Appendix D: Freight Design Considerations

Context of Freight Planning in Norfolk

Norfolk is an international shipping hub and home to the Port of Virginia's largest facility, the Norfolk International Terminal, as well as the Norfolk Naval Shipyard. Although much of the freight that moves through Norfolk does so on ships, trains, and trucks on the interstate highways, a significant amount of freight does pass through Norfolk's streets.

The two main categories of freight that affect Norfolk's multimodal transportation system are:

- Regional freight using the City's streets, and
- Local deliveries.

In Norfolk, both categories of freight are growing. Inter- and intraregional freight is growing thanks to Hampton Roads' strategic location where 40 percent of the US population and 128 million consumers are located within one day's drive.[i] Local deliveries are growing thanks to continued growth in e-commerce and a continuing trend of faster deliveries.

The design considerations in this chapter focus on addressing the first category of freight – regional freight movement that consists typically of larger trucks that travel on Norfolk's streets, but do not stop to make local deliveries. The second category of freight – local deliveries – is addressed in Chapter 9.

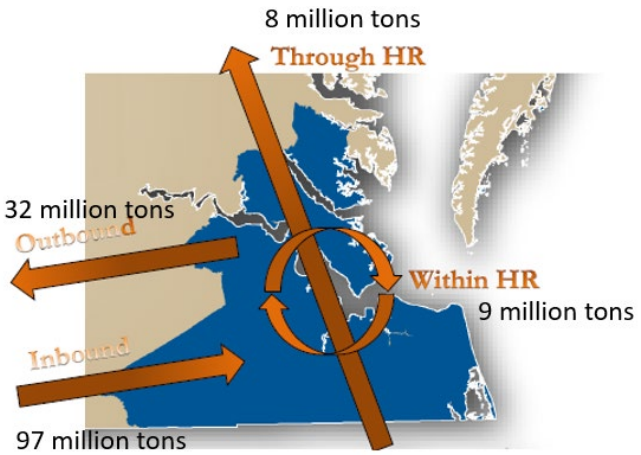
Freight is a huge driver of Norfolk's economy, and there is a complex web of freight planning that happens at the national, state, and regional scale beyond Norfolk's city limits.

Federal Context

At the national level, the U.S. Department of Transportation prepares a National Freight Strategic Plan and designates a National Multimodal Freight Network. The National Multimodal Freight Network is designated to inform freight planning, assist in the prioritization of federal investment, assist states in directing resources toward improved system performance for the efficient movement of freight.

Federal transportation legislation (the FAST Act) lays out requirements for states and MPOs to establish performance targets, including truck travel time reliability on the interstate system.

There is also a National Network of interstate highways and certain primary routes that large trucks like twin-trailers and triple saddlemounts are allowed to operate on per the Surface Transportation Assistance Act of 1982 – this network is also called STAA truck routes.



The Hampton Roads region has a variety of assets and unique characteristics that make it a strategic point of entry and transfer for goods movement. Image Source: HRTPO

State Context

States are required, per the FAST Act, to develop a state freight plan. The Virginia Freight Element of VTrans2040 is Virginia's state freight plan. It identifies freight system trends, needs, and issues; inventories facilities with freight mobility issues; and describes freight policies, strategies, and performance measures that will guide the state's freight-related transportation investment decisions

States also designate Critical Freight Corridors to be included in the National Multimodal Freight Network, where federal resources will be directed for improved freight system performance.

There is also a STAA Network of truck routes at the state level, and DRPT prepares a Statewide Rail Plan that addresses freight movement on privately-owned railways.

Regional Context

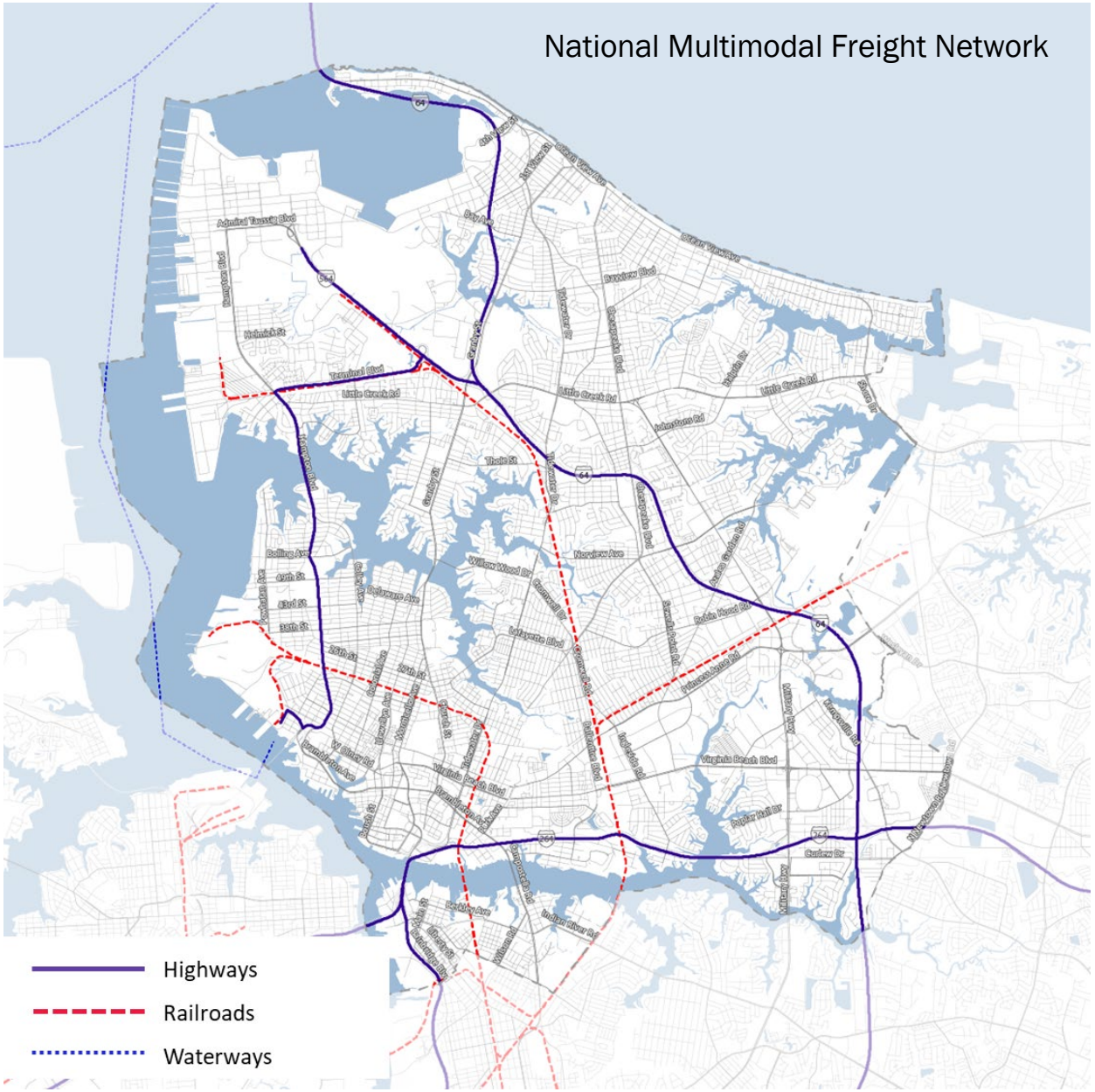
Within the Hampton Roads region, the Hampton Roads Transportation Planning Organization conducts a variety of freight studies, integrates freight into the organization's long- and short-term transportation planning processes, and hosts the Freight Transportation Advisory Committee.

The Port of Virginia and the Navy are private entities whose decisions greatly influence freight patterns and generate freight trips

Local Context

Although the Code of Virginia gives the City of Norfolk authority to prohibit and restrict trucks on roads within its jurisdiction, the feasibility of enacting truck restrictions and prohibitions is complicated.

The City of Norfolk also has authority to design its streets, which can influence the level of accommodation that is provided for large trucks.



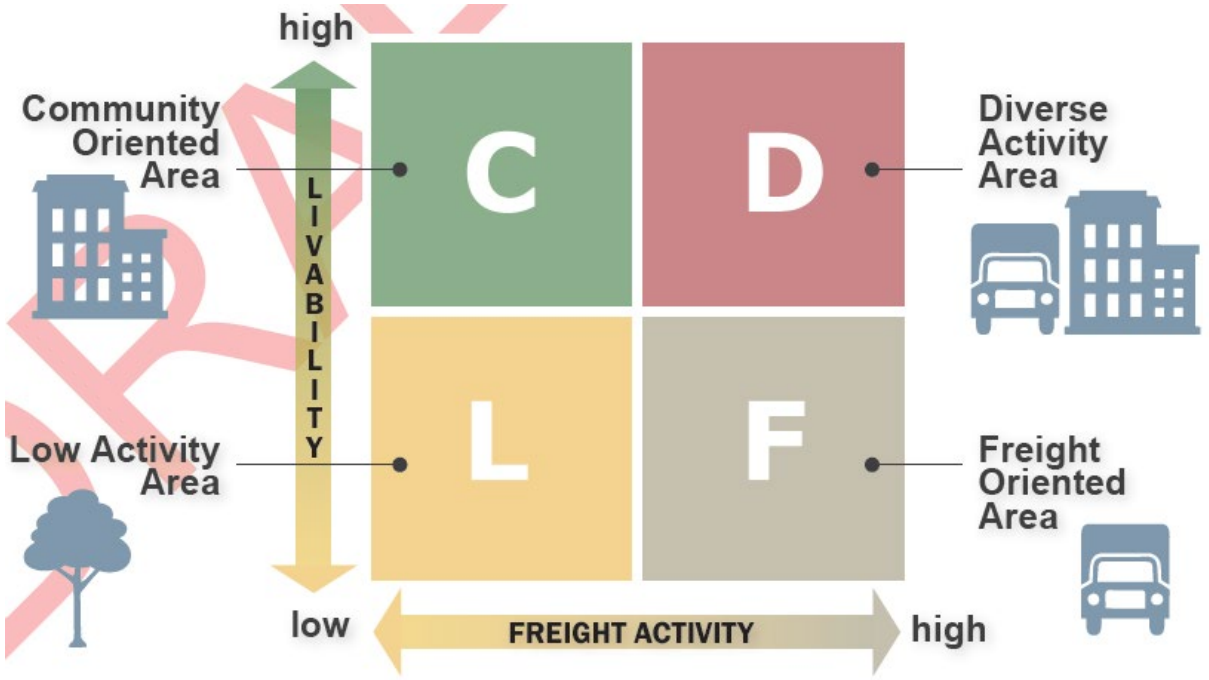
The National Multimodal Freight Network includes highways, railroads, and waterways that are designated by states as critical freight corridors. The National Multimodal Freight Network informs freight planning, assists in the prioritization of federal investment, and assists states in directing resources toward improved system for the efficient movement of freight.

A Framework for Designing for Community Context and Freight Activity

The freight considerations in this chapter use a framework for freight planning and design from a few best practice resources:

- *Tampa Bay Regional Strategic Freight Plan*,[ii] the first plan of its kind to integrate freight activity needs with land use compatibility and community livability
- *Freight Roadway Design Considerations*,[iii] a comprehensive resource for context-sensitive freight design with strategies and guidance for designing corridors and intersections in a variety of land use contexts

Both resources describe a framework for simultaneously considering the intensity of goods movement and the importance of land use patterns and community livability. As shown in the graphic to the right, there is a spectrum of level of freight activity and a perpendicular spectrum of community livability.



Different areas have varying characteristics and functions related to freight activity and community livability. This diagram shows a two-dimensional matrix with freight activity on one axis and community livability on the other. Depending on the combination of freight activity and community livability, areas can be categorized into four different area types. Image Source: *Freight Roadway Design Considerations*, Florida Dept. of Transportation.

Areas can generally fall into four corresponding categories:

- Community-Oriented Areas
- Freight-Oriented Areas
- Diverse Activity Areas
- Low Activity Areas

Community-Oriented Areas are areas where the level of bicycling and pedestrian activity is expected to be relatively high and through truck traffic relatively low. The purpose of these areas is to promote a high level of activity, with a variety of destinations, both residential and non-residential, within walking and bicycling distance.

Freight-Oriented Areas are primarily in industrial areas, including seaports, shipbuilding areas, warehousing, and distribution centers with few if any residential and non-industrial uses where freight activity is high.

Diverse Activity Areas are areas that have an important function for community livability and are also areas where freight movement is important.

Low Activity Areas are generally rural areas whose land use generates low volumes of traffic, including truck traffic.

Design considerations for freight and goods movement on multimodal corridors vary for each area type category.

Correlating Norfolk's Multimodal System Plan to the Freight Activity and Community Livability Area Types

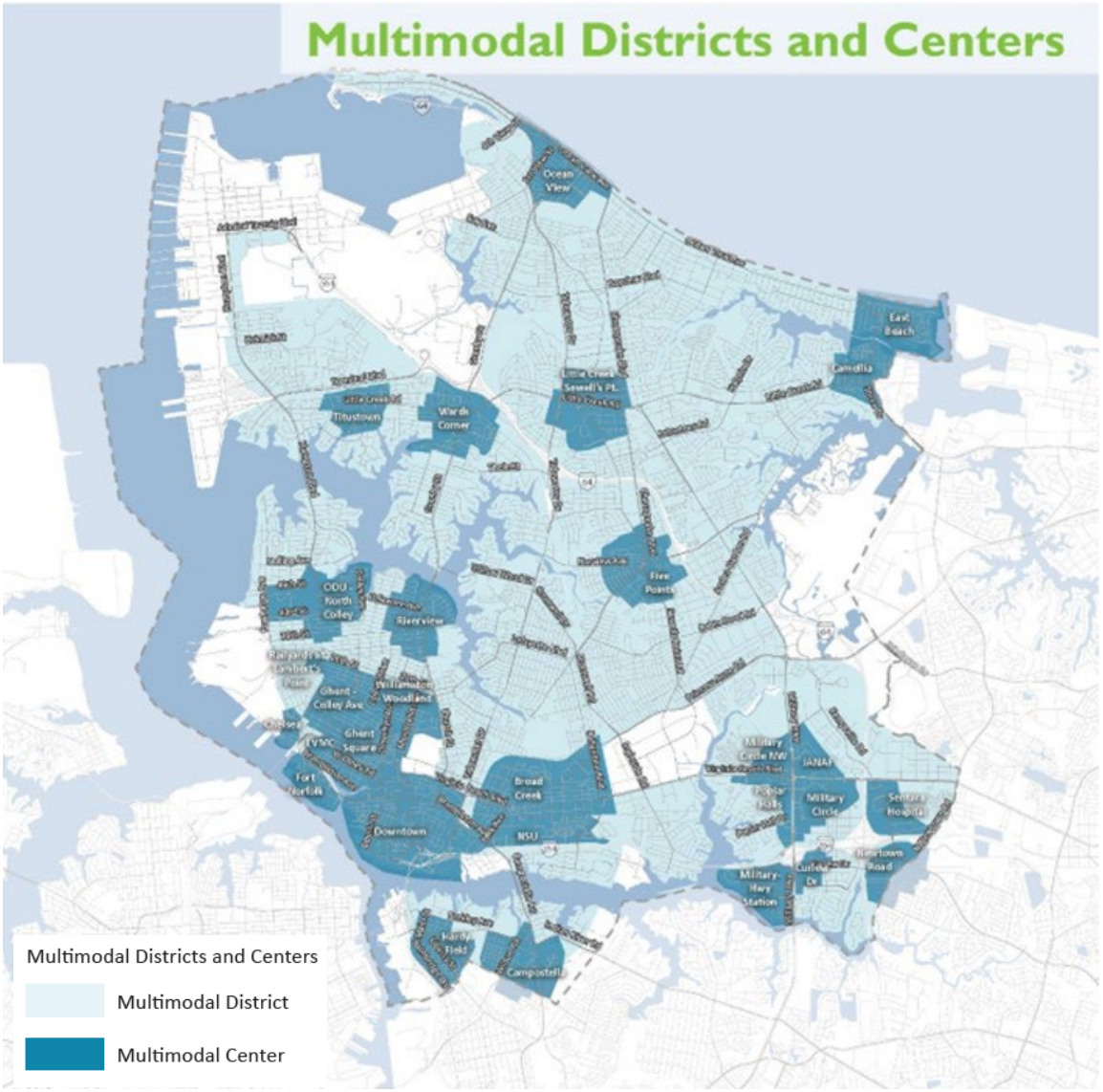
As explained in the Multimodal System Plan in Chapter 4, areas in the City of Norfolk can be generally classified into three broad categories:

- Multimodal Centers
- Multimodal Districts
- Areas outside of Multimodal Districts

For the purposes of freight considerations for multimodal corridor design, these three types of areas from the Multimodal System Plan correspond to three of the four area types in the framework for freight activity and community livability.

- Multimodal Centers generally correspond to Community-Oriented Areas
- Areas outside of Multimodal Districts generally correspond to Freight-Oriented Areas
- Multimodal Districts generally correspond to Diverse Activity Areas

No areas within Norfolk are considered to correspond to Low Activity Areas.



As explained in Chapter 4, areas in the City of Norfolk can generally be classified into three broad categories – Multimodal Centers, Multimodal Districts, and areas outside of Multimodal Districts.

By understanding the various roles a specific multimodal corridor and its surrounding area serve within the Multimodal System Plan, within the network of regional freight activity, and for community livability, designers can select appropriate design strategies that properly balance truck movement needs with the needs of other road users.

The Tampa Bay Regional Strategic Freight Plan provides several intersection design strategies in each area type, which are presented in the following sections. The Freight Roadway Design Considerations document provides a wealth of additional information and design guidance that greatly expands upon these design strategies.

*Designers should reference the **Freight Roadway Design Considerations**, published by the Florida Department of Transportation, for more detailed guidance on the following design strategies for freight considerations.*

Although the *Freight Roadway Design Considerations* was prepared by the Florida Department of Transportation, it is the most comprehensive resource for freight design considerations, and the guidance therein is applicable to all areas within the U.S., not just Florida.

The following pages contain excerpts from the Tampa Bay Regional Strategic Freight Plan, as appropriate for the Norfolk context.

Freight Design Considerations in Freight-Oriented Areas

Intersections in Freight-Oriented Areas should be designed to optimize the operational efficiency of trucks. This is particularly important where two facilities on the freight network meet but applies generally to all intersections.

The following design strategies may be applicable to multimodal corridors with special freight considerations in areas outside of Multimodal Districts.

The graphic above demonstrates recommended strategies for intersection design in Freight-Oriented Areas. Image Credit: *Tampa Bay Regional Strategic Freight Plan.*

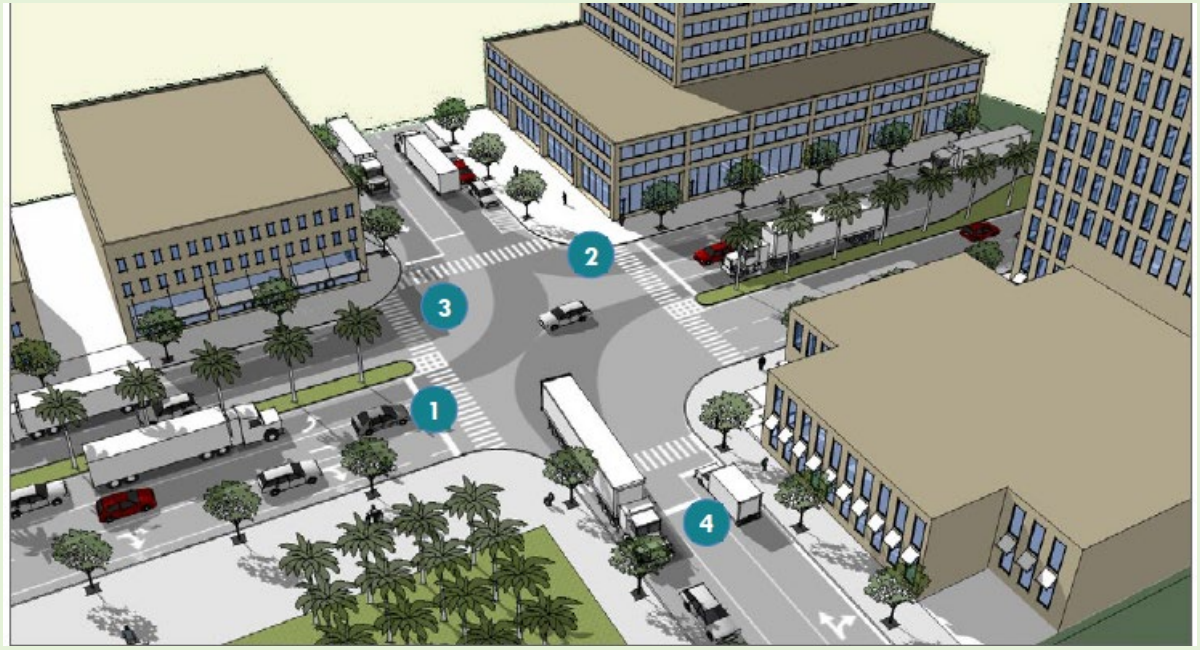
1. **Truck channels** facilitate right turn movements for trucks while providing space for pedestrian refuge and signal poles and equipment. They give the truck storage space that is outside the departing through lane for the yield condition, creating better operating and safety conditions for through traffic.
2. **Median nosings** can be designed to allow additional space for trucks making left turns on or off the mainline facility. They assist trucks in departing left turn lanes and entering receiving lanes. They can be set back from the crosswalk further than normal or striped, depending on the width of the median and the need to guide vehicles into a particular turning pattern.
3. **Left turn lanes** should be designed as single lanes where volumes and the intersection signal phasing and timing strategy support it. Dual lefts can be problematic for traffic in adjacent lanes and opposing traffic in the middle of the intersection where the truck wheel tracking distance is the greatest. Dual lefts can also make it difficult for trucks to enter the receiving lane.
4. **Extended left turn lanes** provide additional storage for trucks and other vehicles. Signal timing and phasing should be designed to allow for processing slower-moving trucks.
5. **Corner radii** should be designed to accommodate trucks turning on and off the mainline facility. In some cases, trucks can use two receiving lanes to complete the turn and each intersection radius can be sized accordingly.

Credit: Tampa Bay Regional Strategic Freight Plan, Florida Dept. of Transportation.

Freight Design Considerations in Community-Oriented Areas

Intersections in Community-Oriented Areas should be designed to accommodate trucks while optimizing the roadway operations for other vehicles and facilitating safe, comfortable and convenient pedestrian access. These areas often have constrained rights-of-way, a limited number of through lanes and shared turn lanes. Roadways should be designed so that smaller trucks can operate. Larger trucks need to be anticipated on the mainline facility but may not be the appropriate design vehicle for side street conditions and turns due to physical limitations or lack of need due to very low large truck volumes.

The following design strategies may be applicable to multimodal corridors with special freight considerations in Multimodal Centers.



The graphic above demonstrates recommended strategies for intersection design in Community-Oriented Areas. Image Credit: *Tampa Bay Regional Strategic Freight Plan.*

1. **Median nosings** can be set back from the crosswalk further than normal on facility where large truck turns are anticipated. Extended median nosings with crosswalks in advance of the nosing do not typically interfere with small truck turning movements.

2. **Curb extensions/bulb outs** and **on-street parking** should be avoided in the portions of receiving lanes that would allow for expanded outside wheel tracking. Providing this space makes it easier for trucks to turn right and left off the mainline facility onto the side street. On street-parking should be avoided on mainline facilities on the Freight Network.

3. **Corner radii** should be designed to accommodate larger trucks on and off the mainline facility at intersections with other facilities on the Freight Network and at major arterials. Radii should be designed to accommodate smaller trucks turning on and off the mainline facility at secondary side streets.

4. **Stop bar setbacks** allow for larger trucks to make left turns from the mainline facility onto the side street by providing more space for inside wheel tracking. Depending on the departure lane and corner condition, they can also help facilitate right turns from the mainline facility onto the side street. The stop bar can be staggered for multiple lane approaches with no median such that only the stop bar on the outside lane is set back from the crosswalk.

Credit: Tampa Bay Regional Strategic Freight Plan, Florida Dept. of Transportation.

Freight Design Considerations in Diverse Activity Areas

Intersections in Diverse Activity Areas should be designed to facilitate truck movements while balancing the needs of other users of the roadway. This often has to occur in constrained rights-of-way where established curb lines, existing infrastructure and equipment and limited right-of-way widths shape truck-friendly solutions.

The following design strategies may be applicable to multimodal corridors with special freight considerations in Multimodal Districts.

The graphic above demonstrates recommended strategies for intersection design in Diverse Activity Areas. Image Credit: *Tampa Bay Regional Strategic Freight Plan.*

1. **Corner radii** should be designed to accommodate trucks turning on and off the mainline facility while maximizing the use of receiving lanes to complete the turn. Tapered curbs and multiple-radius curbs can be used in lieu of increasing a single radius curb to accommodate the truck turn.
2. **Tapered medians** or **expanded receiving lanes** on the side street provide additional turning space where the receiving lanes are inadequate and/or where the corner radius cannot or should not be increased. Tapered medians and expanded receiving lanes do not increase the crossing distance for pedestrians like increased corner radii do. They also do not require additional right-of-way in retrofit conditions.
3. **Tapered curbs** can expand the area for trucks to make left and right turns from the mainline facility to the side street. They do increase the crossing distance for pedestrians. Tapered curbs need to be considered as retrofits in light of a number of conditions, including right-of-way, sidewalk width, drainage and location of equipment.
4. **Bicycle lanes** provide a secondary benefit for trucks beyond their primary function. When trucks are turning right out of a shared through lane, the offset from the curb provides the truck more room to turn by shifting the inside wheel tracking away from the corner radius. When present on the side street, bicycle lanes increase the effective receiving area width.

Credit: Tampa Bay Regional Strategic Freight Plan, Florida Dept. of Transportation.

The design strategies just presented are not a one-size-fits-all set of strategies that must always be employed on every multimodal corridor in each area type.

These design strategies may apply to multimodal corridors with special freight considerations, but careful consideration should be given to the amount of truck traffic on an individual road, the specific land uses on that block, and the role that road plays in the larger regional freight network.

For example, Hampton Boulevard is envisioned to be a Placemaking corridor in the Multimodal System Plan. It traverses several Multimodal Centers with high levels of non-motorized activity, including Downtown and Old Dominion University. And yet, it is one of the most highly used corridors for trucks to connect from Naval Station Norfolk and Norfolk International Terminals to the Portsmouth Marine Terminal, Pinners Point Container Yard, and other major industrial land uses in Portsmouth. Design strategies on Hampton Boulevard may include a range from all three area types presented in this chapter, depending on the unique context and adjacent land use needs.

Design decisions on corridors like Hampton Boulevard are likely to impact a wide array of stakeholders, and in addition to the design considerations presented here, outreach and communication with the variety of stakeholders during the design process will be critical to identifying key tradeoffs and determining the best design solution.

[i] Hampton Roads Alliance, 2016. "About Hampton Roads." *http://www.hreda.com/map-center/?map=majorcities*

[ii] Florida Department of Transportation District Seven, 2018. *Tampa Bay Regional Strategic Freight Plan*. Retrieved Jan 6, 2021 from https://tampabayfreight.com/strategic-freight-plan-web-document.

[iii] Florida Department of Transportation District Seven, 2015. *Freight Roadway Design Considerations*. Retrieved Jan 6, 2021 from https://tampabayfreight.com/frdc.