Converting Distressed Paved Roads to Engineered Unpaved Roads

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Definition

*depave* To undo the act of paving; to remove pavement so as to restore the land to a more natural state.
What has been done on this topic?

- NCHRP Synthesis 485 (2016)
- 2017 TRB LVR Safety Workshop
- 2018 TRB Session on the topic (Presided by Ksaibati)

Some of the slides used in this presentation were secured from the events listed above/FHWA webinars.
NCHRP Synthesis 485 Converting Paved Roads to Unpaved

- Project Objective:
  - To identify:
    - Agencies that have converted roads from paved to unpaved,
    - Tools, metrics, and procedures that have been used in the decision-making process for when and how to convert a road,
    - Impacts of road conversions,
    - Public outreach efforts,
    - Knowledge gaps and research needs

http://www.trb.org/Publications/Blurbs/173716.aspx
The Road Conversion Process

• What does conversion from a paved road to unpaved mean?

• 1. Active Conversion: using equipment and personnel to recycle the old pavement into a pulverized material that can be used as a base for a new aggregate surface or as part of a new unpaved surface.

• 2. Passive Conversion: the natural process of the paved road breaking down and deteriorating to an unpaved surface as a result of exposure to the elements and wear and tear from traffic.

Some aggregate (gravel) generally placed over the surface.
The Road Conversion Process

- Why are road conversions typically done?
The Road Conversion Process

- What roads are being converted?
  - Typically roads with ADT less than 100.
    - Should these roads have been paved in the first place?
The Road Conversion Process

• How are road conversions typically done?
  • Existing pavement is recycled in place.
  • Converted with reclaimer or ripper on a motor grader.
  • When needed, additional gravel is added to supplement existing material.
The Road Conversion Process

• How are road conversions typically done?
  • Typically done by agency staff with agency owned or rented equipment, or by a contractor.
  • Road material is recycled, shaped and compacted
Example of active conversion

Deteriorating road

Road conversion

Newly converted road

2 years post conversion
Example of passive conversion
The Road Conversion Process

- Identified practices to aid in road conversions
  - Know what existing road layer(s) are: (historic maps, core samples, soil testing)
  - Know existing pavement/base thickness
  - Quality of materials on-site or gravel to be added
  - If using soil stabilizer, dust abatement select the appropriate one for the road.
The Road Conversion Process

• The cost of conversion
  • A huge range was reported: $1,000 to $100,000 per road segment or mile.
    • Costs vary greatly due to:
      • How they are tracked by agencies (are all costs included),
      • How the conversion was done (recycling, adding material?)
      • Equipment requirements (In-house, rent, or buy; hourly rates)
      • Supplemental materials (was gravel purchased, hauled, etc.)
      • Surface stabilization or dust abatement included?
      • Were drainage or road based issues addressed?
The Road Conversion Process

• Factors to consider for conversion
  • Road Condition
    • The level of deterioration of the paved surface will dictate whether the surface can be economically repaired as a paved surface, or if there is need for complete rehabilitation or reconstruction. If the latter is the case, and is unaffordable, then conversion to gravel can be considered
The Road Conversion Process

• Factors to consider for conversion
  • Safety
    • Deterioration of a paved surfaced may be such that it may be safer to convert to a gravel surface, either permanently or temporarily, until the road can be rehabilitated or reconstructed.
The Road Conversion Process

- Factors to consider for conversion
  - The number of residents along the roads and social and economic impact of the road
    - The impacts of ride quality and dust on road users, residents, animals, produce, vehicle operating costs, and vehicle productivity (reduced speeds)
The Road Conversion Process

• Factors to be considered for conversion
  • Traffic volume and vehicle distribution/type
    • AADT – overall traffic counts must be considered when converting a road from paved to unpaved, as well as seasonal distribution of traffic
    • Presence of heavy and overweight vehicles – a high volume of heavy vehicles has a significant impact on the standard required for pavement maintenance and rehabilitation. The costs to repave or repair need to be weighed with the cost of converting to gravel but with more frequent maintenance.
The Road Conversion Process

• Factors to consider for conversion
  • Accurate cost of road treatment options
  • Land use
  • Maintenance capabilities
  • Environmental issues and annual precipitation
  • Dust and erosion control
  • Availability of quality gravel for surfacing
  • Public impact issues
  • Network significance
TRB Session 2018

• Converting Paved Roads to Unpaved: California Experience
  The California experience
• Converting Paved Roads to Unpaved: North Dakota Experience
• Converting Paved Roads to Unpaved: Nebraska Experience (City of Omaha)
• Developing Tools for Deciding to Convert from Paved to Unpaved: Minnesota Experience
The North Dakota Experience
Material Breakdown
Multiple Layers

GRAVEL LAYER
Foundation Repairs
Proof Load Test

Ann Taylor, Brosz Engineering
Field Engineer
Dust Suppressant
Air Force Comments

• ... steadily deteriorating condition
• ... condition below a gravel road
• ... condition may affect their mission
  • ________________________________
  • ... very happy with the results
• ... no longer a concern that the road may adversely affect their mission
Transitions
Omaha Experience

• They converted several paved roads into gravel roads successfully in urban environments.

• Current policy requires that the residents would request the conversion prior to the City considering the feasibility.
MnDOT Experience

• Unpave/Revert?
  • Previous slides; great job on the “how”
• Let’s now focus on the “why”
• Highlighting:
  • MN-LRRB System Preservation Study
  • Project Overview
  • Lessons Learned relating to unpave
  • Final Products & Tools
The Local Roads Research Board (LRRB)

- $3.6$ million in annual funding
- $75+$ active projects
- $25+$ new projects each year
- $100+$ tap city and county members
- $12$ city/county board members
MN LRRB Study

It all started with the question:

“How do I unpave a road?”
The question once was...when to pave?

How did we get to asking...when to unpave?

There are many factors that shape our transportation network

- Social Return on Investment
- Safety Concerns
- Route Significance
  - *(Farm to Market, Access to Services, Commerce)*
- Current & Future Land Use
- Social, Economic & Environmental Impact
- Emerging maintenance techniques
- Impact of Autonomous Vehicle Technologies
- Cost
  - *(Initial Cost vs Life Cycle Cost)*
- Level of Service
- Public Perception
Rather than focus on unpaving...

The LRRB focused the study on....

What do you do when you can’t afford to do: the right thing, at the right time, on the right road?
System Preservation

- Working with **pilot counties** develop a system/process that would work statewide
- Identify and communicate **funding gap**
- Identify various **strategies** to reduce gap
- Develop **customized process** for each county
- Facilitate **communication** with elected officials and general public
- **Implementation** within each county
- Develop **interactive, online tool** for statewide implementation
# Pilot Counties

<table>
<thead>
<tr>
<th></th>
<th>Anoka County</th>
<th>Freeborn County</th>
<th>Dakota County</th>
<th>Otter Tail County</th>
<th>Stearns County</th>
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</thead>
<tbody>
<tr>
<td>Population</td>
<td>330,844</td>
<td>31,255</td>
<td>414,686</td>
<td>57,303</td>
<td>154,708</td>
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<tr>
<td>County Seat</td>
<td>Anoka</td>
<td>Albert Lea</td>
<td>Apple Valley</td>
<td>Fergus Falls</td>
<td>St. Cloud</td>
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<tr>
<td>Total Miles</td>
<td>418</td>
<td>634</td>
<td>418</td>
<td>1052</td>
<td>970</td>
</tr>
<tr>
<td>Paved Miles</td>
<td>418</td>
<td>406</td>
<td>355</td>
<td>1052</td>
<td>918</td>
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<tr>
<td>Gravel Miles</td>
<td>0</td>
<td>228</td>
<td>53</td>
<td>0</td>
<td>52</td>
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<tr>
<td>Staff Office</td>
<td>26</td>
<td>4</td>
<td>32</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Maintenance</td>
<td>70</td>
<td>22</td>
<td>55</td>
<td>30</td>
<td>36</td>
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</tbody>
</table>
Process

- Resource Guide
- Identifying Gap
- Preservation Strategies
- Pilot County Case Studies
- Statewide Guide
- Interactive Manual
Gap Analysis

• Purpose
  • There is a problem
  • Analyze current/future needs vs resources
  • Easy to use, “defendable”
  • Communicate relative size of gap (versus exact number)

• Data sources
  • County road system characteristics
  • County maintenance practices and costs
  • Industry “typical” maintenance practices
Gap Analysis

**Measures:**
County Maintenance Practice vs Industry Standards

- **County Data**
  - Expenditures
  - Revenue
  - Maintenance Schedule

- **Industry Standards**
  - Typical Maintenance Practices
  - Cost

- **Sketch Tool**
  - Inflation Factor
  - Gap Analysis

GAP Measures: County Maintenance Practice vs Industry Standards
Measures County Maintenance Practice vs Industry “typical”

Example:

Industry: Seal Coat every 10 years

County has 300 miles; therefore should sealcoat 30 mi/yr

County currently seal coats 20 mi/year....“gap” is 10 miles

10 x $17,500/mi = $175,000/yr

Do for all maintenance (Crack seal, overlay, etc.)
Gap Analysis – Otter Tail County

Otter Tail County
Annual Roadway Need - $15.2 M/yr

Current Expenditure $3.4M/yr

Year 1 Funding Gap $11.8 M/yr

Over 20-years yields a $390M Gap (5% inflation)

Note: This GAP Analysis is for pavement preservation and does not include reconstruction.
Preservation Strategies - Reducing the Gap

• Adopt New Planning Strategies
• Change Size of Road System
• Consider Different Sources of Revenue
• Consider New Maintenance Methods
• Change the Level of Service
Preservation Strategies

1. Interjurisdictional Transfers
2. Tiered Classification of County Roads
3. Unpaved Low Volume Roads
4. Transportation Plan
5. Performance Measures/Standards
6. Project Prioritization
7. Revenue Enhancements
8. New Maintenance Techniques
## Preservation Strategies – who did what...

<table>
<thead>
<tr>
<th>System Preservation Strategies</th>
<th>Anoka</th>
<th>Stearns</th>
<th>Freeborn</th>
<th>Otter Tail</th>
<th>Dakota</th>
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</thead>
<tbody>
<tr>
<td>Jurisdictional Transfers</td>
<td>⬤</td>
<td>$</td>
<td>$</td>
<td>P</td>
<td></td>
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<td>Tiered Classification of County Roads</td>
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<td>⬤</td>
<td>$</td>
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<td>Unpaved Low Volume Roads</td>
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<td>⬤</td>
<td>$</td>
<td></td>
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<tr>
<td>Transportation Plans</td>
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<td>P</td>
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<td>Preservation Performance Measures</td>
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<td>$</td>
<td>P</td>
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<td>Project Prioritization</td>
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<td>New Maintenance Techniques</td>
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<td>P</td>
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<tr>
<td>Decision Making Tools</td>
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<td>⬤</td>
<td>⬤</td>
<td>⬤</td>
</tr>
</tbody>
</table>

- = Selected Strategy Implementation
P = Previously Implemented
$ = New

### Resource Guide
- Identifying Gap
- Pilot County Case Studies
- Statewide Guide
- Interactive Manual
## Case Study - Freeborn County

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</tr>
<tr>
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<td>4</td>
</tr>
<tr>
<td>Maintenance</td>
<td>22</td>
</tr>
</tbody>
</table>

Map showing the location of Freeborn County within the state of Minnesota, with nearby counties labeled as Otter Tail, Stearns, Anoka, Dakota, and Freeborn.
Case Study - Freeborn County Tiered Classification

- Establish a hierarchy within the roadway system
- Implement different levels of maintenance standards/schedules for each level
## Case Study - Freeborn County Tiered Classification

<table>
<thead>
<tr>
<th>Measure</th>
<th>Tier 1 Gold (years)</th>
<th>Tier 2 Silver (years)</th>
<th>Tier 3 Bronze (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of Seal Coat after a major repair</td>
<td>0 - 4</td>
<td>0 - 6</td>
<td>0 - 8</td>
</tr>
<tr>
<td>PCI that triggers Major Overlay</td>
<td>65</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>Overall Average PCI (Current PCI)</td>
<td>&gt; 80 (82)</td>
<td>&gt; 75 (80)</td>
<td>&gt; 70 (77)</td>
</tr>
</tbody>
</table>
Case Study - Freeborn County Unpaving a Low Volume Road

- CSAH 49 – 2 mile segment
- Surfaced in 1989
- ADT = 95

<table>
<thead>
<tr>
<th>Repair Option</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch Existing Pavement w/County Staff</td>
<td>$12,136</td>
</tr>
<tr>
<td>Mill and reclaim asphalt, maintain as a gravel road</td>
<td>$227,341</td>
</tr>
<tr>
<td>Mill and Reclaim asphalt; cover with double chip seal</td>
<td>$283,875</td>
</tr>
<tr>
<td>Mill and reclaim asphalt; pave with 6” asphalt</td>
<td>$715,361</td>
</tr>
</tbody>
</table>
System Preservation Tool
Case Study - Freeborn County
Unpaving a Low Volume Road

- What to consider when deciding to revert paved surfaces?
- How to obtain public and political buy-in?
- What are the available surface treatment/stabilization options?
- What are best practices?
- How have unpaved surfaces been successful in various areas?
Lessons Learned
Case Study - Freeborn County
Unpaving a Low Volume Road

• Communications is key

Unfortunately, due to funding constraints, the resources for replacing the bituminous surface are not available at this time.
Final Products & Tools...
Interactive Manual

- Easy to Use
- Step by Step Process
- Each Step Supported by
  - Research
  - Best Practices
  - Pilot Case Studies
  - Tools

Systems Preservation Guide:
A Planning Process for Local Government Management of Transportation Networks
Guide for the conversion of severely distressed paved roads to unpaved

(MnDOT/LRRB funded, starts July 2018)

- if the road is a candidate for conversion,
- existing road materials and condition,
- methods to convert the road to unpaved (design, construction, maintenance),
- assess the lifecycle costs (construction and maintenance),
- tools to communicate with the public,
- the safety implications of unpaving.
What else needs to be addressed?

- Improved documentation of the results of conversions, procedures, and mechanisms for collecting crash rates and data on low-volume roads, specifically before and after conversions;
  - Collect and process safety data
  - Develop a Research Needs statement

- Assessment of environmental impacts associated with road conversions is needed.
What has worked and what has not worked

• Successful outreach measures
  • Providing the public with information
  • Explaining why the road is being considered for conversion (safety, cost, maintenance, deterioration)
  • Transparency about funding
  • Information on current and future road conditions
What has worked and what has not worked

• Much of the documented public reaction to road conversions has been negative

• If properly maintained, converted roads are generally accepted by the public because of the improved driving surface and increased safety.
Conclusions

• Road conversions are most commonly occurring on roads with ADT $\rightarrow$ 21-100
  • Most common process:
    • Reclaim or recycle deteriorating road
    • Supplement existing materials as needed
    • Compaction
    • Apply or incorporate a surface treatment
Conclusions

• Conversion are occurring because...
  • Lack of funds to support routine maintenance and repaving.
  • Safety
  • Complaints from the public
Conclusions

• There is a lack of available information on this topic.
• The cost data for conversions is highly variable and often not well documented.
• Public outreach and stakeholder involvement = more favorable public reaction.
• Road conversion is another tool to be considered.
Converting Distressed Paved Roads to Engineered Unpaved Roads

Questions?