Chapter 25

NHS Freight Connectors

This chapter describes the investment requirements of National Highway System (NHS) freight connectors. NHS freight connectors are the public roads that lead to major intermodal freight terminals (the entire NHS system is described in Chapter 24). As noted in Chapter 22, freight transportation is critical to our Nation's economy, so it is important to understand the conditions and needs of freight connectors.

Summary of the Nation's Freight Connectors

The NHS freight connectors were designated in cooperation with State departments of transportation (DOTs) and metropolitan planning organizations (MPOs) based on criteria developed by the U.S. Department of Transportation. The criteria considered the level of activity of an intermodal terminal and its importance to a particular State.

A 2000 FHWA report to Congress on the condition and performance of intermodal connectors found that there were 517 freight-only terminals representing port (ocean and river), truck/rail, and pipeline/truck facilities. In addition to these freight-only terminals, 99 major freight airports (which handle both passenger and freight) were included in the list of freight intermodal terminals. Exhibit 25-1 displays NHS freight connector mileage by functional class and population density. It shows that the majority of mileage is in urban areas and is classified as arterials.

Exhibit 25-1

Total NHS Connector Mileage by Functional Class

TOTAL NHS COLLECTOR MILEAGE	POPULATION DENSITY		
FUNCTIONAL CLASS	RURAL	SMALL URBAN	URBANIZED
Rural Interstate	5		
Rural Other Principal Arterial	32		
Rural Minor Arterial	57		
Rural Major Collector	88		
Rural Minor Collector	7		
Rural Local	30		
Urban Interstate/Expressway		27	62
Urban Other Principal Arterial		134	304
Urban Minor Arterial		85	209
Urban Collector		35	82
Urban Local		16	50
Total	219	297	707

Source: Office of Freight Management and Operations, Federal Highway Administration.

The report made several conclusions about physical deficiencies of these connectors. First, connectors to ports were found to have twice the percentage of mileage with pavement deficiencies when compared to non-Interstate NHS routes. Connectors to rail terminals had 50 percent more deficient mileage than non-Interstate NHS routes. Connectors to airport and pipeline terminals appeared to be in better condition with about the same percent of mileage with pavement deficiencies as those on non-Interstate NHS. This may be due to the high volume of passenger travel on airport roads.

Second, problems with shoulders, inadequate turning radii, and inadequate travel way width were most often cited as geometric and physical deficiencies with connectors. Data were not available to directly compare connectors and other NHS routes with regard to rail crossings, lane width, and other deficiencies. A general comparison of functional class attributes suggests that lane width, cross section, and design attributes are significantly more deficient when compared to non-Interstate NHS main routes.

The report to Congress, however, did not include an assessment of needed improvements or investment requirements. A follow-up effort was initiated in 2001 to develop an estimate of current investment needs for the NHS freight connectors based on deficiencies identified by the 1998 inventory conducted for the 2000 report to Congress. This estimate is described in the next section.

Analytical Approach

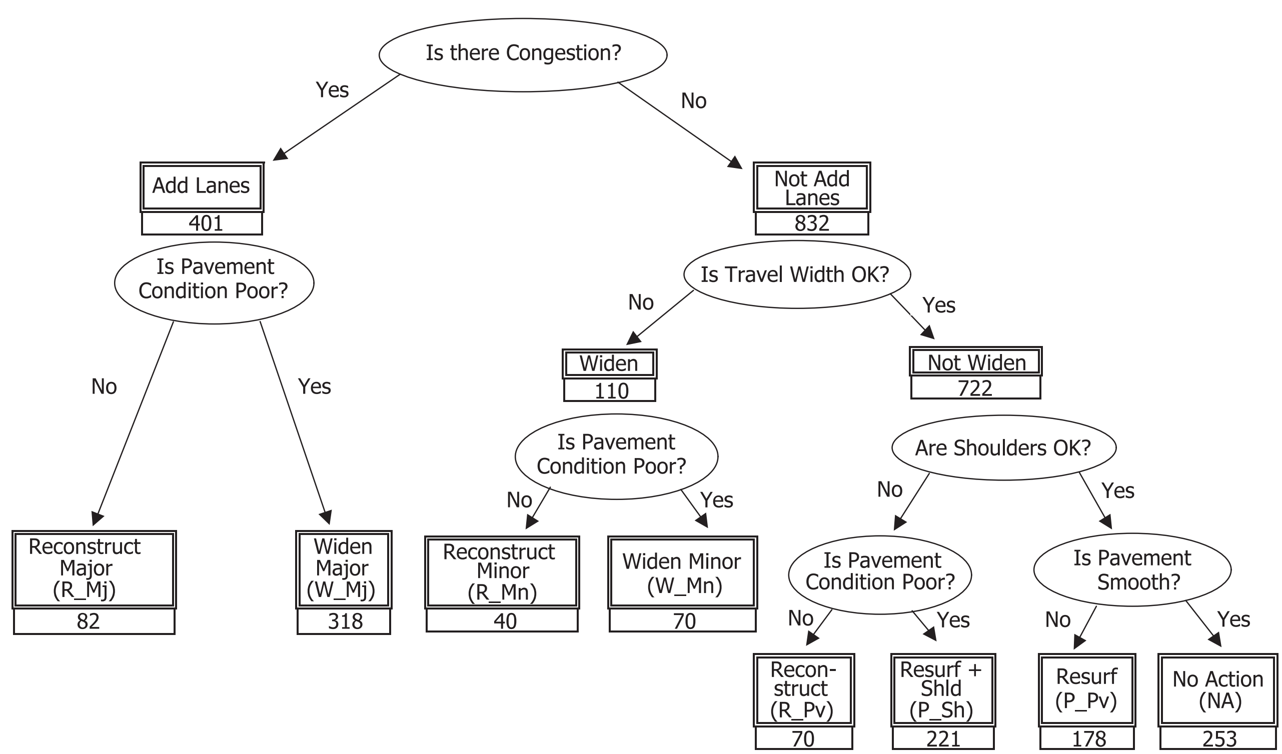
To estimate the investment needs of intermodal freight connectors, physical deficiencies were divided between "linear" and "spot." Linear deficiencies are those that affect the connector along its length and typically are related to pavement, lane width, or number of lanes. Spot deficiencies are localized and typically related to an intersection, railroad crossing, or structure. The investment requirements analyses in Chapters 7 and 24 address some (but not all) of these deficiencies.

Exhibit 25-2 describes the logic employed to examine each connector with respect to the need for linear improvements such as pavement repair and/or expansion of capacity. The analysis first determined if additional capacity was needed based on the identification of congestion in the 1998 field inventory. Capacity needs were met by adding two lanes, unless the connector already had four lanes or more. If additional capacity was needed, then the condition of the pavement was checked to determine the appropriate course of action. If additional capacity was not needed, then requirements for additional lane width were examined. If additional lane width was needed, then the condition of the pavement and shoulder determined the final course of action.

Spot improvements were based on deficiencies involving isolated locations that could act as a bottleneck to the efficient flow of traffic along the connector. The survey identified spot deficiencies for: (1) structures that impose horizontal (width), vertical (height) or structural (weight limit) restrictions on the free flow of freight

Exhibit 25-2

Freight Connectors Analysis Approach



Source: Office of Freight Management and Operations, Federal Highway Administration.

vehicles; and (2) highway intersections and railroad crossings that restrict the free flow of freight vehicles. The analysis identified spot deficiencies on each connector and used spot costs to estimate needed investments in addition to linear improvements.

Unit cost data for this analysis was obtained from a study currently being performed for the FHWA Office of Policy. That study, not yet completed, is designed to develop updated cost data for highway capital improvements for use in the HERS model. Costs are determined by highway functional class and improvement type. The improvement type initials used in the flow chart are also shown:

- Reconstruction - pavement plus adding 2 lanes
- Reconstruction - pavement plus incidentals
- Reconstruction - pavement only
- Widening - major, with adding 2 lanes
- Widening - minor, existing lanes only
- Resurfacing - existing lanes plus shoulders
- Resurfacing - existing lanes only

Unit costs for spot deficiencies were estimated and confirmed with several state DOTs. The unit costs (in millions) used for this analysis are:

- Bridge replacement for vertical, horizontal, or structural deficiency– $2,000,000
- Pavement repair for rough or abandoned railroad crossing – $50,000
- Repair for "humped" railroad arossing – $750,000
- Installation of left or right turn lanes at intersection – $450,000
- Improvement of turning radii at NHS junction – $30,000

Linear Deficiencies

Linear deficiencies were assumed to exist for the entire length of the connector or identified segment. Some connectors were segmented in the inventory when geometry or pavement changed significantly. For these deficiencies, the unit cost for the identified improvement type was multiplied by number of lanes and number of centerline miles.

Exhibit 25-3 shows approximately one third (401 of 1,222 miles) of the connector system was judged to be in need of additional capacity. Of the remaining connector mileage,

Exhibit 25-3

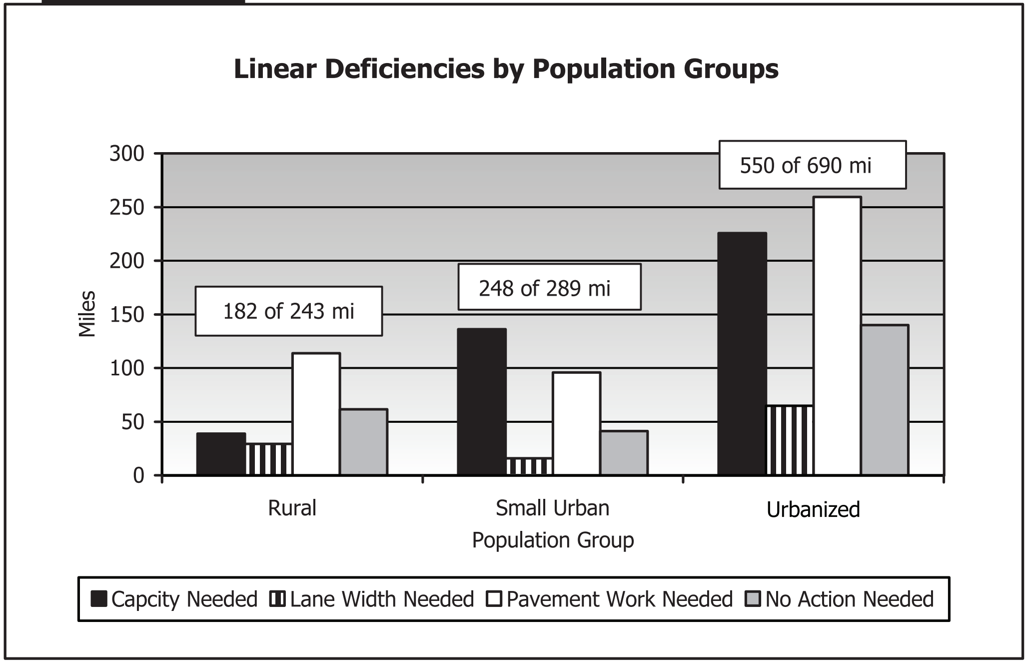
Linear Deficiencies by Improvement Type

IMPROVEMENT TYPES	MILES OF CONNECTORS BY POPULATION GROUP			TOTAL MILES
	RURAL	SMALL URBAN	URBANIZED	
Capacity Needed				401
Reconstruction, Major	7	22	53	
Widen, Major	32	114	173	
Lane Width Needed				110
Reconstruction, Minor	10	4	25	
Widen, Minor	19	12	40	
Pavement Work Needed				469
Reconstruction	24	15	31	
Resurface, Shoulders	63	38	121	
Resurface	27	43	108	
Needed Improvements	182	248	550	979
No Action Needed	62	41	140	243
Totals	**243**	**289**	**690**	**1,222**

Source: Office of Freight Management and Operations, Federal Highway Administration.

579 miles needed pavement or lane width improvements, while roughly twelve percent (243 miles) were considered to have adequate pavement, lane, and shoulder width. Exhibit 25-4 shows the deficiencies by population grouping.

Exhibit 25-4



Source: Office of Freight Management and Operations, Federal Highway Administration.

Spot Deficiencies

Only the existence and types of spot deficiencies were identified for each connector, so it was not always possible to determine the actual number of each type of deficiency on the connector. It was assumed that a positive indication of the existence of a deficiency meant that there was a single occurrence of the deficiency type on the segment. Exhibit 25-5 summarizes spot deficiencies.

The number of spot deficiencies on links with needed linear improvements is shown in Exhibit 25-6.

Exhibit 25-5

Spot Deficiencies

Spot Deficiency Types	NUMBER OF CONNECTORS WITH SPOT DEFICIENCIES BY POPULATION GROUP			TOTAL
	RURAL	SMALL URBAN	URBANIZED	
Bridge-Related				53
Vertical Clearance	2	3	15	
Horizontal Clearance	3	3	12	
Structural	4	2	9	
Rail Crossing-Related				148
Rough Abandoned	5	4	30	
Under Clearance	1	2	11	
Rough	12	22	61	
Intersection-Related				248
Left Turning Lanes	13	35	70	
Turning Radii	10	23	40	
Right Turning Lanes	5	21	31	
Total Spot Deficiencies				**449**

Source: Office of Freight Management and Operations, Federal Highway Administration.

Exhibit 25-6

Spot Improvements by Linear Type

SPOT IMPROVEMENT TYPE		RECONSTRUCT MAJOR & MAJOR WIDEN	MINOR WIDENING AND PAVEMENT WORK	NO OTHER IMPROVEMENT	TOTAL
	Vertical Clearance	9	10	1	20
	Horizontal Clearance	9	7	2	18
Bridge	Weight Limit	9	5	1	15
	Abandoned	14	22	3	33
	Underneath Clearance	2	10	2	14
Rail Crossing	Rough	36	48	11	95
	Turn Lane	77	32	9	118
	Junction Turn Lane	39	27	7	73
Intersection	Junction Turn Radii	27	20	10	57
	Total	**222**	**181**	**46**	**449**

Source: Office of Freight Management and Operations, Federal Highway Administration.

Improvement Strategies

Two needs estimates were developed. The first addressed backlog or existing needs based on costs for the functional class. The table below shows the application of linear unit costs based on deficiency type over the length of the segment. This approach yielded the results shown in Exhibits 25-7 and 25-8.

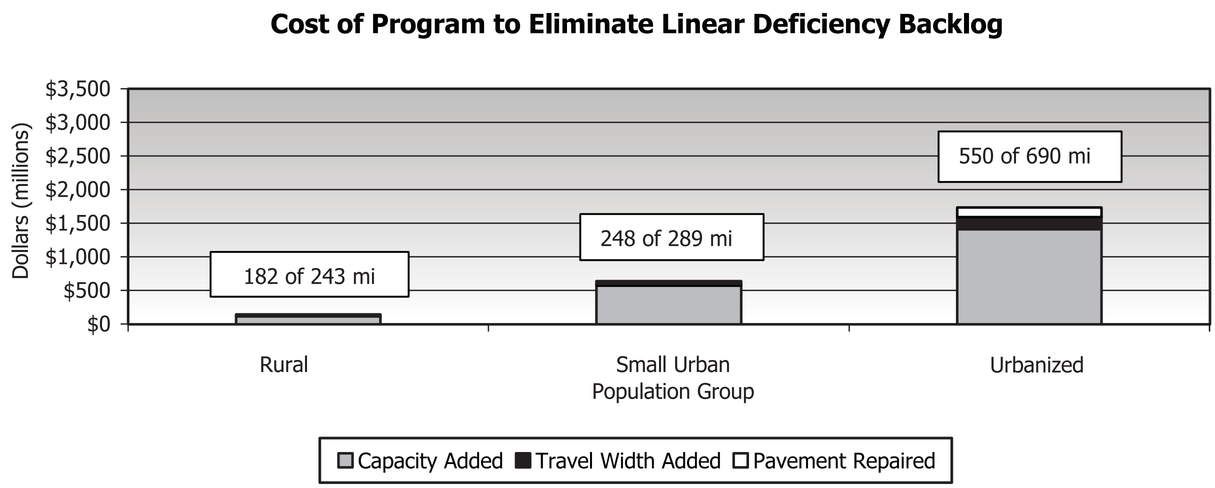
Exhibit 25-7

Cost to Eliminate Linear Deficiency Backlog (millions of dollars)

LINEAR DEFICIENCY TYPE	COSTS BY POPULATION GROUP			TOTAL
	RURAL	SMALL URBAN	URBANIZED	
Capacity Needed				$2,092
Reconstruction, Major	$19	$111	$454	
Widen, Major	$94	$458	$957	
Lane Width Needed				$218
Reconstruction, Minor	$3	$7	$102	
Widen, Minor	$6	$23	$78	
Pavement Work Needed				$200
Reconstruction	$7	$20	$51	
Resurface, Shoulders	$11	$8	$52	
Resurface	$3	$10	$39	
Total Costs	**$128**	**$619**	**$1,640**	**$2,510**

The second needs estimate was done with the objective of raising the performance level of connectors (i.e., design standards) because of expected increases in the level of activity. The identification of improvement types was the same as that employed for the first estimate except that the unit costs for the next higher functional class was employed. An exception was the assumption that all connector mileage in need of pavement improvements used the "reconstruction-minor" unit cost because of increased design standards. As a result, the total cost in the category of "pavement work needed" represented a much larger proportion of overall program cost than the first estimate because the costs for the next higher functional class are greater [See Exhibits 25-9 and 25-10].

Exhibit 25-8



Source: Office of Freight Management and Operations, Federal Highway Administration.

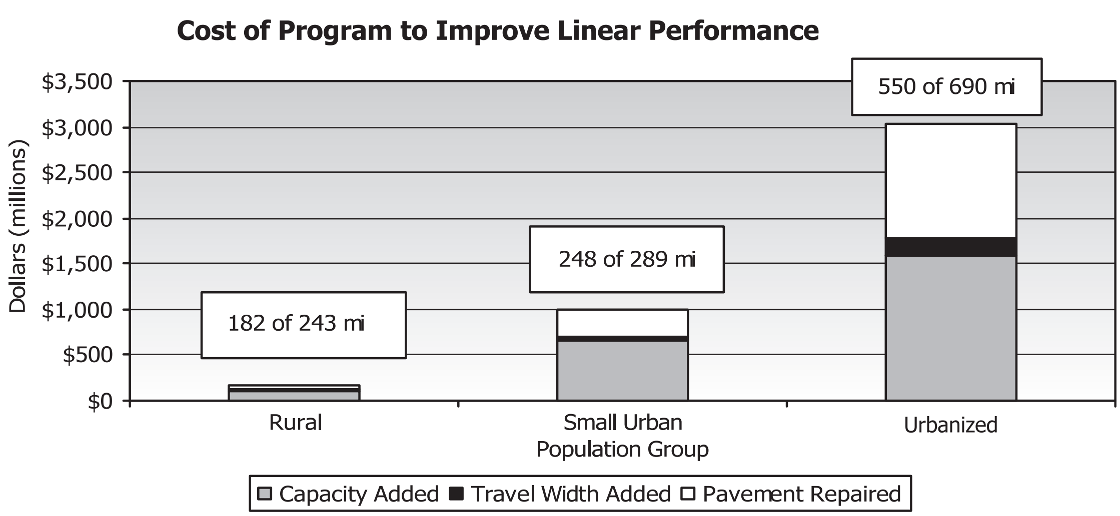
Exhibit 25-9

Cost to Improve Linear Performance Level by Population Group (millions)

IMPROVEMENT TYPE	COST BY POPULATION GROUP			TOTAL
	RURAL	SMALL URBAN	URBANIZED	
Capacity Needed	$113	$664	$1,588	$2,365
Lane Width Needed	$7	$31	$189	$227
Pavement Work Needed	$51	$311	$1,249	$1,611
Total Costs	**$171**	**$1,007**	**$3,027**	**$4,204**

Source: Office of Freight Management and Operations, Federal Highway Administration.

Exhibit 25-10



Source: Office of Freight Management and Operations, Federal Highway Administration.

Spot Improvement Costs

In estimating costs for spot improvements, it was assumed that spot deficiencies occurring on links requiring major reconstruction or major widening were corrected as part of the linear improvement. Thus, the cost for these spot deficiencies was zero. Spot deficiency costs were estimated for other types of improvements and for links for which no other deficiencies were identified. The spot costs are shown in Exhibit 25-11.

Total NHS Freight Connector Investment Requirements

The cost for spot improvements was assumed to be the same for both the backlog needs and the costs for the enhanced connectors. Including the costs for spot deficiencies added $87.1 million to the total of both estimates. As shown in Exhibit 25-12, this resulted in a total cost for the backlog improvement estimate of $2.597 billion, while the cost for improving service due to expected increases in freight volumes would be $4.291 billion.

Exhibit 25-11

Spot Improvement Costs (millions)

SPOT IMPROVEMENT TYPE		RECONSTRUCT MAJOR & MAJOR WIDEN	MINOR WIDENING AND PAVEMENT WORK	NO OTHER IMPROVEMENT	TOTAL
Bridge	Vertical Clearance	$0	$20	$2	$22
	Horizontal Clearance	$0	$14	$4	$18
	Weight Limit	$0	$10	$2	$12
Rail Crossing	Abandoned	$0	$1	$0.2	$1
	Underneath Clearance	$0	$8	$2	$9
	Rough	$0	$2	$0.5	$3
Intersection	Turn Lane	$0	$14	$4	$18
	Junction Turn Lane	$0	$2	$1	$3
	Junction Turn Radii	$0	$1	$0.3	$1
	Total	**$0**	**$72**	**$15**	**$87**

Source: Office of Freight Management and Operations, Federal Highway Administration.

Exhibit 25-12

Cost to Eliminate Backlog Deficiencies (millions of dollars)

IMPROVEMENT TYPE	Using Design Standards For: EXISTING FUNCTIONAL CLASS	HIGHER FUNCTIONAL CLASS
Spot	$87	$87
Linear	$2,510	$4,204
Total Costs	**$2,597**	**$4,291**

Source: Office of Freight Management and Operations, FHWA.