FOURSQUARE ITP
INTEGRATED TRANSPORTATION PLANNING

Demand Responsive Transit Service Design

TRB 2019 INTERNATIONAL CONFERENCE ON DEMAND RESPONSIVE TRANSPORTATION

April 15, 2019

Introduction

- Evolution of Transit Planning Methodologies
- Demand Responsive Transit Service Considerations
- Example Projects
  - Hampton Roads Transit: Transformational Transit
  - Montgomery County: US-29 BRT Corridor Study
  - WMATA: Bus Transformation Project

Why demand responsive transit?

- **Cost efficiency:** Flexible service models can provide service where it is needed when it is needed using the appropriate level of resources.
- **Increase access**: Flexible service models can provide a transit option for a wide range of neighborhoods that could not be served by local bus.
- **Door-to-door**: Flexible service can directly connect passengers to their destination serving a greater range of needs.
- **Direct connections to higher frequency services**: Flexible service can be designed to feed passengers directly into a BRT or high frequency fixed-route transit service. Provides the first/last mile connection that might be lacking.
- **Technology-enabled:** App-based on-demand services provide a convenient way to request and pay for services

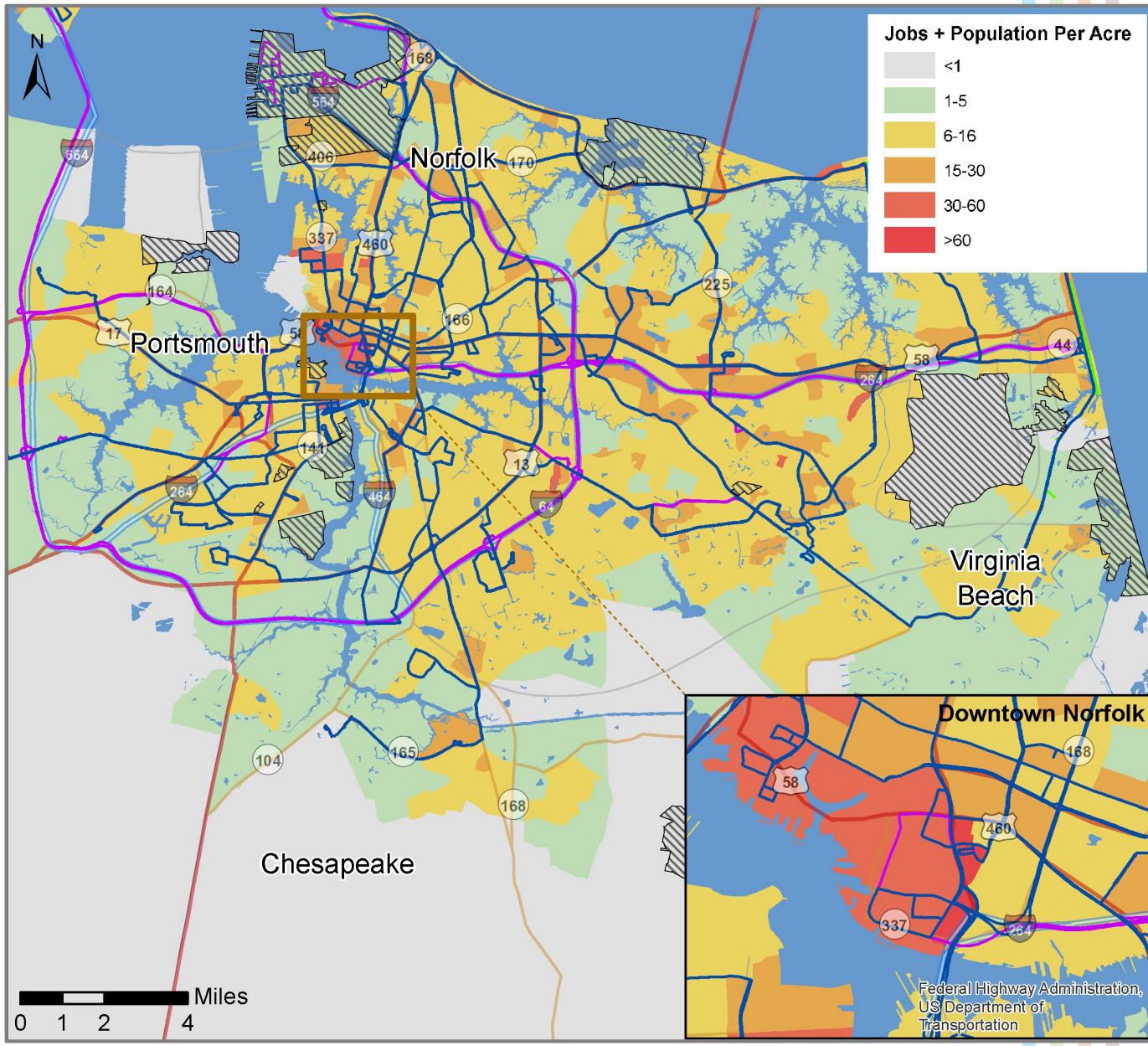
Transit Planning Methodologies (What we look at)

- Traditional Transit Planning
  - Population and employment densities,
  - Demographic and socio-economic considerations,
  - Land uses,
  - Road networks,
  - Transit networks.

- Demand Responsive Transit Planning
  - Population and employment densities,
  - Demographic and socio-economic considerations,
  - Land uses,
  - Road networks,
  - Transit networks.

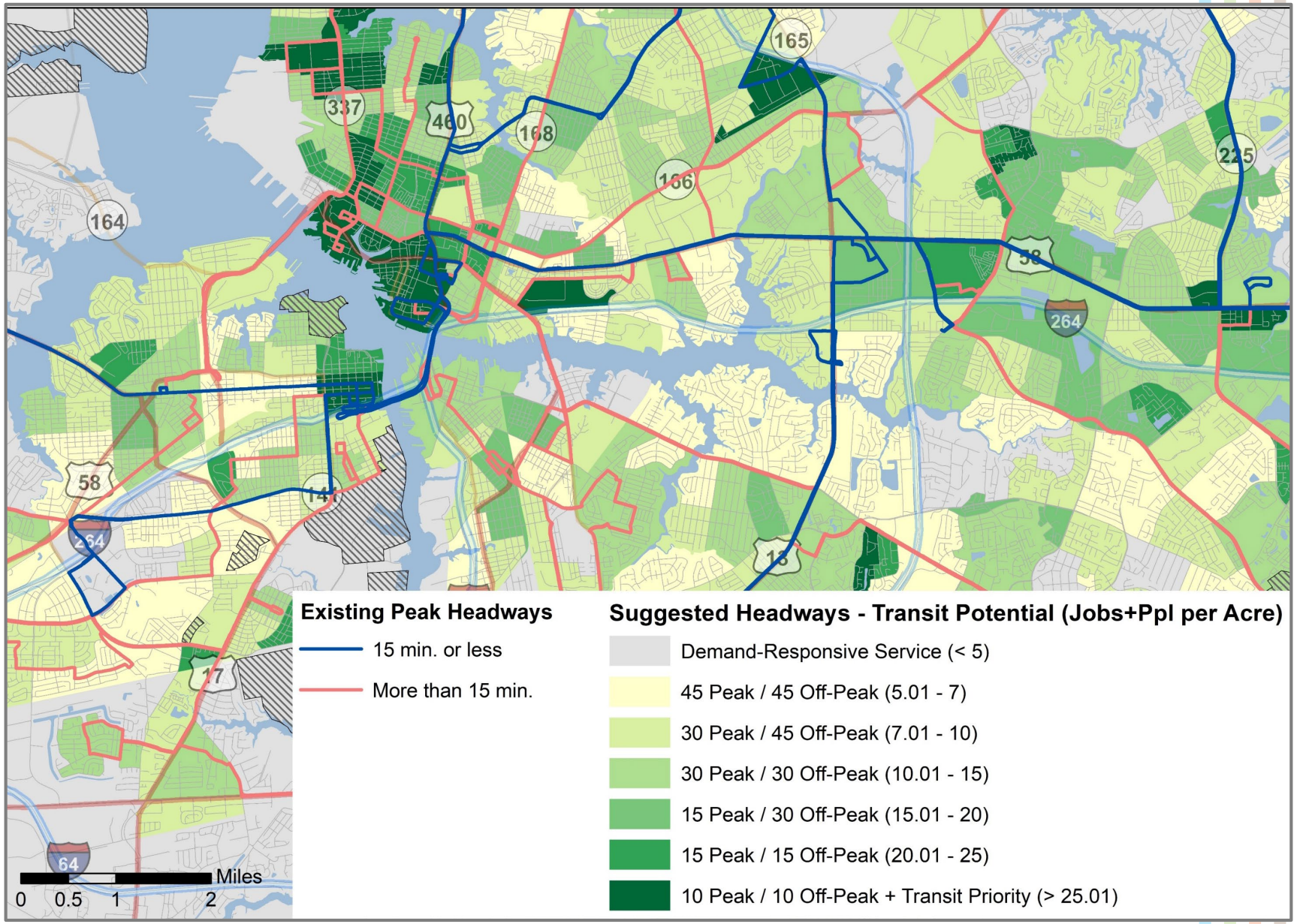
Population and Employment Density

- For fixed-route service it is typical to focus on higher population and employment density areas.



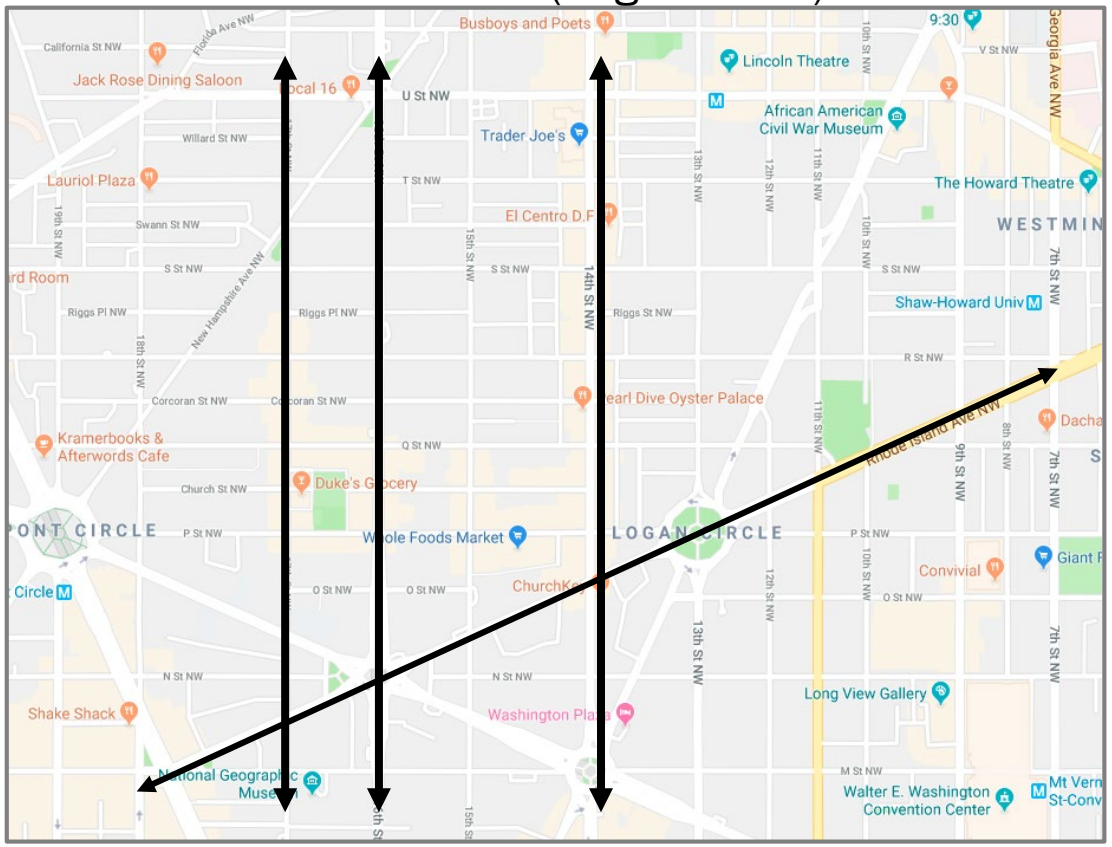
Population and Employment Density

- Flexible transit can be useful in providing transit options to areas that might not be able to sustain fixed-route services because of lower densities.

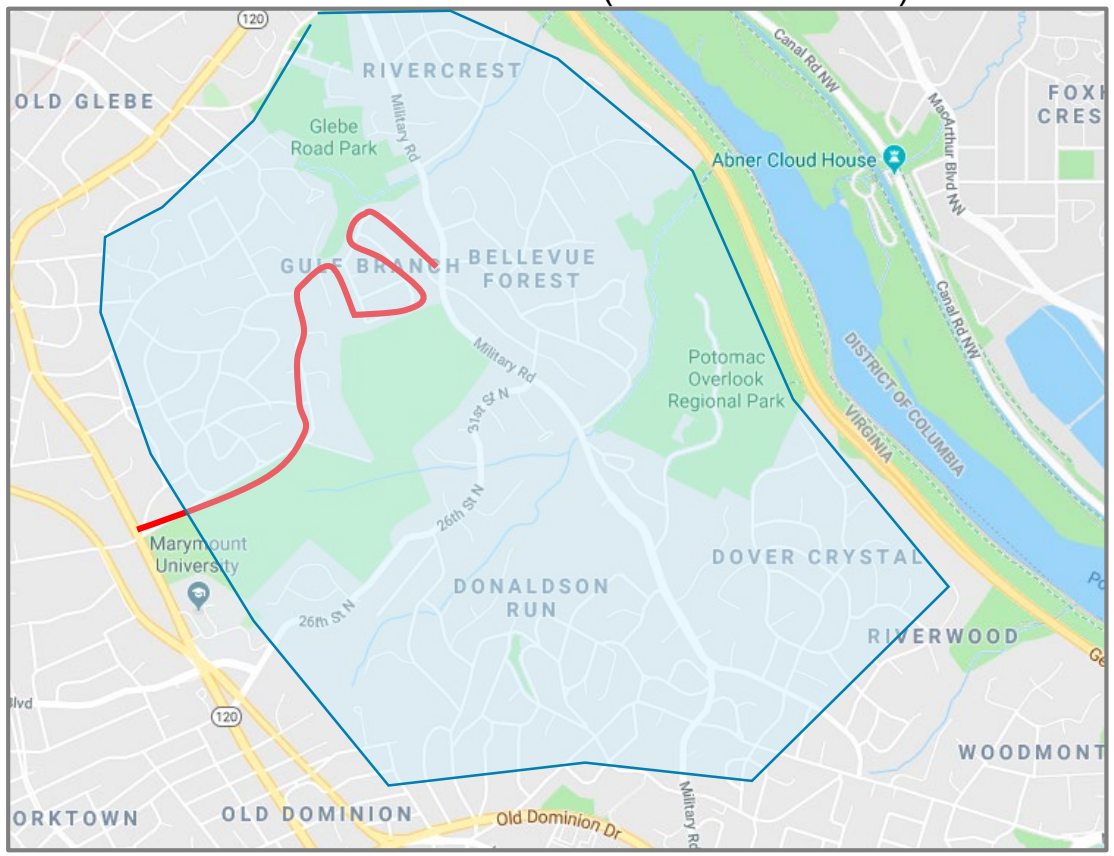


Road Networks / Land Uses

- Grid Networks: Suitable network for scheduled services (larger buses)



- Circuitous Network: Suitable network for more flexible services (smaller buses)



Transit Network Metrics

- **Productivity**
  - Focused on higher passengers per revenue hour/mile, concentrating resources where more ridership can be served.
- **Cost Efficiency**
  - Focused on obtaining lower subsidy or cost per passenger.
- **Access**
  - Total number of jobs or population served, this could be limited when forced to follow a specific route alignment.

- **Productivity**
  - Focused on identifying routes/services with lower passengers per revenue hour/mile and serving.
- **Cost Efficiency**
  - Focused on obtaining overall lower operating costs, even though the cost or subsidy per passenger/trip might be higher.
- **Access**
  - Total number of jobs or population served, this is maximized when extended across a zone.

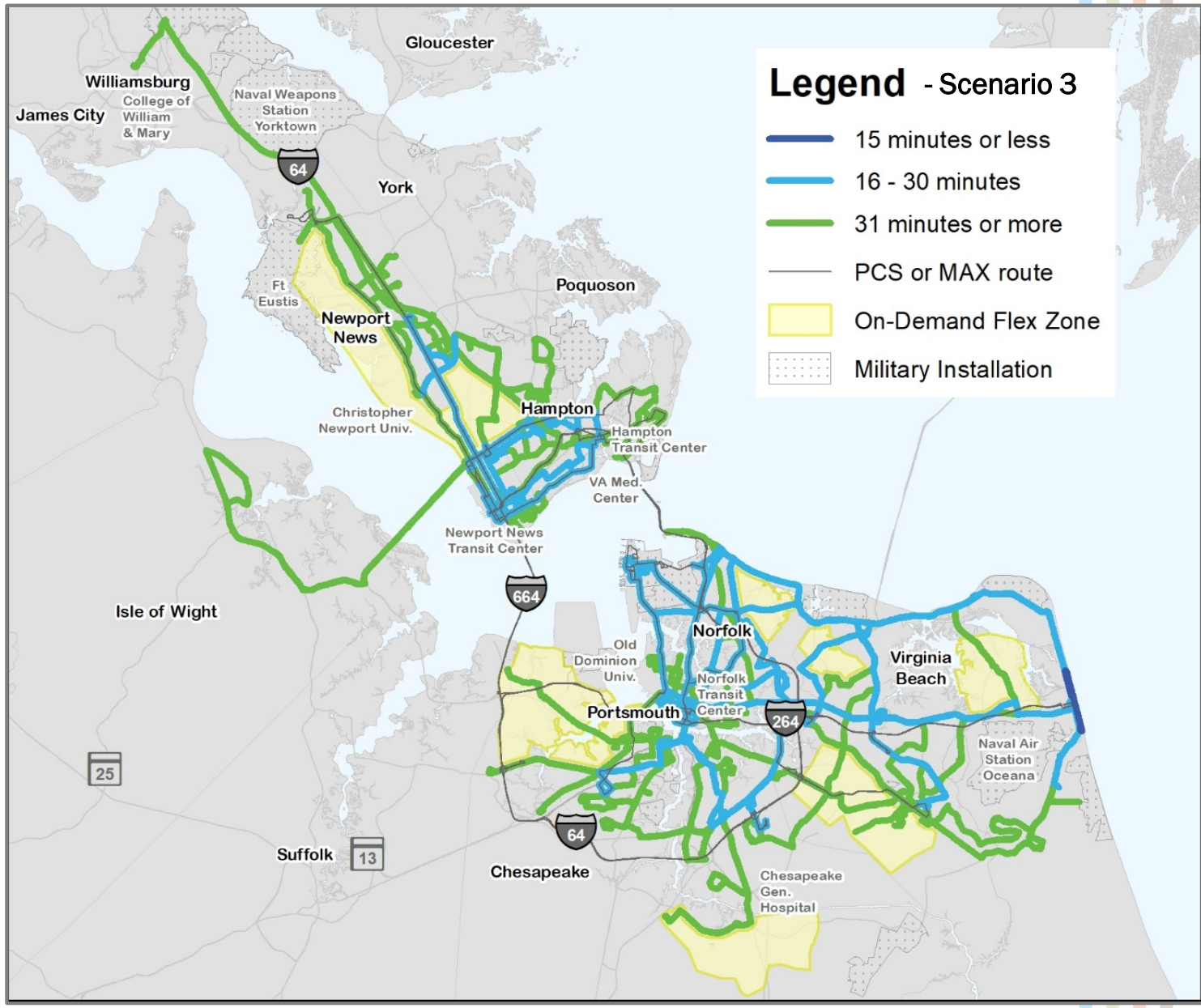
Additional Design Considerations with Demand Responsive Services

- **Types of Services**
  - Route Deviation
  - Point Deviation
  - Demand-Responsive Connector
  - Request Stops
  - Flexible-Route Segments
  - Zone Route

- **How it's operated**
  - Bus agency fully operates flexible service
  - Agency hires vendor to provide technology to support flexible service model, and provides the rest of the service
  - Agency contracts with vendor to provide technology and personnel to manage vehicle operations; agency uses its own vehicles
  - Agency contracts with vendor to provide all aspects of flexible service, including technology, vehicles, operations

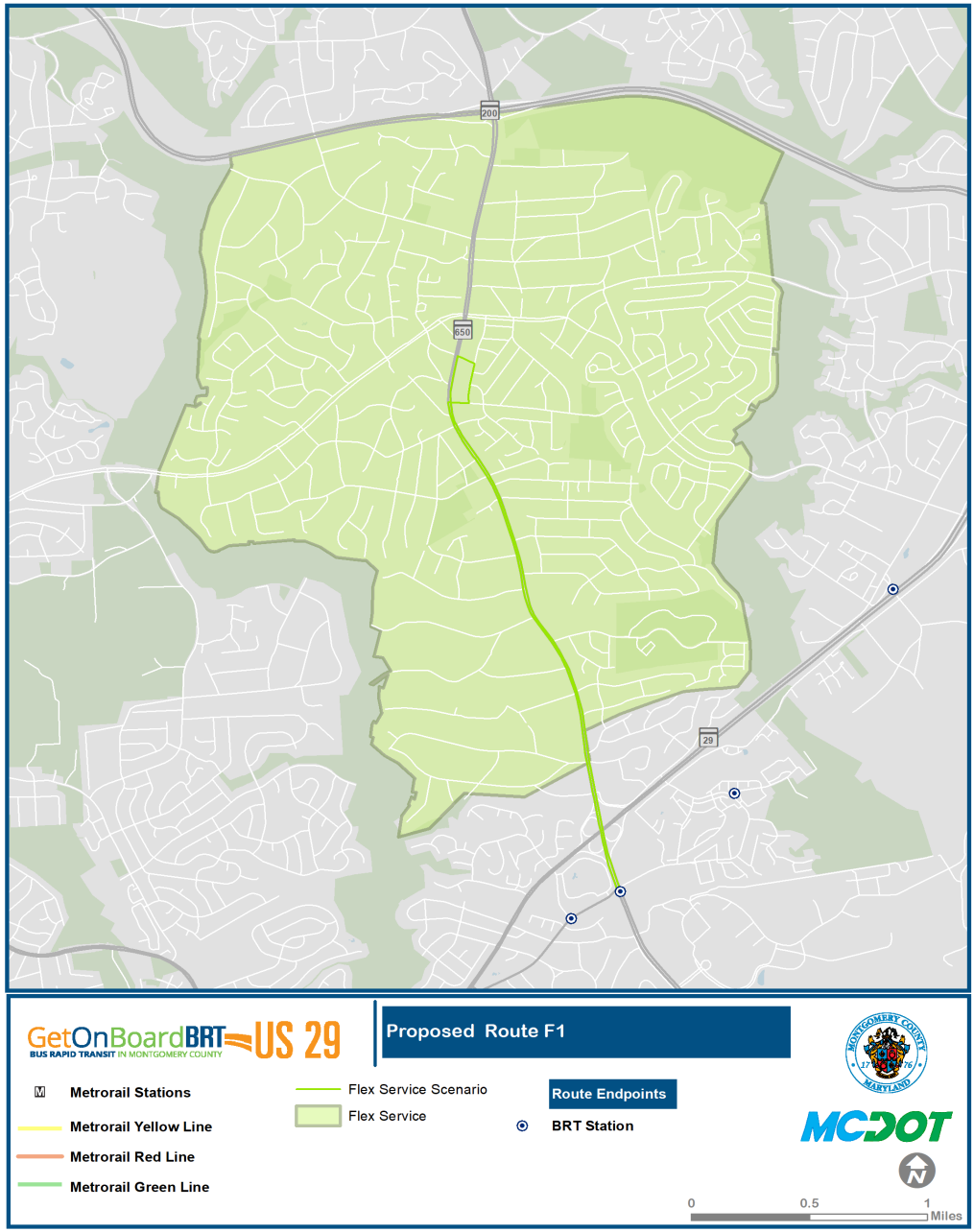
Hampton Roads Transit: Transformational Transit

- Created three varied service scenarios (Matching Supply to Demand, High Frequency, Maximum Coverage)
- Two of the scenarios incorporated on-demand flex zones.
  - The **Matching Supply to Demand Scenario** replaced unproductive service with on-demand zones
  - The **Maximum Coverage Scenario** identified low-density areas that would benefit from expanded coverage and covered them with on-demand zones.



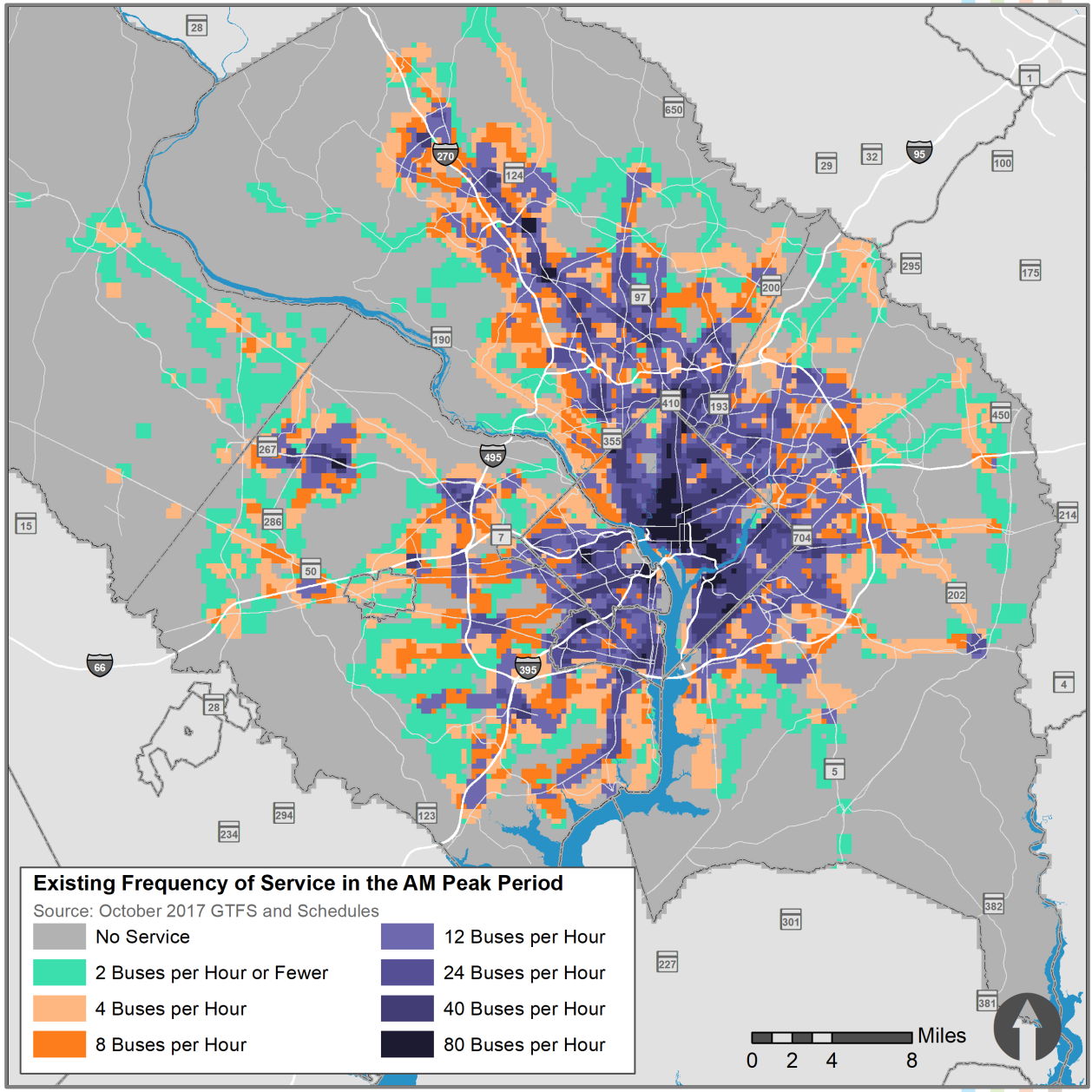
Montgomery County: US-29 BRT Corridor Study

- Created three varied service scenarios (Efficiency, High Frequency, Maximum Coverage)
- The **Maximum Coverage Scenario** explored flexible transit options for providing coverage to local neighborhoods and connecting them directly to the high frequency BRT route.



WMATA: Bus Transformation Project

- Assessed the region to match supply and demand for all types of transit services.
- Used a regression analysis to identify the appropriate level of service throughout the region.
  - Focused on population/employment densities, demographic and socio-economic considerations, as well as additional spatial characteristics.
- Compared against existing services to identify where potential on-demand service pilots might be successful.



Assessing Demand Responsive Services

- **Service Assumptions**
  - Number of vehicles per square mile
  - General span of operation each zone might be served
- **Ridership Modeling**
  - Assume an average number of passengers per square mile
  - Use CityCast modeling software
    - Zone-based on-demand service, satisfying requests that start and end within the zone
    - Allows transfers to another transit stop (bus or rail) inside the zone
    - Outputs include individual travel diaries point-to-point, minute-by-minute on a typical weekday
- **Customer Impacts**
  - Improved access to transit service
  - Reduced wait times
  - Reduced travel times
  - More direct service
  - More convenient service

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THANK YOU

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