

4. PERFORMANCE ASSESSMENT





An important aspect of asset management is using data to assist in determining the right treatment at the right time on the right bridge or pavement so that the most value is received from the funds invested in the transportation network. Iowa DOT uses data about the current condition of assets, estimated benefits from asset treatments, computer modeling to forecast future asset conditions, and budget constraints to assist in determining how to best manage bridge and pavement assets over time, minimizing condition and performance gaps.

Introduction

This chapter presents the results of performance scenarios developed for the 10-year period from 2023 to 2032. These have been developed for bridges and pavements to predict future conditions for various funding scenarios for both Iowa DOT defined metrics and FHWA defined metrics. These performance scenarios build upon the asset inventory and conditions presented in Chapter 2, the life cycle planning processes described in Chapter 3, and assumptions regarding potential future funding described in Chapter 6.

This chapter shows 10-year projections for the Bridge Condition Index (BCI) and Pavement Condition Index (PCI) for various funding scenarios for the Interstate System and non-Interstate Primary Highway System. As discussed in Chapter 2, Iowa DOT uses BCI and PCI to monitor the condition of the Primary Highway System. For the federally required performance measures, this chapter also identifies the 2- and 4-year condition targets for bridge and pavement assets on the National Highway System (NHS) and the desired 10-year states of good repair (SOGR) for those assets. A gap assessment was performed to identify the difference between current and projected asset conditions in achieving the desired 10-year SOGR; other performance gaps and strategies to address them are also discussed, as well as potential future enhancements to monitoring performance.

Federal Requirements

Using the measures of condition defined by FHWA, state DOTs must specify their desired SOGR for the 10-year analysis period of the TAMP consistent with state asset management objectives. The desired SOGR must also support progress towards achieving state and national goals. National goal areas include safety, infrastructure condition, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays.

As part of the FHWA rule on performance management, 23 CFR 490, states must set 2- and 4-year asset condition performance targets. These targets are included in the TAMP but are officially reported separately to FHWA. As part of this performance management rule, states are also required to maintain NHS pavements and bridges to meet the following federally established minimum condition levels.

- States must maintain bridges on the NHS (including culverts greater than 20 feet in length) so that the percentage of deck area of bridges classified as structurally deficient (equivalent to poor in FHWA's metric) does not exceed ten percent of the overall deck area in a state. If FHWA determines a state to be out of compliance for three consecutive years, the state must set aside and obligate a certain amount of National Highway Performance Program (NHPP) funding for eligible projects on bridges on the NHS.
- States must ensure that no more than five percent of pavement lane miles on the Interstate System are in poor condition. If FHWA determines a state to be out of compliance in any given year, the state must obligate a certain amount of NHPP and Surface Transportation Block Grant Program funding for eligible projects on the Interstate System.

If a state exceeds the minimum condition thresholds, funding penalty reassignments will remain in effect until the state is in compliance. Either of these funding penalty reassignments would result in a loss of some flexibility for the use of federal funds for Iowa DOT. However, the percentages of Iowa's NHS bridges and Interstate pavements in poor condition are currently below the minimum condition thresholds and are forecast to remain below those thresholds through the effective period of this TAMP.

FHWA also requires that states establish a performance gap analysis process for TAMPs that includes the following components.

- 10-year desired SOGR based on federal requirements and state goals
- 2- and 4-year state targets for asset condition
- Determine performance gaps
- Develop strategies to close or address the gaps

As part of the gap analysis, states must compare current asset performance to desired performance levels, but they may also compare desired asset performance to projected performance to calculate an expected gap.





4.1 Bridge Performance Assessment

The following sections discuss several topics related to assessing bridge condition.

- Scenarios that were developed to forecast future condition based on various funding levels.
- Projections of the BCI for the Interstate System and non-Interstate Primary Highway System, relative to Iowa DOT's desired average condition for the systems.
- Projections of the federally defined good and poor metrics for the NHS.
- 2- and 4-year targets and the 10-year desired SOGR for the federally defined good and poor metrics for the NHS.

Scenarios

Iowa DOT defined a set of three performance scenarios for its analysis of future bridge conditions. For each scenario, the same basic life cycle strategies are followed to the extent feasible considering available funding. The 100% scenario represents the expected level of funding for bridges. As discussed further in Chapter 6, a total of \$2.5 billion is anticipated to be invested in bridge assets during the 2023-2032 time period.

Other scenarios were defined for budget levels at 75% and 150% of expected stewardship funding. Stewardship funding totals approximately \$1.6 billion in the 100 percent scenario. The remaining funding of approximately \$0.9 billion (reserved for major structures and new construction) was held constant in all of the scenarios.

Once the scenarios were defined, Iowa DOT used the NBI Optimizer to predict future bridge conditions considering existing conditions, predicted deterioration, feasible bridge treatments, and the available budget. The modeling approach, treatments, and costs are described in Chapter 3. A 20-year projection was performed for each scenario.

The following sections discuss output for the Primary Highway System in terms of BCI and the NHS in terms of federally defined good and poor condition. It should be noted that the modeling scenarios represent the most likely outcomes based on the inputs used, but their results need to be considered in the context of several factors. For example, deck area of the system is growing, because when aging structures are replaced the new structures are typically larger. This impacts the rate of change for system-level condition and is difficult to accurately model. Major bridges are typically excluded from the scenarios for reasons discussed in Chapter 3. The modeling also cannot always account for maintenance work that can help prevent a bridge from falling into poor condition. Regarding anticipated funding, the 2021 Infrastructure Investment and Jobs Act added more bridge funding for states, but much of Iowa's increase will go to local bridges. Significant inflation has also been a major concern of late; if high inflation rates continue this could significantly decrease the buying power of available funding.

Bridge Condition Index (BCI) Projections

At a system level, Iowa DOT’s desired BCI is an average of 78 or greater for the Interstate System and an average of 76 or greater for the non-Interstate Primary Highway System. The desired system-level BCI was established in consultation with the Iowa Transportation Commission considering Iowa DOT’s goals and the national goals articulated in MAP-21. Ideally, Iowa DOT would like to maintain current bridge conditions, but some degree of deterioration may be expected even in the most optimistic scenario. The desired system-level BCI reflects the condition Iowa DOT aims to achieve for its bridges, consistent with its goals and objectives for the transportation system, life cycle strategies, and overall level of funding.

Performance projections for Interstate bridges are shown in Figure 4.1, and projections for non-Interstate Primary Highway System bridges are shown in Figure 4.2. Each line in the figures represents average BCI for the system for one investment scenario, while the double flat lines identify the desired system-level BCI. The investment scenarios are labeled by their average level of funding, expressed as a percentage of expected funding. As indicated in the figures, the condition of Interstate and non-Interstate Primary Highway System bridges is projected to be maintained during the 10-year timeframe of the TAMP in the 75% and 100% funding scenarios, though by the end of that timeframe the condition is expected to be lower than it is currently. A longer-term projection is shown to illustrate the substantial decline anticipated across scenarios by the end of the 20-year forecast period, even in the 150% funding scenario. This indicates the importance of continuing to adequately fund bridge needs now in order to not compound the future decline.

Figure 4.1: Interstate bridge condition performance scenarios for BCI

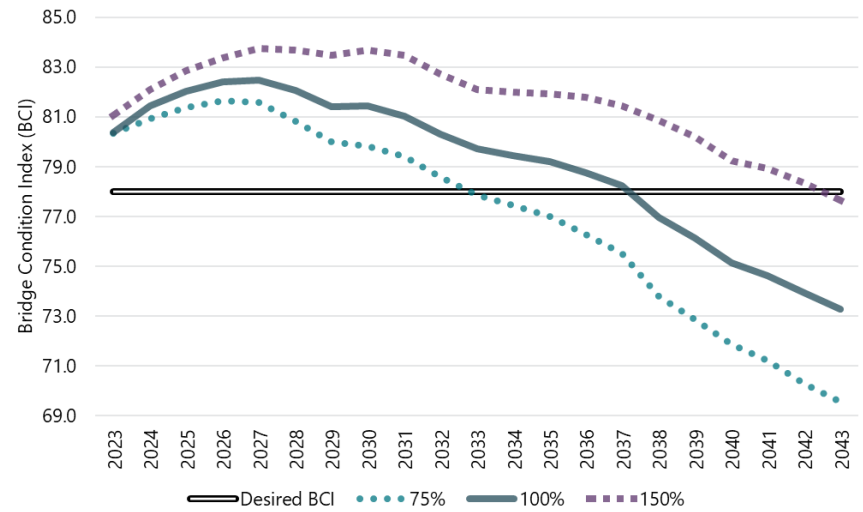
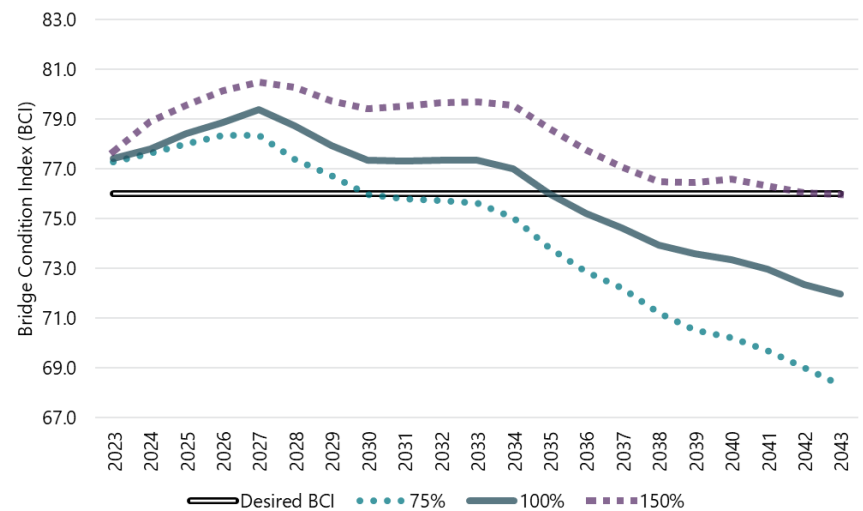


Figure 4.2: Non-Interstate Primary Highway System bridge condition performance scenarios for BCI





2- and 4-Year Targets and 10-Year State of Good Repair (SOGR)

In addition to using BCI to monitor the state-owned highway system, federally defined good, fair, and poor condition metrics are also used to monitor the NHS. These metrics are required to be used for setting 2- and 4-year targets and defining a 10-year desired SOGR for the TAMP.

2- and 4-Year Targets

Federal regulation 23 CFR 490.105 requires that 2 and 4-year targets be set for the condition of bridges on the NHS. The targets identified for bridges on the NHS document the short-term outcomes that are anticipated from project identification and programming that is based on the life cycle planning, risk management, and investment strategies described in this TAMP. The targets help document what progress is anticipated to be made and what outcomes are likely based on current and anticipated investment strategies. Performance targets create a link between projects that will occur in the next few years and the long-term goals and framework of the TAMP and other performance-based plans, providing a way to gauge whether the investments being made in the system are having the desired or anticipated effect on system condition and performance. Two iterations of targets have been established for FHWA's performance measures for NHS bridge condition.

The first performance period for which these regulations were effective was from 2018-2021. Table 4.1 shows the baselines, 2-year targets, 4-year targets, and actual performance for the period for NHS bridges. Iowa DOT achieved its 2- and 4-year targets for this time period.

Iowa DOT established 2 and 4-year targets for the 2022-2025 performance period on October 3, 2022. Targets were established in coordination with Metropolitan Planning Organizations (MPOs) and were reported to FHWA in November 2022. Baselines and targets for this performance period are shown in Table 4.2. Additional detail on the target setting methodology is available at https://iowadot.gov/systems_planning/fpmam/2022-2025-Pavement-Bridge-Targets.pdf.

Table 4.1: NHS bridge performance targets for the 2018-2021 performance period

	Baseline (CY 2017 data)	2-Year Target	2-Year Actual (CY 2019 data)	4-Year Target	4-Year Actual (CY 2021 data)
Percent of NHS bridges in good condition	48.9%	45.7%	48.7%	44.6%	49.4%
Percent of NHS bridges in poor condition	2.3%	3.7%	2.2%	3.2%	2.4%

Note: the year is the data year; e.g., 2019 means 2019 data that was submitted to NBI in calendar year 2020. The percent of bridges is measured in terms of deck area.

Table 4.2: NHS bridge performance targets for the 2022-2025 performance period

	Baseline (CY 2021 data)	2-Year Target (CY 2023 data)	4-Year Target (CY 2025 data)
Percent of NHS bridges in good condition	49.4%	52.5%	56.0%
Percent of NHS bridges in poor condition	2.4%	5.0%	6.6%

Note: the year is the data year; e.g., 2021 means 2021 data that was submitted to NBI in calendar year 2022. The percent of bridges is measured in terms of deck area.

10-Year SOGR

For NHS bridges, the desired 10-year SOGR is at least 46.8% of bridges (measured in terms of deck area) in good condition and no more than 6.5% in poor condition. The SOGRs were established by considering Iowa DOT’s goals and the national goals articulated in MAP-21. As with BCI, Iowa DOT would like to maintain current bridge conditions, but some degree of deterioration may be expected even in the most optimistic scenario. The desired SOGR reflects the condition Iowa DOT aims to achieve for NHS bridges, consistent with its goals and objectives for the transportation system, life cycle strategies, and overall level of funding. The bridge management team reviewed and affirmed the desired SOGR from the 2019 TAMP for this iteration of the TAMP.

The same modeling scenarios used for projecting future BCI were used to project the percentage of NHS bridge deck area in good and poor condition. Figures 4.3 and 4.4 show the output of this analysis. Each line in the figures represents the percentage of deck area in good or poor condition for one investment scenario, while the double flat lines identify the 10-year desired SOGR. The investment scenarios are labeled by their average level of funding, expressed as a percentage of expected funding.

While Iowa DOT’s desired system-level BCI was reached with a lower funding scenario, reaching the 10-year desired SOGR for the percentage of NHS deck area in good condition required slightly more than the 100% funding scenario. Also, the extended forecast shows the dramatic increase in percent poor and decrease in percent good that is projected to occur in the second decade of the projections across funding scenarios. Similar to the BCI projections, this indicates the importance of continuing to adequately fund bridge needs now in order to not compound the future decline.

The gap between projected funding and the desired 10-year SOGR is discussed further in Section 4.3, along with other performance gap considerations and strategies to address the gaps.

Figure 4.3: NHS bridge condition performance scenarios for federally defined good condition

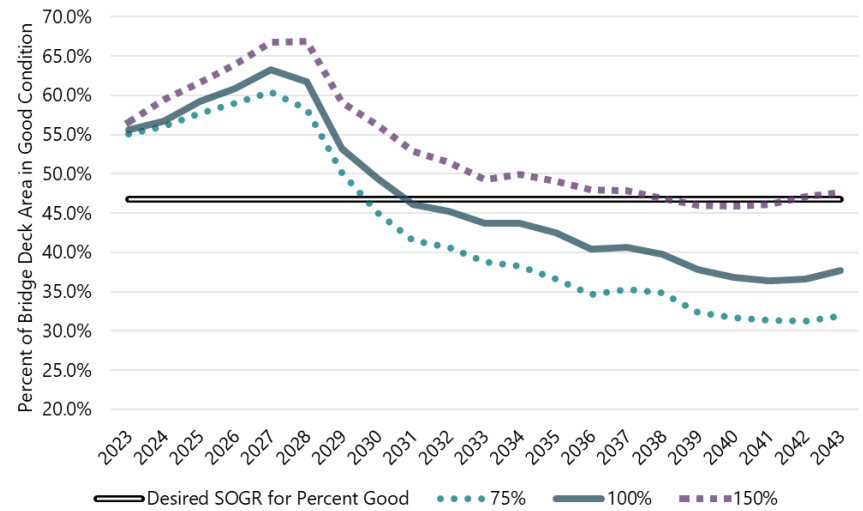
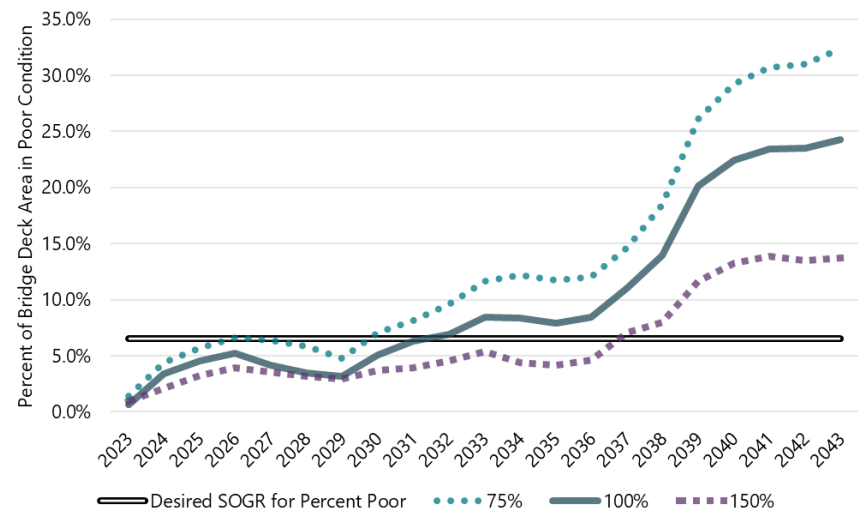


Figure 4.4: NHS bridge condition performance scenarios for federally defined poor condition





4.2 Pavement Performance Assessment

The following sections discuss several topics related to assessing pavement condition.

- Scenarios that were developed to forecast future condition based on various funding levels or treatment selection strategies.
- Projections of the PCI for the Interstate System and non-Interstate Primary Highway System, relative to Iowa DOT's desired average condition for the systems.
- Projections of the federally defined good and poor metrics for the Interstate System and non-Interstate NHS.
- 2- and 4-year targets and the 10-year desired SOGR for the federally defined good and poor metrics for the Interstate System and non-Interstate NHS.

Scenarios

The pavement performance assessment was performed in a similar manner to the bridge performance assessment. In this case, Iowa DOT defined a set of eight performance scenarios for the analysis. For each scenario, the same basic life cycle strategies are followed to the extent feasible considering available funding. The 100 percent scenario represents the expected level of funding for pavements. As discussed further in Chapter 6, a total of \$5.6 billion is anticipated to be invested in pavements during the 2023-2032 time period. Other scenarios were defined at lower and higher investment levels as well as using less optimized project selection methods, where the Iowa Pavement Stewardship Tool (IPST; discussed in Chapter 3) was used to either selected projects randomly or selected the lowest benefit/cost (B/C) projects first. To streamline content for this section, only a subset representing the most realistic of the eight scenarios is shown. While the random and lowest B/C scenarios are not shown, in all cases they resulted in substantially worse performance than the status quo scenarios.

Once the scenarios were defined, Iowa DOT used the IPST to predict future pavement conditions considering existing conditions, predicted deterioration, feasible pavement treatments, and the available budget. The modeling approach, treatments, and costs are described in Chapter 3. A 10-year performance projection was performed for each scenario. The following sections discuss output for the Primary Highway System in terms of PCI and for the Interstate System and non-Interstate NHS in terms of federally defined good and poor condition.

It should be noted that the modeling scenarios represent the most likely outcomes based on the inputs used, but their results need to be considered in the context of several factors. For example, lane miles of the system are growing, because while stewardship is the main focus for most of the system, there are locations where capacity is being added to address mobility and operational issues, particularly on key Interstate corridors. This impacts the rate of change for system-level condition and is difficult to accurately model. Significant inflation has also been a major concern of late; if high inflation rates continue this could significantly decrease the buying power of available funding.

Pavement Condition Index (PCI) Projections

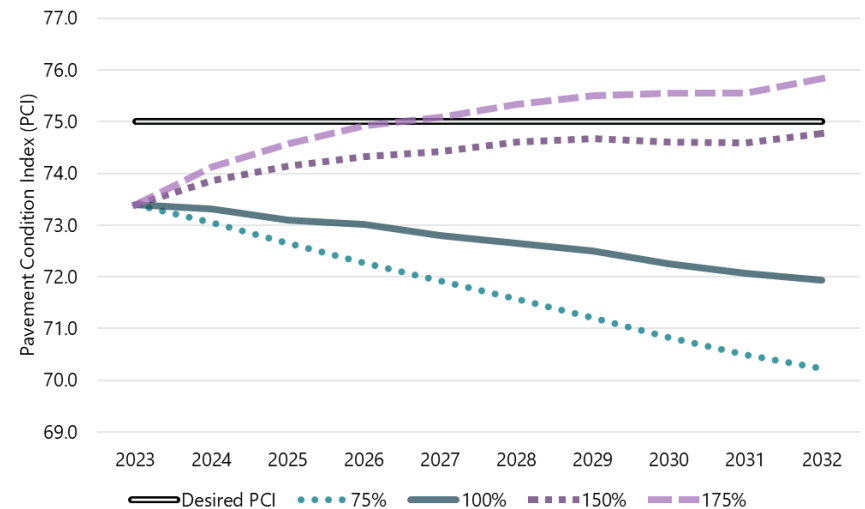
At a system level, Iowa DOT’s desired PCI is an average 80 or greater for the Interstate System and an average of 75 or greater the non-Interstate Primary Highway System. The desired system-level PCI was established in consultation with the Iowa Transportation Commission considering Iowa DOT’s goals and the national goals articulated in MAP-21. Ideally, Iowa DOT would like to maintain current pavement conditions, but some degree of deterioration may be expected even in the most optimistic scenario. The desired system-level PCI reflects the condition Iowa DOT aims to achieve for its pavements, consistent with its goals and objectives for the transportation system, life cycle strategies, and overall level of funding.

Performance projections for Interstate pavements are shown in Figure 4.5 and projections for non-Interstate Primary Highway System pavements are shown in Figure 4.6. Each line in the figures represents average PCI on the system for one investment scenario, while the double flat lines identify the desired system-level PCI. The investment scenarios are labeled by their average level of funding, expressed as a percentage of expected funding. As indicated in the figures, the condition of Interstate System is projected to be maintained in the 100% funding scenario, but the non-Interstate Primary Highway System would require more than 150% of current projected funding to achieve the desired PCI.

Figure 4.5 Interstate pavement condition performance scenarios for PCI



Figure 4.6 Non-Interstate Primary Highway System pavement condition performance scenarios for PCI





2- and 4-Year Targets and 10-Year State of Good Repair (SOGR)

In addition to using PCI to monitor the state-owned highway system, federally defined good, fair, and poor condition metrics are also used to monitor the NHS. These metrics are required to be used for setting 2- and 4-year targets and defining a 10-year desired SOGR for the TAMP.

2- and 4-Year Targets

Federal regulation 23 CFR 490.105 requires that 2 and 4-year targets be set for the condition of pavements on the Interstate System and the non-Interstate NHS. The targets identified for pavements on the Interstate System and non-Interstate NHS document the short-term outcomes that are anticipated from project identification and programming that is based on the life cycle planning, risk management, and investment strategies described in this TAMP. The targets help document what progress is anticipated to be made and what outcomes are likely based on current and anticipated investment strategies. Performance targets create a link between projects that will occur in the next few years and the long-term goals and framework of the TAMP and other performance-based plans, providing a way to gauge whether the investments being made in the system are having the desired or anticipated effect on system condition and performance. Two iterations of targets have been established for FHWA's performance measures for Interstate and non-Interstate NHS pavement condition.

The first performance period for which these regulations were effective was from 2018-2021. Table 4.3 shows the baselines, 2-year targets, 4-year targets, and actual performance for the period. Iowa DOT achieved its 2- and 4-year targets for this time period. It should be noted that baseline performance and 2-year targets were not required for Interstate pavements in the first reporting period. Also, the calculation methodology for non-Interstate NHS pavement condition targets in the first reporting period was based solely on the International Roughness Index (IRI) and did not include other distress metrics.

Iowa DOT established 2- and 4-year targets for the 2022-2025 performance period on October 3, 2022. Targets were established in coordination with MPOs and were reported to FHWA in November 2022. Baselines and targets for this performance period are shown in Table 4.4. Non-Interstate NHS pavement metrics for this performance period are using full distress data and are not comparable to the first performance period. Additional detail on the target setting methodology is available at https://iowadot.gov/systems_planning/fpmam/2022-2025-Pavement-Bridge-Targets.pdf.

Table 4.3: Interstate and non-Interstate NHS pavement performance targets for 2018-2021 performance period

	Baseline (CY 2017 data)	2-Year Target	2-Year Actual (CY 2019 data)	4-Year Target	4-Year Actual (CY 2021 data)
Percent of Interstate pavement in good condition	N/A	N/A	66.1%	49.4%	58.8%
Percent of Interstate pavement in poor condition	N/A	N/A	0.4%	2.7%	0.7%
Percent of Non-Interstate NHS pavement in good condition	50.9%	48.8%	55.4%	46.9%	37.9%
Percent of Non-Interstate NHS pavement in poor condition	10.6%	13.2%	9.3%	14.5%	3.7%

*Note: the year is the data year; e.g., 2019 means 2019 data that was submitted to HPMS in calendar year 2020.
The percent of pavements is measured in terms of lane miles.*

Table 4.4: Interstate and non-Interstate NHS pavement performance targets for 2022-2025 performance period

	Baseline (CY 2021 data)	2-Year Target (CY 2023 data)	4-Year Target (CY 2025 data)
Percent of Interstate pavement in good condition	58.8%	55.0%	55.0%
Percent of Interstate pavement in poor condition	0.4%	3.0%	3.0%
Percent of Non-Interstate NHS pavement in good condition	37.9%	35.0%	35.0%
Percent of Non-Interstate NHS pavement in poor condition	3.7%	6.0%	6.0%

*Note: the year is the data year; e.g., 2021 means 2021 data that was submitted to HPMS in calendar year 2022.
The percent of pavements is measured in terms of lane miles.*



10-Year SOGR

For Interstate pavements, the desired 10-year SOGR is at least 58.8% of lane miles in good condition and no more than 0.7% in poor condition. For non-Interstate NHS pavements, the desired SOGR is at least 39.4% of lane miles in good condition and no more than 5.0% in poor condition. The SOGRs were established by considering Iowa DOT's goals and the national goals articulated in MAP-21. As with PCI, Iowa DOT would like to maintain current pavement conditions, but some degree of deterioration may be expected even in the most optimistic scenario. The desired SOGR reflects the condition Iowa DOT aims to achieve for Interstate and non-Interstate NHS pavements, consistent with its goals and objectives for the transportation system, life cycle strategies, and overall level of funding. The pavement management team reviewed and reaffirmed three of the four SOGRs to be the same as those established for the 2019 TAMP; the non-Interstate NHS poor desired SOGR was lowered as it was determined that the prior SOGR was set at a level that would be higher than acceptable.

The same modeling scenarios used for projecting future PCI were used to project the percentage of Interstate and non-Interstate NHS lane miles in good and poor condition. Figures 4.7-4.10 show the output of this analysis. Each line in the figures represents the percentage of lane miles in good or poor condition for one investment scenario, while the double flat lines identify the desired 10-year SOGR. The investment scenarios are labeled by their average level of funding, expressed as a percentage of expected funding.

For both the Interstate System and the non-Interstate NHS, reaching the 10-year desired SOGR would require additional funding; in both cases, the 125% scenario achieved these condition levels. The gap between projected funding and the desired 10-year SOGR is discussed further in Section 4.3, along with other performance gap considerations and strategies to address the gaps.

Figure 4.7: Interstate pavement condition performance scenarios for federally defined good condition

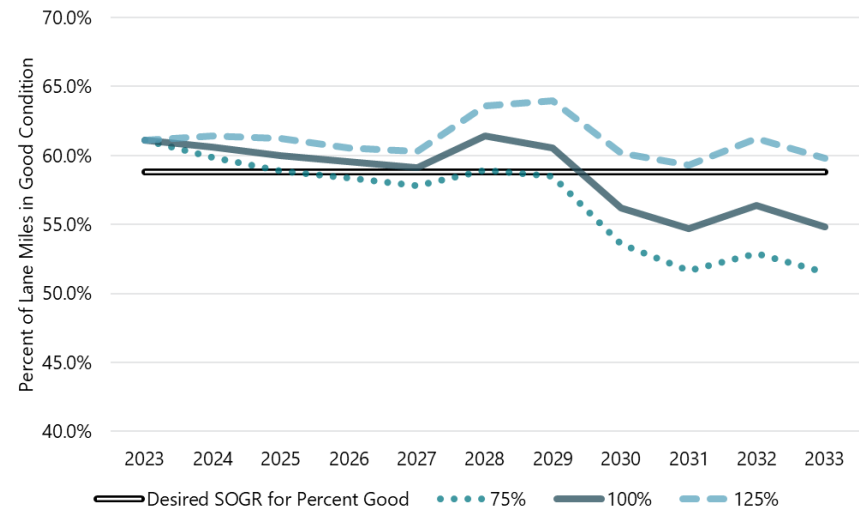


Figure 4.8: Interstate pavement condition performance scenarios for federally defined poor condition

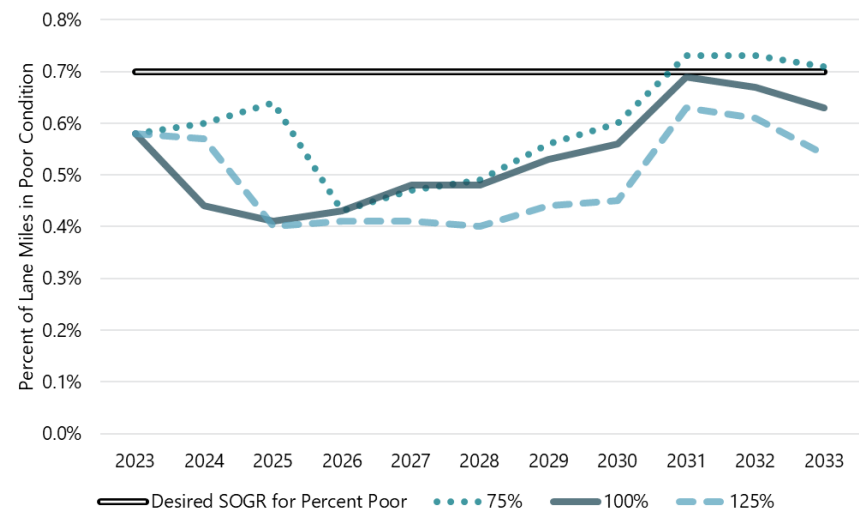


Figure 4.9: Non-Interstate NHS pavement condition performance scenarios for federally defined good condition

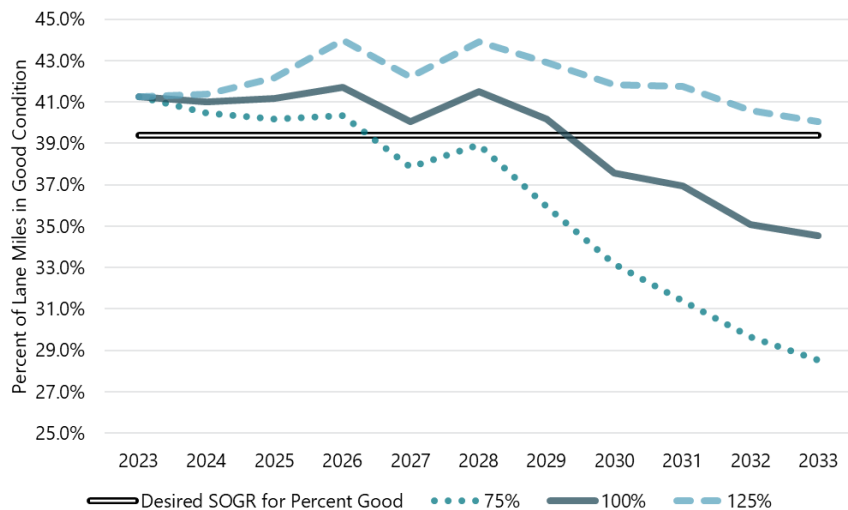
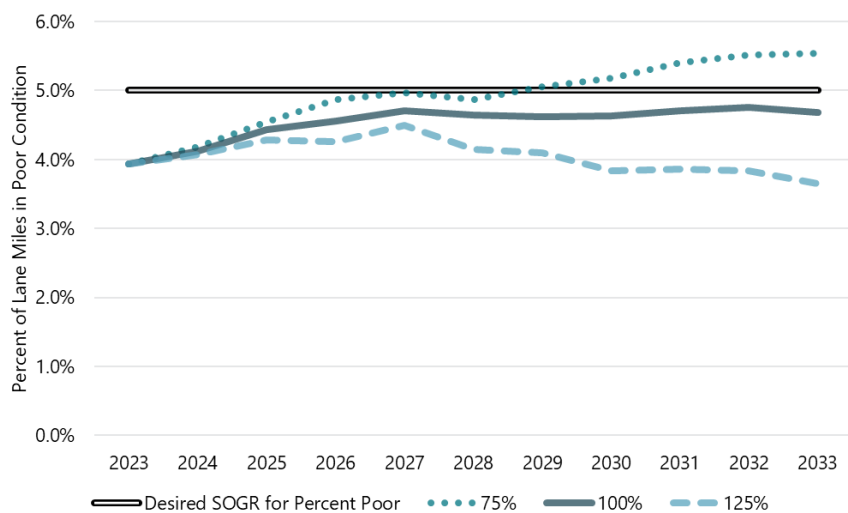


Figure 4.10: Non-Interstate NHS pavement condition performance scenarios for federally defined poor condition



4.3 Gap Assessment

Condition Gaps

FHWA defines a performance gap as “the gaps between the current asset condition and State DOT targets for asset condition, and the gaps in system performance effectiveness that are best addressed by improving the physical assets.” Iowa DOT tracks the gap between current performance and desired SOGR, as well as the gap between 10-year projected performance and desired SOGR. 10-year projected performance is the predicted asset condition assuming current funding levels are continued.

As discussed earlier in this chapter, scenarios with lower funding levels or less optimized project selection were considered in addition to scenarios with additional funding. The less optimal scenarios help Iowa DOT consider the impact of risk on achieving its 10-year SOGR, as the scenarios can be used as sensitivity analyses. They serve as proxies to represent scenarios such as budgets decreasing due to less funding or increased inflation, having less funding for asset management projects due to a need to divert funding for other needs (such as emergency repairs due to natural disasters), or less effectiveness of asset management strategies leading to shorter life cycles for treatments and the need for additional work sooner than anticipated.

Note that current performance uses 2022 data and is consistent with the values presented in Chapter 2 Inventory and Condition. The condition gap assessment is expressed using FHWA’s performance measures for asset condition.



The gap analysis for NHS bridges is shown in Table 4.5. There is no current condition gap for NHS bridges, but there are projected gaps. At the end of the 10-year period of the TAMP, the percent of NHS bridges in poor condition will exceed the desired SOGR by 1.9% and the percent of NHS bridges in good condition will be 3.1% less than the desired SOGR. These projected condition gaps could be addressed with an additional \$784 million in stewardship funding for bridges over the 10-year period of the TAMP.

Table 4.5: NHS bridges performance targets and gap assessment

	Good	Poor
Desired state of good repair	46.8%	6.5%
Current performance	48.6%	2.0%
10-year projected performance	43.7%	8.4%
Current gap	No gap	No gap
Projected gap	3.1%	1.9%

The gap analysis for Interstate pavements is shown in Table 4.6. There are no current gaps for Interstate pavements but there is a projected performance gap for Interstate pavements in good condition. At the end of the 10-year period of the TAMP, the percent of Interstate pavements in poor condition is projected to meet the desired SOGR, but the percent of Interstate pavements in good condition is projected to be 2.4% less than the desired SOGR. The projected condition gap could be addressed with an additional \$77 million in stewardship funding for Interstate pavements over the 10-year period of the TAMP.

Table 4.6: Interstate pavements performance targets and gap assessment

	Good	Poor
Desired state of good repair	58.8%	0.7%
Current performance	58.8%	0.4%
10-year projected performance	56.4%	0.7%
Current gap	No gap	No gap
Projected gap	2.4%	No gap

The gap analysis for non-Interstate NHS pavements is shown in Table 4.7. There are current and projected condition gaps for non-Interstate NHS pavements in good condition. At the end of the 10-year period of the TAMP, the percent of non-Interstate NHS pavements in poor condition will be slightly under the desired SOGR, but the percent of non-Interstate NHS pavements in good condition will be 4.4% less than the desired SOGR. The projected condition gap could be addressed with an additional \$254 million in stewardship funding for non-Interstate NHS pavements over the 10-year period of the TAMP.

Table 4.7: Non-Interstate NHS pavements performance targets and gap assessment

	Good	Poor
Desired state of good repair	39.4%	5.0%
Current performance	37.9%	3.7%
10-year projected performance	35.0%	4.8%
Current gap	1.5%	No gap
Projected gap	4.4%	No gap

For both Interstate and non-Interstate NHS pavements, gaps are expected for good condition but not poor. This suggests Iowa DOT is doing a good job of preventing pavements from slipping into or staying in poor condition, but, overall, more pavements are expected to transition from good to fair over the next decade. This is likely partially due to the way that the federal measures are calculated, where all distress metrics must be in the good category for a segment to be rated as good; even one distress metric in the fair category results in the pavement being considered to be in fair condition.

Other Gaps

The targets documented in the prior sections help support the implementation of the goals and strategies not just of the TAMP, but also of several other Iowa DOT plans, including Iowa in Motion 2050, which is the State Long-Range Transportation Plan (SLRTP), the State Freight Plan (SFP), the Iowa Interstate Investment Plan (I3P), and the Strategic Highway Safety Plan (SHSP). As discussed in Chapter 1, in Iowa DOT's overall planning and programming process, the SLRTP, TAMP, SFP, I3P, SHSP, and other system and modal plans help to focus attention and priorities based on system needs, risks, and strategies. These broader planning efforts help guide the planning and project development process that ultimately leads to the specific investments identified in the Five-Year Program for Iowa DOT projects and the four-year Statewide Transportation Improvement Program (STIP) that includes all projects utilizing federal aid.



The TAMP focuses specifically on bridge and pavement condition. The SLRTP, SFP, I3P, SHSP, and other system and modal plans discuss other potential performance gaps through analysis of transportation system needs and risks, with the aim to improve its performance in areas aligned with national goals, including safety, infrastructure condition, system reliability, freight movement, and reduced congestion. Some of the strategies and projects identified in these plans will likely result in modifications to NHS pavements and bridges, though not necessarily within the 10-year timeframe of the TAMP. If all the strategies from the various plans were implemented, they would likely impact the gap between existing and desired pavement and bridge condition on the NHS by improving or expanding NHS pavement and bridge assets, or by diverting funding that may have otherwise been used to improve NHS pavement or bridge condition. The intent, however, is that these strategies will be implemented over a longer period, and that tactics to minimize any negative impacts on the performance gaps for pavement and bridge condition will be utilized. This would include actions such as performing work to address other issues in an opportunistic fashion when pavement and bridge condition issues are being addressed, and funding non-condition needs from sources other than funds targeted towards pavement or bridge condition improvements.

The remainder of this section highlights analysis and strategies from these other planning efforts and how they may help in closing various performance gaps.



State Long-Range Transportation Plan (SLRTP)

The SLRTP was adopted in 2022 and includes analysis and strategies for the various modes of transportation in the state. For highways, this includes the ten different analysis layers noted below. Pavement and bridge needs on the NHS are anticipated to be addressed primarily through the asset management processes described in this TAMP; for the other analysis layers, the SLRTP helps focus attention on priority locations where there are performance gaps. Implementing projects to address the pavement and bridge needs as well as the other identified needs and risks could result in changes to the bridge and pavement assets on the NHS.

- The **pavement condition** analysis identified candidate condition improvement locations by using the Infrastructure Condition Evaluation (ICE) tool, which provides a composite rating based on the most recent infrastructure condition and performance data.
- The **bridge condition** analysis identified candidate condition improvement locations by using the Bridge Condition Index (BCI), which is calculated based on structural adequacy and safety; serviceability and functional obsolescence; essentiality for public use; and special vulnerabilities.
- The **bottleneck** analysis identified candidate bottleneck improvement locations through a system screening that used traffic speed data to identify segments categorized as bottlenecks due to recurring traffic slowdowns.
- The **Super-2** analysis identified candidate statewide corridors where Super-2 improvements such as passing lanes and turn lanes would enhance operations and complement the state's multilane highway network.
- The **capacity** analysis identified candidate capacity improvement locations through analysis of volume-to-capacity (V/C) conditions based on the statewide travel demand model, MPO travel demand models, and traffic forecasts completed for studies and projects.
- The **operations** analysis identified corridors considered to be higher risk from an operations perspective by using the Infrastructure Condition Evaluation for Operations (ICE-OPS) tool, which is a system screening tool that quantifies the relative risk to the safe and reliable operation of the system.
- The **flood resiliency** analysis (discussed further in Chapter 5) identified corridors vulnerable to a 100-year flood event by using a resiliency metric that includes robustness, redundancy, and criticality components.
- The **safety** analysis identified locations with the greatest potential for crash reduction (PCR) through a statewide analysis that calculated the PCR by examining the predicted numbers of crashes based on the roadway and traffic environment.
- The **bicyclist** analysis identified locations considered to be higher risk for bicyclists based on a statewide analysis that developed composite scores for locations by considering several roadway factors related to the likelihood for risks to bicyclists.
- The **pedestrian** analysis identified locations considered to be higher risk for pedestrians based on a statewide analysis that developed composite scores for locations by considering several roadway factors related to the likelihood for risks to pedestrians.

Iowa Interstate Investment Plan (I3P)

The I3P established a long-term statewide vision for Iowa's Interstate System that can be achieved with available resources. The plan initially detailed the intended purpose and type of work to be performed on every segment of Iowa's Interstate System through the year 2040, and has since been expanded to 2050. The investments described in the I3P were identified to maintain the high level of service in terms of safety and overall pavement and bridge conditions while addressing identified capacity issues. By looking forward 30 years, the I3P ensures projects will address both current and future needs. This supports prioritization of projects by recognizing trends in travel and highway usage to ensure funding is spent where it will provide the most benefit for the longest period of time.

Most of the system will be subject to stewardship treatments aimed at managing the condition and performance of existing pavements and bridges for the lowest achievable life cycle cost. During development of the I3P, Iowa DOT identified segments of the Interstate System expected to require capacity improvements based on projections of future traffic levels. The plan addresses these capacity needs on a prioritized basis. As these projects are developed, they may improve performance in terms of congestion reduction or increased travel time reliability, but if lanes are added rather than utilizing operational solutions the result will be additional inventory of NHS lane miles and bridge deck area that will need to be accounted for in planning future maintenance needs.

State Freight Plan (SFP)

The SFP, updated in 2022, identifies important considerations that may lead to changes to some NHS routes to enhance mobility and/or reduce delay. One such consideration is the identification of the Iowa Multimodal Freight Network (IMFN), which includes several NHS routes. This network is meant to recognize corridors that are critical to truck freight in order to protect and enhance their ability to facilitate freight movement. The IMFN may also lead to department policies regarding the design and use of these corridors, and help assist in programming decisions. The SFP identifies several strategies that may result in investments on NHS routes. These include the following.

- Target investment to address mobility issues that impact freight movements.
- Target investment in the IMFN at a level that reflects the importance of this system for moving freight.
- Rightsize the highway system and apply cost-effective solutions to locations with existing and anticipated issues.
- Enhance planning and asset management practices for the IMFN by utilizing designs and treatments that are compatible with significant freight movements.

Specific investments identified in the SFP include projects on I-80 in Johnson and Cedar counties that will improve the condition and performance of the NHS; however, these projects involve lane expansions that will also increase future maintenance needs.



Strategic Highway Safety Plan (SHSP)

The 2019-2023 SHSP includes engineering strategies to help address issues with lane departure crashes and to improve intersections. These improvements are being implemented as appropriate throughout the state's highway system and may include enhancements to NHS routes. Many of these strategies would not necessarily impact the condition of pavements or bridges or the timeframe in which assets are rehabilitated or replaced. Strategies to help prevent lane departures include the installation of countermeasures such as centerline rumble strips, shoulder/edge line rumble strips, curve delineation, shoulder treatments, and median cable barriers. Strategies to help improve intersections include implementing innovative improvements such as roundabouts, reduced conflict intersections, diverging diamond interchanges, and offset turn lanes; traffic signal modifications; intersection lighting; and bicycle/pedestrian intersection improvements.

Transportation Systems Management and Operations (TSMO) Planning

Several TSMO planning efforts have been underway in recent years, aiming to improve the system's reliability. The goal of TSMO is to proactively manage the performance of the state's transportation system, particularly by managing or mitigating congestion and incidents. Iowa DOT's TSMO Plan, individual Service Layer Plans, and regional studies for integrated corridor management have included projects and activities that will continue to advance the use of TSMO strategies in the state and improve operations of the highway system. TSMO solutions can be beneficial to the NHS as they can help improve its performance without necessarily adding pavement to the system.

Closing the Gaps

Iowa DOT continually reevaluates and works to address the gaps, needs, and risks of the transportation system. This includes refining life cycle planning by integrating new or improved treatments for bridges and pavements and improving modeling systems to help determine what are the right treatments at the right times. Addressing gaps also involves considering the risks documented in Chapter 5 and implementing the response strategies that have been developed to mitigate, or, in the case of positive risks, enhance them. Investment strategies are evaluated annually as part of the development of the Five-Year Program, and funding levels for asset management have increased over time due to growing needs. Investment strategies are also evolving to address critical needs, such as programming funds towards non-Interstate pavement replacement projects.

As noted previously, if all the strategies identified in the various plans were implemented, they would likely impact the gap between existing and desired pavement and bridge condition on the NHS. The gaps, needs, and risks identified through these planning efforts need to be balanced with those discussed in the TAMP as well as the achievement of state and national goals in various areas, including safety, infrastructure condition, system reliability, freight movement, and reduced congestion. Since budgets are limited, implementing the optimal mix of strategies involves tradeoffs. While many projects have benefits for multiple goal areas, some types of projects may improve performance in one area while widening the gap in another. For example, additional lanes may decrease congestion, but those decreases may be temporary, and the long-term outcome includes additional maintenance burdens and potentially increased traffic and emissions. These tradeoffs reinforce the importance of continuing to analyze the system; monitor condition and performance gaps, needs, and risks; develop rightsized solutions that address current needs without increasing future burdens; and refine and implement effective asset management strategies.

Future Gap Assessments

Throughout this chapter, both the Primary Highway System and NHS have typically been discussed in terms of Interstate and non-Interstate portions of each system. The NHS is addressed in this manner due to the federal requirements for the TAMP to address the NHS and for pavement targets to be set separately for the Interstate System and non-Interstate NHS. Iowa DOT has also historically divided the Primary Highway System into Interstate and non-Interstate portions for the purposes of defining preferred system-level BCI or PCI and forecasting various investment scenarios.

As noted in Chapter 1, as part of the 2022 SLRTP update, a rightsizing policy was adopted. The rightsizing policy includes ten policy statements for various areas, many of which relate to asset management. These include defining project needs, incorporating comprehensive needs, placing an emphasis on stewardship, and stratification of the system for purposes like setting state of good repair targets and defining asset management treatments. A work plan is currently being developed to identify ways to implement these policies throughout the project development process, and several activities are already underway.

The rightsizing statement for stratification of the system is: *"The department shall evaluate and consider implementing an approach to stratify the Primary Highway System for the purpose of defining corresponding state of good repair targets and informing investment decisions. Such stratification should consider existing designations, including the National Highway System and Commercial and Industrial Network, functional classification, current and forecasted use, and network redundancy."*

The reason this policy statement was developed is that the Primary Highway System is diverse and complex. It ranges from urban multilane Interstates with over 130,000 vehicles per day to rural two-lane roads with less than 1,000 vehicles per day. Different roadways have different contexts, users, and needs, such as freight routes, commuter corridors, community access, and so on. These purposes may need to be managed differently and to a different level. For example, it may be appropriate to target a higher level of service or condition level on a busy freight route than on a less utilized highway that primarily provides access for local traffic. Stratification beyond Interstate and non-Interstate could inform condition targets as well as the types of treatments that would be considered for particular roadways. Only defining desired PCI and BCI at the Interstate and non-Interstate Primary Highway System levels for pavements and bridges does not provide adequate delineation given the wide range of characteristics seen on non-Interstate highways. Additional stratification would provide important context to asset management planning and investment decisions.

The discussion of how to stratify the system began with a working group formed under the TAM Technical Committee. The group reviewed formal and informal ways that the highway system is classified for various purposes. Ultimately, a recommendation was made to move forward with a system stratified into the following four classifications by priority, which are shown in Figure 4.11.

- **Interstate System**
- **Commercial and Industrial Network (CIN)**, which is an Iowa DOT designation for a specific network of highways which are critical for linking regional centers, providing continuity with major highways in adjacent states, and carrying a large portion of non-Interstate traffic; the CIN is entirely on the NHS
- **Other NHS**
- **Other Primary Highway System (non-NHS)**



While not yet incorporated into the processes discussed in this TAMP, an evaluation of PCI and BCI metrics for the new stratification is currently underway. The pavement and bridge management teams will review this information and consider future steps, which may include developing distinct state-level PCI and BCI targets for the classifications, incorporating the stratification into pavement and bridge modeling scenarios, and considering policies or investment strategies related to the range of treatment types that will be considered based on stratification. Since the stratification is still separating the NHS and non-NHS portions of the Primary Highway System, it has the benefit of being able to be integrated with the TAMP and the requirements that are specific to the NHS. This could ultimately lead to a more advanced gap discussion for pavement and bridge condition in the next iteration of the TAMP by introducing additional nuances related to the more detailed stratification.

Figure 4.11: Recommended Primary Highway System stratification

