



Indiana
Department of Transportation

Strategic Asset Management Plan

SEPTEMBER 2020

INDOT Strategic Asset Management Plan

Document History

Version	Date	Modified By	Summary of Changes
SAMP v1	August 28, 2019	KPMG	First draft of SAMP completed
Draft SAMP v2	September 2020	KPMG	Graphical refresh, updates to asset lifecycle strategies, inventory counts, financials, appendices



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Executive Summary



The Indiana Department of Transportation (“INDOT”, the “Agency”, or the “Department”), is responsible for the construction and maintenance of state roads, interstates, and U.S. routes, as well as for traffic control devices (signs and traffic signals) on its roadways. There are six District offices across Indiana that manage day-to-day operations, such as construction, detours, traffic signal operations, permits, maintenance operations, etc.¹ INDOT owns or is responsible for maintaining approximately 11,000 centerline miles and over 5,700 bridges across the state.²

To account for INDOT’s plans for increased investments in infrastructure and ongoing changes in external environmental factors, INDOT has established a long-term approach for sustaining its infrastructure assets and effectively managing its investments. INDOT’s Strategic Asset Management Plan (SAMP) guides the processes, policies, and procedures related to INDOT’s management of roads and bridges to help the Department effectively manage its breadth of assets. The SAMP takes into account INDOT’s Strategic Plan and other policies to establish a coordinated approach for developing and maintaining good practice asset management, highlighting the role of the overall “asset management system” in the delivery of asset management goals and objectives.

INDOT’s goal is to achieve no more than 5% of pavement and 3% of bridges in poor condition by 2037. To achieve these condition targets, INDOT has developed 20-year statewide treatment plans for pavement and bridges to support steady and consistent improvement in these assets. With the passage of Next Level Indiana, INDOT plans to increase its annual investments to an average of \$469 million in its pavement preservation plan and \$481 million in its bridge preservation plan over the next ten years.³ With these investments, INDOT anticipates steady improvement in the conditions of its statewide roadway network, achieving 95% of overall pavement and 97% of statewide bridges in fair or better condition by year 2037.⁴

By creating a SAMP for INDOT’s transportation assets, this document helps ensure all stakeholders have a clear and common understanding of asset management within the INDOT organization, including asset management goals, objectives, policies, procedures, and business processes. Strategic asset management activities will guide how and where INDOT deploys resources and are critical in helping INDOT achieve its long-term vision and goals.⁵

¹ KPMG, “Asset Management Current Situation Analysis and Roadmap Report Indiana Department of Transportation,” version 10, October 3, 2018

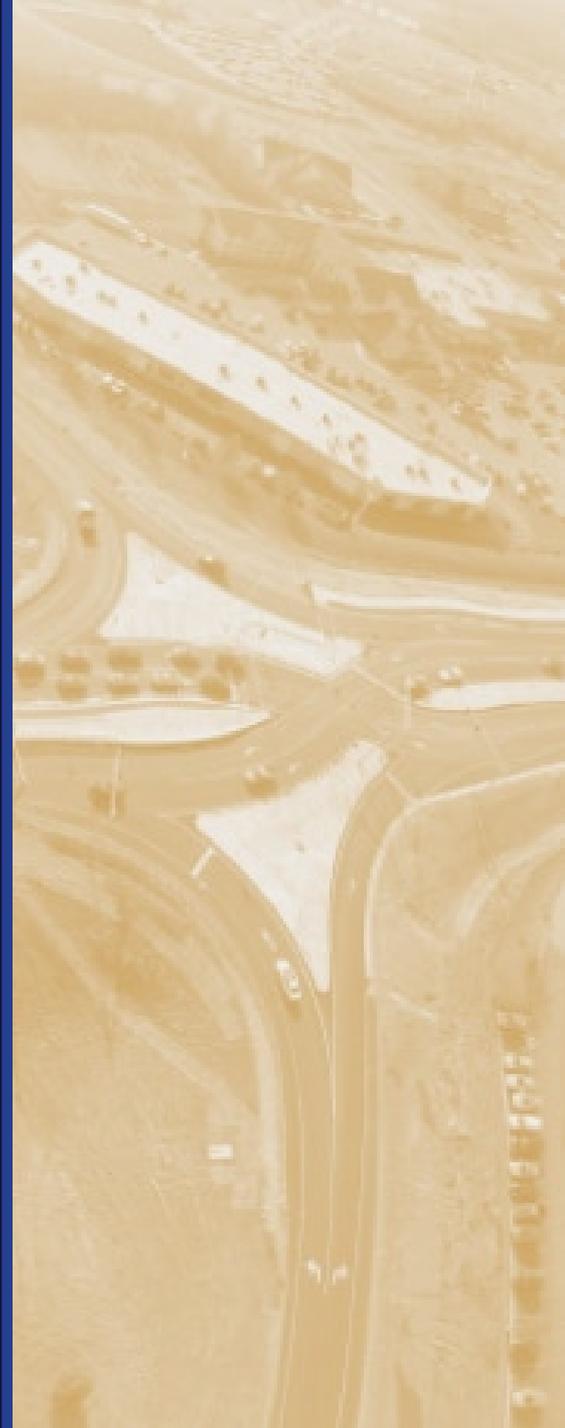
² Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

³ “Targets 6.24.20 vs. 9.20.19,” Excel spreadsheet of legislative funding targets for bridges and pavement. Indiana Department of Transportation, August 12, 2020.

⁴ Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

⁵ Indiana Department of Transportation, *Indiana Department of Transportation 2019 Strategic Plan*, version 6

Operating Context



What is INDOT's Operating Environment?

Overview

The Indiana Department of Transportation (INDOT) is responsible for the construction and maintenance of state roads, interstates, and U.S. routes, as well as for traffic control devices (signs and traffic signals) on its roadways. There are six District offices across Indiana that manage day-to-day operations such as construction/detours, traffic signal operations, permits, maintenance operations, etc. for approximately 11,000 centerline miles of roadways (including 13 interstate highways)⁶ and over 5,700 bridges.⁷

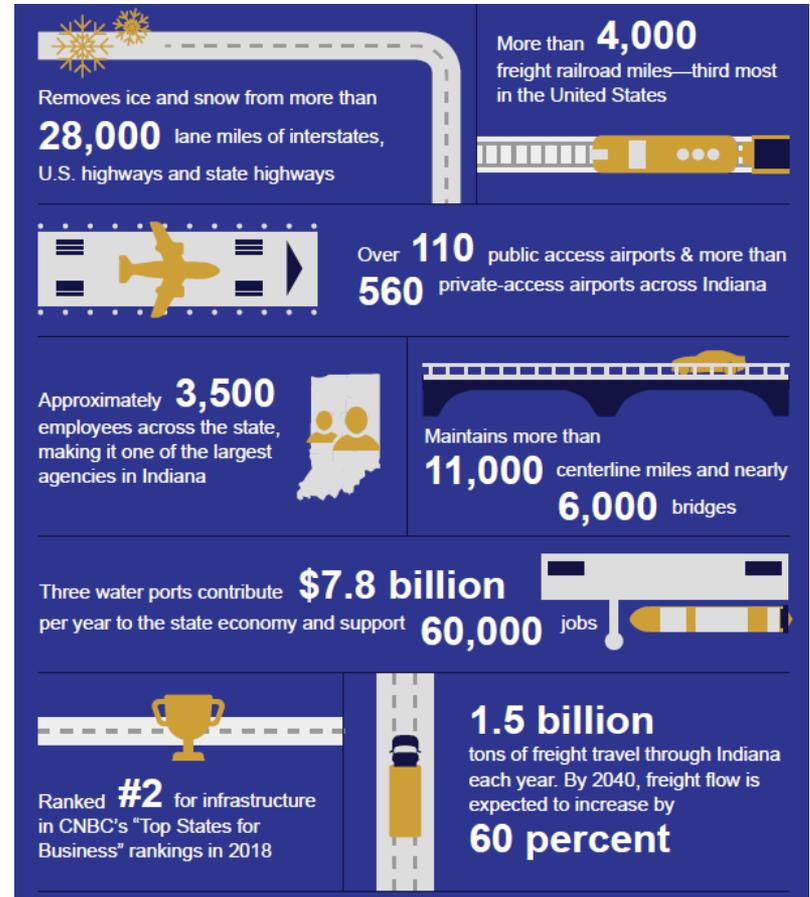
Like many transportation agencies, INDOT has witnessed disruptive changes to its operating environment over the past several years:

New technologies

The advancement of new technologies in the automotive industry has resulted in unprecedented changes to transportation and its related infrastructure, including the **rise of autonomous, connected, and electric vehicles and advancements in multi-modal transit** and “big data” analytics and solutions.⁸

Social environment

INDOT is also impacted by Indiana's overall shifts in demographics and economic factors. **From 2010 to 2018, Indiana's population has grown approximately 3%,⁹ with increases expected in future years.** Coupled with advances in technologies, INDOT will prepare for increased congestion on its roadways.



⁶ "INDOT Facts" website, <https://www.in.gov/indot/2337.htm>.

⁷ "BIAS State Bridges No Culverts," Excel spreadsheet of bridge inventory and conditions, Indiana Department of Transportation, July 26, 2019

⁸ Indiana Department of Transportation, *Indiana Department of Transportation 2019 Strategic Plan*, version 6

⁹ "Indiana Quick Facts," website, US Census Bureau, <https://www.censusbureau.gov/quickfacts/indiana/>

How is INDOT Addressing these Challenges?

INDOT's Initiatives

Factoring these disruptive changes in the technological, economic, and social environment, INDOT's Strategic Plan has identified service objectives to drive INDOT's planning and decision-making. Such service objectives include the need to ensure road safety, enhance mobility, and achieve asset sustainability.



The passage of Next Level Indiana legislation in 2017, championed by Governor Eric Holcomb, is a critical element in addressing these changes by

helping INDOT sustain the infrastructure supporting the transportation network. Recognizing the need to improve highway quality in the long-term to meet increased demand and technological advancements, Next Level Indiana plans for over \$30 billion in funding over the next 20 years,¹⁰ establishing a sustainable plan to fund INDOT's bridges and roads.

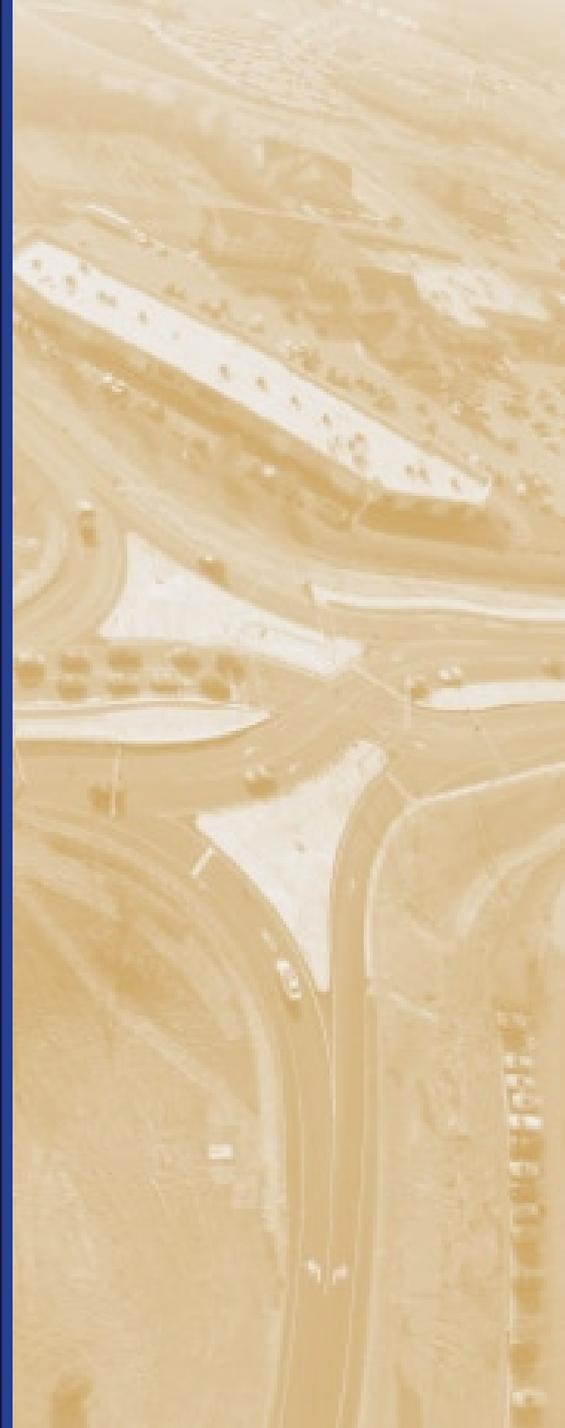
With INDOT's plans for increased investments in infrastructure to address these environmental impacts, it is critical that INDOT establish a long-term approach for sustaining its infrastructure assets and effectively managing its investments.

Successful implementation of INDOT's Asset Management Program will help the Department to effectively maintain its infrastructure in the long-term and ensure a safe, high-quality, and sustainable transportation network for Indiana's citizens and travelers.



¹⁰Indiana Constructors, Inc., "LF ICI PowerPoint" (program update, Indiana Department of Transportation, Indianapolis, IN, 2019)

Overview of the SAMP



What is the Purpose of the SAMP?

Objectives of the SAMP

The SAMP serves as the principle guiding document for INDOT's asset management practices and the overall Asset Management Program. The objectives of the SAMP are to:

- Detail the role of assets, asset management, and the asset management system in supporting achievement of the Strategic Plan's objectives, and to provide clarity and direction for all organizational stakeholders, from top management to delivery teams;
- Translate organizational objectives into strategic asset management objectives and reconcile these with other strategic objectives;
- Guide the approach for developing the asset management plans and the asset management system, while applying the INDOT Asset Management Policy to ensure alignment;
- Document the decision-making criteria that enable the definition of value realization for INDOT and its stakeholders and the coordinated approach for performance evaluation;
- Present a consolidated plan at the asset portfolio level for achieving strategic asset management objectives and link to the organization's financial plans;
- Present a plan for creating or improving the asset management system in order to ensure the required capabilities and resources are available to achieve the asset management objectives.

The SAMP translates INDOT's strategic objectives, identified by stakeholder requirements and internal and external issues, into asset management initiatives and objectives. The SAMP provides the guiding principles to support asset management planning and decision-making for INDOT's functional and asset lifecycle strategies. The SAMP also supports delivery of the Strategic Plan and other INDOT policies and documents to develop a detailed approach for developing and maintaining good practice asset management throughout INDOT.



How does the SAMP Relate to INDOT?

The SAMP and its Role in the Asset Management System

The SAMP takes a system-wide approach to managing INDOT’s assets, highlighting the role of the overall “asset management system” to support the delivery of the asset management goals and objectives. The asset management system includes all business processes, policies, procedures, documents, and the supporting framework that enables the achievement of asset management.

The SAMP also operates within INDOT’s greater operating environment. Other documents that establish INDOT’s strategic objectives and initiatives include the INDOT Strategic Plan, the Multimodal Freight & Mobility Plan, Long-Range Transportation Plan, Next Level Indiana, Federal Highway Administration (FHWA) Transportation Asset Management Plan (TAMP), and the Asset Management Policy. The Multimodal Freight and Mobility Plan and 20-Year Long Range Transportation Plan establish INDOT’s long-term priorities, as well as the 20-year Next Level Indiana legislation, which provides additional funding sources to address INDOT’s long-term asset needs. These planning documents feed into INDOT’s TAMP and the SAMP, which provide the guiding principles and objectives for the upcoming 10-years. In turn, the TAMP and SAMP serve as the foundation for developing INDOT’s 5-Year Construction Plan, which informs the programming for the upcoming Statewide Transportation Improvement Program (STIP).¹¹

¹¹Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

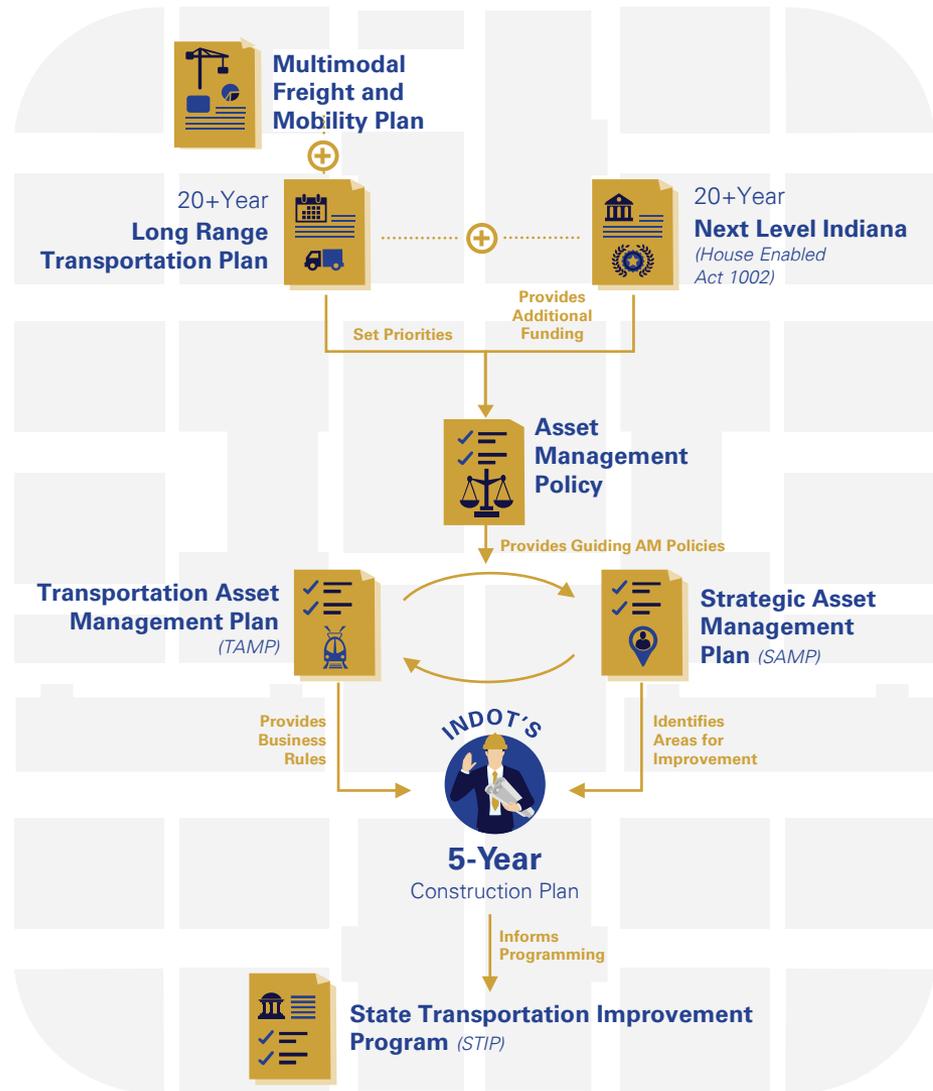


Figure 1: Operating Context of the SAMP

What is Included in the SAMP?

Scope of the SAMP

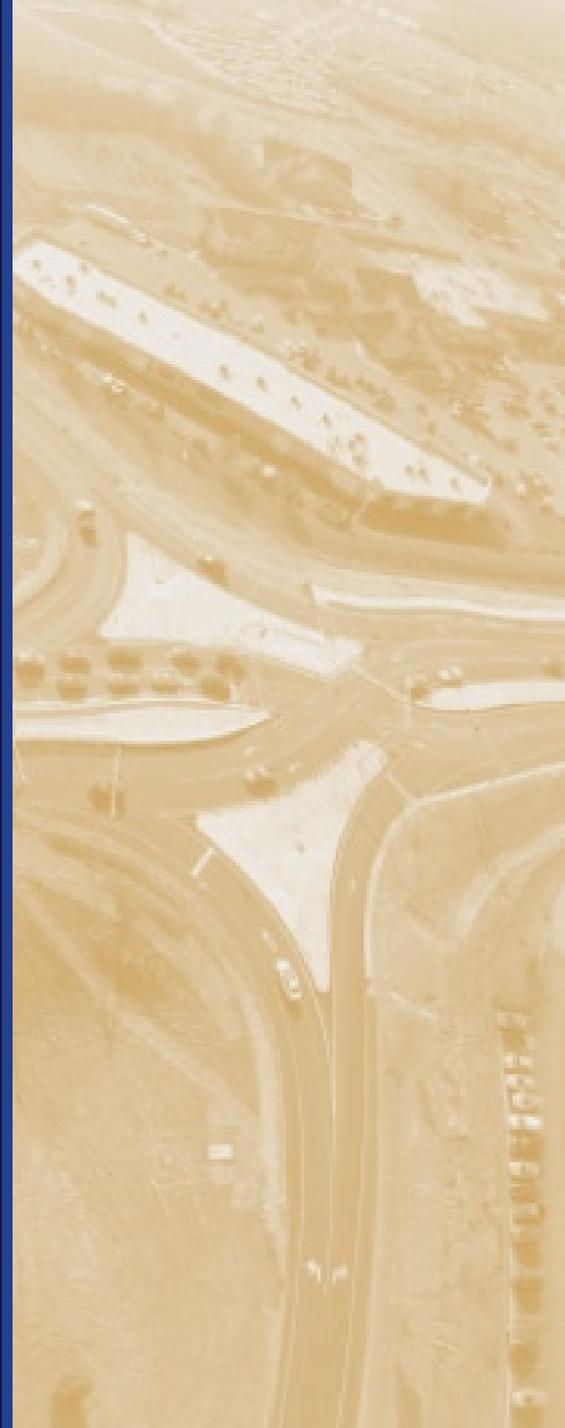
While the SAMP is intended to provide guidance for managing INDOT's entire portfolio of infrastructure assets, the current SAMP focuses on INDOT's pavement and bridge portfolio inventory. Future versions of the SAMP may include details related to INDOT's additional assets as more data becomes available.

Processes and plans outlined within the SAMP for bridges and pavement include INDOT's 20-year plans, investment decision-making criteria, and lifecycle strategies. While the SAMP provides a summary overview of these business processes, the SAMP does not provide details on the calculations used to develop the scoring methodologies, nor does it provide specifics on the calculations used to develop lifecycle strategies. The SAMP is meant to provide a high-level overview of these processes; additional details can be found in INDOT's operational policies for bridges and pavement, the INDOT Design Manual, and other policy and procedural guidelines.

While the SAMP includes 20-year bridge and pavement treatment plans, financial data for the SAMP is forecasted through FY30. As additional data becomes available, future versions of the SAMP should align the planning horizons for the asset strategies and associated financial plans to deliver the asset strategies.



Asset Portfolio



How does INDOT Categorize its Roads?

INDOT Roadway Categories

Indiana has a vast network of roads, including National Highway System (NHS) interstates, NHS non-interstate roads, and roads not on the NHS. For the purpose of the SAMP, bridges and pavement within INDOT's asset portfolio include only those INDOT owns or for which INDOT is responsible for maintaining.

INDOT categorizes its roads by functional classification and traffic volume. Capital and operating and maintenance (O&M) targets for Service Levels are assigned to each road category, and, while Service Level targets may vary by road category, they are uniform across the state.¹²

Table 1: INDOT Road Category Definitions

Road Category		Sub-Category		Description
A	Interstates	1	Urban Interstates and High Volume Interstates	Interstate with average daily traffic >40,000
		2	Rural Interstates	Interstate with average daily traffic <40,000
B	Freeways and Principal Arterials	1	Urban High Volume NHS Roads	Freeway or principal arterial with average daily traffic >5,000 per lane
		2	Rural High Volume	Freeway or principal arterial with average daily traffic <5,000 per lane
C	Remaining Roads	1	Urban Low Volume	Any other INDOT-owned road with average daily traffic >5,000
		2	Rural Low Volume	Any other INDOT-owned road with average daily traffic <5,000

Note: Current pavement inventory is dated from 2017.



¹²"Pavement 3.21.19," Excel spreadsheet of pavement inventory, Indiana Department of Transportation, March 21, 2019.

What is INDOT's Pavement Inventory?

INDOT Pavement Inventory Overview

INDOT's pavement network totals 10,946 centerline miles and 28,021 lane miles across the state. The following table presents INDOT's pavement inventory by District and by roadway category.

Note that the pavement inventory counts are based off of data gathered in 2019, and inventory varies year to year due to relinquishments, realignments, and new road construction.¹³

Table 2: INDOT Inventory of Pavement by District (dated 2019)

District	A1		A2		B1		B2		C1		C2	
	Center Line Miles	Lane Miles										
Crawfordsville	76	329	133	531	139	484	341	1,084	180	368	919	1,839
Fort Wayne	29	146	105	420	365	1,117	248	701	151	307	988	1,998
Greenfield	227	1,189	36	142	277	954	216	512	277	660	530	1,089
LaPorte	78	445	28	111	472	1,579	355	994	204	450	680	994
Seymour	67	301	168	670	244	738	358	817	189	386	905	1,814
Vincennes	0	0	197	787	210	764	317	799	275	573	962	1,929

Pavement Inspection

INDOT inspects all pavement, both INDOT-owned and maintained on an annual basis. Pavement condition is evaluated according to whether the pavement is in fair, good, or poor condition. Condition data is collected in the following evaluation zones: the right wheel path, left wheel path, two non-wheel path zones, outside pavement edge, and outside shoulder zone.

Assessments are based on the roughness, rut, faulting, and cracking, as depicted below. While FHWA's measurement of overall pavement condition is dependent on the pavement type and number of the above measures that have received a good, fair, or poor rating, INDOT's key performance indicator (KPI) is based on the IRI of the right wheel path.



International Roughness Index (IRI)

Roughness of the pavement



Rut (RUT)

Depressions or grooves in the roadway



Faulting

Displacement of pavement at the joints or cracks along the roadway



Cracking

Roadway distress that can lead to potholes

¹³AADT Results 8.12.19 (Updated Sep. 3), "Excel spreadsheet of pavement inventory, Indiana Department of Transportation, September 3, 2019.

What are the Conditions of INDOT's Pavement?

INDOT Pavement Conditions by District

Using FHWA's measurement, approximately 0.8% of INDOT's interstate pavement and 3.1% of INDOT's non-interstate pavement was in poor condition, as of 2016. Using INDOT's measurement (e.g., the IRI of the right wheel path), approximately 89% of overall pavement was in good condition,

as of 2017.¹⁴ The following charts present the percentages of pavement in good, fair, or poor condition. Current conditions use data collected from 2017 and are displayed by District and road category.¹⁵

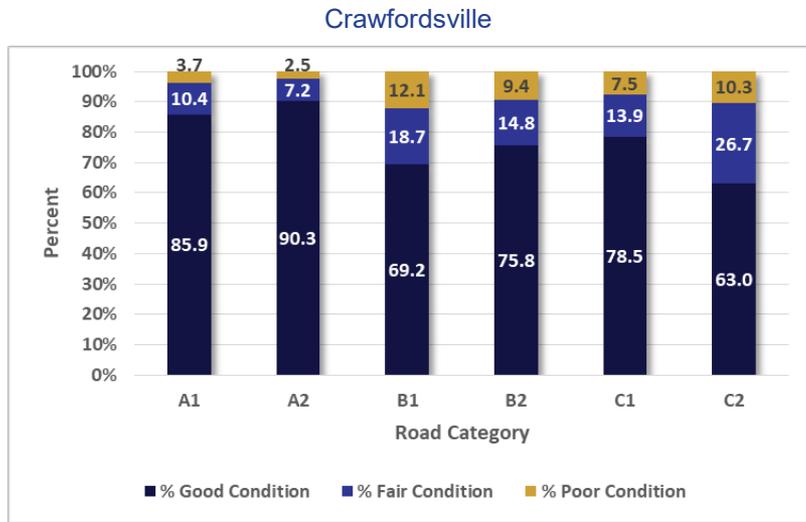


Figure 2: Crawfordsville Pavement Conditions by Road Category

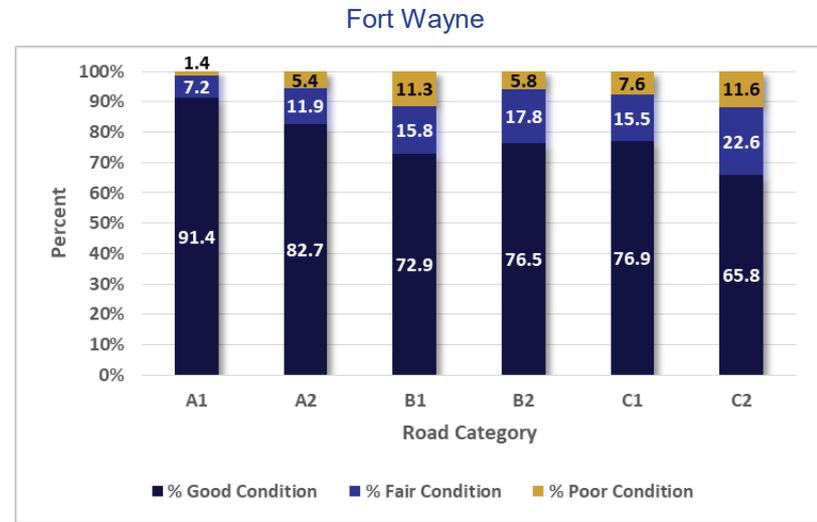


Figure 3: Fort Wayne Pavement Conditions by Road Category

¹⁴"Pavement 3.21.19," Excel spreadsheet of pavement inventory, Indiana Department of Transportation, March 21, 2019

¹⁵"Pavement Conditions Results 4.3.19," Excel spreadsheet of pavement conditions, Indiana Department of Transportation, April 2019

INDOT Pavement Conditions by District

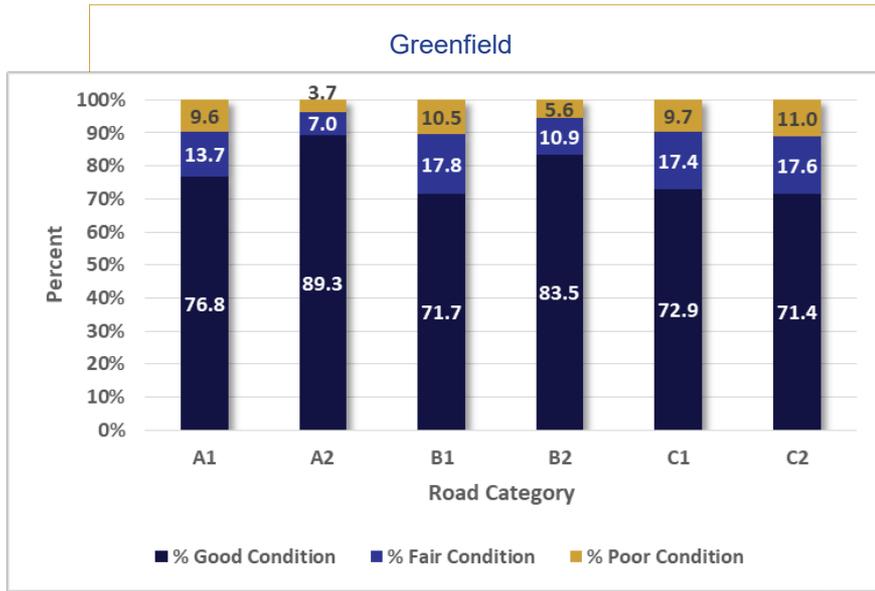


Figure 4: Greenfield Pavement Conditions by Road Category

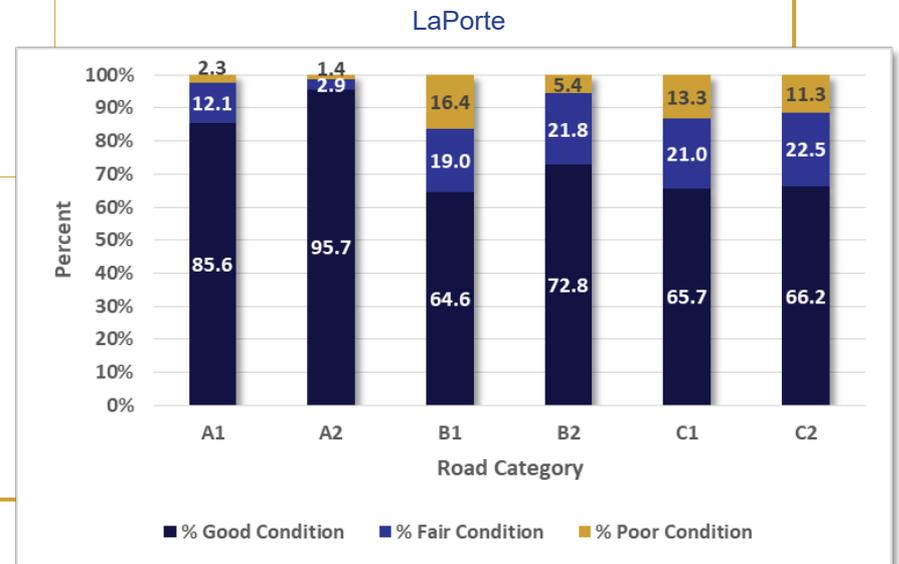


Figure 5: LaPorte Pavement Conditions by Road Category

INDOT Pavement Conditions by District

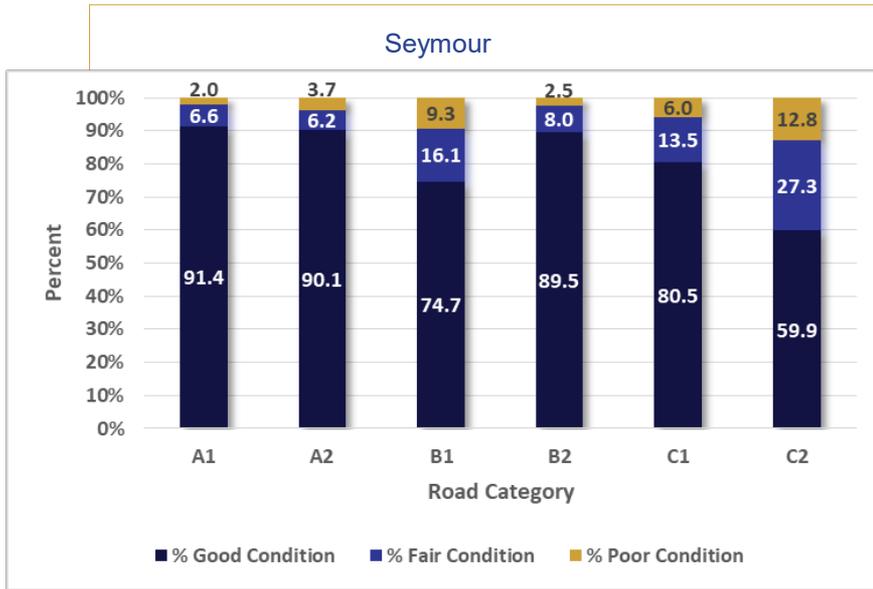


Figure 6: Seymour Pavement Conditions by Road Category

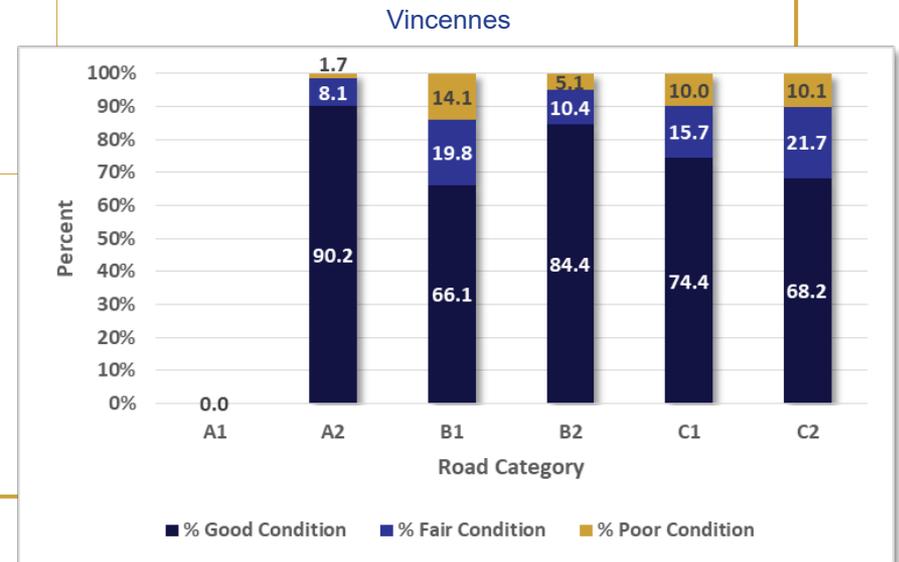


Figure 7: Vincennes Pavement Conditions by Road Category

What is INDOT's Bridge Inventory?

INDOT Bridge Inventory by District and Road Category

INDOT's bridge network is comprised of 5,729 total bridges throughout the State of Indiana. This number includes all bridges within the National Bridge Inventory (NBI) that INDOT owns or is responsible for maintaining.¹⁶ The table below lists INDOT's bridge inventory by District and roadway category. Note that inventory data is from 2019, and bridge inventory counts vary year to year due to relinquishments, realignments, and new road construction.

INDOT assesses whether bridges are in good, fair, or poor condition, using both KPIs for INDOT and the FHWA. INDOT assesses the conditions of its bridges based on wearing surface, deck, superstructure, and substructure. While INDOT's KPI for a bridge's overall condition is based on the ratings of the four components, and all bridges are scored equally (e.g., no weighting), FHWA's measurement for a bridge's condition rating is based on the deck, superstructure, and substructure subsystem components, and scores are weighted to the deck area.¹⁷

Table 3: INDOT Bridge Inventory by District (dated 2019)

District	A1	A2	B1	B2	C1	C2	NA	Total
Crawfordsville	61	111	93	174	109	366	2	916
Fort Wayne	27	136	175	103	58	269	0	768
Greenfield	443	32	211	77	221	205	6	1197
LaPorte	132	14	255	146	101	192	3	843
Seymour	90	151	142	140	102	338	3	966
Vincennes	0	270	147	130	111	369	12	1039
State Totals	753	716	1023	770	702	1739	26	5729



¹⁶ "BIAS State Bridges No Culverts," Excel spreadsheet of bridge inventory and conditions, Indiana Department of Transportation, July 26, 2019.

¹⁷ National Performance Management Measures for Assessing Bridge Conditions," Code of Federal Regulations, title 23, part 430, subpart D (2017)

What are the Conditions of INDOT's Bridges?

INDOT Bridge Conditions by District

Overall, 96.35% of INDOT's bridges were in good or fair condition as of 2019 according to INDOT's KPI, and 97.97% of INDOT's bridges were in good or fair condition in 2019 according to the FHWA measurement.

The following charts summarize the current percentages of bridges in good, fair, or poor condition across the Districts and road categories, as of July 2019. The charts display both INDOT's and FHWA's KPIs for bridge conditions.¹⁸

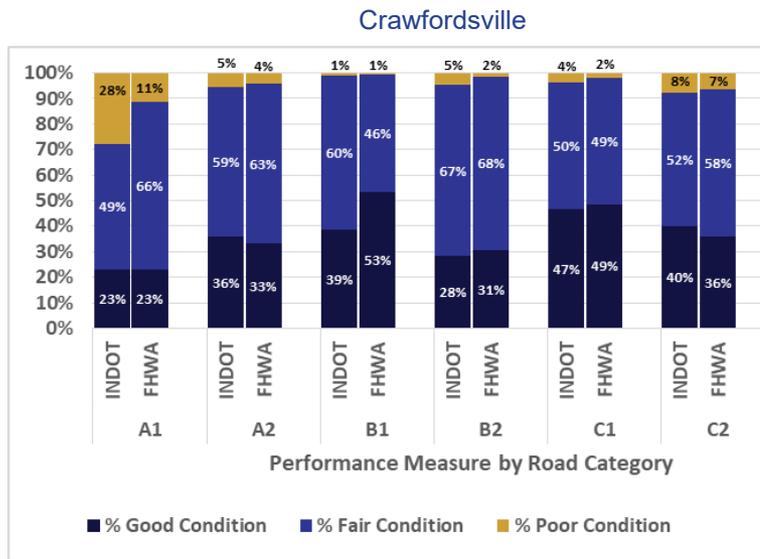


Figure 8: Crawfordsville Bridge Conditions by Road Category

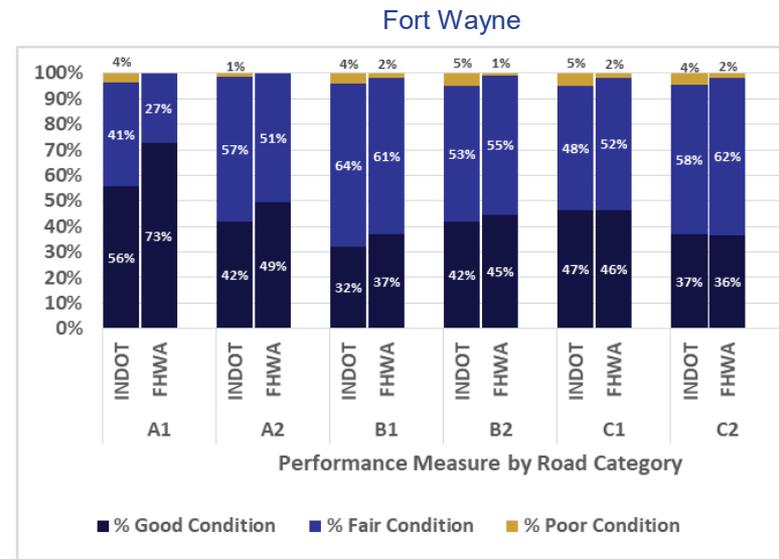


Figure 9: Fort Wayne Bridge Conditions by Road Category

¹⁸ "BIAS State Bridges No Culverts," Excel spreadsheet of bridge inventory and conditions, Indiana Department of Transportation, July 26, 2019

INDOT Bridge Conditions by District

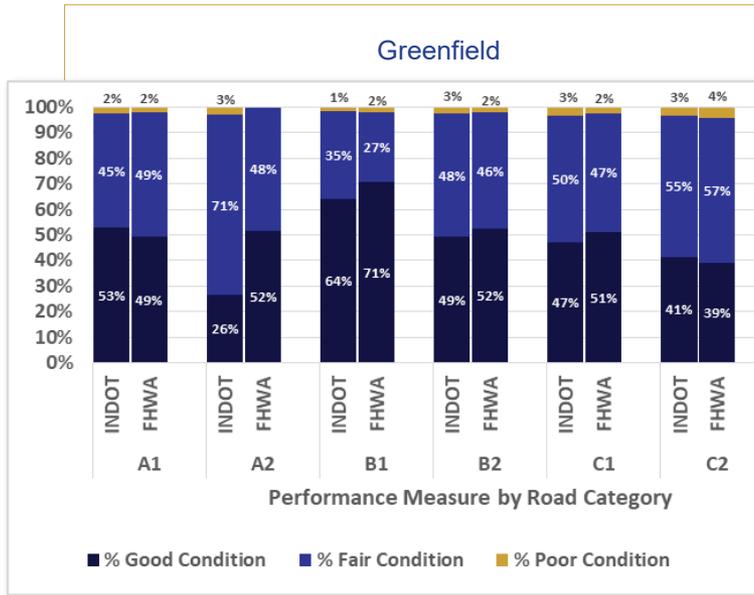


Figure 10: Greenfield Bridge Conditions by Road Category

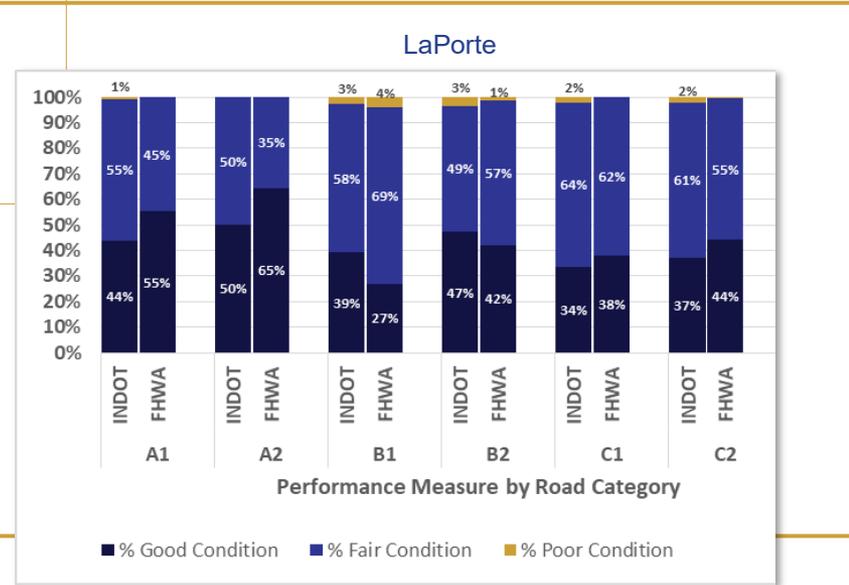


Figure 11: LaPorte Bridge Conditions by Road Category

INDOT Bridge Conditions by District

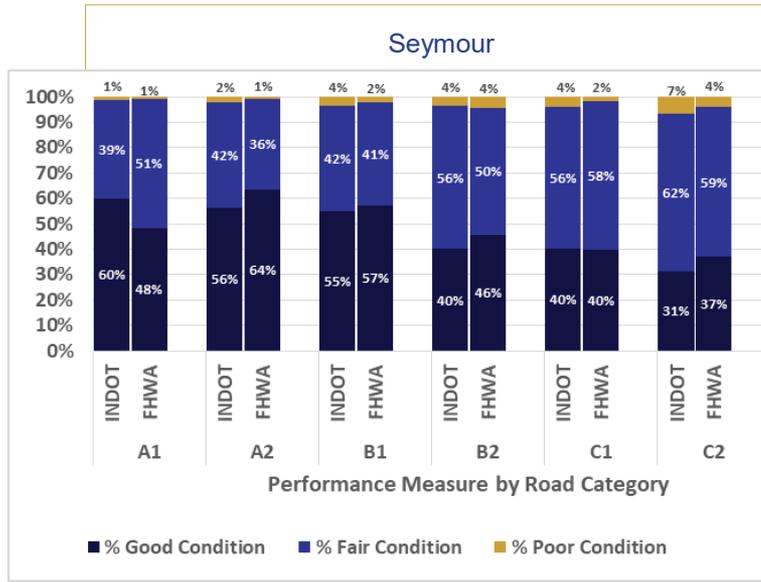


Figure 12: Seymour Bridge Conditions by Road Category

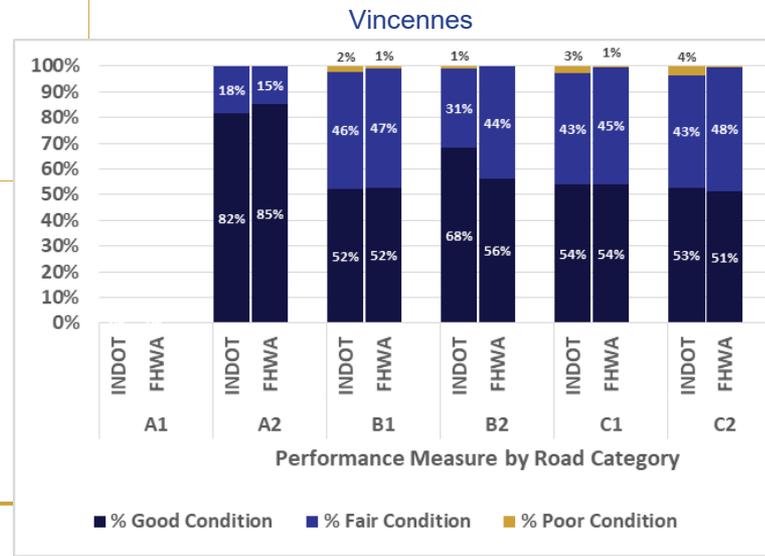


Figure 13: Vincennes Bridge Conditions by Road Category

How Much would it Cost to Replace INDOT's Bridges and Pavement?

Valuing INDOT's Bridges and Pavement

Using historical analysis, INDOT estimates \$1 million is required to rebuild one lane-mile of highway. Based on this unit rate, the current value of its pavement assets is over \$28 billion. INDOT estimates a need of \$220 per square foot to replace an interstate bridge, \$200 per square foot to replace a non-interstate bridge or non-NHS bridge, \$220 per square foot to replace a border bridge, and approximately \$800 million to replace seven bridges over the Ohio River.

Based on these unit rate estimates, the current value of bridges is over \$15 billion across the portfolio of bridge assets. Therefore, because of these significant costs for replacing its bridges and roads, it is critical that INDOT prioritize preserving the condition of its assets to ensure cost-savings in the long-term. The following table lists total estimated costs to replace all INDOT-owned bridges and pavement in its network.¹⁹

Table 4: Cost to Replace INDOT-Owned Bridges and Pavement (\$ Billions)*

Asset	Interstate	NHS Non-Interstate	Non-NHS	Border Bridge	Total Replacement Costs
Bridge	\$3.9	\$2.4	\$3.8	\$5.2	\$15.3
Pavement	\$5.1	\$7.4	\$16.1	N/A	\$28.6
				Total**	\$43.9

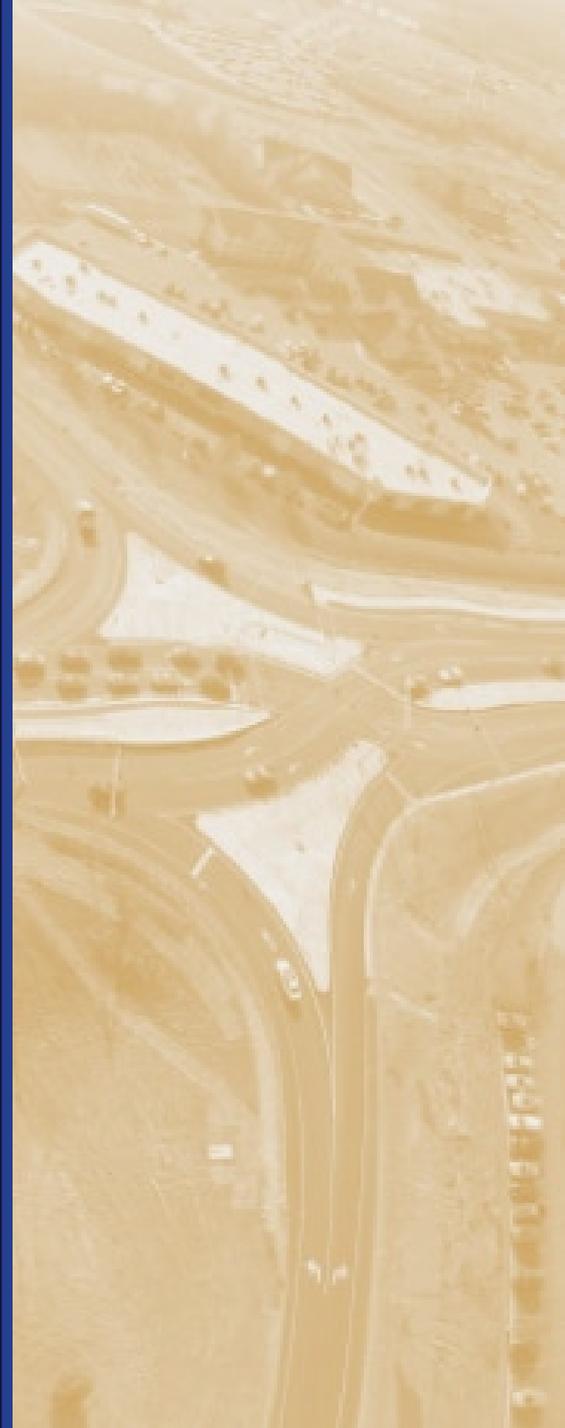
* The following table differs from Table 16 in the Transportation Asset Management Plan (TAMP) in that the TAMP also includes total costs to replace bridges and pavement not owned by INDOT (e.g., Indiana Toll Road, other state agencies, local, private owners).

** Total costs represented in the table may differ from actual total costs due to rounding to the nearest tenth.



¹⁹ Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

Strategic Objectives & Asset Management Objectives



INDOT's Strategic Objectives

INDOT's Mission, Vision, and Service Objectives

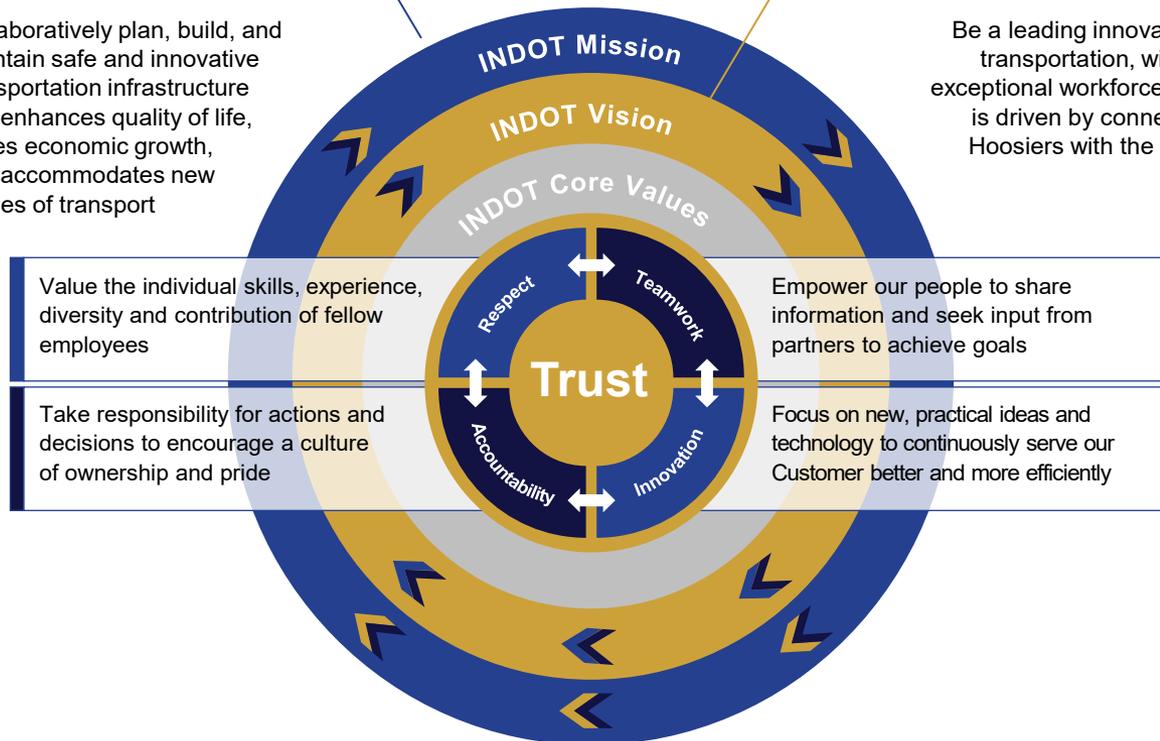
The following are INDOT's Mission, Vision, Core Values, and Service Objectives. INDOT's strategic objectives are detailed within the INDOT Strategic Plan.²⁰

INDOT Mission

Collaboratively plan, build, and maintain safe and innovative transportation infrastructure that enhances quality of life, drives economic growth, and accommodates new modes of transport

INDOT Vision

Be a leading innovator in transportation, with an exceptional workforce, that is driven by connecting Hoosiers with the world



	Safety Ensure road safety for citizens and personnel
	Mobility Enhance end-to-end customer and freight journeys across all modes of transportation
	Customer Service Ensure local engagement and timeliness of services and response
	Economic Competitiveness Improve economic outcomes for Indiana
	Asset Sustainability Enhance the ability to manage and maintain assets throughout their lifecycle
	Organization and Workforce Provide employees with the tools, training, and information to succeed
	Innovation and Technology Harness technology and innovation to develop more effective transportation solutions

Figure 14: INDOT's Mission, Vision, Service Objectives

²⁰ Indiana Department of Transportation, Indiana Department of Transportation 2019 Strategic Plan, version 6

Measuring INDOT's Strategic Objectives

Measurements of INDOT's Service Objectives

The Strategic Plan identifies key performance indicators (KPIs) to measure INDOT's performance against the service objectives outlined in the Strategic Plan.²¹

Table 5: INDOT Strategic Plan Service Objective Proposed Measurements

	Service Objective	Measurement
	Safety Ensure road safety for citizens and personnel	<ul style="list-style-type: none"> • Work zone incidents • Severe crashes on state-controlled roads • Safety investment • Rate of fatalities
	Mobility Enhance end-to-end customer and freight journeys across all modes of transportation	<ul style="list-style-type: none"> • Accessibility to transit • Mobility Index (Personal Miles Traveled / Vehicle Miles Traveled x Avg. Speed)
	Customer Service Ensure local engagement and timeliness of services and response	<ul style="list-style-type: none"> • Customer satisfaction • Service Level Agreement (SLA) adherence
	Economic Competitiveness Improve economic outcomes for Indiana	<ul style="list-style-type: none"> • Truck travel time reliability • Accessibility to employment and population
	Asset Sustainability Enhance the ability to manage and maintain assets throughout their lifecycle	<ul style="list-style-type: none"> • Asset Sustainability Index • State-controlled roads and bridges in fair or better condition
	Organization and Workforce Provide employees with the tools, training, and information to succeed	<ul style="list-style-type: none"> • Agency retention • Investment dollars per employee
	Innovation and Technology Harness technology and innovation to develop more effective transportation solutions	<ul style="list-style-type: none"> • Innovation Index • Return on Product Development Expense • Joint Transportation Research Program (JTRP) Conversion Rate

²¹ Indiana Department of Transportation, *Indiana Department of Transportation 2019 Strategic Plan*, version 6

Translating Strategic Objectives to Asset Management Objectives

Determining INDOT's Asset Management Objectives

INDOT's 2019 Strategic Priorities and associated Strategic Plan aim to meet INDOT's service objectives and help INDOT ultimately achieve its Mission and Vision. Each of the Strategic Priorities includes major initiatives that form the foundational activities for delivering the service objectives.

To help achieve these overall service objectives, INDOT has established asset management principles and imperatives to guide INDOT's decision-making related to its portfolio of assets. By developing guiding principles and imperatives, these help INDOT achieve its goals for asset sustainability, enhancing mobility, ensuring road safety, and maintaining customer service, all while enhancing INDOT's economic competitiveness. These asset management imperatives and principles form the foundation for developing INDOT's asset management objectives. Asset management objectives apply to both INDOT's capital and operating expenditures and drive INDOT's investments in their infrastructure assets and staff. INDOT's asset management objectives focus on establishing Service Levels and condition targets for pavement and bridges. Through improvements to INDOT's roadway conditions and maintaining its Service Levels, this will enable INDOT to effectively manage and maintain its assets throughout their lifecycle, enhance the end-to-end journeys of its customers (e.g., road users) on its roadways, and ensure the safety for all citizens and INDOT personnel.

The adjacent graphic demonstrates how INDOT's strategic objectives help shape INDOT's asset management imperatives and principles and, ultimately, INDOT's asset-level objectives.



Figure 15: Translating Strategic to Asset Management Objectives

INDOT's Asset Management Policy

INDOT's Asset Management Imperatives and Principles

To support the service objectives outlined in the Strategic Plan, INDOT has identified the following imperatives and principles to asset management, documented within the Asset Management Policy.²² These imperatives are key to helping ensure that INDOT achieves its overall service objectives of asset sustainability, customer service, safety, mobility, and economic competitiveness.

INDOT's Four Imperatives			
Safety First	21 st Century Workforce	Great Service	Our Investment Strategy
 <p><i>We will always ensure safe and sustainable asset utilization, protection our customers and staff</i></p>	 <p><i>We will develop our workforce and align our employees around INDOT's Mission</i></p>	 <p><i>We will deliver great service, balancing the needs of our customers with available funding</i></p>	 <p><i>We will align our asset-related decision making to ensure effective delivery of our 20 year Road and Bridge Plan</i></p>
INDOT's Asset Management Principles			
Forward Looking and Sustainable		Continual Improvement	
 <p>INDOT will incorporate social, legislative, environmental, and financial considerations into its decisions, accounting for present and future service commitments. Additionally, INDOT will emphasize the long-term stewardship of its assets.</p>	 <p>INDOT will make continual improvement a key part of its asset management approach, focusing on driving innovation through the development of tools, techniques, and solutions.</p>		
Making Robust, Repeatable, Transparent Decisions		Lifecycle Cost Perspective	
 <p>INDOT will utilize a formal, but scalable, consistent, and repeatable approach to managing infrastructure assets. INDOT will collect, collate, control, and circulate the right asset information, at the right time, informing the right asset management decisions.</p>	 <p>INDOT will take an integrated, "big picture" approach to asset management that considers the combined impacts of all aspects of the asset lifecycle within INDOT's control. New assets will not be constructed or acquired without considering future operating and maintenance costs.</p>		
Risk Based and Optimal		People Focused (Customers & Staff)	
 <p>INDOT will direct resources and expenditures to achieve agreed service outcomes and benefits, balancing stakeholder and customer needs with available funding, at an acceptable level of risk. INDOT will manage assets by their role and within their full system context, promoting reliability in the transportation system.</p>	 <p>INDOT will adopt a customer-focused approach to managing its assets, only accommodating additional demand for services when considering the impacts on current Service Levels. INDOT will recruit, train, and retain the right staff and work with university and trade school partners to develop the best workforce for INDOT.</p>		

²² Indiana Department of Transportation, *Asset Management Policy*, August 2018.

Operations and Maintenance (O&M) Targets

Operations and Maintenance (O&M) Service Level Targets

INDOT has established maintenance and customer response measures to meet their Service Levels for INDOT’s roadways and other assets. INDOT’s Service Level maintenance activities are categorized by the nature of activity and the cause for occurrence. The following tables represent INDOT’s cyclical maintenance activities, and their frequencies, that are programmed according to INDOT’s Maintenance Owner’s Manual. Interventions are categorized by Pavement, Roadside, Drainage, Traffic, and Bridge Treatments.²³

Table 6: INDOT Service Levels for Maintenance Activities

Pavement Treatments						
Roadway Type						
Treatment	A1	A2	B1	B2	C1	C2
Asphalt Crack Seal	Every 3 years					
Blading Shoulders			Every 3 years	Every 3 years	Every 3 years	Every 3 years
Clipping Shoulders	Every 3 Years					
Chip Seal						Every 6 years

Roadside Treatments						
Treatment	A1	A2	B1	B2	C1	C2
Mowing	5 cycles	3 cycles	5 cycles	2 cycles	2 cycles	2 cycles
Herbicide	Annual	Annual	Annual	Annual	Annual	Annual
Attenuator Inspection	Annual	Annual	Annual	Annual	Annual	Annual
Guardrail End Treatment Inspection	4 Years	4 Years	4 Years	4 Years	4 Years	4 Years
Litter Removal	Monthly	5x per Year	Monthly	As Needed	As Needed	As Needed
Sweeping (Urban Areas)	Monthly	N/A	Monthly	N/A	2x Year	N/A

²³"Maintenance Owner’s Manual 5-26-20," Excel spreadsheet of maintenance activities, Indiana Department of Transportation, May 26, 2020.

Operations & Maintenance (O&M) Targets

Table 6: INDOT Service Levels for Maintenance Activities (continued)

Drainage Treatments						
Treatment	A1	A2	B1	B2	C1	C2
Pipe Inspection	4 Years					
Drain Cleaning	Annual		Annual		Annual	
Underdrain Cleaning and Inspection	Annual	Annual	Annual	Annual	Annual	Annual
Traffic Treatments						
Treatment	A1	A2	B1	B2	C1	C2
Sign Modernization	20 Years					
Panel Sign Inspection	5 Years					
Delineator/Reflector Maintenance	Annual	Annual	Annual	Annual	Annual	Annual
Re-Striping (Paint Markings)	Annual	Annual	Annual	Annual	Annual	Annual
Special Markings Inspection	Annual	Annual	Annual	Annual	Annual	Annual
Signal PM	2x Year					
Flasher PM	Annual	Annual	Annual	Annual	Annual	Annual
Signal Indication Replacement	10 Years					
Signal Overhead Inspection	5 Years					
Lighting Surveillance	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Lighting Re-Lamp (HPS)	2 Years	3 Years	2 Years	3 Years	3 Years	3 Years
Lighting Re-Lamp (LED)	15 Years					

Operations & Maintenance (O&M) Targets

Table 6: INDOT Service Levels for Maintenance Activities (*continued*)

Bridge Treatments						
Treatment	A1	A2	B1	B2	C1	C2
Bridge Clean/Flushing	Annual	Annual	Annual	Annual	Annual	Annual
Bridge Deck Seal/Crack Fill	5 Years					
Joint Repair/Replacement	7 years					
Bearing Repair/Replacement	As needed					
Brush and Tree Removal	2 years					

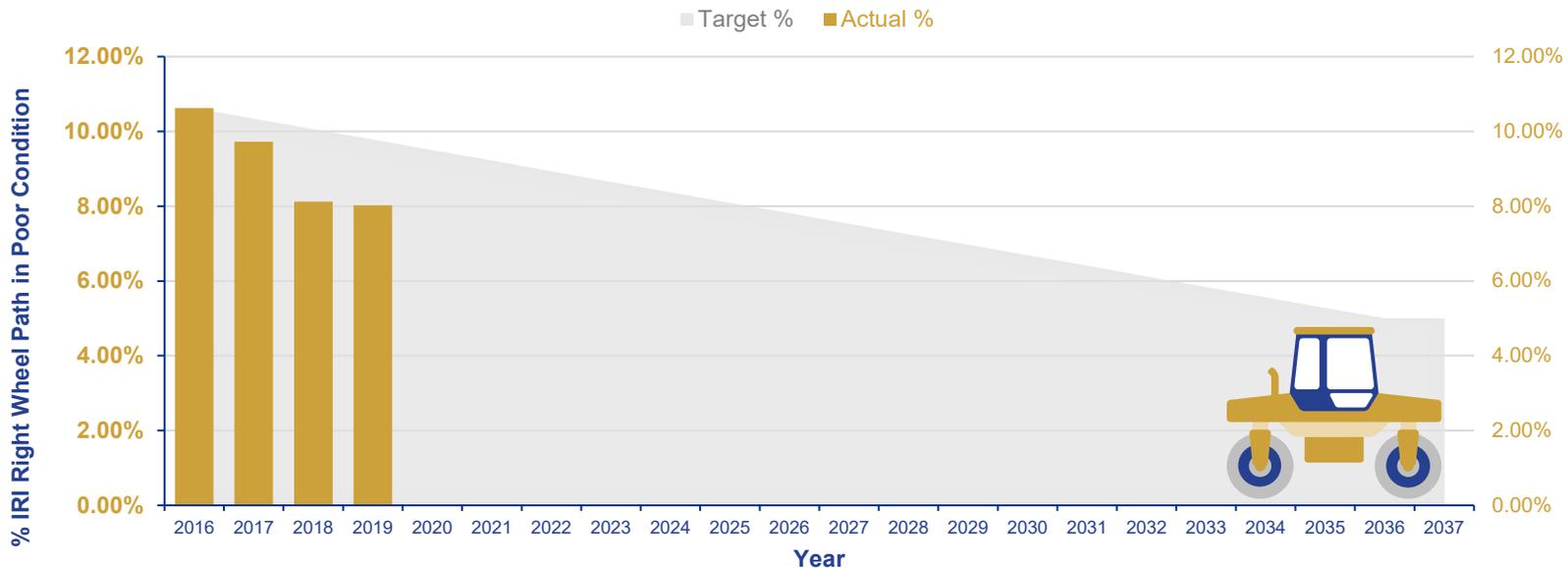
Pavement and Bridge Condition Targets

INDOT's Condition Targets

INDOT has established condition targets for all roads, highways, and bridges within INDOT's inventory. By meeting these condition targets, this will ensure that INDOT's roadway and bridge network achieves a state of good repair, helping to improve safety on the roads and ensure financial sustainability by decreasing long-term costs for repairs. Overall, INDOT's goal is to have no more than 5% of its roadway and 3% of its bridges in the entire network in poor condition.

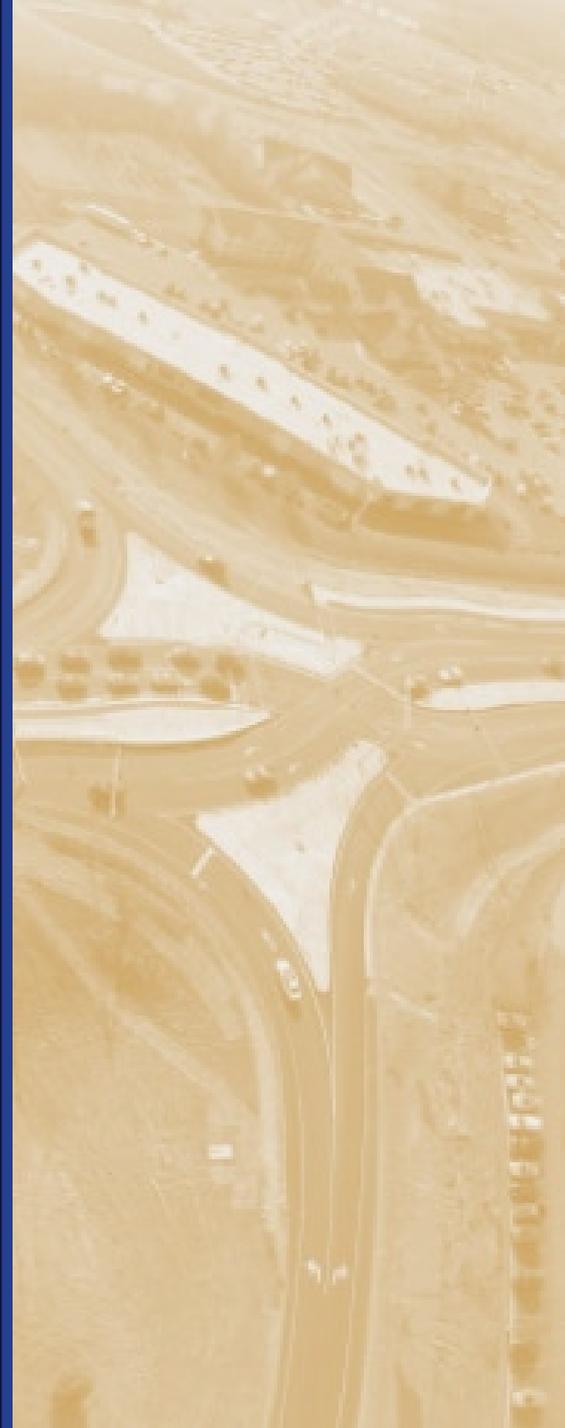
For pavement, INDOT has established this measurement based on the IRI of the right wheel path. For bridges, INDOT's KPI for overall bridge condition rating is based on subcomponent ratings for wearing surface, deck, superstructure, and substructure, while FHWA's KPI for overall bridge condition rating does not factor wearing surface. The following table summarizes INDOT's overall pavement condition targets each year to attain its overall 20-year target.²⁴

Table 7: INDOT Annual Pavement Condition Targets (measured by IRI of the Right Wheel Path)



²⁴ Indiana Constructors, Inc., "LF ICI PowerPoint" (program update, Indiana Department of Transportation, Indianapolis, IN, 2019).

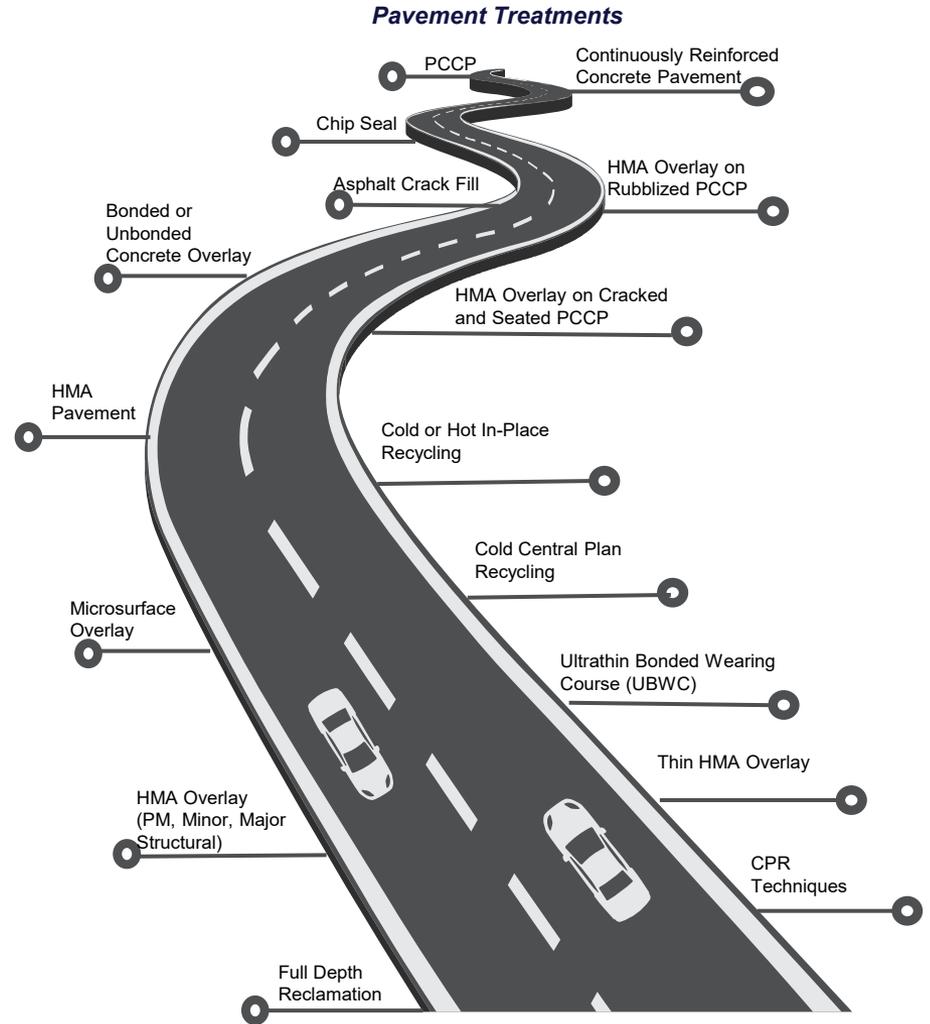
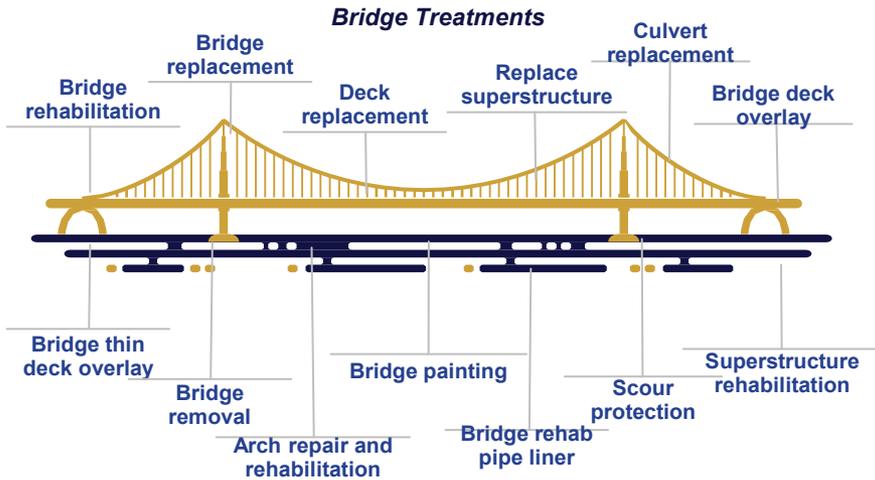
Asset Portfolio-Level Plan



What are INDOT's Portfolio-Level Plans?

Overall Context of Asset Portfolio-Level Plans

INDOT's pavement and bridge plans are developed using input from both INDOT's long-range plans and short-term delivery programs. INDOT's Multimodal Freight and Mobility Plan, Long-Range Transportation Plan, and Next Level Indiana plan identify INDOT's long-term strategies over a 20-year horizon. These strategies are the foundation for developing INDOT's shorter-term delivery programs, such as the 5-Year Construction Plan and STIP. The 20-year Next Level Indiana plan, passed in April 2017, ensures INDOT receives adequate funding to support its asset management plan for the upcoming 20 years. To achieve these targets, INDOT has established 20-year statewide treatment plans for pavement and bridges to support steady and consistent improvement in its bridges and pavements. The intervention options used to prepare the 20-year bridge²⁵ and pavement plans²⁶ are shown in the below and adjacent graphics, respectively.



²⁵ "20 Year Bridge Statewide Combined 1-18-19," Excel spreadsheet of bridge treatment projections, Indiana Department of Transportation, January 18, 2019

²⁶ "20 Year Pavement Combined," Excel spreadsheet of pavement treatment projections, Indiana Department of Transportation, February 21, 2019

How do INDOT's Portfolio Plans Translate to Bridges and Pavement?

Role of the STIP

INDOT's 20-year bridge and pavement plans help inform and influence decision-making in INDOT's preparation of its annual STIP. The STIP is a four-year fiscally constrained document that identifies all projects for which INDOT anticipates receiving Federal funding within the upcoming four years and all state projects that INDOT has identified as regionally significant.²⁷ The STIP includes a list of INDOT's planned state preservation and local initiated projects for the upcoming four years, forming the foundation of INDOT's near-term capital program. The STIP includes each county's list of planned projects and each project's anticipated capital needs per fiscal year, as well as Federal aid and state matches and the estimated cost to complete the project, the latter of which may extend beyond the four-year scope of the STIP.

Impact of 20-Year Plans on Pavement and Bridge Conditions

Through increased investment in its pavement and bridge preservation programs through Next Level Indiana, INDOT can expect to achieve its 20-year condition targets for its pavement and bridge portfolio of assets. With a planned average investment of \$469 million annually in pavement preservation over the next ten years, INDOT anticipates steady improvement in the conditions of its statewide roadway network, achieving 95% of overall pavement in fair or better condition (INDOT KPI) within 20-years. Similarly, by investing an average of \$481 million annually in bridge preservation, INDOT anticipates steady improvement in bridge conditions,²⁸ achieving 97% of statewide bridges in fair or better condition (INDOT KPI) within 20-years. The following charts depict the positive impacts of INDOT's investment in its bridge and pavement preservation programs on conditions, as well as the negative impacts that may result if taking no action to invest in bridge or pavement preservation.²⁹

²⁷ Indiana Department of Transportation, *Statewide Transportation Improvement Plan, 2018-2021*

²⁸ "Targets 6.24.20 vs. 9.20.19," Excel spreadsheet of legislative funding targets for bridges and pavement. Indiana Department of Transportation, August 12, 2020.

²⁹ Indiana Department of Transportation, *Transportation Asset Management Plan, August 2019*

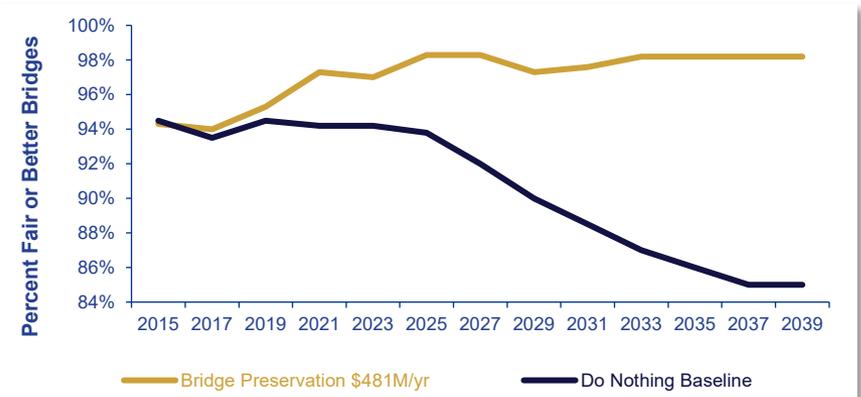


Figure 16: INDOT Projected Bridge Conditions against Investments

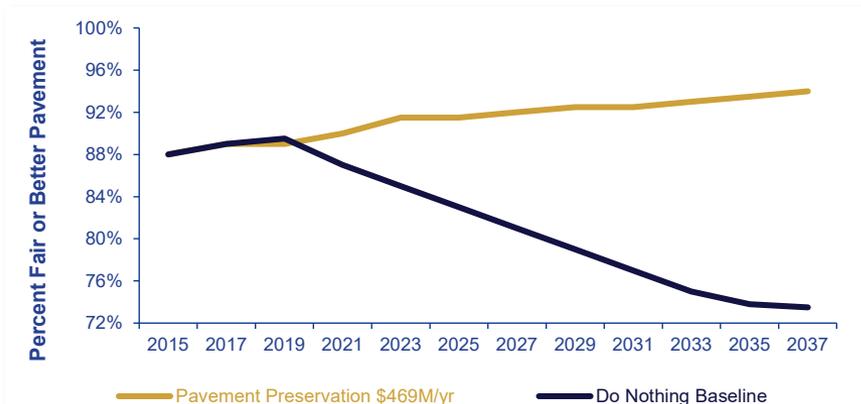


Figure 17: INDOT Projected Pavement Conditions against Investments

Financial Plan to Achieve Asset Management Objectives



What is INDOT’s Financial Plan for Bridges and Pavement?

Overview of INDOT’s Investment Financial Plans

To achieve INDOT’s condition targets for its bridges and pavement, INDOT plans to spend an average of \$481 million annually for its bridge preservation plan and \$469 million annually for its pavement preservation plan from years FY20 to FY30.³⁰ To support this investment, INDOT expects an increase in available revenue through additional funding from Next Level Indiana. Next Level Indiana dedicates more than \$30 billion total from years 2017 to 2037 to improve the conditions of existing roads and bridges, finishing major state and local projects and building for the future.³¹ Next Level Indiana provides additional revenue to the State of Indiana through a fuel tax increase on gasoline, increase of special fuel tax, increase of motor carrier surcharge tax, transportation improvement fee for all vehicle registrations, supplemental registration fee for electric vehicles, and redirection of sales taxes on fuel from the state general fund to dedicated highway funds.



FY20-FY30 Financial Estimates

INDOT has estimated its annual legislative funding for years FY20 through FY30 for its bridges, pavement, and safety. The following table below represents INDOT’s anticipated fiscal year total Federal and state funding available for bridges and pavement. INDOT anticipates a steady increase in its fiscal year funding from \$859 million annually in FY20 to nearly \$1.1 billion in FY30.³²

Table 8: INDOT Forecasted Total Available Funding for Bridges and Pavement, FY20-FY30 (\$ Millions)*

Year	FY Funding Total	Estimated Funding for Pavement	Estimated Funding for Bridges
FY20	\$859.2	\$424.2	\$435.0
FY21	\$833.2	\$411.3	\$421.9
FY22	\$873.1	\$431.0	\$442.1
FY23	\$901.4	\$445.0	\$456.4
FY24	\$920.7	\$454.5	\$466.2
FY25	\$946.0	\$467.0	\$479.0
FY26	\$971.3	\$479.4	\$491.8
FY27	\$997.8	\$492.6	\$505.2
FY28	\$1,022.2	\$504.6	\$517.6
FY29	\$1,047.5	\$517.1	\$530.4
FY30	\$1,068.5	\$527.5	\$541.0

*Note: All funding values in the table have been inflated using a projected rate.

³⁰Asset Targets 6.24.20 vs. 9.20.19," Excel spreadsheet of legislative funding targets for bridges and pavement. Indiana Department of Transportation, August 12, 2020.

³¹Indiana Constructors, Inc., "LF ICI PowerPoint" (program update, Indiana Department of Transportation, Indianapolis, IN, 2019)

³²Asset Targets 6.24.20 vs. 9.20.19," Excel spreadsheet of legislative funding targets for bridges and pavement. Indiana Department of Transportation, August 12, 2020."

What are INDOT’s 5-Year Financial Estimates?

STIP FY20-24 Estimate of Total Available Funding

The STIP details INDOT’s estimated funding and anticipated expenditures over the near-term horizon. The adjacent table depicts the STIP’s estimated total available funding from FY20-24 in Federal aid, state, and local highway funds.³³

STIP FY20-24 Forecast of Total Uses

With an estimate of over \$2 billion in total annual funding through FY24, INDOT anticipates investing an average of \$939 million annually in its preservation and expansion projects from FY20-24. INDOT’s other annual expenditures include local MPO and non-MPO projects, FTA programs, Ohio River Bridges, I-69 projects, INDOT’s operating budget, and debt service. The following table depicts INDOT’s anticipated total uses, based on the STIP Financial Summary for FY20-24.³⁴

Table 9: STIP Forecasted Total Funding, FY20-FY24 (\$ Millions)

Year	Federal-Aid Funds	State Funds	Local Highway Funds	FY Funding Total
FY20	\$1,170.82	\$1,636.52	\$63.64	\$2,870.99
FY21	\$1,146.82	\$1,708.96	\$62.97	\$2,918.75
FY22	\$1,097.29	\$1,493.62	\$63.01	\$2,653.92
FY23	\$1,099.33	\$1,570.23	\$63.52	\$2,733.07
FY24	\$1,097.12	\$1,681.31	\$62.97	\$2,841.40

**Note: The STIP does not provide funding estimates beyond the 5-year cycle. Forecasts identified in the STIP differ from the independent calculations conducted for the TAMP.*

Table 10: STIP Forecasted Total Uses, FY20-FY24 (\$ Millions)

Year	Local MPO & Non-MPO Projects	FTA Programs	Preservation & Expansion Projects	Ohio River Bridges	I-69 Section 5	I-69 Section 6	Operating Budget	Debt Service
FY20	\$318.22	\$22.75	\$1,496.39	\$42.22	\$1.39	\$214.66	\$415.37	\$101.20
FY21	\$314.84	\$22.75	\$1,441.89	\$40.20	\$0.30	\$250.53	\$419.37	\$101.90
FY22	\$315.05	\$22.75	\$720.83	\$41.20	\$0.60	\$333.72		
FY23	\$317.60	\$22.75	\$875.69	\$42.23	\$0.10	\$246.86		
FY24	\$314.84	\$22.75	\$157.96	\$43.29	\$0.10	\$203.35		

³³ Indiana Department of Transportation, Statewide Transportation Improvement Plan Financial Summary 2020-2024, v23.

³⁴ Ibid

Decision-Making Criteria



How does INDOT Make Investment Decisions in its Bridges?

Overview of Bridge and Culvert Decision-Making

INDOT's Bridge Asset Management Team (BAMT) is responsible for establishing INDOT's current practices for developing INDOT's bridge investment strategy. The Bridge Asset Management Team uses data-driven decision-making to identify the most cost effective improvement projects for INDOT's bridges, large culverts (4'-20'), and small culverts (<4').

INDOT begins its investment decision-making process based on known budgetary constraints. Through Next Level Indiana, INDOT plans to invest an average of approximately \$481 million annually for its bridge preservation plan from years FY20 to FY30.³⁵ INDOT has also developed budgetary forecasts for the upcoming five years using projections within the STIP, as well as estimates through FY27 for the FHWA TAMP.

INDOT uses the 20-year plan as the basis for its overall bridge asset strategy. From the 20-year plan, INDOT then develops an initial list of its bridge treatment priorities from an optimized list of treatments provided by the Deighton Total Infrastructure Management System's (dTIMS) bridge management system (BMS). The software uses simulation modeling to forecast the deterioration for each asset using condition and inventory data. The software forecasts deterioration, identifies potential performance gaps in relation to condition targets, and visualizes the impacts of various alternative treatment strategies on an asset's condition. dTIMS considers all eligible treatment strategies to produce a benefit-cost-effective strategy for improving the condition of the asset portfolio. dTIMS uses historical costs from the previous four years to develop cost estimates of treatments and produces a cost-effective strategy based on known budget constraints.³⁶

Bridge Project Scoring Methodology

After identifying candidate projects recommended during the lifecycle cost analysis process, the Bridge Asset Management Team uses a project scoring methodology to prioritize projects. The purpose of the scoring system is to demonstrate INDOT's investment decision-making and better understand how projects should be prioritized for the capital program. Unique project scoring systems have been developed based on whether the candidate project falls into one of the following categories:³⁷



INDOT's Bridge Asset Engineers (BAEs) evaluate the recommended projects provided by dTIMS using the project scoring system and based on their field and engineering knowledge. Based on their recommendations, projects are then submitted for statewide deliberation for inclusion in the capital program.

³⁵"Asset Targets 6.24.20 vs. 9.20.19," Excel spreadsheet of legislative funding targets for bridges and pavement. Indiana Department of Transportation, August 12, 2020.

³⁶Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

³⁷Indiana Department of Transportation, "Scoring Guidelines and Business Rules for Bridge and Large Culvert Asset Program," August 23, 2018

Prioritizing Bridge and Culvert Projects

Bridge and Culvert Project Prioritization

INDOT’s project scoring system and prioritization helps inform its bridge investment decision-making. Scoring for bridge rehabilitation, reconstruction, and replacement projects is based on the following four factors related to the bridge:

	Condition of the Asset
	Cost-Effectiveness of the Project
	Functional Classification Priority <i>(e.g., roadway category and associated traffic of volume carried per the category)</i>
	Average Annual Daily Traffic (AADT)

Candidate projects are scored on a 100-point weighted scale, with a potential supplementary 35-points assigned to qualifying projects where non-traditional and/or external revenue would be contributed to offset the project’s total cost. Culverts leverage a similar scoring methodology but are scored separately from bridges because of their structure types and availability of data. Bridge and Culvert Preventative Maintenance Agreement (BCPMA) candidate projects follow a different process for scoring projects, as BCPMA projects receive a specified budget set aside each fiscal year allocated across the Districts.³⁸

Table 11: Bridge Rehabilitation, Reconstruction, and Large Culvert Scoring Factors and Weights

Scoring Factor Number	Scoring Factor Description	Score	Weight	Maximum Weighted Score
#1	Condition*	0-10	5	50
#2	Cost Effectiveness	0-10	3	30
#3	Functional Classification Priority	0-10	1	10
#4	AADT Impacts	0-10	1	10
Subtotal				100
Supplemental Factor	Earmarks, Other Contributions	0-5	7	35
Grand Total				135

*Note: The Condition Scoring Factor for bridges is based on the individual component conditions, whereas Condition for large culverts is scored using the overall culvert condition.

Table 12: Maintenance and Preservation Project Scoring System

Scoring Factor Number	Scoring Factor Description	Score	Weight	Maximum Weighted Score
N/A	Project Meeting (BCPMA*) Condition	0-5	20	100
Total				100

*BCPMA = Bridge and Culvert Preventative Maintenance Agreement

³⁸ Indiana Department of Transportation, "Scoring Guidelines and Business Rules for Bridge and Large Culvert Asset Program," August 23, 2018

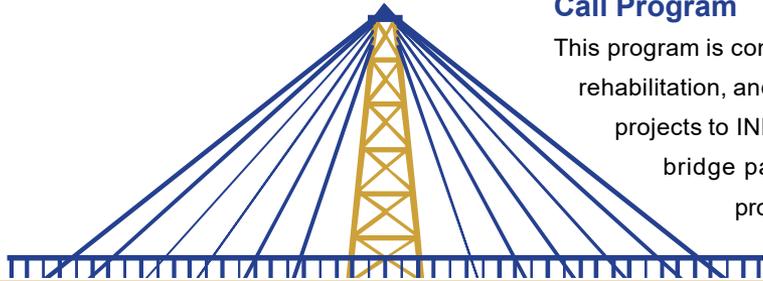
INDOT's Investment Programs

Bridge and Culvert Investment Program Overview

When determining allocation of funding, INDOT categorizes its bridge and culvert projects into two programs, the Call Program and Bridge and Culvert Preventative Maintenance Agreement (BCPMA) Program, based on the type of project.

Call Program

This program is comprised of major bridge replacement, major component rehabilitation, and reconstruction projects, as well as smaller upgrade projects to INDOT's bridges and culverts, such as deck overlays, bridge painting, and culvert lining. The development time for projects within the Call Program is **5 years**.



Bridge and Culvert Preventative Maintenance Agreement (BCPMA) Program

This program is comprised of projects whose objectives are to perform preservation and maintenance activities to INDOT's bridges and culverts. Typical activities may include deck patching, joint replacement, thin deck overlay, scour protection, railing repair, and culvert repair. Projects within the program are driven either by scheduled maintenance or by condition, and the development time for this program is typically **1.5-2 years**. Benefits are reported annually to determine appropriate funding levels for the program, which is typically about 10-15% of the overall bridge program for INDOT's State-Owned Bridge Network.³⁹

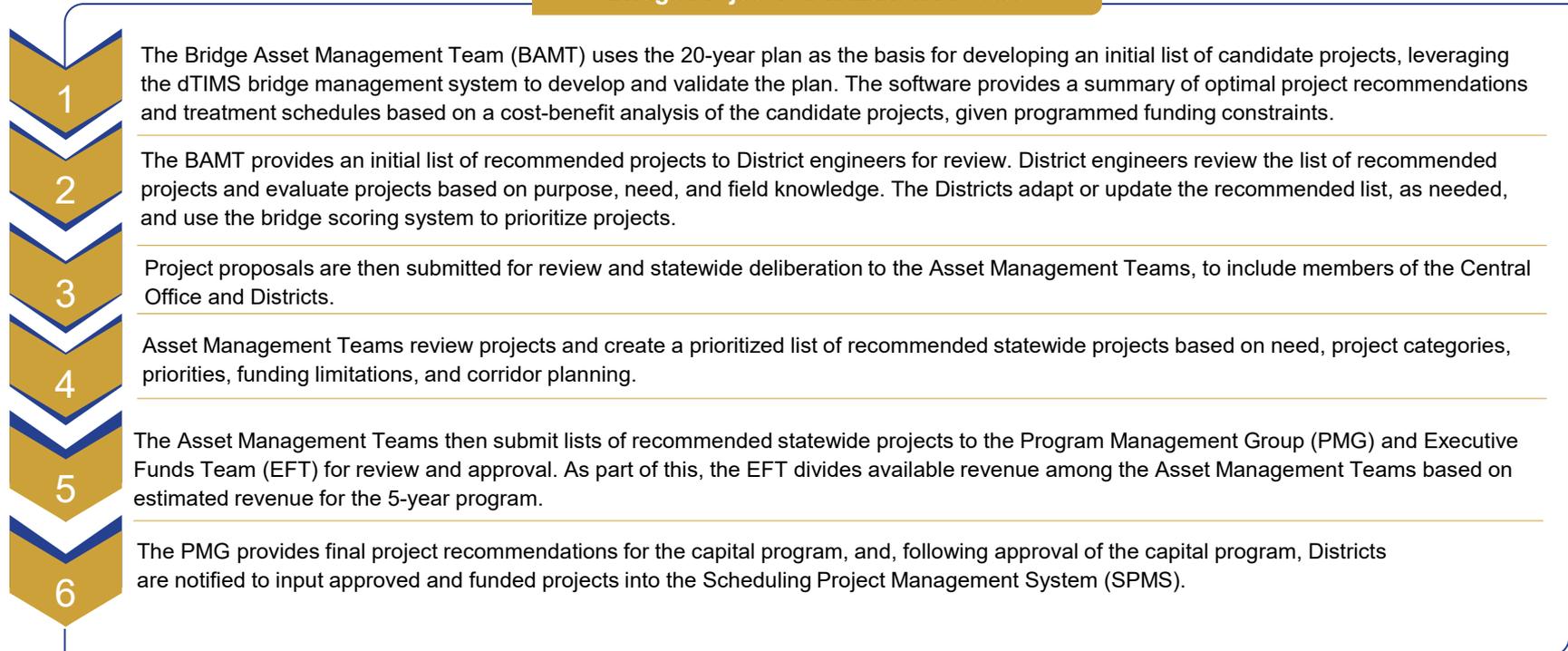
³⁹Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

Bridge Project Prioritization for the Capital Program

Call Program Prioritization Process for Bridges

INDOT's Bridge Asset Engineers (BAEs) use the scoring criteria to assign project scores to candidate bridge and culvert projects. Based on the project scores, the Bridge Asset Management Team prepares a list of projects recommended for programming in the capital Call program:⁴⁰

Bridge Project Prioritization Process



⁴⁰ Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

How does INDOT Make Pavement Investment Decisions?

Overview of Pavement Decision-Making

INDOT's Roadway Asset Team is responsible for establishing INDOT's current practices for developing the INDOT's pavement investment strategy. INDOT uses data-driven decision making to identify cost-effective improvement projects for INDOT's pavements, while meeting service levels and balancing the appropriate level of risk.

INDOT begins its pavement investment decision-making process based on known budgetary constraints. INDOT plans to invest an average of approximately \$469 million annually for its pavement preservation plan from years FY20 to FY30.⁴¹ INDOT has also developed budgetary forecasts for the upcoming five years using projections within the STIP, as well as estimates through FY27 developed for the FHWA TAMP.

INDOT uses the 20-year plan as the basis for its overall pavement asset strategy. INDOT uses the dTIMS' pavement management system to develop and validate the 20-year plan, preparing an initial list of candidate projects. The software uses simulation modeling to forecast pavement deterioration, identify potential performance gaps in relation to condition targets, and visualize the impacts of various alternative treatment strategies on the asset's condition. The software considers all eligible treatment strategies to identify an optimal strategy for improving the condition of the portfolio. Based on user-defined costs, dTIMS develops cost estimates of treatments and produces a cost-effective strategy based on known budget constraints.⁴²

⁴¹"Asset Targets 6.24.20 vs. 9.20.19," Excel spreadsheet of legislative funding targets for bridges and pavement. Indiana Department of Transportation, August 12, 2020.

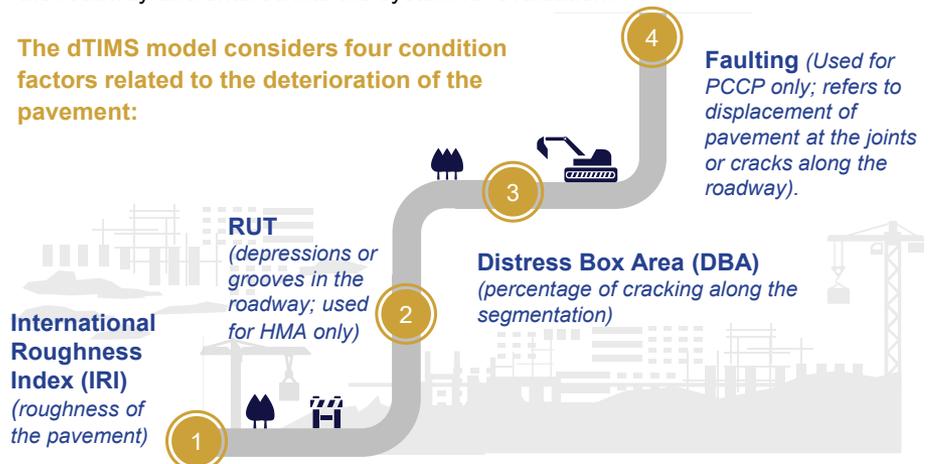
⁴²Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

⁴³Indiana Department of Transportation, "Roadway Asset Scoring Rules," August 2019.

Pavement Project Scoring Methodology

After identifying candidate projects recommended during the lifecycle cost analysis process, the Roadway Asset Team uses a project scoring methodology to prioritize projects. The purpose of the scoring system is to demonstrate INDOT's investment decision-making and better understand how projects should be prioritized for the capital program. The project scoring system uses project-level data on condition and traffic and assesses projects based on pavement material (e.g., HMA or PCCP), accounting for differences in the performance and needs of the pavement types. Projects are scored based on the level of cracking, roughness, roadway category, truck volume, and cost effectiveness.⁴³ INDOT reviews and updates its scoring methodology on an annual basis.

INDOT uses roadway condition data when evaluating roadway improvement projects. Data is collected annually by evaluation zones based on the location on the roadway and entered into the system for evaluation.

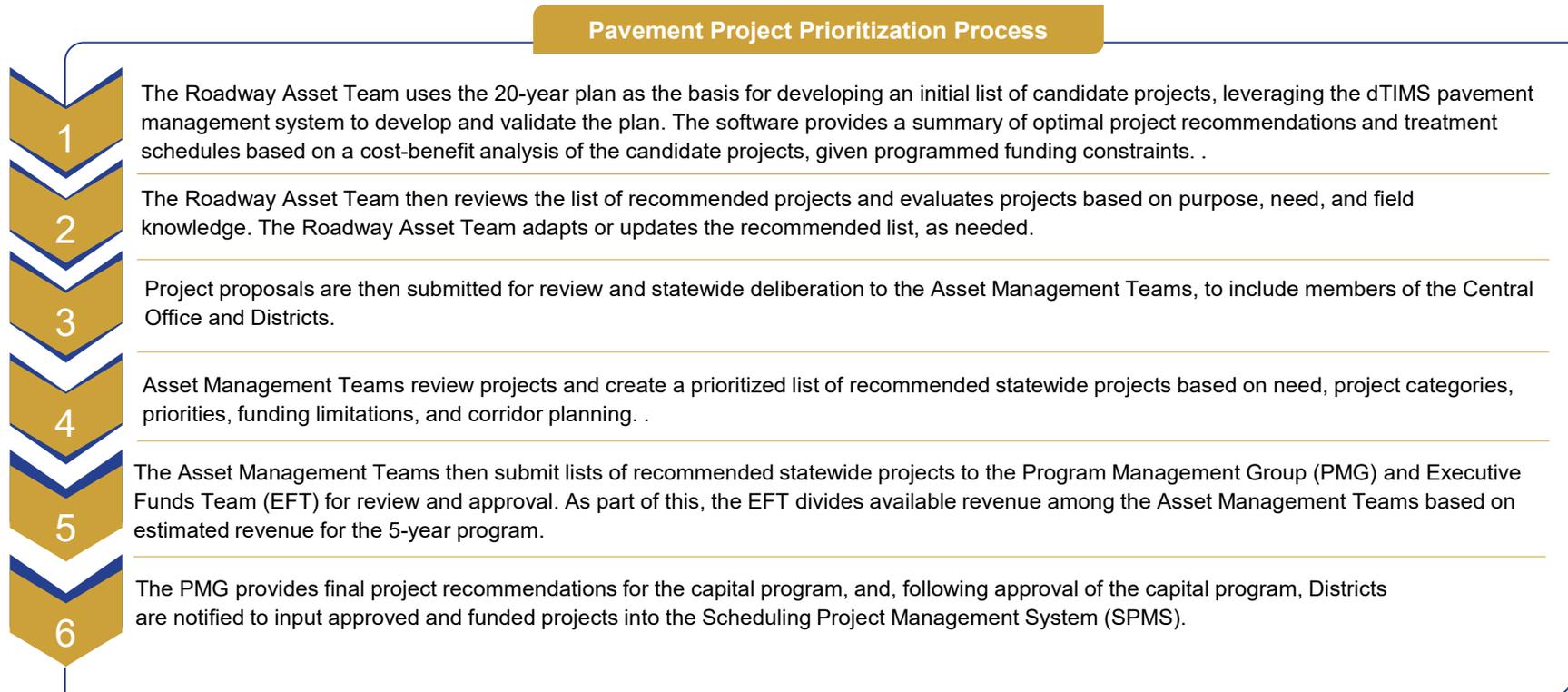


The output of the dTIMS model provides a list of candidate projects, with associated benefit-cost effectiveness, for inclusion in the capital program.

Pavement Project Prioritization for the Capital Program

Pavement Project Prioritization Process

INDOT leverages the following process to prioritize and select pavement projects for the upcoming capital program:



Projects that are not included in the final program due to funding limitations are put on hold and may be considered during the upcoming call for projects, following the same process as described above.⁴⁴

⁴⁴ Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2019

Asset Lifecycle Strategies & Other Functional Strategies



What is INDOT's Process for Preparing Lifecycle Strategies for its Bridges and Pavement?

Overview of Asset Lifecycle Strategies

Consistent with industry good practice, INDOT maintains bridge and pavement management systems to support management of the State's bridges and roadways. INDOT's bridge and pavement databases are known as BIAS and Roads and Highways, respectively. These store the asset inventory and condition data that then serve as the foundation for the lifecycle treatment modeling performed using Deighton's Total Infrastructure Management System (dTIMS) software. The triggers, or criteria, used to determine treatment type and timing are captured in INDOT's bridge and pavement treatment rules. Details surrounding the asset conditions and associated data attributes that trigger certain treatments are captured in these rules. Collectively, BIAS, Roads and Highways, dTIMS, and INDOT's treatment rules form the Department's bridge and pavement systems, which are required by Federal regulations.

Based on the bridge and pavement data stored in INDOT's databases, and using the triggers and treatment logic, dTIMS software uses simulation modeling to forecast the deterioration for each asset and recommend treatments based on user-defined constraints, such as budgetary constraints and expected bridge and pavement performance. The dTIMS software then considers all potential eligible treatment strategies per asset, for all assets, and identifies an optimal benefit and cost strategy that provides the most cumulative benefit to the network (portfolio) when considering the known budgetary constraints. The impacts of various alternative treatment strategies on an asset's condition over time can be visualized in dTIMS as depicted in the adjacent figures.^{45, 46}

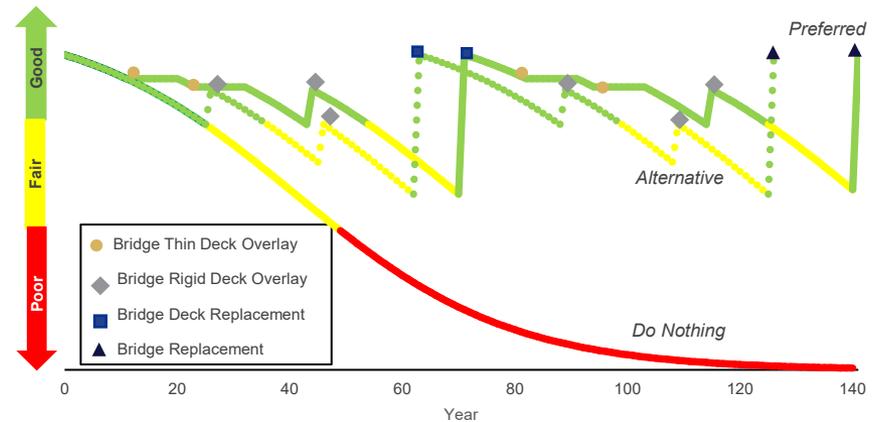


Figure 18: Illustrative Bridge Decay Curve, Deck Condition (9,000 ft²) (northern Interstate)

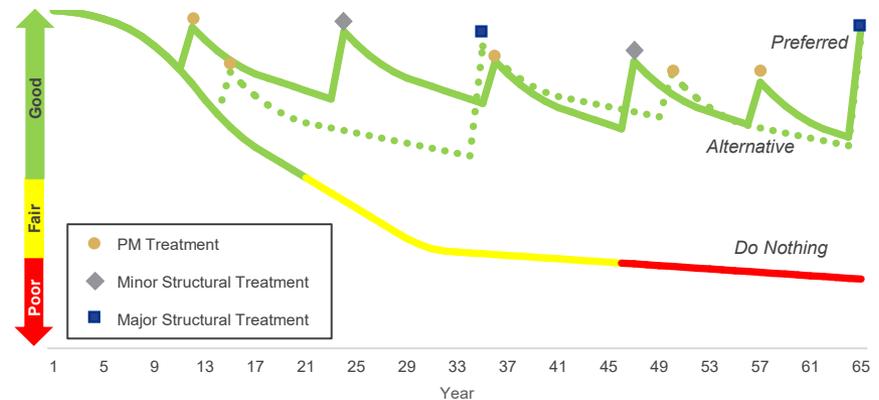


Figure 19: Illustrative Asset Decay Curve, HMA A1 Pavement

⁴⁵ Indiana Department of Transportation, "Asset Lifecycle Strategies, Bridges," version 16, August 2020

⁴⁶ Indiana Department of Transportation, "Asset Lifecycle Strategies, Pavement," version 28, August 2020

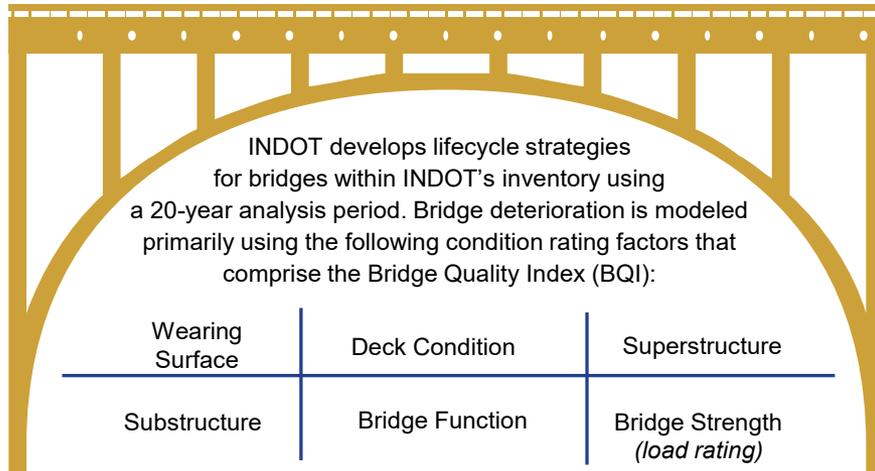
What is INDOT's Process for Bridge Lifecycle Strategies?

Bridge Lifecycle Strategies

INDOT's bridge treatment rules used within dTIMS describe the eligible treatment types and triggers for each treatment type. The following treatment types are considered for bridges:

Bridge Treatment Types

- Bridge Painting
- Deck Overlay
- Thin Deck Overlay
- Superstructure Replacement
- Deck Replacement
- Bridge Replacement
- Culvert Replacement



The 20-year plan outlines INDOT's asset strategies for bridges. Bridge asset strategies vary by material to reflect the differing needs in the frequency and type of treatments performed based on the material and levels of service.

Based on the underlying deterioration models and the triggers captured in the bridge treatment rules, dTIMS then provides suggested alternative treatment strategies that would enable the asset to achieve a state of good repair, measured by whether INDOT has achieved the established condition target for the overall network, which is to have no more than 3% of bridges in poor condition. The software provides suggestions for both an initial treatment strategy that would address the performance gaps in the short-term and a subsequent long-term strategy to be applied after implementing the initial strategy. Recommended treatments also consider the costs and benefits of the strategies across all assets, using historical data on treatment costs from the previous four years. INDOT verifies and updates the costs within the system on an annual basis. Benefits of the treatments are determined by impacts the treatments may have on the BQI score of the deterioration curves modeled within dTIMS.

After evaluating all costs and impacts, the software produces a benefit-cost-effective list of recommended projects, given the programmed funding constraints. Outputs of dTIMS, in terms of recommended treatments, are then evaluated and verified by INDOT's bridge engineers, who incorporate their local knowledge of the bridges to approve or update the dTIMS' list of recommendations.⁴⁷

⁴⁷ Indiana Department of Transportation, "Asset Lifecycle Strategies, Bridges," version 16, August 2020

What is INDOT's Process for Pavement Lifecycle Strategies?

Pavement Lifecycle Strategies

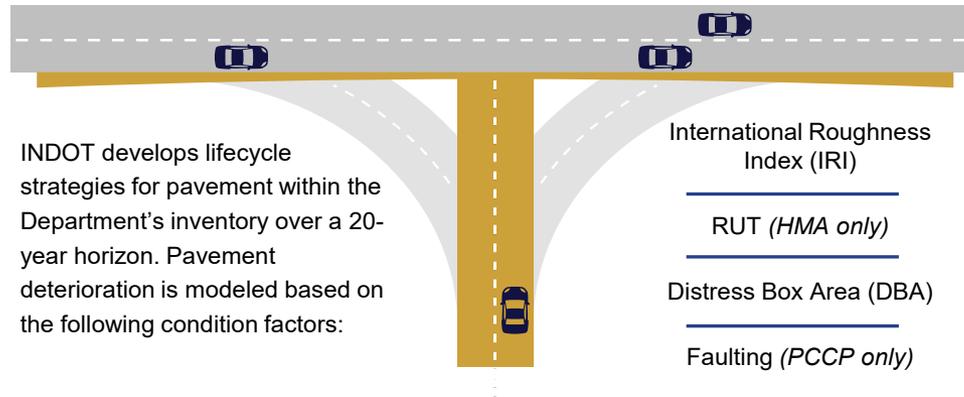
INDOT's pavement treatment rules describe the eligible treatment types and triggers for each treatment type. The following treatment types are considered for pavement, based on whether the material is Hot Mix Asphalt (HMA) or Portland Cement Concrete Pavement (PCCP):

HMA Treatment Types

- Pavement Preservation Treatments
- Preventative Maintenance Treatments
- Minor Structural Treatments
- Major Structural Treatments

PCCP Treatment Types

- Pavement Preservation Treatments
- Preventative Maintenance Treatments
- Major Structural Treatments



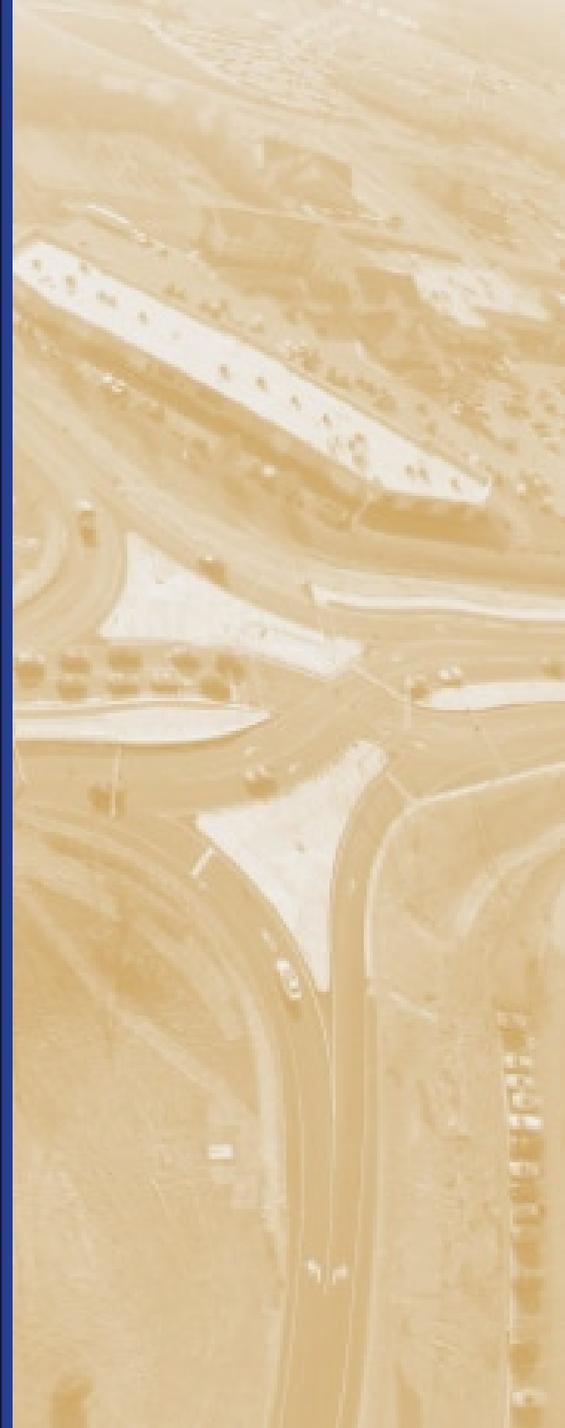
The 20-year plan outlines INDOT's asset strategies for pavement. Pavement asset strategies vary by roadway category to reflect the differing needs in the frequency and type of treatments performed based on the level of service and risk factor, coupled with the anticipated traffic.

Based on the underlying deterioration models and the triggers captured in the treatment rules, dTIMS then provides suggested alternative treatment strategies that would enable the asset to achieve a state of good repair, measured by INDOT's established condition target to have no more than 5% of the overall road network in poor condition. Eligible treatment types are dependent on pavement type (i.e., asphalt or concrete) and roadway traffic volume and roadway category. The dTIMS software then provides suggestions for both an initial treatment strategy that would address the performance gaps in the short-term and a subsequent long-term strategy to be applied after implementing the initial strategy. Recommended treatments also consider the costs and benefits of the strategies. Benefits are measured based on the treatment's impact to the pavement's condition.

After evaluating all costs and impacts, the dTIMS software produces a benefit-cost effective list of recommended projects, given the programmed funding constraints and compared to the project benefits to the pavement. Outputs of dTIMS, in terms of recommended treatments, are then evaluated and verified by INDOT's roadway engineers, who incorporate their local knowledge of the pavements to approve or update the list of recommendations.⁴⁸

⁴⁸Indiana Department of Transportation, "Asset Lifecycle Strategies, Pavement," version 28, August 2020

Capabilities & Competencies



How does INDOT Identify the Necessary Skills and Competencies to Perform Asset Management?

INDOT Asset Management Competency Framework

The INDOT Asset Management Competency Framework is a framework that identifies a standard set of skills and competencies needed to perform asset management activities within a staff member's given position. The framework was developed using the Institute of Asset Management's (IAM) Competencies framework and is therefore based on industry best practices. INDOT's Competency Framework can be

leveraged to optimize the delivery and performance of the Agency's asset management personnel and will allow INDOT to review select positions related to asset management roles within the organization (e.g., bridge engineer) and accurately assign the competency levels needed for these positions.⁴⁹ The framework is structured around the following key roles related to asset management:

Table 13: Skills and Competencies Framework Key Roles

Policy & Strategy Development	Asset Management Planning	Asset Management Implementation	Asset Management Capabilities	Asset Performance Monitoring	Asset Information Management
Ensures asset management activities are aligned with and achieve the organizational strategic plan. Includes policy-making, identifying strategic requirements, demand analysis and forecasting, and strategy development.	Focuses on the identification, appraisal, optimization, prioritization of asset investment options and the development of effective asset management plans to implement the asset management strategy and deliver on objectives.	Examines how the complete asset lifecycle is managed, as well as planning and controlling the delivery of its main components.	Manages or influences the processes that support effective delivery of the asset management strategy, objectives, and plans. Ensures competence is developed and managed in the boardroom, the workplace, and the supply chain.	Ensures the organization acknowledges, understands, and manages risk effectively, and that performance is reviewed and improved over time. Risks include, safety, security, environment (including climate change), reputation, and finance.	Defines the asset information needed, how it is gathered and analyzed, how it is interpreted and managed, and how the knowledge generated is applied.

⁴⁹KPMG, "INDOT Asset Management Phase 2 Steering Committee Meeting" (program update, Indiana Department of Transportation Asset Management Steering Committee, Indianapolis, IN, October 2018)

How is INDOT Augmenting its Asset Management Capabilities?

Select Positions Related to Asset Management

The following Central Office and District positions within INDOT have significant asset management activity competency requirements:⁵⁰

District Level Positions

- Technical Services Director
- Pavement Asset Manager
- Traffic Engineer
- System Asset Manager
- Bridge Asset Engineer
- Highway Maintenance Director

Central Office Positions

- Director, Pavement Asset Management
- Director, Project & Program Delivery
- Managing Director, Asset Management
- Director, Bridge Asset Management
- Director, Traffic Engineering
- Statewide Highway Maintenance Director

Individuals who hold these positions qualify as candidates for the Asset Management Competency Framework and may leverage the framework to determine the required skills and competencies for these positions and identify any deficiencies between existing and desired competencies.

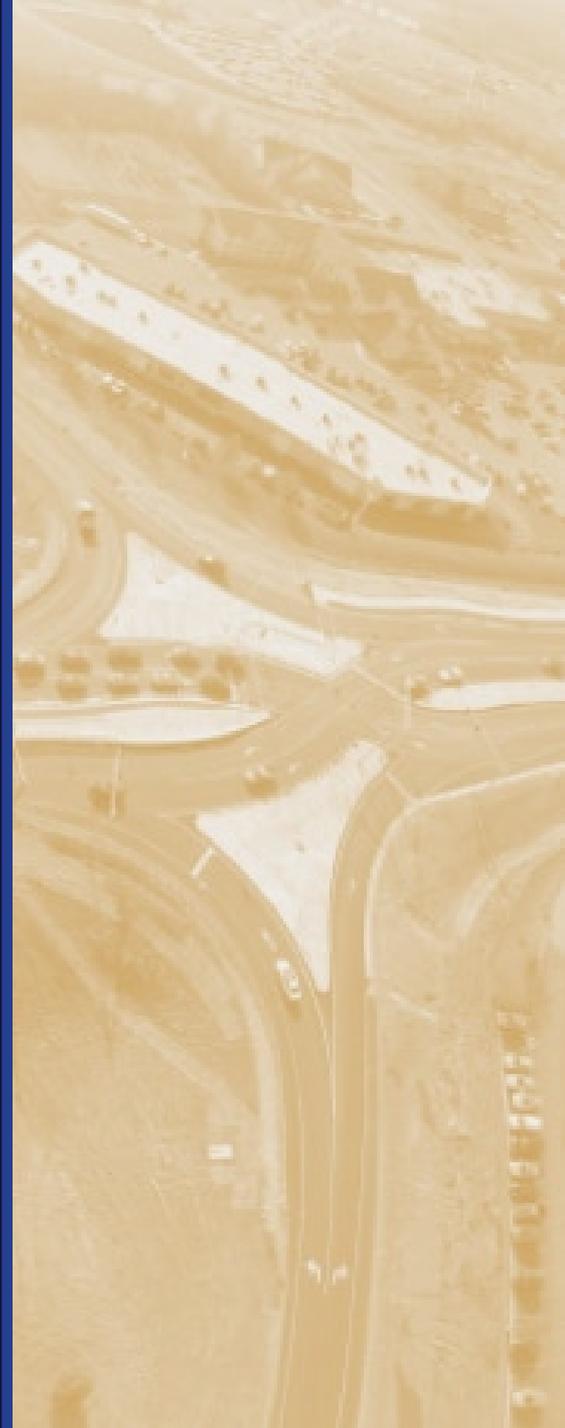
Asset Management Training and Development Opportunities for INDOT Staff

INDOT's Asset Management Training and Development Plan is aligned to its Asset Management Competency Framework. The Asset Management Training and Development Plan provides training opportunities to address the gaps identified in INDOT's existing asset management competencies when compared against those listed in the competency framework.



⁵⁰ KPMG, "INDOT Asset Management Phase 2 Steering Committee Meeting" (program update, Indiana Department of Transportation Asset Management Steering Committee, Indianapolis, IN, October 2018)

Asset Management Roles & Responsibilities



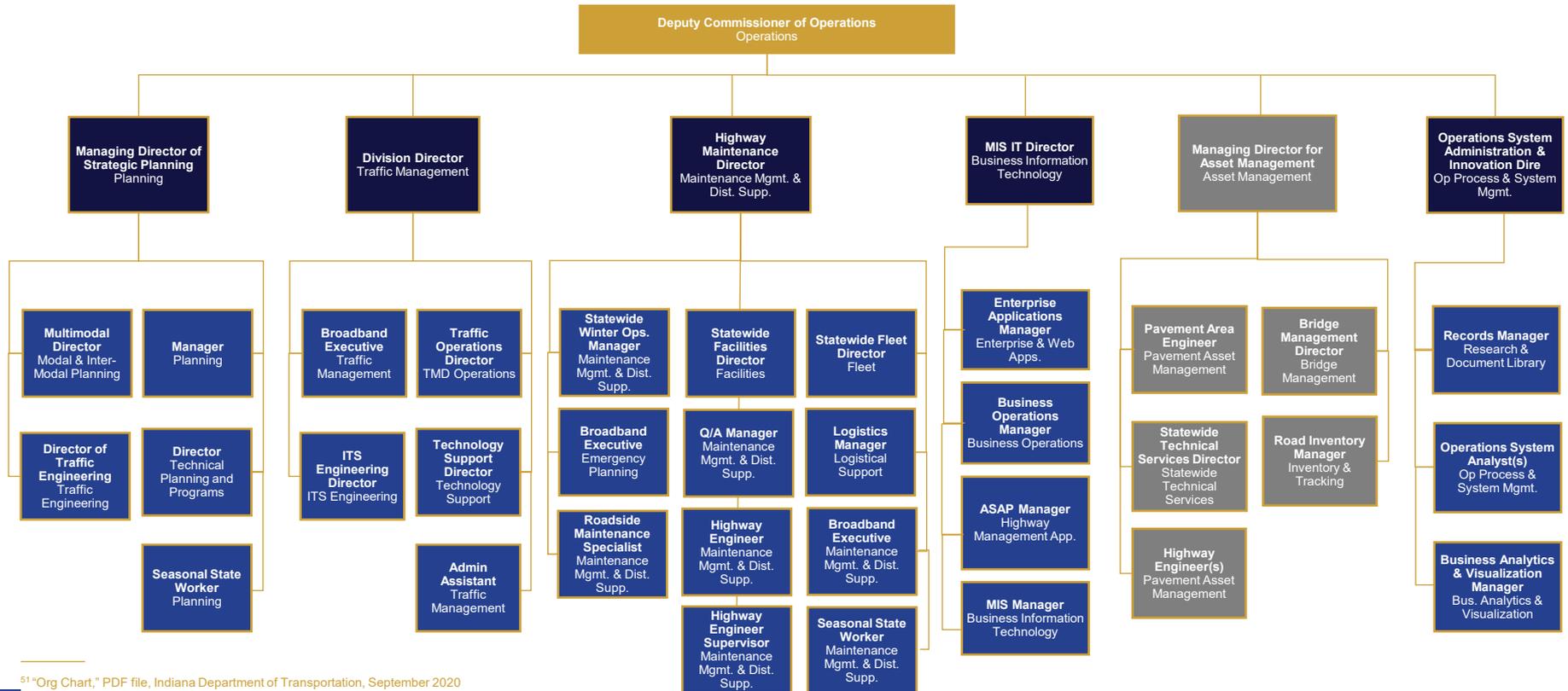
Where does Asset Management Fit in the Organization?

Overview of the INDOT Organization

The INDOT organization is structured by six District offices and one Central Office. Under INDOT's organization structure, Asset Management falls under the Operations group. The Asset Management group is led by the Statewide Technical Services Director, who reports to the Deputy Commissioner of Operations of

Operations. The Asset Management group is comprised of Statewide Technical Services, Pavement Asset Management, Bridge Management, and Inventory and Tracking. The following depicts INDOT's Operations organization structure.⁵¹

Figure 20: INDOT Operations Organization Structure



⁵¹*Org Chart," PDF file, Indiana Department of Transportation, September 2020

Who is Responsible for Asset Management in INDOT?

INDOT Asset Management Governance Structure

INDOT has established an Asset Management Governance Structure to provide guidance on the delivery and sustainability of the Asset Management Program and ensure that developed concepts and practices are consistently communicated.

INDOT's Asset Management Governance Structure is separated into two primary groups, the Executive Leadership Team and the Asset Management Steering Committee, that each have different responsibilities and are coordinated through the Managing Director of Asset Management.

The roles and responsibilities of the Executive Leadership Team, Asset Management Steering Committee, and the Managing Director of Asset Management are outlined below.⁵²

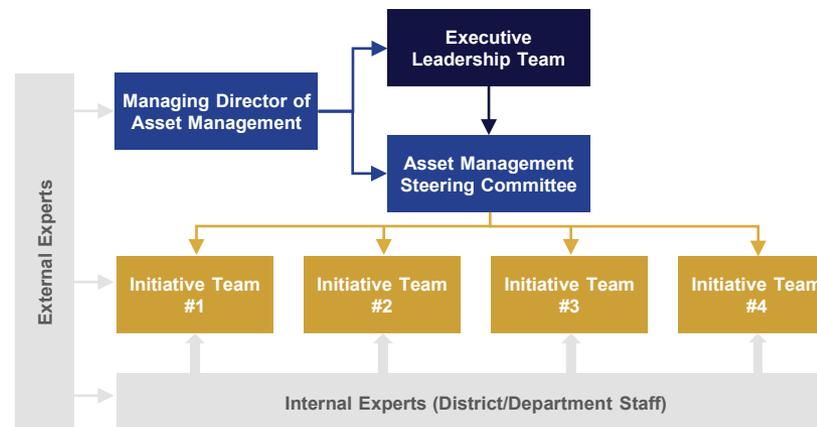


Figure 21: Representation of INDOT Asset Management Governance Structure

Table 14: Asset Management Stakeholder Roles and Responsibilities

Executive Leadership Team	Asset Management Steering Committee	Managing Director of Asset Management
<ul style="list-style-type: none"> Makes budget recommendations to Legislature Provides sponsorship and leadership to embed innovative practices and concepts Provides overall guidance and direction to develop and apply major initiatives Ensures adequate resources are available to develop and implement initiatives Monitors and reviews overall schedule for the Asset Management Program Translates changes and strategic direction to the District & monitors compliance 	<ul style="list-style-type: none"> Ensures adequate resources are available Plays an active role in the key decision making, stakeholder management, risk management and issue resolution Takes any action necessary to ensure the smooth integration of tactics and strategies within and between projects Provides support and direction for Asset Management practices at the District-level Monitors progress and performance Ensures consistency in approaches 	<ul style="list-style-type: none"> Provides organization-wide leadership in asset management practices & concepts Provides Asset Management Steering Committee coordination Facilitates key skills development related to asset management within INDOT Facilitates communications and change management related to asset management Participates in Steering Committee and implementation Initiative Teams as part of the asset management development process

⁵² Indiana Department of Transportation, "Asset Management Program Phase II Communications and Stakeholder Engagement Plan," version 4, November 5, 2018

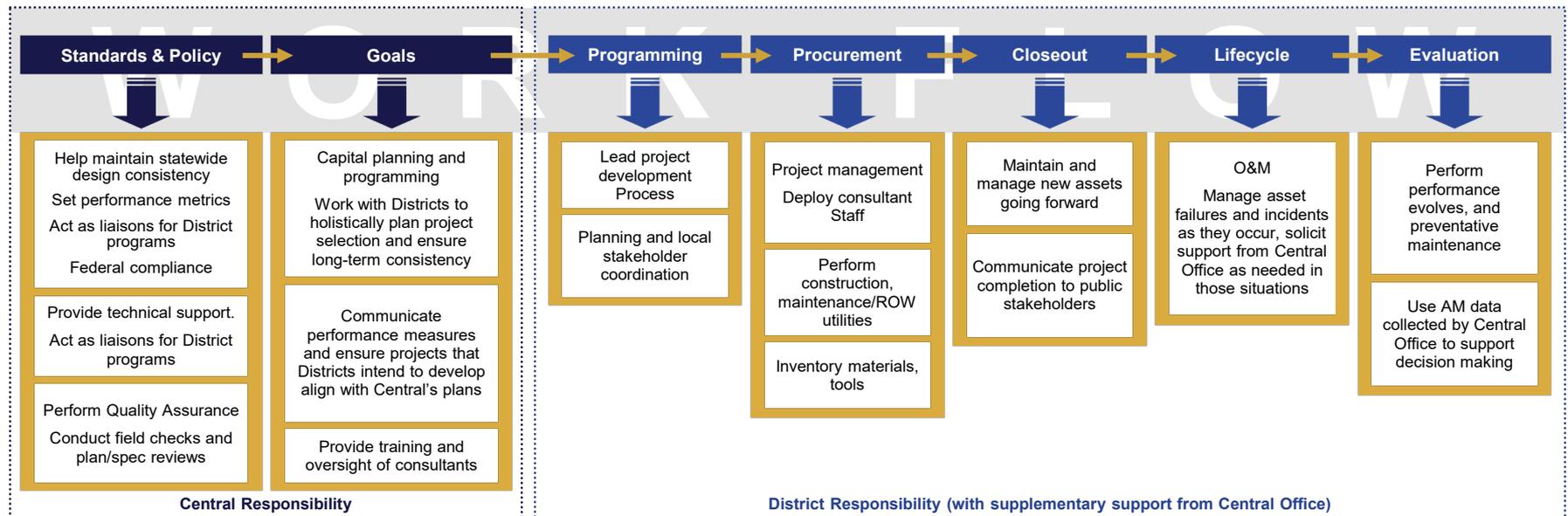
What are the Roles of the Central Office and Districts in Asset Management?

Central and District-Level Roles and Responsibilities

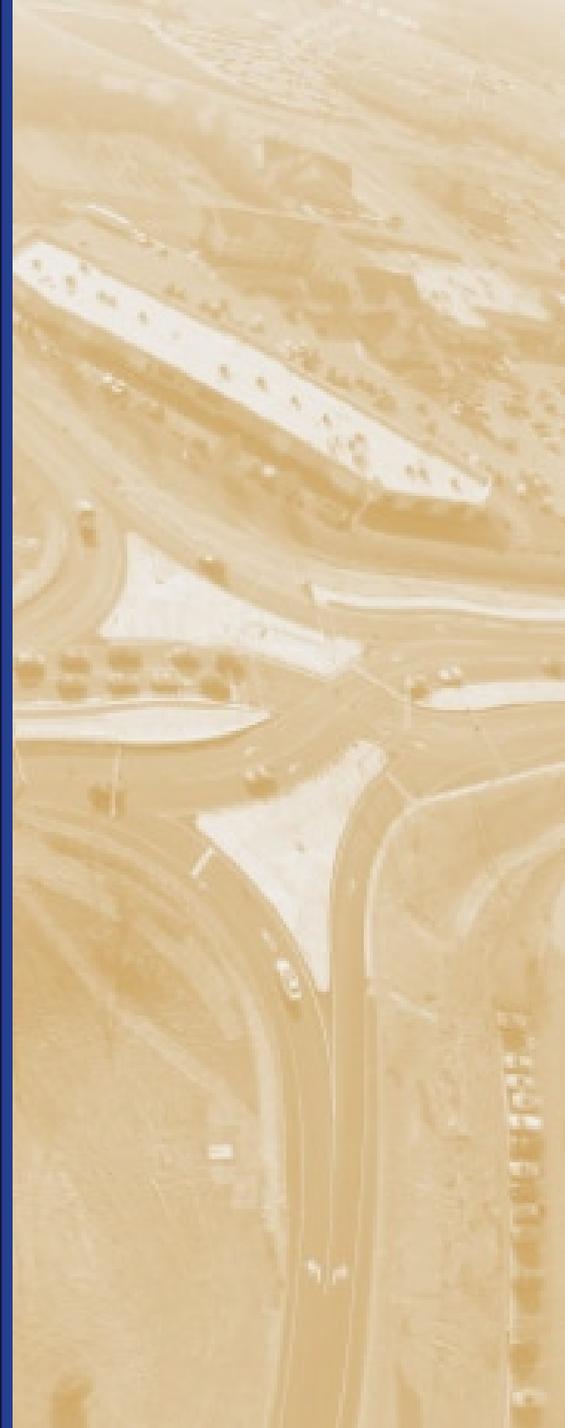
The role of the Central Office is to establish the standards, policies, and goals for the Asset Management Program and provide the supporting processes, tools, mechanisms, and governance framework necessary to implement asset management activities, liaising with the Districts and providing oversight activities to support the districts in achieving good practice asset management. The six District offices are responsible for managing a wide range of assets that make up

Indiana's infrastructure base and manage day-to-day operations, including construction and detours, traffic signal operations, permits, and maintenance operations, and therefore manage a wide range of assets that make up its infrastructure base. The role of the Districts is therefore to implement asset management activities, under the direction of the Central Office. The process flow chart below delineates asset management activities between the Central Office and District-levels.

Figure 22: Asset Management Lifecycle Activities



Opportunities & Risks in Delivering the SAMP



What are INDOT's Risks to Asset Management?

INDOT has developed a risk management framework to help identify opportunities and threats related to asset management, quantify and prioritize them based on their probability and impact, and develop risk mitigation strategies based on the highest priorities. INDOT assesses its risks according to likelihood and consequence (probability and impact).

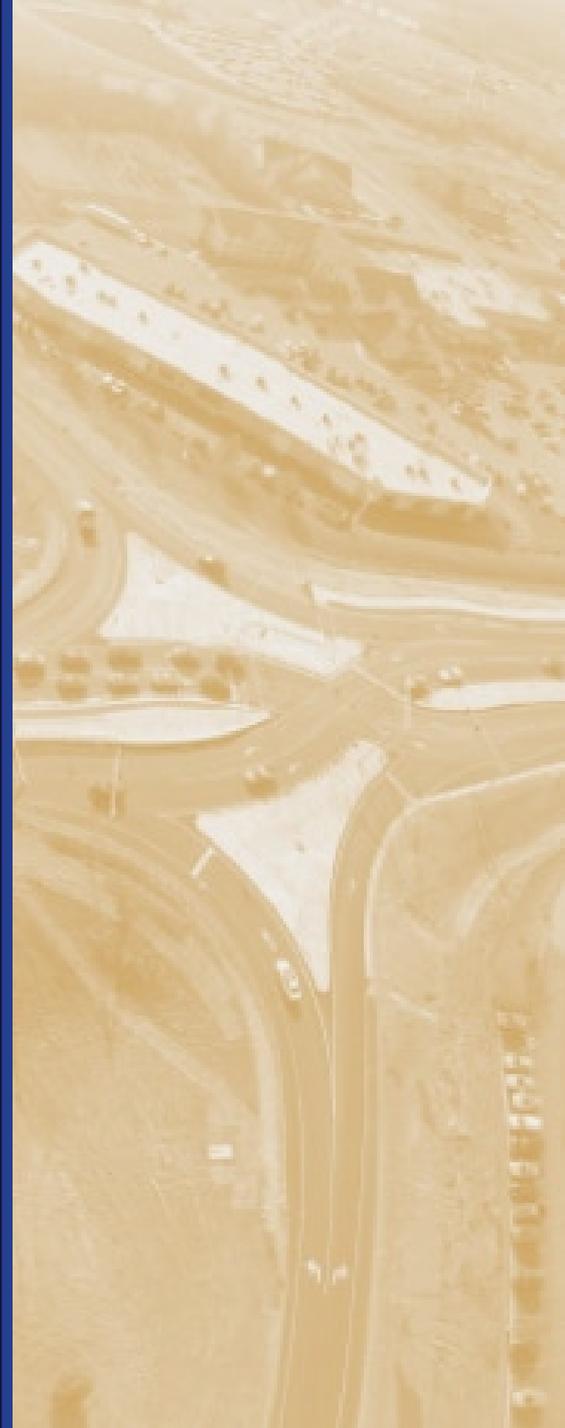
Using its risk management framework, INDOT has identified its top 25 risks related to asset management, including 16 threats and 9 opportunities. The chart below depicts the risks by severity, measured on a scale of 0 to 1. Risks were identified during a risk assessment workshop prepared for the TAMP. Descriptions of the top opportunities and threats are on the following page; for additional details on risks and mitigation strategies, please refer to the TAMP.⁵³

Figure 23: Opportunities and Threats to INDOT's Asset Management Program



⁵³ Indiana Department of Transportation, Transportation Asset Management Plan, August 2019

Plans for Improving the Asset Management System



What are INDOT's Future Asset Management Initiatives?

Plans to Improve the Asset Management System

As INDOT continues efforts to enhance its Asset Management Program, INDOT will continue to improve and build upon its asset management system to support the successful implementation of the program. INDOT has identified several initiatives to augment the asset management system.

These efforts are either planned efforts or efforts in development. This list is not exhaustive, and additional efforts beyond those identified below may be required to fully develop an optimal asset management system.

Table 15: INDOT Asset Management Program Initiatives

#	Initiative	Description
1	Asset Management Training Program	As INDOT further progresses to develop content for its asset management program, there is a need to further upskill staff with regard to asset management best practices, both within the Transportation industry and beyond. While there are a number a training courses currently available, this typically focuses on more tactical elements and does not provide a broader view of the asset management end to end process.
2	Business Process Development	This task is aimed at the creation of missing, high priority processes. These will be developed utilizing small process specific working groups, who will be available to provide guidance.
3	Communications and Change Management	For this task, the Communications and Change Management Plan will move into implementation. Specific areas of focus include development of content for both the internal INDOT asset management webpage, along with the asset management webpage for the INDOT external internet site.
4	Revise Bridge & Pavement Asset Lifecycle Strategies	This initiative includes the development of an owner's manual that summarizes INDOT's lifecycle strategies for bridges and pavement and further optimizes the strategies by incorporating data collected.
5	Asset Information Strategy & Data Collection Plan	This initiative will develop a strategy that establishes INDOT's data requirements, including the rationale for collecting data, at what granularity, timescale, return on investment, etc. The output is a prioritized plan for data collection.
6	Asset Risk Model	This initiative further develops INDOT's risk model and utilizes the risk model for select assets, such as Bridges.
7	Data Governance	This initiative continues efforts to implement INDOT's data governance processes, policies, and standards within asset management.

Monitoring Progress of SAMP Implementation



What is INDOT's Process to Monitor the SAMP?

Monitoring Progress

As INDOT progresses its Asset Management Program, INDOT will monitor the effectiveness of the SAMP and its successful implementation. The Asset Management Steering Committee will be responsible for monitoring and controlling implementation of the Asset Management Program.

At a minimum, INDOT will review its asset management condition targets and Service Level objectives on an annual basis. INDOT will monitor its current delivery of the 20-year bridge and pavement plans according to whether INDOT is delivering the plans and Service Levels within scope, schedule, and budget, noting any variances in delivering on the targeted treatments per year, performing the treatments within schedule, or variances in the anticipated cost estimates against known funding availability. The Steering Committee will also monitor whether the successful delivery of the scope of work identified within the 20-year plans will meet INDOT's 20-year condition targets. Similarly, INDOT will monitor whether the successful delivery of the planned maintenance activities continues to meet INDOT's Service Levels. The Steering Committee will also holistically review the asset management system to monitor whether the system is effectively supporting the delivery of the Asset Management Program and its objectives.

The Steering Committee may determine that corrections are needed to the Asset Management Program if the program's initiatives are not effectively contributing to INDOT's asset management objectives and/or strategic objectives. The Steering Committee will submit any proposed changes to the Managing Director of Asset Management for final approval. The Asset Management Steering Committee will maintain a log of all approved changes for internal record.

Reviewing and Updating the SAMP

If changes are made that impact the Asset Management Program, INDOT will also amend the SAMP to reflect these changes. At a minimum, the SAMP will be reviewed and updated every four years, consistent with the update for the FHWA TAMP. However, INDOT may choose to review and update the SAMP more frequently, as the SAMP and/or strategies identified within the SAMP will be adjusted on an ad hoc basis if/when known changes to the Asset Management Program will impact elements within the SAMP.

The Asset Management Steering Committee will review the SAMP at least every four years and determine whether changes or updates are required to the SAMP content. The Asset Management Steering Committee will identify whether adjustments or updates are required to the SAMP, draft any changes to the SAMP, and submit a draft updated version of the SAMP to the Managing Director of Asset Management for final approval. The Asset Management Steering Committee will maintain a log of all approved changes made to the SAMP for internal record.



Appendix



Appendix A

FHWA Performance Measurements for Pavement

INDOT's key performance indicator (KPI) for pavement condition is based on the International Roughness Index (IRI) of the right wheel path. INDOT also uses FHWA's performance measurements for pavement. For the FHWA's measurement, pavement condition is evaluated according to whether the pavement is in fair, good, or poor condition. Condition data is collected in six evaluation zones, including the right wheel path, left wheel path, two non-wheel path zones, outside pavement edge, and outside shoulder zone. Assessments are based on the following factors:

- **International Roughness Index (IRI):** Roughness of the pavement
- **Rut (RUT):** Depressions or grooves in the roadway
- **Faulting:** Displacement of pavement at the joints or cracks along the roadway
- **Cracking:** Roadway distress that can lead to potholes

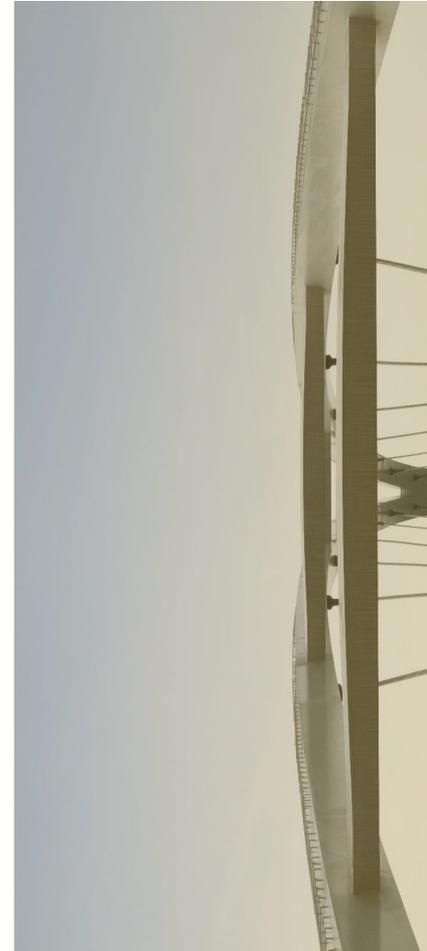
Performance Measure	Good	Fair	Poor
IRI (inches/mile)	<95	95-170	>170
RUT (inches)	<0.20	0.20-0.40	>0.40
Faulting (inches)	<0.10	0.10-0.15	>0.15
Cracking (percent)	<5	5-20 (asphalt), 5-15 (JCP)*, 5-10 (CRCP)**	>20 (asphalt), >15 (JCP), >10 (CRCP)

*Joint Concrete Pavement

**Continuously Reinforced Concrete Pavement

When assessing overall conditions, asphalt and JCP must receive a "good" rating in IRI, cracking, and RUT/faulting to be considered in overall good condition. CRCP must receive a "good" rating in both IRI and cracking to be considered in overall good condition. Conversely, asphalt and JCP must receive a "poor" rating in at least two measures to be considered in overall poor condition, and CRCP must receive a "poor" rating in both measures to be in overall poor condition. For all other combinations, pavement is considered in "fair" overall condition.⁵⁴

⁵⁴ Indiana Department of Transportation, *Transportation Asset Management Plan*, April 2018



Appendix B

FHWA Performance Measurements for Bridges

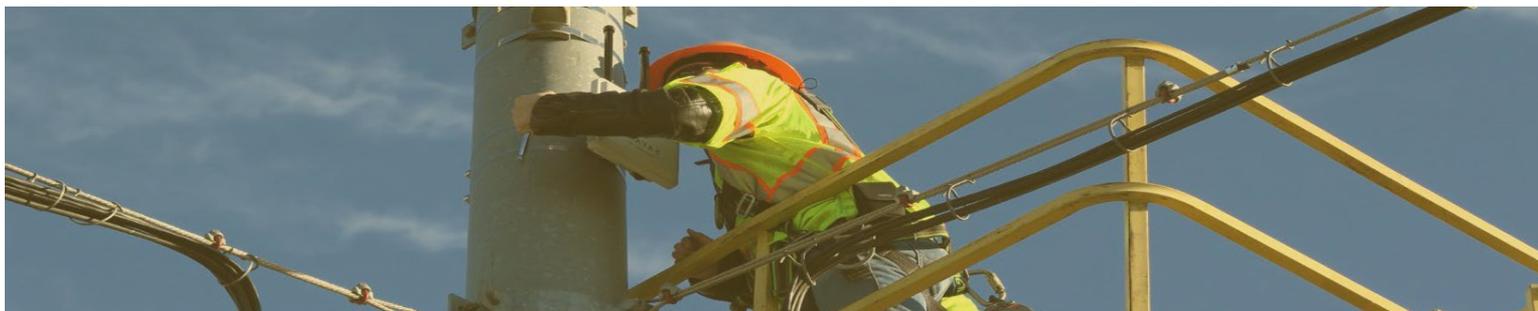
According to the FHWA's National Performance Management Measures for Assessing Bridge Conditions, a bridge's overall condition is based on the deck, superstructure, and substructure subsystem components. Condition ratings are captured for the three subsystem components and are ranked on a 0 to 9 scale, with a lower scale indicating a greater level of deterioration.

- If any of the three ratings receive a 4 or below, the bridge is considered in overall poor condition.
- If all three ratings receive a 7 or above, the bridge is considered in overall good condition.
- For any other combination of ratings, the bridge is considered in fair condition.

The scores are then weighted to the deck area, so that a larger bridge receives a greater weighting than a smaller bridge.⁵⁵

The following is the scale used to determine the condition ratings for the subsystem components.⁵⁶

Bridge Condition Ratings										
Scale	Excellent	Very Good	Good	Satisfactory	Fair	Poor	Serious	Critical	Imminent Failure	Failed
	9	8	7	6	5	4	3	2	1	0



⁵⁵ Federal Highway Administration. "National Performance Management Measures for Assessing Bridge Conditions." Code of Federal Regulations, title 23, part 430, subpart D (2017)

⁵⁶ Indiana Department of Transportation, *Transportation Asset Management Plan*, August 2018

Appendix C

INDOT Performance Measurements for Bridges

INDOT measures a bridge's overall condition based on wearing surface, deck, superstructure, and substructure. Condition ratings are captured for the three subsystem components and are ranked on a 0 to 9 scale, with a lower scale indicating a greater level of deterioration.

- If any of the four ratings receive a 4 or below, the bridge is considered in overall poor condition.
- If all four ratings receive a 7 or above, the bridge is considered in overall good condition.
- For any other combination of ratings, the bridge is considered in fair condition.

INDOT does not weight its bridges by deck area, so that all bridges are weighted equally.



Appendix D

Bridge Inventory and Conditions by Road Category and District

The following table summarizes the number of INDOT's bridges in good, fair, and poor condition by road category, District, and according to INDOT's and FHWA's KPIs, as of July 2019:⁵⁷

Category	Crawfordsville		Fort Wayne		Greenfield		LaPorte		Seymour		Vincennes	
	INDOT	FHWA	INDOT	FHWA	INDOT	FHWA	INDOT	FHWA	INDOT	FHWA	INDOT	FHWA
A1 Total	61	61	27	27	443	443	132	132	90	90	0	0
Good	14	14	15	19	234	246	58	67	54	55	0	0
Fair	30	44	11	8	198	191	73	65	35	34	0	0
Poor	17	3	1	0	11	6	1	0	1	1	0	0
A2 Total	111	111	136	136	34	34	14	14	151	151	270	270
Good	40	43	57	61	9	11	7	7	85	87	221	227
Fair	65	63	77	75	24	23	7	7	63	62	49	43
Poor	6	5	2	0	1	0	0	0	3	2	0	0
B1 Total	93	93	175	175	211	211	255	255	142	142	147	147
Good	36	48	56	64	136	144	100	107	78	79	77	82
Fair	56	44	112	107	73	66	148	142	59	58	67	64
Poor	1	1	7	4	3	1	7	6	5	5	3	1
B2 Total	174	174	103	103	77	77	146	146	140	140	130	130
Good	49	61	43	47	38	40	69	73	56	56	89	90
Fair	117	106	55	55	37	35	72	69	79	79	40	40
Poor	8	7	5	1	2	2	5	4	5	5	1	0
C1 Total	109	109	58	58	221	221	101	101	102	102	111	111
Good	51	56	27	28	104	108	34	38	41	42	60	63
Fair	54	50	28	28	110	107	65	62	57	58	48	46
Poor	4	3	3	2	7	6	2	1	4	2	3	2
C2 Total	366	366	269	269	205	205	192	192	338	338	369	369
Good	147	155	100	114	85	90	71	78	106	110	195	198
Fair	190	185	157	148	113	109	117	112	210	208	160	168
Poor	29	26	12	7	7	6	4	2	22	20	14	3
NA Total	2	2	0	0	6	5	3	3	3	3	12	12
Good	2	2	0	0	4	6	1	1	2	2	7	7
Fair	0	0	0	0	0	0	1	1	1	1	5	5
Poor	0	0	0	0	2	1	1	1	0	0	0	0
Totals	916	916	768	768	1197	1197	843	843	966	966	1039	1039

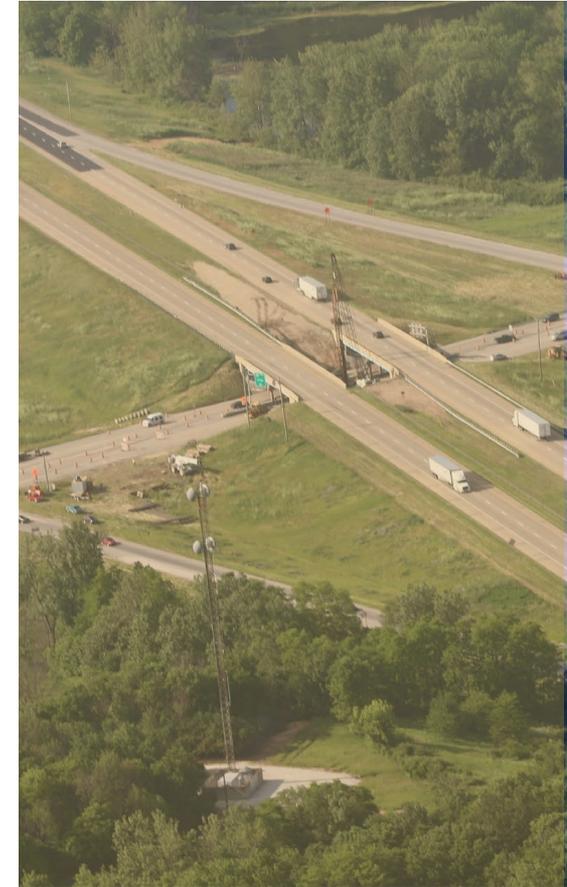
⁵⁷ "190726 BIAS-State Bridges-No Culverts." Excel spreadsheet of bridge inventory and conditions, Indiana Department of Transportation, April 18, 2019

Appendix E

Pavement Conditions by District and Road Category

The following table summarizes current pavement conditions by District and road category. Total centerline miles and current condition ratings are dated from 2017. Future iterations of the SAMP may include condition targets by roadway category and District, as more information becomes available.⁵⁸

Roadway Category	District	Total Centerline Miles	Current % Good or Fair Condition
A1	Crawfordsville	75.96	96.3%
	Fort Wayne	14.26	98.6%
	Greenfield	226.60	90.4%
	LaPorte	78.08	97.7%
	Seymour	66.11	98.0%
	Vincennes	0.0	N/A
A2	Crawfordsville	132.87	97.5%
	Fort Wayne	119.34	94.6%
	Greenfield	35.44	96.3%
	LaPorte	27.69	98.6%
	Seymour	151.99	96.3%
	Vincennes	196.48	98.3%
B1	Crawfordsville	154.83	87.9%
	Fort Wayne	367.02	88.7%
	Greenfield	280.88	89.5%
	LaPorte	470.13	83.6%
	Seymour	255.07	90.7%
	Vincennes	209.33	85.9%



⁵⁸ "Pavement Conditions Results 4.3.19," Excel spreadsheet of pavement conditions, Indiana Department of Transportation, April 3, 2019

Appendix E (continued)

Roadway Category	District	Total Centerline Miles	Current % Good or Fair Condition
B2	Crawfordsville	320.81	90.6%
	Fort Wayne	249.01	94.2%
	Greenfield	215.96	94.4%
	LaPorte	355.10	94.6%
	Seymour	360.55	97.5%
	Vincennes	317.53	94.9%
C1	Crawfordsville	177.55	92.5%
	Fort Wayne	149.51	92.4%
	Greenfield	306.27	90.3%
	LaPorte	203.22	86.7%
	Seymour	195.41	94.0%
	Vincennes	282.17	90.0%
C2	Crawfordsville	940.27	89.7%
	Fort Wayne	995.80	88.4%
	Greenfield	530.21	89.0%
	LaPorte	679.86	88.7%
	Seymour	909.30	87.2%
	Vincennes	956.41	89.9%



Appendix F

INDOT's Risk Management Framework

INDOT has developed a risk management framework to help identify risks related to asset management, quantify and prioritize them based on their probability and impact, and develop risk mitigation strategies based on the highest priorities.

Risk is defined as “the positive or negative effects of uncertainty or variability upon agency objectives.” Similarly, risk management is defined as “the processes and framework for managing potential risks.”⁵⁹

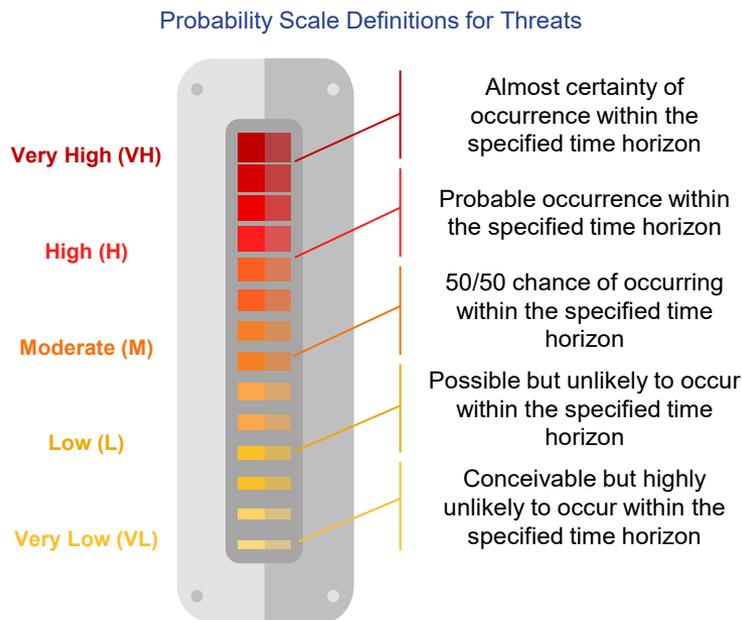
INDOT assesses its risks according to likelihood and consequence, or probability and impact. INDOT uses the following equation to quantify risks:

$$\text{Risk} = \text{Probability} \times \text{Impact}$$



Measuring Probability

Probability is the chance that a risk might occur, in which case the risk becomes an incident or an event. Probability can be defined, determined, or measured either objectively or subjectively and can be expressed either qualitatively or quantitatively. Probability can be ranked on a scale using the following range of occurrences, set to a pre-determined time horizon:⁶⁰



Note: For threats, the legend uses yellow, orange, and red colors to identify low, medium, and high scales, respectively. For opportunities, purple, blue, and green colors are used to identify low, medium, and high scales, respectively.

⁵⁹Federal Highway Administration, “Asset Management Plans Definitions,” Code of Federal Regulations, title 23, part 515, subpart 5 (2017)

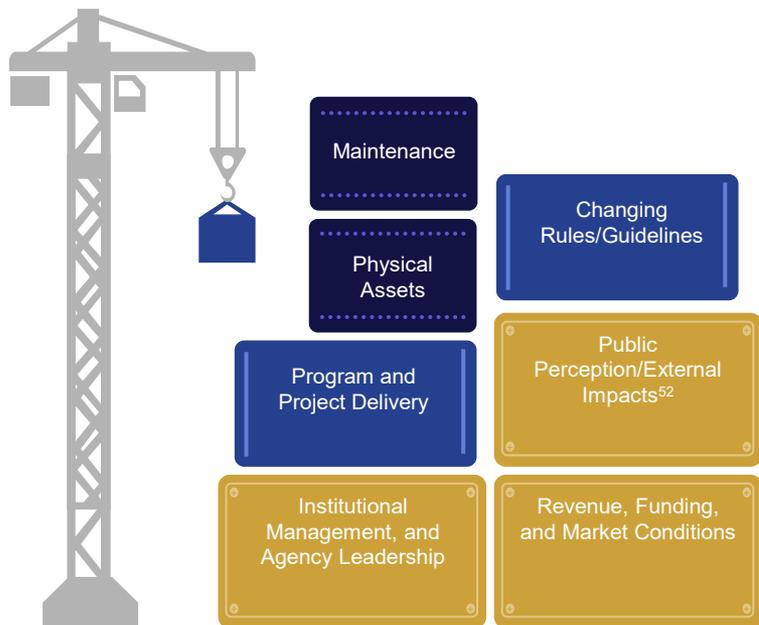
⁶⁰KPMG, “INDOT Asset Management Phase 2 Risk Management Framework Overview Slides” (program update, Indiana Department of Transportation, Indianapolis, IN, February 2019)

Appendix F (continued)

Measuring Impact

Impact is the outcome of an event that impacts INDOT's objectives. Impact is also measured on a Very Low to Very High scale.

Risks that are identified may fall into specific categories based on the type of risk posed to the organization and how it impacts the organization. INDOT categorizes its risks by the following:



Quantifying Opportunities and Threats

For each identified risk, scores are assigned to both the risk's probability and impact, and the total risk score is the product of the likelihood score and the consequence score. The total scores of the risks can be used to rank and prioritize risks to determine the greatest risks to INDOT's ability to manage its bridges and roads.⁶¹

Probability and Impact Scores for Opportunities and Threats

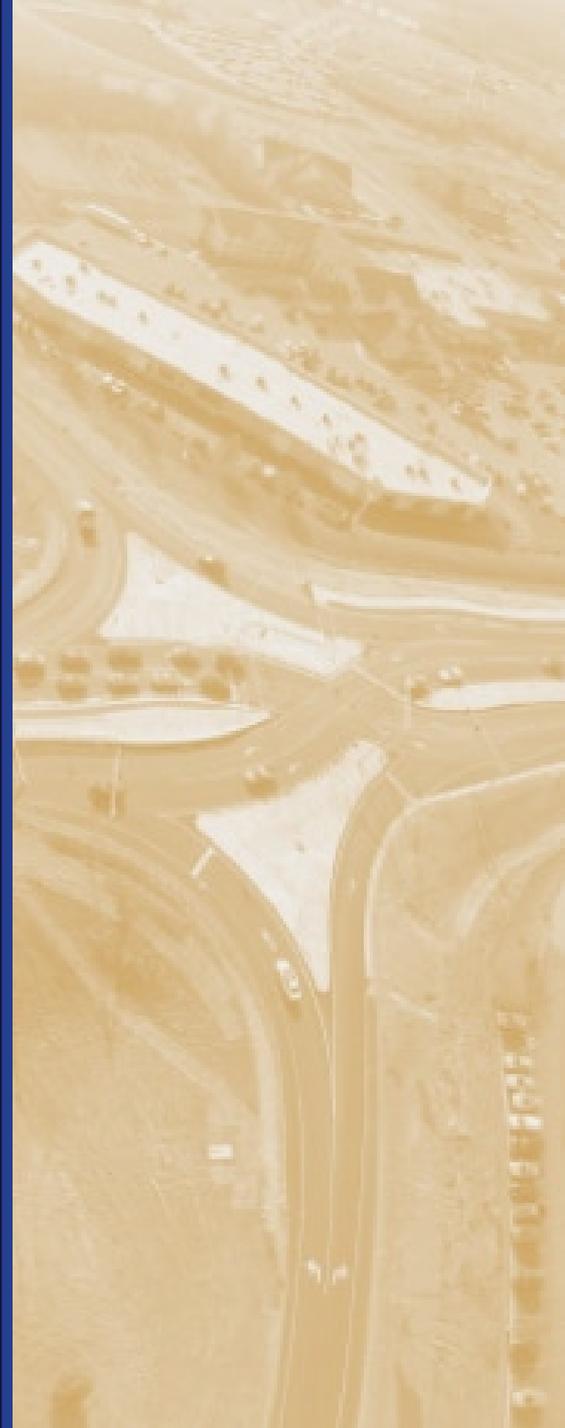
Threats						
Probability	VH	0.2	0.4	0.6	0.8	1
	H	0.16	0.32	0.48	0.64	0.8
	M	0.12	0.24	0.36	0.48	0.6
	L	0.08	0.16	0.24	0.32	0.4
	VL	0.04	0.08	0.12	0.16	0.2
	VL	L	M	H	VH	
Impact						

Opportunities						
Probability	VH	0.2	0.4	0.6	0.8	1
	H	0.16	0.32	0.48	0.64	0.8
	M	0.12	0.24	0.36	0.48	0.6
	L	0.08	0.16	0.24	0.32	0.4
	VL	0.04	0.08	0.12	0.16	0.2
	VL	L	M	H	VH	
Impact						

Legend			
Threat		Opportunities	
High	Medium	High	Medium
Medium	Low	Medium	Low
Low		Low	

⁶¹ "INDOT TAMP Risk Register," PDF file, Indiana Department of Transportation, February 20, 2019

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