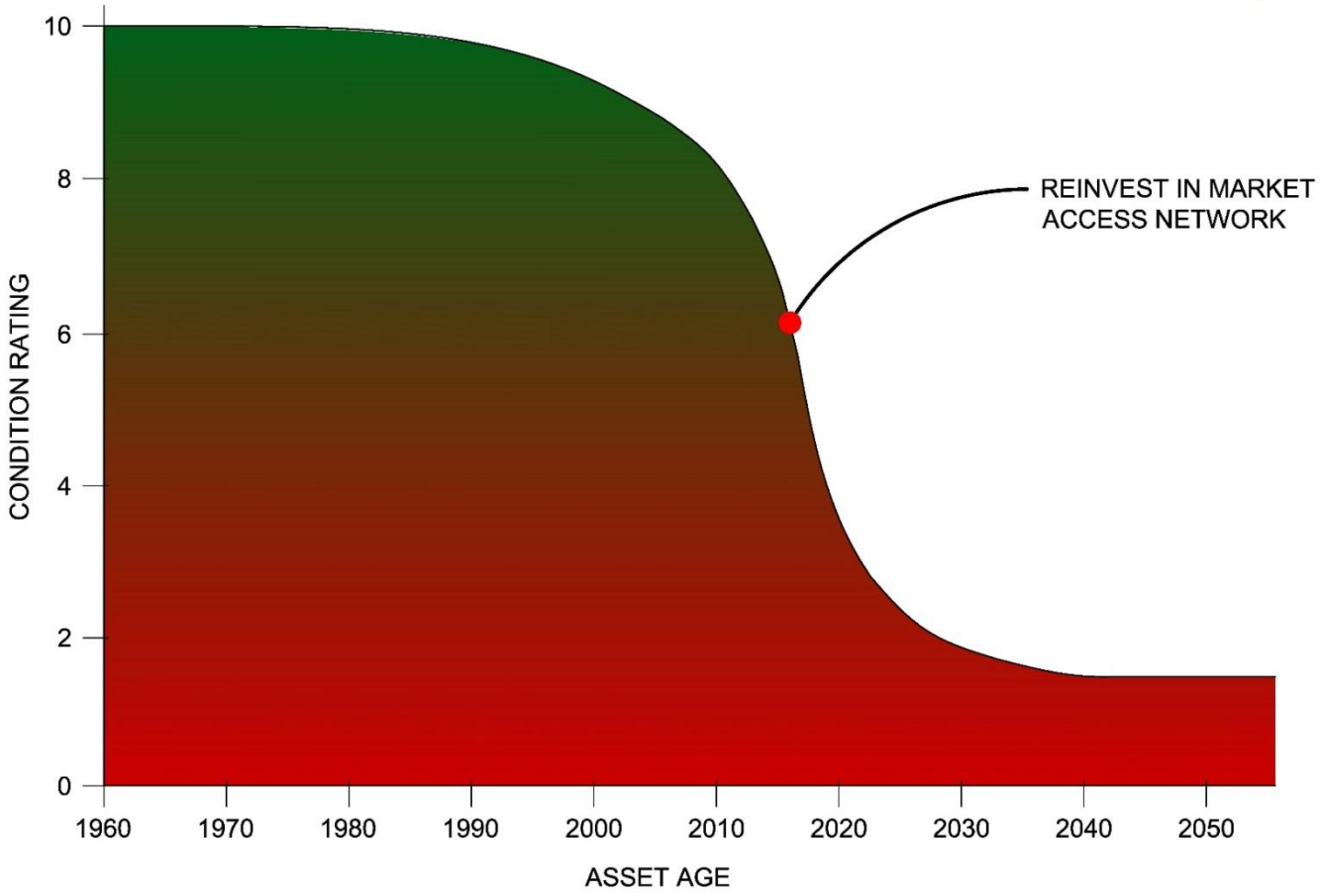


(Data from Mistakis Institute of the Rockies, 2004)

Map by Resource Information Unit, Lethbridge.
Base Map Data, Spatial Data Warehouse Ltd.


Barons
Turin
Iron Springs
Nobleford
Picture Butte
Shaughnessy
Monarch
Diamond City
Chin
Kipp
Coalhurst
Coaldale
Fairview
City of Lethbridge
Lethbridge County Haul Routes and Intensive Livestock Operations
Intensive Livestock Operation
Roads
Surface Type
Gravel
Cold Mix
Paved
Haul Routes
Provincial Highway
City of Lethbridge Roads
Railway
Urban Boundary
Water

ASSET DETERIORATION 1960-2050



PRESENTATION OUTLINE

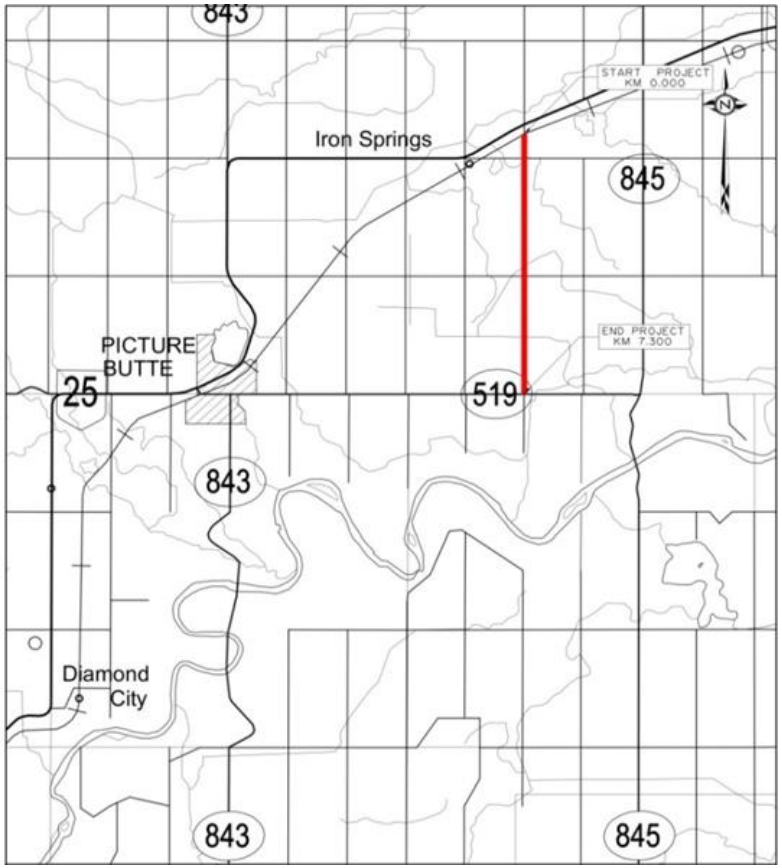
- BACKGROUND
- TEST SECTIONS – RECAP
- POST CONSTRUCTION ANALYSIS
- FINDINGS/CONCLUSIONS
- 2016 STABILIZATION PROGRAM
- FUNDING & PUBLIC CONSULTATION
- CLOSING COMMENTS/QUESTIONS

BACKGROUND

- 1,800 km of Gravel Road, 215 km of Haul Routes
- Haul Routes Introduced in 2013
- Haul Route Business Case – WSP (2014)
- Determine Most Cost Effective Solution
- Calcium Chloride Stabilization
- Test Project Constructed in 2014
- Report Submitted at the End of 2015

TEST ROAD

- Range Road 20-3 from Hwy 519 to Hwy 23



TREATMENT TYPES

- 24 Test Sections – 1,000 Feet
- 6 Types – Repeated 4 Times

TREATMENT NO.	TREATMENT TYPE	% $CaCl_2$ BY DRY WEIGHT GRAVEL	APPLICATION TYPE	APPLICATION RATE	MIXING EQUIPMENT	TREATMENT DEPTH
1	Liquid $CaCl_2$	2.22	Liquid Distributor	3L/m^2	Blade Laid	25mm
2	Liquid $CaCl_2$	1.11	Liquid Injected	3L/m^2	MillRazor™	50mm
3	Dry $CaCl_2$	1.50	Dry Distributor	1.75kg/m^2	MillRazor™	50mm
4	Dry $CaCl_2$	1.00	Dry Distributor	1.17kg/m^2	MillRazor™	50mm
5	Dry $CaCl_2$	1.50	Dry Distributor	2.63kg/m^2	MillRazor™	75mm
6	Untreated	N/A	N/A	N/A	N/A	N/A

WSP

LETHBRIDGE COUNTY

CONSTRUCTION

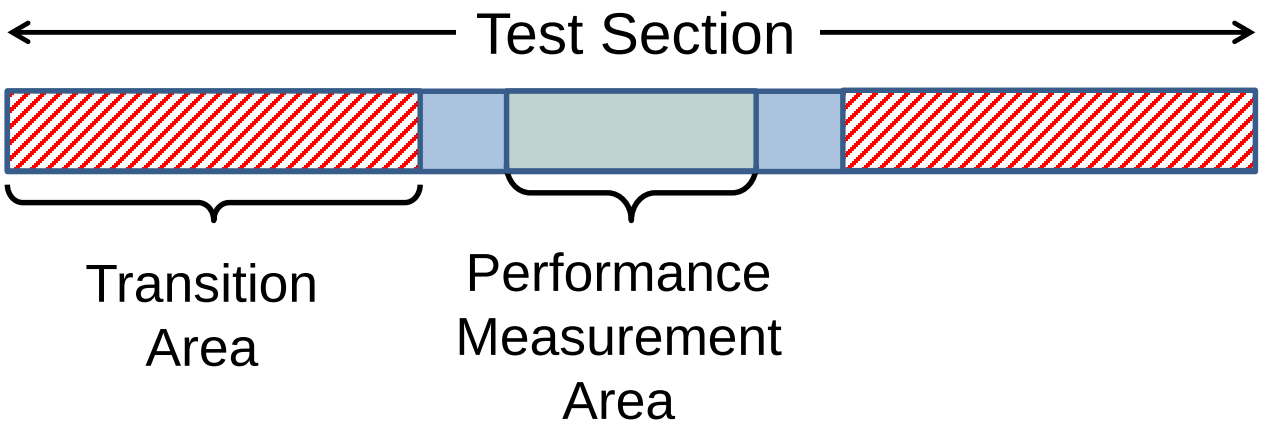
- Constructed in Summer of 2014
- Blade Mix and Rotary Mixer MillRazor™

POST CONSTRUCTION ANALYSIS

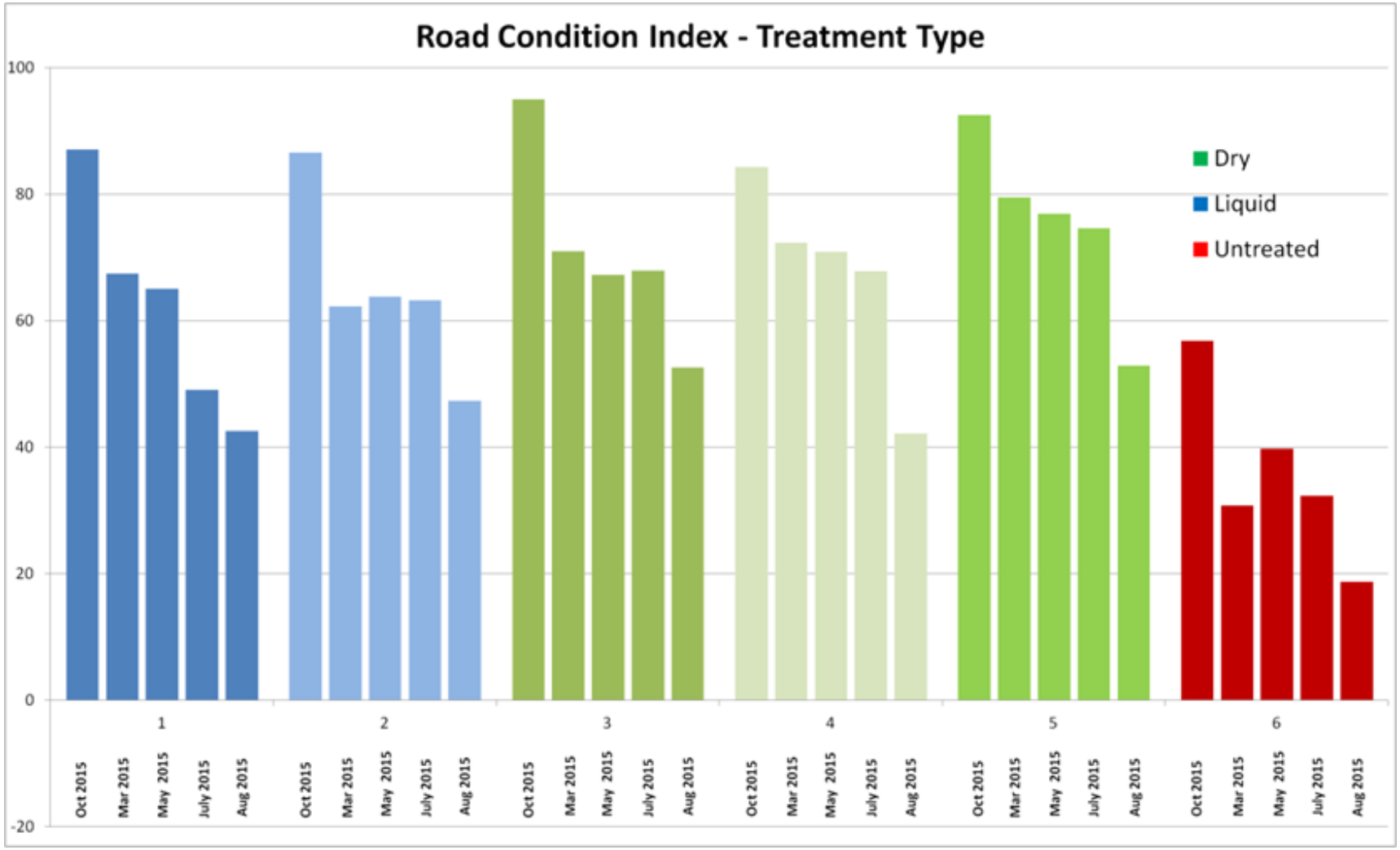
- Sections Monitored from Summer 2014 to Fall of 2015
- Road Condition
- Construction Costs
- Maintenance Costs
- Gravel Loss
- Traffic Counts
- Weather Data

ROAD CONDITION SURVEY

- Road Condition Surveys
- Completed Monthly – Except During Winter
- Evaluate 5 Different Aspects (Washboards, Potholes, Rutting, Loose Gravel and Dust)



ROAD CONDITION INDEX



ROAD CONDITION INDEX

- Average Road Condition Index 35.6 to 75.3
- Highest Condition Received Highest Ranking

TREATMENT TYPE	$CaCl_2$ PRODUCT	% $CaCl_2$ BY DRY AGG. WGT.	TREATMENT DEPTH (mm)	ROAD CONDITION INDEX	RANKING
5	Dry at 94% Conc.	1.5	75	75.3	1
3		1.5	50	70.7	2
4		1.0		67.5	3
2	Liquid at 31% Conc.	1.11		66.1	4
1		2.22	25	64.0	5
6	Untreated			35.6	6

CONSTRUCTION COSTS

- Costs Tracked During Construction
- Costs Include All Materials Equipment and Labour
- Majority of Cost is From the 100mm of Aggregate
- Average Construction Costs $51K to $61K per Km
- Lowest Construction Cost Received Highest Rank

TREATMENT TYPE	$CaCl_2$ PRODUCT	% $CaCl_2$ BY DRY AGG. WGT.	TREATMENT DEPTH (mm)	TEST SECTION CONSTRUCTION COST (PER 1.2KM)	TEST SECTION CONSTRUCTION COST (PER KM)	RANK
6	Untreated			$ 62,919.68	$ 51,607.35	1
1	Liquid at 31% Conc.	2.22	25	$ 64,518.41	$ 52,918.64	2
2		1.11	50	$ 65,747.18	$ 53,926.49	3
4	Dry at 94% Conc.	1.0		$ 68,661.37	$ 56,316.74	4
3		1.5		$ 71,814.00	$ 58,902.56	5
5			75	$ 75,233.78	$ 61,707.50	6

MAINTENANCE COSTS

- Maintenance Costs Tracked by the County
- Costs Include All Materials, Equipment and Labour
- Based on a 15 Month Period
- Average Maintenance Costs $1.1k to $2.5k per Km
- Lowest Maintenance Cost Received Highest Rank

TREATMENT TYPE	$CaCl_2$ PRODUCT	% $CaCl_2$ BY DRY AGG. WGT.	TREATMENT DEPTH (mm)	TEST SECTION MAINTENANCE COST (PER 1.2KM)	TEST SECTION MAINTENANCE COST (PER KM)	RANK
4	Dry at 94% Conc.	1.0	50	$ 1,416.64	$ 1,161.94	1
3		1.5		$ 2,073.13	$ 1,700.40	2
5			75	$ 2,073.13	$ 1,700.40	2
1	Liquid at 31% Conc.	2.22	25	$ 2,073.13	$ 1,700.40	2
2		1.11	50	$ 2,764.18	$ 2,267.21	5
6	Untreated			$ 3,060.35	$ 2,510.13	6

TRAFFIC DATA

- Each Test Section Assigned a Traffic Volume
- 8 Vehicle Counters Installed Throughout the Project
- Traffic Volumes Ranged from 157 to 220 ADT
- 29% Heavy Truck Traffic
- Highest Volume Received Highest Ranking

TREATMENT TYPE	$CaCl_2$ PRODUCT	% $CaCl_2$ BY DRY AGG. WGT.	TREATMENT DEPTH (mm)	ADT	AVG. TRAFFIC VOLUME	RANK
1	Liquid at 31% Conc.	2.22	25	220	80,494	1
4	Dry at 94% Conc.	1.0	50	193	70,524	2
3		1.5		174	63,612	3
6	Untreated			170	62,173	4
5	Dry at 94% Conc.	1.5	75	159	58,052	5
2	Liquid at 31% Conc.	1.11	50	157	57,174	6

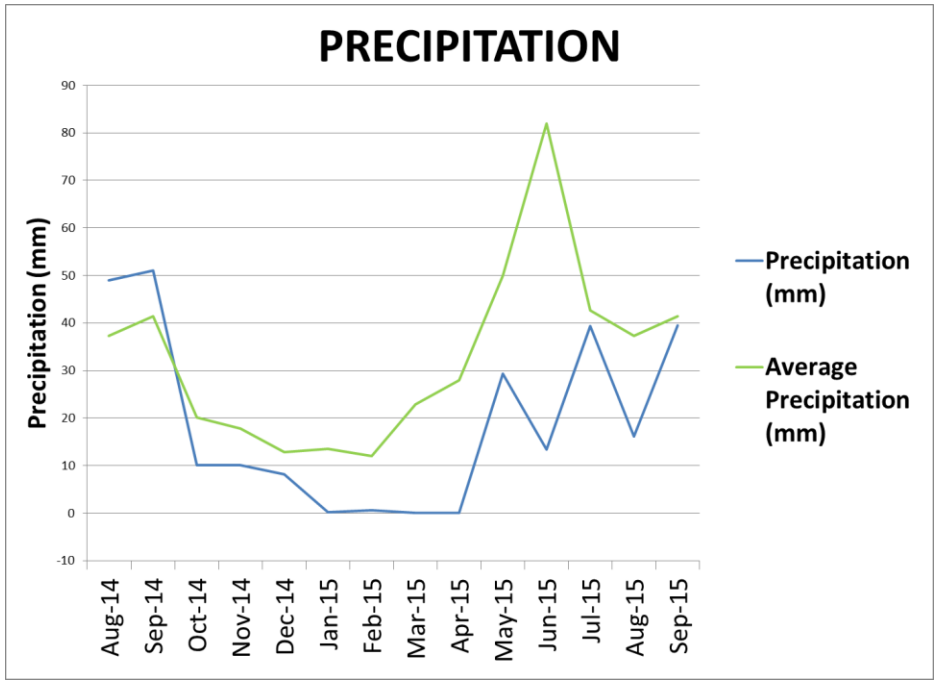
GRAVEL LOSS

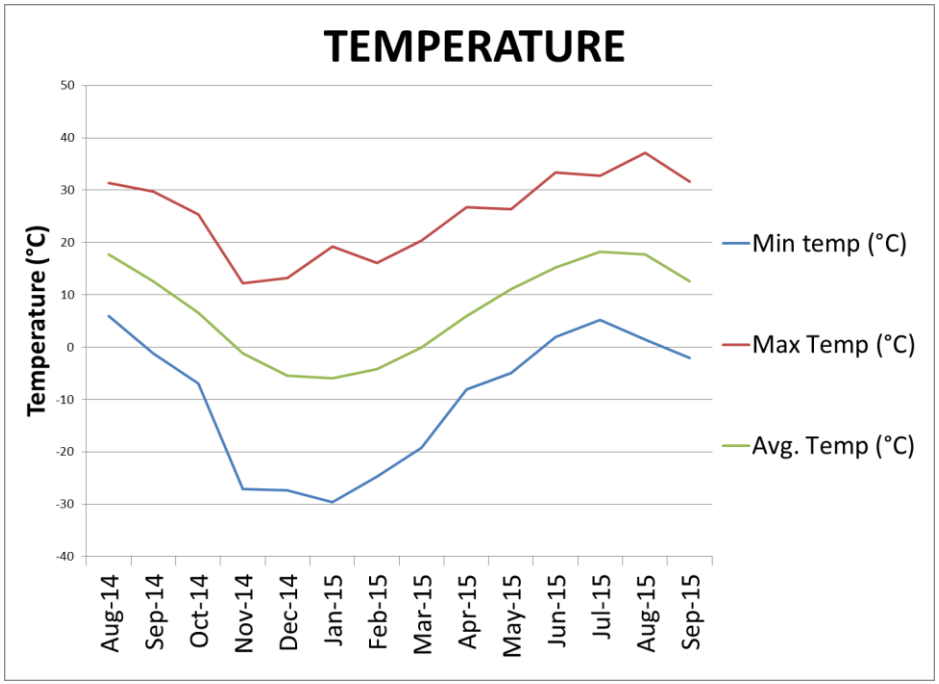
- Based Average Weight of Loose Gravel
- Lowest Value Received Highest Rank

TREATMENT TYPE	$CaCl_2$ PRODUCT	% $CaCl_2$ BY DRY AGG. WGT.	TREATMENT DEPTH (mm)	AVERAGE LOOSE GRAVEL (KG/KM)	RANK
5	Dry at 94% Conc.	1.5	75	192.76	1
3			50	221.04	2
4		1.0		253.79	3
2	Liquid at 31% Conc.	1.11		286.00	4
1		2.22	25	328.97	5
6	Untreated			764.54	6

WEATHER DATA

- Weather Data Obtained from Environment Canada and Alberta Agriculture & Forestry for Lethbridge Area
- Precipitation in 2015 Significantly Less Than 2014





RANKING SYSTEM

- Ranking System Based on Even Weighting of the 5 Characteristics Evaluated (Condition, Traffic, Gravel Loss, Construction Costs and Maintenance Costs)

RANKING SYSTEM

- Treatment 4 (Dry Pellet $CaCl_2$ at 1.0% at 50mm)

TREATMENT TYPE	ROAD CONDITION INDEX	TEST SECTION CONSTRUCTION COSTS ($)[2]	TEST SECTION MAINTENANCE COSTS ($)	AVERAGE YEARLY TRAFFIC (VEHICLES)	TOTAL LOOSE GRAVEL WGT[1] (lbs)	RANKING
4	67.5 (3)	$ 68,661.37 (4)	$ 1,416.64 (1)	70,525 (2)	253.79 (3)	1 (13)
3	70.7 (2)	$ 71,814.00 (5)	$ 2,073.13 (2)	63,612 (3)	221.04 (2)	4 (14)
5	75.3 (1)	$ 75,233.78 (6)	$ 2,073.13 (2)	58,052 (5)	192.76 (1)	3 (15)
1	64.0 (5)	$ 64,518.41 (2)	$ 2,073.13 (2)	80,494 (1)	328.97 (5)	2 (15)
2	66.1 (4)	$ 65,747.18 (3)	$ 2,764.18 (5)	57,174 (6)	286.00 (4)	5 (22)
6	35.6 (6)	$ 62,919.68 (1)	$ 3,060.35 (6)	62,173 (4)	764.54 (6)	6 (23)

FINDINGS/CONCLUSIONS

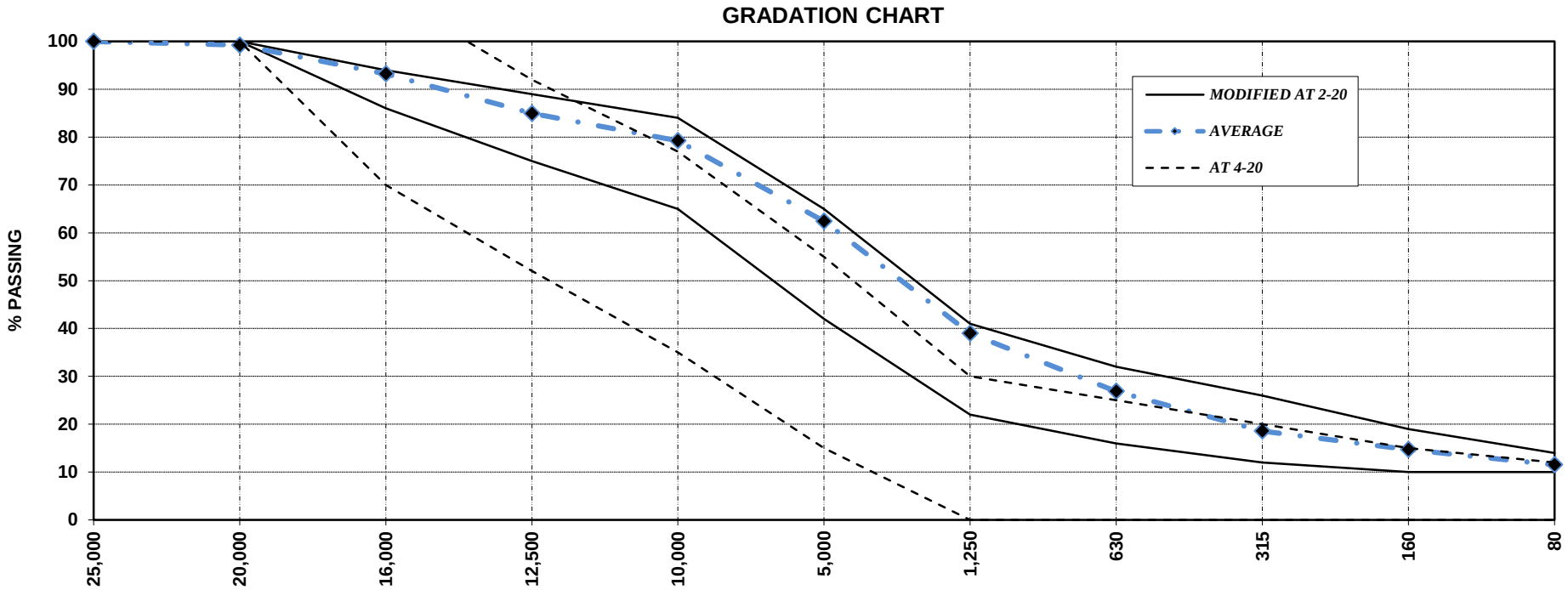
- Dry Pellet $CaCl_2$ Sections Highest Condition Ratings
- Treatment 5 Highest Condition Rating
- Use of Rotary Mixer Increased Performance
- Minimizing Segregation Extends Surface Life
- Subgrade Strength Increased by 38%
- Chloride Retention Increases with Compaction
- Untreated Sections – Lowest Construction Cost
  Highest Maintenance Cost
- Lack of Precipitation has Adverse Effects on Performance

RECOMMENDATIONS

- Calcium Chloride Stabilization is a Cost Effective Surfacing Treatment for Lethbridge County's Haul Route Network
- Develop a Surfacing Aggregate Specification with Higher PI and Fracture
- Develop and Implement Maintenance Practices for $CaCl_2$ Stabilized Roadways
- Increase Crown to 4% Minimum
- Continual Monitoring of $CaCl_2$ Haul Route Stabilization Program

MODIFIED AGGREGATE SPECIFICATION

MOISTURE	FRACTURE	PI	80 um Sieve with Bentonite	PI + 80um Sieve with Bentonite	25,000	20,000	16,000	12,500	10,000	5,000	1,250	630	315	160	
3.3	87.9	11.4	13.4	24.9	100	99	93	85	79	62	39	27	19	14.7	



2016 STABILIZATION PROGRAM

- County Purchased a Mill Razor from RM Equipment
- Planned on Stabilizing 23 Km of Haul Route in 2016 and Upgrading the 7 km of Test Road to Selected the Treatment
- RFP was Issued for Modified Aggregate Production
- ~2,000 tonnes per km for 8.5m width x 100mm deep
- Bentonite Clay Pellets Added to Increase PI
- Produced using a Pug Mill for Consistency
- 27 Km of Haul Routes Stabilized in 2016

2016 STABILIZATION PROGRAM

FUNDING CHALLENGES

Farmland mill rate is 20

- 3x Provincial average as the County doesn't receive oil and gas revenue

Assessment challenges

- Very little oil & gas revenue
- Farmland assessment limitations

Limited revenues

- In 2015 collected $14 million in Municipal taxes
- Bridge funding grants not available
- New Provincial and Federal governments

FUNDING OPTIONS CONSIDERED

- Local Improvement Tax
- Business Licences
- Development Levy
- Business Tax
- Special Tax

- Had an existing by-law referencing NRCB units in 1998 but it was never implemented

WHAT'S AT RISK

- $1.06Billion in producers' revenue
- Road Closures – increased detour length
- Increased safety and liability risks
- Maintenance and repair costs increase exponentially
- Adapting to changing mobile infrastructure (tractors, heavy haulers)
- 1 bridge closed now – more to follow

HOW DID WE ADDRESS THE PROBLEM

- Held four roundtable discussions with key stakeholder groups
- Developed a public consultation strategy to engage residents in process

GOALS OF ENGAGEMENT STRATEGY

- Educate stakeholders on options that have been developed and why
- Understand stakeholders views about the options that have been developed (benefits and concerns)
- Provide opportunity to submit alternative funding solutions

ENGAGEMENT PLAN CONSIDERATIONS

- Risks include “pitting” stakeholder groups against each other (livestock producers against irrigated/dryland farmers). Also, residential properties will want to see farmland producers pay their fair share.
- There is a sensitivity to the amount of revenue that needs to be collected by a minimal amount of owners
- Tight timelines to conduct public consultation sessions
- There are imminent risks to The County if they do not collect the required $3.5M in 2016
- 7 open houses scheduled (5 prior to 1st reading and 2 prior to 3rd reading)

ADVERTISING CAMPAIGN

- Radio Advertising
- Newspaper Advertising
- Dedicated Website
- Social Media
- Media Interviews
- Op-ed
- Key Messaging for staff/council
- On-line feedback forms

RESULTS

- Over 300 participants through open houses and/or feedback forms
- Council deliberated options and passed the following motion

FUNDING OPTIONS

Business Tax

Animal Unit	$ per Animal Unit	Total
Beef	70% ($3/unit)	$1,855,695
Dairy		
Chicken		
Hogs		
Goat/Sheep		

Special Tax

Farmland	30%	$694,286

PRIORITIZATION SESSIONS

- Feedback from first round open houses resulted in second series of open houses
- Detailed questionnaire developed to prioritize market access network
- Four additional workshops scheduled to work through questionnaire to assist traffic modelling study

LESSONS LEARNED

- Lack of understanding of municipality's opportunities for revenue generation and infrastructure status
- Long term reinvestment strategies
- Importance of Asset Management Plan
  - Inventory
  - Condition
  - Level of Service
  - Risk
- Implementation Strategies
- Continuing dialogue with residents and stakeholders

MOVING FORWARD

- Advantages of completing all haul roads in 2017
  - All rate payers will have improved roads at the same time
  - Locked in 2017 material prices
  - Low interest rates provide for the ability to debenture over longer period and defer capital expenditures
  - Realizing efficiencies of reduced road maintenance and supplied aggregate volumes

FUNDING

Anticipated annual budget reductions

- A 30% reduction in annual gravel use over the entire County
- A 30% reduction in the road reconditioning budget
- A 25% reduction in road reconstruction budget
- A 100% reduction in dedicated haul route maintenance
- A 12% reduction in general road grading

Expenses including assumed annual maintenance costs and surfacing treatment every 6 years equates to approx. 50% of the annual savings leaving a net gain.

Contacts/Further Information

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QUESTIONS