

Research Paper – Economics

This paper identifies economic trends shaping the transportation planning process. The 2050 LRTP recognizes that transportation is West Virginia’s largest investment and backbone of the state economy, driving employment which empowers manufacturing, trade, and industry. Economic development and transportation investment are interdependent: transportation provides access and moves the economy.

- Slower statewide economic growth relative to peers and declining population and workforce in many communities create challenges for employers looking to expand in West Virginia.
- Steady trade partners are benefiting from rising industries like pharmaceuticals and chemical manufacturing which are shifting logistics patterns across West Virginia.
- COVID-19 is changing employment and travel patterns, and the return of economic activity in important industries like tourism and hospitality will need to adapt to new social patterns and preferences in the post-pandemic world.

1. Introduction

Economics and transportation are interdependent.

Economic trends can inform how WVDOT works with its partners to prepare for change and plan for future transportation system users’ needs. West Virginia’s economy will continue to change over the coming decades alongside industry, business, and employment. This research paper analyzes economic information to describe West Virginia’s current and expected economic trends.

Economic and transportation development are interdependent. Historic, current, and projected economic data help explain powers behind West Virginia’s economy and shapers of future development. As part of West Virginia’s economic context, employment, household income, industry and trade, and energy are also explored to help focus efforts on what West Virginian’s want and need.

Understanding these underling parameters will help WVDOT advance the current system to continue to serve and diversify the economy through 2050. As one of a series of white papers, illustrating the economic context will influence the development of needs, strategies, and ultimately recommendations that will become a critical outcome of the 2050 LRTP planning process.

1.1 Data Evaluation and Interpretation

Historic and current data from government, nonprofit, academic, media, and corporate sources are all used to explain West Virginia’s underlying economic context. Additionally, results from the West Virginia Chamber of Commerce 2019 Survey (containing 405 responses) also guide focus on addressing the key economic development priorities of improving roadways and creating as well as protecting jobs. Current economic information from the Federal Reserve Bank of St. Louis (St. Louis FRED), Bureau of Economic Analysis (BEA), Federal Highway Administration (FHWA), US Department of Agriculture (USDA), and the Bureau of Labor Statistics (BLS) is coupled with material from local news articles, academic publications, and transportation as well as manufacturing organizations to further understand West Virginia’s economic engines. Full source information is detailed in **Appendix A**.

2. Where Are We Today: What Moves West Virginia’s Economy?

2.1 Gross Domestic Product (GDP)

Slight Growth

Despite growth over 5% during the past ten years (**Figure 1**), West Virginia’s was the 42nd largest state economy based on GDP (gross domestic product, a measure of total economic activity). In 2010, West Virginia was the 40th largest state economy (New Hampshire and Idaho have since passed) but recent growth is promising.

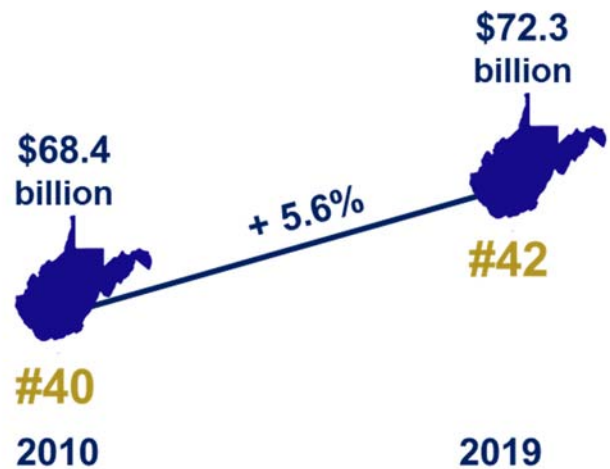


Figure 1 West Virginia GDP Change (2010 vs. 2019)¹

Total GDP of \$72 billion in 2019 will only increase with continued building and expansion of industry and trade, which depends on ample employment opportunities. Employers need educated and healthy workers with the right training and ability to access job sites. Without any of these pieces, employers do not expand their local workforce, jobs become scarcer, and poverty increases as household income falls. Residents want to see roads improved to reach their jobs, more job opportunities created, efforts spent to retain employees, industry and trade expanded, and energy diversified. Investing in these pieces together will drive West Virginia’s economy forward over the coming decades.^{1 2 3 4 5}

2.2 Transportation

Reliable Roadways

Transportation is West Virginia’s largest investment, employer, and employment engine; industries rely on safe road access to manufacturers and markets; citizens rely on direct access to education and workforce development; and families rely on access to health services. Everyone uses West Virginia’s highway network to meet these daily travel needs, collectively supporting job creation which has economic impacts.

Nearly 31% of the state’s roads are in poor condition, and about 19% (1,372) of West Virginia’s bridges are structurally deficient which costs drivers \$723/year from dealing with congestion and crash-related delays, vehicle operating costs, and other unfavorable roadway conditions.⁶ State investment in roads and bridges is a top priority because improving transportation infrastructure statewide increases safety, efficiency, and employment.^{7 8 9 10 11}

¹ WVU Bureau of Business and Economic Research.

² St. Louis FRED Economic Data. Federal Reserve Bank of St. Louis.

³ Gross Domestic Product by State, 1st Q 2020. Q2 2020 released 8/27/2020.

⁴ McElhinny, Brad. “West Virginia leads nation in GDP growth for most recent period.” July 15, 2019. WV Metro News.

⁵ “Best States: West Virginia.” US News and World Report.

⁶ West Virginia Infrastructure Overview. Infrastructure Report Card. ASCE. 2017.

⁷ West Virginia Transportation By The Numbers. February 2017. TRIP: A Transportation Research Group.

⁸ Prezkop, Jennifer Jeff. “Infrastructure at a Glance.” WV Executive. August 17, 2018.

⁹ Sauter, Michael B. “States with the Most Dangerous Roads.” 24/7 Wall Street. March 26, 2019.

¹⁰ “West Virginia Ranked in the Top 10 for Traffic Danger.” Bottner & Skillman Attorneys at Law. April 2, 2019.

¹¹ West Virginia Department of Motor Vehicles.

2.3 Employment

Job Creation and Retention

West Virginian's are focused on creating and protecting jobs because employment drives West Virginia's Economy (**Figure 2**). With just over half of total residents employed at 55% (the fewest in the US), job growth also lags the nation and drives the educated workforce out. Most West Virginian's are employed between the ages of 30 and 44 working as nurses, cashiers, cooks, grade schoolteachers, or as drivers and/or sales workers (**Figure 3**).^{12 13 14}

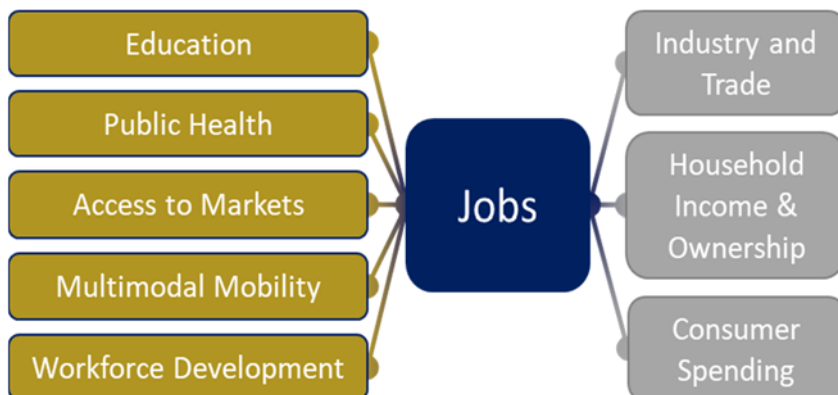


Figure 2 Employment Drives West Virginia's Economy

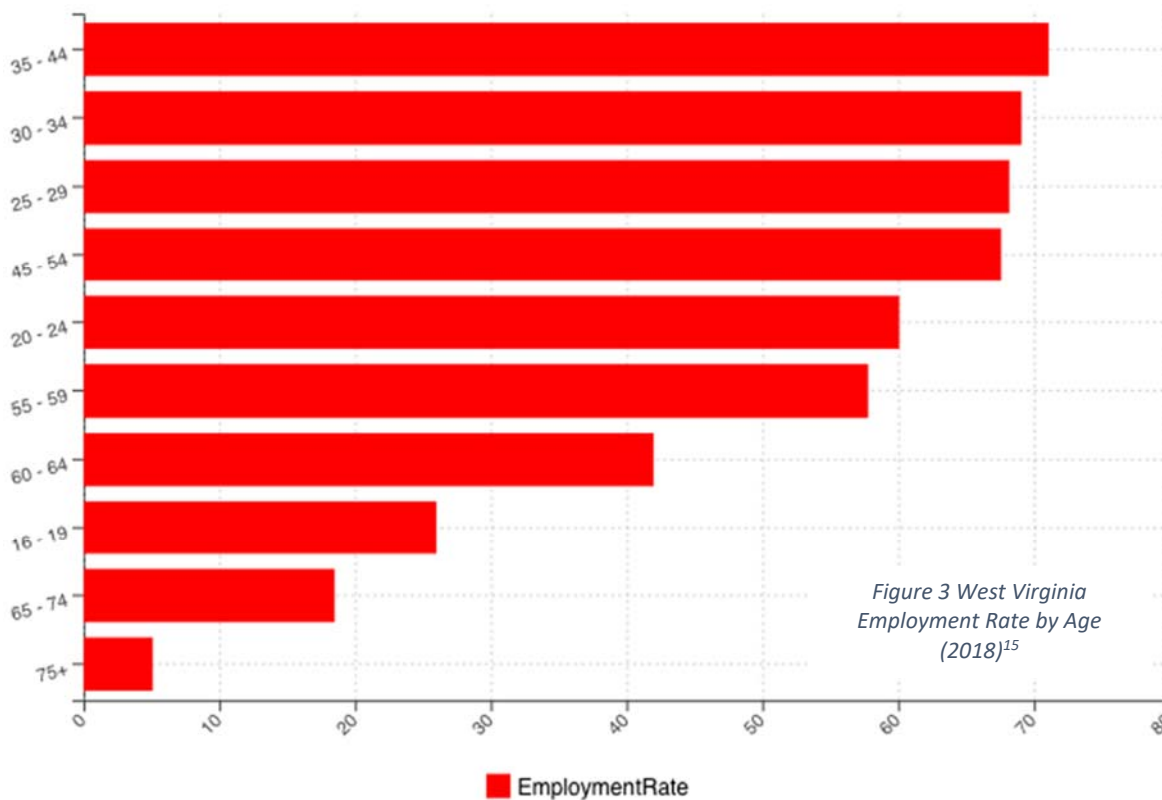


Figure 3 West Virginia Employment Rate by Age (2018)¹⁵

Healthcare continues to grow as doctors in West Virginia still receive the highest salaries at \$247.5K/year as of 2018, followed by nurse anesthetics (\$226.2K/year). The next highest paying jobs are geological as well as mining engineers (\$196.8K/year) and chemists/material scientists (\$139.7K/year).

¹² Damron, Jordan, "Gov. Justice announces best job rate in West Virginia in 11 years." Office of the Governor: Jim Justice. May 29, 2019.

¹³ McElhinny, Brad. "West Virginia's Labor Force Participation Remains Last." September 1, 2019.

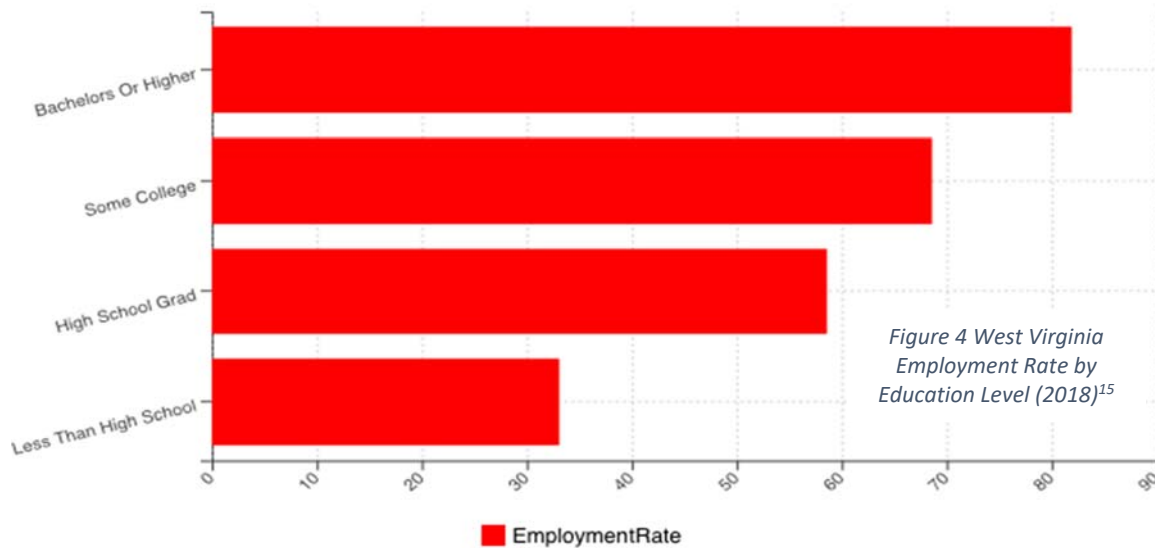
¹⁴ West Virginia Population. World Population Review.

TRENDS, DRIVERS, AND OPPORTUNITIES



A change from 2014, business operations specialists used to trail doctors, followed by detectives and criminal investigators, electrical engineers, and lastly, geological as well as mining engineers. Mining is prevalent in rural West Virginia, but healthcare, trade, and service industry employers have provided the most jobs both in urban and rural parts of the state, each employing between 48,000 and 50,000 West Virginians as of 2018.^{15 16}

Rural parts of West Virginia have historically (2014-2016) suffered from higher unemployment (8.5%) and lower workforce participation than urban metro areas (6.5%). More educated workers combined with more job opportunities both contribute to lower poverty levels, particularly in urban areas (**Figure 4**). The 2010 through 2018 EPOP (Employment to Population) Ratio also showed more residents are employed in urban (51.6%) areas versus rural (46%) areas.



The highest unemployment rates exist for those who have not finished high school (**Figure 5**). The state’s unemployment rate was improving up until February 2020 with the lowest unemployment rate since 2008 (4.7%). While the COVID-19 pandemic caused the unemployment rate to reach 12.9% in May 2020, unemployment is back down to 6.4% as of October 2020.¹⁷

Workforce development remains a primary effort across every industry, especially in rural areas to combat higher unemployment. Even though healthcare and grade schools are big state employers, West Virginia continues to suffer from poor public health and weak public education; investment for training is needed across both to increase employment and improve public health as well as education. Job creation and retention remains a statewide effort across big employers which will continue to require widespread support.

| | |
|-----------------------|--------|
| Less Than High School | 29.72% |
| High School | 15.69% |
| Some College | 12.47% |
| Bachelors or Greater | 4.73% |

Figure 5 West Virginia Poverty Rate by Education Level (2018)¹⁵

¹⁵ Boettner, Ted; O’Leary, Sean; and Rick Wilson. State of Rural West Virginia. West Virginia Center on Budget and Policy. America Friends Service Committee. October 2018.

¹⁶ WV Data USA.

¹⁷ Economy at a Glance: West Virginia. U.S. Bureau of Labor Statistics (BLS).

2.4 Households

Income and Homeownership

Household income and homeownership depend on steady employment across varied industries. While West Virginia’s household income continues to lag at around \$44,000 as of 2018, homeownership has not, surpassing the US for the past six years and now by more than 10%. Homeownership has remained strong since 2014, holding a consistent average of having 72% of homes owner-occupied. Home value is also increasing, most recently growing 1.3% up to a median value of \$121.K as of 2018 but still falls below average values in neighboring states.¹⁸

Not all residents are lucky enough to benefit from homeownership. About 17.8% of West Virginian’s suffer from living in poverty, with higher concentrations in rural areas (19.3%) than urban areas (16.3%). Investing in transportation and employment will increase household income, keep homeownership strong, and reduce poverty levels.^{19 20}

2.5 Commerce and Industry

Trade Expansion

Creating and retaining jobs depends on expanding industry and trade as well as supporting existing growth. Consistent domestic as well as international trade partners for nearly the past ten years has stabilized state exports, which continually exceed imports and fortifies the local economy. Stable domestic trade partners are Pennsylvania, Virginia, North Carolina, and Ohio. Canada is both a top foreign import and export partner helping West Virginia’s \$82.B of total exports and \$3.4B of total imports. India is another top foreign export partner, and Japan is an additional top foreign import partner (**Figure 6**).²¹

| | Rank | Good/Commodity | 2018 \$ |
|---------|------|-----------------------|---------|
| Exports | 1 | Oil/Mineral Fuels | \$4.5B |
| | 2 | Plastics | \$1.1B |
| | 3 | Industrial Machinery | \$590M |
| Imports | 1 | Industrial Machinery | \$1.1B |
| | 2 | Organic Chemicals | \$282M |
| | 3 | Precision Instruments | \$268M |

Figure 6 West Virginia Top Exports and Imports (2018\$)²²

West Virginia also recently started taxing remote sellers which has helped diversify the state’s public funding base.²² West Virginia’s economy benefits from strong tourism and manufacturing with good access to domestic and international markets. Tourism outpaces the nation, growing for the past three years with traveler spending increased another 7% to \$4.55B during 2018. Year-over-year growth has

¹⁸ Economic Research Service (ERS). US Department of Agriculture. Rural Health Information Hub. January 3, 2019.

¹⁹ US Census: WV Quick Facts.

²⁰ “2020, 2019 Current Population Demographics and Statistics for West Virginia by age, gender and race.” SuburbanStats.Org.

²¹ 2019 West Virginia Manufacturing Statistics. nam.org.

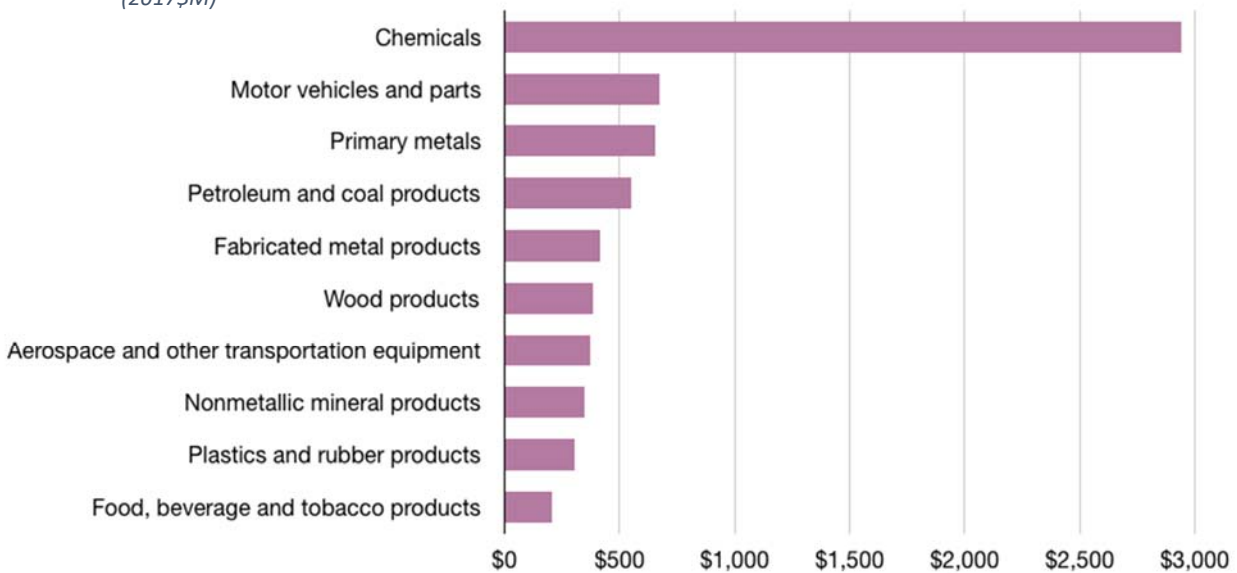
²² Cole, Gale. “West Virginia to Tax Remote Sales Starting January 1, 2019.” Avalara Blog. October 5, 2018.

helped grow jobs in restaurants and food service businesses, consistently one of West Virginia’s largest employers.^{23 24 25 26 27}

Mining is still prevalent as coal remains one of West Virginia’s largest products, but chemicals, motor vehicles and parts, as well as primary metals all now exceed coal manufacturing (**Figure 7**). Mining coal powers state electricity and employment for geotechnical and mining engineers, but chemical manufacturing is the largest manufacturing sector by dollar value as pharmaceutical and medicine manufacturing have experienced the most job growth statewide.

Figure 7 West Virginia Top Manufacturing Sectors (2017\$M)²²

Top 10 West Virginia Manufacturing Sectors, in Millions of Dollars, 2017



2.6 Energy

Diversification and Resilience

Balancing coal use alongside diversifying energy sources will make West Virginia’s economy more resilient. Nearly all (90%) of the state’s electricity comes from coal, and no electricity comes from solar. With only 10% of electricity coming from other renewables (natural gas and wind/hydro power), West Virginia’s economy remains heavily at risk from lack of energy diversification. Recent passage of the Solar Bill will help diversify energy sources by influencing more use of renewables and raw materials and shift the economy through changes in statewide supply/demand.²⁸

²³ Damron, Jordan. “West Virginia Tourism Industry Outpaces National Growth by 58%.” Office of the WV Governor: Jim Justice. October 16, 2019.

²⁴ Global Edge. Michigan State University.

²⁵ Freight Analysis Framework: Freight Analysis Tool.

²⁶ Burton, Mark L. and David B. Clark. “An Economic Analysis of the Appalachian Coal Industry Ecosystem: Transportation Implications Of Coal.” Prepared for the Appalachian Regional Commission. West Virginia University and The University of Tennessee. January 2018.

²⁷ “Freight Facts and Figures.” US Department of Transportation and Bureau of Transportation Statistics. 2017.

²⁸ Patterson. “Passage of Utility Solar Bill.” West Virginia Public Broadcasting. March 2020.

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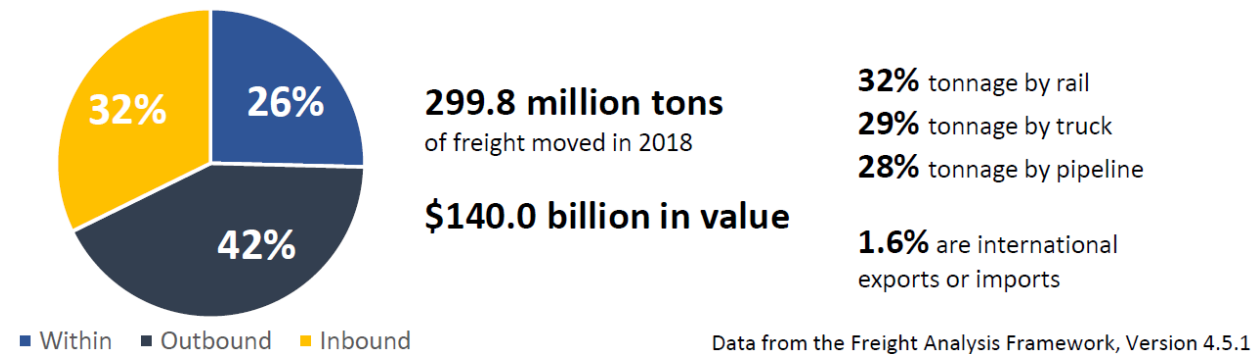


Current Impact on Transportation – Transportation is the state’s largest investment and largest employer because every industry relies on access to operate, and most residents choose driving as their primary mode of transportation. In 2019 according to the U.S. Census, 83.3% of workers drove alone to work car, traveling an average of 25.6 minutes (4% of residents commuted over 90 minutes), and 9% of workers carpooled, and 3% worked at home.

Lack of adequate infrastructure investment costs residents in vehicle operating costs, congestion-related delays, and traffic crashes. Residents depend on reliable transportation, which means safe roadways to provide reliable access. The changing job market is affecting commuting patterns, and travel has changed as a result of the global pandemic, but driving has remained residents’ primary transportation choice for all trips, especially when commuting to work.

An efficient and well-maintained transportation system – including highways, freight rail, airports, intermodal facilities and ports, and pipelines help ensure that goods are moved safely and on-time. While many of these assets are owned and operated by private entities, highways are critical to move goods to construct and support these networks while facilitating a large share of total goods movement through trucking.

Freight movement in West Virginia is nearly evenly split between inbound, outbound, and within the state trips totaling 299.8 million tons of freight moved in 2018 with a value of \$140.0 billion. The distribution of this freight movement by mode is also evenly distributed across rail, truck, and pipeline, with the remaining 10% to air cargo and barge traffic. As movement of coal by rail across West Virginia decreases, and new manufacturing industries and logistics patterns emerge, increasingly, more total tonnage will be moved by trucks. Coal transportation costs and total volumes have steadily decreased across the U.S. over the last five years, consistent with information reported annually by the US Department of Energy, Energy Information Administration.²⁹



As of October 2020, data, nearly 26 percent of total employment in West Virginia are in sectors where transportation is critical to total activity, including manufacturing, mining and logging, and trade, transportation, and utilities according to data from the Bureau of Labor Statistics.³⁰

²⁹ Coal transportation rates in the United States decreased for the fifth consecutive year. Energy Information Administration, May, 2020. <https://www.eia.gov/todayinenergy/detail.php?id=43695>

³⁰ https://www.bls.gov/regions/mid-atlantic/west_virginia.htm#tab-2

3. Future Direction: What Do West Virginian’s Want?

3.1 Top Issues

The West Virginia Chamber of Commerce sponsored a 2019 Survey to collect information on what West Virginian’s want. Residents were permitted to name two topics, and the 405 responses fell into five top issues (**Figure 9**) which guide focus on addressing the resident’s key social development priorities. Each issue depends on and effects West Virginia’s economy, and economics as well as economic trends influence long range transportation planning because economic development and transportation investment are interdependent.

| Issue | Topic | % Priority |
|-------|----------------------------|------------|
| 1 | Improve Roads and Highways | 37% |
| 2 | Improve Public Education | 31% |
| 3 | Create and Protect Jobs | 26% |
| 4 | Stop the Opioid Crisis | 26% |
| 5 | Fix Healthcare | 25% |

Figure 4 West Virginia Chamber of Commerce 2019 Survey Results³¹

3.2 Transportation

Improve Roadways

Most West Virginian’s drive and need safer roads to drive on. As the state’s largest investment, employer, and employment engine, transportation enables industries to operate strong transportation corridors provide safe road access for the people behind the operations. State investment in roads and bridges is a top priority because improving transportation infrastructure statewide increases safety and efficiency, enabling growth in industry and commerce, feeding employment, and increasing household income which all drive West Virginia’s economy.

Most roadway maintenance is paid for by motor fuel taxes and privilege taxes, but WVDOT also receives federal funding as reimbursements mostly for taking care of federal roadways within the state. Certain roadway improvement projects qualify for federal funding, which can end up covering 80% to 90% of total project costs depending on the road project.

Local roadway improvements are already underway thanks to the Governor’s Roads to Prosperity Program created in 2017. Through this program, the State of West Virginia has been able to raise funds for roadway improvement projects by selling General Obligation (GO) bonds, with over \$1B raised to date.³² The most recent bond sale in December 2019 was so successful, more funds were raised for projects (\$746.5M) than bonds actually sold (\$600M)!³³ Funds from selling these bonds are being used to build and/or fix bridges, highways, and local roadways throughout the state.

³¹ Respondents could name 2 issues. MetroNews Staff. “New Survey Finds Roads, Education Top Issues West Virginian’s Concerned About.” June 23, 2019

³² GO Bonds have been issued 2017, 2018, and 2019, and an additional \$200M of GO Bonds is expected to be issued as part of the Roads to Prosperity Program before June 30, 2021 to provide additional funding for roadway projects. Page 13. West Virginia Commissioner of Highways 2018 \$78M Special Obligation Notes Official Statement (OS) and December 2020 interview with Carla Rotsch, WVDOT Business Manager.

³³ Druga, Melina. “WV Sells \$600M in State Road Bonds.” December 5, 2019. Transportation Today: Diving Discussion on Transportation and Infrastructure.

To fund more local highway and road construction projects, WVDOT sold an additional \$5 million of Surface Transportation Improvements Special Obligation Notes, known as GARVEE Bonds, in 2017 on top of the \$53.38 million GARVEE Bonds issued in 2016. Federal funds from the Federal Highway Trust Fund (HTF) pay debt expenses on both of these bonds. Additionally, as part of the West Virginia Transportation Alternatives and Recreational Trails Program, the WVDOT recently awarded around \$7.4M across 38 federal transportation grants to improve local roadways.³⁴

Generating funding for public road investments is the first step towards building a safer transportation system for future West Virginians because with these bond proceeds, WVDOT can fund much needed improvements as well as commission planning studies to analyze transportation alternatives and other transportation investments across the state for future construction projects.

3.3 Education

Strengthen Public Schools

Explained further in the Demographics Research Paper, improving public education in both urban as well as rural areas will empower West Virginia's future workforce to drive the economy. Educating and training future employees starts in schools like teaching relevant skillsets across industries and offering internships as entry to full time employment.

3.4 Employment

Increase and Preserve Jobs

Expanding industry and trade in addition to supporting existing growth will help increase and preserve jobs. Major employers and industries like tourism and hospitality will need help recovering from COVID-19 to still thrive in a post-pandemic world. Spending time to understand and estimate changes in employment patterns with more remote working and less business travel will ensure employment needs match available resources. As healthcare and grade schools remain big employers, investing in training across both will increase employment and improve public health as well as education.

Clorox announced new operations in West Virginia expected by 2022 and will be offering more than 100 new positions. Facebook is building Broadband through the state which will allow for faster internet and cable services to offer employers reliable technology to remain connected and competitive. Attracting more large corporations like Clorox and Facebook to invest in these technologies as well as build manufacturing facilities in West Virginia will bring additional jobs and open up more rural areas for development. As large employers create jobs, jobs remain filled and stay protected by continually educating staff. Focusing on workforce participation will retain young professionals and strengthen West Virginia's aging workforce as job creation and retention remain statewide efforts with widespread support.^{35 36}

3.5 Public Health

Amplify Healthcare Spending Also explained further in the *Demographics and Social Development Research Paper*, public health improvements in both urban as well as rural areas will

³⁴ "State Awards \$7.4M in Transportation Grants." June 1, 2020. WV Metro News.

³⁵ "Clorox Plans New Manufacturing Facility in West Virginia." The Associated Press. January 16, 2020.

³⁶ Johnson, Shauna. "Facebook 'Long-Haul' Fiber Build Across West Virginia." West Virginia MetroNews. March 4, 2019.

strengthen West Virginia's future workforce needed to drive the economy. Healthy individuals will perform the best work and bring the most value. Taking care of each and every citizen will help strengthen the state economy, but more spending on healthcare is needed to take care of all West Virginians, especially those who are suffering from chronic conditions. While per capita personal healthcare spending in West Virginia has increased, it still remains around \$10K, and leveraging relationships with private stakeholders will help amplify public health resources.

Future Impact on Transportation – Enhancing mobility and safety throughout West Virginia's transportation corridors where residents live, work, and play will drive the economy, increase workforce participation, improve public health, and create widespread economic opportunity. Employers need educated healthy workers with the right training and ability to access job sites, and these pieces together lower poverty alongside raising household income. Investing in transportation and public health jobs will improve employment, transportation, and public health all at once. Keeping transportation as the state's largest investment and largest employer will ensure every industry reliable access to continue to operate.

4. Capturing Future WVDOT Opportunities

Economic trends in West Virginia are creating opportunities and challenges for the future of multimodal transportation and its ability to provide access for firms to skilled workers and to manufacturers and markets. Four critical trends impacting transportation's future include:

- **Slower statewide economic growth relative to peers and declining population and workforce in many communities create challenges for new and expanding employers looking to expand in West Virginia.** This also creates a challenge for funding multimodal transportation – particularly given that transportation mobility and asset preservation needs will continue to increase in West Virginia.
- **Combined demographic and economic trends are shifting logistics patterns across West Virginia.** These shifts, including declines in natural resource extraction, are shifting the use of freight modes more predominantly to trucking. Increasing household reliance for on-demand products increases the potential for warehousing and distribution within West Virginia as well as smaller-scale manufacturing of key products such as pharmaceuticals.
- **Continued declines in natural resource extraction industries and associated businesses in rural West Virginia will continue to lead to population and jobs decreases in these communities.** These changes could create opportunities for clean-up and reuse of industrial sites for new development and conversion of abandoned rail lines to trails to support tourism and recreation.
- **COVID-19 continues to change employment and travel patterns.** Increased reliance on remote working, education, and health care will continue to create greater demand on access to reliable high-speed internet across urban and rural areas in West Virginia. This need is particularly critical in more disconnected rural communities, both for small businesses and households.
- **The return of economic activity in important West Virginia industries like tourism and hospitality will need to adapt to new social patterns and preferences in the post-pandemic world.** Continuing to enable high-quality and reliable access to attractions across West Virginia from key markets across the United States will be critical – including from new post-pandemic direct commercial air service and other modes like passenger rail.

WVDOT's Future Direction

WVDOT should continue to target transportation investments that help grow and diversify its economy to be more resilient in the face of uncertainty across the coming decades. This includes investments and policies that facilitate piloting and testing of new transportation technologies, like autonomous vehicles, drones, and Hyperloop. Investments must also help improve efficiency and safety of the multimodal transportation system to optimize workers access to jobs and lowering logistics costs.^{37 38}

Building industry and trade while supporting existing growth goes together with balancing coal use alongside diversifying energy sources to make West Virginia's economy more resilient as a whole. Changes in logistics patterns could rise from additional taxing policies, more use of renewable energy, multimodal improvements expediting transport, and additional private companies building local facilities. Transportation, manufacturing, and trade will all be affected from any of these developments which could impact state economy and change the statewide relationship of supply and demand with local, neighboring, and global markets.

Residents want to see roads improved to reach their jobs, more job opportunities created, efforts spent to retain employees, industry and trade expanded, and energy diversified. Jointly investing in these pieces will drive West Virginia's economy to 2050. Economic resilience is created from continued economic opportunity necessary for public, private, personal, and community income growth, funding public services, supporting senior citizens, and developing the future workforce. As the economy changes and technology expands, WVDOT can expand training and opportunities for workforce development to ensure that WVDOT staff and its partners have access to skills and resources to remain economically competitive and stay ahead of technology evolution. This will help WVDOT foster development of the 21st century workforce and share with partner state and regional agencies.

Workforce development first comes from education and retention, and noticing emerging top industries helps to create workforce opportunity and siphon unemployment. Changes in top state employers and top paying jobs necessitate matching training with needed skills to ensure worker supply meets economic demand to increase workforce participation. Then, with education and training, West Virginia's workforce needs access and an opportunity to perform. Transportation provides this access, vital for students, workers, and seniors to go to school, get to work, and receive health care.

Improving job access through transportation will especially help residents in disadvantaged areas access workforce development initiatives and benefit from employee retention efforts. Seniors especially will place more demand on state services and resources, and without tax reforms combined with policy, current services remain expensively inefficient because of inadequate programs. Economic efforts invested in people and public structure, including transportation, will create widespread opportunity to improve the quality of life for all West Virginian's.

³⁷ Wood, Molly. "Five Reasons for a Self-Driving Car Slowdown." WV Public Broadcasting. January 30, 2018.

³⁸ WVU Research Gives Self Driving a Boost." September 19, 2017.

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