

# Section 3

## Development of Alternative Railroad Alignments

This study used evaluation criteria applied in a multi-step screening process to better understand the universe of potential corridors and to assess which alternatives might be the most viable alternatives that address security, railroad operations, engineering, and environmental considerations. The Railroad Working Group, the NCPC Interagency Security Task Force, and the Railroad Owners/Operators Group were an integral part of this process. During 10 meetings throughout the study, these stakeholders helped to shape the alternative development process and outcome.

In the first step in the screening process, several mandatory factors were applied to the universe of potential alignments to combine them into seven preliminary corridors that would provide alternative rail freight routes from north of Richmond to the north side of the District. Next, qualitative screening criteria were applied to the corridors to identify those that were more feasible alternatives. Finally, more-detailed quantitative screening factors were applied to these alternatives to generate alternatives that appeared most viable. These alternatives were then evaluated for how they responded to the project goals.

In each step of alternative development, the minimum possible number of criteria were applied that were necessary to distinguish among the alternatives and address the project goals.

### Development of Preliminary Corridors

To further analyze the set of potential alignment corridors described in the previous section, several initial factors were considered. Because these were considered the most critical in responding to the project goals and developing reasonable alternative alignments, all of these criteria were mandatory. If a potential corridor did not meet one of the criteria, it was viewed as being not as feasible as the other alternatives.

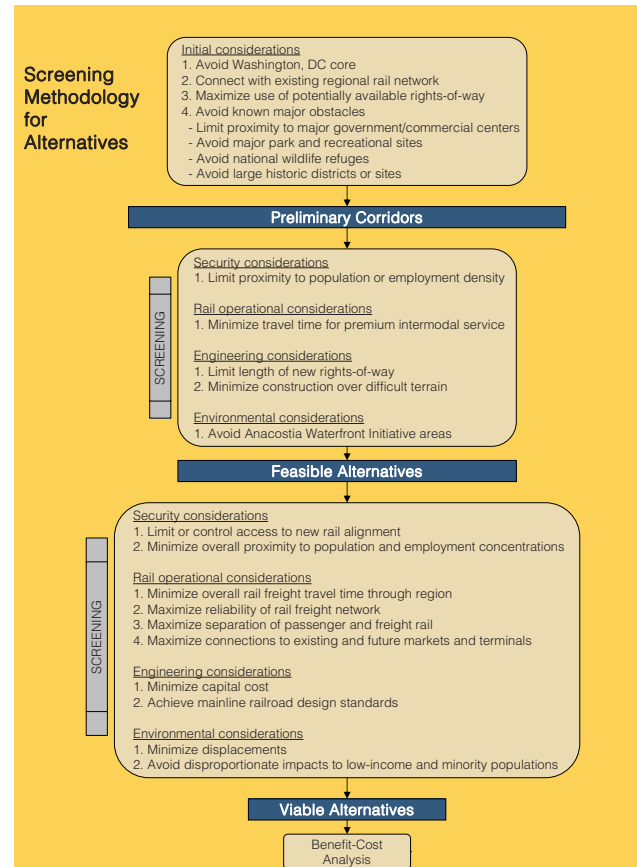


Figure 3-1. Alternative Development Process



Figure 3-2. Railroad near U.S. Capitol

## Development of Alternative Railroad Alignments

The first criterion was to **avoid the Washington, DC Monumental and Central Business District Core**.

By doing so, a corridor would meet the project goal of increasing security of the Monumental Core and the U.S. Capitol as well as the goal of increasing access to the Anacostia River. Iconic structures such as the White House and the U.S. Capitol, shown in Figure 3-2, are potential terrorist targets; removing the freight railroad from their vicinity would inherently decrease the risk of a freight railroad-related incident.

To maintain efficient commerce and the convenient movement of goods and people, the second criterion was that the corridors **connect with the existing regional rail network** in a direct way, providing a route for north-south rail freight traffic to bypass the existing route through the District's core.

The third criterion was to **maximize use of potentially available rights-of-way**. This would include existing active or abandoned railroad rights-of-way, existing or planned highway corridors, and existing or planned utility corridors. Collocating infrastructure in this manner typically allows for cost savings and construction simplicity, and tends to minimize the extent of residential and commercial property acquisition, community disruption, and effects on environmental resources.

The final criterion was to **avoid known major obstacles** such as government and commercial centers, major parks and recreation sites, national wildlife refuges, and large historic districts or sites.

Most of the corridor segments identified in the previous section met the mandatory criteria and were incorporated into one or more of the preliminary corridors, with a few exceptions. Three of the four possible eastern crossing options near Indian Head were not explored further because they did not avoid known major obstacles. The option with a Potomac River crossing at Possum Point presented significant challenges because it would run through the middle of the Naval Surface Warfare Center, Indian Head Division, on the east side of the Potomac River.

The option with a river crossing at Ft. Belvoir was not explored further because it, too, would require traversing a major military installation and could be within the viewshed of Mount Vernon. The option with a river crossing at Mason Neck was deemed undesirable, since this would have passed through or in close proximity to a riverfront area clustered with parks, wildlife refuges, protected views, and wetland. The southernmost option near Indian Head, with a river crossing near Arkendale, south of the Marine Base at Quantico, was retained for further study because it satisfied all of the mandatory criteria.

Within Maryland, the potential corridor segment between Jessup and Frederick in the MD Route 32 and I-70 corridor was eliminated from further consideration. Development in the corridor has already claimed much of the potential right-of-way that was initially identified for this alignment. Instead, the option that would include upgrading the Old Main Line was retained for further study, since it would minimize new rights-of-way and provide an east-west route for freight traffic bypassing the main CSX east-west route via the Capital and Metropolitan Subdivisions. It would also avoid a portion of the east-west route that lies near the Washington, DC monumental core.

Between the north end of the Pope's Creek Branch at Bowie and the CSX mainline at Halethorpe, only one of two potential routes was retained for further study. The route paralleling the Amtrak Northeast Corridor from Bowie to Halethorpe was eliminated from further consideration, since it would not provide a connection to the existing CSX yard at Jessup and would include a greater amount of new rail line construction. The option of constructing a new freight right-of-way between Bowie and Jessup was retained.

In summary, the application of the mandatory criteria resulted in the identification of seven preliminary corridors, shown in Figure 3-3. These included two corridors that would follow a westerly route around the District, three that generally follow the existing



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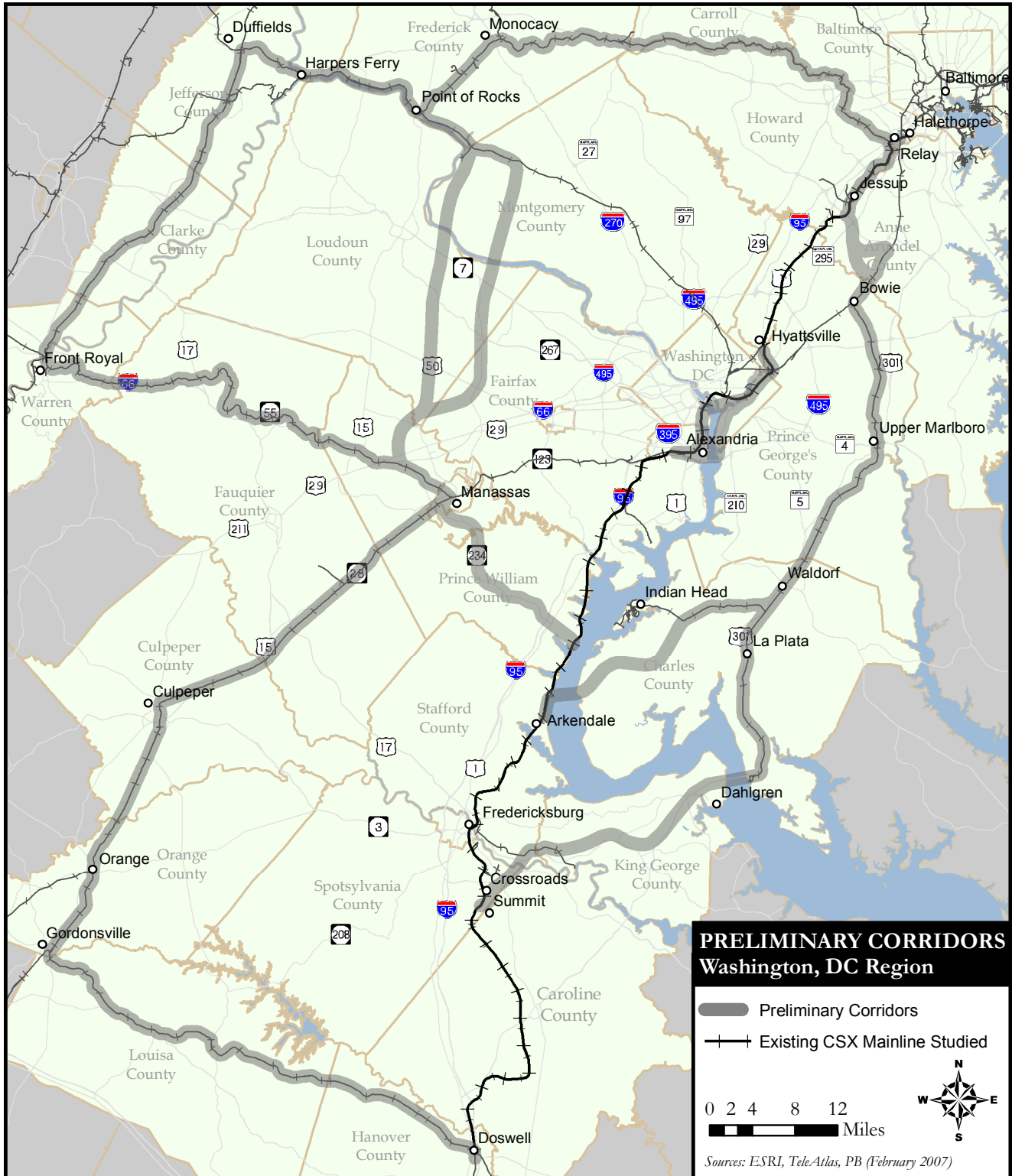


Figure 3-3. Preliminary Corridors

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railroad right-of-way except for differences at the Potomac River crossing near the District, and two corridors that take an easterly route around the District using the CSX Pope’s Creek Branch.

## Western Corridors:

- Existing railroad
- New right-of-way

## Central Corridors:

- Rail yards tunnel
- Alexandria north crossing
- Alexandria south crossing

## Eastern Corridors:

- Indian Head
- Dahlgren

## Development of Feasible Alternatives

The seven preliminary corridors were screened down to four feasible alternative alignments using qualitative criteria. Unlike the initial considerations in the first step, the criteria were not mandatory, but simply a way to rate and compare the corridors in four categories—security, railroad operations, railroad operations, engineering, and environmental characteristics.

### SECURITY

Because this stage of screening used qualitative criteria, the security factor used was to **limit proximity to population and employment density**. Terrorists look to impact lives and disrupt commerce in a visible manner; thus, the feasible alternative alignments should minimize their exposure to areas with security risks.

The Western Existing corridor would run through the rural counties on the west side of the Washington, DC region and therefore, would have the lowest proximity to population and employment density. The Western New, Eastern Indian Head, and Eastern Dahlgren corridors would have medium exposure; they would travel through medium-density residential areas such as Sterling, Centreville, Chantilly, Dale City, La Plata, Waldorf, and Bowie but avoid the higher-density areas close to the District. The three central corridors, Central Yards, Central Alexandria North, and Central Alexandria South, would all run relatively close to concentrations of dense residential population and employment such as Old Town Alexandria, Potomac Yard, and developing areas east of the Anacostia River.

### RAILROAD OPERATIONS

Because time-sensitive intermodal is the highest priority type of freight, the study focused on **minimizing travel time for premium intermodal freight service**, particularly in the north-south corridor between Richmond and Baltimore.

The intermodal freight rail travel time would be



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highest for both western corridors, as they would entail a major detour to the west around the Washington, DC region. In addition, the topography of the region would handicap the western corridors, since both of these routes would require trains to ascend and descend across the Blue Ridge and other significant ridgelines that form part of the Appalachian mountain chain. The western routes would add several hours of running time for CSX north-south freight trains. Conversely, all of the central and eastern corridors would have comparable and relatively low intermodal freight travel times, as they would retain the general orientation of the current alignment.

## ENGINEERING

An inherent project consideration was to minimize capital cost. To do so, the study sought to **avoid difficult** terrain by limiting proposed construction in urbanized areas with its higher cost, community disruption, and potential for controversy. In addition, construction through hilly terrain was considered undesirable for cost and engineering feasibility reasons. Any new freight railroad would be required to meet railroad engineering standards, which limit vertical grades to no more than one percent.

In addition, the study sought to **limit the length of new rights-of-way** required for the realigned freight railroad for the same reasons as the above criterion.

The Western Existing and Central Yards corridors would require the least amounts of new rights-of-way, whereas the Western New would require the most. The difficulty of construction was also determined to be least with the Western Existing corridor, as it would use all existing rights-of-way and run through predominately rural areas. Some of the existing railroad lines it would use would need significant upgrade, as they traverse hilly or mountainous terrain in Virginia and Maryland; however, there are many parts of the corridor that are relatively flat. The difficulty of construction would be highest with the Western New, Central Alexandria North, and Central Alexandria South corridors because of their

proximately to developed areas.

## ENVIRONMENTAL CHARACTERISTICS

To open up access to the Anacostia River and to avoid adverse effects on the District's Anacostia Waterfront Initiative (AWI) plans, the criterion was to **avoid the AWI areas**. All the preliminary corridors were found to have minimal or no impact to AWI areas except for the Central Alexandria North and Central Alexandria South corridors. Both corridors would cross the Potomac River and run above-ground along the Anacostia River, parallel to the Shepherd Industrial Track. Introducing a new barrier, a freight railroad, to this area would limit the District's opportunities to reunite divided communities.

Though it was not a specific screening criterion, the available National Wetlands Inventory data was reviewed at this stage of the study. The Western New corridor would require construction of a new railroad through or close to a cluster of wetlands along the Potomac River north of Dulles International Airport.

## RESULTS

After consultation with the Railroad Working Group, the NCPC Interagency Security Task Force, and the Railroad Owners/Operators Group, the Western New corridor was dropped from further consideration due to its high travel time for north-south intermodal freight service, its extensive required construction through difficult terrain, and its need for substantial property acquisition for new railroad rights-of-way. The Western Existing corridor was retained because it would follow existing railroad rights-of-way for its entire length, avoid AWI areas, and limit proximity to population and employment density.

The Central Alexandria North and Central Alexandria South corridors were dropped from further study due to their proximity to population and employment density, their need for new right-of-way acquisition in heavily urbanized areas, and their potential effect on AWI development areas. The Central Yards alternative would minimize these effects by providing a tunnel between two existing railroad rights-of-way and,

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therefore, was retained. These results are shown in Table 3-1.

The project stakeholders agreed to carry the remaining four feasible alternatives forward for more detailed analysis. The feasible alternatives, which were renamed to be more specific alignments, are shown in Figure 3-4 and listed below.

- Western
- DC Tunnel
- Indian Head
- Dahlgren

## Development of Viable Alternatives

Finally, the four feasible alternatives were evaluated based on a quantitative set of screening criteria that revealed more detail on their security, rail operations, engineering, and environmental characteristics. Again, these criteria were not mandatory, but a means to compare the alternatives.

### SECURITY AND SAFETY

To evaluate the security risks of each freight railroad alignment alternative, a security risk assessment was incorporated into the screening criteria. The assessment included consideration of threats, vulnerabilities, and consequences. Because railroads carry toxic inhalation hazard (TIH) materials, their potential impacts on dense population and economic centers were a particular concern. This study used chlorine as the type of TIH, since it is the TIH cargo most frequently carried by rail.

Two security criteria were used to assess the risk of each alternative:

1. **Limit or control access to new rail alignment.**  
This was measured by the length of each alternative rail alignment within 3,700 feet of a freeway or interstate. The U.S. Bureau of Alcohol, Tobacco, Firearms, and Explosives cites the

**Table 3-1. Development of Feasible Alternatives**

	Security	Rail Operations	Engineering		Environmental	
<b>PRELIMINARY CORRIDOR</b>	proximity to population density	intermodal travel time	length of new right-of-way	difficulty of construction	impact to AWI areas	<b>SCREENING RESULT</b>
Western Existing	low	high	low	low	low	<b>Advance</b>
Western New	medium	high	high	high	low	<b>Drop</b>
Central Yards	high	low	low	medium	low	<b>Advance</b>
Central Alexandria North	high	low	medium	high	high	<b>Drop</b>
Central Alexandria South	high	low	medium	high	high	<b>Drop</b>
Eastern Indian Head	medium	low	medium	medium	low	<b>Advance</b>
Eastern Dahlgren	medium	low	medium	medium	low	<b>Advance</b>

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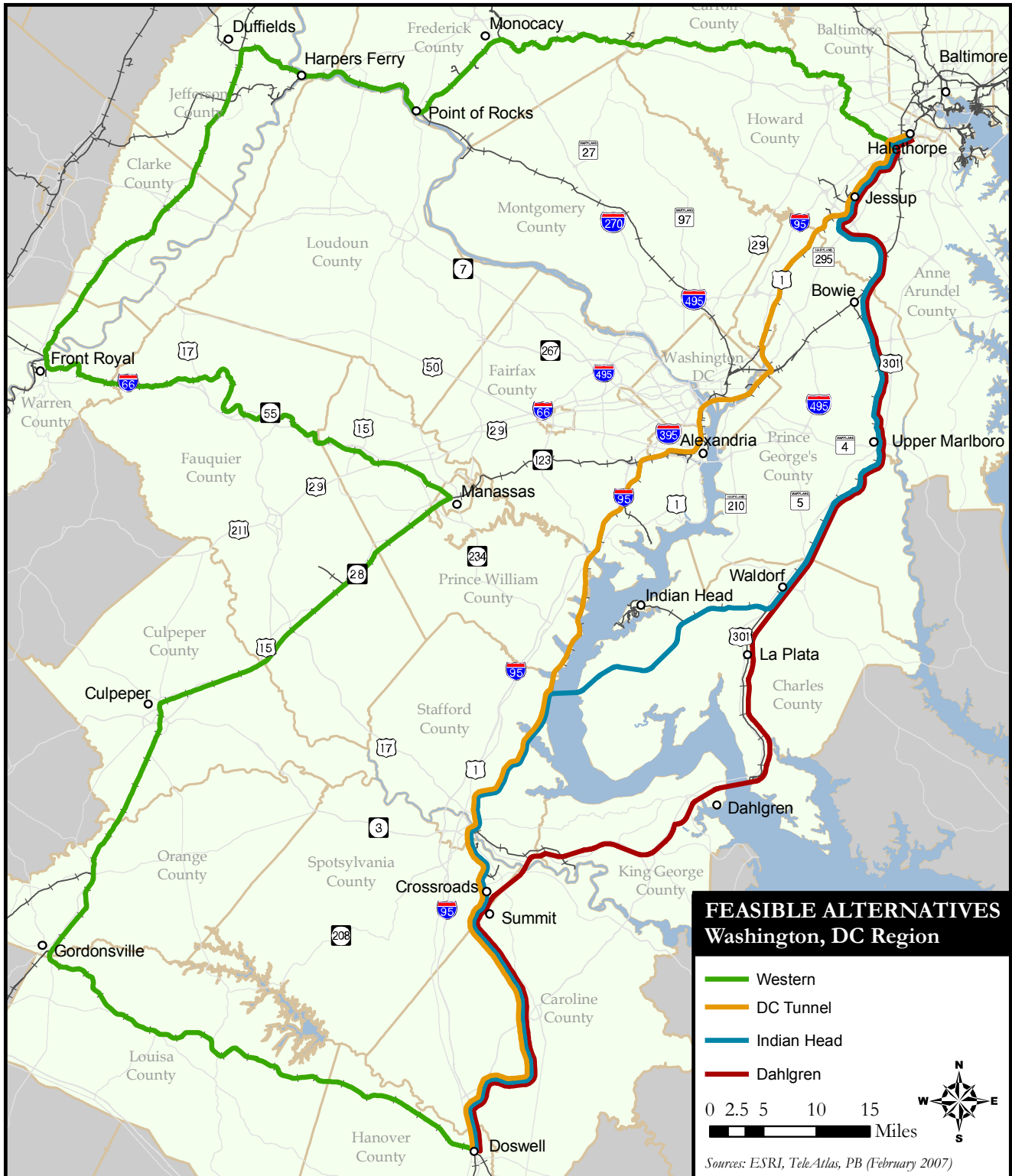


Figure 3-4. Feasible Alternatives



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potential for structures within this range to sustain damage from a small truck or cargo van explosion and recommends this distance to be the minimum evacuation distance. A high level of access to the railroad alignment means a greater chance for a train with TIH cargo to be damaged by such a blast.

2. **Minimize overall proximity to population and employment concentrations.** The study measured the amount of residential population, number of total jobs, and number of federal government jobs within 800 feet of an alternative rail alignment. The U.S. Department of Transportation uses this distance as the initial isolation area, or hot zone, for a major hazmat spill, including a chlorine release from a tanker-car. This criterion responds to not only security—protecting from terrorist attacks—but also the safety concerns from an accidental derailment.

The alternatives that would have the least highway access are the Indian Head and DC Tunnel alignments. Their short length is one reason they would be more secure, for there would be less distance over which highways could be close by. The Western alternative would have the greatest highway access and so was considered least secure by this measure.

The Indian Head and Dahlgren alignments would have the fewest residents, approximately 20,000, within the immediate isolation distance. The Western alternative would be similar. Even though the portion of the DC Tunnel alternative in the District’s core would be encased in a secure tunnel in which a TIH release could be contained, the above-ground portion would still pass through dense areas along parts of the existing alignment. Therefore, this alternative would have a much higher number of nearby residents, approximately 54,000. Within those same limits, the existing CSX railroad travels close to approximately 61,000 residents.

Figure 3-5 shows the distribution of federal employment in the region. Of the four feasible alternatives, the one with the lowest number of

both total and federal jobs within the initial isolation distance would be the Western alternative. This result is expected, as this alignment completely bypasses the District and its immediate suburbs. Also expected, the DC Tunnel alignment would have the highest number of both total and federal jobs within the same distance. While approximately 15,000 federal government jobs would be within 800 feet of the DC Tunnel alignment, approximately 46,000 are within this distance of the existing railroad.

## RAILROAD OPERATIONS

One of the project goals was to expand the passenger and freight capacity within the Washington, DC region of the East Coast rail corridor. This study assumed that the entire length of each alternative alignment would be built or upgraded to be state-of-the-art double-track, double-stack railroad. Therefore, each of the feasible alternatives would meet the basic objectives of increasing railroad capacity to permit free-flowing freight operations and eliminating the clearance barriers to double-stack intermodal service.

With the goal of **minimizing overall rail freight travel time through the region**, this study measured the north-south intermodal rail freight travel time and the average speed through the Washington, DC region, from north of Richmond (Doswell, Virginia) to just south of Baltimore (Halethorpe, Maryland). For a realignment alternative to maintain the efficiency of the railroad system, its travel time must generally meet or be less than that of the present route.

Another important result of relocating the CSX freight railroad from the District would be to remove freight trains from the tracks that Amtrak and Virginia Railway Express (VRE) use. Conflicts with CSX trains are often the cited cause of VRE service delays. If freight and passenger trains continue to share the same tracks through this corridor, VRE’s and Amtrak’s ability to expand passenger service is limited. To **maximize separate of passenger and freight rail**, this study measured passenger railroad capacity by the number of route-miles carrying only passengers.

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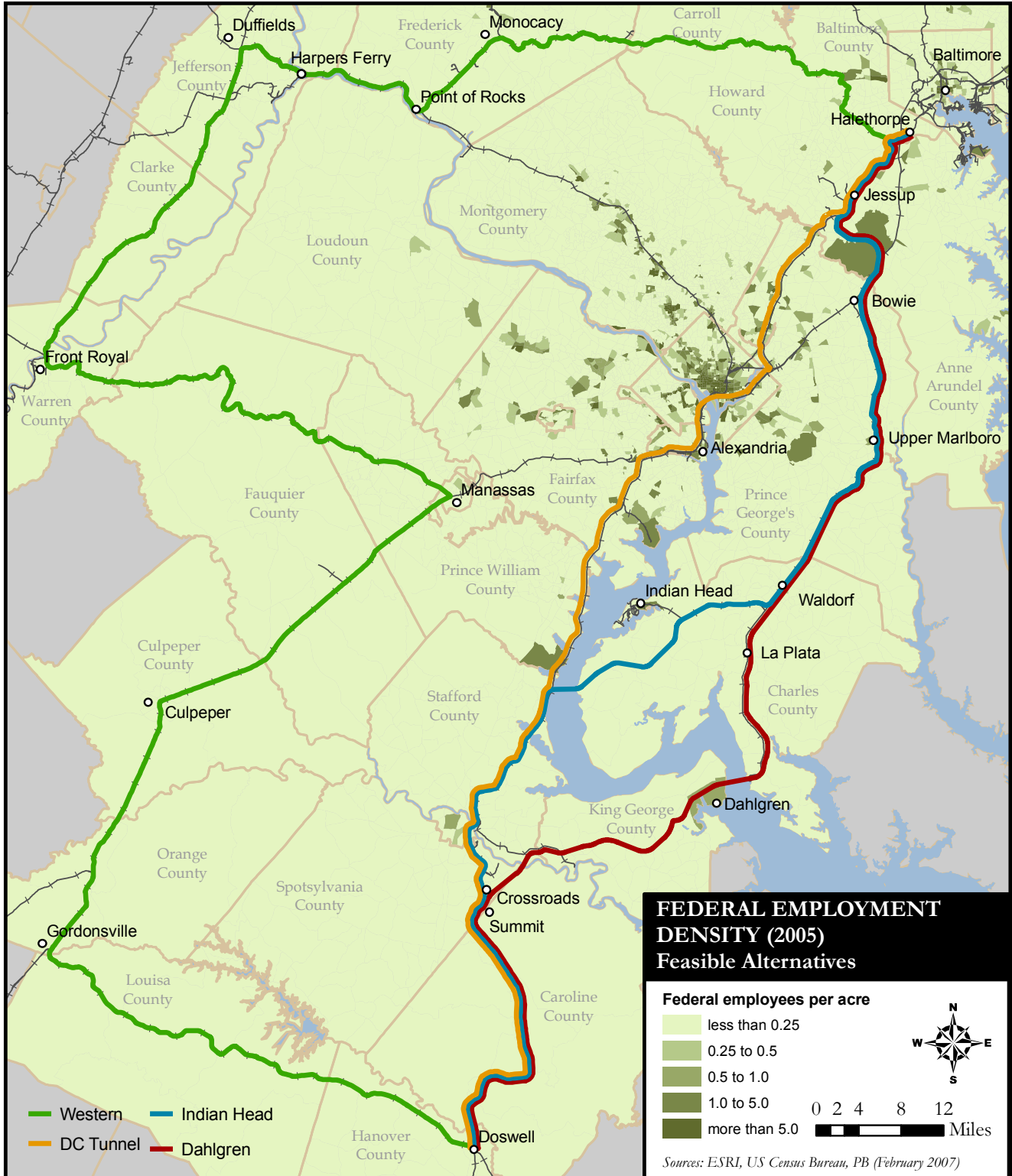


Figure 3-5. Federal Employment in the Region



## Development of Alternative Railroad Alignments

The Western alternative alignment would have the highest intermodal travel time. This is partly because it is the longest route. In addition, it would travel on the existing B Line from Manassas to Front Royal, which has speed restrictions because of its curves. The Western alternative alignment's average speed through the region would be 25 mph, compared to the existing average speed of 36 mph. This travel speed would be unacceptable to the freight railroad industry. In addition, the reliability of its service would be low because of its long route and increased exposure to delay. However, because it would divert from the CSX railroad at Doswell, the Western route would offer the maximum separation of passenger and freight rail, approximately 90 miles.

The DC Tunnel alignment would only divert from the existing CSX-owned rail line, shared by freight, commuter, and Amtrak trains, for the portion of the line that would travel under the Potomac and Anacostia Rivers and avoid the District's monumental core. Therefore, it would offer the least passenger-freight railroad separation. The travel time of this alternative would be comparable to the existing railroad. This alternative would retain the basic traffic pattern as the existing alignment and offer the best connectivity to existing freight customers.

Both the Dahlgren and Indian Head alignments would offer the lowest intermodal travel times through the region, with travel speeds of approximately 45 mph. Although their alignments would be slightly longer than the existing, either would be an upgraded, fully double-tracked route that would reduce passenger-freight train interference and allow overhead freight trains to operate through the region unimpeded and with minimal delays.

The Dahlgren alternative would remove overhead freight traffic from the entire 60-mile long VRE Fredericksburg Line. Amtrak service in the Richmond-Washington corridor would share tracks with freight trains for only 48 percent of the 107-mile route. The Indian Head alternative would entail slightly more shared track usage between

passenger and freight traffic. The first 21 miles of track south of Fredericksburg, north of the VRE yard, would be shared by VRE, Amtrak, and freight trains. Approximately 33 percent of the Richmond-Washington route would be passenger-only.

During the evaluation process, the study created two variations on the Western alternative: one that would divert all CSX through freight traffic onto the Western route, and one that would divert only merchandise freight trains carrying hazardous materials onto the Western route, while CSX intermodal and other time-sensitive trains would continue to operate via the existing CSX right-of-way. The former would require major upgrades to the Western route such that it would meet double-track mainline standards, and the latter would require a much lower level of investment in track and right-of-way upgrades due to its lower traffic levels and lower-priority movements. Both options were included in the quantitative evaluation.

The stakeholders found the option that would split intermodal and merchandise freight railroad traffic to be unacceptable due to its failure to separate passenger and freight traffic, its failure to measurably improve average freight travel speed, its failure to reduce congestion and train interference delays, and its effect on the AWI development areas. However, following the Railroad Working Group's suggestion, the study considered this option as a short-term security solution. This scenario is discussed further in Appendix B.

### ENGINEERING

This study drafted each alternative alignment in a very preliminary manner to ensure that all could meet railroad design standards. Initial order-of-magnitude cost estimates were prepared for these preliminary alignment definitions. This was the first step at comparing costs among the alternatives; a more refined cost estimate is presented in the benefit-cost discussion. The engineering criterion used in this step was to **minimize the capital cost of the alternatives**. Though all alternatives would be costly, this provided a means for early comparison.



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The Western alternative, built out to freight mainline standards with double-track, double-stack capacity, was estimated to be the most costly because it would include upgrading a large number of railroad route-miles. The Indian Head alternative was estimated to be the least costly of the alternatives being considered, in part because it is the shortest above-ground alignment.

## ENVIRONMENTAL CHARACTERISTICS

The study considered various environmental factors as part of the initial considerations and first screening step. In this step, key environmental considerations were quantified. These included minimizing community impacts, ensuring environmental justice, and responding to the District’s urban design and development goals.

The environmental criteria used include:

1. **Minimize displacements.** The application of this criterion would help reduce the impact of a relocated freight railroad on a community. This was measured by the number of route-miles of new and/or widened right-of-way for each alternative. The length of new right-of-way is the best available measure at this stage of the project since a new right-of-way would most likely result in displacements of some type. The most accurate way to assess displacements is to inventory the parcels affected by the railroad right-of-way; however, at the feasibility level of analysis, this information is not yet available.
2. **Avoid disproportionate impacts to low-income and minority populations.** This study evaluated environmental justice by measuring the percentage of population below the poverty level and the percentage of population that is an ethnic and/or racial minority within 800 feet of an alternative railroad alignment. The buffer distance that was used not only accounts for the immediate isolation area after a chlorine spill, but also the additional noise that a freight railroad would introduce.
3. **Avoid AWI areas.** This study measured the intrusion on riverfront-related development areas by the number of route-miles of freight railroad



Figure 3-6. Pope’s Creek Branch, Upper Marlboro



Figure 3-7. Pope’s Creek Branch, Waldorf



Figure 3-8. Pope’s Creek Branch, La Plata

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in the AWI project area for each alternative. Though this study used a similar criterion in previous screening steps, at this stage it was quantified. The criterion responds not only to approved urban design and development plans but also to the desire to provide the public benefits of opening access to the Anacostia River waterfront.

These criteria are sufficient to guide analysis at this stage of the project; however, more detailed environmental analysis is required for future project steps such as an environmental impact statement.

The DC Tunnel alignment would have the least amount of displacements because it would largely use the existing CSX right-of-way. By the measure used here, the Dahlgren alignment could have the greatest amount of displacements, as it includes widening the Pope’s Creek Branch to be a double-track railroad. However, at this stage of project development when property boundaries are unknown, this measure should be used with caution. This study developed a generalized conceptual alignment, but a future engineered alignment might include one or more bypasses or other mitigation measures to minimize displacements where necessary.

Of the four alternatives, the Dahlgren and Indian Head alignments would run through the lowest percentage of low-income population; only 4.5 percent of the nearby population is below the poverty level, compared to the existing alignment at 10 percent. However, there are pockets of greater poverty near La Plata and Waldorf. Because the DC Tunnel alignment would run through low-income neighborhoods in the Southeast quadrant of the District—east of Benning Yard, where it is aboveground—approximately 9 percent of the nearby population would be below poverty level.

The Western alignment is the alternative with the lowest proportion of minority populations. This is demonstrated in Figure 3-10, which shows the highest concentrations of minority populations generally on the east side of the Washington, DC region. Like the

previous measure, the DC Tunnel alignment would have the highest proportion of nearby minority populations, approximately 52 percent, which is similar to the existing alignment. The Indian Head and Dahlgren alignments would run near a population that is approximately 40 percent minority.

By these measures, the Western, Indian Head, and Dahlgren alignments would best meet environmental justice objectives.

The only alternative that includes a freight railroad alignment through the AWI project area would be the DC Tunnel alignment, with less than one route-mile of aboveground railroad along Kenilworth Avenue east of the Anacostia River. The existing railroad runs through approximately five miles of the AWI project area.

## RESULTS

The evaluation of the four feasible alternatives is shown in Table 3-2. After consultation with the Railroad Working Group, the Western alternative was dropped from further study due to its high north-south intermodal freight travel time, its high capital cost, and its high security and safety risk with regard to highway access and proximity to residential population. The alternative did not perform as well as the other three alternatives when measured with the study criteria, but it could be studied further in future project steps.

The Western Split Traffic variation would involve no displacements and would be relatively low in cost; however, it would significantly affect the AWI project area because the existing CSX railroad would remain. This, along with its poor to moderate rail operations performance, its failure to achieve state-of-the-art rail system improvements, and the increased exposure of the long route to safety incidents, resulted in a decision to drop this option from further consideration as a long-term solution. This study considered this operational scenario as a short-term improvement, however, which is discussed in Appendix B.



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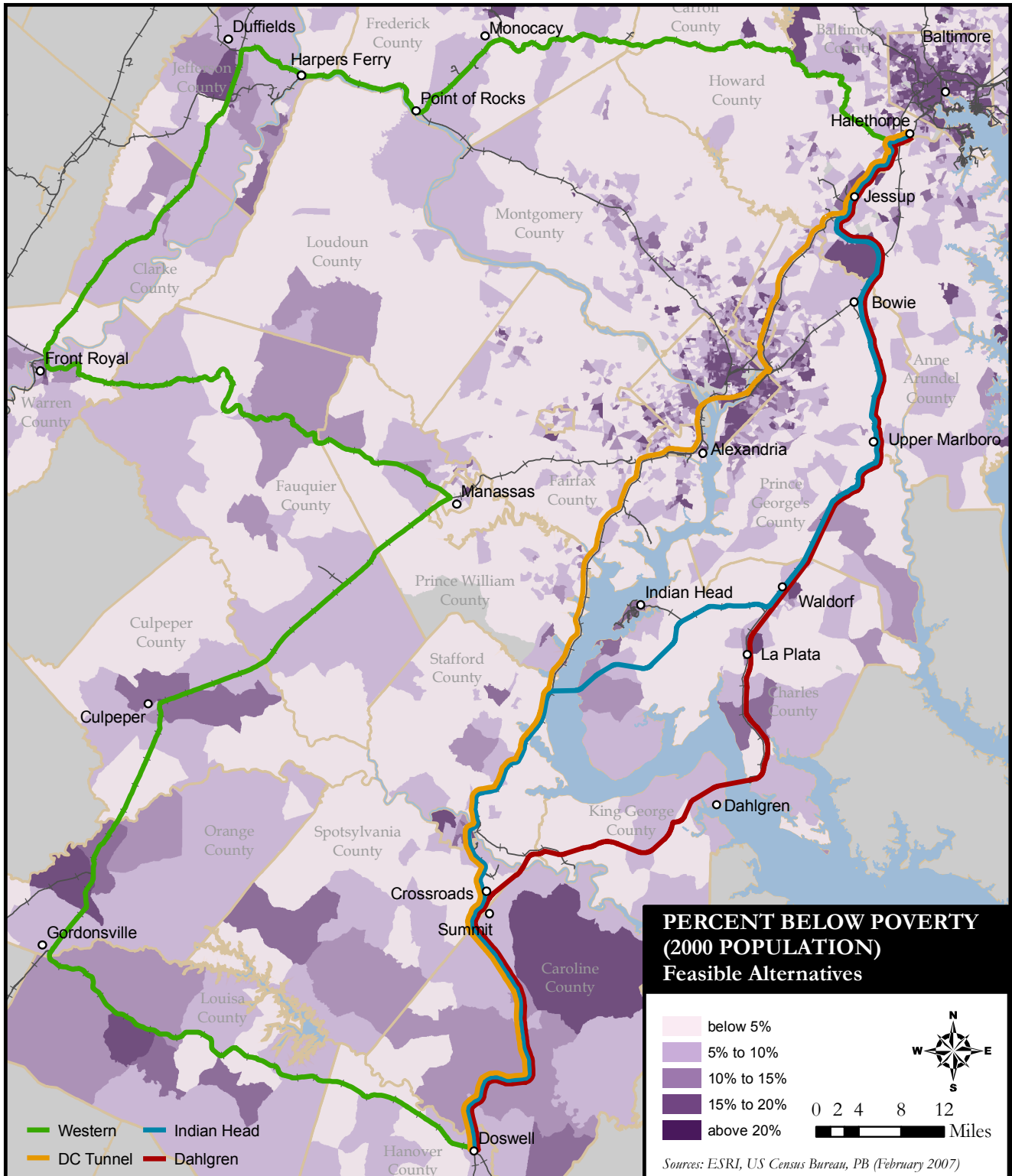


Figure 3-9. Distribution of Low-Income Population



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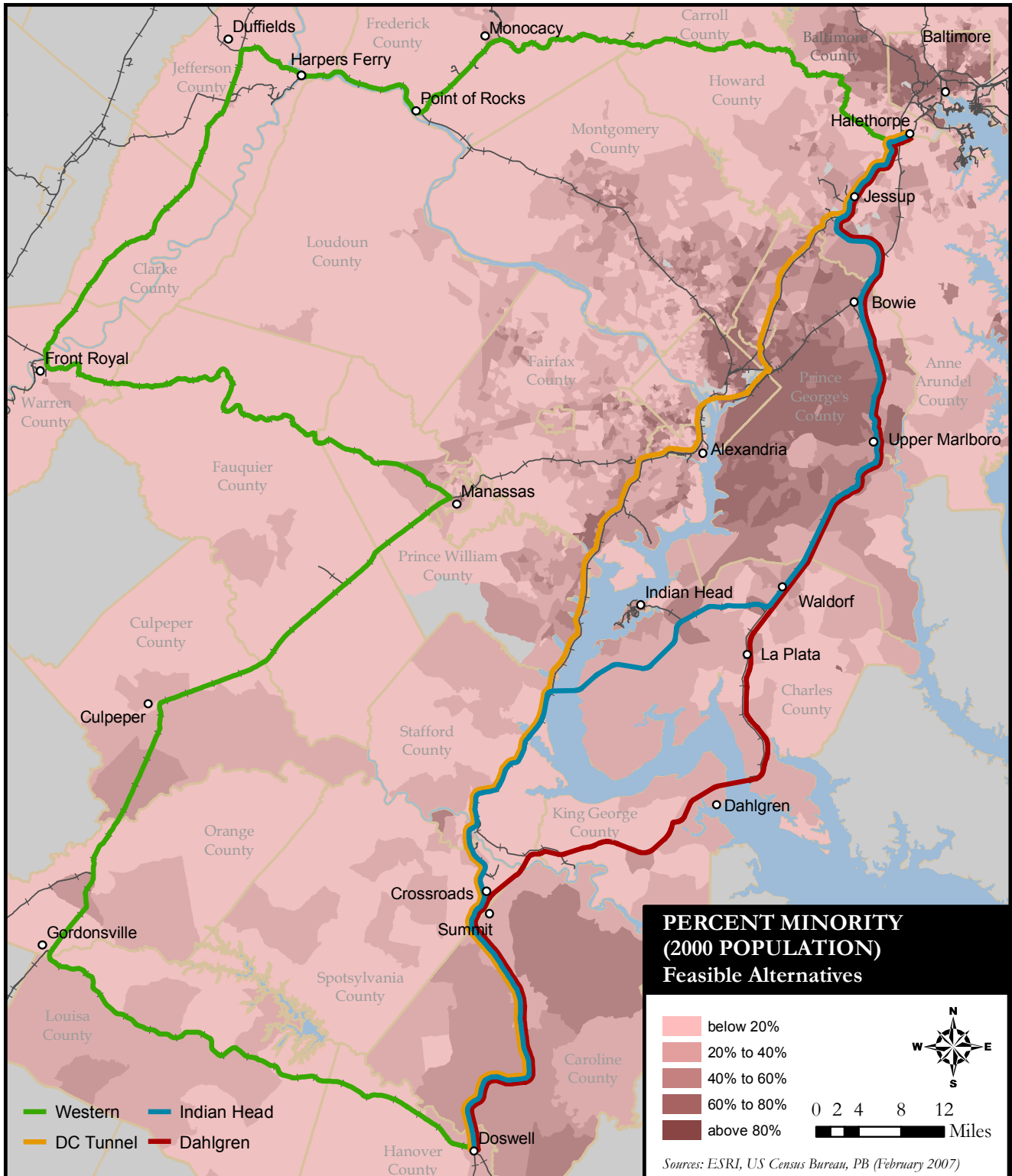


Figure 3-10. Distribution of Minority Population

# Development of Alternative Railroad Alignments

Stakeholders from the Railroad Working Group, the NCPIC Interagency Security Task Force, and Railroad Owners/Operators Group participated in the development of the three viable alternatives. These alternatives—DC Tunnel, Indian Head, and Dahlgren—were carried forward for the benefit-cost analysis and final evaluation.

To avoid affecting the AWI project area and to better meet environmental justice and security objectives, the DC Tunnel alignment was refined in the next step of this study. The tunnel was extended east to the vicinity of the District-Maryland border.

**Table 3-2. Development of Viable Alternatives**

Evaluation Factor			Outcome					
Category	Goal	Measure	Western		DC Tunnel	Indian Head	Dahlgren	Existing
			Full Diversion	Split Traffic				
Rail Operations	<i>Minimize overall rail freight travel time through region</i>	Intermodal rail freight travel time from Doswell to Halethorpe	11' 30"	7' 30"	3' 20"	2' 55"	3' 05"	3' 30"
		Average speed (mph)	25	38	38	45	43	36
	<i>Maximize separation of passenger and freight rail</i>	Number of rail route-miles carrying only passengers	90	0	5	39	59	0
Engineering	<i>Minimize capital cost</i>	Rail freight bypass cost based upon rough initial estimates	Highest	Low	High	Medium	Medium	Low
Security	<i>Limit or control access to freight rail line</i>	Length of alternative rail alignment within 3,700 feet of freeway and interstate network (miles)	160.2	160.2	66.7	47.4	80.3	71.2
	<i>Minimize proximity to population and employment concentrations within potential bot zone</i>	Number of people in 2005 within 800 feet of alternative rail alignment	23,230	23,230	53,940	20,783	18,022	60,614
	<i>Minimize proximity to population and employment concentrations within potential bot zone</i>	Number of total jobs in 2005 within 800 feet of alternative rail alignment	12,322	12,322	69,046	14,603	14,213	117,202
	<i>Minimize proximity to population and employment concentrations within potential bot zone</i>	Number of federal government jobs in 2005 within 800 feet of alternative rail alignment	404	404	15,496	1,658	2,035	45,816
Environmental	<i>Minimize displacements</i>	Route-miles of new and/or widened right-of-way	13	0	6	26	34	N.A.
	<i>Avoid disproportionate impacts to low-income and minority populations</i>	Percent of population below poverty level within 800 feet of alternative rail alignment	6.6	6.6	8.7	4.6	4.4	10.0
		Percent of population that is an ethnic and/or racial minority within 800 feet of alternative rail alignment	19.9	19.9	52.4	40.0	40.5	53.3
	<i>Avoid Anacostia Waterfront Initiative Areas</i>	Route-miles of freight railroad in AWI area	0	4.7	0.8	0	0	4.7
<b>RESULT</b>			Drop	Drop	Advance	Advance	Advance	

