Transit Equity and Environmental Justice in Newport News, Virginia

A sustainable transportation project proposal for historically disadvantaged communities in Hampton Roads

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Executive Summary

Environmental justice is based on the principle that historically, certain groups have borne unequal environmental and economic burdens and unhealthy living conditions as a result of industrial, municipal, and commercial operations and/or federal, state, and local laws, regulations, and policies. EJ is based on direct engagement of marginal communities with the goal of ensuring they are engaged in the planning, design, and implementation of projects that may have an effect on those communities. Transportation equity is a critical component of environmental justice and servicing environmental justice communities. Transportation Equity is defined as the fair distribution of benefits and burdens of transportation projects, plans, policies, and processes.

This proposal for a transportation equity project in Newport News and surrounding areas was borne out of community member concerns about public transit access. These concerns were documented by project authors through a conversation facilitated by Virginia Organizing and through a survey which was distributed to community members. Common themes arose regarding issues with frequency of public transit in the Newport News and Hampton Roads area, as well as access to neighborhood bus stops. The goals of the project were to respond directly to community member concerns about frequency and access to public transit, while at the same time minimizing or reversing the total greenhouse gas and air pollutant emissions of the project.

The above stated goals are proposed to be met through a purchase of 10 electric buses with associated chargers to be deployed in the Newport News, Hampton, and Portsmouth area of Hampton Roads. The intent of these buses is not to replace currently-running diesel buses, but to supplement existing buses in order to increase frequency and access to transportation in these areas. The proposal also budgets for bus route optimization services with a focus on equity, to ensure that communities with the highest need for public transit are able to access these transportation opportunities. Community engagement should be made central, and money is also allocated to prioritize this goal. Finally, part of the budget goes to workforce development with the goal of job creation in the local communities. Federal funding for environmental justice and transportation equity projects is available in unprecedented amounts due to executive initiatives such as Justice40. Two funding sources identified for this project include the RAISE discretionary grants offered by the Department of Transportation and the Clean Heavy-Duty Vehicles program through the Environmental Protection Agency. It is imperative that communities with a history of environmental justice concerns, areas of high poverty, and inaccessible transportation take advantage of these funding opportunities to improve transit and overall quality of life for historically underserved communities. The city of Newport News and the bigger Hampton Roads region stand to benefit substantially from this type of federally funded project.

I. Introduction

This report was created to examine options for the development of a new sustainable transportation project in the city of Newport News, Virginia. A primary goal of this report is to understand the types of transportation projects that can reduce emissions in comparison to business-as-usual (BAU) transportation operations, while also providing the greatest direct benefits to disadvantaged communities (DACs) and Environmental Justice (EJ) populations in the city. The result of this report is the framework for development of a sustainable public transportation project, which could be designed to leverage federal competitive or formula grant funding to facilitate implementation. This framework will be used for creation of a cost-effective low-emissions transportation project in Newport News that meets the needs of EJ populations residing in the city based upon criteria provided directly by those populations.

This report will first establish a definition of EJ and describe its criticality for design of transportation projects that enable equitable economic development. An introduction to the role the EJ has played in transportation planning nationally will be provided, including a brief assessment of the status of EJ planning in the city of Newport News. Following this, a description of the socioeconomic characteristics of Newport News will be presented, including a description of DAC and EJ designated communities in the region. An overview of the transportation sector in Newport News will be provided, with a focus on public transportation, along with key metrics for improvement of services.

Subsequently, this report will provide examples and case studies of EJ-centric transportation projects that have been implemented in the United States (U.S.). Results of these projects and lessons learned will be explored to understand real-world benefits through implementation. Costs, design criteria and implementation strategies will be provided to provide insight for how a project in Newport News could be planned. Following this, an overview of best practices related to stakeholder engagement and EJ planning will be provided based upon a literature review of guidance documents published by state and local agencies, Transportation Planning Organizations (TPOs) and Non-Governmental Organizations (NGOs). These best practices will be presented to inform how criteria could be implemented into transportation planning efforts in the City of Newport News. A selection of federal funding programs will be introduced that are applicable to support implementation of EJ transportation projects, with recommendations for how the city might best utilize these programs to improve transportation services to EJ populations.

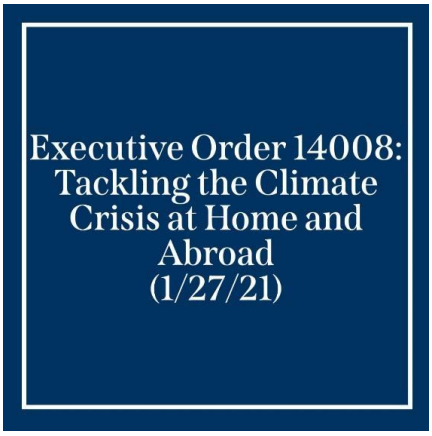
Following this literature review and overview of best practices, an introduction to the goals of project design will be presented, including the selection of key criteria that were used to inform project selection. A methodology for engagement with EJ communities in Newport News will be provided, including elements of stakeholder engagement that were used in development of this report. A narrative overview of listening sessions and a stakeholder survey will be provided, which was used as a baseline to establish critical needs for EJ populations in the City.

Finally, two project design frameworks will be presented based upon the known characteristics, goals and needs of EJ populations in Newport News. Each project will be described with provision of estimated costs, populations served, emission reduction calculations, workforce development opportunities, and grant funding available to support implementation.

II. Environmental Justice and Transportation Equity

A. Context

Environmental justice is based on the principle that historically, certain groups have borne unequal environmental and economic burdens and unhealthy living conditions as a result of industrial, municipal, and commercial operations and/or federal, state, and local laws, regulations, and policies. It is the idea that all people and communities have the right to equal environmental protection under the law, and to the right to live, work and play in communities that are safe, healthy and free of life-threatening conditions[1]. The critical reality is that historically marginalized communities have experienced an outsized share of the negative consequences of air and water pollution and a loss of economic development opportunities, all of which are expected to be exacerbated by the impacts of climate change unless specific actions are taken. EJ is based on direct engagement with members of marginal communities to ensure that they are engaged in the planning, design and implementation of new project development and are given a voice and a platform to determine if, and how, those projects are implemented in their communities.



Transportation equity is a critical component of environmental justice and servicing environmental justice communities. Transportation equity "seeks fairness in mobility and accessibility to meet the needs of all community members. A central goal of transportation is to facilitate social and economic opportunities by providing equitable levels of access to affordable and reliable transportation options based on the needs of the populations being served, particularly populations that are traditionally underserved."[2] As transportation equity and environmental justice are intimately connected, these terms may be used interchangeably throughout the narrative of this report.

B. Federal and State Action

At the federal level, EJ has been defined as "the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development,

[1] https://detroitenvironmentaljustice.org/what-is-environmental-justice/

[2] https://www.planning.dot.gov/planning/topic_transportationequity.aspx#:~:text=Equity%20in%20Transportation%3F-,What%20is%20Equity%20in%20Transportation%3F,needs%20of%20all%20community%20members.

implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no population bears a disproportionate share of negative environmental consequences resulting from industrial, municipal, and commercial operations or from the execution of federal, state, and local laws, regulations, and policies. Meaningful involvement requires effective access to decision makers for all, and the ability in all communities to make informed decisions and take positive actions to produce environmental justice for themselves.[3]

Executive Order 14008[4], enacted on January 27, 2021, put EJ at the forefront of federal action by establishing the government-wide Justice40 Initiative[5], which made it a goal that 40% of the overall benefits of certain federal investments flow to communities that are marginalized, underserved, and overburdened by pollution. In addition to directing all federal agencies to achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, EO 14008 directed the publication of the EJScreen Environmental Justice and Screening Tool.[6]

EJScreen provides a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators. This publicly available resource enables users to see the demographic socioeconomic and environmental information for a particular region in order to understand the distribution of EJ communities. This tool was used to develop numerous other EJ tools for sector-specific review, including the Joint Office of Transportation and Energy Electric Vehicle Charging Justice 40 map.

As of March 2021, 10 states had codified environmental justice in some form, with another 13 states following suit with pending legislation. 13 states have established Environmental Justice Offices, Commissions and Task Forces. In Virginia, Environmental Justice Act of 2020 established the Virginia Council on Environmental Justice and codified the definition of EJ as "… the fair treatment and meaningful involvement of every person, regardless of race, color, national origin, income, faith, or disability, regarding the development, implementation, or enforcement of any environmental law, regulation, or policy."

C. Environmental Justice in Transportation

Equity plays a significant role in the development of new transportation planning. Historically, DACs and marginalized populations have been negatively impacted by the development of transportation infrastructure. Environmentally hazardous facilities and infrastructure are often located in low-income communities and communities of color where residents are exposed to elevated levels of air, water, and noise pollution. This has resulted in racial health disparities and economic disinvestment in these communities. Highway infrastructure has had significant

[3] https://www.energy.gov/lm/services/environmental-justice/what-environmental-justice

[4] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

[5] https://www.whitehouse.gov/environmentaljustice/justice40/

[6] https://www.epa.gov/ejscreen

negative impacts on local communities, creating physical divisions between once connected regions, which has resulted in significant economic loss for local residents.

Transportation Equity is defined as the fair distribution of benefits and burdens (Table 1) of transportation projects, plans, policies, and processes.[7] Transportation equity can be classified into three different types based on how fairness is assessed[8]:

- **Procedural Equity**: degree of involvement of diverse public stakeholders in the processes by which transportation decisions are made
- **Geographic Equity**: distribution of impacts across geography and space
- **Social Equity**: distribution across population groups that can be equal or differ by income, social class, and mobility ability

Table 1. Transportation Benefits and Burdens (APA 2020)

Transportation Benefits	Transportation Burdens
• Increased access to social, educational, and economic opportunities • Increased access to high-quality mobility options • Travel time savings • Cost savings • Congestion mitigation • Reduction of pollution • Improved connectivity within communities • Opportunities for physical activity through active transportation modes • Reduction in traffic injuries and fatalities • Local hiring and job training for jobs in construction, maintenance, and operation	• Reduced access to essential opportunities and services • Restricted or no access to high quality transportation • Long/increased travel times • Financial burdens • Traffic congestion • Increased pollution • Physical division of communities • Creation of barriers to bicycling and walking • Exposure to traffic-related safety risks • Vulnerability to climate impacts • Inequitable enforcement

Historically, the majority of federal and state level transportation and infrastructure spending has been focused on highway and air travel applications. In 2021, 41% of federal spending was allocated to highway transportation and 32% on air travel; only 19% was spent on rail and public transportation projects. As a result, low-income communities have been far less likely to receive direct benefits from this infrastructure investment and has resulted in more costly and less frequent public transportation options.

[7] Equity-Oriented Performance Measures in Transportation Planning (apacalifornia.org)
[8] Addressing Urban Transportation Equity in the United States (fordham.edu)

Nationally, 60% of all public transit riders are people of color,[9] 25% are Black, and 19% are Latinx/Hispanic. Only 6% of White households in the U.S. do not have access to a car, as opposed to 18% and 11% for Black and Latino households, respectively[10]. Buses and trains are critical for the transportation needs of disadvantaged communities and people of color, who experience significantly higher average commute times than white populations. Investments in public transit can therefore contribute to economic opportunity for working communities of color by providing access to jobs, education, medical care, culture, goods and services, and community engagement. Improved public transportation can provide greater economic mobility and lower household costs, without barriers linked to race, income, age, or ability.

National averages show that public transportation produces significantly lower greenhouse gas emissions per passenger mile than private vehicles. Heavy rail transit, such as subways and metros, produce 76% less in greenhouse gas emissions per passenger mile than an average single-occupancy passenger vehicle. Light rail systems produce 62% less and bus transit produces 33% less.[11] Investment in public transportation can support equitable economic development while also effectively meeting climate goals.

There are numerous mechanisms to improve policies and programs at the federal, state and local level to address equity issues related to transportation planning, ranging from pedestrian infrastructure to capacity expansion. A sample of priorities include:

- Improve bus network design to maximize travel efficiency, prioritizing travel needs of communities of color and low-income neighborhoods
- Implementing comprehensive networks of bus-only lanes on major routes
- Improve pedestrian and bicycle connections to transit stops and add shelters and other amenities at bus stops.
- Increase investment in pedestrian safety along major transit routes
- Add station elevators and improve information access to make transit infrastructure universally accessible
- Make rail service more useful and affordable to lower-income riders who've been excluded by the 9-to-5 suburban service model
- Integrate fares, routes, and schedules between overlapping bus and rail services
- Structure fares to make transit affordable for everyone, people with low incomes, people with disabilities, seniors, students, and kids
- Increase presence of transit riders, women, Black and brown people, people with disabilities, and other under-represented groups on agency governing boards

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[9] https://www.apta.com/wp-content/uploads/Resources/resources/reportsandpublications/Documents/APTA-Who-Rides-Public-Transportation-2017.pdf

[10] https://nationalequityatlas.org/indicators/Car_access#/

[11] https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf

- Prioritize maintenance and upgrades of existing transit infrastructure above aesthetically-driven projects or high-cost capital expansions
- Implement major capacity expansion projects targeting concentrations of people and jobs to maximize benefit, not where resistance is lowest

Stakeholder engagement is critical to the implementation of any transportation project. An equitable transportation plan considers the circumstances impacting a community's mobility and connectivity needs. Public project developers must consider the disproportionately high and adverse effects on minority and low-income populations, and community voices that have been historically absent from transportation planning discussions must be heard. A two-way dialogue between community members and project planners must be facilitated to ensure that concerns and needs are adequately expressed and addressed, and a thorough understanding of how a project may improve or harm the lives of community members must be understood.

III. Newport News in Context

A. Geography and Socioeconomics

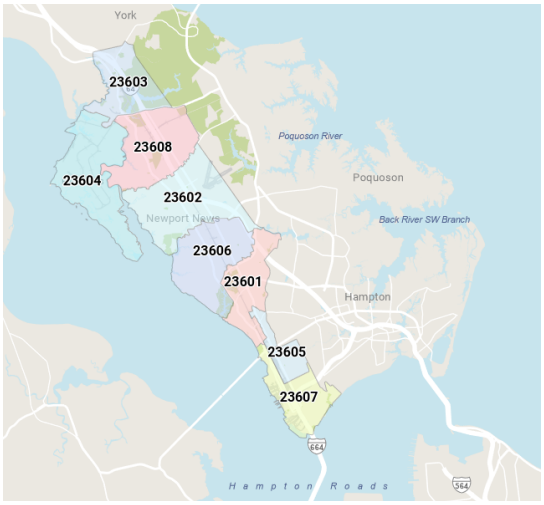


Figure 1: Map of Newport News, VA by zip code

The city of Newport News is located in the Hampton Roads region of Virginia, which also includes Norfolk, Portsmouth, Chesapeake, Hampton, Virginia Beach and Suffolk. The coastal city is 68.99 mi^2 and is home to 184,587[12] residents; population has remained flat over the past decade, with a total population of 180,719 in 2010. The population of Newport News is 46.6% White, 40.9% Black or African American, 9.4% Hispanic or Latino and 3.2% Asian; 10.2% of the population speaks a language other than English at home.

The median household income in Newport News is $54,511, while 14.8% of the population has been identified as living in poverty; the unemployment rate is 4.4%. At the national level, median household income is $70,784, the poverty rate is 11.6% and the unemployment rate is 3.5%[13] making it one of the most economically distressed areas in the region.

Incidents of poverty are significantly higher along the northern and southern portions of the region, with poverty rates reaching as high as 36.4% in the southernmost census block groups.[14] Incidents of poverty and poor physical health are higher in many of the communities which are located along

[12] https://www.census.gov/quickfacts/fact/table/newportnewscityvirginia/PST045221
[13] https://www.census.gov/library/publications/2022/demo/p60-276.html#:~:text=Highlights,and%20Table%20A%2D1).
[14] https://www.ghrconnects.org/indicators/index/view?indicatorId=240&localeTypeId=3&periodId=6955

the Norfolk Southern/CSX rail corridor that travels from the Port of Newport News north towards Williamsburg. Notably, this port hosts the Dominion Terminal, a coal export terminal and coal storage facility that provides 22 million tons per year of coal export capacity and 1.7 million tons of coal ground storage[15]. There is currently a study being undertaken by the Virginia Department of Environmental Quality (VDEQ) through EPA to understand the air quality impacts of this facility on local populations.[16]

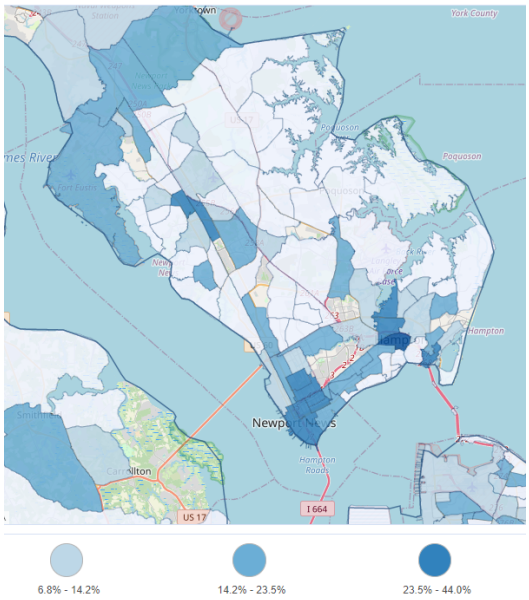


Figure 2: Poverty levels in Hampton Roads, VA

Citywide, residents primarily use single occupancy vehicles for transportation and commuting. 78.7% of the population reports commuting alone, while 13.0% carpool. Less than 7% of the population reported using public transportation, walking or other means (such as biking) as their conveyance to travel to work. There are 115,887 registered vehicles in Newport News, with 10.6% of households reporting that they did not have a vehicle available, far higher than the 6.2% rate across the state.[17]

B. Public Transportation and Planning

Newport News operates within the Hampton Roads Transit (HRT) area, which is overseen by the Hampton Roads Transportation Planning Organization (HRTPO). Across the HRT area, monthly ridership across all modes (ferry, light rail, paratransit and transit bus) in 2022 ranged from 400,282 (January) to 669,326 (August), revealing the increased utilization of public transportation during tourism season in the area. There are 22 bus routes that serve Newport News[18] connecting it with local regions including Norfolk and Portsmouth (Figure 3). In 2022 HRT also announced two ride-share pilot programs that are operating in Newport News and Virginia Beach[19]. HRT is operating an on-demand, public transportation, shared ride program in Newport News, whereby residents can request a shared ride for $2 via a mobile app within a specified service zone (Figure 4). This pilot program is limited in geographic scope and is only operational until the close of 2022 currently.

[15] https://pitchbook.com/profiles/company/175835-89#overview
[16] https://www.virginiamercury.com/2022/04/19/virginia-will-begin-monitoring-air-pollution-around-hampton-roads-coal-terminals/
[17] https://www.countyoffice.org/va-newport-news-city-motor-vehicles-dmv/
[18] https://gohrt.com/routes/newport-news/
[19] https://gohrt.com/ondemand/

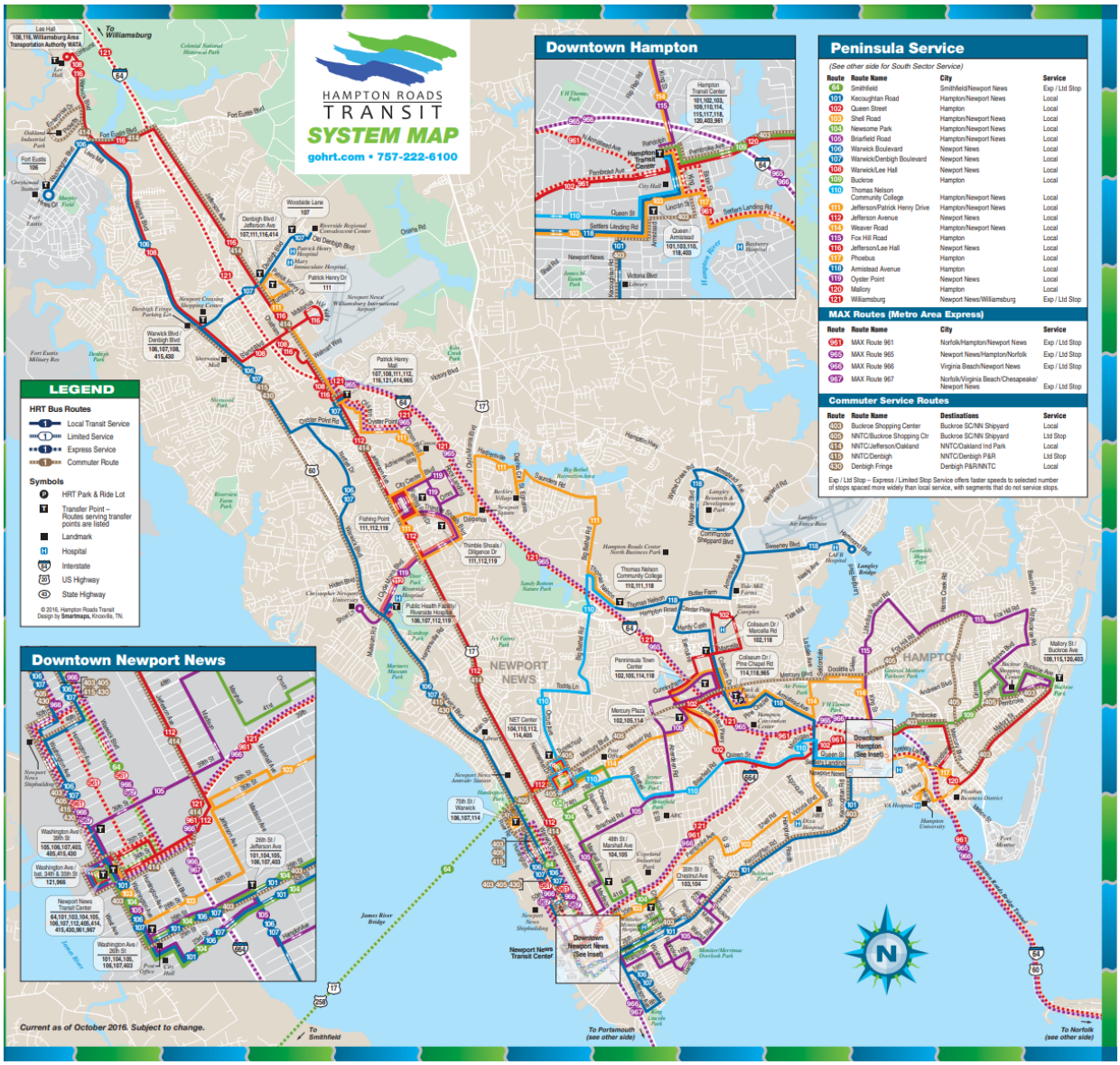


Figure 3. HRT Bus Routes - Norfolk, Portsmouth and Newport News

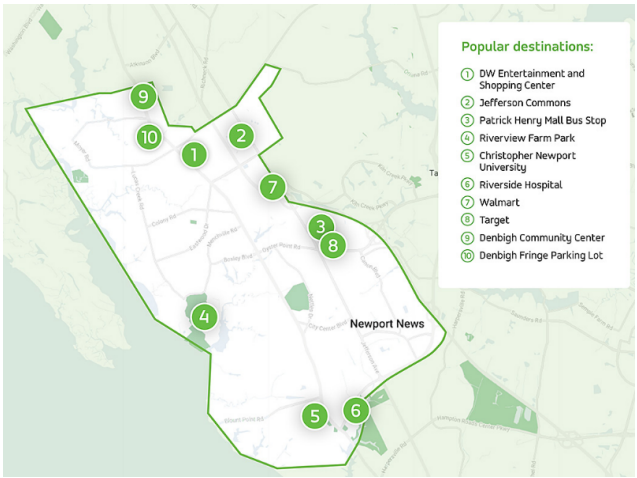


Figure 4: Map of HRT Ride-Share Pilot Program

HRT also announced the construction of a new $74 M transportation center in Newport News to be located on Bland Blvd in close proximity to the Newport News/Williamsburg International Airport. The center is now expected to be operational in fall 2023. The station Master Plan includes 80,000 sf office, 125 key hotel, 9,600 sf of retail, and public open space for passive recreation along with bus accommodations for Amtrak, thruway buses, HRT and intercity bus, and airport shuttles.

In its 2040 comprehensive plan, the city of Newport News has identified several programs for improvement of the existing transportation system. This includes the implementation of a "Transit-Oriented Development" land use designation for an area located within ¼ mile of existing and planned transit stations (Figure 5). This designation is intended to provide for walkable, mixed-use neighborhoods supported by a mix of residential, office, and retail uses. The plan also calls for bus rapid transit lines and expansion of bike and shared use paths, in addition to more conservative programs such as road widening.

In development of its 2018 Comprehensive Plan, the city conducted significant stakeholder outreach activities including community workshops, surveys, focus groups, roundtables and interviews between 2013 and 2014. The results of this feedback identified numerous issues and priorities for the city to address related to transportation planning, including:

- Improved public access is needed to open space and recreational areas including Newport News Park.
- Public access to the waterfront is needed throughout the city for access to all residents
- Light rail or BRT is needed along the CSX line with feeders to neighborhoods and activity centers throughout the city to relieve congestion and improve connection to jobs, services and shopping
- Transportation options should target various age groups including youth and young military members, many of whom do not have access to privately owned vehicles
- Bike lanes and routes are needed throughout the city and in key areas such as Newport News Park to improve connectivity and safety.
- A bicycle master plan is needed
- The airport use is expanded and becomes the center of an aerotropolis node.
- Parking garages and charging stations should be located citywide
- Rail infrastructure in the downtown is used for emergency evacuations of citizens in the southern district
- Public transportation is also provided using the waterways in the form of ferries and water taxis.
- All bus stops are safe and provide shelter
- Lack of curbs and gutters citywide should be addressed before sidewalks are widened
- Transportation and land use planning need to occur simultaneously – transit-oriented development should support new transit lines and existing stops

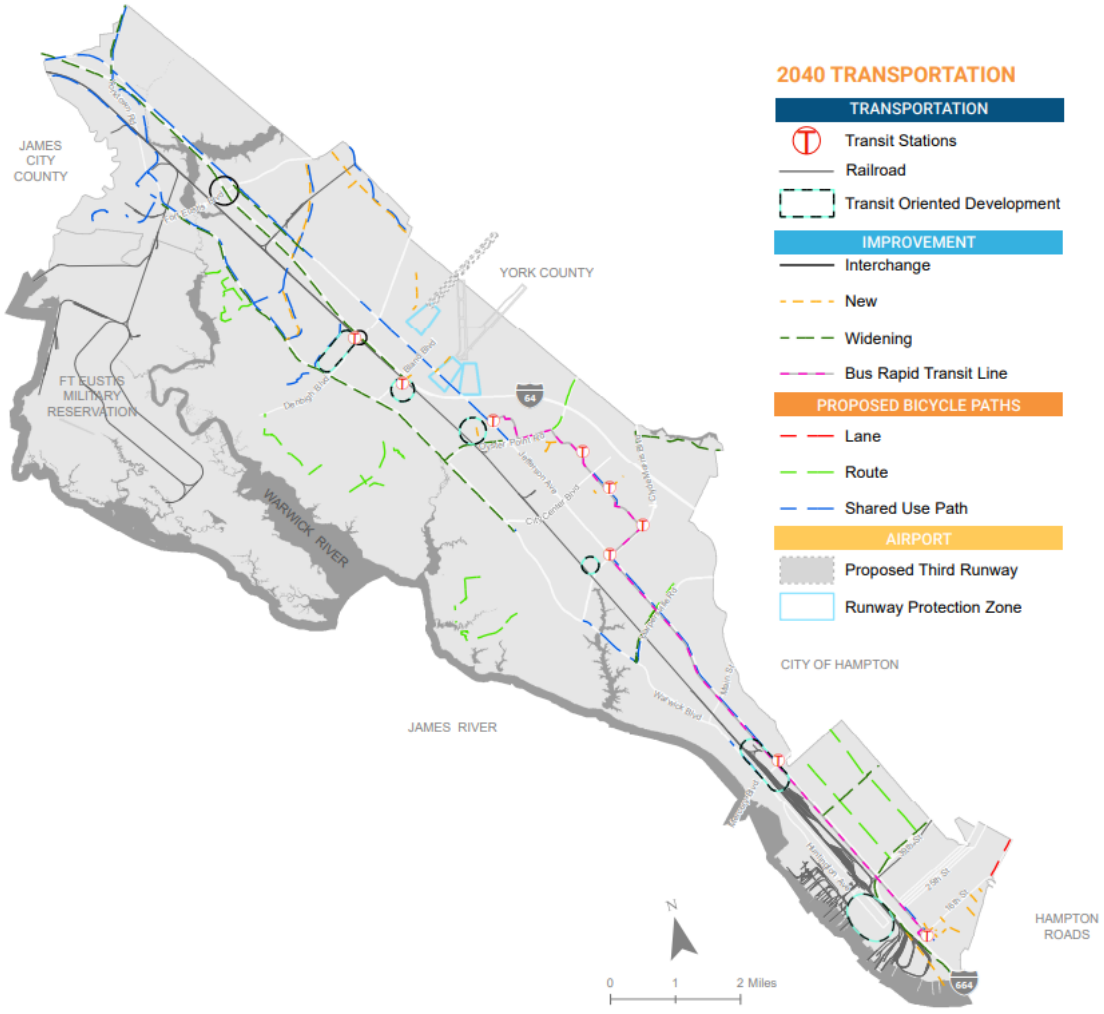


Figure 5. Newport News 2040 Comprehensive Transportation Plan

C. Federal Designations

Through its implementation of the Justice40 initiative, the Department of Transportation (DOT) developed a definition for DACs that may be used under Justice40-covered grant programs. To support applicants, DOT developed an online mapping tool that can be used as a baseline to identify DACs and facilitate engagement with members of those communities for the implementation of equitable transportation projects (Figure 6). These designations highlight energy and transportation-burdened communities, communities facing high rates of environmental pollution, those whose economies are highly dependent on fossil energy sources, and those with high rates of social vulnerability.

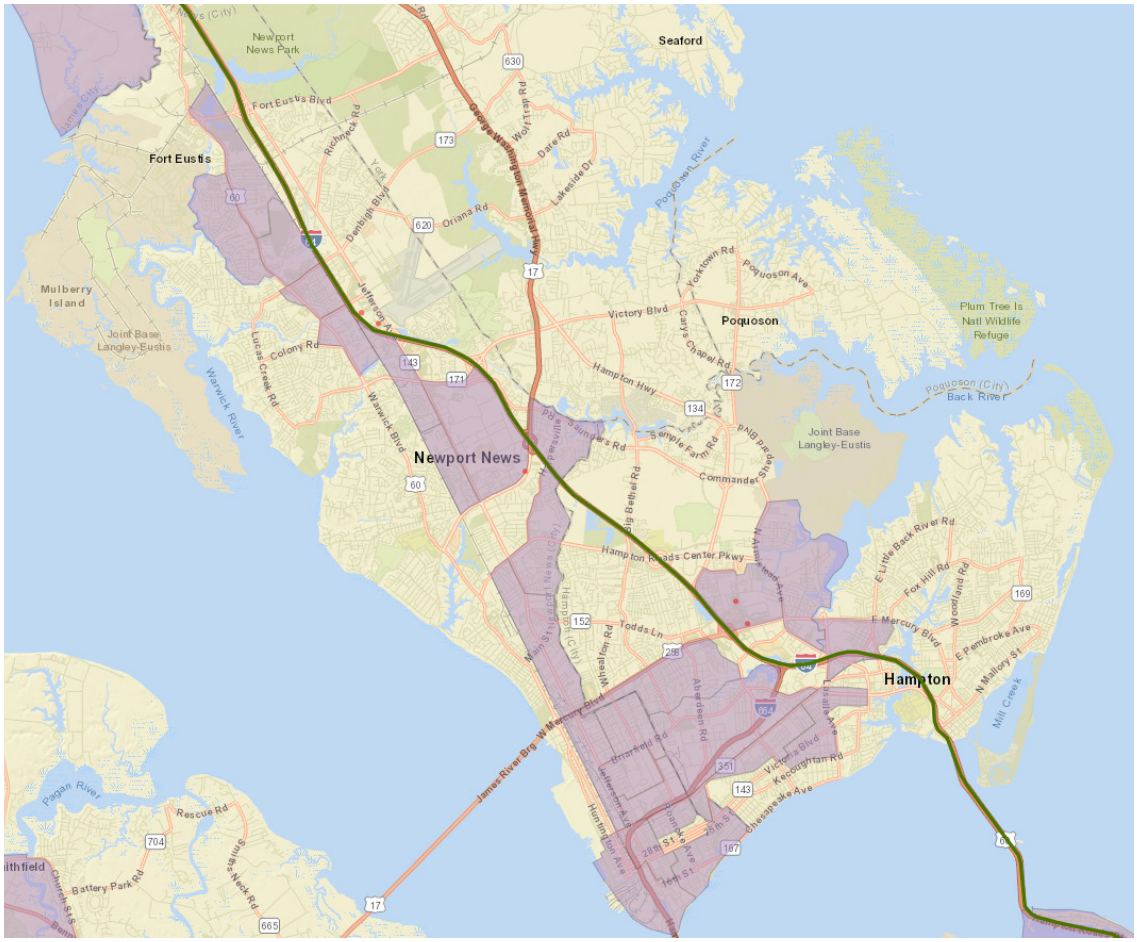


Figure 6. Electric Vehicle Charging Justice40 Map

The distribution of these communities in Newport News is significant, extending through the majority of the CSX rail corridor. This map provides a baseline to orient the city as it works to develop new equitable transportation options in the region, and orient those regions which may be prioritized for funding through federal competitive grant and formula funding programs.

IV. Transportation Equity Case Studies

A. Methodology for project prioritization in MPOs

The following section provides an introduction to the methodology that Metropolitan Planning Organizations (MPO) have historically employed to prioritize transportation equity projects. Each approach to planning has benefits and limitations, and an integration of approaches is recommended to facilitate a comprehensive equity plan. A study funded by the Center for Transportation Equity, Decisions, and Dollars (CTEDD) in 2019[20] analyzed nineteen MPOs with the goal of determining the common practices used to prioritize transportation projects with an equity lens. Researchers also

[20] https://ctedd.uta.edu/research-projects/integrating-equity-into-mpo-project-prioritization/

sought to evaluate these practices and provide guidance to MPOs in regards to promoting environmental justice and equity through transportation planning. The study focuses on a variety of methodological domains, and four of these domains are highlighted below:

Domain 1: Determining communities of concern (COCs)

Domain 2: Practices for involving COCs in project decisionmaking

Domain 3: Systematic evaluation of projects with a focus on equity

Domain 4: Assessment and evaluation of project outcomes

B. Determining Communities of Concern (COCs)

Prior to conducting an equity analysis to ensure communities of concern are not overburdened with effects and have access to benefits of any transit projects, specific COCs must be identified within the Metropolitan Planning Organization's geographic region. The first step in this analysis is to determine how the MPO will define communities of concern. Due to Title IV and requirements by executive order, low-income and minority populations are included in this definition. However, MPOs are also increasingly considering the needs of other populations such as the disabled community, households without personal vehicles, and youth when prioritizing projects through an equity lens. Once COCs are defined, MPOs have various tools at their disposal to locate these communities within their region. Most commonly, MPOs will use mapping tools that indicate when certain areas of their operating region include a higher density of individuals falling within the defined parameters of communities of concern. One example of this is the Atlanta Regional Commission's (ARC) equity dashboard, shown in Figure 7.[21] This allows the user to visualize areas of Atlanta by various criteria, including ethnic and racial minorities, low income households, people with disabilities, and limited English proficiency. The map then color codes the area by density of households with these criteria, with the purpose of identifying communities of concern.

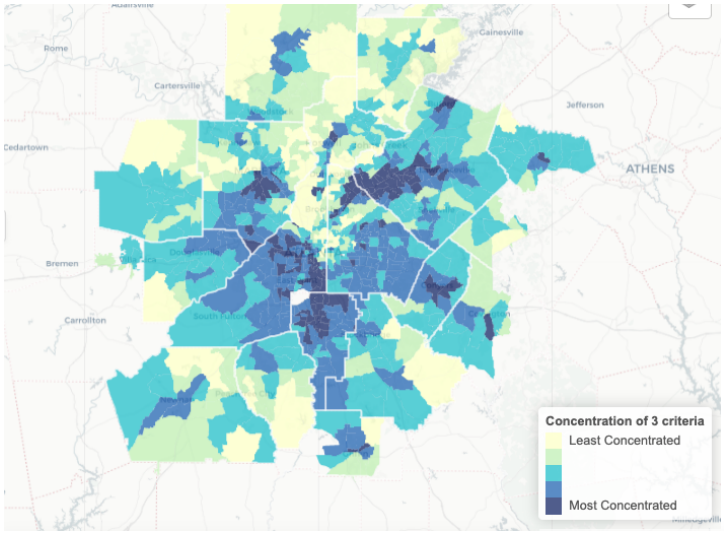


Figure 7: ARC equity dashboard

[21] https://atlregional.github.io/DASH/Equity.html

C. Practices for involving COCs in decisionmaking

While MPO reliance on demographic data and mapping tools can provide a baseline assessment of communities of concern, this does not ensure that community needs are being met by any proposed transit projects. Early environmental justice efforts centered around the minimization and equitable distribution of harm from government and industrial projects but did not seek to create an actively positive impact on affected communities. Even with transit projects designed to provide additional services to the community, proximity does not necessarily equal access. Increasingly, MPOs are recognizing the need to include COCs in the project prioritization and decisionmaking stages of the process. This allows communities to directly communicate their needs and address any barriers that might exist for these communities to access the services being provided by the new project. Effective MPOs are leaving behind passive "comment periods" in favor of a more active engagement of communities of concern. Ways MPOs might engage COCs in the project prioritization and planning processes include focus groups, mobility audits, workshops, surveys, and other outreach efforts. Figure 8[22] details an example of public engagement activities from the MPO in Portland, OR included the CTEDD study.

Metro (Portland, Oregon)	• Transportation equity working group and having COCs identify their priorities • Bring in historically marginalized communities into the conversation including representatives from community, human services, advocacy, public health as well as jurisdictional partners on the technical working group to bring together different perspectives to inform the development of the evaluation • Numerous engagement activities involving gathering input from historically marginalized communities including surveys and focus groups

Figure 8: Public engagement efforts from Portland's MPO

D. Systematic Evaluation of Projects for Prioritization

Metropolitan Planning Organizations employ a variety of strategies in an attempt to determine which transit projects are ultimately funded. Proposed projects are evaluated by staff at different stages in the process—from creating a long-term transportation plan, to moving projects to a shorter-term transportation improvement plan, to determining which projects ultimately move forward into reality. Some MPOs use a more qualitative approach, where staff consider equity concerns and benefits amongst a range of other factors. Many MPOs, however, have turned to more quantitative and objective approaches. These approaches allow staff members to score different criteria, equity and access being two of them, and quantitatively compare projects side by side. The goal of this is to move beyond staff judgment into a space where projects can be considered without bias and with a

[22] https://ctedd.uta.edu/research-projects/integrating-equity-into-mpo-project-prioritization/

focus on prioritizing projects that address the greatest needs of COCs. For example, Hampton Roads Transit (HRT), the study area, included a quantitative environmental justice evaluation as part of its long-range plan for 2045. It ranked various proposed projects by their positive impact on environmental justice communities. Projects with the potential for particularly high positive impact on environmental justice communities were highlighted for consideration.

APPENDIX B: ENVIRONMENTAL JUSTICE OVERLAY ANALYSIS WITH 2045 LRTP CANDIDATE PROJECTS CONTINUED

2045 ID	2045 LRTP CANDIDATE PROJECTS	LOCALITY	PROJECT CATEGORY	TOTAL BLOCK GROUPS ASSOCIATED WITH PROJECT	TOTAL BLOCK GROUPS WITH 5 OR MORE ENVIRONMENTAL JUSTICE COMMUNITIES	NUMBER OF BLOCK GROUPS WITH CARLESS HOUSEHOLDS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH DISABLED POPULATIONS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH ELDERLY POPULATIONS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH FEMALE HEAD OF HOUSEHOLDS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH HOUSEHOLD RECEIVING CASH PUBLIC ASSISTANCE ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH HOUSEHOLDS RECEIVED FOOD STAMPS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH LIMITED ENGLISH PROFICIENCY POPULATIONS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH LOW-INCOME HOUSEHOLDS ABOVE REGIONAL AVERAGE	NUMBER OF BLOCK GROUPS WITH MINORITY POPULATIONS ABOVE REGIONAL AVERAGE
2045-504	Ferry Service	Multi-jurisdictional	Transit	35	14	14	11	8	17	9	19	3	16	17
2045-505	Ferry Service	Multi-jurisdictional	Transit	29	11	18	12	13	21	11	12	3	11	12
2045-506	High-Speed and Intercity Passenger Rail - DRPT Tier I EIS ROD - Preferred Alternative	Multi-jurisdictional	Transit	136	69	57	76	56	72	50	65	56	69	76
2045-506	High-Speed and Intercity Passenger Rail - DRPT Tier I EIS ROD - Preferred Alternative	Multi-jurisdictional	Transit	114	69	57	76	56	72	50	65	56	69	76
2045-508	High -Speed Water Taxis System	Multi-jurisdictional	Transit	41	18	4	15	19	25	17	22	4	16	26
2045-509	Peninsula Commuter Rail	Multi-jurisdictional	Transit	65	31	26	35	35	31	26	30	23	29	34
2045-511A	Peninsula High Capacity Transit Extension - Alt 3	Multi-jurisdictional	Transit	88	55	45	53	40	52	35	48	30	47	59
2045-511A1	Peninsula High Capacity Transit Extension - Alt 3 (Future)	Multi-jurisdictional	Transit	43	20	18	21	11	21	13	19	23	18	28

Figure 9: Quantitative environmental justice analysis for HRT long-range plan

E. Assessment and Evaluation of Project Outcomes

In addition to having specific criteria to determine project priorities, it is imperative that MPOs also establish metrics to evaluate whether or not the equity goals of a particular project are being met. These outcome-related assessments can take a variety of forms, including the tracking of:

- Transit ridership rates in communities of concern
- Average distance from transit and transit time for COCs
- Access to community places such as grocery stores, community centers, schools, etc.
- Access to jobs for COCs within a certain radius
- Affordability of transit options for COCs

These evaluation metrics provide MPOs with feedback regarding the efficacy of equity efforts and are crucial to understanding which projects have the ability to make real differences in communities of concern.

F. Example Transportation Equity Projects

In addition to the Center for Transportation Equity, Decisions, and Dollars mentioned above, other organizations have made it a priority to determine best practices for transportation equity and provide educational resources for transit organizations. One such organization is TransitCenter, whose mission is to "improve public transit in ways that make cities more just, environmentally sustainable, and economically vibrant."[23] In a guidebook created by TransitCenter, called *Equity in*

[23] https://transitcenter.org/wp-content/uploads/2021/09/Equity-in-Practice_web.pdf

Transit, researchers highlight case studies of MPOs implementing transit projects with an equity focus. Five case studies relevant to this project are highlighted below:

Table 2a: Strengths and Challenges of NextGen Bus Plan (Los Angeles, CA)

Location	Initiative
Los Angeles County Metropolitan Transportation Authority (Los Angeles, CA)	NextGen Bus Plan
Strengths	
• Plan to increase walking access to bus stops from 48% to 83% for riders below a certain income level • Informed by data from COCs (cell phone location-based data and fare card data) • Working group participation from members of 60 community organizations • Use of "transit equity score" for project prioritization	
Challenges	
• Recent LA Metro budget cuts endanger the full implementation of NextGen • Stakeholders involved in creating NextGen were not consulted when the budget was created • Misalignment of goals across divisions within the agency	

Table 2b: Strengths and Challenges of the Better Bus Project and Public Engagement Plan (Boston, MA)

Location	Initiative
Massachusetts Bay Transportation Authority (Boston, MA)	Better Bus Project and Public Engagement Plan
Strengths	
• Focused on bus network redesign to better meet the needs of the community • Informed by location-based services (LBS) data and surveys • Used working groups and open house meetings for community participation	
Challenges	
• None listed	

Table 2c: Strengths and Weaknesses of Better Bus Stops (Minneapolis-St.Paul, MN)

Location	Initiative
Metro Transit (Minneapolis-St.Paul, MN)	Better Bus Stops
Strengths	
• Shifted focus from light-rail project (which serves mostly suburban customers) to bettering the transit experience for urban neighborhoods • Goal to construct additional bus shelters in "racially concentrated areas of poverty" (p. 50) • Grant founded by US DOT's Ladders of Opportunity Program • 10% of budget went to community outreach, which was done systematically • Successful outcomes that have expanded across the service area	
Challenges	
• None listed	

Table 2d: Strengths and Challenges of the Advocate-led Bus Network Redesign (Miami, FL)

Location	Initiative
Transit Alliance (Miami, FL)	Advocate-led Bus Network Redesign
Strengths	
• Focus on a grid of frequent bus routes that doubled the number of residents within a 5 minute walk a bus stop • Buses arriving at least every 15 minutes • Transparency regarding past failures when promoting new initiative • Used information from COCs to redesign the bus network	
Challenges	
• None listed	

Table 2e: Strengths and Challenges of Nighttime Transit Service Initiative (Boston, MA)

Location	Initiative
TransitMatters (Boston, MA)	Advocating for Nighttime Transit Service
Strengths	
• Focused on increasing bus services during "off hours"—early mornings and late nights—by 140 more trips per week • Informed by survey data to assess community access needs for low-income workers • Also used origin-destination data from multiple sources to design routes	
Challenges	
• Overnight ridership unpopular due to several strategic mistakes • Lack of diversity of workforce	

V. Project Goals

This impetus for this project came from community members in the Hampton Roads area who expressed concern about the state of public transportation in Newport News and the surrounding areas. The purpose of this project is to create two feasible plans for transportation upgrades in the Hampton Roads MPO area. These plans will seek to address specific community member needs while simultaneously working toward the goals of local emissions reductions and energy equity for communities of concern. The project goals include:

1) *Direct engagement with community members and assessment of critical needs*
2) *Establishment of potential projects to meet the needs of the communities of concern while simultaneously working to decrease local transportation emissions*
3) *Assessment of Federal and State funding opportunities aligned with the community's transportation needs*

VI. Community Engagement

As established through the literature and case studies on environmental justice initiatives, stakeholder participation is crucial to effectively assessing the needs of the community and creating solutions designed to meet those specific needs. The idea for this project was borne out of community member concerns about transportation in their local area, and the project was designed to keep those needs central. The goal was to hear directly from those community members regarding the specific issues

they face in regards to transportation, their overall transportation or environment-related concerns, and what types of solutions they would most like to see. Directly engaging community members came in two forms: 1) attending a chapter meeting for Virginia Organizing on Tuesday October 18, 2022 and 2) asking Virginia Organizing to distribute a survey to a wider group of people in Newport News.

A. Virginia Organizing chapter meeting rationale and findings

The first step in community engagement was attending a Virginia Organizing chapter meeting on Tuesday October 18, 2022 at 7:00 PM. This was a virtual meeting attended by six members of Virginia Organizing and the two authors of this project. The goals of attending this meeting were 1) to introduce the goals and structure of the transportation project to chapter members, 2) to hear directly from community members about their transportation concerns and have the ability to ask follow-up questions, and 3) explain and distribute the survey detailed below. This chapter meeting provided a launching point and initial fact-finding opportunity and gave some anecdotal evidence about community concerns.

Table 3: Transportation concerns of community members in Newport News

Transportation Access Concerns	• Buses do not stop frequently enough. Long wait times at each stop. • Long distances from house or workplace to bus stop (not enough stops) • People who work off-hours are unable to get bus service
Environmental Concerns	• Air and water pollution concerns with transportation—many have economic ties to the surrounding water bodies
Other concerns	• Concerned about the lack of racial diversity in the transportation workforce • Many stops don't have shelters or lighting, creating an unsafe environment

B. Survey Development and Rationale

While speaking directly to community members was an important first step, a survey was also developed in order to hear from a wider range of voices. The survey was created to inventory both current transportation usage and concerns related to the current usage. This information was used to determine community needs specific to Newport News and is not intended to be applied to any other communities or generally. Survey questions were developed by the project authors but were screened and edited by a staff member of Virginia Organizing to ensure the survey questions and distribution methods were suitable to the community members. The survey was created in a paper format and in

a Google Form format with associated QR codes so participants could fill the survey out on a smartphone. Both survey formats were distributed in English and Spanish. Members of Virginia Organizing distributed the survey in person to community members, through their email network, and by posting the QR codes at the public library.

Table 4: Community Transportation Survey Questions (English)

Question Number	Question	Response Options
1	What is your most common way to travel for work, school or for other daily errands? **Please select one.**	__Car owned by you or other person in your household __Shared vehicle (carpooling with other community members you do not live with) __Public transportation (bus, train, etc.) __Ride-sharing service (Uber, Lyft, etc.) __Bike, scooter or other non-car vehicle __Walking
2	How long is your average commute to work or school one way? **Please select one.**	___ Under 30 minutes ___ 30-60 minutes ___ 60-90 minutes ___ Over 90 minutes
3	Please rank the following transportation problems from 1 to 5 with **1 being most important or relevant to you and 5 being least important or relevant to you.**	___ The bus does not come frequently enough or at the right times. ___ There are not enough bus stops near my house or my place of work. ___ The cost of the bus prevents me from using it. ___ I would like to walk or bike more but there are not enough sidewalks or bike paths. ___ I am concerned with air pollution in our city and negative health impacts.
4	What is the most important use of transportation to you? **Please select one.**	___ To get back and forth to work or school ___ To go places with my family and/or children ___ To go grocery shopping or other errands ___ For personal and recreational activities
5	What would improve bus transportation for you? **Please select one**.	___ More frequent bus service on existing routes ___ New bus routes that reach different places
6	I am interested in public transportation options besides the bus, such as a ride-sharing program.	___ Yes ___ No
7	Please let us know any ideas you have about how to improve transportation options in your community.	*Free response question, no answer choices given.*

C. Survey Results

Twenty-two community members responded to the survey. While not a large sample, it provides insight into the common transportation issues experienced by communities connected to Virginia Organizing. First, it was important to establish the transportation context of survey respondents including type of transportation utilized, length of commute, and common purposes of transportation use. Of the survey respondents, 86% are reliant primarily on public transportation (Figure 10). The most common average commute time was 30-60 minutes (Figure 11). Somewhat surprisingly, the most commonly cited usage of transportation was errands, followed by commuting to work or school (Figure 12).

After establishing how survey respondents were currently using transportation, the survey sought to understand the types of issues they were facing while using public transit, in particular. This was accomplished by asking survey respondents a ranked choice question to determine which transportation issues were most important and relevant to them. The exact wording of the ranked choice options is included above but stated briefly included infrequency of bus transit, location of bus stops being too far away from either home or workplace

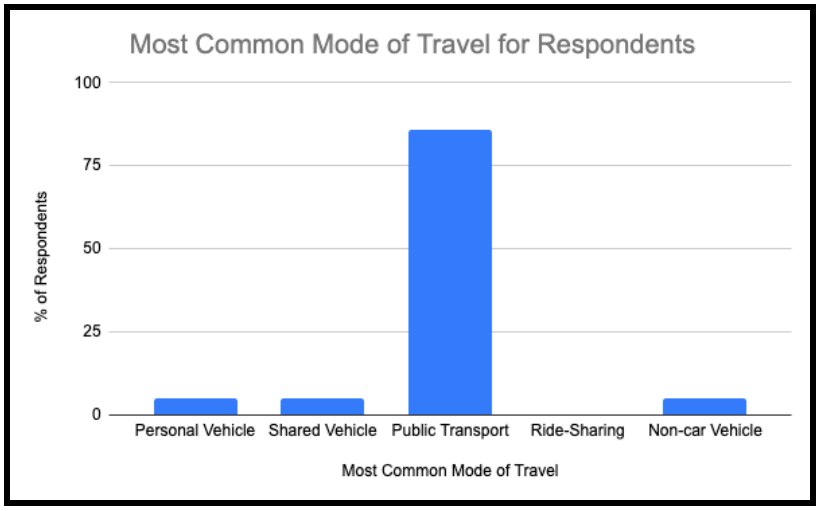


Figure 10: Most common type of transit for survey respondents

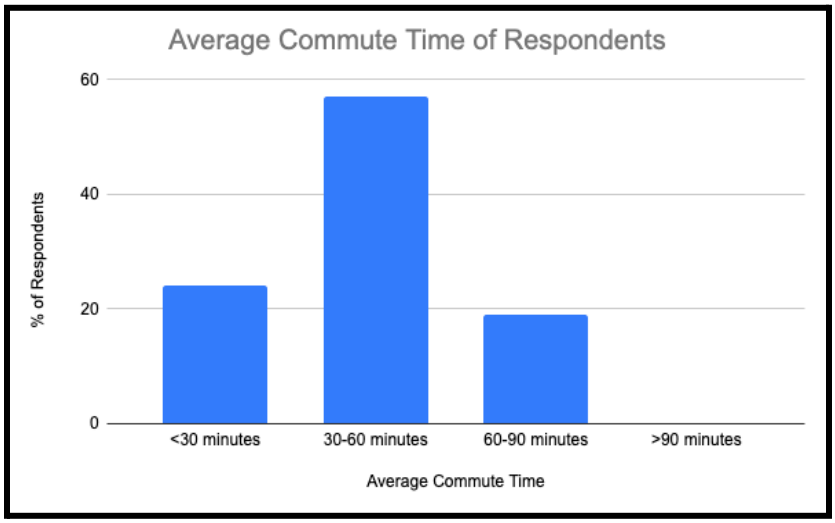


Figure 11: Average commute time for survey respondents

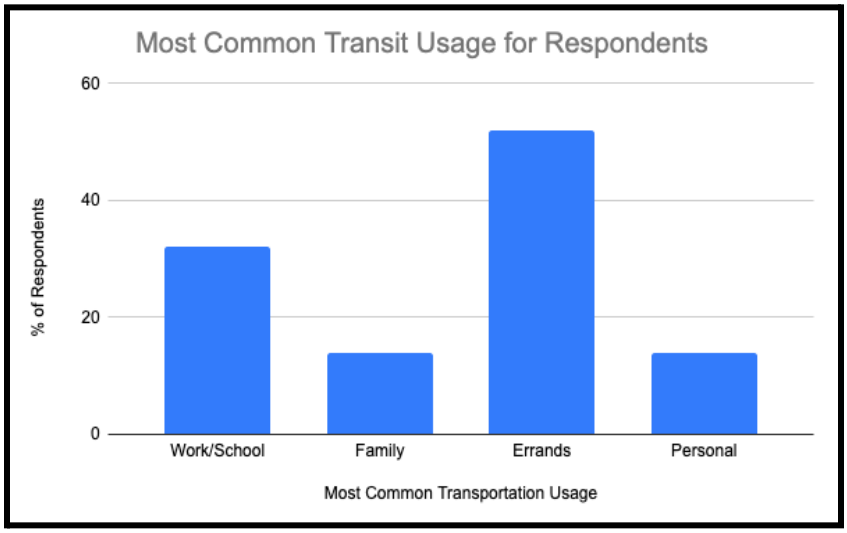


Figure 12: Common transit usage for survey respondents

or both, the cost of transportation being too expensive, the inability to walk to places in the neighborhood, and air pollution caused by transportation. Survey respondents were asked to rank them as "1" being the most important issue to the respondent and "5" being the least important. These numerical values were inverted during analysis to create an average "importance score," where higher numbers reflect a more important transit problem to survey respondents. The responses to this ranked choice question are displayed in Figure 13. Frequency of bus routes was the most important or relevant issue to survey respondents, with an average importance score of 3.56 out of 5. The second most important issue to survey respondents (2.78 out of 5) was the location of bus stops not being close enough to home or places of business, and the third was pollution (2.67 out of 5). Cost of transportation and walkability of neighborhoods seemed to be secondary issues to most survey respondents.

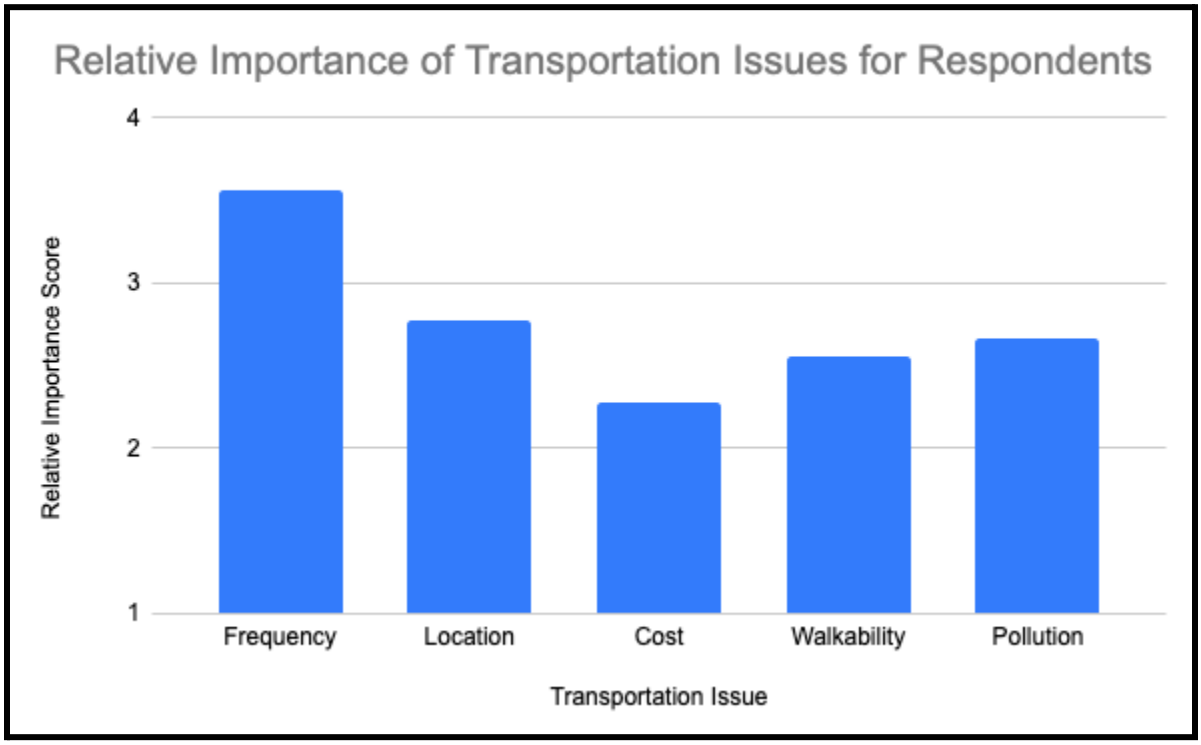


Figure 13: "Importance scores" of transit issues from ranked choice options chosen by survey respondents

Survey respondents citing frequency of bus service and location of bus stops as the two most pressing issues corroborates the information learned at the listening session during the Virginia Organizing chapter meeting. Survey respondents were asked in a separate question which of these two options would provide more of a benefit: having more frequent service on existing bus routes or having new routes that would reach different places. As can be seen in Figure 14, survey respondents answered each option fairly equally, with 57% citing more frequent service and 43% citing new routes. However, as will be explained below, some survey respondents noted that both improvements are sorely needed in their community. Finally, it was important to gauge interest in opportunities

beyond improving existing transportation systems in the Newport News and surrounding Hampton Roads area. The last question (shown in Figure 15) asked survey respondents if they would be interested in a ride-sharing program as a solution to the transportation issues they experience in their community. While some respondents (26%) said they would be open to exploring ride-sharing programs, most (74%) survey participants responded that they would not.

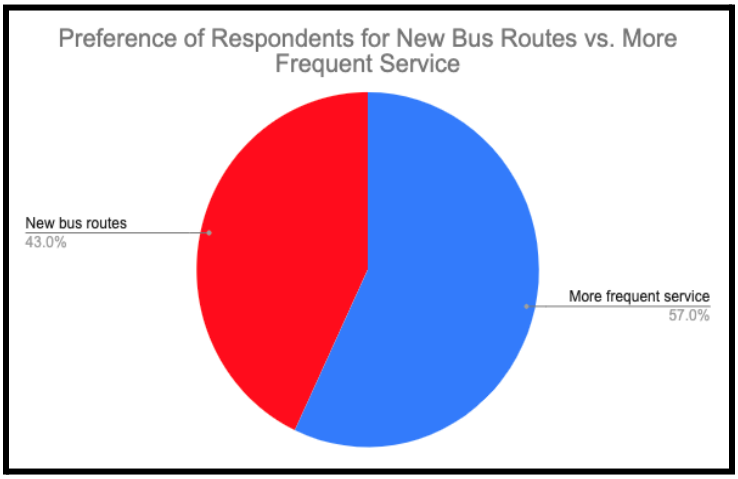


Figure 14: Preference of survey respondents for more frequent bus service or new bus routes

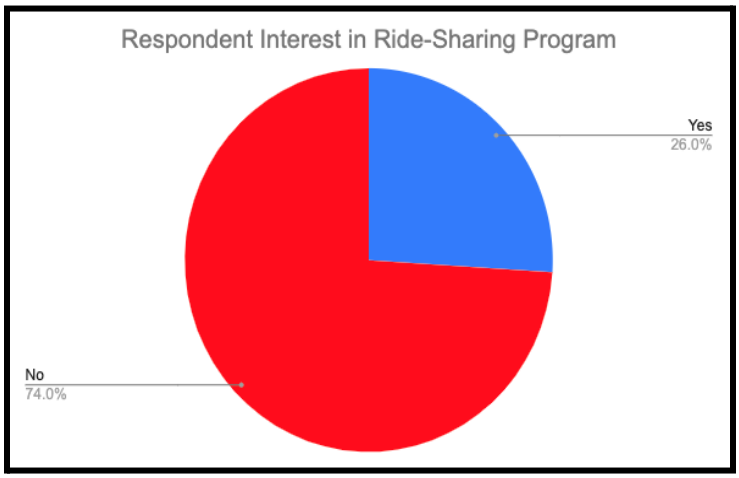


Figure 15: Interest of survey respondents in ride-sharing program

At the end of the survey, participants were invited to share any other thoughts regarding transit issues or ideas they had for solutions to these issues. Some participants used this space to clarify their responses to other questions, so those responses are not included in the chart below. However, the response of any participant that gave more details on transportation issues or ideas for solutions is detailed below in Table 5. A number in parentheses beside a bullet point indicates the number of survey participants who gave the same or a similar response.

Table 5: Survey participant open responses regarding transit issues and solutions

Additional information regarding transportation issues	• Many people don't live near a bus stop and are in need of better routes • Bus is unreliable—is canceled or re-routed without assistance to riders • Bus doesn't come on time and schedule is not user-friendly (2) • Bus is not safe for elderly to use
Ideas for changes or solutions	• All transit needs to be accessible for disabled riders and ADA compliant • Signs should be translated into multiple languages • There is a need for new buses • Would like to see more courteous and respectful bus drivers • Need for BOTH more frequent routes and also new routes (2) • HRT should pay for ride service when bus is canceled or rerouted • Mobile bus passes and more reliable live tracking of buses for riders (2) • Wi-fi on buses • Buses need to run through the night hours

VII. Selection of Transportation Project

Several common themes arose when compiling survey data from respondents in the Newport News and Hampton area. Ninety-one percent of survey participants utilized either public transportation or a non-car vehicle as their most common mode of transportation. However, these respondents identified a specific set of issues they encounter when attempting to use public transportation for their daily transit needs. The two most common issues identified were the frequency of bus routes and the location of bus stops. Some participants indicated that buses only come once an hour at minimum, which makes it challenging to get to and from work. Other participants indicated that bus stops were often far away from their home or workplace, creating additional complications to their commute or other errands. These complaints were verified on the Hampton Roads Transit website and an example of a route map and schedule are included below.

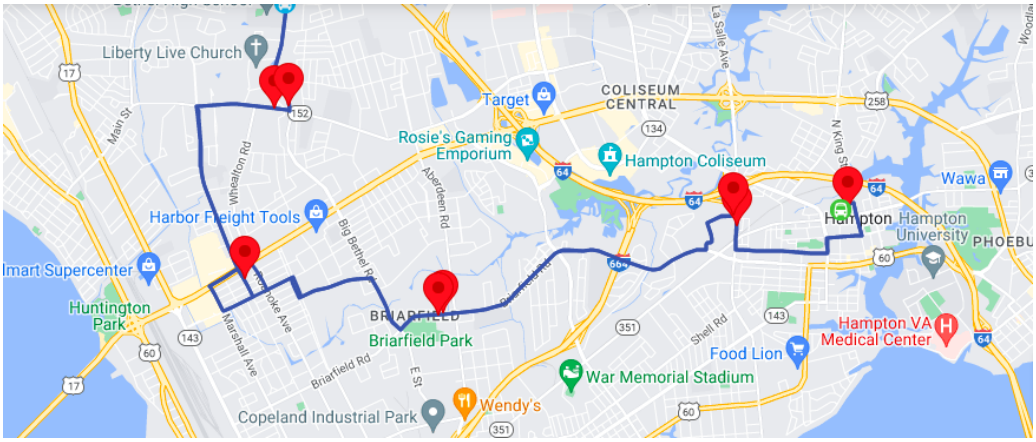


Figure 16: Example route map from Hampton Roads Transit - Route 110[24]

HAMPTON TRANSIT CENTER	LASALLE & MICHIGAN	BRIARFIELD & ABERDEEN	ORCUTT & 81ST	TODDS & OLD BIG BETHEL	VA PENINSULA COMMUNITY COLLEGE
600a	610a	620a	633a	640a	650a
700a	710a	720a	733a	740a	750a
800a	810a	818a	833a	840a	848a
900a	910a	918a	933a	940a	948a
1000a	1010a	1018a	1033a	1040a	1048a
1100a	1110a	1118a	1133a	1140a	1148a
1200p	1210p	1218p	1233p	1240p	1248p

VA PENINSULA COMMUNITY COLLEGE	BIG BETHEL & TODDS	ORCUTT & 81ST	BRIARFIELD & ABERDEEN	MICHIGAN & LASALLE	HAMPTON TRANSIT CENTER
655a	703a	710a	723a	733a	743a
755a	803a	810a	823a	833a	843a
855a	903a	910a	920a	928a	938a
955a	1003a	1010a	1020a	1028a	1038a
1055a	1103a	1110a	1120a	1128a	1138a
1155a	1203p	1210p	1220p	1228p	1238p
1255p	103p	110p	120p	128p	138p

Figure 17: Example bus schedule from Hampton Roads Transit - Route 110[1]

Based on the information gleaned through survey results and speaking directly with community members, there are community members in the Newport News and Hampton Roads area who would benefit from more frequent bus service and additional bus routes run to neighborhoods lacking in easy bus access. This accomplishes Goal 1 of the project, which was to engage directly with community members to assess their critical needs. Goal 2 requires the establishment of potential projects that meet the needs of community members while simultaneously working to decrease transportation emissions in the local community. Because the community members identified a need for an increase in frequency of bus routes and additional bus routes and stops, community goals could be met through the purchase of ten additional buses which can run on existing routes to increase frequency and run on new or expanded routes for additional access. In the following sections, the types of buses that could be purchased by HRT to fulfill this need are compared by cost and emissions production. All data used in the analysis comes from the Alternative Fuel Life-Cycle

[24] https://gohrt.com/route/110/

Environmental and Economic Transportation (AFLEET) Tool created by the Argonne National Laboratory (ANL) for the Department of Energy and the Environmental Protection Agency.[25]

A. Cost comparison of bus types

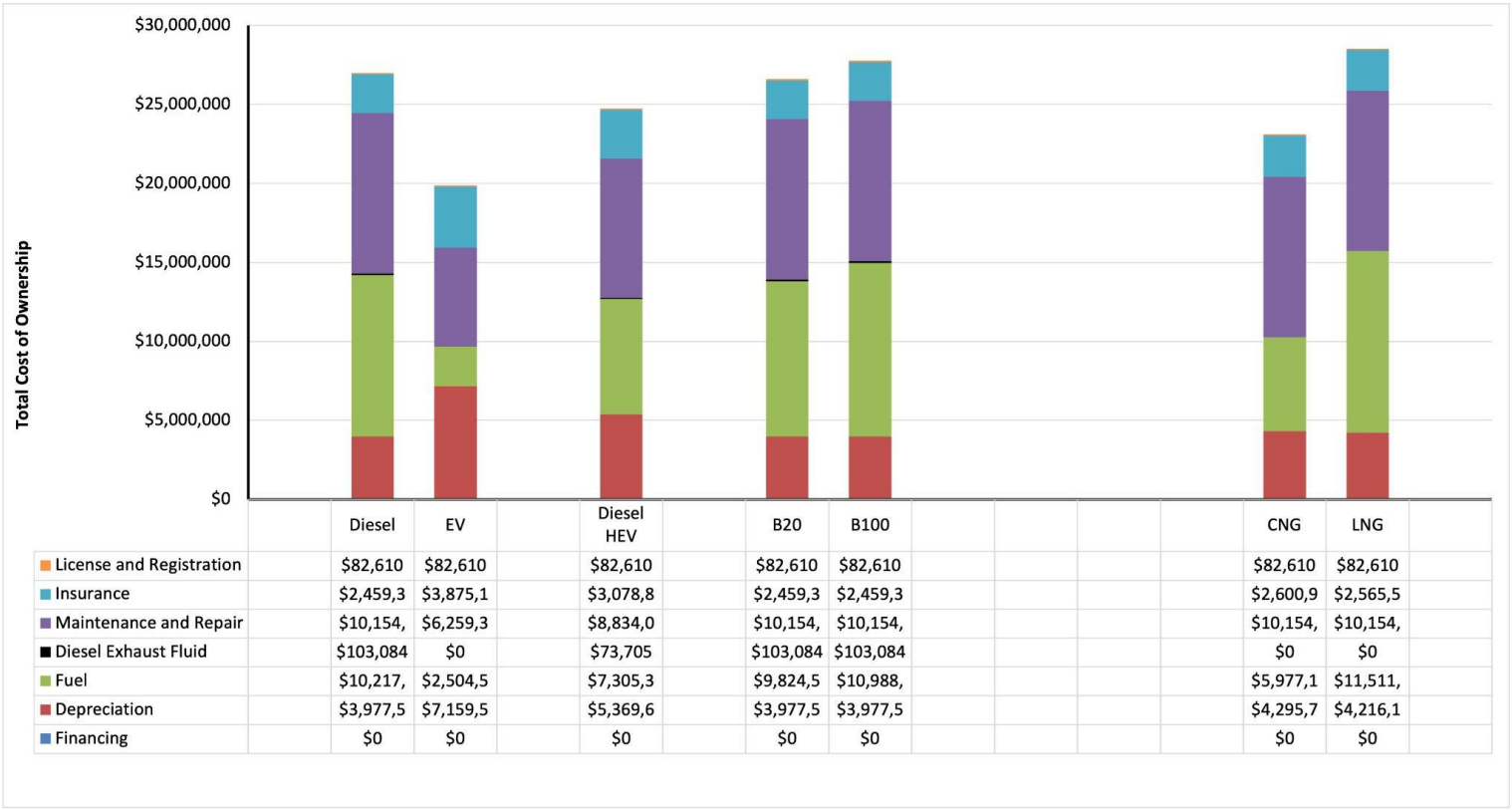
In order to meet the increased transportation needs of Newport News and surrounding communities, Hampton Roads Transit has multiple options for bus purchasing that could meet these goals. Although not a comprehensive list, the bus types that will be compared for suitability are included in the table below. An important consideration when deciding which buses would be most beneficial in meeting the needs of the community is cost. Included in this comparison is both the upfront purchase price and the total lifetime costs of ownership for each vehicle.

Table 6: Approximate purchase price of seven buses by fuel type

Diesel	$500,000
All-Electric Vehicle (EV)	$879,000[26]
Diesel Hybrid Electric (HEV)	$675,000
Biodiesel (B20)	$500,000
Biodiesel (B100)	$500,000
Compressed Natural Gas (CNG)	$540,000
Liquefied Natural Gas (LNG)	$530,000

As shown in table 6, diesel buses still remain the cheapest option with an upfront cost of $500,000. This includes all diesel buses, regardless of type of diesel fuel (petroleum diesel, biodiesel, or renewable diesel). However, it is important to also consider the operational costs of the buses over the lifetime of the vehicle in order to determine the total cost of ownership for the transit authority.

[25] https://greet.es.anl.gov/afleet
[26] Note: This price includes the bus ($800,000) plus one charger ($79,000)



	Diesel	EV	Diesel HEV	B20	B100	CNG	LNG
License and Registration	$82,610	$82,610	$82,610	$82,610	$82,610	$82,610	$82,610
Insurance	$2,459,3	$3,875,1	$3,078,8	$2,459,3	$2,459,3	$2,600,9	$2,565,5
Maintenance and Repair	$10,154,	$6,259,3	$8,834,0	$10,154,	$10,154,	$10,154,	$10,154,
Diesel Exhaust Fluid	$103,084	$0	$73,705	$103,084	$103,084	$0	$0
Fuel	$10,217,	$2,504,5	$7,305,3	$9,824,5	$10,988,	$5,977,1	$11,511,
Depreciation	$3,977,5	$7,159,5	$5,369,6	$3,977,5	$3,977,5	$4,295,7	$4,216,1
Financing	$0	$0	$0	$0	$0	$0	$0

Figure 18: Total Cost of Ownership (TCO) for a fleet of 10 buses, by fuel type. Source: AFLEET

Note: Because local price per gallon data was not available for all fuel types, national average data was extracted from the July 2022 Alternative Fuel Price Report created by the Department of Energy[27]

Figure 18 considers the total cost of ownership for different types of buses by fuel type. Although diesel engine buses are still currently the lowest cost solution in terms of upfront costs, consideration of other external costs including maintenance and fuel costs shows that electric buses are the most cost-effective solution in the long term. Even considering the close to $1,000,000 price tag for each electric bus, the lifetime savings of ownership are substantial when compared to diesel buses (of any kind), hybrid buses, or buses run on natural gas (either compressed or liquefied). Table 7 below shows the calculated lifetime savings between electric buses and buses of other fuel types.

[27] https://afdc.energy.gov/files/u/publication/alternative_fuel_price_report_july_2022.pdf

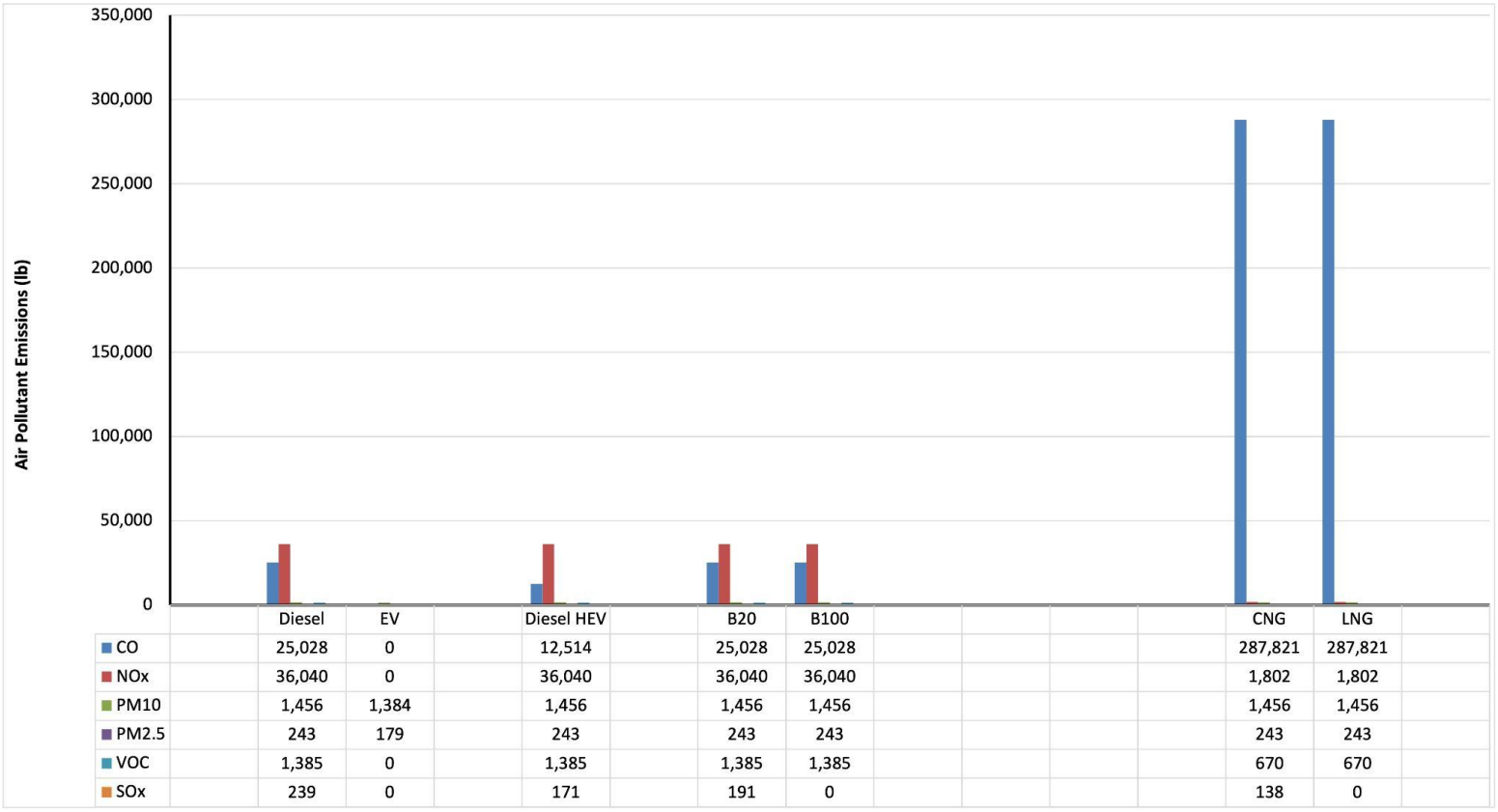
Table 7: Total Cost of Ownership (TCO) comparison between electric buses and other fuel types.

Bus Fuel Type	TCO of Fuel Type	TCO of Electric Bus	Cost Savings with Electric Bus Purchase
Diesel	$26,993,494	$19,881,010	$7,112,484
Diesel Hybrid Electric (HEV)	$24,744,015	$19,881,010	$4,863,005
Biodiesel (B20)	$26,600,994	$19,881,010	$6,719,984
Biodiesel (B100)	$27,764,494	$19,881,010	$7,883,484
Compressed Natural Gas (CNG)	$23,110,310	$19,881,010	$3,229,300
Liquefied Natural Gas (LNG)	$28,529,210	$19,881,010	$8,648,200

B. Emissions comparison of bus types

Although cost is an important factor for any transit authority when considering vehicle fleet and infrastructure purchasing, a competing goal of this project is to provide more frequent and accessible transportation without creating a substantial increase in local transit emissions. Figure 19 below shows the local air pollution emitted for each bus type when the vehicle is in operation. As can be seen by this figure, all types of diesel fuels produce a similar amount of air pollutants while in operation. Hybrid buses produce approximately half the amount of CO and sulfur emissions, but similar amounts of other pollutants. Both types of natural gas (compressed and liquefied) produce smaller amounts of most air pollutants, but substantially more carbon monoxide. Electric vehicles produce no exhaust emissions but do produce other types of non-exhaust particulate matter (PM) such as tire, brake, and road wear and kicking up dust and dirt while the vehicle is in operation.[28]

[28] https://www.sciencedirect.com/science/article/pii/S0045653522020161?via%3Dihub



	Diesel	EV	Diesel HEV	B20	B100				CNG	LNG
CO	25,028	0	12,514	25,028	25,028				287,821	287,821
NOx	36,040	0	36,040	36,040	36,040				1,802	1,802
PM10	1,456	1,384	1,456	1,456	1,456				1,456	1,456
PM2.5	243	179	243	243	243				243	243
VOC	1,385	0	1,385	1,385	1,385				670	670
SOx	239	0	171	191	0				138	0

Figure 19: Lifetime fleet (10 buses) air pollutants created while in operation– comparison of seven fuel types

When considering emissions, it is also important to look at the bigger picture emissions of the fuel source, known as "well-to-wheels," which accounts for variables such as fuel production emissions and in the case of EVs, emissions created during electricity production. Emissions from electricity production will be different depending on the particular energy source mix of the grid in question, so the AFLEET model calculates this number using local data. In this case, the city of Newport News was chosen as the location site. Figure 20 shows the well-to-wheels petroleum usage and greenhouse gas (GHG) emissions for the seven bus types by fuel source. Diesel buses, B20 biodiesel blend, hybrid buses, and both types of natural gas fuel emit the highest levels of GHGs. Electric buses, due to the local electricity grid mix in Newport News, still produce close to 10,000 short tons of GHGs. A 100% blend of biodiesel produces the lowest amount of GHG emissions, at 8,108 short tons.

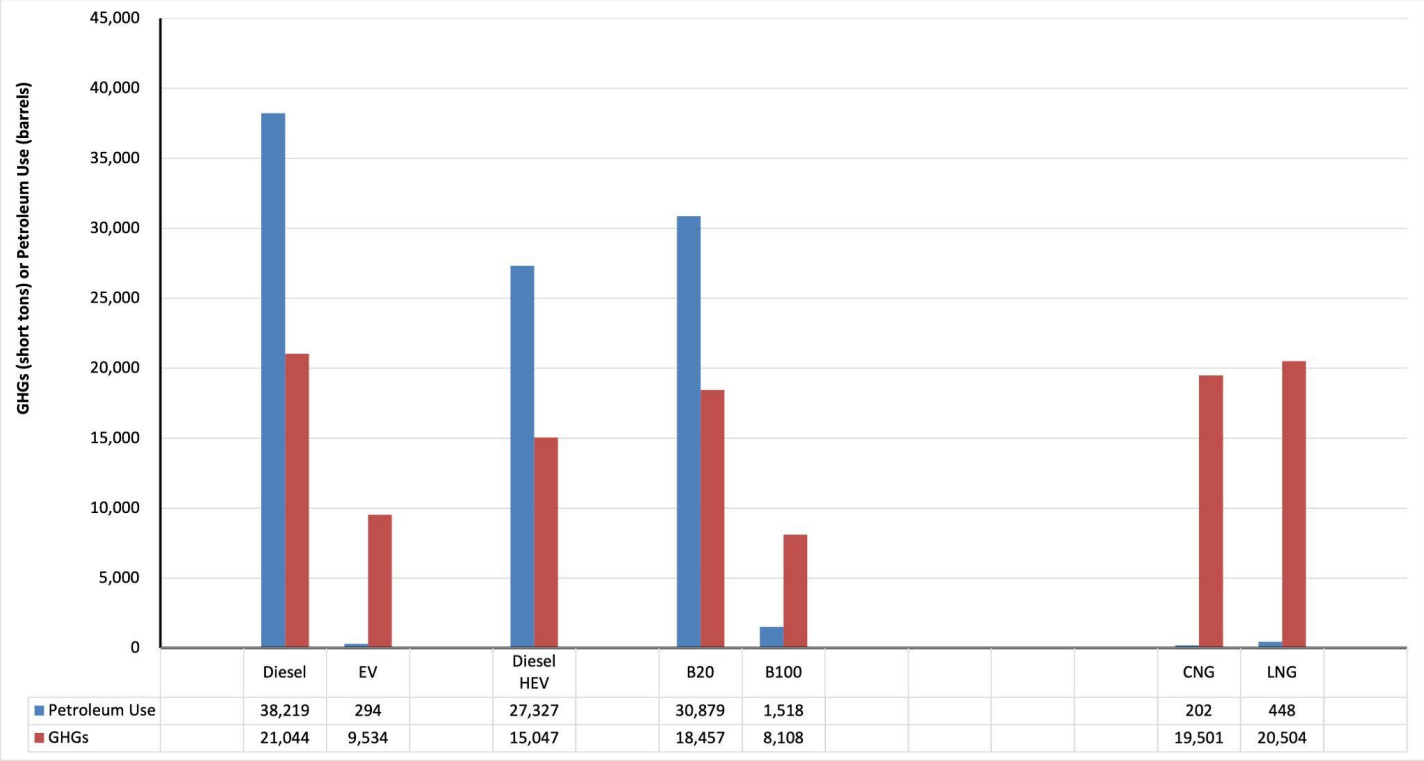


Figure 20: Well-to-wheels petroleum use and GHG emissions of fleet (10 buses) by fuel type

Table 8: Lifetime use GHG emissions of fleet (10 buses)- comparison of fuel types

Bus Fuel Type	GHG emissions of fuel type (short tons)	GHG emissions of EV fleet (short tons)	GHG reduction with EV fleet (short tons)
Diesel	21,044	9,534	-11,510
Diesel Hybrid Electric (HEV)	15,047	9,534	-5,513
Biodiesel (B20)	18,457	9,534	-8,923
Biodiesel (B100)	8,108	9,534	+1,426
Compressed Natural Gas (CNG)	19,501	9,534	-9,967
Liquefied Natural Gas (LNG)	20,504	9,534	-10,970

C. Overall analysis of transit fuel types

Two important considerations when choosing new buses for a transit fleet are cost and environmental impact. Although electric buses have a higher upfront cost than traditional diesel buses, two important considerations make them the most cost effective choice: 1) the total cost of ownership over an electric bus's lifespan is over $7,000,000 less than that of diesel buses due to lower fuel and maintenance costs and 2) funding opportunities are available specifically for localities to purchase electric or alternative fuel buses, and companies such as Proterra are offering incentives for transit authorities to obtain electric buses at discounted rates.[29] In terms of environmental impact, electric buses produce the lowest amount of local air pollution of all bus types, although they do still produce non-exhaust particulate matter. A diesel bus using a B100 biodiesel fuel blend does produce fewer greenhouse gases than an electric bus when considering total well-to-wheels emissions. However, electric buses are still the most environmentally and socially sustainable choice for two reasons: 1) biodiesel still produces local air pollution, which adversely affects communities of concern where the buses would be running and 2) electrical grids continue to become cleaner over time as more renewable energy is added to the mix, which means the projected GHGs of electric buses should decrease over time. Taking these two major factors into consideration, the purchase of ten electric buses would provide the most cost effective and sustainable solution to increasing the frequency and access of transit in Newport News and surrounding Hampton Roads areas.

D. Determination of project focus locations

In order to provide equitable, accessible transportation with these new buses and changes to bus routes, focus needs to be given to communities with the highest need. The federal government's EJScreen tool gives the ability to look at various socioeconomic factors of communities and to determine which communities might fall under the Justice40 designation, which is important for securing federal funding for environmental justice projects (more on funding sources in section IX). Figure 21 below is taken from the EJScreen tool and shows the communities that are eligible for Justice40 funds and should be the focus, or at least a starting point, for this transportation project.

[29] Note: funding sources and discounts will be discussed in a subsequent section

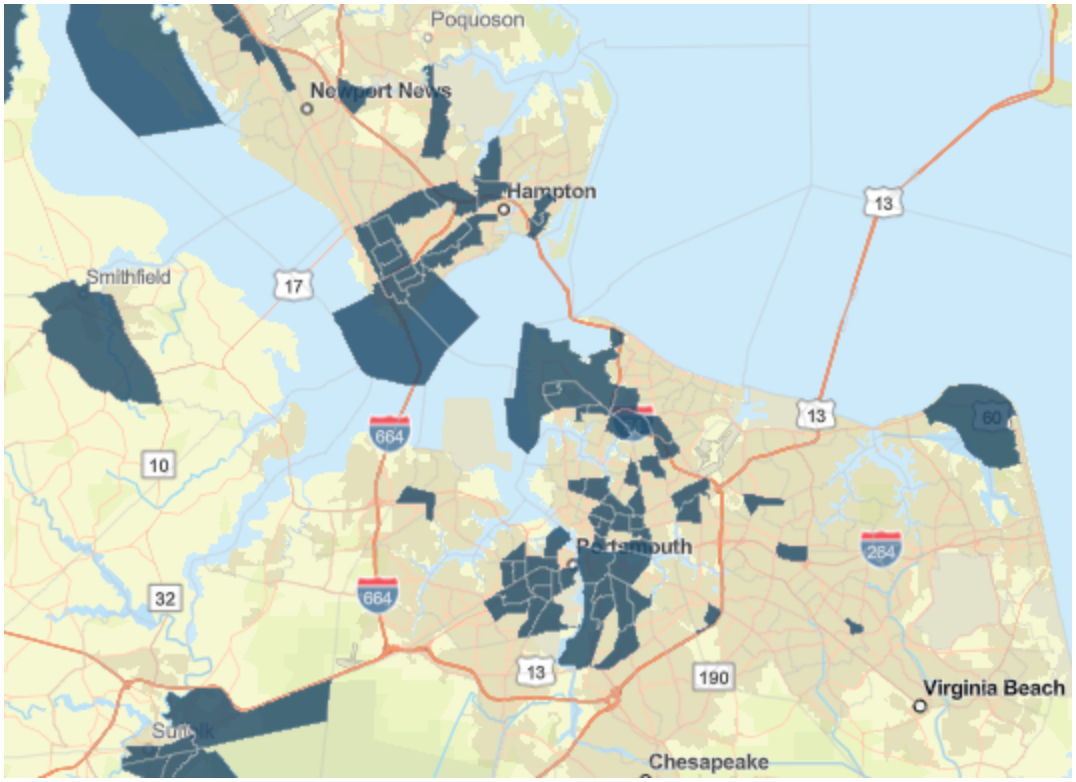


Figure 21: Justice40 eligible communities in Hampton Roads area (shown in blue)[30]

The EJScreen tool also allows for the display of communities at high risk for certain environmental factors. Of particular importance for this project are air pollution factors, such as diesel particulate matter and risk of respiratory illness due to air toxics. Figure 22 below shows the areas of Hampton Roads at high risk for above average diesel particulate matter. Figure 23 shows the areas of Hampton Roads at high risk for health hazards due to air toxics. These communities, many of which overlap with the Justice40 designation areas, are the perfect focus areas for more frequent and accessible, but also cleaner, transportation opportunities.

[30] https://www.epa.gov/ejscreen

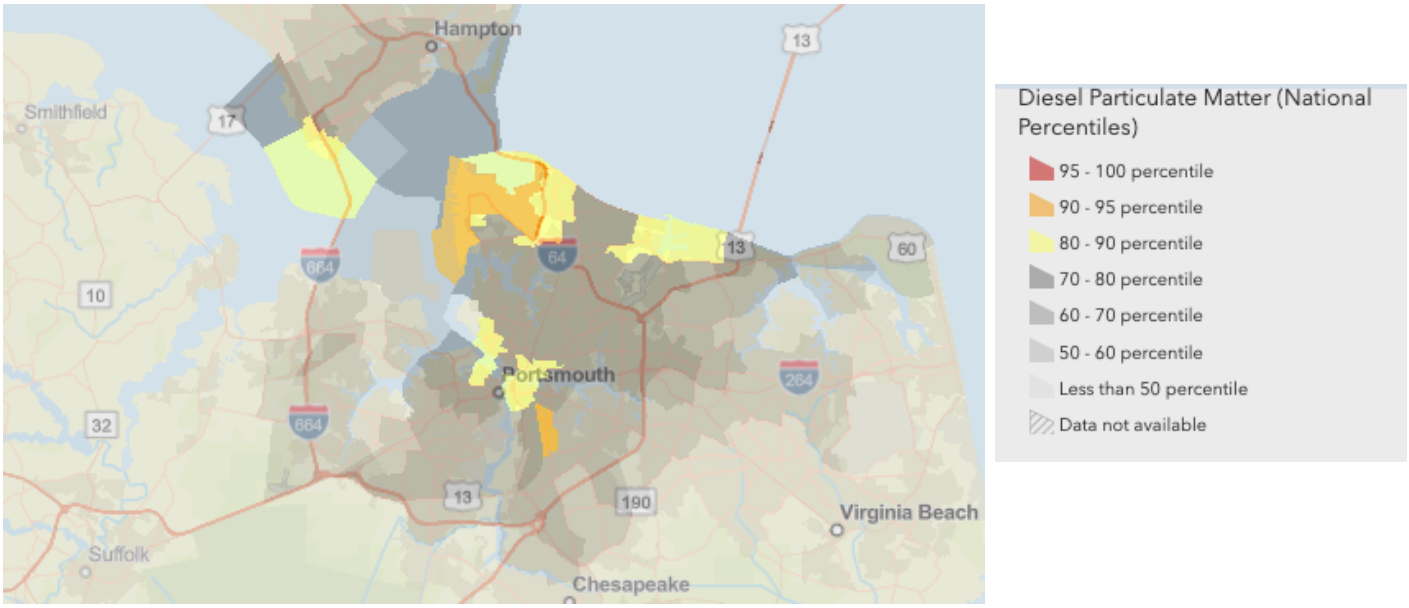


Figure 22: Hampton Roads communities at higher risk for diesel particulate matter.

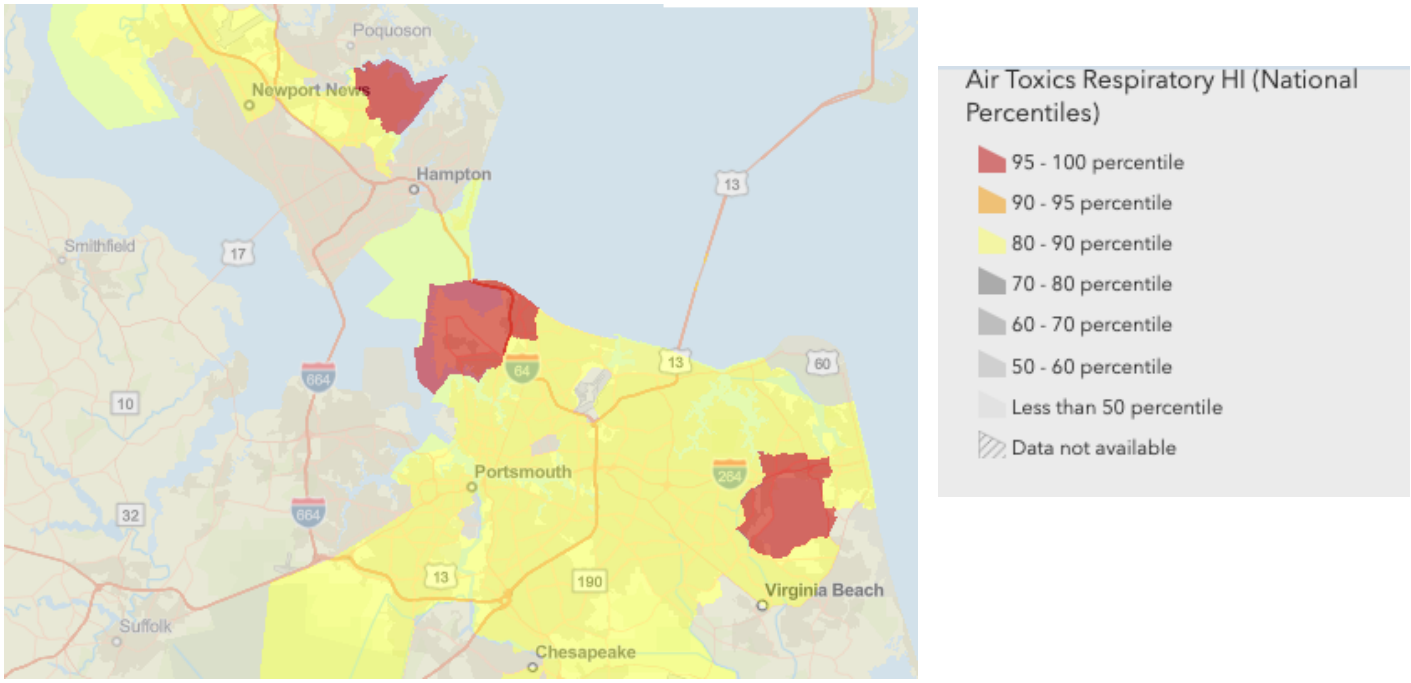


Figure 23: Hampton Roads communities at higher risk for respiratory hazards due to air toxics

VIII. Project Details

A. Purchase of 10 electric battery buses with chargers

In order to run more frequent routes and increase the number of routes and stops throughout the Hampton Roads Area, additional buses must be purchased. This project will increase the number of miles driven in the Newport News and Hampton region, so in order to not subsequently increase emissions, these new buses must be battery electric buses (BEBs), as shown in the analysis above. Hampton Roads Transit has already purchased its first six electric buses[31], which are Proterra Catalyst buses that run along HRT's Route 20, located along Virginia Beach boulevard. Because Hampton Roads Transit serves the communities of Chesapeake, Hampton, Norfolk, Portsmouth, and Virginia Beach in addition to Newport News, their transit routes are necessarily connected to one another. The purchase of these ten new buses is not for the purpose of replacing currently running buses on existing routes but for the purpose of expanding service to historically underserved areas of the Hampton Roads Transit service area, such as the communities identified in the previous section. Currently running diesel buses can be shifted to existing routes with the goal of increasing frequency of service on these routes. The new electric buses can then be run on new or expanded routes to reach more community members.

Proterra 40-foot buses range in price depending on the model, but a commonly quoted price is approximately $775,000.[32] This quote is for the bus itself and does not include additional features such as a GPS system, sunshades, a driver's seat, or a public address system. Therefore, the cost for each bus is rounded up to $800,000 to account for these additional features. Furthermore, chargers will need to be purchased for these buses. The approximate cost of a 125 kW charger with two dispensers is $79,000.[3] Because each charger has two dispensers, it is possible to purchase five chargers for the ten buses. The total cost of buses and chargers will be $8,395,000– ten buses at $800,000 for a total of $8,000,000 and five chargers at $79,000 each for an additional $395,000.

In addition, Proterra offers discounted buses for transit authorities who want to enter into a battery contract with the company. Proterra will then be contracted to conduct maintenance on the batteries for a set number of years, but it allows transit authorities to purchase electric buses at price parity with a new diesel bus.[33]

[31] https://gohrt.com/2021/05/hrt-goes-electric/
[32] https://www.gsaadvantage.gov/ref_text/GS30F026BA/0W04R6.3RQHPX_GS-30F-026BA_PROTERRATEXTFILE.PDF
[33] https://www.proterra.com/services/financing-bus-fleets/

B. Bus route optimization with equity as a factor

The goal of this project is to provide more frequent, accessible, and reliable transportation to community members whose transit needs are not currently being met. This goes beyond purchasing electric buses for the purpose of replacing diesel buses and into ensuring that transit plans are meeting the needs of historically disadvantaged communities, which are more heavily reliant on public transit. There have been an increasing number of studies looking at optimal deployment of electric buses, with a focus on charging infrastructure.[34,35] Proterra even offers route planning as an add-on service for a fee. However, equity must also be considered as a central factor, and not just an afterthought, in order to ensure that historical inequities in transit do not continue to be reinforced. In fact, the goal of this project is to give electric bus priority to those disadvantaged communities in order to improve their transportation service overall while also decreasing emissions.

Creating specific route plans and stops for Hampton Roads Transit is outside the scope of this project. The survey created as part of this project gives a snapshot of community member needs, but a larger and more systematic community-needs inventory needs to be created. Liu et al. (2021) provide one possible way to conduct this route planning in their paper "Bi-objective Optimization for Battery Electric Bus Deployment Considering Cost and Environmental Equity.[36]" Their route planning framework includes a combination of mathematical modeling and GIS spatial-temporal analysis to maximize environmental impacts for particular communities while minimizing costs. The model was piloted in two case study locations in Utah and Oregon and allowed these transit authorities to create flexible plans in multiple stages to meet equity goals in battery electric bus deployment.

Finally, community engagement in the creation stages of route planning is integral to the success of this project. Computational modeling and data usage can be an important first step in determining planned routes for deployment of the new buses. However, community engagement by members of the communities that will be impacted by the project needs to be conducted throughout all stages of the project, with a goal of obtaining knowledge about community needs and potential solutions that cannot be gleaned from computational modeling alone. Route optimization and community engagement, since they are priorities in the project, should have earmarked funds in the project budget to ensure it is being done effectively. A flexible fund of $1,000,000 should go to professional consultation for route planning, multiple salaries or stipends for those doing community engagement, and funds for community engagement incentives such as food for working groups or participation stipends.

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[34] https://doi.org/10.1016/j.ijtst.2022.02.007
[35] https://atlaspolicy.com/wp-content/uploads/2022/05/Deploying-Charging-Infrastructure-for-Electric-Transit-Buses.pdf
[36] https://ieeexplore.ieee.org/document/9310704

C. Workforce development

Multiple survey participants and other community members mentioned the need for a more diverse workforce in the transportation sector. The purchase of new buses requires job creation in the form of drivers, maintenance workers, and logistical operators. New and existing employees will need to be trained to use and maintain the new electric buses and charging infrastructure. $1,000,000 in the project budget should go toward workforce development. This should include a focus on hiring community members in the same communities of focus for electric bus deployment.

D. Total Project Costs and Benefits

The following table outlines the specific costs of each portion of the project budget and the proposed benefits for each budget item.

Table 9: Costs and Benefits of Budget Items

Item	Cost	Benefits
10 Proterra electric buses with additional features	10 x $800,000 = **$8,000,000**	Addition of new routes with more frequent stops without increasing emissions
10 two-dispenser 125kW chargers	10 x $79,000 = **$790,000**	Two-dispenser chargers allow for the purchase of 5 chargers for 10 buses
Route optimization consultation services and community engagement	**$1,000,000**	Ensure BEB deployment and new route creation optimizes efficiency and equity for underserved communities
Workforce development	**$1,000,000**	Job creation for community members
Total	**$10,790,000**	

IX. Funding Opportunities

Deployment of battery buses is becoming a more common step in the effort to reduce local transit pollution and overall greenhouse gas emissions. However, battery electric buses and their associated accessories such as chargers are expensive and at times out of reach of the budget of local transit

agencies or Metropolitan Planning Organizations. The current administration has demonstrated a focus on both clean energy transition and environmental justice initiatives. Funding opportunities are available for both of these types of projects and especially projects that combine these two goals. Listed below are two project funding opportunities available—each associated with a statute passed during the current Biden-Harris Administration.

A. RAISE Discretionary Grant (Department of Transportation)

The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Discretionary Grant program through the Department of Transportation has been providing funding for local projects since 2009. The recent Bipartisan Infrastructure Law has more than doubled[37] the amount of funding for grants through this program. These grants allow local municipalities such as MPOs to apply directly for funding projects that "modernize transit" and "achieve national objectives,"[8] such as the clean energy transition and environmental justice. Multiple local transit projects in Virginia were funded in 2022 through this program. In order to apply for funding opportunities through this grant, the project area must fall under the definition of Area of Persistent Poverty or Historically Disadvantaged Communities. Multiple census tracts in the Hampton Roads area, including in Hampton and Newport News, meet the criteria for this grant funding. Funding opportunities for the 2023 cycle are expected to be posted this month (November 2022) and more information can be found here: https://www.transportation.gov/RAISEgrants/apply.

B. Clean Heavy-Duty Vehicle Program (Environmental Protection Agency)

In addition to money available through the Department of Transportation and the Bipartisan Infrastructure Law, an unprecedented amount of money coming from the Inflation Reduction Act (IRA) will soon be available for electrification in all sectors, including transportation. Through this legislation, the Environmental Protection Agency (EPA) is given $1 billion dollars to invest in a program called the Clean Heavy-Duty Vehicle Program. This allows municipalities to apply for funding for clean vehicles, such as electric Proterra buses, and the supporting infrastructure and workforce development. This funding source is still in the public comment period, but more information can be found here: https://www.epa.gov/newsreleases/epa-seeks-public-input-inflation-reduction-act-programs-fight-climate-change-protect

[37] https://www.transportation.gov/RAISEgrants

X. Conclusions

Community members in the Newport News and surrounding Hampton Roads area have indicated a need for more frequent, accessible and reliable transportation. These communities rely primarily on public transportation but are challenged by infrequent and unreliable bus schedules and bus stops far from their houses or workplaces. These same communities in Hampton Roads are the ones with high poverty rates, low car ownership, and historically high levels of environmental hazards, including air pollution from transit sources. The Biden-Harris administration has placed an emphasis on environmental justice initiatives, which means that more federal money is available for combating environmental injustices than ever before. Large portions of the Hampton Roads area fall under the Justice40 community designation and it would be beneficial for Hampton Roads Transit to seek out a portion of these funds to help aid underserved communities in Hampton Roads. The project proposed in this report seeks to add buses to existing routes and create new routes to further serve areas with inadequate access to public transit. In order to add more buses and routes without further exacerbating local air pollution challenges, the project proposes the addition of 10 electric buses to be deployed in historically underserved areas of Hampton Roads. Along with buses and chargers, the project calls for route optimization services that are focused on equity to ensure these buses are deployed to areas with the highest need. Additionally, money toward workforce development has the ability to create local jobs for these same communities. Federal funding opportunities for this type of project are posed to increase through the Justice40 initiative, but two possible funding sources were identified for this project: 1) the RAISE discretionary grant program, funded partially through the Bipartisan Infrastructure Law and coordinated by the Department of Transportation and 2) the Clean Heavy-Duty Vehicle Program funded through the Inflation Reduction Act and coordinated by the Environmental Protection Agency. It is imperative that communities with a history of environmental justice concerns, areas of high poverty, and inaccessible transportation take advantage of these funding opportunities to improve transit and overall quality of life for historically underserved communities.

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