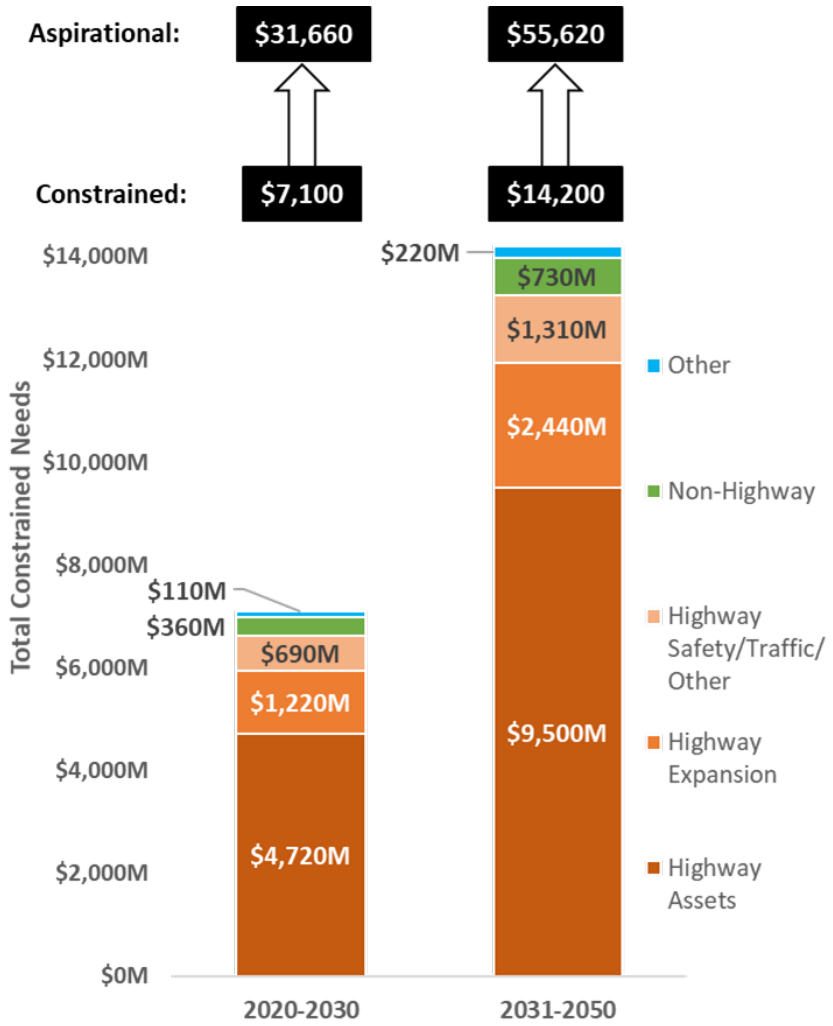
Technical Report – Existing and Future Multimodal Transportation Needs

This report identifies and explains multimodal transportation capital, maintenance and operating investment needs instrumental to the transportation planning process led by West Virginia Department of Transportation. Addressing multimodal transportation needs is vital for meeting system efficiency, reliability, durability, and safety goals.

- Transportation needs come from data, tools, plans, and expert input on asset deficiencies, traffic safety challenges, highway congestion and reliability, multimodal network gaps, and other critical issues that are part of maintaining and operating a safe, efficient, and reliable system.
- Not all needs are the same – **constrained needs** are more real and associated with existing plans and programs; **aspirational needs** are unconstrained and focus on long-term transportation visions and goals.
- Required spending such as debt service, routine maintenance, and administrative costs are considered mandatory and are not reflected as needs.
- Transportation systems require upkeep for safe and reliable use. **Pavement and bridge assets** across 38,000 miles of roadway representing 67% ($4,720 million) of constrained transportation needs through 2050.
- Highway safety is a transportation and public health issue. **Highway safety, expansion, and operations** connects residents and businesses, representing 27% ($1,910 million) of constrained transportation needs through 2050.
- Multimodal and intermodal connections keep West Virginia's economy moving and provides opportunities to all residents. **Non-highway needs** include active transportation, aviation, transit, and rail – representing 5% ($360 million) of constrained transportation needs through 2050.
- **Other needs** reflect statewide transportation actions that leverage other state and federal agency commitments to cross-cutting issues like public health, education, tourism, and resiliency.
- **Needs typically exceed revenues. West Virginia may face a revenue shortfall of $1.1B by 2030 and $6.4B by 2050 based on conservative revenue estimates.**
- **Total aspirational needs are 3 to 4 times higher than constrained needs.**
- The 2050 LRTP will help WVDOT prioritize approaches to address these needs, leading to future investments by mode, timeframe, and system responsibility.

Estimated Summary of Future Needs



1. Introduction

Needs Inform Investments

Detailing a comprehensive inventory of multimodal transportation capital, maintenance, and operating needs ("needs") is foundational to the development of the 2050 West Virginia Long-Range Transportation Plan (LRTP). Future needs support Phase 3 of the planning process **(Figure 1)** designed to inform future priority investment recommendations in Phase 4 and Phase 5. The LRTP needs presented through a single, multimodal framework provides a full accounting of short- and long- term forecasts associated with transportation demand, asset conditions, and other factors impacting West Virginia's transportation system. Itemizing, organizing, and understanding the depth and breadth of system-wide multimodal needs helps guide future program level investment decisions necessary to deliver safe, efficient, and reliable travel for all current and future transportation system users.

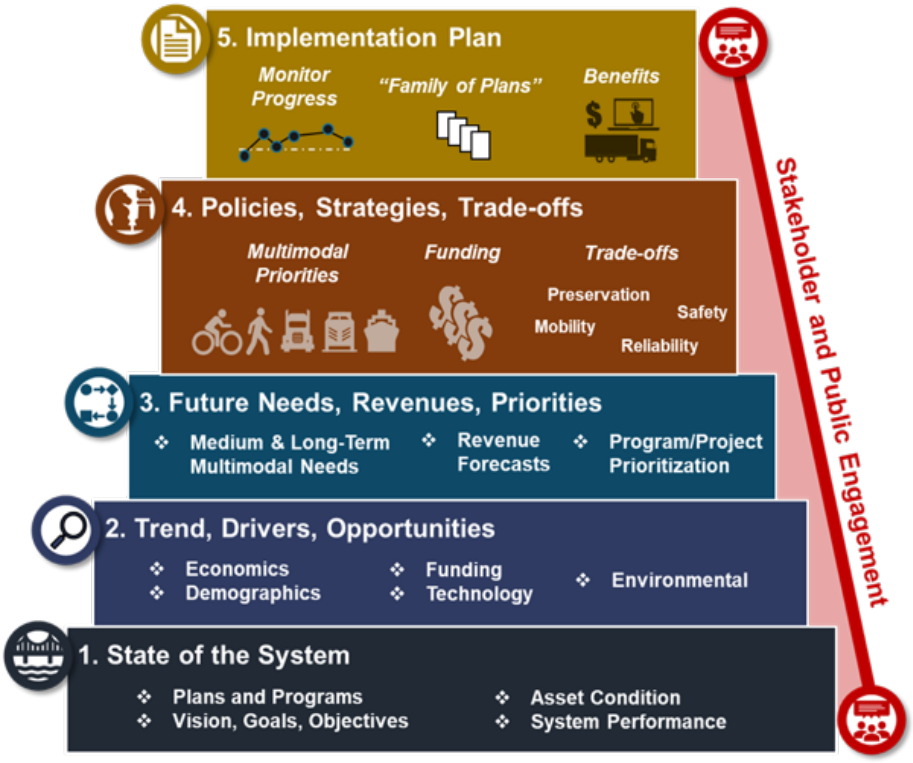


Figure 1 – Needs within the 2050 Plan Development Process

Multimodal needs include publicly maintained multimodal systems under the responsibility of West Virginia Department of Transportation (WVDOT), assets maintained by the West Virginia Parkways Authority, as part of the West Virginia Turnpike, and locally managed transportation services. WVDOT maintains 90% of the state's public road miles with nearly 83% of these miles in rural areas. This size of system responsibility and mountainous terrain directs most financial resources towards preserving, rehabilitating, and replacing highway bridge and pavement assets. Non-highway needs are addressed through a mix of federal and non-WVDOT funding sources. Aviation and transit operators rely on federal grants and local contributions to manage, maintain, and improve capital and operating services. Rail improvements depend on annual recurring state appropriations, federal formula funding and private railroad commitments. As an operator the West Virginia State Rail Authority (WVSRA) can also fund system improvements through service revenues or issuance of bonds. Active transportation accommodation can occur through state funded highway improvements or through federal grants and local support. ***This Needs Assessment provides the overarching approach, methodologies, and processes used to construct a full range of estimated needs to 2050.***

Section 1: Introduction describes the process which governs the approach and frames the results. **Section 2: Sources to Underlying Needs** documents key sources foundational to the Needs Assessment. **Section 3: Summary of Estimated Needs** presents needs by asset type, mode, and program area through 2030 and 2050. **Section 4: Highway Needs** and **Section 5**: **Non-Highway Needs** presents needs by mode and asset. **Section 6: Needs in Perspective** details high level takeaways and overarching conclusions. The **Appendices** provide technical detail as well as *"At-A-Glance"* 2-page Fact Sheets itemizing short- and long-term estimates and emerging trends.

Defining Needs

Multimodal transportation needs within the 2050 LRTP are drawn from a diversity of sources to compile needs in a comprehensive fashion over multiple decades. The focus of the assessment is on capital investment needs – expenses for debt service, routine maintenance, staff salaries and other expenses not directly attributable to capital costs are assumed to be mandatory and are accounted for separately.

Utilizing a comprehensive methodology requires multiple tools and sources to address and define needs across different time horizons, ultimately focusing to 2050 (**Figure 2**). Identifying individual needs by timeframe helps to address shared statewide multimodal transportation interests across WVDOT as well as partner needs through active transportation, transit, rail, and aviation systems. The methodology also incorporates needs from regional stakeholders such as Metropolitan Planning Organizations (MPOs), Regional Planning Development Councils (RPDCs), federal and state partners, interest groups, and elected officials to help meet the objectives of developing a multimodal statewide plan.

The 2050 LRTP research and analysis shows that needs can be structure-driven, plan-driven, and/or data-driven. Understanding current and expected conditions requires using an inclusive analytical process to allow needs to be "rolled-up" into a summary as well as "rolled-down" into individual details. West Virginia's transportation needs reflect a "bottom-up" approach compiling project specific needs with projected network-based improvements across time periods, local geographies, as well as state-maintained and locally managed systems. Needs framed by programs allows WVDOT to evaluate tradeoffs between competing priorities to aid developing a long-term investment portfolio addressing broad, cross-cutting statewide goals (economic, health, technology, education, tourism), facilitate decision making, and investment placement.

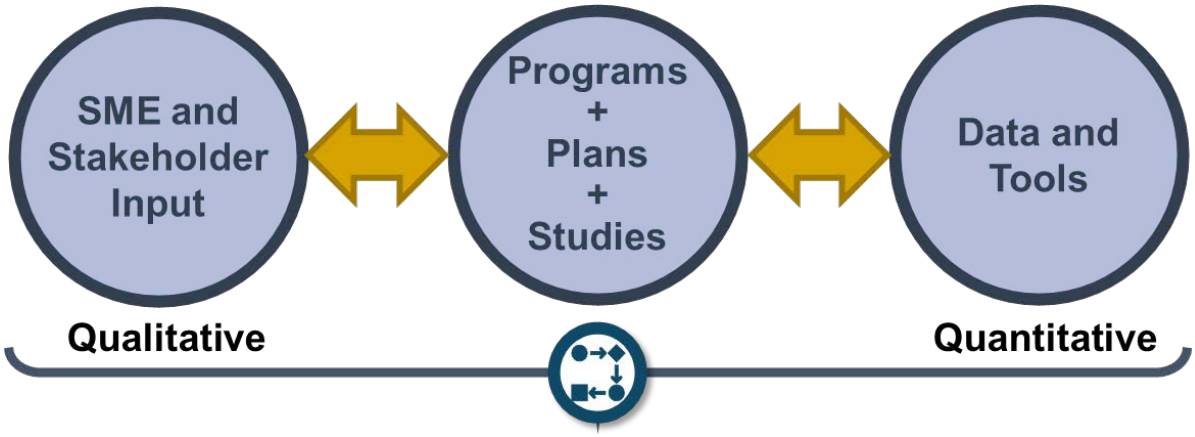


Figure 2 – Needs Assessment Inputs

Needs are defined as network-based and project-specific capital costs reflective of the sources and methods which generate them. Different owners and operators are responsible for multimodal transportation capital and operating improvements which prevents one model from representing all of West Virginia's transportation needs. To the extent possible, methodologies differentiate multimodal needs from sources of needs that are drawn from projections of future demand, asset deterioration, and locally based project lists. WVDOT staff and subject matter expert (SME) review at each step validated the analytical process alongside known limitations important for interpreting estimates.

Results of the needs assessment should be interpreted in-light of some methodology limitations including:

- **Planning Level Estimate** Quantifying statewide multimodal transportation needs to 2050 is challenged by forecasting uncertainty beyond the next 5 to 10- years and reliance on a mix of source assumptions and variables outside a single model. Highway and non-highway project and asset improvement needs vary across regions based on local demand and underlying infrastructure conditions represented on a statewide scale. Therefore, while useful, planning-level estimates should be interpreted as order-of-magnitude outcomes.
- **Snapshot-in-Time** Need estimates cannot predict changing conditions likely to occur over 30-years. Changes may occur unevenly across West Virginia urban and rural geographies and other dependencies like technology infrastructure for automated or connected vehicles. The LRTP forecast is based on best available data informed by analytical predictions of future infrastructure deterioration and demand as well as short-term agency policy, projects, and programs like Roads to Prosperity or State Transportation Improvement Program (STIP) projects.
- **Performance Applicability** WVDOT's performance management approach continues to improve, both to address Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) requirements, while also increasingly integrating performance measures into investment decisions. The quality and confidence of performance trends are variable by asset and system, constraining how widespread performance can be used to inform needs.
- **Statewide Travel Demand Model** The absence of a single tool to predict future statewide travel demand limits specifying highway expansion needs to plans and projects instead of using a "top down" network- or corridor-based approach.
- **Asset Management Systems** WVDOT's Bridge and Pavement Management Systems (BMS/PMS) are the primary tools to forecast asset condition estimates beyond the next 10 years. The BMS/PMS model capabilities are still evolving subject to further calibration to reflect real world conditions. The model remains heavily reliant on accurate and timely existing asset condition data, system decision trees, treatment costs, and deterioration curves.
- **Rural Needs** Sources include WVDOT plans and studies, input from stakeholder surveys, and limited project-specific information through RPDCs. There are limited comprehensive planning documents in rural areas upon which needs can be based.

Information Sources

Information from multiple methods (**Figure 3**) helped to validate needs. BMS/PMS results for bridges and pavements were reviewed and adjusted compared to revenue assumptions, agency commitments, and performance targets. Long-term trends were guided by mode or system specific studies and local long-range plans. Survey feedback informed priorities and imminent needs while stakeholder interviews identified and prioritized upcoming actions.

Needs Organization

Needs are reported and organized (**Figure 4**) by highway, multimodal and cross cutting categories and subcategories. Highway needs are broken down into asset, safety, operation, and expansion related subcategories. Multimodal needs are organized by non-highway mode. An additional step ties highway and non-highway needs to broader state goals and objectives. This association facilitates strategic consideration of transportation investment to future WVDOT program priorities such as scoping a new interchange within highway expansion to an emerging employment center (**economic**) or supporting partnerships which deliver broadband to underserved communities through corridor improvements (**technology**).

Asset Management Systems Bridge and pavement needs developed through WVDOT models and guided by baseline revenue and performance-based scenarios.

Metropolitan Planning Organization (MPO) LRTPs Multimodal project- specific improvements from eight (8) urbanized regions including both fiscally constrained and vision projects.

Subject Matter Experts (SMEs) WVDOT staff who oversee specific programs and/or modal divisions helped "ground truth" information to supplement the analysis.

Stakeholder Survey Results from a public survey with 106 participants representing WVDOT, MPOs, Regional Planning and Development Councils, and other agencies.

Figure 3 – Information Methods and Sources

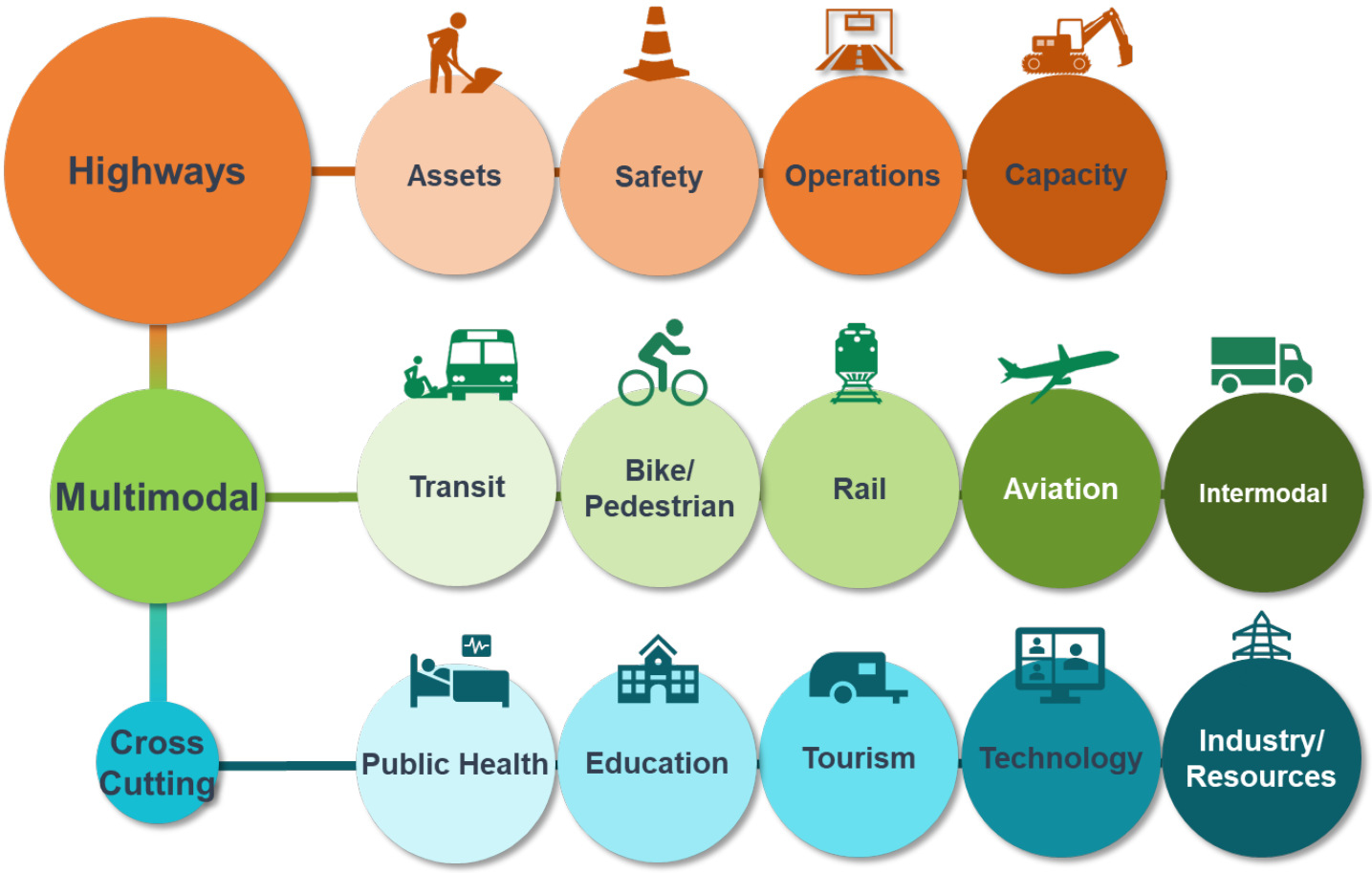


Figure 4 – Organization of Needs Assessment

Performance Targets & State Goals West Virginia's transportation needs are determined from costs of recommended projects within long-range plans meeting future demand, and from performance-based assessments to maintain acceptable levels of pavement and bridge condition across the transportation network. National Highway System (NHS) and non-NHS bridge and pavements are evaluated through deterioration assumptions assumed in WVDOT's BMS/PMS sourced to WVDOT average per mile treatment costs for improving assets to desired condition levels. BMS/PMS assigns a WVDOT-approved level of treatment to assets based on desired performance targets to maintain/reduce the percentage of miles or structures in Good or Fair/Poor condition.

Needs also reflect the cost of addressing existing and future demand in area- (MPO LRTP) or mode-specific (Rail) plans and scenarios to maintain acceptable asset conditions. Bridge and Pavement assets were evaluated through asset management system models designed to allocate treatments to meet established targets. Estimating needs based on performance targets separated by mid- and long-range timeframes help describe minimum investment levels required to meet and maintain operational standards as well what surpasses expectations. Performance measures guide mode-specific goals into improvement opportunities necessary to translate into financial estimates meeting state goals.

Constrained and Aspirational

The needs inventory starts from a 2020 baseline and is reported in 10-year and 30-year increments to show the extent of needs by decade, tied to assumed population growth, infrastructure system needs, program expenditures (such as safety and traffic operations), and other demand- and/or project-specific improvements from sources outlined in **Section 2**.

"Low" and "high" ranges describe the full representation of highway and non-highway needs based on multiple sources, scenarios and assumptions bound by **constrained** versus **aspirational** benchmarks (**Figure 5**). The **constrained** benchmark includes a tailored list of highway and non-highway mobility projects, fiscally constrained MPO LRTP recommendations, and outputs from PMS/BMS guided by a constrained revenue forecast. The **aspirational** benchmark includes the **constrained** estimates plus a list of unfunded and vision-based mobility improvements reflective of investment required to meet higher performance on bridges and pavement.

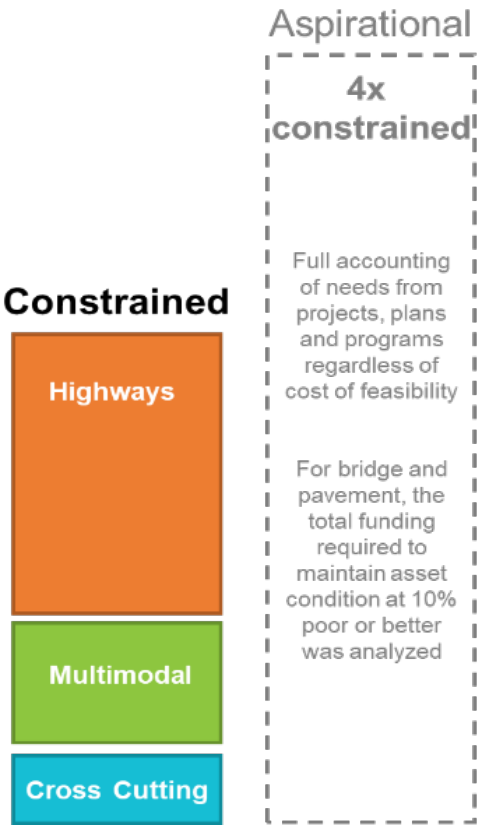


Figure 5 – Needs Assessment Ranges

Needs Assessment Platform (NAP)

The inventory of short- and long-term transportation needs is captured in the **Needs Assessment Platform (NAP)**. The NAP houses all transportation needs in an Excel database capable of reporting needs by timeframe, mode, sub mode, source, and other program plus investment-related categories. NAP results illustrate forecasts of mode-specific, program-based, or deterioration-based analyses from conversations with SMEs as well as from tools like the **dTIMS** used in all asset analyses. As a live, evolving database, the **NAP** is able to support future LRTP, system and mode-specific plans as they come online. Future **NAP** functionality could add geospatial reference components and other tailored reporting capabilities to respond to a variety of federal, state, or local partner inquiries.

Missing Links

Preexisting gaps compound needs across multiple years, and needs can become buried once published in plans or studies. Individual conversations with stakeholders helped collect and itemize needs present throughout rural West Virginia as most rural transportation assets are excluded from NHS and/or WVDOT management. Some needs were comparable to documented needs along uncompleted sections of the Appalachian Development Highway System (ADHS) in West Virginia, but other needs had never been documented by WVDOT, an MPO, or an RPDC. Developing a single base year brought needs from prior published plans to the same year as needs from current sources. Needs without clear sources like rural needs from non-government assets are organized, reconciled, and brought to the base year for a construction cost in 2020 dollars for immediate relevance and applicability.

2. Need Sources

Existing plans that document fiscally constrained and needs-based projects help to qualitatively shape 2050 LRTP needs. **Twenty-five (25) sources** assisted in developing the inventory including LRTPs from West Virginia's eight MPOs; recent federally required statewide multimodal system plans like the Rail Plan, Freight Plan, and the Transportation Asset Management Plan (TAMP); as well as other current and historical state sources like current and prior LRTPs and mode-specific materials.

Studying prior plans, studies, and reports provides context to build the foundation for demand forecasts and analyses used to build future trends into long-term needs (**Figure 6**). These specific sources used across non-highway and highway need categories were refined into short- and long-term multimodal transportation needs resulting in a combination of project specific, network based (assets), and program-based needs sourced to a single need like continuing to fund effective road safety programs.

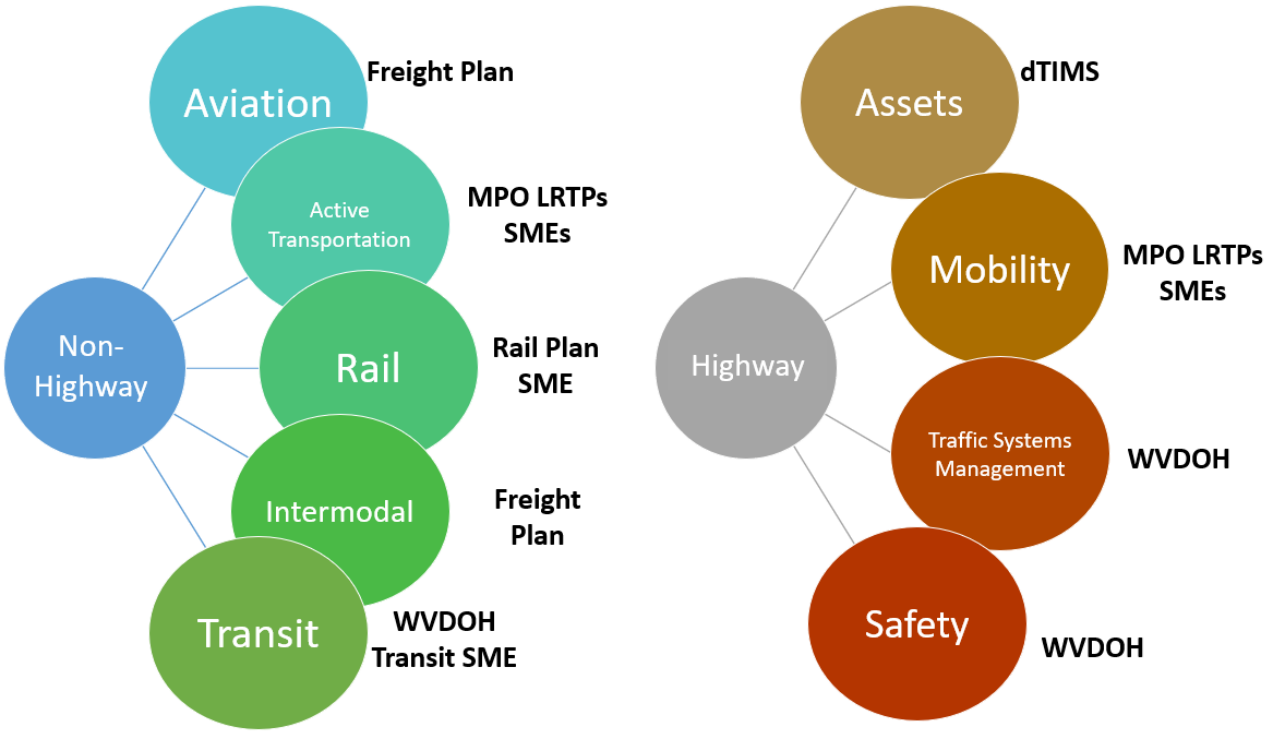


Figure 6 Non-Highway and Highway Sources

Long-term (2030 – 2050) needs are influenced by a number of difficult to measure external factors. These factors can include inflation and labor and material cost changes, changing or elevating statewide priorities such as safety as noted in the West Virginia Strategic Highway Safety Plan (2017 – 2021) and the integration of technology within the transportation system as noted in the recent West Virginia Broadband Plan (2020 – 2025). Some needs highlighted within these plans and others are considered outdated given publish dates around five (5) to ten (10) years ago combined with the statewide system's overall expansion across all modes in addition to external factors like changing demographics and development patterns.[1]

[1] For example, the Multi-Modal Plan in 2010 identified project needs between 2010 and 2035 for each mode. The needs analysis mainly focused on system deficiencies for highway and bridges, totaling $4 billion in 2007 dollars.

Transportation Asset Management Plan (TAMP)

As the most recent available source, West Virginia's 2019 TAMP was invaluable for compiling pavement and bridge asset needs on the NHS. The TAMP provides a baseline for forecasting long-term 2030-2050 needs from documented 10-year bridge and pavement needs. As highlighted in the TAMP, WVDOT is already working proactively to implement strategies extending performance life of critical assets and balancing investments needed to maintain statewide targets in the areas of safety, mobility, congestion, and freight.

- **Bridges** Out of the 1,294 bridges, a majority are in fair condition, but 30% currently in service in West Virginia were built in the 1960's-1970's. Approximately a third of bridges are around 50 years old, many are close to reaching the end of their design life and are crossing into the poor category. Future issues relative to climate-change and extreme weather will also create risk to these assets.
- **Pavement** Out of 3,451 NHS centerline miles, 83% of the Interstate miles and 61% of non-Interstate NHS is in good condition based on FHWA metrics adopted through the rule making process for MAP-21 and the FAST Act. Overall funding has declined in recent years for the bridge program, due to an increased interest in rehabilitation of pavement projects in areas of the state which are depressed or unsafe and for system expansion projects.

WV State Rail Plan

West Virginia's latest State Rail Plan published in 2020 addresses freight and passenger rail needs to improve movement and facility access. Rail freight needs aim to grow opportunities to diversify the commodity base by providing connections to intermodal facilities as well as existing or emerging industries through expanded capacity and mainline improvements. Rail passenger needs focus on enhancing the reliability and functionality of the existing system for riders. This includes a combination of station improvements and marketing to attract users as well as the necessity for thru-bus and other mode-to-mode connections bringing passengers to rail terminals. The 2020 plan includes stakeholders and customer perspectives on emerging and long-term needs. Needs cited in this report are sourced to both the 2020 plan and unfunded projects from the 2013 plan.

WV State Freight Plan

West Virginia's State Freight Plan, published in 2018, identifies 94 transportation projects from the State Rail Plan, Strategic Port Master Plan, and the Multimodal Statewide Transportation Plan as well as incorporates input from stakeholders benefiting freight movement. Projects are in areas of increasing freight bottlenecks which are essential to alleviating freight congestion as well as improving mobility on the highway system.

MPO LRTPs

West Virginia has eight (8) MPOs that develop their own LRTP every 3-4 years focused on their individual districts encompassing separate geographic areas (**Figure 7**). Five (5) of the eight (8) MPOs share borders with neighboring states. MPOs are federally required to develop LRTPs with a minimum 20-year planning horizon; planning horizons for these LRTPs are between 2040 and 2045. These LRTPs contain both short-term Transportation Improvement Program (TIP) and long-range projects with planning-year construction cost estimates.

MPOs develop plans specific to individual transportation-modes to flesh out long-term needs and cost estimates vital for the 2050 LRTP. Sources are reviewed extensively to compare to WVDOT sources, to eliminate duplicates, check cost estimates, and verify project descriptions. MPOs use a mix of approaches to estimate project costs spanning form current costs to nominal dollars to projected year of expenditure values to inflate estimates. For consistency, prior year values or nominal forecasted values are inflated or deflated to bring all estimates to a 2020 base year.

RPDC CEDS West Virginia has eleven (11) RPDCs created by state legislature in 1971 to serve as "development districts to more effectively utilize funding resources and maximize small communities' chances of attracting funds from federal, state, and local organizations to foster community and cooperation throughout the state"[2] (**Figure 8**). Reviewing Comprehensive Economic Development Strategy Plans (CEDS) created by the RPDCs helped further develop long-term needs for the 2050 LRTP as the CEDS identify regional economic and community development needs to guide economic growth strategies. Regional Councils publish other plans also helpful to review in building out the long-term needs like Broadband, Traffic Mitigation, Hazard Mitigation, and Coordinated Public Transit-Human Services plans.

Figure 7 West Virginia MPOs

Source: WVAMPO

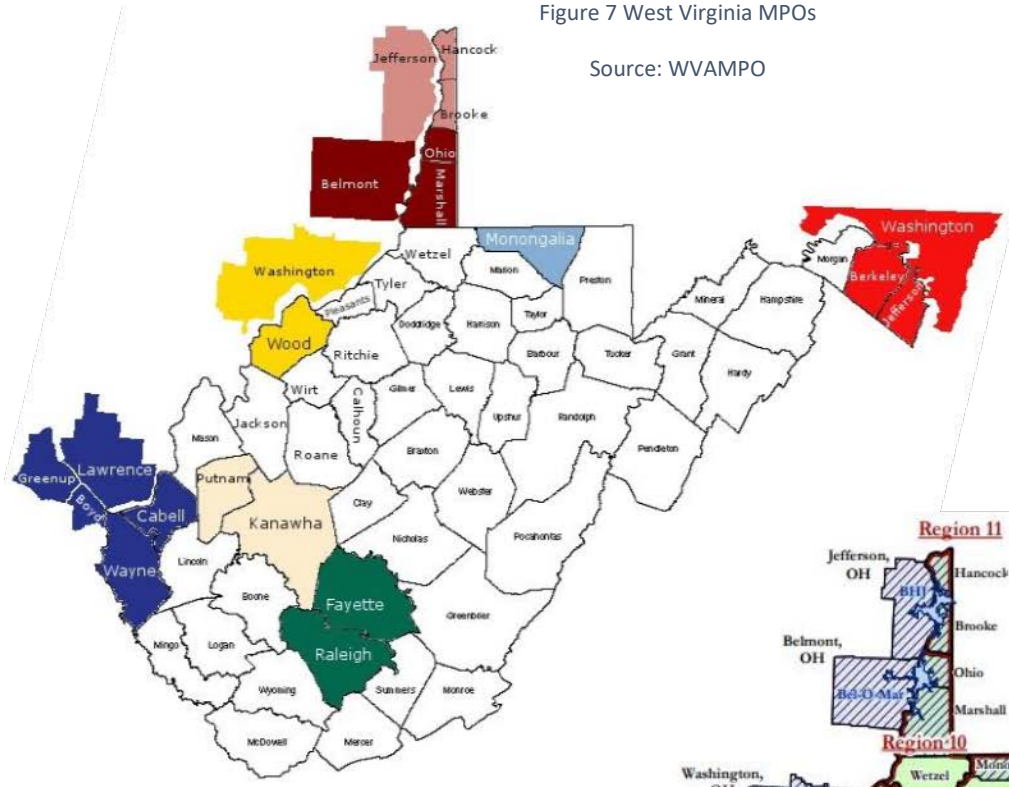
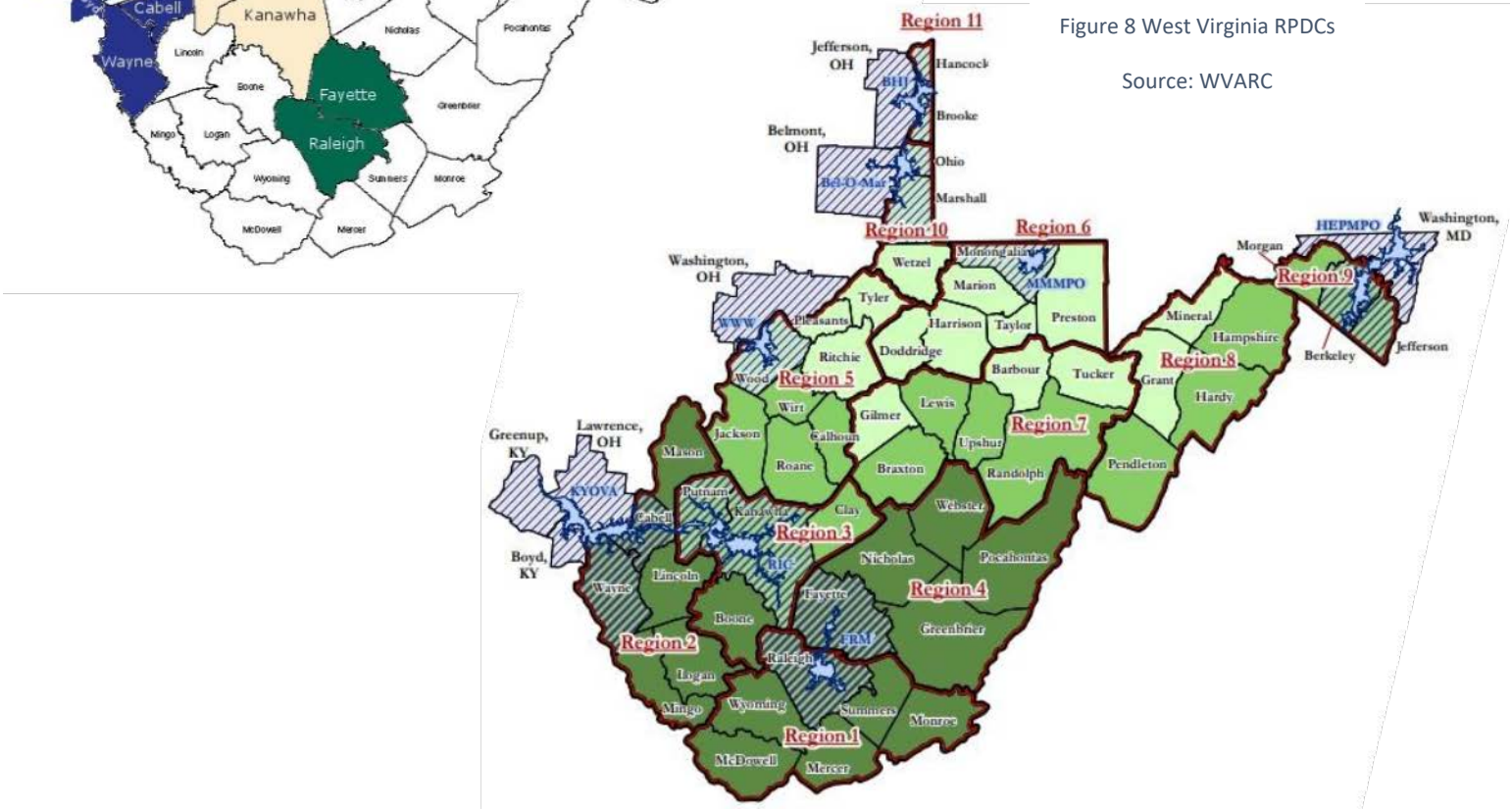


Figure 8 West Virginia RPDCs

Source: WVARC



[2] https://www.wvregionalcouncils.org/

3. Summary of Estimated Needs

Needs are estimated from a 2020 base year by mode and sub-mode across different methodologies, tools, and sources (**Figure 9**).

Mode	Sub-Mode	Methodology	Tools / Sources	Representation
Highway	Assets* (Bridge and Pavement)	Deterioration-based; treatment in line with revenue availability, thresholds for State of Good Repair or stated performance	BMS/PMS	Quantitative
	Expansion (widening, bypasses, interchanges, etc…)	Demand- and inventory-based; forecasted passenger and freight volume/capacity	MPO LRTPs 2018 WVDOT Freight Plan, 2010 WVDOT LRTP	Quantitative/ Qualitative
	Safety	Forecasted annualized obligations for statewide safety treatments	SME input / historical trends	Qualitative
	Traffic Operations	Forecasted annualized expenses to maintain and install new infrastructure; project specific localized needs	SME input / MPO plans	Qualitative
Non-Highway	Active Transportation, Aviation, Transit, Rail	Project specific localized needs	MPO LRTPs 2018 WVDOT Freight Plan 2013,2020 WVDOT Rail Plan	Quantitative/ Qualitative
Other	Highway and Non-highway projects	Project specific needs which do not fall within highway or non-highway modes	Scan of DOH, MPO plans	Qualitative

* Note: Drainage, guardrail, retaining walls and slide assets were not included. These represent a significant investment for WVDOH.

Figure 8 Methodology Representation by Mode

In general, non-highway multimodal needs are sourced to specific system plans and/or MPO LRTPs. Supporting components of highway assets – such as drainage, guardrail, retaining walls, signs and lighting were outside the analysis and not quantified. Specific analytical steps for all modes/sub-modes except *highway safety*, *pavements*, *bridges, and operations* were as follows:

- **Sources to Needs** Costs of projects listed across twenty-five (25) sources (**Section 2**) are added to create a final list of Needs. Short-term commitments for Roads to Prosperity program and 2020-2026 STIP projects are excluded from the final list and treated as "committed for construction." Turnpike needs are also excluded as toll revenue funds capacity needs. Across MPO LRTPs, projects in the first phase or MPO TIP as well as projects outside West Virginia (Ohio, Maryland, Kentucky) are excluded.
- **Needs into Categories** Projects are organized into three (3) categories: ***mode*** (ex. highway), ***sub-mode*** (ex. expansion), and ***sub-category*** (ex. widening) as well as separated by **constrained** versus **aspirational** guidelines based on sources and input from WVDOT.
- **Consistent Dollars ($)** All values are inflated or deflated to reach current 2020 dollars ($) using an assumed annual rate of 4.5% consistent with the average inflation across MPO LRTPs and FHWA practice.
- **Adjustments** Project costs from researched plans were updated reflecting information from WVDOT. If the project was deemed to be partially completed, costs were reduced 25%. All duplicate projects between MPO and/or WVDOT plans were eliminated and/or consolidated to reflect the most recent information. Adjustments were applied to serve as the basis for 30 year planning level estimates. Highway projects less than $20 million were increased by 40% and those more than $20 million were increased by 20% to reflect anticipated construction cost increases over the planning horizon.

- **SME Input** Interviews with eight (8) SME groups between December 2020 and January 2021 provided valuable qualitative information behind needs, supplementing publicly available information, and expanding on other trends behind mode-specific needs and challenges. Conversations with SMEs were instrumental to validate data files and provide additional source materials, supporting follow-up requests, and facilitating opportunities for further connections integrating across the system.
- **Stakeholder Survey Input** Survey results included asking stakeholders to prioritize highest order of needs and provide feedback on needs focus areas. The survey results reinforced research findings based on perspectives from WVDOT staff, local partners, and state agencies (for more information see the **Needs Assessment Fact Sheets on the 2050 LRTP website**).[3] Key takeaways include:
  - **Highway safety is the second-most important need statewide and locally.**
  - **Highway expansion is the second-least important need in non-urban areas.**
  - **WVDOT and MPO employees agreed that maintaining a State of Good Repair was the most important need statewide and locally.**
  - **Pedestrian amenities are the most important non-highway need within urban areas.**
  - **Generally, on-demand transit service in rural areas is considered more important than fixed-route service in urban areas.**

Describing needs, trends, and emerging issues which shape each **constrained** and **aspirational** forecast by mode and program portrays how qualitative needs inform the presentation of quantitative values. Needs are reported in 10 and 30-year increments starting from 2020 and are based in 2020 dollars in line with the ***Revenue Forecast*** (**Figure 10** and **Figure 11**).

Section 4 and **Section 5** in addition to the **2-page Fact Sheets** (**available as companion summary documents on the LRTP website)** explain needs by mode and program area, summarizing projected needs by improvement type and short and long-term estimates. Multimodal needs are a synthesis of forecasted results developed through methodologies and processes noted above to articulate needs generated across the spectrum of quantitative to qualitative analysis validated from subject matter expert input.

[3] The Stakeholder Survey consisted of 23 responses from WVDOT employees, 16 responses from MPO employees (at least one person from every MPO). Many responses came from individuals representing cities in West Virginia like Martinsburg and Morgantown as well as from Development Authorities like the Berkeley County Development Authority. Individuals within many WVDOT agencies also responded, representing Civil Rights, Highways, Public Transit, Governor's Highway Safety Program, Aeronautics, and Parkways.

CONSTRAINED (LOW-END ESTIMATE)			
	2020-2030	2031-2050	Total
Highways	**$6,630 M**	**$13,250 M**	**$19,880 M**
Bridge	$2,170 M	$4,620 M	$6,790 M
Pavement	$2,550 M	$4,880 M	$7,430 M
Highway Expansion	$1,220 M	$2,440 M	$3,660 M
Highway Traffic Ops	$270 M	$550 M	$820 M
Highway Safety	$400 M	$720 M	$1,120 M
Highway Other	$20 M	$40 M	$60 M
Non-Highways	**$360 M**	**$730 M**	**$1,090 M**
Active Transportation	$120 M	$240 M	$360 M
Aviation	$40 M	$80 M	$120 M
Transit	$150 M	$300 M	$450 M
Rail	$50 M	$110 M	$160 M
Other	**$110 M**	**$220 M**	**$330 M**
Total	**$7,100 M**	**$14,200 M**	**$21,300 M**

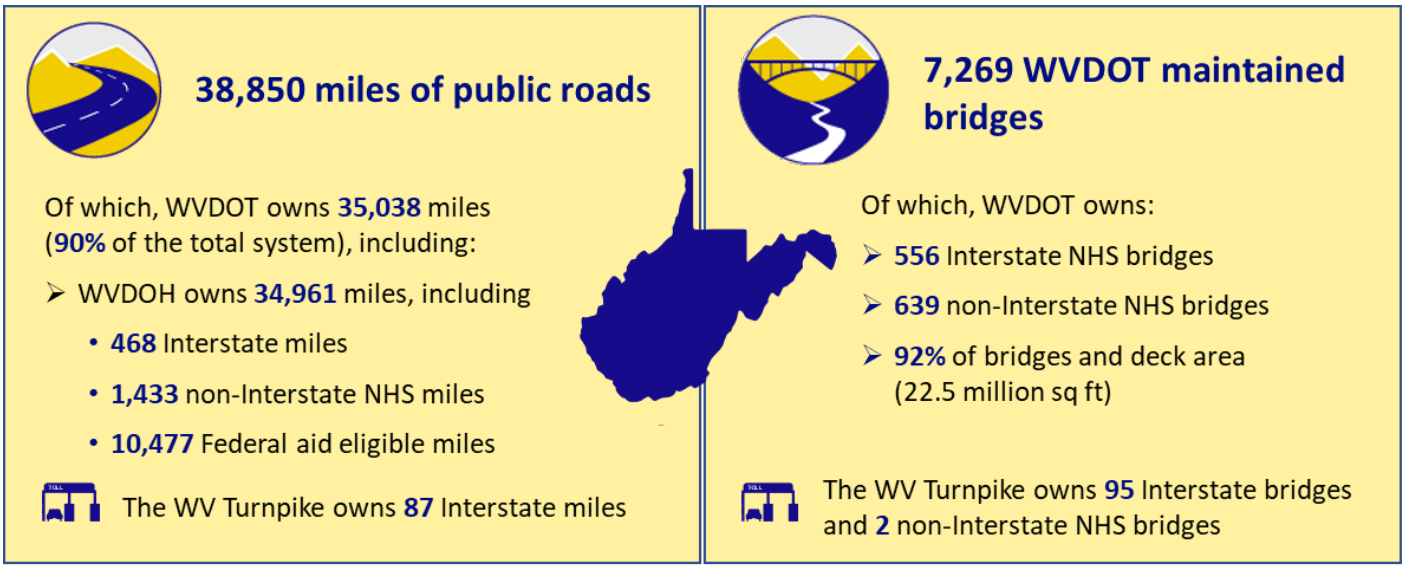
Figure 10 Constrained Needs

ASPIRATIONAL (HIGH-END ESTIMATE)			
	2020-2030	2031-2050	Total
Highways	**$30,740 M**	**$53,750 M**	**$84,490 M**
Bridge	$7,900 M	$8,340 M	$16,240 M
Pavement	$3,920 M	$7,660 M	$11,580 M
Highway Expansion	$18,180 M	$36,350 M	$54,530 M
Highway Traffic Ops	$320 M	$640 M	$960 M
Highway Safety	$400 M	$720 M	$1,120 M
Highway Other	$20 M	$40 M	$60 M
Non-Highways	**$700 M**	**$1,440 M**	**$2,140 M**
Active Transportation	$230 M	$470 M	$700 M
Aviation	$80 M	$160 M	$240 M
Transit	$290 M	$590 M	$880 M
Rail	$100 M	$220 M	$320 M
Other	**$220 M**	**$430 M**	**$650 M**
Total	**$31,660 M**	**$55,620 M**	**$87,280 M**

Figure 9 Aspirational Needs

4. Highway Needs: Asset, Expansion, Traffic Operations & Safety

The state's interconnected system of local roadways, primarily two-lane routes, expressways, and interstates comprise WVDOT's bridge and pavement assets. Routine maintenance and reinvestment keep the system operating efficiently and in good repair. Within West Virginia, NHS routes consist of the Interstate System with expressways and two-lane primary roadways (**Figure 12**). [4] Asset condition data drives decisions behind infrastructure management principles to meet life cycle costs.



Note, all miles presented as centerline miles. All mileage stats from FHWA 2018 Highway Statistics series.

Other asset facts:

- 8 welcome centers, 10 Interstate rest areas, 4 Turnpike travel plazas
- 10 District offices and 55 county maintenance headquarters
- 1,400+ traffic signals and over 50,000 signs
- Over 60,000 roadway lights
- Fleet of over 2,000 passenger cars, 1,131 dump trucks, and 781 other pieces of maintenance and construction equipment

Figure 11 West Virginia Roadway and Bridge Statistics

Non-NHS routes are all remaining routes maintained by WVDOT, including those eligible for Surface Transportation Program (STP) Federal Aid funds, but private and municipally maintained routes are excluded from state funding. Federal requirements mandate inspection condition data to be maintained for all NHS and Non-NHS bridges, providing the base condition data for the bridge evaluations

Non-NHS routes are all remaining routes maintained by WVDOT, including those eligible for Surface Transportation Program (STP) Federal Aid funds and routes maintained with state funding, but private and municipally maintained routes are excluded. Federal requirements mandate inspection condition data to be maintained for all NHS and Non-NHS bridges, providing the base condition data for the bridge evaluations.[5] Most of West Virginia's bridges are reaching the end of their life cycle, and as WVDOT maintains most of the state's secondary roads, the BMS also determines Non-NHS bridge conditions in the same manner as NHS bridges to give a total estimate of needed bridge repairs.

[4] The WV Turnpike is part of the NHS system but is separately operated and maintained by the WV Parkways Authority. The WV Turnpike generates a profit from charging tolls to fund operations and capital improvements. The Turnpike operates about 100 bridges and is centralized on I-77 in Mercer, Raleigh, Fayette, and Kanawha counties entirely on the NHS system.

[5] When developing the 2019 TAMP, complete base condition data for Non-NHS pavements was not available, preventing further analysis. The final TAMP, bridge and pavements along the NHS, Non-NHS and Turnpike systems were thoroughly evaluated utilizing the AMS except for Non-NHS pavement.

Highway Asset Needs As the largest asset category, **constrained** highway assets are estimated at $14,220 million **(Figure 13 and 14),** representing 67% of the overall **constrained** highway needs estimate. Bridge needs comprise just under half (48%) while pavement needs account for just over half (52%) of all highway asset needs.

- **Bridge need estimates assume that there is a $50 million annual program increase to the bridge program starting in 2024, as directed by WVDOT leadership, and further programmatic resource or policy shifts can address long-term performance needs.**
- **72% pavement miles are on local 2-lane Non-NHS roadways providing access to small communities and will continue to decline without regular overlay treatments.[6]**
- **Most NHS bridges are nearing the end of their expected life resulting in a "wave" of considerable investment need in the next 10-15 years.**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
NHS	$1,050M	$2,430M	$3,480M	51%	$3,900M	$4,110M	$8,010M	49%
Non-NHS	$960M	$1,800M	$2,760M	41%	$3,470M	$3,670M	$7,140M	44%
West Virginia Turnpike	$160M	$390M	$550M	8%	$530M	$560M	$1,090M	7%
Total	**$2,170M**	**$4,620M**	**$6,790M**	**100%**	**$7,900M**	**$8,340M**	**$16,240M**	**100%**

Figure 12 Bridge Asset Needs

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
NHS	$1,270M	$2,540M	$3,810M	51%	$1,270M	$2,540M	$3,810M	33%
Non-NHS	$1,130M	$2,100M	$3,230M	44%	$2,500M	$4,880M	$7,380M	64%
West Virginia Turnpike	$150M	$240M	$390M	5%	$150M	$240M	$390M	3%
Total	**$2,550M**	**$4,880M**	**$7,430M**	**100%**	**$3,920M**	**$7,660M**	**$11,580M**	**100%**

Figure 13 Pavement Asset Needs

As identified in the 2019 TAMP, NHS bridge assets systemwide will soon require significant funding, driving WVDOT to commit to maintaining current pavement investment levels as well as provide an additional $50 million per year starting in 2024. Maintaining pavement investment levels would prevent future decay alongside the additional $50 million per year towards bridges would reduce the amount of bridge deck area systemwide projected to reach "poor" condition.

Consistent with the 2019 TAMP, evaluating bridge and pavement investments versus resulting projected asset conditions with the BMS/PMS analyzes projected asset conditions over time by applying a combination of various different reconstruction, rehabilitation, maintenance, and preservation treatments to maximize asset life cycle conditions and optimize investments. BMS/PMS evaluates bridge and pavement condition performance independently because WVDOT assets are funded differently than Turnpike assets, which are solely funded through user toll revenue (see **Funding & Finance Fact Sheet**).

[6] FHWA 2016 Statistics: https://www.fhwa.dot.gov/policyinformation/statistics/2016/

The BMS/PMS are built to meet all FHWA and WVDOT evaluation standards, and numerous condition criteria powers both systems to further allow comparing against bridge and pavement inspection condition data and generate asset condition results of "good, fair, or poor." Both systems estimate the costs to maintain asset conditions based on available funding or desired performance. The systems also aid in developing investment decisions based on the projected conditions, constrained funding or performance goals.

An integrated condition target and expenditure forecast was assembled once NHS and Turnpike model runs were complete to allow for scenario analysis under two scenarios: **1. Revenue-Constrained** and **2. Performance-Driven** along 10- and 30-year horizons using the BMS/PMS. The complete process analyzing asset needs for the 2050 LRTP is available by request to WVDOH.

1. Revenue-Constrained – The BMS/PMS estimated projected conditions to meet **constrained** criteria based on expected limited funding levels. This approach acknowledges that the limited funding levels will constrain WVDOTs ability to meet current and future performance targets in the NHS, particularly for percent of bridges in poor condition. The team reviewed and updated projected revenues from the 2019 TAMP (which included a 2019 to 2020 forecast) as a means to extend estimated revenues to 2050. Planned operational costs like debt service, administrative expenses, and routine maintenance were subtracted from revenues to determine available funds for NHS, Non-NHS, and Turnpike facilities. Estimated future revenues and available capital funding was crosschecked by WVDOT to address short-term revenue impacts due to the COVID-19 pandemic, trends towards alternative fuel vehicles, and other changes like bond sales and industry shifts. Capital investments to NHS, Non-NHS, and Turnpike bridges and pavement were fiscally **constrained based on projected available revenues.** After allocating funding to bridge and pavement assets, funding for each asset was then extended to 2050 to determine long-term asset condition.

2. Performance-Driven – The BMS/PMS estimated costs to maintain NHS bridge and pavement conditions at under 10% "poor" which is in line with FHWA-established targets. Costs to maintain applicable Non-NHS assets were estimated at the same target which was set as **aspirational**. The BMS/PMS identified a mix of treatments and associated costs over the 30-year performance period. Configuring the BMS/PMS to gradually meet the set condition target over a 10-year period between 2024 and 2034 is constrained by resource allocation possibilities that incorporate the resources and timing necessary to design, permit, and implement bridge and pavement maintenance improvements.

Maintaining long-term pavement conditions across all roadway assets at minimal states of good repair requires adaptive funding and treatment to delay future degradation. Industrial shifts like a reduction in coal extraction alongside stabilized oil and gas operations could lead to less travel on NHS roadways, causing less wear and tear but also generating less revenues collected from motor fuel taxes.

Highway Expansion Needs

As the second largest asset category, **constrained** highway expansion needs are about $3,660 million and represent about 17% of the overall **constrained** needs estimate. **Aspirational** highway expansion needs are roughly $54,530 million which represents about 62% of the overall **aspirational** needs estimate (**Figure 15**). About 33% of expansion needs come from MPO plans, and 66% of expansion needs come from WVDOT-sponsored plans. Additionally:

- **Needs include completion costs for Appalachian Development Highway System (ADHS) Corridor H.**
- **Population influx to urban areas increasing tourism combined with growing freight demand will continue to push highway expansion.**
- **Alternative routes must also consider expansion needs to adequately respond to natural disasters and other events impacting throughput.**
- **The most future expansion needs will be concentrated in major corridors running through the state in regional/local large scale widening as well as new location projects.**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Interchange Improvements	$150M	$300M	$450M	13%	$290M	$590M	$880M	2%
New Roadways	$640M	$1,280M	$1,920M	52%	$12,480M	$24,960M	$37,440M	68%
Widening Projects	$430M	$860M	$1,290M	35%	$5,410M	$10,800M	$16,210M	30%
Total	**$1,220M**	**$2,440M**	**$3,660M**	**100%**	**$18,180M**	**$36,350M**	**$54,530M**	**100%**

Figure 14 Highway Expansion Needs

Future expansion needs are based on two (2) primary state sources (2010 LRTP, 2018 Freight Plan) and eight (8) MPO LRTPs. The estimate developed is primarily cross-checked against completed projects in the WVDOT STIP and the Governor's 2017 Roads to Prosperity program to reach a complete set of publicly identified mobility needs represented as projects. Highway expansion needs vary across the state by urban and rural geography, localized travel patterns, and future freight volumes moving through particular regions or corridors which in turn require roadway expansion.

Prior unfunded expansion projects from state sources are reviewed and organized into **constrained** and **aspirational** categories based on scope development and near-term pipeline projects moving toward WVDOT's programming window.[7] Assumptions guide organization of **aspirational** and **constrained** categorization highway expansion needs for MPO LRTPs (**Figure 16**). An additional "real world" cost escalation is applied to both categories of projects to reflect realistic construction costs for mountainous terrain in 2020 dollars.

Note, the focus in this aspect of the needs assessment on "projects" rather than actual "needs" is due in part to the lack of a comprehensive tool, like a statewide travel demand model, to assess specific highway network needs. The needs assessment assumes that projects will address current or future needs in a cost-efficient manner consistent with WVDOH design and implementation standards.

Aspirational expansion needs are expansion projects outside the fiscally constrained portion of MPO LRTPs and unfunded expansion projects (many not yet implemented from the prior LRTP) from WVDOT plans and sources.

Constrained expansion needs are unfunded, near-term capacity projects moving towards the WVDOT STIP window. These projects are included in the fiscally constrained portion of the LRTPs. Projects exclude TIP commitments or Phase 1 short-term commitments at the time of plan adoption which varied across the eight MPOs.

Project Costs as nominal dollars within future phases or interim horizon years are deflated back to 2020.

External Projects are excluded from neighboring states (Ohio, Maryland, Kentucky) within WV MPO boundaries.

Operational and Capacity projects are classified as expansion needs if most improvements were expansion-related defined by milage or scope.

Figure 15 Expansion Needs Classification Guidelines

Highway Safety Needs

As the third highway category, **constrained** highway safety needs are about $1,120 million and represent roughly 5% of the overall needs estimate. Due to the state's mountainous terrain, roadway departure continues to be the top single requirement for safe infrastructure and additional funding (**Figure 17**). More resources towards traffic record-keeping would streamline crash and data analyses for local law enforcement. Additionally:

[7] Estimates for BHJ MPC projects are identical for both **Aspirational** and **Constrained** categories as the MPO does not specify "vision-level" projects.

- **The State Highway Safety Plan (HSP), Highway Safety Improvement Program (HSIP), and Strategic Highway Safety Plan (SHSP) have adopted a series of goals, strategies, and performance targets to reach zero fatalities by 2030 with an annual reduction of 3.2%/year.**
- **Needs estimates assume that most safety funding will continue to focus on roadway departures.**
- **Counter measures (guardrails, rumble strips) and behavioral programs through the Governor's Highway Safety Program can support addressing future safety needs.**
- **Continued legislation inhibiting dangerous driving behavior (such as House Bill 4464 passed in 2020) and encouraging WVDOT districts to regularly recommend safety improvement locations eligible for HSIP funding.**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Roadway Departure	$330M	$620M	$950M	84%	$330M	$620M	$950M	84%
Non-Infrastructure	$70M	$100M	$170M	16%	$70M	$100M	$170M	16%
Total	**$400M**	**$720M**	**$1,120M**	**100%**	**$400M**	**$720M**	**$1,120M**	**100%**

Figure 16 Highway Safety Needs

Ensuring safety and security for all transportation system users is a top priority in West Virginia. In 2019, the State had 1,078 serious injuries and 279 fatalities. According to the USDOT, motor vehicle crashes contribute an estimated $1,400 million in annual economic cost in West Virginia.[8] West Virginia is a Vision-Zero state which directs its Strategic Highway Safety Plan (SHSP) and Highway Safety Improvement Program (HSIP) towards preventative initiatives and treatments to reduce crashes and serious injuries. By keeping safety at the forefront of transportation investments West Virginia can enhance the overall network and livability while reducing the number of incidents.

West Virginia's mountainous terrain, narrow roadways, and small shoulder areas create locational safety challenges. Over the last decade, traffic fatalities and serious injuries have decreased but un-helmeted motorcycle fatalities and pedestrian fatalities have risen. Distracted driving and rural roadway fatality rates continue to remain acute issues. West Virginia's Governor Highway Safety Program (WV GHSP) and Regional Traffic Safety Coordinators (RTSC) play critical roles to assess countermeasure programs (guardrail, rumble strips) at high frequency crash locations and coordinate law enforcement, public education and occupant protection activities which influence driver behavior. These efforts combined with the construction of future WVDOT STIP projects will improve safety features of roadways and report accomplishments which advance towards stated performance targets.[9] Highway expansion projects typically contain standard safety components as part of their design and implementation such as establishing normal crown for proper drainage and to reduce hydroplaning.

It is impossible to predict rates of future traffic crashes, fatalities, and/or injuries which complicates determining long-term safety needs and needed resources. Safety exposure risks can be correlated to population growth and VMT, investigated as part of determining network-based safety needs. However, reviewing West Virginia SHSP emphasis areas, HSIP programs, and input from West Virginia safety SMEs defines long-term safety needs as an annualized amount directed primarily towards roadway departure. These types of activities have been proven to be cost effective over time. WVDOT obligates $36 million per year in safety funds which equates to a $1,100 million estimate over 30-year time period, but these needs exclude new programs or legislative initiatives which would increase future estimates.

[8] West Virginia Highway Safety Plan (HSP, 2021); West Virginia Strategic Highway Safety Plan (SHSP, 2017); and West Virginia Highway Safety Improvement Program (HSIP, 2013-2019)
[9] West Virginia Highway Safety Plan (HSP, 2021)

Highway Traffic Operations

Constrained highway traffic operations are roughly $820 million, representing about 4% of the overall needs estimate (**Figure 18**). **Aspirational** estimates include unconstrained operational improvements from MPO LRTPs. Investments in traffic operations, like cameras, signal operations and synchronization, and other active traffic management strategies are important cost-effective methods to optimize and manage traffic during incidents and major events, and also everyday travel patterns. Technology and best practices in traffic operations is rapidly advancing and expanding. Consideration in the needs assessment include opportunities associated with:

- **Emerging technologies like automated and connected vehicles, electric vehicles, and intelligent transportation systems (ITS) will drive new funding opportunities, research, pilot deployment, and development, cultivating a "technology awareness" culture with WVDOT and its partners.**
- **Advancing a Transportation System Maintenance and Operations (TSMO) Plan while leveraging WVDOT's Statewide Traffic Control Device Maintenance Program will help promote innovative project delivery and expand awareness and resources within WVDOT.**

Maintaining statewide traffic management systems (closed circuit cameras, weather information sensors, digital message signs) costs about $180 million per year which allows WVDOT to monitor and communicate traffic conditions and incidents. WVDOT also maintains and manages related roadside and traffic control infrastructure statewide to optimize highway capacity, enhance safety, and improve travel reliability (**Figure 19**).

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Traffic Mgmt. Center	$20M	$40M	$60M	8%	$20M	$40M	$60M	6%
Intersection Improvements	$70M	$140M	$210M	25%	$80M	$170M	$250M	26%
Other Ops. Improvements	$180M	$370M	$550M	67%	$220M	$430M	$650M	68%
Total	**$270M**	**$550M**	**$820M**	**100%**	**$320M**	**$640M**	**$960M**	**100%**

Figure 17 Highway Traffic Operations Needs

Investments in ITS support reliable traffic flow which in turn help save user fuel costs and generate measurable travel time benefits.[10] WVDOT uses the Traffic Incident Management Program (TIM) to identify and respond to incidents through a statewide Traffic Management Center (TMC) coordinating across first responders to clear and analyze post-crash incidents. WVDOT also administers the "511 Program" to provide real-time traffic information informing travel routing decisions for users. Network investments along with corridor and project specific needs identified through MPO LRTPs (turn lanes, signal synchronization, interchange redesigns) help define future highway traffic operations needs estimates.

Traffic Signals and Systems

Highway Lighting Program

LOGO Signing Program

Electric Traffic Control Regulation

Pavement Marking Program

Figure 18 Roadside and Traffic Control Infrastructure Management

Network needs reflect annualized amounts to maintain existing ITS equipment and install new ITS equipment in strategic locations along Interstate, ADHS corridors, and high priority state routes. WVDOT expects to add five (5) closed circuit cameras and one (1) to two (2) message boards per year, costing roughly $200,000 to $250,000 per year, equaling about $7.5 million over the 30-year planning period. Estimates do not include ITS equipment for the Parkways Authority toll facilities nor the modernization of toll collection systems at toll plazas as the WV Turnpike is a separate operating entity funded solely from toll revenues.

[10] US Department of Transportation (USDOT). *Intelligent Transportation Systems: Benefits, Costs, and Lessons Learned*. Final Report. March 2018.

Other Highway Needs This needs category represents a set of potential investments that do not fit cleanly within the other four categories. **Constrained** highway needs are roughly $60 million, representing less than 1% of the overall needs estimate (**Figure 20**). These needs reflect investments in highway projects that directly connect to broader state goals and objectives which highlight how infrastructure investment is critical to the state's long-term prosperity. Other highway needs also include projects which support roadside protective activities (like slope stabilization).

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Total	**$20M**	**$40M**	**$60M**	**100%**	**$20M**	**$40M**	**$60M**	**100%**

Figure 19 Other Highway Needs

5. Non-Highway Needs: Active Transportation, Aviation, Transit, & Rail

Source documents like recent WVDOT led plans, MPO LRTPs and SME interviews determined mode-specific forecasts. SME interviews included questions to identify needs absent from as well as clarify needs listed in source documents. Mode-specific steps and assumptions are explained further below.

Active Transportation This non-highway needs category is statewide, relevant in both urban and rural areas. Total **constrained** active transportation needs are roughly $360 million, representing about 2% of the overall needs estimate (**Figure 21**). **Aspirational** estimates represent unconstrained needs from MPO LRTPs. National and West Virginia trends show an increased demand for bicycle and walking options to remain economically competitive, attract major employers, provide a higher quality of life, and expand tourism based spending and economic impacts. While the potential needs and benefits are significant, the challenge of implementing a statewide Complete Streets Policy while simultaneously maintaining the condition of statewide active transportation facilities is an ongoing challenge. Active transportation needs are characterized by:

- **Community focus: most projects come from local governments, MPOs, and advocacy groups. Collective goals from these plans and groups call for better sidewalks, bicycle lanes, and more rail-to-trail projects to support healthy living, multimodal connectivity, and safe travel.**
- **Focus on implementing recommendations in West Virginia's Bicycle Connectivity Plan including spending on signs and pavement markings across 1,440 miles of state bicycle routes to connect to recreational destinations and regional trails and directly impact West Virginia's strong tourism industry.**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Greenways, Regional Trails	$40M	$90M	$130M	36%	$90M	$170M	$260M	37%
Complete Streets	$20M	$30M	$50M	14%	$30M	$70M	$100M	14%
On-Road Bike Lanes	$30M	$60M	$90M	25%	$60M	$120M	$180M	25%
Sidewalks, ADA Compliance	$30M	$60M	$90M	25%	$50M	$110M	$160M	24%
Total	**$120M**	**$240M**	**$360M**	**100%**	**$230M**	**$470M**	**$700M**	**100%**

Figure 20 Active Transportation Needs

A top-down network perspective combined with project specific improvements sourced to MPO LRTPs, local communities, and advocacy groups represent short- and long-term active transportation needs. Active transportation needs bring low-cost, high-impact improvements focusing on complete signage and pavement markings along designated routes like the State Bicycle Network. These improvements will facilitate safe, statewide travel while local/regional investments in sidewalks, protected bicycle lanes, and rail-to-trail projects encourage healthy lifestyles as well as create multimodal connections to link long distance trails to popular destinations like National and State Parks.

West Virginia adopted the Complete Streets policy in 2013 which will require more investment to bring concepts to reality.[11] Several states and municipalities have already passed legislation for and adopted Complete Streets principles. In addition to creating safer street environments for all users, the West Virginia Bill also proposed a Complete Streets Advisory Board of members from various agencies, including WVDOT. Additionally, WVDOT's Bicycle-Pedestrian Committee is working towards a broader Complete Streets plan to further embed active transportation opportunities with roadway and corridor design and has a lead Coordinator for citizens to contact for information and discuss bicycle and/or pedestrian issues.

WVDOT continues to develop bicycle and pedestrian facilities as part of the project planning process. West Virginia's 2017 Bicycle System Plan identifies highway routes, bicycle trails, and US Bike Routes to facilitate region-to-region and long-distance bicycle travel statewide, pinpointing connections to major nodes including cities, census designated urban areas, state and national parks and forests and major local parks or recreational areas, neighboring states and Amtrak stations.

In urbanized areas, WVDOT is including bicycle facilities in all new highway construction or reconstruction projects. In rural areas, bicycle facilities are considered when projects are being designed and incorporated in multiple ways (**Figure 22**). Trail construction accommodates bicyclists all skill levels: experienced/confident as well as casual/less confident.

Project Designation: Bikeway, Bicycle Route, **or** Shared Use Path

Project Design: Bicycle Lane **or** Shared Use Path

Figure 21 Bicycle Facilities

Aviation **Constrained** aviation needs are roughly $120 million and represent 1% of the overall needs estimate (**Figure 23**). **Aspirational** estimates reflect unconstrained needs from MPO LRTPs and conceptual projects from the 2018 West Virginia State Freight Plan. West Virginia's strong tourism economy will bring passenger enplanement counts back to pre-pandemic levels at the state's three commercial service airports, but unmet infrastructure needs could hinder the state's aviation industry from remaining competitive, including expanding unmanned aerial system (UAS) opportunities. Other considerations within the Needs Assessment include:

- **Aviation is an important non-highway mode which facilitate economic development through and in proximity of medium and small-scale airports. Investments in terminal expansions and roadway access improvements to existing airports benefits the West Virginia economy, including sales and income taxes paid by employees and businesses associated with the airport and the capital improvement projects.**
- **Air cargo is being consolidated to larger facilities industry-wide to improve operational efficiency, and West Virginia's small cargo facilities have recently experienced a decline in traffic. As airline freight continues to change, WVDOT will reevaluate expansion of large scale commercial and general aviation airports.**

[11] "Complete Streets" promotes safer, more livable streets designed to serve all citizens alike, including motorists, cyclists, pedestrians, wheelchairs or mobility scooter users, transit passengers, and shoppers. Complete Streets improvements reduce crossing distances for pedestrians and bicyclists, highlight conflict zones, create dedicated roadway space for non-motorized users, reinforce safe roadway behavior, increase visual stimulation or a sense of enclosure, and/or actively reduce speeds through geometric roadway changes foster safer speeds and behavior among all roadway users.

- **Per the 2018 West Virginia State Freight Plan, there were three public-use airports listed regarding continued or new air cargo opportunities. Two of the airports are categorized as primary commercial service airports by the National Plan of Integrated Airport Systems (NPIAS): Yeager Airport in the City of Charleston and Huntington Tri-State Airport in the City of Huntington. The third airport is a general aviation local reliever airport, as categorized by the NPIAS, in the City of Martinsburg: Eastern West Virginia Regional Airport.**
- **The ongoing West Virginia Aviation Economic Impact Study will quantify return on investment (ROI) for 24 publicly operated airports and highlight strategic aviation improvement opportunities, which serve to direct future system investments and enhance connections between airports and other transportation modes.[12]**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
General Aviation	$20M	$50M	$70M	58%	$40M	$90M	$130M	54%
Commercial Service	$20M	$30M	$50M	42%	$40M	$70M	$110M	46%
Total	**$40M**	**$80M**	**$120M**	**100%**	**$80M**	**$160M**	**$240M**	**100%**

Figure 22 Aviation Needs

A statewide aviation system plan does not currently exist to outline future airport specific needs or aeronautical system improvements. The 2018 West Virginia State Freight Plan, MPO LRTPs and SME input were used to develop aviation estimated needs.[13]

West Virginia's thirty-four (34) public-use airports facilitate business activity, cargo movement, tourism, educational opportunity, and essential services collectively, which benefits the state and local economies. Twenty-four (24) of the thirty-four (34) airports are eligible for Federal Aviation Administration (FAA) Airport Improvement Program (AIP) funding administered through the West Virginia State Aeronautics Commission's (WVAC) matching grant program. Seventeen (17) of the public-use airports are general aviation (GA) public-use airports which operate without scheduled service or have scheduled service with less than 2,500 passenger boardings per year. Three (3) of the 34 airports are "primary use" including Yeager Airport in the City of Charleston, Huntington Tri-State Airport in the City of Huntington; and North Central West Virginia Airport associated with the City of Clarksburg.

The WVAC oversees planning, acquisition, construction, improvement, maintenance and operation of airports and other air navigation facilities in the state. The Commission's vision is twofold - first focused on enhancing location specific services already in place in commercial air transportation, general aviation, emergency medical evacuation, flight training, and high-altitude flight testing. Looking forward, the Commission aspires to expand the use of support services, which rely on airport infrastructure to provide training (firefighting, homeland security, and emergency response) and to advance aviation programs and policies which attract future investment in proximity to airports across the state.

Transit **Constrained** transit needs are roughly $450 million and represent about 2% of the overall needs estimate (**Figure 24**).[14] **Aspirational** estimates reflect unconstrained needs from MPO LRTPs. Expanding and enhancing reliability of public transit services provides increased mobility for disadvantaged individuals like elderly and disabled residents while simultaneously reducing congestion and improving air quality. Transit-Oriented Development (TOD) which links local land use and transit service can enhance the economy and decrease vehicle dependency. Other considerations within the Needs Assessment include:

[12] West Virginia Aviation Economic Impact Study.
[13] 2018 West Virginia State Freight Plan and MPO LRTPs.
[14] "Transit" refers to fixed route services in urban areas, rural transit providers, and intercity bus systems. "Rail" transit needs are in the Rail Non-Highway Needs section.

- **Establishing a statewide formal planning process to document rural transit needs will help identify future transit routes, headways, and transit services as well as develop a long-term statewide strategic transit plan to highlight state, regional, and local service connection opportunities like increasing service coverage from thirty-seven (37) counties currently to all fifty-five (55) counties.**
- **Ensuring statewide transit assets are maintained by improving bus stop amenities and access to real-time arrival information, in addition to supporting traveler access by increasing park-and-ride facilities near high-demand bus stops.**
- **Transit vehicle replacements and fleet expansions with electric buses using Volkswagen's West Virginia environmental mitigation settlement funds for newer and cleaner fuel sources promotes clean energy.**
- **Funding constraints and serving long travel distances between health care, education, and employment destinations remain challenging for rural transit services. More coordination with MPOs and respective departments can help address rural transit issues and identify funding solutions.**
- **Operating more flexible fixed-route services in rural areas alongside new mobility options such as *micro-transit* and *mobility-as-a-service* (MaaS) will help keep transit a competitive service choice for riders.[15] [16] As autonomous and connected vehicles become more prevalent and technology improves, transit systems may adapt certain aspects geared towards transit.**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Urban Fixed	$140M	$290M	$430M	94%	$280M	$560M	$840M	96%
Intercity Bus	$5M	$5M	$10M	3%	$5M	$5M	$10M	1%
Mobility Services	$5M	$5M	$10M	3%	$10M	$20M	$30M	3%
Total	**$150M**	**$300M**	**$450M**	**100%**	**$295M**	**$585M**	**$880M**	**100%**

Figure 23 Transit Needs

Public transit collectively carries over seven (7) million trips per year. Urban, rural, and intercity transit systems support widespread mobility needs in West Virginia. West Virginia's median age is 10% higher than the US average which will require an aging population to rely on public transit for everyday mobility.

The Division of Public Transit (WVDPT) is the state agency for all federal and state public transportation programs and the designated state organization to receive Federal Transit Administration (FTA) funding. Working with WVDOT, WVDPT also addresses Park-And-Ride facilities as well as bicycle/pedestrian accommodations. Projects stemmed from the eight (8) MPO long-range plans in addition to an analysis on Commuter Bus Service from the Eastern Panhandle Transit Authority to forecast transit needs. All project costs are inflated/deflated to the year 2020 to display costs in current-year dollars.

Providing timely and frequent transportation options to residents with mobility limitations to health care, education, employment, or educational opportunities is a significant funding challenge. Funding constraints limit new fixed route services to destinations, combined with a declining population presents a challenge to service in rural areas. In urban areas, public transportation will increasingly complete with the steady growth of new mobility options, such as micro-transit curb to curb service which are convenient and attractive to choice riders.

[15] *Microtransit* are private- or publicly operated vehicles where customers reserve trips and algorithms match passengers with similar routes (e.g. UberPool or LyftLine).
[16] *Mobility as a Service* (MaaS) is where an individual pays for access to a public and private network of vehicles (buses, cars, bikes, scooters) and reserves service with mobile applications.

Rail **Constrained** rail needs amount to $160 million which represent only 1% of the overall needs estimate (**Figure 25**). **Aspirational** estimates reflect unfunded, qualitative concept needs from the 2013 and 2020 Rail plans. Increasing accessibility and Americans with Disabilities Act (ADA) compliance across intercity passenger rail stations throughout West Virginia improves passenger movement and creates new opportunities to access jobs as well as key destinations. Collaborating with West Virginia's 12 freight railroads, logistics terminals, inland port facilities and local development organizations further enhances economic growth through freight movement throughout over 2,000 railroad miles. Other considerations within the Needs Assessment include:

- **As population and market needs in urbanized areas surrounding West Virginia grows, the state's rail infrastructure is an increasingly important asset to move goods as well as people safely, efficiently, and reliably.**
- **Improving communication and coordination with railroads in other states, like Ohio, through more frequent annual meetings with all classes of railroads to discuss railroad and state investment priorities alongside revitalizing Class I rail service through specific urban areas and bottlenecks further increases overall movement as well as industrial opportunities.**
- **Rebrand rail for rail tourism and economic development by revitalizing a state rail association to introduce grant education, coordination of safety improvements, passenger rail programs, as well as corridor improvements and/or extensions like an additional 28 miles to Bergoo.[17]**
- **Reestablish the Cardinal Passenger Train Enhancement Fund to administer routine maintenance and capital improvements through collaborative partnerships like with the Boy Scouts of America together with Amtrak and CSX to increase service on the Cardinal and provide reliable train access to the Summit Bechtel Reserve, the permanent home of the Boy Scout National Jamboree.[18]**
- **Improving data and property management will assist managing state rail assets, securing grade crossings, and allocating funding through the State Rail Development Fund as the local match for federal grants and loans.**

	Constrained				Aspirational			
	2020-2030	2031-2050	Total	%	2020-2030	2031-2050	Total	%
Class I Railroads	$10M	$30M	$40M	25%	$30M	$50M	$80M	25%
Short line Railroads	$10M	$30M	$40M	25%	$30M	$50M	$80M	25%
Passenger Rail	$10M	$10M	$20M	12%	$10M	$30M	$40M	12%
Tourist Trains	$20M	$40M	$60M	38%	$40M	$80M	$120M	38%
Total	$50M	$110M	$160M	100%	$110M	$210M	$320M	100%

Figure 24 Rail Needs

As policy and program recommendations from the 2020 State Rail Plan informed the 2050 LRTP development, rail needs were primarily gathered from the 2020 and 2013 West Virginia State Rail Plans with supplemental rail-specific projects from the 2018 State Freight Plan, the RIC MPO LRTP, West Virginia Grade Crossing Program, and the final year of the 2020 WVDOT STIP. All projects were then inflated/deflated to the year 2020 to display all costs in current-year dollars.

[17] Survey feedback from the 2020 WV State Rail Plan.
[18] In 2019, the International Jamboree was held, hosting more than 50,000 scouts globally, but the Cardinal was unable to provide adequate train service to scouts and staff.

West Virginia's rail network links freight and passenger movement between Midwest, Mid-Atlantic, and Southeast markets. Amtrak's intercity and Maryland Area Regional Commuter (MARC) commuter rail services provide West Virginians rail access through daily roundtrip service to neighboring regions. However as of March 2021 West Virginia will no longer subsidize MARC operational funding. New arrangements to fund future commuter service are to be determined. Amtrak operates two long-distance routes through West Virginia, the daily Capitol Limited and the tri-weekly Cardinal, stopping at local stations serving as gateways into each region and spurring local economic activity.

Class I freight railroads (CSXT and Norfolk Southern) own and operate more than three-quarters (1,640 miles) of West Virginia's 2,312-mile rail network. The remaining miles are operated by short line railroads, the West Virginia Rail Authority (WVSRA), and seasonal tourist trains running on freight-owned track.[19] With limited funding, the West Virginia Division of Tourism and WVSRA work together and share responsibility for serving as well as protecting passenger rail needs. WVSRA also works with Class I and shortline operators to advance rail investment and economic development. Many passenger rail improvements and investments previously recommended in the 2013 West Virginia State Rail Plan remain unfunded and disjointed funding agreements complicate improvements.[20] Further financial and administrative limitations restrict Amtrak (intercity) trains like the Cardinal service despite industry-wide growth predictions and local stakeholder support.[21] Meeting with states along the Cardinal route to lobby for increased service collectively grows passenger and economic movement along the entire Cardinal corridor.

As Class I freight railroads own and operate most of West Virginia's rail assets and services, collectively CSXT and Norfolk Southern are responsible for transporting over 164 million tons (2.6 million carloads) of freight starting in, moving through, or ending in West Virginia.[22] Most freight (90%) is coal, but total rail freight flows are expected to decline through 2040 primarily due to anticipated reduced reliance on domestic coal. However, growth of other intermodal rail-dependent commodities transported in containers and trailers alongside increased oil and gas production, chemicals, and non-metallic minerals could reverse the trend, diversifying and strengthening West Virginia's commodity base as well as rail competitive position and impact statewide trucking corridors.[23] [24] Continued investments in oil and gas in North Central West Virginia will move more raw products into facilities and redistribute more finished projects through the rail network spurring further economic growth.

[19] Seasonal tourist trains operating in freight-owned rail lines cannot offer connections to other passenger services. 2020 West Virginia State Rail Plan.
[20] WVSRA's funds are used to operate, maintain, and invest in the freight and tourist railroads under its jurisdiction, while the Division of Tourism has the authority to enter into agreements with Amtrak and related stakeholders to improve service. 2020 West Virginia State Rail Plan.
[21] PRIIA and Amtrak.
[22] Surface Transportation Board. Waybill Data for West Virginia (2018).
[23] 2020 West Virginia State Rail Plan.
[24] Intermodal improvements in the 2013 Statewide Strategic Port Master Plan from the West Virginia Public Port Authority (WVPPA) exclude cost estimates and are excluded from the 2050 LRTP needs analysis. Intermodal terminals are not currently active in West Virginia as the Prichard/Huntington Terminal along the Norfolk Southern Line Heartland corridor still lacks a permanent operator.

6. Needs in Perspective

West Virginia's total multimodal transportation improvement needs should be viewed within the context of the analyses' strengths and limitations and the stakeholder coordination which shaped the process. The results should also be viewed with respect to current and changing statewide social and domestic anchors like education and healthcare, economic and industrial growth, technological development, and financial estimates to ensure future revenues match future needs (see the ***Funding & Finance Fact Sheet*** and the ***Financial Plan***).

There are many uncertainties within the needs assessment. Short and long-term impacts of the COVID-19 pandemic, such as sustained high rates of teleworking, could impact commute travel needs, including transit. Changing car ownership models (for example subscribing to a transportation as a service provider rather than owning a vehicle may change how people make travel and mode decisions). Freight patterns will continue to change in West Virginia as the state continues to rely less on natural resource extraction industries and more on pharmaceuticals and chemicals. There are also unknowns, including unforeseen events, economic downturns, or other crises that strain WVDOT resources.

The following implications of the needs estimates will guide WVDOT to establish direction for long-term investments and shift policy in light of limited resources and competing priorities.

- **Importance of Asset Management** Bridge and pavement asset needs are nearly two-thirds of total transportation needs. This proportion is actually much higher when accounting for other asset needs like guardrails, stormwater, retaining walls and slides. WVDOT's diverse roadway network and challenges to sustained funding necessitate strong asset management principals to ensure maintenance, preservation, rehabilitation, and reconstruction across bridge and pavement assets.
- **Future Safety Needs** Estimates based on historical funding may not represent the full scope and breadth of systemic, statewide needs which vary by exposure and risk across West Virginia's different geographies. Although fatality rates and crashes have decreased, un-helmeted, distracted driving, crashes at pedestrian crossings, and impaired driving collisions require continued focus and strategic programmatic investment.
- **Transportation Industry Changes** Needs change over time as transportation systems become more durable, technology offers more travel options, and more technology comes to West Virginia's transportation network. Shifts in construction materials and methods with highway operations to optimize existing capacity can extend asset life cycles and reduce the need for future expansion projects.
- **Needs and Broader State Goals** Associating needs to broader statewide goals and objectives highlight strategic investment opportunities such as including additional access to a future industry park to support economic impact as part of a highway expansion project. These opportunities can be overlooked in traditional project scoping.
- **Cost of Doing Nothing** Unaddressed needs will continue to cost West Virginia users more in wasted fuel, operating costs, and lost time.[25] These vehicle-related expenses will continue to escalate if the network falls further behind from a state of good repair. Knowing current funding sources are based on vehicle and fuel purchases instead of asset usage and funds exclusively improve highways, revenue adjustments combined with additional revenue mechanisms will help ensure West Virginia's transportation needs are met.

[25] An average driver in West Virginia uses 853 gallons of fuel (15,786 miles assuming 18.5 miles per gallon). Each driver pays about $283 in state fuel taxes annually (853 gallons x 0.33.2 cents/gallon), or 77 cents a day. West Virginians for Better Transportation.