To Pave or Not to Pave?

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Making Informed Decisions on When to Upgrade a Gravel Road

How to decide when to pave or not?

- Two new reports offer some help:
- Cost Comparison of Treatments Used to Maintain and Upgrade Aggregate Roads
  - Completed in 2005 and funded by the MN LRRB. Examined surface construction and maintenance costs to determine possible threshold values to go from gravel to paved.
- Local Road Surfacing Criteria
  - Completed in 2004 and funded by the SD DOT. Developed a tool to compare the costs associated with different types of roads to determine the most economical surface type.

These reports offer

- A cost analysis based on spending history for low volume roads
- A method for estimating maintenance and construction costs
- An economic analysis procedure, including present worth evaluation

Key questions pertaining to gravel roads

- Two key questions when developing a maintenance plan for gravel road:
  - What is the best way to maintain a gravel road?
  - When should it be upgraded to a paved road?

Why is this an issue?

- Maintenance costs for both paved and unpaved roads are rising, and we need to optimize them over time.
- Reduced funding and resources require us to be more efficient spenders.
- Preparing for future maintenance and upgrades allows us to manage funds that are available

Other issues

- Increased traffic due to development in the urban fringe
- Altered expectations due to changing rural lifestyles
- Shifts in agribusiness needs requires a shift in our roadway maintenance and construction strategies

When to pave?

When to pave?

- Savings in routine and ongoing maintenance costs
- Increased quality of life
  - less dust, cleaner environment
- Lower vehicle operating expenses for users
- Increased safety and skid resistance
- Positive economic development
    - people want to live, work and drive on paved roads, so economic activity will follow them
- Political issues

When not to pave?

When not to pave?

- Lack of funding for initial construction costs
- Traffic doesn't warrant it
- Control growth in the area
- Adjacent property owners don't want it
- Control speed on the roadway
- Political issues

Risks with paving

- Funding eventual rehabilitation of pavement
- Heavy traffic may overload, if not designed strongly
- May require full alignment and profile upgrade for safety
- May increase vehicle speeds and attract more traffic
- Some stakeholders may prefer gravel

Early roads

Lincoln Highway between Ames and Nevada, 1918.
(Courtesy: Iowa State Highway Commission)

Plank roads

Planks covering mud holes on Grand Avenue, north of Ames, 1920.
(Courtesy: Iowa State Highway Commission)

Minnesota project overview

- This project offered an analysis of county maintenance costs, practices, and traffic volumes for individual roads to help determine when it may be advantageous to upgrade the road based on cumulative maintenance costs.
- Other agencies can use the information to develop their own costs

Minnesota project overview

- Data collection
  - Evaluated Minnesota County Road Historical Costs
  - Conducted Interviews and collected data from 16 county highway departments
    - County road maintenance costs for both gravel and bituminous roads
    - Minnesota county road costs vs. Average Annual Daily Traffic (AADT)

Data overview

- Data obtained from annual reports submitted to State Aid Office from 1997-2001
  - Roads were grouped by funding source
    - County State Aid Highways (CSAH)
    - County Roads (funded entirely by county funds)
    - Township and Municipal Roads
  - Detailed maintenance costs for each road were summarized and split into five main categories
- County traffic maps were used to obtain average daily traffic for each road segment

Typical maintenance activities

Routine Maintenance	**Repairs & Replacements**
Smoothing Surface*	**Reshaping***
Minor Surface Repair*	**Resurfacing****
Cleaning Culverts & Ditches	**Culverts, Bridges, Guardrails**
Brush & Weed Control	**Special Work**
Snow & Ice Removal	**Dust Treatments***
Traffic Services & Signs	**Mud Jacking & Frost Boils***
Betterments	
New Culverts, Rails, or Tiling	**Special Agreements**
Seeding & Sodding	
Bituminous Treatments***	

* Costs related to routine maintenance of road surface

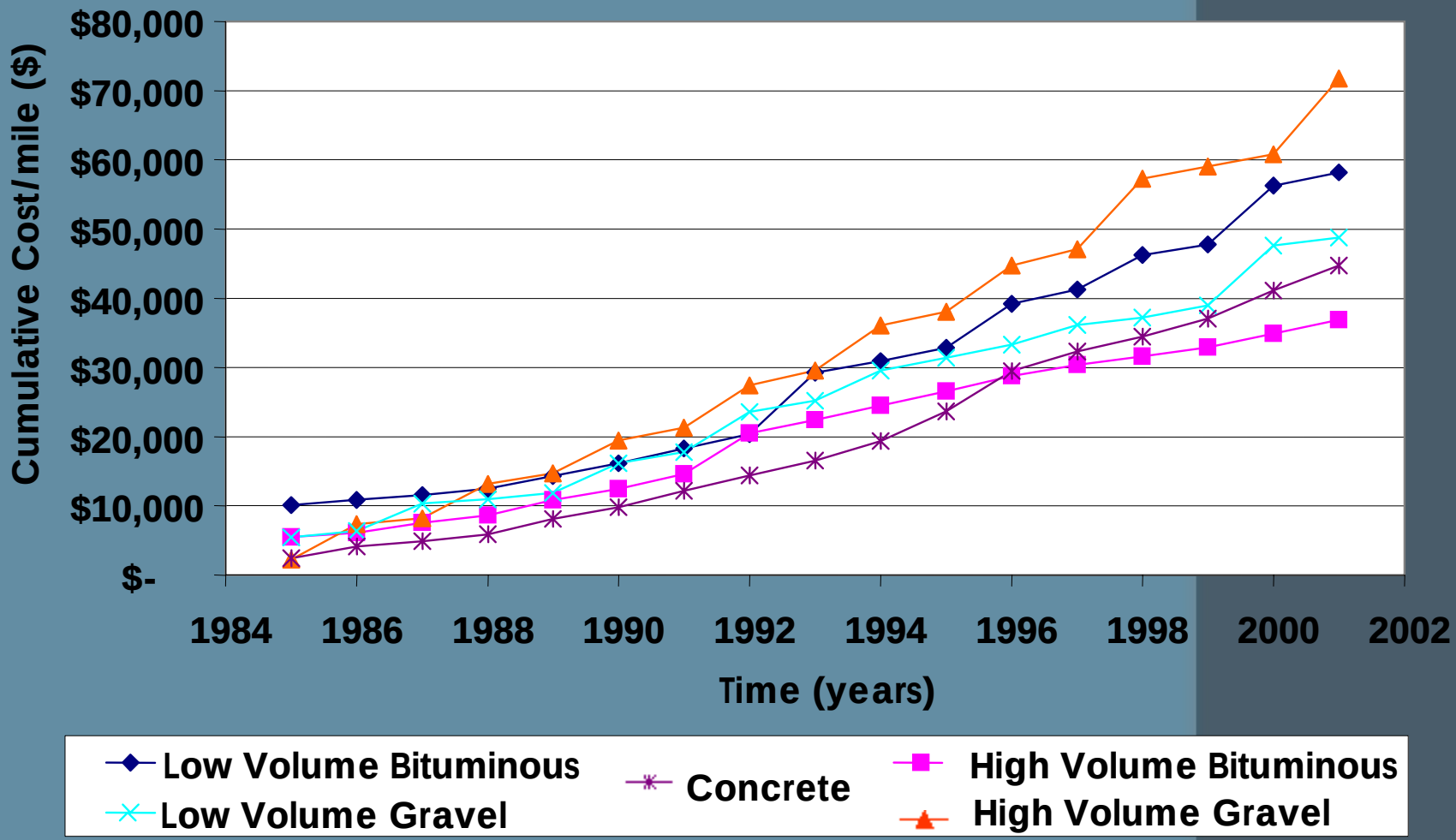
** Costs related to periodic maintenance of road surface

*** Cost can be for routine or periodic maintenance of road surface

Data analysis

- Initial data analysis done for Waseca County
  - Provided a snap shot of the kind of information available for use in this study
- Assumed that maintenance cost would increase with an increase in traffic
- Roads chosen based on:
  - surface types
  - high and low volume traffic counts

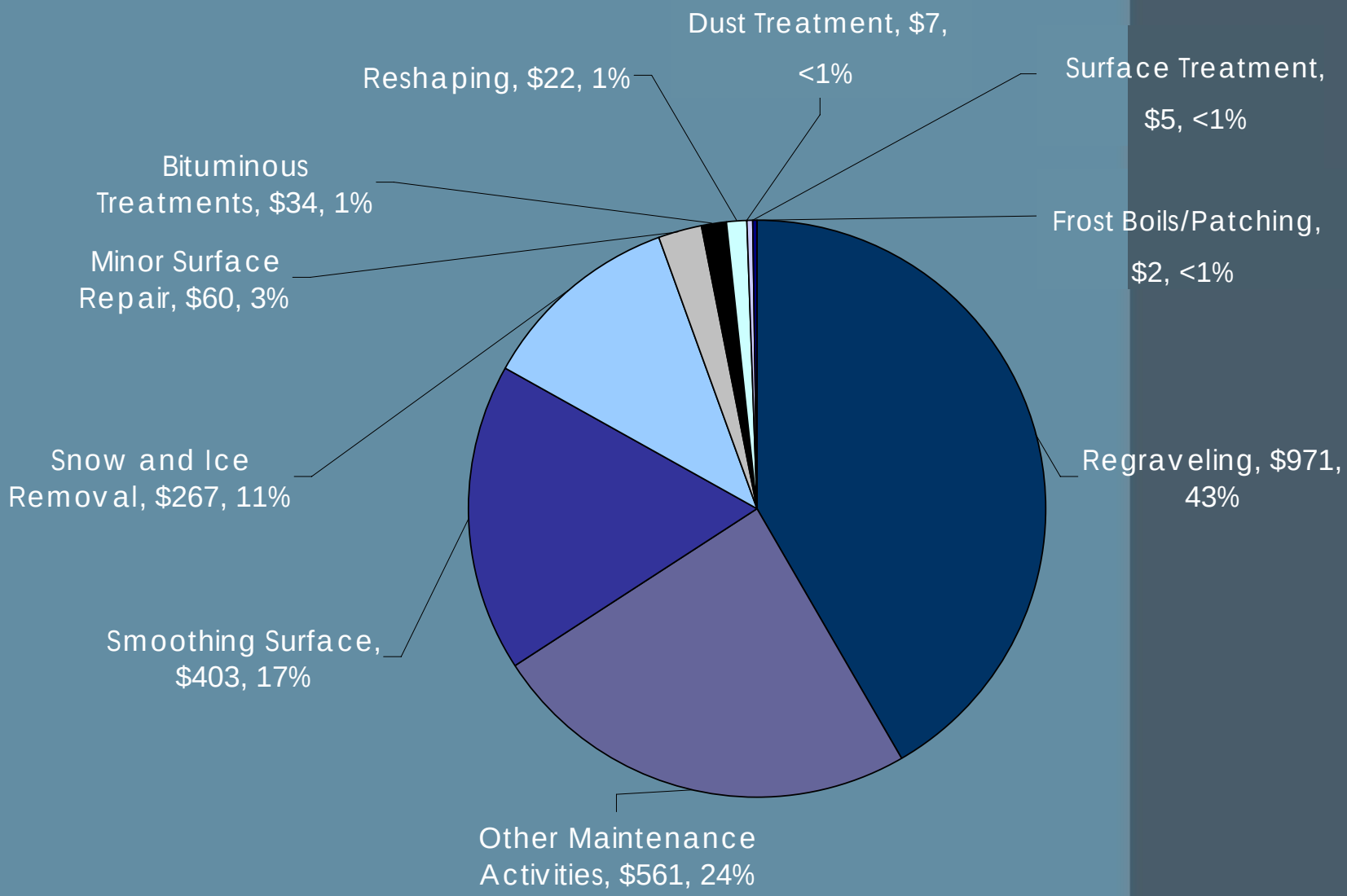
Waseca County Cumulative Maintenance cost/mile



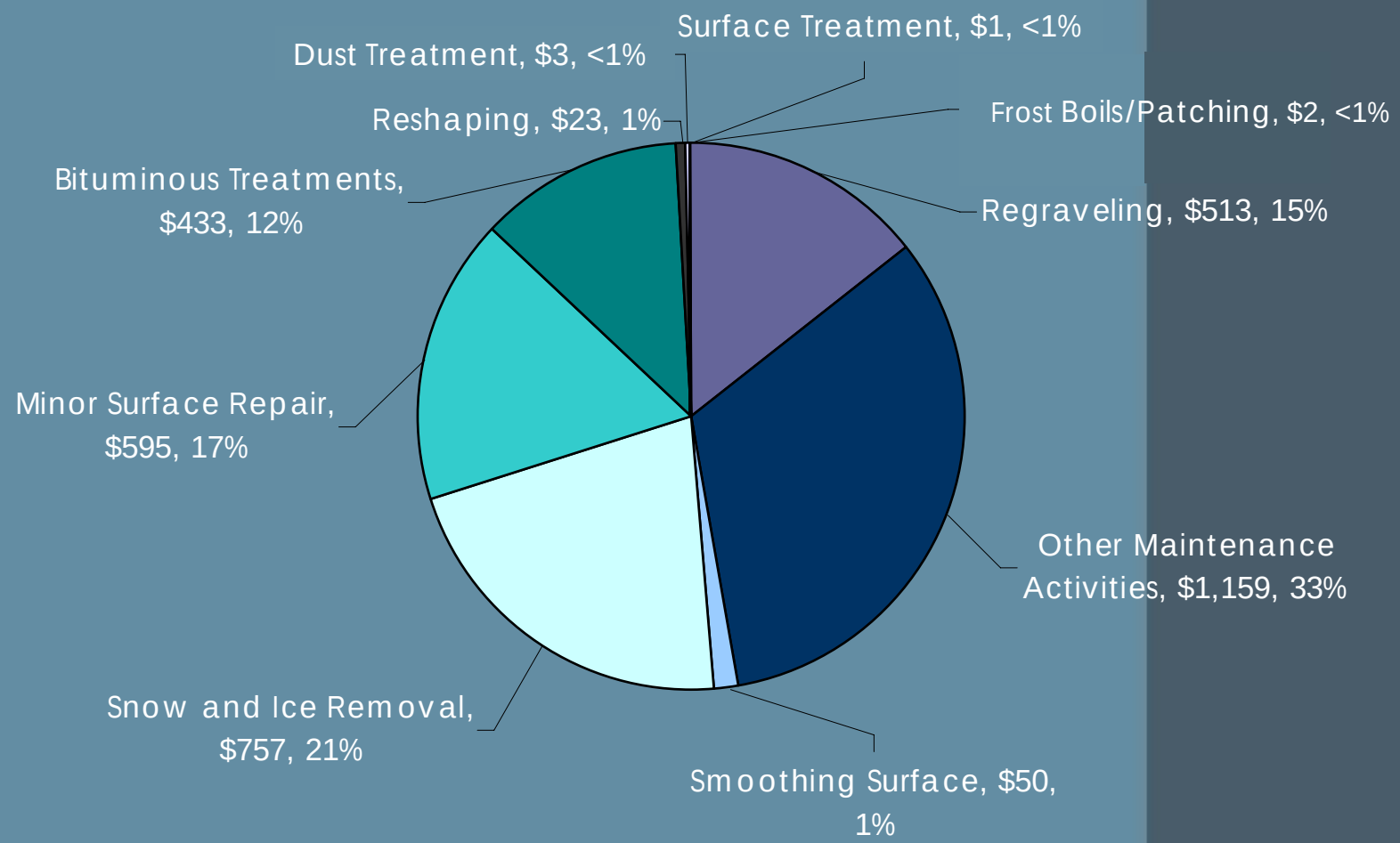
Typical maintenance costs/mile

County`	Road Type	Miles	Total Cost/Mile of Activities Influenced by Surface Type
A	Gravel	313	$1,863
	Bituminous	189	$638
B	Gravel	228	$1,456
	Bituminous	442	$1,320
C	Gravel	297	$2,004
	Bituminous	426	$2,105
D	Gravel	64	$273
	Bituminous	198	$210

Average cost/mile for gravel road maintenance activities for one county

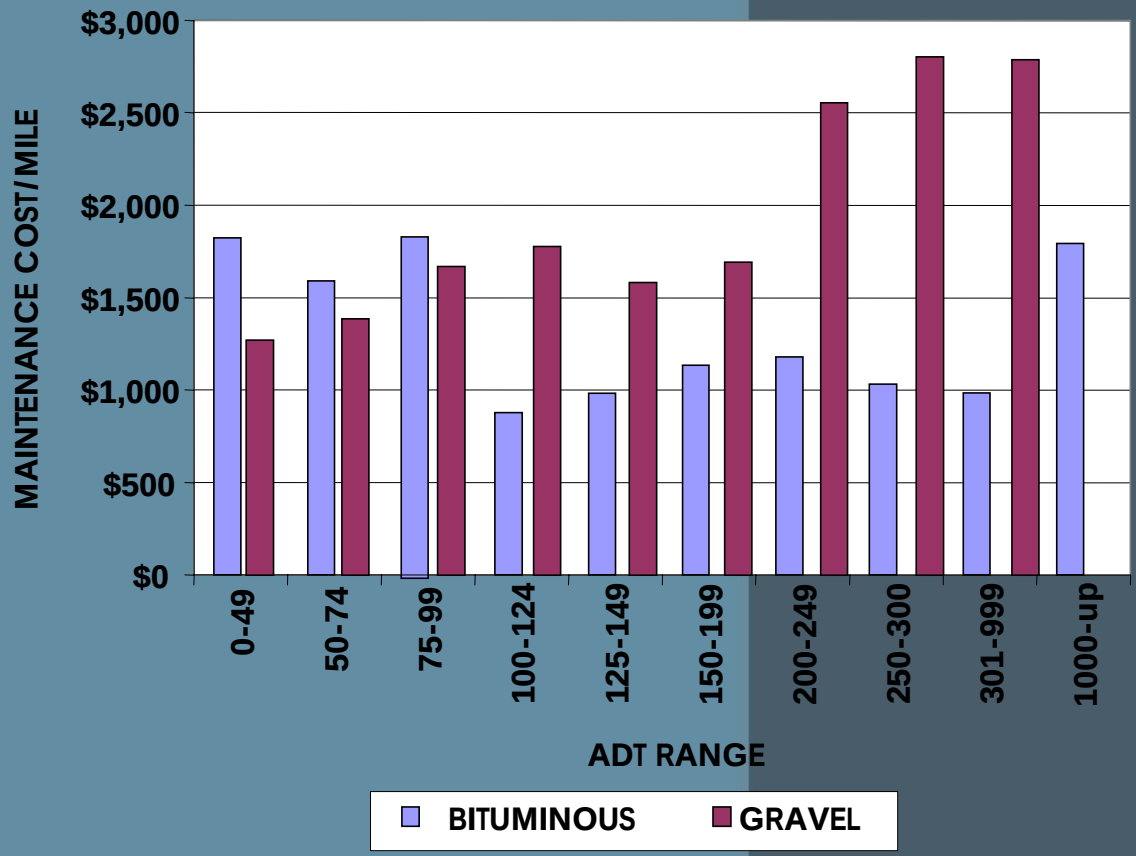


Average cost/mile for bituminous road maintenance activities for one county



Traffic's effect on maintenance costs/mile

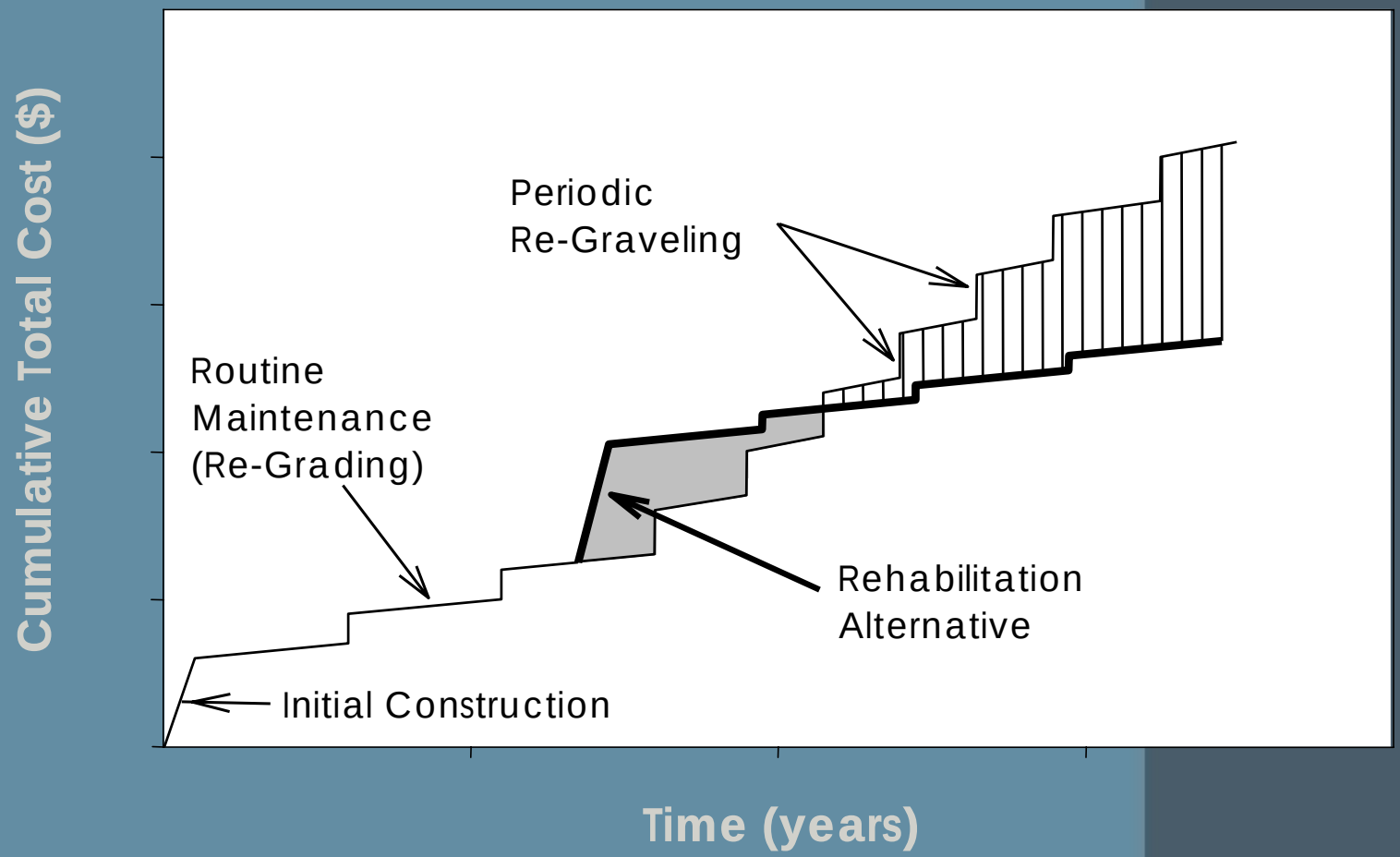
- Roads grouped by traffic volumes and surface type
- An increase in traffic should lead to an increase in maintenance costs, particularly for gravel roads
  - More gravel needed
  - More blading and smoothing of road surface needed



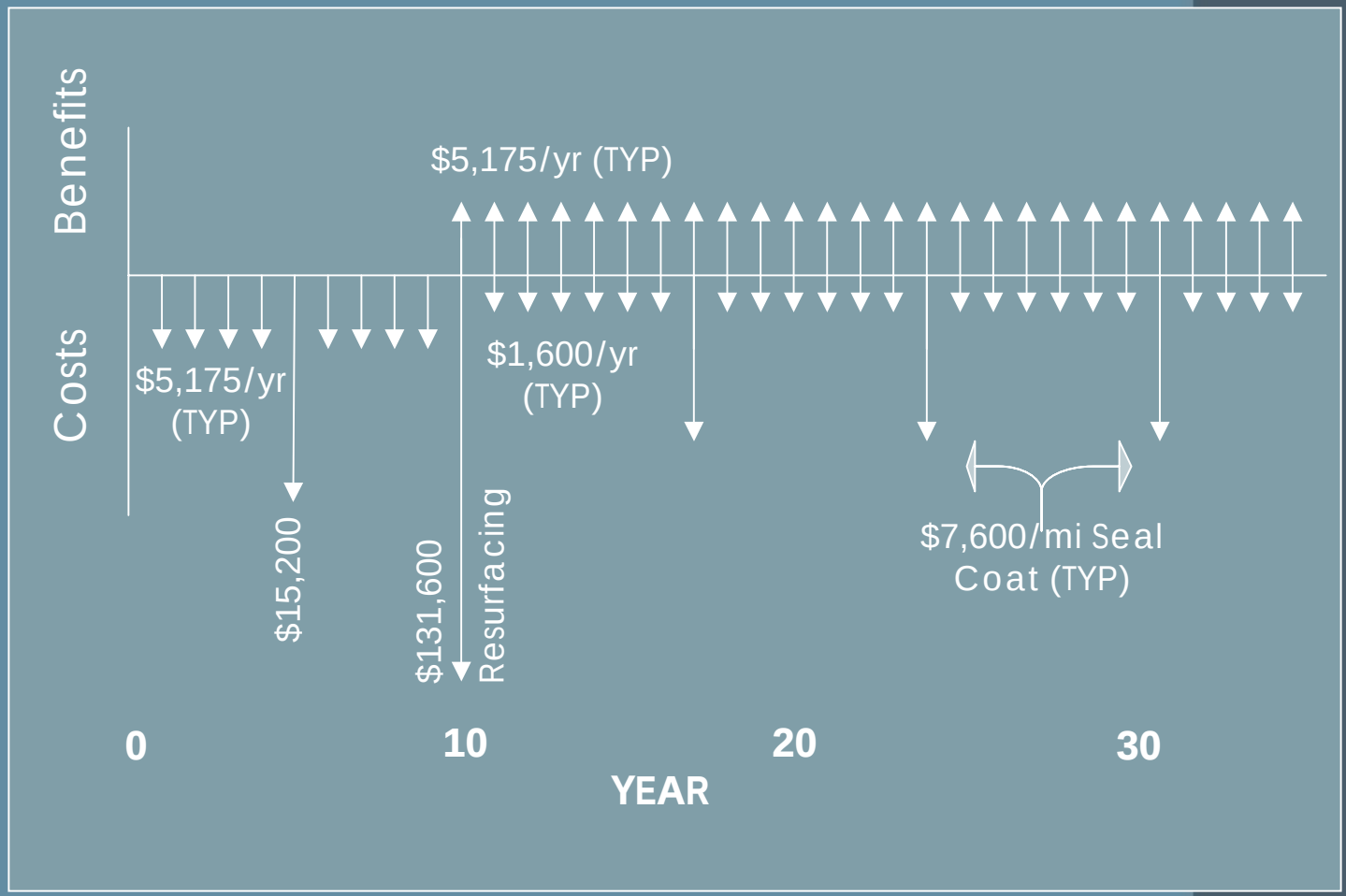
How to compare gravel vs. paved?

- Review the historical costs of maintaining bituminous roads
- Compute estimated costs of maintaining gravel roads
- Develop a cost estimate in the same way a contractor would
- Review the maintenance and construction costs, plot the costs over time, and make a decision.

Cumulative maintenance costs/mile over time for a gravel road



Example: Present Worth Inputs



How does that apply to this agency?

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South Dakota project overview

- Investigated surfacing criteria for low volume roads
- Create a process comparing maintenance requirements for different surface types to assist in deciding the most economical surface type under a given set of conditions
- Surface types include:
  - HMA
  - Blotter
  - Gravel
  - Stabilized gravel

SD report products

- Final product is a computerized tool that allows an agency to modify the costs and treatments to fit their own conditions

SD procedure

1. Identify the road section
   - Project limits
   - Average Daily Traffic (ADT) count
2. Determine agency costs
   - Dependent on surface type
   - Includes typical maintenance activities
3. Determine user costs
   - Vehicle operating costs
   - Crash costs
   - Scale the user costs

SD procedure

4. Summarize the total costs
5. Evaluate non-economic factors
   - Growth rates
   - Housing concentration and dust control needs
   - Mail routes
   - Industry and truck traffic
   - Political factors

How does that apply to this agency?

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Conclusions

- Paved roads provide improvement over gravel in ways that are hard to quantify with dollars
- These include:
  - Improved winter surfaces
  - Improved safety from improved signage and delineation
  - Surface with higher skid resistance
  - Smoother surface that increases user satisfaction and reduces vehicle maintenance costs
  - Redistribution of traffic away from gravel roads
  - Increased tax base on adjacent property

Conclusions

- Costs vary considerably from one agency to another and from one season to another
- MN Study found that gravel road maintenance costs per mile appear to increase considerably after 200 vehicles/day
- SD study found that gravel roads are most cost effective at ADT levels below 150
- Begin planning for surface upgrades when traffic reaches 100 vehicles per day

Recommendations

- Our agency should begin to record maintenance and construction costs for future decisions and use of these tools, and for comparison to historical data
- Both tools can be used to make informed decisions about paving or not paving a roadway section