

Future Needs and Revenues

Note: All information based on data available as of April 2021

Gap Assessment Summary

Understanding current and future needs alongside current and future revenues is critical to positioning WVDOT to prioritize investments relative to available funding, while keeping the transportation system safe and reliable.

As transportation needs continue to exceed transportation revenues, forming a gap, alternative investment strategies will need to make efficient use of resources and consider new funding options to meet future needs.

1. Defining the Gap

Identifying maintenance and improvement costs associated with multimodal transportation needs compared to available revenue is vital to meeting WVDOT's system efficiency, reliability, durability, and safety goals. Within the 2050 Long-Range Transportation Plan (LRTP), needs inevitably will change as West Virginia's population and economy changes, and the yield of existing revenue sources will also change as the movement of people and goods changes. The needs and revenues presented in the 2050 LRTP represent a snapshot view in 2020 and 2021 based on the prior decade trends and understanding of future conditions.

Needs Assessment

West Virginia's multimodal transportation needs are documented across many sources – plans and studies, data and models, and stakeholders and experts. These sources present a comprehensive inventory of possible improvements across time periods, local geographies, and state-maintained and locally managed systems (**Figure 1**).

Transportation needs assessed for the 2050 LRTP represent publicly maintained multimodal systems under the responsibility of WVDOT, assets maintained by the West Virginia Parkways Authority, as part of the West Virginia Turnpike, and locally managed transportation services, including transit providers.

Over 90% of transportation revenues in West Virginia are managed by the WVDOT Division of Highways (DOH). Needs details are highlighted in the 2050 LRTP **Needs Assessment** and summaries by mode and highway need type in **Needs Assessment Fact Sheets**.

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

Metropolitan Planning Organization (MPO) LRTPs Multimodal project-specific improvements from eight 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 needs assessment.

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

Figure 1 – Needs Information Sources

WVDOT (including DOH and Turnpike owned and operated facilities) maintains 90% of the state's public road miles with nearly 83% of these miles in rural areas. The scope of responsibility in a mountainous terrain and rural areas directs most financial resources towards maintaining highway bridge and pavement assets. Highway safety and traffic operations needs are funded through dedicated programs that are critical to ensuring safe and reliable statewide travel.

The State Road Fund (SRF) finances nearly all of WVDOH's work through state revenue sources. Motor Fuel Taxes (MFT) on fuel purchases; Privilege Taxes on purchased or leased vehicles; and Vehicle Registration as well as License Fees paid upon registering generate the state funds used to operate, maintain, and improve West Virginia's extensive public roadway system. The SRF receives federal funds in the form of reimbursements for WVDOH expenditures for the preservation, improvement or the initial construction of roads and bridges on federal-aid eligible facilities. WVDOH may also be reimbursed for debt service payments associated with GARVEE bonds.

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Non-highway needs are addressed through a mix of federal, state, and local funding sources. Aviation and transit operators rely on federal grants and local contributions to manage, maintain, and improve services. Rail improvements depend on annual recurring state appropriations, federal formula funding, and private railroad commitments.

The framework in Figure 2 is the basis to organize and report future needs by highway, non-highway, and other categories relevant to WVDOT's mission, the 2050 LRTP goals, and state public health, economic, tourism, technology and education-related objectives.

No single model or method can accurately predict transportation conditions over a 30-year period. Future change may occur unevenly across West Virginia's urban and rural geographies or accelerate as new technologies emerge. As a result, needs are segmented as constrained or aspirational.

Constrained needs are more

pertinent and associated with existing plans and programs; **aspirational needs** include the constrained needs plus a list of unfunded, vision-based mobility improvements and investment necessary to meet higher performance thresholds on bridges and pavement.

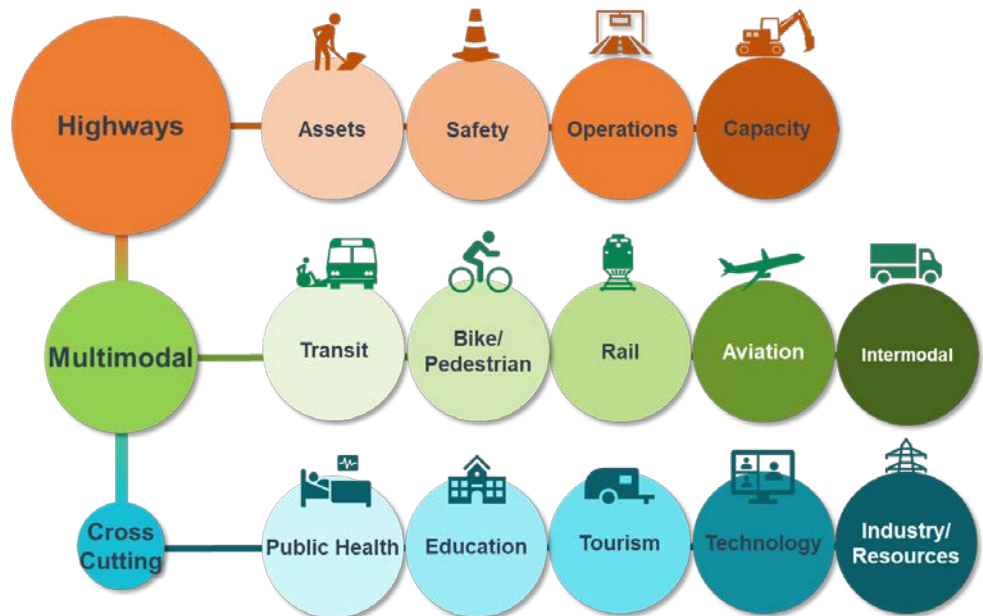


Figure 2 – Organization of Needs Assessment

Funding and Finance

The 2050 LRTP **Financial Plan** summarizes future baseline state highway revenue trends and a suite of alternative outcomes and sources to evaluate revenue risks and options to offset risks. The approach creates a detailed understanding of revenue trends, sources, fee and tax rates, and escalation assumptions so that an accurate forecast can be developed. This baseline revenue information is available in the **Funding & Finance Fact Sheet**.

The baseline revenue information establishes a platform for developing revenue forecasts by source through 2030 and 2050. This includes assumptions on how macroeconomic changes in West Virginia, including total population, will impact future revenue. Baseline revenue forecasts consider multiple population forecasts in order to conclude on a consensus revenue baseline – consistent with an economic recovery in West Virginia that will turn around decades of population decline. The baseline forecast focuses on total and constrained revenues. **Constrained revenues represent the total funding remaining for capital investments after WVDOT meets debt service requirements and is able to fund administration of the agency and routine operations and maintenance.** All revenues, like needs, are represented in constant 2020 dollars.

The Financial Plan takes the baseline revenue forecast two directions as presented in Figure 3:

1. Explores the potential impact of alternative macroeconomic futures (or scenarios) on existing revenue sources through 2030 and 2050, and
2. Explores the potential of existing modified and new revenue sources through 2030 and 2050 to raise new funding to support growing needs.

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The findings from these two directions include:

- The continuing shift to an electric transportation system could significantly impact yields from DOHs primary revenue source.
- High inflation, recurring events that impact system assets, and other economic risks will reduce available resource for DOH to maintain, operate, and expand the system.
- Changing passenger and freight travel patterns could act to both decrease or increase revenue from existing sources. Many of these impacts are reliant on macroeconomic patterns and private investment that DOH has minimal ability to control.

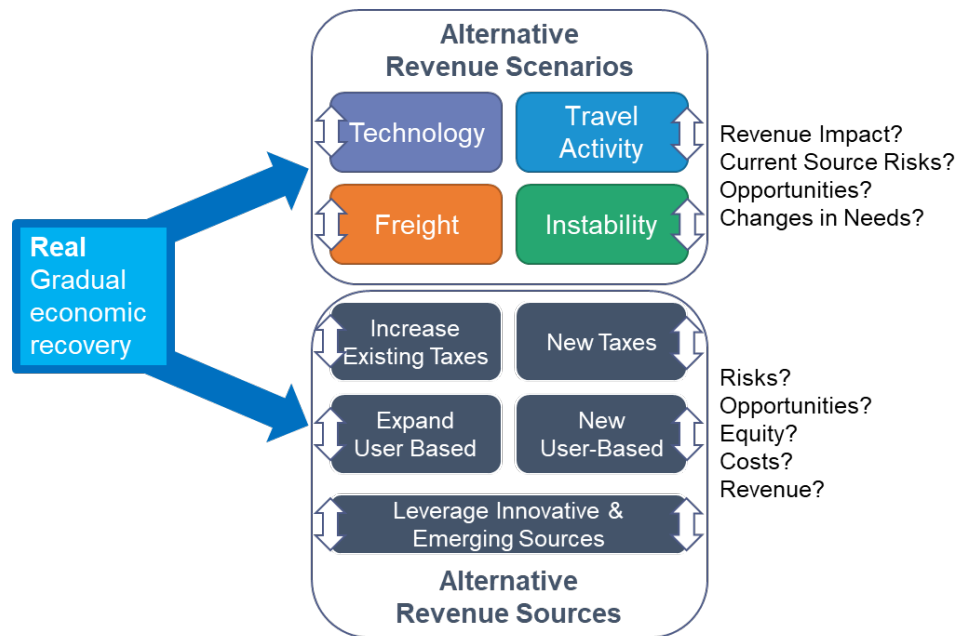


Figure 3 – Organization of the Financial Plan

- Increasing the existing motor vehicle fuel tax rate consistent with inflation helps mitigate the risks associated with inflation in construction costs and positions DOH to better meet changing needs
- Emerging ideas like vehicle miles traveled fees, sales taxes for transportation, and other user fees could serve to augment or ultimately replace the motor vehicle fuel tax.

Needs Versus Revenues

Focusing on the gap between constrained needs and the baseline revenue forecast provides the framework to compare existing and alternative revenues against constrained and aspirational needs. This comparison represents the platform for developing 2050 LRTP investment portfolios and strategies.

Existing gaps between transportation needs and revenues compound across multiple years and continue to increase due to various funding limitations and increases in infrastructure costs (Figure 4).

Needs typically exceed revenues, and WVDOH will face a growing gap between revenues and expenses through 2050. The total revenue shortfall is projected to be \$600 million by 2030 and \$4.14 billion by 2050 based on consensus constrained revenue estimates and constrained needs.

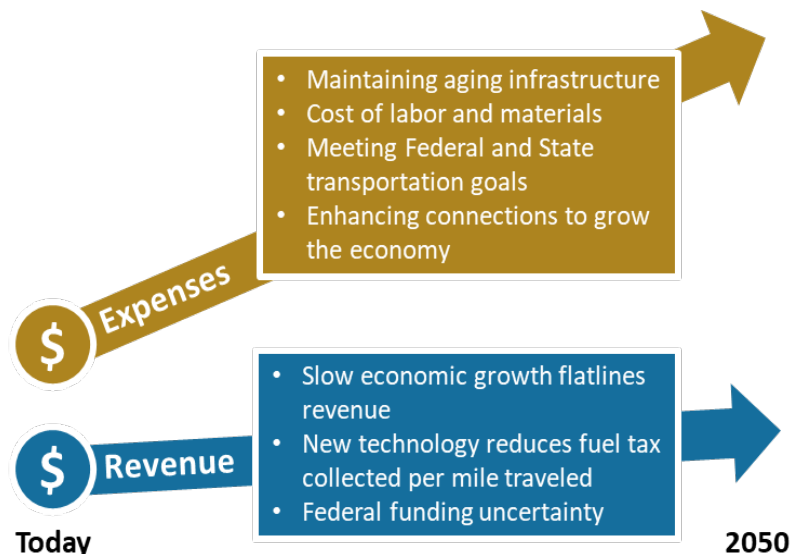


Figure 4 – Expenses Versus Revenues

Contributing factors include:

- **Total DOH revenues remain flat** – Limited increases in current revenue sources (motor fuel tax and registration and license fees) caused by slow population growth as well as demographic and societal shifts (aging West Virginians outpacing birth rates and new residents and changing home and auto ownership decisions) have kept revenues flat compared to inflation and increasing needs.
- **Non-DOH revenues are stable, but not keeping up with changing needs** – Federal grants supporting West Virginia airports, transit systems, and passenger and freight rail continue to support operations, while limiting the scope of system expansion activities. This is particularly true for West Virginia transit operators, who rely on a combination of federal grants and revenue from the farebox to keep systems moving. In 2020, the impacts of COVID-19 on transit ridership have had a critical, and potentially sustained impact on many operators.
- **Increasing costs** – Material and labor costs regularly are exceeding the consumer price index (CPI) and economic growth. This further increases the burden on overall maintenance and improvements by affecting non-construction and construction-related costs, routine operating and/or capital expenses, administrative expenses, fuel and/or utility costs, and/or technology costs.
- **Deterioration of roads and bridges outpace resources to repair** – WVDOT manages a vast highway network spread across a challenging topography alongside juggling weather and other factors that complicate asset management. In addition, many roadway assets, including much of West Virginia's Interstate and National Highway System are nearing the end of their useful life and require significant rehabilitation and replacement activities, especially for bridges. As highlighted in the Transportation Asset Management Plan (TAMP), these needs will continue to grow, straining WVDOT resources to maintain the system and balance this with investments to expand the system.
- **Importance of asset management** – Highway asset needs represent nearly two-thirds of the total transportation needs estimate. DOH continues to deploy best-practice asset management principles to ensure a mix of maintenance, preservation, rehabilitation, and reconstruction treatments utilized for bridge and pavement assets. There are many other critical assets also requiring action, including roadside systems (signals, lighting, signs), management of stormwater facilities and maintenance of slides, and other passenger and maintenance facilities.
- **Projected safety needs** – Because of the diverse roadway network WVDOT manages and challenges to reliable funding mechanisms, estimates based on historical funding do not represent the full scope and breadth of systemic, statewide needs which vary by exposure and risk across geographies. Although fatality rates and crashes are trending down, unhelmeted, distracted driving, pedestrian crossing crashes, and impaired driving require continued focus and strategic programmatic investment.
- **Post-pandemic travel** – Estimating COVID-19's short and long-term effects on transportation revenue and travel patterns complicate efforts to anticipate future needs and revenues. Sustained virtual workplaces may lead to lower vehicle ownership and less business travel, all which will impact revenue sources. In addition, the pandemic has elevated issues that demand more significant attention and will require resources, including broadband expansion in rural areas and improved access to health care and education.
- **Economic changes** – Shift in economic demand as industries change will alter travel patterns and transportation needs. Natural resource extraction industries are declining while biotechnology and chemical manufacturing increases, affecting freight movement and logistics alongside employment.
- **Cost of unaddressed needs** – Unaddressed needs will continue to cost West Virginia users more in lost fuel and operating costs. Vehicle expenses will continue to escalate if the network falls further behind from a state of good repair. Unaddressed needs will also have economic impacts – harming West Virginia's economic competitiveness in growing existing industries and attracting new employers.

TRANSPORTATION NEEDS & REVENUES



Gap Summary

Needs – Total transportation needs are segmented by highway, non-highway (multimodal), and other needs (**Figure 5**). Needs are also split into short-term (the next 10 years from 2020 to 2030) and long-term (the following 20 years from 2031 to 2050).

- In the short-term, West Virginia will require a **constrained \$7.10 billion** to fund transportation needs and in the long-term, the state will need **\$14.20 billion**.
- Highway needs in the short-term are **\$6.63 billion**, and in the long-term are **\$13.25 billion**.
- Total **aspirational needs** for the short- and long-term are **\$31.66 billion** and **\$55.62 billion**, about 3-4 times greater than the constrained needs.

In both short-term and long-term horizons, highway needs make up the vast majority of total transportation needs (approximately 93% in each time period) given the extent of the system managed statewide and its importance to the state economy and quality of life. Compared to non-highway needs, there is a more comprehensive understanding and established tools and processes to track and assess these needs, including WVDOHs bridge and pavement asset management systems.

Revenue – Projecting existing highway revenues based on different scenarios and population estimates produced a spread between conservative and aggressive revenue estimates. **Over the total plan horizon, constrained highway revenues are estimated to equal \$15.15 billion (Figure 6).**

Funding for non-highway modes has fluctuated but is approximately \$31 million per year (reported in 2010), escalated to approximately \$44 million in 2020 dollars. Future estimates of non-highway funds have the potential to vary over the next three decades. **Assuming a conservative growth rate at or below inflation (roughly 1.5 to 2% annual), total non-highway revenues over the total plan horizon could total \$1.55 billion (not included in Figure 6).**

Comparing needs to transportation revenues requires carefully assessing state-directed uses. West Virginia's traditional funding sources (motor fuel taxes, registration and license fees, privilege taxes and user fees) are exclusively tied to highway-related improvements and purchase patterns. The balance of transportation needs to revenue continually fall towards highway improvements given system extent and overall travel preferences.

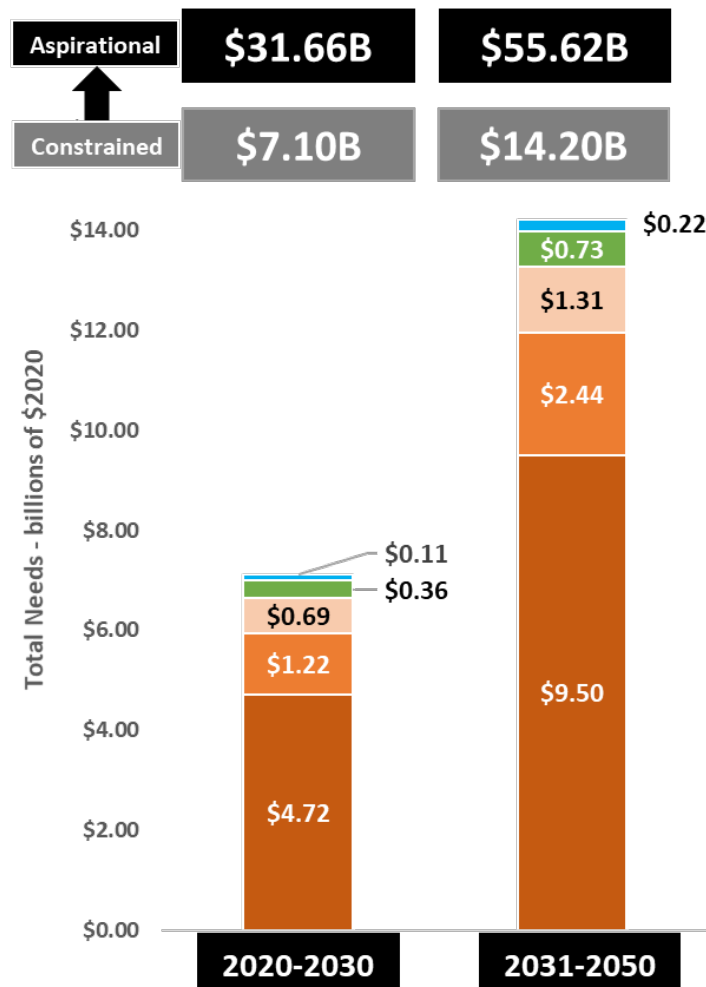


Figure 5 – Total Needs by Mode

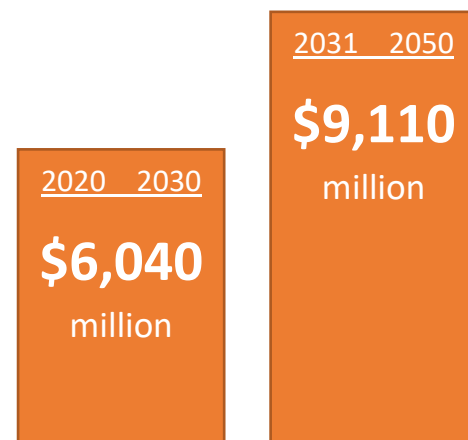


Figure 6 – Constrained Highway Revenues

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Combining highway and non-highway needs in comparison to total revenue presents a complete picture of the long-range planning analysis (**Figure 7**). As noted previously, West Virginia may face a highway revenue shortfall (constrained gap) of **\$600M in 2020-2030** and **\$4,140M in 2031-2050** for highways based on constrained needs. **Due to the limitations in developing detailed forecasts of non-highway revenues (compared to the detailed approach for highway revenues), the focus of the gap assessment is on the gap between highway needs and revenues.** Non-highway needs and the high-level estimate presented earlier (\$1,550 million) for non-highway revenue is made available for reference.

Constrained Needs vs. Constrained Revenues

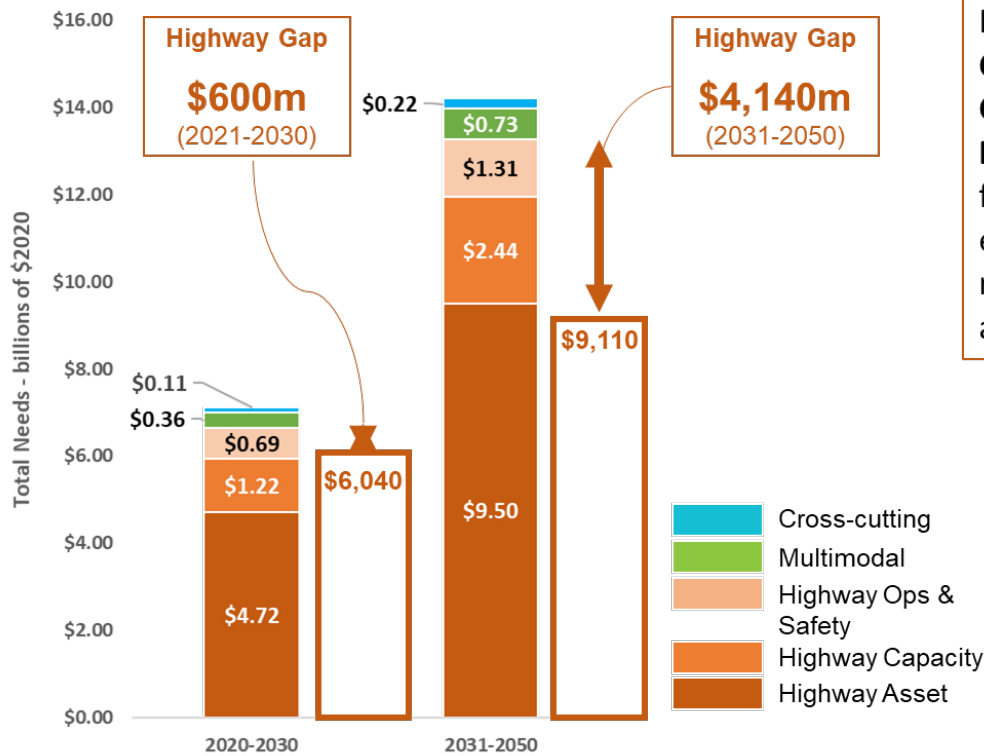


Figure 7 – Illustration of Baseline Funding Gap

Needs Exceed Revenues

Focusing on **Constrained Needs vs. Constrained Baseline Revenues** provides a framework to compare existing and alternative revenues against **constrained** and **aspirational** needs

Platform for developing Portfolios & Strategies

Perspectives on the constrained gap include:

- Increasing materials cost combined with inflation impacts purchasing power, which will increase the estimated short-term and long-term gap between transportation needs and revenues. Shortfalls are anticipated to average \$100 million per year over the next decade but grow to \$250 million per year between 2030 and 2050 compounded by greater long-term uncertainty.
- Even if baseline needs grow slower than anticipated, unanticipated recovery costs following extreme natural hazards combined with the existing maintenance and operations will result in needs continuing to exceed revenues.
- Failing to address the short-term gap will increase the long-term gap as infrastructure continues to deteriorate without repair necessitating full replacement which consumes more financial resources.
- Aspirational needs cannot be addressed without first closing the short-term gap.

The review of constrained needs, constrained revenues, and the resulting gap provides the framework to compare existing and alternative revenues against constrained and aspirational needs. It also establishes the platform for developing investment portfolios and strategies within the 2050 LRTP.

2. Factors Affecting the Gap

Many factors impact current and future revenues like new technologies, economic shocks to public health, changes in energy sources, as well as system shocks caused by weather and/or system deterioration. To quantify these challenges, the 2050 LRTP investigates:

- **Alternative Revenue Scenarios**, which evaluate potential macroeconomic outcomes following shifts in vehicle fleet technologies, travel patterns, freight and logistics, and unforeseen events and crises.
- **Alternative Revenue Sources**, which study individual potential modified and new revenue sources to see how different options could affect bottom line future available revenues.

Combined, this review aims to match changes in travel, living, and lifestyle with options to adjust current revenue sources to better align with future transportation needs. Figure 9 details how Alternative Scenarios and Sources work together to communicate a complete picture of revenue considerations through 2050.

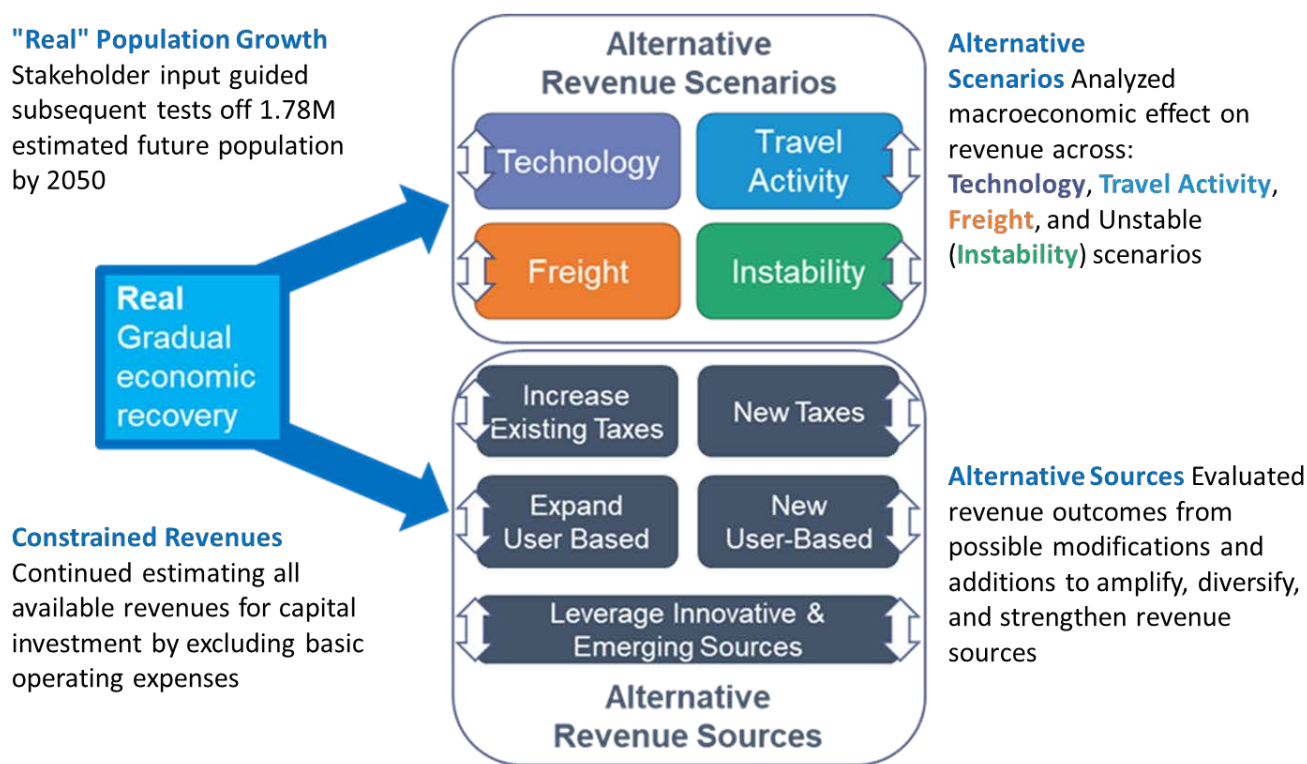


Figure 9 – Complete Picture of Revenue Considerations Through 2050

Alternative Revenue Scenarios

Four Alternative Revenue Scenarios were developed with three different levels of sensitivity (conservative, medium, and aggressive outcomes) to create a range of revenue outcomes. Each scenario and associated sensitivity test were “ramped-up” to show the near-term impact (through 2030) and long-term impact (2031 – 2050). The **Financial Plan** and the **Funding & Finance Fact Sheet** fully document details and analyses behind the alternative revenue scenarios.

The results show significant risks to motor fuel taxes, the primary DOH revenue source (approximately 50% of state revenue sources), through 2030 and 2050. Impacts to the other 50% of state revenue sources, like privilege taxes and vehicle registration fees, are less tied to the impacts of these scenarios which primarily impact types of vehicle technologies in operation and the amount of vehicle travel.

- Enhancing vehicle efficiency from improving internal combustion and increasing more reliable lower cost electric technologies could decrease revenues from the motor fuel taxes by **11 to 20 percent through 2030 and as high as 52 percent by 2050** based on tax rates per gallon consistent with current rates. The high impact assumes that 40% of total passenger vehicle VMT in West Virginia is completed by electric vehicles by 2050.
- Changes in travel behavior are less certain and less widespread given West Virginia's economic conditions and geography. Decreases in VMT or car ownership resulting from more work from home, more remote retail and healthcare, and new mobility options would primarily impact travel behavior in urban areas and could reduce statewide revenue as high as **4 percent** over the next three decades. These trends could also lead to decreases in privilege tax and registration fee revenue.
- Trucks will continue to move the most freight in West Virginia, and growth of truck travel relative to West Virginia's economy could positively and negatively impact revenues. Differing truck freight movement growth rates pivoting from assumptions in the Statewide Freight Plan could lead to increases or decreases in motor carrier fuel tax receipts by as much as **3 percent**. Other aspects like continued decline of the coal industry, logistic pattern shifts, new manufacturing industries, or more available freight rail capacity increasing state revenues through other non-transportation taxes and fees could also shift logistics patterns.
- Many other external factors or events potentially impacting available revenues for capital transportation investments in West Virginia like recurring severe weather, economic recessions, pandemics or other economy-wide shocks, and high inflation could result in a **20 percent decrease in revenues through 2050**.

Alternative Revenue Sources

Five Alternative Revenue Sources were explored to capture supplemental revenues and to compare those revenues against the baseline revenue forecast. Full details about the "Real" population growth baseline forecast and the results of the Alternative Revenue Sources analyses are outlined in the *Financial Plan* and the *Funding & Finance Fact Sheet*.

These alternative revenue sources all have some history and differing levels of success across the US. Still relying on traditional existing sources, a majority of states have recently adjusted motor fuel tax rates, including approaches to annually index motor fuel tax rates to inflation. Introducing new electric vehicle fees are becoming more widespread as states seek methods to offset revenue losses and ensure electric vehicle owners contribute a fair share for highway use. The Eastern Transportation Coalition through a [mileage-based user fee pilot](#) across five states in 2020, is assessing the revenue potential of approaches to replace the motor fuels tax. Other states like Utah and Oregon are implementing voluntary based programs enabling vehicle owners to choose the approach best for their transportation preferences.

Highlights from the alternative revenue sources analysis include:

- **One time increases to the motor fuels (\$0.01/gal or a 1% increase) tax provides an initial and very modest bump in revenue, up to around \$10 million annually.** The new purchasing power of this additional revenue quickly falls behind inflation, putting West Virginia back in the same situation it was before increasing the tax.
- **An annual increase of 1% would create an average of \$20 million more per year this decade, and almost \$90 million more per year from 2030 to 2050.** This type of increase would help DOH nearly offset the impact of inflation on costs, allowing the state to maintain spending and delivery at rates consistent with today.
- **An annual increase of 2%, approximately aligned with inflation, would represent a massive boost to DOH, with over \$40 million more per year this decade, and over \$190 million more per year from 2030 to 2050.** Multiple states, including Maryland and Virginia currently index their motor fuel tax rates annually to the consumer price index (CPI). Nationwide, from March 2020 to March 2021, the CPI (including energy and food costs) increased 2.6%.

- **One-time increases in other fees and taxes, like vehicle registration and privilege taxes, could increase annual revenue by \$50 million per year through 2030 and around \$60 million per year from 2030 to 2050.** Other fees, like \$200 per year fees for electric vehicles registered in West Virginia, have larger potential for revenue, especially over the longer term to help offset revenue lost from electric vehicles through the motor fuels tax. Depending on electric vehicle market share in West Virginia, annual revenue increases could be as high as \$66 million per year through 2030 and nearly \$120 million per year 2030 to 2050.
- **Other taxes or VMT fees could serve to augment or potentially replace the motor fuels tax. The revenue sources from these programs are directly tied to statewide economic conditions and impact nearly all residents and businesses.** Total revenues from these sources (individually) could be as high as \$230 million per year through 2030 and over \$280 million per year 2030 to 2050. If these four sources (VMT fee, real estate transfer tax, base fee for transportation, sales tax for transportation) are combined together, total revenue could nearly replace all existing state revenues, generating over \$600 million per year through 2030.

All of these sources have varying levels of exposure to external forces that could decrease potential revenue or purchasing power for WVDOT, including:

- Declining or stable population levels affecting overall economic activity and vehicle miles traveled for both passenger and commercial vehicles – **impacts all potential revenue sources**
- Increasing fleetwide vehicle fuel efficiency through continued mile per gallon improvements to internal combustion powered vehicles and/or continued market share growth of electric vehicles – **impacts all fuel-based revenue sources; electric vehicle market share growth will increase fees**
- Inflation escalates costs of consumer goods, housing, materials, and labor – **impacts revenue sources based on real estate or sales taxes as well as vehicle registration and privilege tax revenues**
- Other macroeconomic shifts, such as unemployment, energy cost, housing prices, and interest rates – **impacts all revenue sources through both direct and indirect relationships**

3. Bringing Needs and Revenues Together

The Needs Assessment presents constrained and aspirational multimodal transportation needs through 2030 and 2050 based on a diversity of resources. **Total constrained multimodal needs are \$7.1 billion through 2030 and \$14.2 billion from 2030 to 2050, all presented in 2020 dollars. Approximately 93% of constrained multimodal needs are for highways maintained and operated by WVDOH and the WV Turnpike.**

The Financial Plan presents a detailed assessment of constrained revenues for WVDOH across the diversity of state revenue sources based on a “Real” population growth baseline through 2050. Constrained revenues reflect total available revenue for capital investment, removing forecasted spending to address debt service, administration, and routine maintenance. **Total constrained revenue for WVDOH is \$6.04 billion through 2030 and \$9.11 billion from 2030 to 2050, all presented in 2020 dollars.** Non-highway revenues are a combination primarily of Federal and local sources, and based on a high-level estimate could total \$1.55 billion for aviation, ports, rail, and transit through 2050.

The gap between constrained highway needs and constrained highway revenues is \$600 million through 2030 and \$4.14 billion from 2030 to 2050.

- **Through 2030, constrained revenues would need to increase 10% to catch up to needs (also can be achieved through a combination of more efficient spending and more revenue).**
- **From 2030 through 2050, revenues would need to increase 45% to catch up to needs (also can be achieved through a combination of more efficient spending and more revenue).**

TRANSPORTATION NEEDS & REVENUES

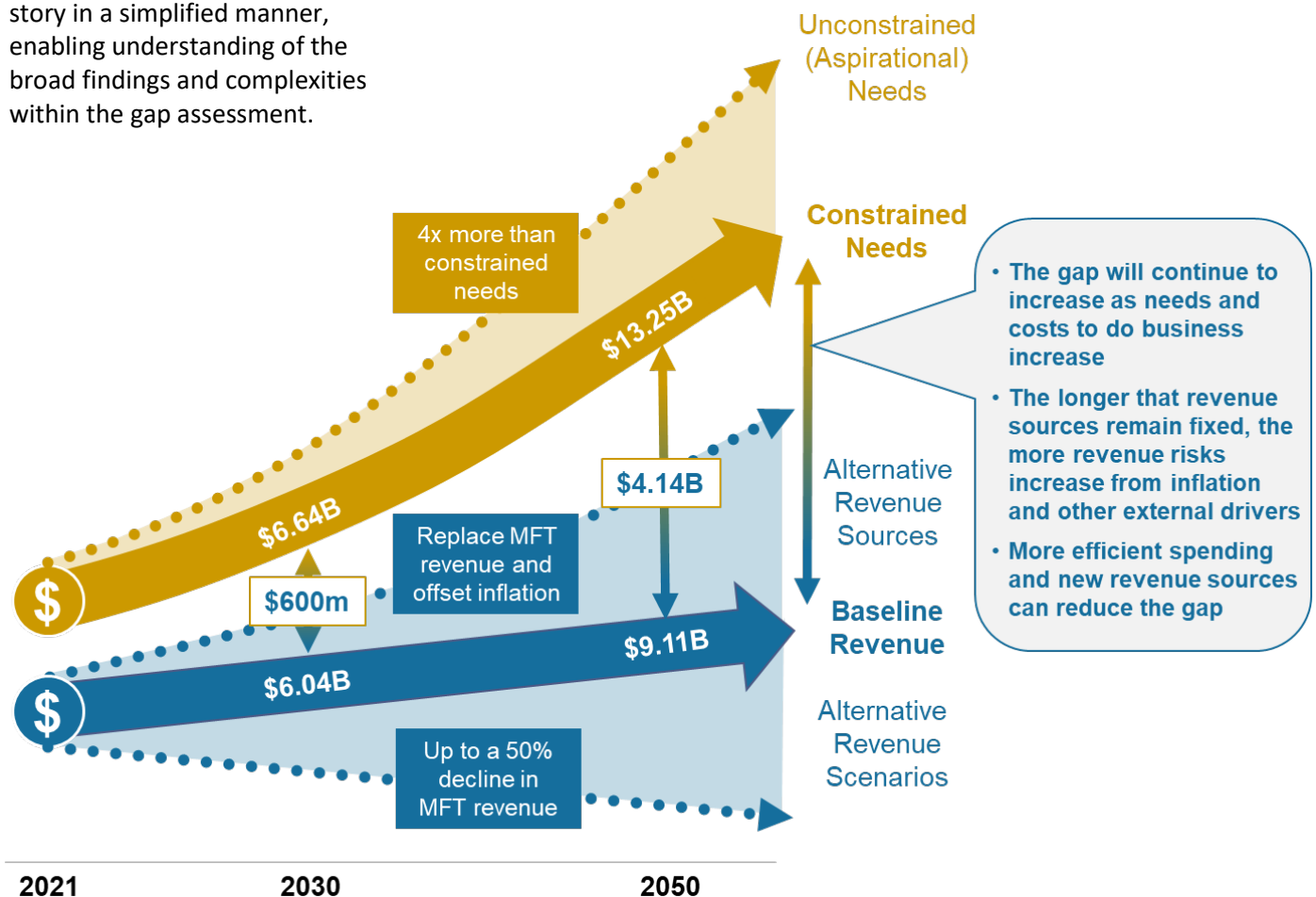


The real picture is more complex than the absolute values presented above. The core issue is that needs to maintain, operate, and strategically expand the transportation system will continue to grow and become more expensive to deliver, while revenues will grow at a slower rate and have less purchasing power given expected continued inflation of costs to operate and maintain the system. The complications to the core issue include:

1. Needs will continue to change as West Virginia's demographics, economy, transportation technology, and environmental resources change through 2050, as indicated in *Drivers, Trends and Opportunities Research Papers*. Based on the cost to meet bridge and pavement asset condition goals (no more than 10% poor across the entire WVDOH managed highway system) plus additional unfunded, long-term projects in MPO plans and other planning documents, **total unconstrained needs could be 3 to 4 times more than constrained needs.**
2. There is potential for great change to how people and goods travel in West Virginia over the next three decades. **The drivers behind the alternative revenue scenarios create more risks than opportunities for existing revenue sources for WVDOH.** For example, if by 2050, 40 percent of total VMT in West Virginia is completed by electric vehicles and fuel economy for traditional internal combustion vehicles continue to improve consistent with existing Federal fuel economy standards, total revenue from the existing motor fuels tax could decrease by 50%.
3. There are many opportunities from the revenue perspective to change the direction of the gap. **Many states are recognizing the need to increase transportation revenues in a sustainable manner and current discussions in Washington D.C. on the next surface transportation reauthorization are exploring new sustainable tax and user fee options to increase federal revenue.** In West Virginia, these options could extend the value of existing sources, like the motor fuels tax, by indexing them annually to inflation, or supplementing existing sources with new options. Ultimately, if electric vehicle market shares become a reality, the motor fuels tax may need to be replaced.

Figure 10 presents the complete story in a simplified manner, enabling understanding of the broad findings and complexities within the gap assessment.

Figure 10 – Overview of Needs, Revenues, and Gap Through 2050



4. Strategies Closing the Gap to Meet Needs

Prioritizing Investments

Matching future transportation needs to future revenues, given that needs exceed revenues now and that only increases in the future, is a challenging task given the breadth and depth of transportation needs. **As depicted in Figure 11 (left side), existing trends for needs and revenues are working toward an increasing gap between needs and revenues.**

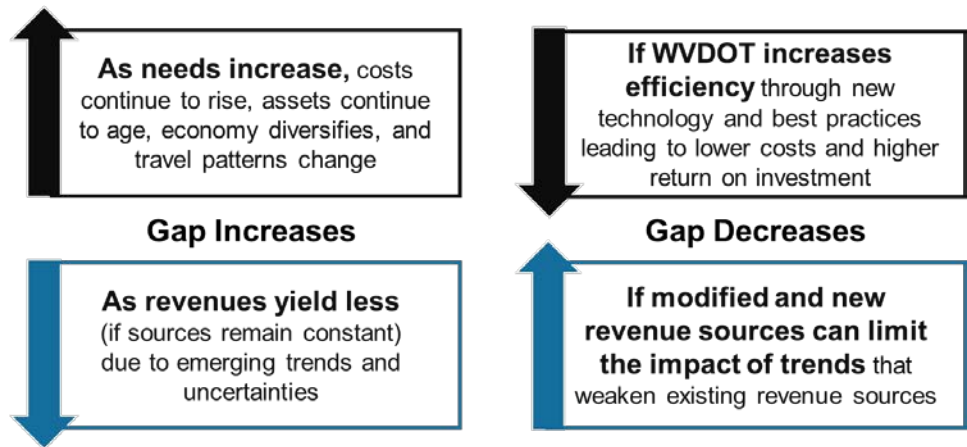


Figure 11 – Options for Redirecting WVDOT's Needs and Revenue Future

As also depicted in Figure 11 (right side) there are options to change this direction. While West Virginia can decide to modify existing revenue sources or implement new sources, these changes take time, legislative action, and public referendums. WVDOT can help this process through providing information to elected officials and the public on the revenue realities.

Another option, and the real focus of the 2050 LRTP, is to identify investment portfolios, strategies, and actions that help WVDOT focus limited resources to the most pressing needs. In addition to prioritizing, implementing cost-effective and sustainable transportation maintenance and capital investment projects and programs can help to manage current and future costs. Emerging technology opportunities, new materials, contracting processes, project delivery, and private sector partners can help to reduce costs and enable more efficient delivery.

Examples of ongoing WVDOT activities supporting this focus are presented on the following pages, including:

- Utilizing drones for maintenance savings and efficiency
- Secondary roads maintenance initiative
- Risk identification

Cost-Effective and Sustainable Maintenance and Capital Investments at WVDOT

Utilizing Drones for Maintenance Savings and Efficiency

Beginning in 2017 WVDOT initiated a drone program following a “Build, Scale, Innovate” model and with help from the West Virginia Department of Environmental Protection.¹ WVDOT began flying test missions in 2019 after planning for the program, pitching it, and obtaining funding, identifying that drones could potentially be utilized for completing stockpile surveys. The WVDOT has 177 sites across the state that contain stockpiled materials and must be physically surveyed annually to calculate the volume of material. After building a foundation of policies and proof of concept, WVDOT entered the “scale” phase of the drone program, hiring and training 9 drone pilots and investing in 12 drones to start the fleet.

¹ <https://skyward.io/west-virginia-dot-deploys-drones-and-quickly-finds-roi/>

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WVDOT utilized a single platform to coordinate missions to the stockpile sites in West Virginia, to obtain airspace permissions, and to demonstrate compliance with FAA regulations and WVDOT's rules. Traditionally, workers would have had to physically climb each of the 177 stockpile sites across the state with specialized equipment to conduct an inventory of each stockpile annually. Utilizing the drone, it can fly around the pile and capture extensive imagery. Processing software then stitches together images to build a 3D model of the pile, allowing crews to calculate stockpile volumes with survey-grade accuracy in a fraction of the time of conventional methods.

Inventorying each stockpile conventionally with workers climbing the structures took 42 surveyors, 15 workdays, and about \$378,000 each year. Utilizing drones, the same work took only 9 days and cost approximately \$35,000, creating a savings of \$343,000 each year, as shown in **Figure 12**.

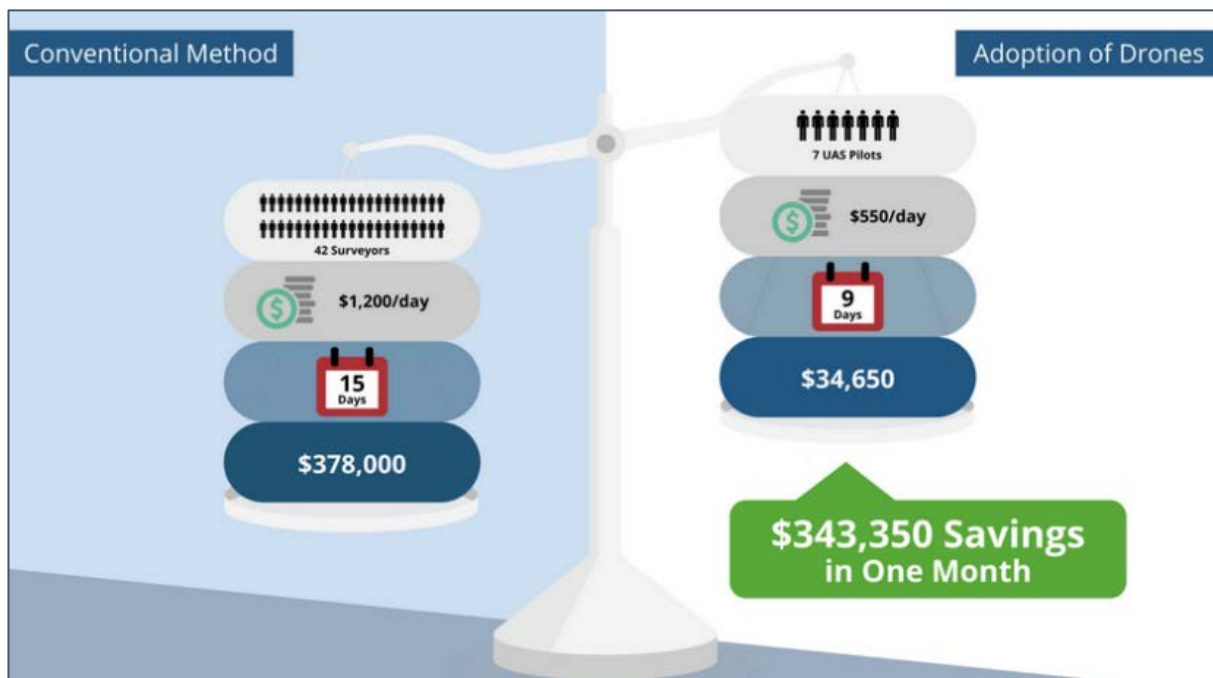


Figure 2 -- Cost Savings from Utilizing Drones

Secondary Roads Initiative

Secondary roads are the vital link to numerous homes, businesses, and recreational areas throughout the state. The Secondary Roads Initiative provides dedicated funding to this important roadway system to allow for Core Maintenance activities, resurfacing, and improvements where needed. A full prioritized list of secondary roads needing the greatest amount of maintenance was identified by WVDOT district managers and county supervisors. This list is intended to guide activities on the secondary roads in the coming years. The WVDOT's goal is to address as many of these maintenance and repair concerns as soon as possible and in the most cost-effective way. In order to provide transparency to the citizens of West Virginia the WVDOT utilizes an interface on their website to demonstrate the planned projects and maintenance work associated.

Together, the Roads to Prosperity and Secondary Maintenance Initiative increase the funding availability for pavement and bridge projects. Both programs leverage asset management systems to integrate funding from the view data-driven recommendations on the conditions and financial availability to maintain those assets. Through the use of the current asset management systems in place for bridges and pavements, WVDOT will utilize their Annual Operations, Roads to Prosperity, Secondary Roads Funding and any future funding mechanisms to ensure all assets are maintained and their life cycle treatment costs are considered. This effort also supports compliance with the goals outlined in the TAMP and the Core Maintenance Plans, ultimately supporting both the primary and secondary roadway networks within the state.

Risk Identification

WVDOH is dedicated to developing risk-based approaches and strategies that reflect federal requirements on examining assets and repeated emergency events resulting in damage. As discussed in the WVDOH TAMP, reviewing risks in the State begins with creating a Risk Register. The Asset Management Coordinator from WVDOH reviews and updates the Risk Register on a regular basis and utilizes workshop engagement to ensure all risks are accounted for and appropriately defined and discussed. The Risk Management Workshop is attended by a diverse group of representatives both from the Districts and Central Office including individuals from a wide array of sectors that review levels of risks related to NHS pavement and bridges.

At the workshops, WVDOH and partner agency staff heard about how risk management is imperative to safety, mobility, and congestion and review the current risk assessment process. The discussion revolves around the scoring framework and methods that include dollar ranges for each consequence as well as the frequency ranges used for the likelihood and probability ratings which make up the Risk Register. The Risk Register components measure quantitative and qualitative information that include types of risk, asset class (pavement, bridge), impacts of uncertainty, scoring risk of impacts, and proposed risk management remedies.

Through these Workshops new risks are identified, discussed, and compared to the current Risk Register to check whether they are already present in the Register in some form and need to be modified, or if they are new risks. Once the Risk Register has been revised and updated, the WVDOH identify, implement and monitor specific initiatives to address the highest priority risks where appropriate. From the latest Risk Workshop, the participants identified 23 top priority risks to be evaluated and their associated asset management program along with options to mitigate via Treat, Tolerate, Transfer or Terminate risk management approaches. A comprehensive list can be viewed in the Appendix of the WVDOH TAMP. The top five identified risks from the WVDOH TAMP are shown in **Figure 13**.

Priority	Risk Level	Asset Class	Event Occurrence	Risk Score
1	Agency	Pavement/Bridge	The lack of personnel, vacant positions and uncertainty in being able to backfill employees who leave	75
2	Program	Bridge	Not delivering programmed bridge projects on time (even when budget is available)	65
3	Program	Pavement/Bridge	Minor (50-year events) flooding events	55
4	Agency	Pavement	Variability in materials costs based on uncertainty in competition	55
5	Program	Bridge	Not performing routine maintenance	50

Figure 3 – Top 5 Risks Identified in WVDOH Risk Register

Source: West Virginia DOH Transportation Asset Management Plan (2019)

For each of the high-scoring risks in the Risk Register, the outcome of the effort is to set initiatives that can be justified to address those risks through strategies. Then the group identifies strategy options, estimates the benefits and costs of each option, and implements the high ranked strategies.

5. Transitioning the Funding Gap into Priorities

Many uncertainties will impact future transportation needs and revenues. 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 like 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 like unforeseen events, economic downturns, or other crises that can strain WVDOT resources.

Identifying both anticipated and unforeseen risks to revenue structures as the economy, transportation industry, and transportation technology change is also necessary to keep assets maintained and people as well as goods moving safely. Changes in population, behavior, spending, business, industry, and travel all affect transportation, movement, and overall economic health. Upkeep of statewide systems to meet demand ensures safe and reliable mobility. Choosing future revenue structures that mitigate the impact of these anticipated and unforeseen risks will help ensure a more sustainable and constant revenue picture.

Identifying investment portfolios and trade-off analysis helps to focus limited revenues to the most pressing needs today and those that are evolving in the future. Five portfolios have been developed to help prioritize future investments, a brief overview of each is provided in **Figure 15**.

Within each portfolio, the LRTP will detail strategies and implementation actions within the next 5-years that will help WVDOT continue to meet its goals while proactively positioning to meet emerging issues.

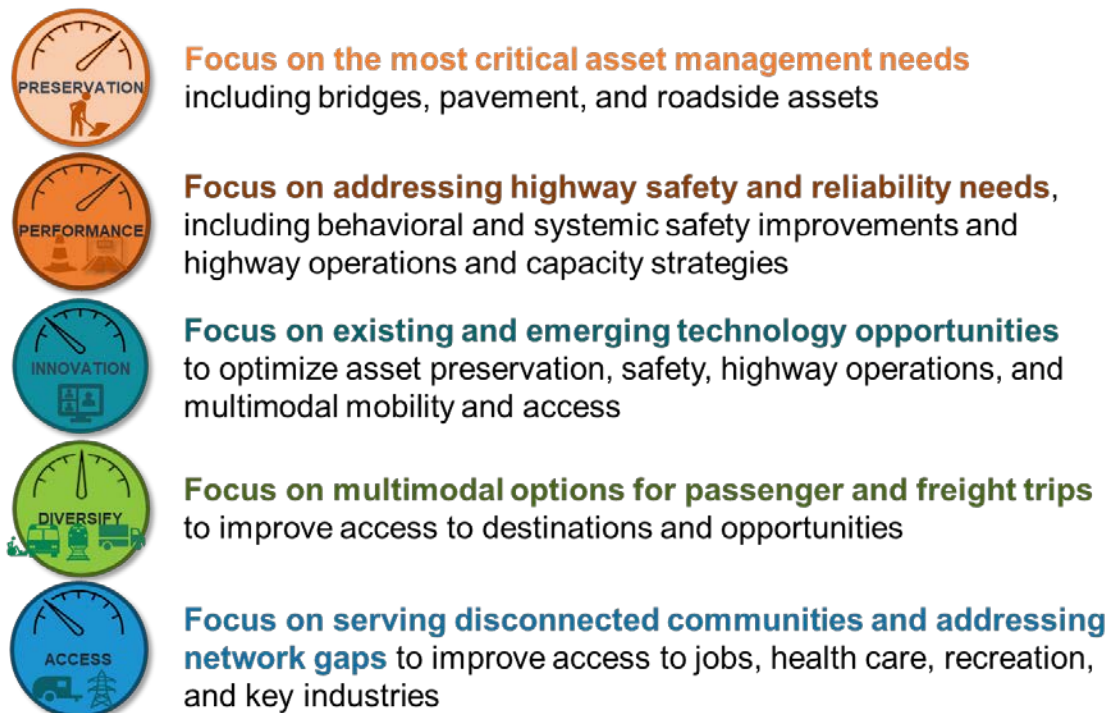


Figure 4 – Defining Proposed Investment Portfolios