APPENDIX A - RISK TIERS AND GLOSSARY

Figure A-1: Risk Mitigation Priorities Tier One by Asset Type, 1 of 2

RISK CODE	TIER ONE RISK MITIGATION PRIORITIES	RISK PRIORITY	RISK REDUCTION	COST SCORE	TOTAL SCORE
1P	Pavements: Provide better training for construction inspectors. Change design (or over-design) according to better projections (VMT, HCVMT, ESALs, environmental factors)	1	3	3	7
2P	Pavements: Use various tools to communicate the need/ benefit of following the lowest LCP strategy by implementing a regular pavement management schedule	3	3	1	7
3P	Pavements: Identify alternative revenue sources due to reductions from various sources resulting from technological changes. Continue to research how to optimize MnDOT's dollars	3	3	1	7
4P	Pavements: Study cost-benefit of treating ancillary pavements as separate assets independent of mainline using different measures, deterioration modeling, data collection, etc.	2	4	3	9
1B	Bridges: Improve design and construction practices	1	2	1	4
2B	Bridges: Dedicate full-time inspectors and staff with proper training. Focus more quality assurance and training resources to state-owned system	2	4	1	7
3B	Bridges: Expand practices to identify more shelf-projects that can be addressed with more funding. Lobby for more funding and better communicate funding needs. Tie expansion projects to maintenance budgets	3	4	1	8
1BLDG	Buildings: Develop a plan for data collection and maintenance	1	4	1	6
4BLDG	Buildings: for Funding: Implement the Facilities Asset Management Plan	3	4	4	11
1HCDST	Culverts and Deep Stormwater Tunnels: Inspect tunnels according to inspection schedules (local jurisdictions conduct inspections on tunnels with shared water)	2	1	1	4
2HCDST	Culverts and Deep Stormwater Tunnels: Rehab culverts before failure occurs and make permanent fixes during future pavement projects	1	3	1	5
3HCDST	Culverts and Deep Stormwater Tunnels: Better model and research deterioration. Address culvert needs earlier in pavement project scoping-- (e.g., during STIP/CHIP development)	1	4	1	6
4HCDST	Culverts and Deep Stormwater Tunnels: Perform regular Inspections and invest in recommended repairs (follow ideal LCP strategy)	1	1	5	7

Figure A-1: Risk Mitigation Priorities Tier One by Asset Type, 2 of 2

RISK CODE	TIER ONE RISK MITIGATION PRIORITIES	RISK PRIORITY	RISK REDUCTION	COST SCORE	TOTAL SCORE
5HCDST	Culverts and Deep Stormwater Tunnels: Collect statewide location inventory and inspection data of storm drains	2	1	5	8
6HCDST	Culverts and Deep Stormwater Tunnels: Communicate funding needs. (e.g., more cost-effective to align culvert replacement with pavement projects; emphasize this approach as an optimization strategy)	3	4	1	8
1ITS	Intelligent Transportation Systems: Communicate funding needs. Develop and track performance measures	3	3	2	8
1NW	Noise Walls: Annually collect asset inventory and condition data using LiDAR. Maintain a regular inspection schedule to collect data that LiDAR cannot capture. Inspect noise walls at appropriate frequencies to promptly address fixes	2	2	3	7
2NW	Noise Walls: Consider noise walls earlier in scoping process to include them in project costs	3	3	1	7
3NW	Noise Walls: Set up work plans for walls based on their age and condition	1	4	3	8
1OS	Overhead Signs: Inspect every five years using a standard inspection form to identify overhead signs that may require more frequent inspections. Revise standards (e.g., MnDOT previously used grout but found it led to premature deterioration)	1	4	1	6
2OS	Overhead Signs: Identify when sign panel sizes are outside of standards. Verify with engineer the use of current design specifications in standard plans	4	2	1	7
3OS	Overhead Signs: Train installers and certify inspectors. Ensure construction inspections are done correctly and any construction flaws are fixed	4	1	2	7
1PED	Pedestrian Infrastructure: Collect pedestrian assets using mobile LiDAR	2	2	3	7
2PED	Pedestrian Infrastructure: Develop and pilot performance measures for maintaining pedestrian facilities in partnership with local jurisdictions. Identify consistent maintenance approaches to better define responsibilities included in maintenance agreements under cooperative agreements and in master maintenance agreements	1	4	3	8
1SLHMT	Traffic Signals, Lighting, and High-Mast Light Towers: Ensure adequate staffing for structural inspection throughout asset life cycle. Develop life cycle replacement or preservation program for standalone projects	1	1	1	3
2SLHMT	Traffic Signals, Lighting, and High-Mast Light Towers: Document and communicate needs (e.g., business plans)	3	3	1	7

Figure A-2: Risk Mitigation Priorities Tier Two by Asset Type, 1 of 2

RISK CODE	TIER TWO RISK MITIGATION PRIORITIES	RISK PRIORITY	RISK REDUCTION	COST SCORE	TOTAL SCORE
5P	Pavements: Significant damage to the asset through human-made or natural events	4	4	2	10
4B	Bridges: If premature replacement due to widening is necessary, communicate loss of service life costs and how it impacts projections	5	4	1	10
2BLDG	Buildings: ***Rest areas and headquarters:*** Include Americans with Disabilities Act assessment information in project selection criteria. ***All buildings:*** Identify communication gaps and find a way to address them	4	4	2	10
3BLDG	Buildings: Develop a plan for data collection and maintenance	2	5	3	10
5BLDG	Buildings for Competing Stakeholder Expectations: Implement the Facilities Asset Management Plan	6	4	1	11
7HCDST	Culverts Deep Stormwater Tunnels: Formalize the process of checking hydraulic capacity and the availability of existing culvert storage when deciding whether to line it. Keep track of culverts in areas with flooding problems to determine if they need repair	4	2	3	9
8HCDST	Culverts Deep Stormwater Tunnels: Add recommended tunnel capacity	4	1	5	10
9HCDST	Culverts Deep Stormwater Tunnels: Complete location inventory, continue current inspections and identify damage and repair needs	4	2	5	11
2ITS	Intelligent Transportation Systems for Infrastructure Resilience: Update standards in design manual and provide training on standards. Create a construction manual and provide certification training. Create an operations and maintenance manual and provide training	4	4	3	11
3ITS	Intelligent Transportation Systems for Succession Planning: Update standards in the design manual and provide training on standards. Create a construction manual and provide certification training. Create an operations and maintenance manual and provide training	7	1	3	11
4ITS	Intelligent Transportation Systems: Develop workflows	8	2	1	11
4NW	Noise Walls: Set cyclical repair either as part of the inspection process or from TAMS recommendations	8	2	1	11
4OS	Overhead Signs: Develop a new response process and make sure it is well understood by all parties. (Continue to focus on response due to an inability to predict these events)	4	3	1	8
3PED	Pedestrian Infrastructure: Fully integrate assets into TAMS work order process. Develop MnDOT guidance on best practices for maintenance of pedestrian assets	1	3	4	8
3SLHMT	Signals, Lighting, and High Mast Light Towers: Continue to follow through and fully implement "in-process" mitigation strategies. Have trained inspectors inspect assets during construction	4	1	4	9

Figure A-2: Risk Mitigation Priorities Tier Two by Asset Type, 2 of 2

RISK CODE	TIER TWO RISK MITIGATION PRIORITIES	RISK PRIORITY	RISK REDUCTION	COST SCORE	TOTAL SCORE
4SLHMT	Signals, Lighting, and High Mast Light Towers: Increase resources to respond to incidents more quickly (there are several options for prevention, but none that are based on competing factors)	4	3	3	10
5SLHMT	Signals, Lighting, and High Mast Light Towers: Use more secure passwords (Cybersecurity mitigation provided through MNIT). Add locks to cabinets, mostly done through vendors	8	1	1	10
6SLHMT	Signals, Lighting, and High Mast Light Towers: Need dedicated statewide construction inspectors trained in signals and lighting (e.g., electrical components)	4	4	3	11

Figure A-3: Risk Mitigation Priorities Tier Three by Asset Type, 1 of 2

RISK CODE	TIER THREE RISK MITIGATION PRIORITIES	RISK PRIORITY	RISK REDUCTION	COST SCORE	TOTAL SCORE
6P	Pavements: Create a vocational program for highway technicians. Improve tech certification program by working with industry to improve outreach	7	4	1	12
7P	Pavements: Educate the public on what it takes to maintain the roads. (e.g., surface rating vs. the structure itself, what it takes to maintain roads and what jurisdiction is responsible)	6	4	4	14
5B	Bridges: Identify and prioritize bridges in need of debris removal. Use flood vulnerability model output to prioritize areas in need of further checking criticality/loss of structure. Implement Bridge Watch, a GIS-based predictive program for rain events and how they impact existing infrastructure. Bridge Watch sends alerts to maintenance crews to identify bridges that may be impacted	4	4	4	12
6B	Bridges: Improve recruiting practices, change job requirements for certain positions and improve cross-training	7	4	1	12
7B	Bridges: Identify critical elements, increase the inspection/ monitoring frequency, including better access for equipment and traffic control	4	4	5	13
8B	Bridges: Identify which assets have had repeat hits and are considered high-risk. Install warning systems and cameras at high-risk locations (lower cost option than re-placements) or Meet standards for high-risk locations be-fore planning replacements	4	4	5	13
9B	Bridges: Understand proposals, identify what challenges they pose and make changes accordingly	8	4	1	13
10B	Bridges: Receive adequate funding to fully implement the current mitigation strategy. Base federal targets on an element-level approach	6	5	5	16
11B	Bridges: Fully implement using element-level based bridge performance measures and preventive maintenance performance measures	8	4	5	17

Figure A-3: Risk Mitigation Priorities Tier Three by Asset Type, 2 of 2

RISK CODE	TIER THREE RISK MITIGATION PRIORITIES	RISK PRIORITY	RISK REDUCTION	COST SCORE	TOTAL SCORE
6BLDG	Buildings: Design based on truck station standards manual	7	4	1	12
7BLDG	Buildings: Identify communication gaps and address them	8	4	2	14
5ITS	Intelligent Transportation Systems: Add more details into requests for proposals to ensure support and reliability when selecting potential vendors	7	4	1	12
6ITS	Intelligent Transportation Systems: Create plans to address potential obsolescence	8	4	1	13
7ITS	Intelligent Transportation Systems: Standardize certain materials rather than customizing based on location	8	4	2	14
5NW	Noise Walls: Fund aesthetics based on performance-based paint specifications (alternatively, MnDOT will prioritize additional funding through other means unless there is dedicated aesthetic funding)	6	4	5	15
5OS	Overhead Signs: Train and hire staffing concurrently. Fostering consistent documentation standards across districts	7	4	1	12
6OS	Overhead Signs: Pilot new technology with experimental projects before widespread implementation	8	5	5	18
4PED	Pedestrian Infrastructure: Increase capacity among existing staff and hire additional staff at the district level	7	1	4	12
5PED	Pedestrian Infrastructure: Continue current control and mitigation strategies. Incorporate 3D modeling to improve planning, design and construction	4	4	5	13
6PED	Pedestrian Infrastructure: Implement the master maintenance agreements	7	4	3	14
7PED	Pedestrian Infrastructure: Develop performance measures based on location, type of repair and response timeframe to address complaints. Identify trends to support a more proactive approach	6	4	4	14
7SLHMT	Signals, Lighting, and High Mast Light Towers: Modernize tunnel lighting by providing backup power systems (focus on tunnels due to more critical safety risks). Communicate to the traveling public when systems are out of operation	7	3	2	12
8SLHMT	Signals, Lighting, and High Mast Light Towers: Continue to upgrade equipment to the central system. Follow life cycle management strategy on all equipment to minimize failures	5	4	5	14
9SLHMT	Signals, Lighting, and High Mast Light Towers: Follow life cycle management strategy on all equipment to minimize failures	5	4	5	14
10SLHMT	Signals, Lighting, and High Mast Light Towers: Implement signal timing performance measures (e.g., retime on-demand, as needed)	8	4	3	15

RISK MANAGEMENT GLOSSARY

Adaptation - anticipation of, or response to, a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects.

Climate Change - any significant change in the measures of climate lasting for an extended period of time. Climate change includes major variations in temperature, precipitation, or wind patterns, among other environmental conditions, that occur over several decades or longer. Changes in climate may manifest as a rise in sea level, as well as increase the frequency and magnitude of extreme weather events now and in the future.

Consequence - outcome of an event affecting objectives

Event - occurrence or change of a particular set of circumstances

Extreme Weather Events - significant anomalies in temperature, precipitation and winds and can manifest as heavy precipitation and flooding, heatwaves, drought, wildfires and windstorms (including tornadoes and tropical storms). Consequences of extreme weather events can include safety concerns, damage, destruction, and/or economic loss. Climate change can also cause or influence extreme weather events.

Likelihood - chance of something happening

Monitoring - continual checking, supervising, critically observing or determining the status in order to identify change from the performance level required or expected

Resilience/Resiliency - the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions

Risk - effect of uncertainty on objectives

Risk Analysis - process to comprehend the nature of risk and to determine the level of risk

Risk Assessment - overall process of risk identification, risk analysis and risk evaluation

Risk Appetite - The types and amount of risk, on a broad level, an organization is willing to accept in pursuit of value

Risk Identification - process of finding, recognizing and describing risks

Risk Management - coordinated activities to direct and control an organization with regard to risk

Risk Owner - person or entity with the accountability and authority to manage a risk

Risk Management Plan - scheme within the risk management framework specifying the approach, the management components and resources to be applied to the management of risk

APPENDIX A - RISK TIERS AND GLOSSARY

Risk Management Policy - statement of the overall intentions and direction of an organization related to risk management

Risk Management Process - systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring and reviewing risk

Risk Treatment - process to modify risk

Uncertainty - the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood

Vulnerability - weaknesses or gaps in risk management efforts

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