Roadside Infrastructure Condition

A SYSTEM STEWARDSHIP INVESTMENT

Roadside Infrastructure is one of the thirteen investment categories of MnSHIP, a fiscally constrained plan MnDOT uses to balance the needs and risks of Minnesota's state highway network. Folios for each investment category describe potential levels of investment and associated outcomes. Through MnSHIP, MnDOT will create an investment direction that guides state highway capital investments for the next 20 years.

INVESTMENT CATEGORY DETAILS

What is Roadside Infrastructure Condition?

Roadside Infrastructure Condition represents an array of non-pavement and bridge assets found on Minnesota's state highway system that support the safe, reliable, and efficient movement of people and goods throughout the state.

Roadside Infrastructure Condition elements include:

- Drainage, culverts, and deep stormwater tunnels;
- Traffic signals, lighting, and Intelligent Transportation Systems (ITS);
- Highways signs and sign structures including traffic and directional signs;
- Noise walls;
- Earth retaining walls;
- Pavement markings;
- Guardrail and concrete barriers, including attenuators and cable-median barriers, and;
- Other infrastructure such as fencing.

Roadside Infrastructure investment involves the repair, rehabilitation or replacement of previously existing elements. Traveler Safety projects may address similar elements (i.e. cable median barrier, rural intersection lighting, pavement markings) however such investment is typically for new infrastructure that is intended to expand the roadside infrastructure system.

Why is Roadside Infrastructure Condition important?

Roadside Infrastructure Condition investments promote safe and informed driving. Center and edge line striping, and rumble strips help drivers stay within their travel lane. Guardrails and cable-median barriers deflect vehicles if they swerve past shoulders. Culverts and drainage systems prevent flooding on the roadways during heavy rains and settle out pollutants that could damage rivers, creeks, and wetlands. Lighting, signs, signals, and ITS help drivers find their way safely to destinations while noise walls provide barriers to help reduce traffic noise from reaching nearby homes.

How does investing in Roadside Infrastructure Condition support the Minnesota GO Vision and Statewide Multimodal Transportation Plan?

Investing in Roadside Infrastructure Condition supports the guiding principles laid out in the 50-year vision for the state's transportation system, Minnesota GO. Among those are:

- Strategically fix the system;
- Integrate safety; and
- Ensure accessibility to key resources and amenities throughout communities.

Building upon these principles, investment in Roadside Infrastructure Condition strengthens multiple strategies identified in the Statewide Multimodal Transportation Plan (SMTP), notably:

- Ensure that safety, operations, and maintenance needs are considered and addressed in transportation planning and programming;
- Implement strategic and sustainable engineering solutions to improve traveler safety;
- Work with transportation partners to implement a transparent and collaborative approach to corridor investment along the state highway system; and
- Work together to improve accessibility and safety for everyone traveling on, along, and across roads.

Roadside Infrastructure plays an important role keeping people traveling on, along, and across roads safely moving. Noise walls help mitigate traffic noise, median guardrail and barriers make roads safer, ITS infrastructure improves mobility, and signs let the traveling public know where to go.

How did MnDOT create the investment levels?

The performance levels outlined in the table represent plausible investment levels for Roadside Infrastructure Condition. A risk-and performance-based analysis was undertaken in the summer of 2015 to illustrate potential future scenarios. Performance levels reflect investments between 2022 and 2037 (2018-2021 funding levels influenced by 2013 MnSHIP). PL 0 through PL 3 represent a range of options to help stakeholders and decision-makers understand outcomes, risks, and system investment strategies for Roadside Infrastructure Condition.

How has the planning context for Roadside Infrastructure Condition changed since 2013 MnSHIP?

The Moving Ahead for Progress in the 21st Century Act (MAP-21) requires states to develop a risk-based Transportation Asset Management Plan (TAMP) for pavements and bridges on the National Highway System (NHS) to improve or preserve asset condition and the performance of the system. MnDOT elected to expand the TAMP beyond the MAP-21 requirements and include all state roads and bridges as well as highway culverts, deep stormwater tunnels, overhead signs, and high-mast light towers. Since completion of the TAMP, MnDOT has expanded asset management planning to other roadside infrastructure - highway lights, intelligent transportation systems (ITS), noise walls, and signals. Both efforts identified performance measures and targets for assets not identified in federal legislation (MAP-21) or the 2013 MnSHIP, and will be included in this MnSHIP update. Additionally, the performance measures and targets will become part of MnDOT's formally adopted measures and targets.

How does MnDOT measure performance in Roadside Infrastructure Condition?

Performance for many roadside infrastructure assets is identified as part of an inspection process and typically measured by condition or age. Information is then included in stand-alone management systems. For highway culverts, HydInfra, a MnDOT-developed statewide geographic information application, is used to manage the inventory as well as inspections and maintenance activities. During inspections, a condition rating is assigned to each culvert. The ratings range from 1 to 4, with 1 representing a feature in Like New condition and 4 representing a feature in Very Poor condition with serious deterioration. Condition or age-based rating systems have been developed for assets in MnDOT's TAMP (table below). Rating systems allow MnDOT to know current conditions - how good or bad an asset is. Understanding an asset's current condition and how much deterioration will occur over a given time allows MnDOT to set targets (i.e. desired condition), and therefore determine investment need.

Roadside Infrastructure Performance Targets

Roadside Infrastructure Asset	Performance Target
Culverts	Very Poor ≤ 3%, Poor ≤ 8%
Deep stormwater tunnels	Very Poor ≤ 3%, Poor ≤ 8%
ITS infrastructure	Very Poor ≤ 2%, Poor ≤ 4%
Lighting	Very Poor ≤ 2%, Poor ≤ 4%
Noise walls	Poor ≤ 2%
Overhead sign structures	Very Poor ≤ 2%, Poor ≤ 4%
Signals	Very Poor ≤ 2%, Poor ≤ 4%

Tips for using this table

Performance Levels

- **Performance Level 0 (PL 0)** represents a strategy which corresponds to the most extreme risk level MnDOT would consider for investing in Roadside Infrastructure Condition.
- MnDOT's current spending in Roadside Infrastructure Condition approximately corresponds to **PL 1**.
- Cost + benefit increase and risks decrease from left to right.
- PLs for Roadside Infrastructure Condition are independent of other performance categories.

Investment Approach

- See **MnSHIP Investment Approaches** folio

Investment Levels

- The **pie charts** represent MnSHIP's total planning investment for years 2022-2037 ($16.3 billion) and the portion of it which will be dedicated to Roadside Infrastructure Condition investment at each PL.
- **Base investment for other categories** is the amount required to invest at PL 0 in every other category.
- **Remaining revenue available** is the additional investment beyond the base investment for all categories in MnSHIP.

Outcomes

- Highlights key outcomes associated with each PL. For Roadside Infrastructure Condition, outcomes correspond with key performance measures.

Risks

- Identified as **high**, **medium**, or **low** in each PL; each risk decreases in severity from left to right.

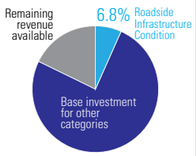
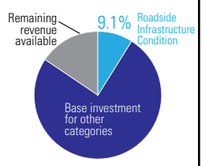
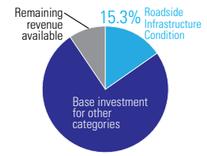
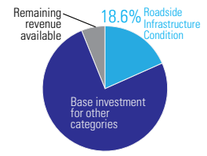
System Investment Strategies

- Details the steps MnDOT would make to mitigate risk at each PL.

Roadside Infrastructure Condition

Overarching Goal: Effectively manage non-pavement and non-bridge asset infrastructure to support a safe, accessible, and reliable roadway system.

Performance Objectives: Install, maintain, replace and upgrade critical infrastructure elements to manage performance and life-cycle costs to improve efficiency and condition, and reduce risks to the public.

	Performance Level 0 *Lowest cost, greatest risk*	Performance Level 1 *Lower cost, higher risk*	Performance Level 2 *Greater cost, lower risk*	Performance Level 3 *Greater cost, lowest risk*
Investment Approach *(See Approaches Folio)*	**Approach C**	**Approach A, B** Approximately corresponds with current investment	PL does not correspond with an Investment Approach	PL does not correspond with an Investment Approach
Investment Level *Total* *Years 5-10 (2022-2027)* *Years 11-20 (2028-2037)*	**$1,135 M** $56.3 M/yr $79.8 M/yr 	**$1,516 M** $75.1 M/yr $106.5 M/yr 	**$2,548 M** $126.3 M/yr $179.0 M/yr 	**$3,091 M** $153.2 M/yr $217.2 M/yr 
Investment Description	Reduction from current funding. Rely primarily on Pavement investment to initiate much of Roadside Infrastructure Condition. Stand-alone work only initiated through maintenance.	Maintain current funding. Rely primarily on pavement investment to initiate much of Roadside Infrastructure Condition. Some stand-alone work initiated.	Maintain current conditions. Rely on both pavement investment and stand-alone work to initiate Roadside Infrastructure Condition.	Meet performance targets. Rely on both pavement investment and stand-alone work to initiate Roadside Infrastructure Condition. Allocate a sizeable amount of funding to replace and repair assets at the end of service life.
Outcomes *To what extent would MnDOT meet performance targets for Roadside Infrastructure Condition?*	• Poor culverts increases to more than 15% • More than 75% of tunnels will be in poor/very poor condition • Reflectivity of most signs below standards - illegible • Significant increase in poor/very poor lighting, signals, and ITS infrastructure - replacement occurs beyond expected service life • More than 40% of noise walls in poor/very poor condition or older than design life • Significant increase in poor-quality pavement markings	• Meet 3% percent very poor culverts target but poor increases to almost 13% • Tunnels in 50% poor and 24% very poor condition • All signs replaced at or beyond 20 years • Increase in poor/very poor lighting, signals, and ITS infrastructure - majority of replacements occurs at end of expected service life • 33% of noise walls in poor condition or older than design life • Increase in poor-quality pavement markings	• Culvert condition remains at 3% percent very poor and 10% poor • Tunnels in 23% poor and 1% very poor condition • Signs begin to be replaced at 15 years • Signals replaced to maintain 12% poor and 8% very poor condition, and ITS infrastructure • Majority of ITS and lighting replacements occurs at end of expected service life • 98 noise walls replaced; condition remains at 6% poor and 2% poor for wood and concrete noise walls • 16,000 miles of pavement markings refreshed annually	• Culvert, drainage and tunnel condition at 3% percent very poor and 8% poor • Signs begin to be replaced at 15 years • Signals, lighting, signs/sign structures, and ITS condition at 2% very poor and 4% poor • Noise walls condition at 2% poor • Average pavement markings refreshment decreased to two years with use of more durable material; markings increased from 4" to 6" wide and recessed
Risks	**High** • Replace/repair burden shifts from capital to maintenance budget • Reduced reliability leads to system closures - greater interruptions and increased safety risk • Delayed replace/repair not aligned with optimal life cycle investments results in increased costs • Decreased replace/repair results to an inability to meet public expectations and standards	**Medium** • Replace/repair burden shifts from capital to maintenance budget • Reduced reliability leads to system closures - greater interruptions and increased safety risk • Delayed replace/repair not aligned with optimal life cycle investments results in increased costs • Decreased replace/repair results to an inability to meet public expectations and standards	**Medium** • Delayed replace/repair not aligned with optimal life cycle investments results in increased costs **Low** • Replace/repair burden shifts from capital to maintenance budget • Reduced reliability leads to system closures - greater interruptions and increased safety risk • Decreased replace/repair results to an inability to meet public expectations and standards	**Low** • Replace/repair burden shifts from capital to maintenance budget • Reduced reliability leads to system closures - greater interruptions and increased safety risk • Delayed replace/repair not aligned with optimal life cycle investments results in increased costs • Decreased replace/repair results to an inability to meet public expectations and standards
System Investment Strategies *What strategies would MnDOT use to manage risk?*	• Rely on maintenance budget to keep system in good repair • Respond to non-functional or very poor condition elements only through pavement and bridge investment	• Repair/replace infrastructure in very poor condition or beyond service life • Replace assets with greatest exposure to traveling public through pavement and bridge investment and some stand-alone projects	• Repair failed infrastructure as needed • Replace infrastructure that is functional but damaged/outdated • Invest in preventive repairs to avoid future higher replacement costs	• Repair/replace infrastructure in poor and very poor condition or at end of service life • Long-term replacements made when appropriate • Upgrades and innovations to improve functionality and improve life cycle

How does MnDOT typically invest in Roadside Infrastructure Condition?

MnDOT often repairs, replaces, or rehabilitates roadside infrastructure as a part of a larger pavement, bridge, or intersection project. An example of this is striping of roadways as a part of a paving project. On a typical pavement project, approximately 12% is spent on roadside infrastructure elements.

Sometimes, MnDOT carries out corridor-wide standalone roadside infrastructure projects for assets such as culverts, signs, or lights. Roadside infrastructure features damaged from weather or crashes are usually repaired as part of routine maintenance and funded through the operations and maintenance budget.

Where is MnDOT headed?

MnDOT is projected to spend an average of $55 million annually on Roadside Infrastructure Condition for the next 20 years based on investment levels identified in 2013 MnSHIP. At this rate, poor MnDOT culverts will increase from 10 to almost 13 percent. Poor stormwater tunnels will increase slightly from 23 to 24 percent and very poor will increase from 1 to 50 percent. The number of noise walls that are in poor condition increases from 2 percent to almost 33 percent. ITS, signals, and lighting assets become older than targeted service life, which means that a portion of lighting drops below recommended lighting standards while some ITS and traffic signal technology becomes functionally obsolete. Pavement markings and signs will fall below retro-reflectivity standards, and guardrail will be repaired as needed primarily through maintenance and operations budgets. Most roadside infrastructure assets are unable to be upgraded to new system standards.

What risks are addressed through increased Roadside Infrastructure Condition Investment?

Generally, the more MnDOT invests in Roadside Infrastructure Condition, the more MnDOT is able to reduce these key risks for automobile users, transit users, passengers, freight, and other system users:

- Replace/repair burden shifts from capital to maintenance budget
- Reduced reliability leads to system closures—greater interruptions and increased safety risk
- Delayed replace/repair not aligned with optimal life cycle investments results in increased costs
- Decreased replace/repair results to an inability to meet public expectations and standards

How is MnDOT enhancing financial effectiveness through Roadside Infrastructure Condition Investment?

Recent asset management activities have helped MnDOT to better understand management practices for roadside infrastructure. Using the TAMP as a guide, MnDOT now has a better handle on inventories and conditions, life-cycle costs, performance measures and targets, and investment strategies for many roadside infrastructure elements.

Using this information MnDOT aims to preserve the amount of Roadside Infrastructure Condition in good condition and manage risks using the following strategies:

- Coordinate investments with other projects—repair or replace roadside assets as part of larger pavement and bridge projects to help reduce unit costs.
- Implement standalone projects as needed—repair or replace roadside assets as part of corridor-wide, standalone projects when addressing multiple purposes - condition, safety, functional obsolescence, mobility, etc.
- Perform optimal treatments to extend asset life—invest in the optimal treatment approach while balancing the most critical (highest risk) issues and performance outcomes.
- Maintain or manage most critical, oldest or worst condition assets—repair or replace the most critical roadside assets to align with public expectations.

Culverts divert water along, under, and away from roadways to prevent flooding and make for safer travel..

Find more information with these additional folios!

Asset Management
- Pavement Condition
- Bridge Condition
- Jurisdictional Transfer
- Facilities

Traveler Safety
- Traveler Safety

Critical Connections
- Twin Cities Mobility
- Greater Minnesota Mobility
- Bicycle Infrastructure
- Accessible Pedestrian Infrastructure

Transportation In Context
- Regional + Community Improvement Priorities

Other
- Project Delivery
- Small Programs

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