

LRRB – DID YOU KNOW!

SAFETY PROJECTS (AND AN UPDATE OF NEW PROJECTS)

Minnesota County Engineers Summer Conference 2022



Michael Marti





Agenda

- Overview of LRRB Safety Projects (past 5 years)
- Status of new research ideas (brainstorming during last fall pre-Screening Board)

Why invest in safety...

**Someone's sitting in the shade *today*
because someone planted a tree
*a long time ago.***

LRRB Safety Projects (2017-2022)

Topic	Number of Studies
Pavement Markings/Rumble Strips	6
Speed	4
Signs/Signals	10
CAV	4
Bike/Pedestrians	9
Miscellaneous	7

LRRB Safety Projects

PAVEMENT MARKING AND RUMBLES

Title	Year	Author
<u>Assessing Pavement Markings for Automated Vehicle Readiness</u>	2020	Pike
<u>Pavement Markings - Wet Retroreflectivity Standards</u>	2020	Pike
<u>Rectangular Rumble Strip Safety Evaluation</u>	2020	Storm
<u>Transverse Rumble Strips at Rural Intersections</u>	Active	Hallmark
<u>Investigating the Necessity and Prioritizing Pavement Markings on Low Volume Roads</u>	2018	Veneziano
<u>Minnesota Local Agency Pavement Marking: Mining Existing Data</u>	2017	Smadi



RECTANGULAR RUMBLE STRIP SAFETY EVALUATION

- 2008-12 1,850 K&As due to vehicles departing roadway
- 2011 MnDOT implemented RS policy
- Study to determine the safety effect of rumble strips

Rural 2-lane roads w/shoulder RS

- 32% fewer TOT crashes
- 24% fewer SVROR crashes

Rural 2-lane w/centerline and shoulder RS

- 27% fewer TOT crashes
- 32% fewer SVROR crashes
- 36% fewer HOSSOD crashes

Rural 4-lane divided w/shoulder RS

- 34% fewer TOT crashes
- 60% fewer SVROR crashes



PRIORITIZING PAVEMENT MARKINGS ON LOW-VOLUME ROADS

Goal: Develop a decision-making tool (using b/c) for pavement markings on low volume roads

- Lit search of b/c of 4" and 6" markings
- Surveyed MN counties: current practices
- Reviewed CRSP: methodology used to rank at-risk road segments
- Develop a prioritization approach and a decision-making tool, final report and brochure

Pavement Marking Prioritization Tool

Enter data into highlighted boxes and under the highlighted sections.

1.) Enter total marking budget: \$150,000.00

2.) Enter total marking cost estimates (per foot):
(i.e. cost for two edgelines on a roadway, not individual.)

Centerlines	Edgelines	Centerlines & Edgelines	Enhanced Visibility	Milled Markings
\$0.05	\$0.08	\$0.13	\$0.17	\$0.54

3.) Enter project data in cells below:

Project/Roadway	Length (miles)	Road Type:	# of CRSP Stars (0 if not CRSP project)	Route Prioritization				Total pavement width (in feet):	Marking Type Preference:
				Roadway Functional Class:	Pavement Condition:	Traffic Volume	Current marking age		

LRRB Safety Projects

SPEED

Title	Year	Author
<u>Guidelines for Determining Speed Limits on Municipal Roadways</u>	2021	Arvidson
<u>Impact of Speed Limit Changes on Urban Streets</u>	2020	Davis
<u>Speed Limit Change (55 mph to 60 mph) Safety Evaluation</u>	2020	Saleem
<u>Speed Notification System Warns Drivers Approaching Urban Work Zones</u>	2019	Hourdos



SPEED NOTIFICATION SYSTEM WARNS DRIVERS APPROACHING URBAN WORK ZONES

- Posting advisory speed limit messages near work zones has not been effective
- MnDOT developed a Smart Work Zone Speed Notification (SWZSN)
 - designed to detect changes in speed near WZ
 - then generate a message on a variable message sign about slowed traffic ahead.
- Tested/evaluated over 2 seasons
- SWZSN is clearly noticed by drivers; statistically significant influence on drivers' behavior



LRRB Safety Projects

SIGNS/SIGNALS

Title	Year	Author
<u>Driver Comprehension of Flashing Yellow Arrows</u>	Active	Davis
<u>Towards Implementation of Max-pressure Signal Timing on Minnesotan Roads</u>	Active	Stern
<u>Best Practice Guidelines for Intelligent (Active) Warning Devices</u>	Active	Miller
<u>Research on Traffic Sign Retroreflective Sheeting Performance: A Synthesis of Practice</u>	2021	Hawkins
<u>Eval of the Effectiveness of Stop Lines in Increasing the Safety of Stop-Controlled Intersections</u>	2020	Hourdos
<u>Evaluation of Intersection Conflict Warning Systems in Minnesota</u>	2018	Hallmar
<u>Rural Intersection Conflict Warning System Evaluation and Design Investigation</u>	2018	Morris
<u>Addressing Citizen Requests for Traffic Safety Concerns</u>	2017	Kuehl

ADDRESSING CITIZEN REQUESTS FOR TRAFFIC SAFETY CONCERNS

Purpose: to provide local agency a best practice approach to addressing citizen's requests for signing and pavement markings

- importance of communication w/citizens
- guidance on logging requests
- steps for following up
- standard responses
- explanation of why a requested strategy may or may not be the appropriate



LRRB Safety Projects

CAV

Title	Year	Author
<u>Development of a Phone App to Warn Drivers of Unintentional Lane Departure Using GPS</u>	Active	Hayee
<u>Influence of Autonomous and Partially Autonomous Vehicles on Minnesota Roads</u>	Active	Rajamani
<u>Implementation of Lane Boundary Guidance System for Snowplow Operations</u>	2021	Donath
<u>Tool to Estimate the Safety Impact of Vehicle Levels of Automation on Minnesota Roads</u>	2021	Hourdos



IMPLEMENTATION OF LANE BOUNDARY GUIDANCE SYSTEM FOR SNOWPLOW OPERATIONS

Objective: Improve plow safety and efficiency by allowing operators to maintain a desired path on the roadway under poor visibility conditions.

Developing a lane boundary guidance system on three MnDOT plow trucks in rural districts; improving issues identified previously.



LRRB Safety Projects

BIKE/PEDS

Title	Year	Author
<u>Designing and Implementing Maintainable Pedestrian Safety Countermeasures</u>	2021	<u>Veneziano</u>
<u>Multi-Method Investigation of Pedestrian Safety Impacts of Right-Turn Lanes</u>	2021	<u>Craig</u>
<u>Assessing the Impact of Pedestrian-Activated Crossing System</u>	2020	<u>Hourdos</u>
<u>Understanding the Factors that Influence Vehicle Yielding to Peds at Unsignalized Intersections</u>	2020	<u>Stern</u>
<u>Pedestrian Crosswalk Policy Development Guidelines</u>	2020	<u>Miner</u>
<u>Pedestrian User Experience at Roundabouts</u>	2020	<u>Godavarthy</u>
<u>Eval of Sustained Enforcement, Education, and Engineering Measures on Pedestrian Crossings</u>	2019	<u>Morris</u>
<u>Phase 2: Understanding Pedestrian Travel Behavior & Safety in Rural Settings</u>	2019	<u>Lindsey</u>

PEDESTRIAN USER EXPERIENCE AT ROUNDABOUTS

Roundabouts reduce the severity of crashes, agencies have received some feedback that roundabouts, can be difficult for peds to navigate.

Developing a guidebook and decision tools for improved designs and controls for current and future roundabouts.



LRRB Safety Projects

MISCELLANEOUS

Title	Year	Author
<u>Traffic Safety Evaluation at Reduced Conflict Intersections in Minnesota</u>	2021	Moreland
<u>Reducing Traffic Violation Behaviors for Teenage Drivers at the Early Time of Licensure</u>	2021	Morris
<u>Design Standards for Unobstructed Sight Lines at Left-Turn Lanes</u>	2019	Noyce
<u>Examining Optimal Sight Distances at Rural Intersections</u>	2019	Morris
<u>Evaluation of Safety and Mobility of Two-Lane Roundabouts</u>	2017	Hourdos
<u>Flagger Operations: Investigating Their Effectiveness in Capturing Driver Attention</u>	2017	Harder
<u>Reduce Vehicle-Animal Collisions with Installation of Small Animal Exclusion Fencing</u>	2017	Stapleton



PEDESTRIAN USER EXPERIENCE AT ROUNDABOUTS

Sight distance, cross-traffic velocity, and vehicle placements significantly affect driver judgment and behavior

A series of rural, two-lane thru-STOP simulated intersections with differing sight distances and traffic speeds were created and then validated by county and state engineers.

Results demonstrated a systematic improvement in the performance of both minor and major road drivers with the implementation of a 1,000-foot sight distance at rural thru-STOP intersections.





Status of LRRB New Ideas

Potential New LRRB Research Ideas

- LRRB 1 Sawing and Sealing Joints in Bituminous Pavements to Control Cracking
- LRRB 2 Use of Plastics in Road Materials (paving)
- LRRB 4 Winter Maintenance vs Environmental Concerns
- LRRB 5 Fleet Life Cycle (Buy v Lease)
- LRRB 6 Mitigating Issues with Compaction (adj buildings/trench settlement)
- LRRB 7 Effectiveness of Rubber Tired Rollers
- LRRB 8 Right Turn Lane Safety Improvements for Pedestrians
- LRRB 10 Advancing Equity in Capital Investment Decision-Making
- LRRB 11 Pavement Design: Performance of Base v Subbase

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Potential New LRRB Implementation Ideas

- RIC 1 Seal Coats: Synthesis of MN Research
- RIC 2 Asphalt Rejuvenators
- RIC 3 Safety: Addressing Behavioral Factors in Improving Road Safety
- RIC 4 Rules/Guidelines for Prescriptive ROW
- RIC 6 Impacts on Design Standards Related to Speed
- RIC 7 CIP Tool
- RIC 8 Grow Your Own Maintenance Workers
- RIC 9/17 Public Works 101 for Elected Officials & the Public

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Potential New LRRB Implementation Ideas

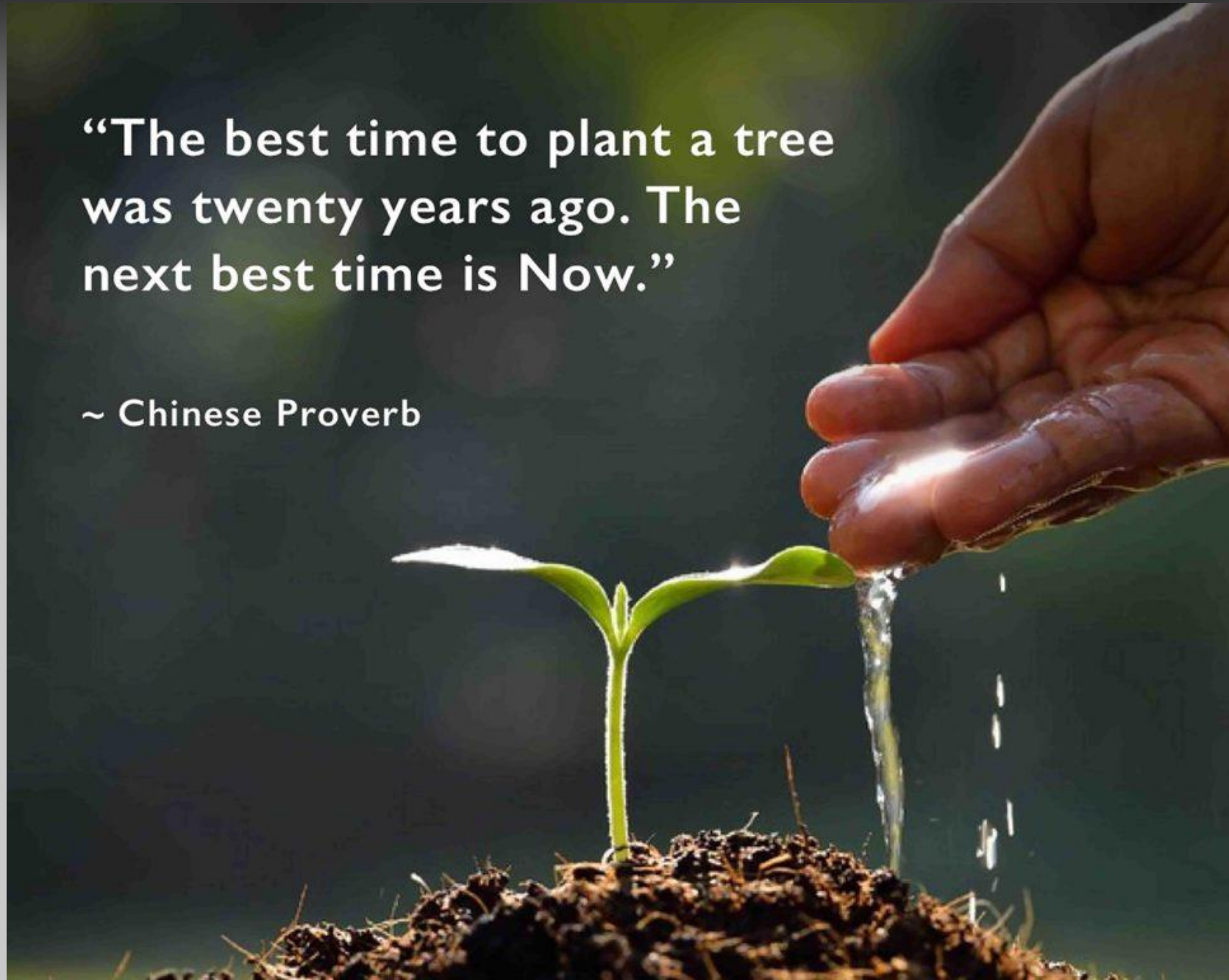
- RIC 10 Stop Signs: Responding to Requests and Promoting Compliance
- RIC 13 Gravel Shoulder Maintenance
- RIC 14 Gravel Road Maintenance
- RIC 15 Promote a Career as a County/City Engineer
- RIC 18 Snowplow Operator Training
- RIC 22 Crash Benefit of Non-Motorized Facilities (bike lanes, median islands, etc.)

Potential New LRRB Implementation Ideas

RIC	10	Stop Signs: Responding to Requests and Promoting Compliance
RIC	13	Gravel Shoulder Maintenance
RIC	14	Gravel Road Maintenance
RIC	15	Promote a Career as a County/City Engineer
RIC	18	Snowplow Operator Training
RIC	22	Crash Benefit of Non-Motorized Facilities (bike lanes, median islands, etc.)

“The best time to plant a tree
was twenty years ago. The
next best time is Now.”

~ Chinese Proverb



Thank You!



Michael Marti

Director

mmarti@srfconsulting.com