

Appendix G

Transit Access for Environmental Justice and Disability Populations

- Green Line Extension Environmental Justice Analysis
- Green Line Extension Disability Impact Analysis

Green Line Extension Environmental Justice Analysis

**Green Line Extension EIR Analysis:
Environmental Justice Analysis for
Minority and Low Income Populations**

**DRAFT Prepared by
Central Transportation Planning Staff
November 26, 2008**

As part of the Boston Metropolitan Planning Organization (MPO) regional equity program, an examination was conducted of the impacts of the Green Line Extension, including the distribution of the transportation system's benefits and burdens among environmental justice population zones. (These types of zones are defined in the section below.) The study's performance measures focus on mobility, accessibility, and environmental impact concerns.

Environmental justice areas are geographic regions determined by the demographics of the people living in a transportation analysis zone (TAZ). A TAZ is an aggregation of census geography based on population and estimated trip volumes. According to the definition used for the Boston MPO's regional equity program, "A TAZ will be considered an Environmental Justice Area if it is over 50 percent minority or has a median household income at or below 60 percent of the region's median" (60 percent of the region's median household income of \$55,800 is \$33,480). The TAZ's total minority population must be at least 200.

The number of environmental justice areas in the Green Line Extension project area was defined using TAZ's based on thresholds developed by the Boston MPO to examine equity in the region. The Boston MPO thresholds were developed for the Regional Transportation Plan and offer a greater inclusion of TAZ's than the Massachusetts Executive Office of Environmental Affairs (EOEA) definition of environmental justice populations. The Boston MPO's thresholds for these environmental justice populations are as follows:

- Low income – The Boston MPO median household income in 2000 was approximately \$55,800. A low-income TAZ was defined as having a median household income at or below 80 percent of this level (\$44,640).
- Minority – 21.4 percent of the MPO population in 2000 was composed of minorities (nonwhite and Hispanic). A minority TAZ was defined as having a percentage of minority population greater than 21.4 percent.

The resulting environmental justice population zones in the Green Line Extension project area are shown in Figure 1.

The 2030 demographic forecasts used for this study assumed the attributes of the residential populations in the project area TAZs remain the same as they were observed in the 2000 US Census. The Build, Bus Base Line, and No-Build scenarios used the same demographic forecasts.

Performance Measures

Performance measures were used as indicators of benefits and burdens for environmental justice and non-environmental justice population zones' populations. These measures fall into three categories:

- Accessibility to needed services and jobs
- Mobility and congestion
- Environment

Accessibility Analysis

This study analyzed access to needed services and jobs in terms of average transit and highway travel times from environmental justice population zones to industrial, retail, and service employment opportunities; health care; and institutions of higher education. The accessibility analysis featured an examination of the number of destinations within a 40-minute transit trip and a 20-minute auto trip. The analysis of transit travel times included destinations within a 40-minute transit trip, and the analysis of highway travel times included destinations within a 20-minute auto trip.

Differences were calculated between the No-Build, Bus Base Line, and Build scenarios (Scenario 2 – the Riverside Branch is extended to Mystic Valley and the Heath Street Branch is extended to Union Square - and Scenario 7 – the Riverside and Heath Street Branches are extended to Mystic Valley) for environmental justice and non-environmental justice population zone residents. Results are aggregated for each type of population zone, and the reported averages are weighted by the number of residents in each environmental justice or non-environmental justice population zone.

The examined accessibility performance measures were:

- The average number of industrial, retail, and service jobs within a 40-minute transit trip and a 20-minute auto trip.
- The average travel time to industrial, retail, and service jobs within a 40-minute transit trip and a 20-minute auto trip.
- The average number of hospital beds within a 40-minute transit trip and a 20-minute auto trip.
- The average travel time to a hospital, weighted by the number of hospital beds, within a 40-minute transit trip and a 20-minute auto trip.
- The average number of students at facilities of two- and four-year institutions of higher education within a 40-minute transit trip and a 20-minute auto trip.

- The average travel time to facilities of two- and four-year institutions of higher education, weighted by enrollment, within a 40-minute transit trip and a 20-minute auto trip.

Mobility, Congestion, and Environmental Analysis

The mobility, congestion, and environmental impacts were analyzed by comparing performance measures for environmental justice population zones to those for non-environmental justice population zones. As in the accessibility analysis, differences between the average levels of these performance measures within the two types of zones were calculated for the No-Build, Bus Base Line, and Build scenarios. The results are aggregated in the same manner.

The examined mobility, congestion, and environmental performance measures were:

- VMT per square mile – the number of vehicle-miles traveled per square mile of dry land within a TAZ.
- CO per square mile – the number of kilograms of carbon monoxide emitted per square mile of dry land within a TAZ.
- Transit production time – the average door-to-door travel time for all transit trips produced in the TAZ.
- Highway production time – the average door-to-door travel time for all highway trips produced in the TAZ.
- Transit attraction time – the average door-to-door travel time for all transit trips attracted to the TAZ.
- Highway attraction time – the average door-to-door travel time for all highway trips attracted to the TAZ.

Summary of Green Line Extension Results

The environmental justice analysis determined that while the Green Line Extension Build scenarios improve accessibility, mobility, congestion, and environmental conditions relative to the No-Build and Bus Base Line scenarios for both environmental justice population zones and non-environmental justice population zones, in most cases environmental justice population zones benefit slightly more.

Accessibility Analysis Results

Results from the accessibility analysis show the following for trips from environmental justice population zones to nearby jobs, colleges, and hospitals (Tables 1 and 2):

- People in environmental justice population zones will be able to access more area destinations within a 40-minute transit ride in the Build scenarios than in the No-Build and Bus Base Line scenarios. This change is more pronounced under Scenario 7 than under Scenario 2.
- Travel times to area destinations are less for environmental justice population zones in the Build scenarios when compared to those in the No-Build and Bus Base Line scenarios. This trend is stronger with Scenario 7 than with Scenario 2.

Since the highway impedances were assumed to remain the same for all scenarios, the accessibility by highway travel does not change between the four scenarios.

Mobility, Congestion, and Environmental Analysis Results

Results from the mobility, congestion, and environmental analysis show the following for trips within environmental justice population zones (Tables 3 and 4):

- Travel times are slightly less for environmental justice population zones in the Build scenarios than in the No-Build and Bus Base Line scenarios. Scenario 7 produces more significant changes than does Scenario 2.
- VMT per square mile is less for environmental justice population zones in the Build scenarios compared to the No-Build and Bus Base Line scenarios. This difference is expected to be larger with Scenario 7 than with Scenario 2.
- The Build scenarios yield less CO emissions per square mile for environmental justice population zones when compared to the No-Build and Bus Base Line scenarios. This change is expected to be more pronounced under Scenario 7 than under Scenario 2.

More Detailed Results from the Accessibility, Mobility, Congestion, and Environmental Analyses

MPO staff compared model results for the 2030 No-Build, Bus Base Line, and Build scenarios to see how conditions are estimated to change for environmental justice population zones. The results of these comparisons are summarized below.

Other Accessibility Analysis Results

Figures 2-4 show that the average environmental justice population zone resident has transit access to notably more jobs than the average non-environmental justice population zone resident. These figures also show that

people are estimated to have access to more jobs with the Build scenarios than with the No-Build and Bus Base Line scenarios – more so with Scenario 7 than with Scenario 2.

Figures 5-7 show that while average transit travel times to area jobs are at least 30 minutes, they are notably less for environmental justice population zones than for non-environmental justice population zones. These figures also show that the travel times are expected to become smaller in the Build scenarios compared with the No-Build and Bus Base Line scenarios – to a greater extent with Scenario 7 than with Scenario 2.

Figures 8-9 show that the average environmental-justice population zone resident has transit access to notably more two- and four-year colleges and hospitals than the average non-environmental justice population resident. This pattern is expected to become more evident with the Build scenarios – especially with Scenario 7.

Figures 10-11 show that while average transit travel times to area colleges and hospitals are at least 30 minutes, they are notably less for environmental justice population zones than for non-environmental justice population zones. These figures also show that the travel times are expected to become smaller with the Build scenarios than with the No-Build and Bus Base Line scenarios – to a greater extent with Scenario 7 than with Scenario 2.

Other Mobility, Congestion, and Environmental Analysis Results

Figures 12-13 show that average transit travel times for attractions and productions are shorter for environmental justice population zone residents than for non-environmental justice population zone residents, with reductions (larger for Scenario 7 than for Scenario 2) under the Build scenarios relative to the No-Build and Bus Base Line scenarios.

Figure 14 shows that average VMT per square mile is greater for environmental justice population zone residents than for non-environmental justice population zone residents. However, the difference is less with the Build scenarios (more so with Scenario 7 than with Scenario 2) than the No-Build and Bus Base Line scenarios, meaning that the disparity decreases with the Green Line Extension.

Figure 15 shows that average CO emissions are greater for environmental justice population zone residents than for non-environmental justice population zone residents. However, both of the Build scenarios improve conditions over the No-Build and Bus Base Line scenarios (Scenario 7 to a greater extent than Scenario 2), meaning that the disparity decreases with the Green Line Extension.

Conclusion

The environmental justice analysis indicates that while the 2030 Green Line Extension Build scenarios improve accessibility, mobility, congestion, and environmental conditions relative to the No-Build and Bus Base Line scenarios for both environmental justice-population zones and non-environmental justice-population zones, it benefits environmental-justice population zones slightly more.

Figure 1 Green Line Extension Study Area

Environmental Justice Population TAZs

Legend

Rapid Transit

- Blue Line
- Green Line
- Orange Line
- Red Line

Commuter Rail

- EJ Population Zones
- Other Study Area Zones

Town Boundaries



1 inch equals 1.351648 miles

0 1,700 3,400 6,800 10,200 13,600 Feet

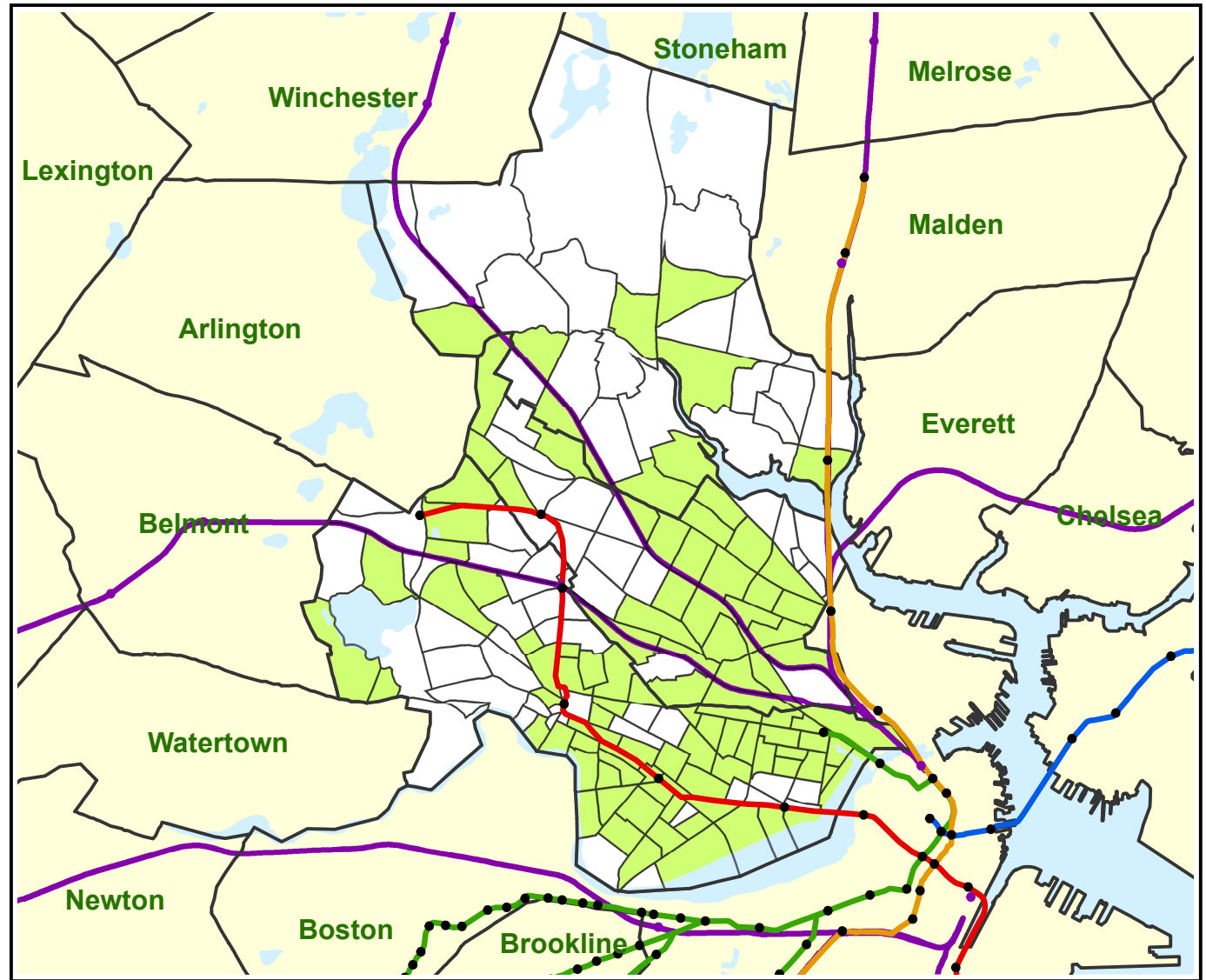


Table 1

	<u>Basic Employment</u>				<u>Retail Employment</u>				<u>Service Employment</u>			
	<u>Transit Access</u>		<u>Transit Time</u>		<u>Transit Access</u>		<u>Transit Time</u>		<u>Transit Access</u>		<u>Transit Time</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
No-Build	57,953	45,652	32.9	34.4	51,617	40,824	32.1	34.0	384,920	301,423	32.0	34.1
Bus Base Line	58,841	46,021	32.7	34.4	52,489	41,233	31.9	34.0	390,084	304,035	31.8	34.1
Scenario 2	61,485	48,140	32.5	34.2	55,085	43,789	31.6	33.8	407,592	320,678	31.3	33.7
Scenario 7	62,791	49,536	32.3	34.1	56,035	45,072	31.4	33.7	414,466	329,839	31.1	33.6
Bus BL vs No-Build	1.5%	0.8%	-0.4%	-0.1%	1.7%	1.0%	-0.5%	-0.1%	1.3%	0.9%	-0.5%	0.0%
Scen 2 vs NB	6.1%	5.5%	-1.2%	-0.7%	6.7%	7.3%	-1.5%	-0.5%	5.9%	6.4%	-2.1%	-1.0%
Scen 7 vs NB	8.3%	8.5%	-1.7%	-1.0%	8.6%	10.4%	-2.1%	-0.9%	7.7%	9.4%	-2.8%	-1.5%
Scen 2 vs Bus BL	4.5%	4.6%	-0.9%	-0.6%	4.9%	6.2%	-1.0%	-0.5%	4.5%	5.5%	-1.6%	-1.0%
Scen 7 vs Bus BL	6.7%	7.6%	-1.3%	-0.9%	6.8%	9.3%	-1.6%	-0.8%	6.3%	8.5%	-2.3%	-1.5%
Scen 7 vs 2	2.1%	2.9%	-0.5%	-0.3%	1.7%	2.9%	-0.6%	-0.4%	1.7%	2.9%	-0.7%	-0.5%
	<u>Highway Access</u>		<u>Highway Time</u>		<u>Highway Access</u>		<u>Highway Time</u>		<u>Highway Access</u>		<u>Highway Time</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
All Scenarios	151,055	155,007	13.1	14.3	116,377	116,692	12.3	13.6	702,381	695,968	12.0	13.7

Table 2

	<u>College Enrollment</u>				<u>Hospital Beds</u>			
	<u>Transit Access</u>		<u>Transit Time</u>		<u>Transit Access</u>		<u>Transit Time</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
No-Build	51,875	34,333	32.1	33.5	3,039	2,337	32.5	34.3
Bus Base Line	52,078	32,942	31.9	33.2	3,120	2,423	32.4	34.3
Scenario 2	55,808	36,450	31.9	33.4	3,337	2,553	32.0	33.9
Scenario 7	57,786	36,701	31.8	33.3	3,548	2,623	31.9	33.7
Bus BL vs No-Build	0.4%	-4.1%	-0.4%	-0.8%	2.7%	3.7%	-0.4%	0.2%
Scen 2 vs NB	7.6%	6.2%	-0.5%	-0.2%	9.8%	9.3%	-1.5%	-1.0%
Scen 7 vs NB	11.4%	6.9%	-0.6%	-0.6%	16.8%	12.2%	-1.9%	-1.8%
Scen 2 vs Bus BL	7.2%	10.7%	-0.1%	0.6%	6.9%	5.4%	-1.1%	-1.1%
Scen 7 vs Bus BL	11.0%	11.4%	-0.3%	0.2%	13.7%	8.3%	-1.5%	-2.0%
Scen 7 vs 2	3.5%	0.7%	-0.1%	-0.4%	6.3%	2.7%	-0.4%	-0.8%
	<u>Highway Access</u>		<u>Highway Time</u>		<u>Highway Access</u>		<u>Highway Time</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
All Scenarios	98,994	91,081	11.8	13.6	8,957	8,183	12.7	13.2

Table 3

	<u>Production Times</u>		<u>Attraction Times</u>	
	<u>Transit</u>		<u>Transit</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
No-Build	35.8	38.3	40.5	40.6
Bus Base Line	35.5	38.2	40.2	40.5
Scenario 2	35.1	37.9	40.0	40.4
Scenario 7	34.8	37.6	39.7	40.2
Bus BL vs No-Build	-0.7%	-0.2%	-0.6%	-0.2%
Scen 2 vs NB	-2.0%	-1.1%	-1.2%	-0.5%
Scen 7 vs NB	-2.8%	-1.7%	-1.9%	-1.0%
Scen 2 vs Bus BL	-1.3%	-0.9%	-0.6%	-0.2%
Scen 7 vs Bus BL	-2.1%	-1.5%	-1.3%	-0.8%
Scen 7 vs 2	-0.8%	-0.7%	-0.7%	-0.5%
	<u>Highway</u>		<u>Highway Access</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
All Scenarios	11.8	11.5	15.3	12.6

Table 4

	<u>VMTperSqMi</u>		<u>COperSqMi</u>	
	<u>EJ</u>	<u>NonEJ</u>	<u>EJ</u>	<u>NonEJ</u>
No-Build	189,606	142,358	1,623,838	1,225,150
Bus Base Line	189,529	142,250	1,623,216	1,224,133
Scenario 2	188,488	141,870	1,614,202	1,220,942
Scenario 7	188,172	141,715	1,611,340	1,219,541
Bus BL vs No-Build	0.0%	-0.1%	0.0%	-0.1%
Scen 2 vs NB	-0.6%	-0.3%	-0.6%	-0.3%
Scen 7 vs NB	-0.8%	-0.5%	-0.8%	-0.5%
Scen 2 vs Bus BL	-0.5%	-0.3%	-0.6%	-0.3%
Scen 7 vs Bus BL	-0.7%	-0.4%	-0.7%	-0.4%
Scen 7 vs 2	-0.2%	-0.1%	-0.2%	-0.1%

Figure 2: Transit Access to Basic Employment Jobs

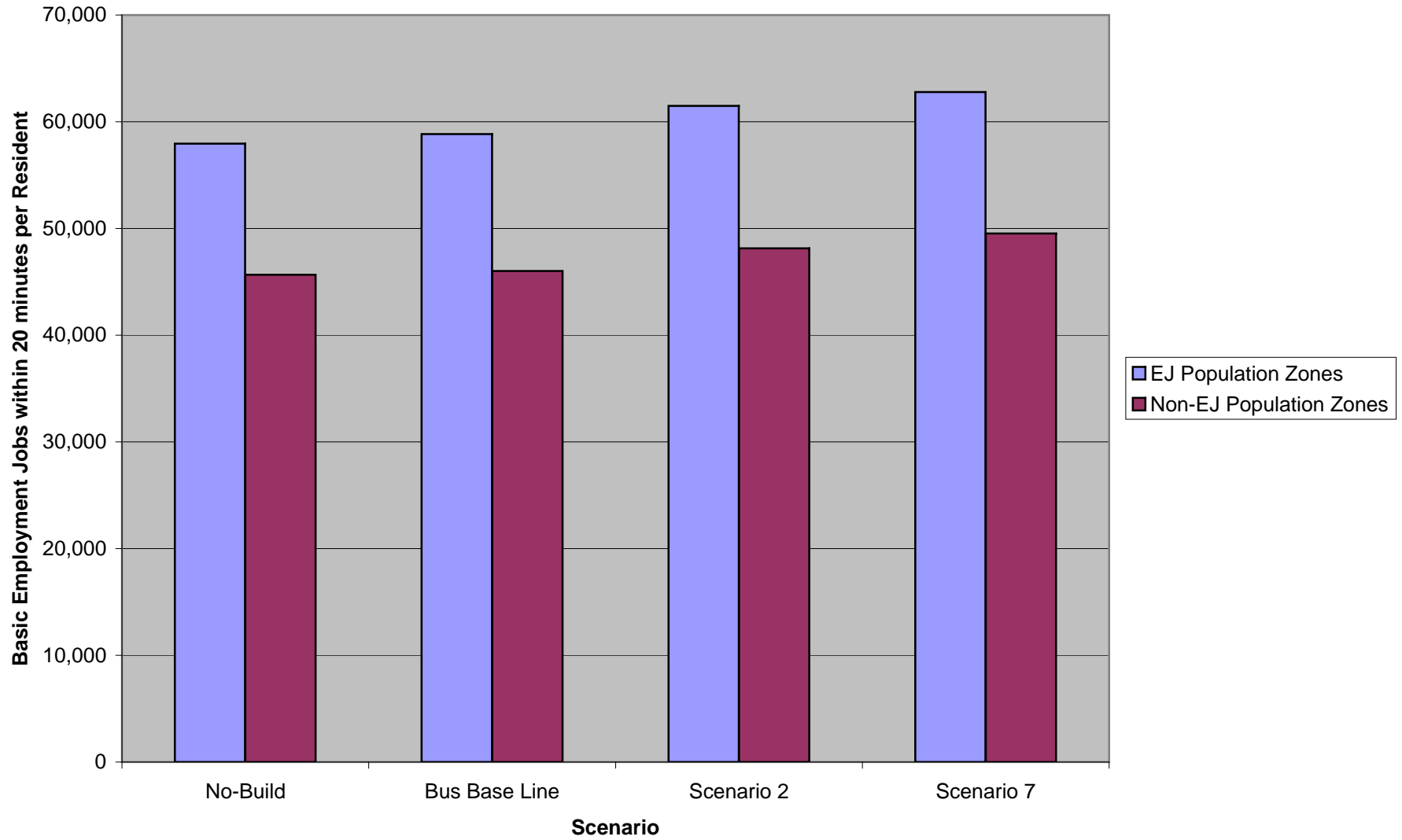


Figure 3: Transit Access to Retail Employment Jobs

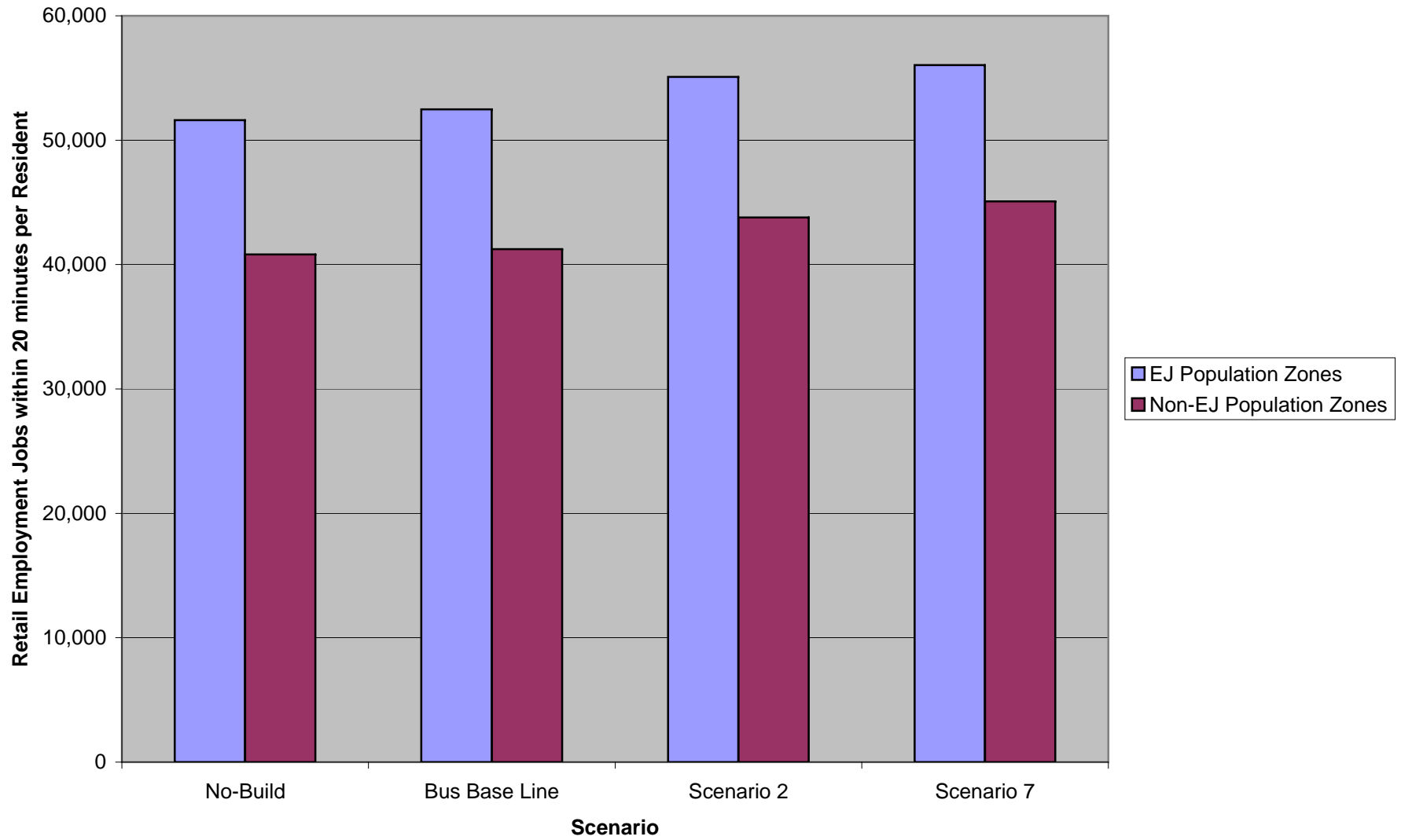


Figure 4: Transit Access to Service Employment Jobs

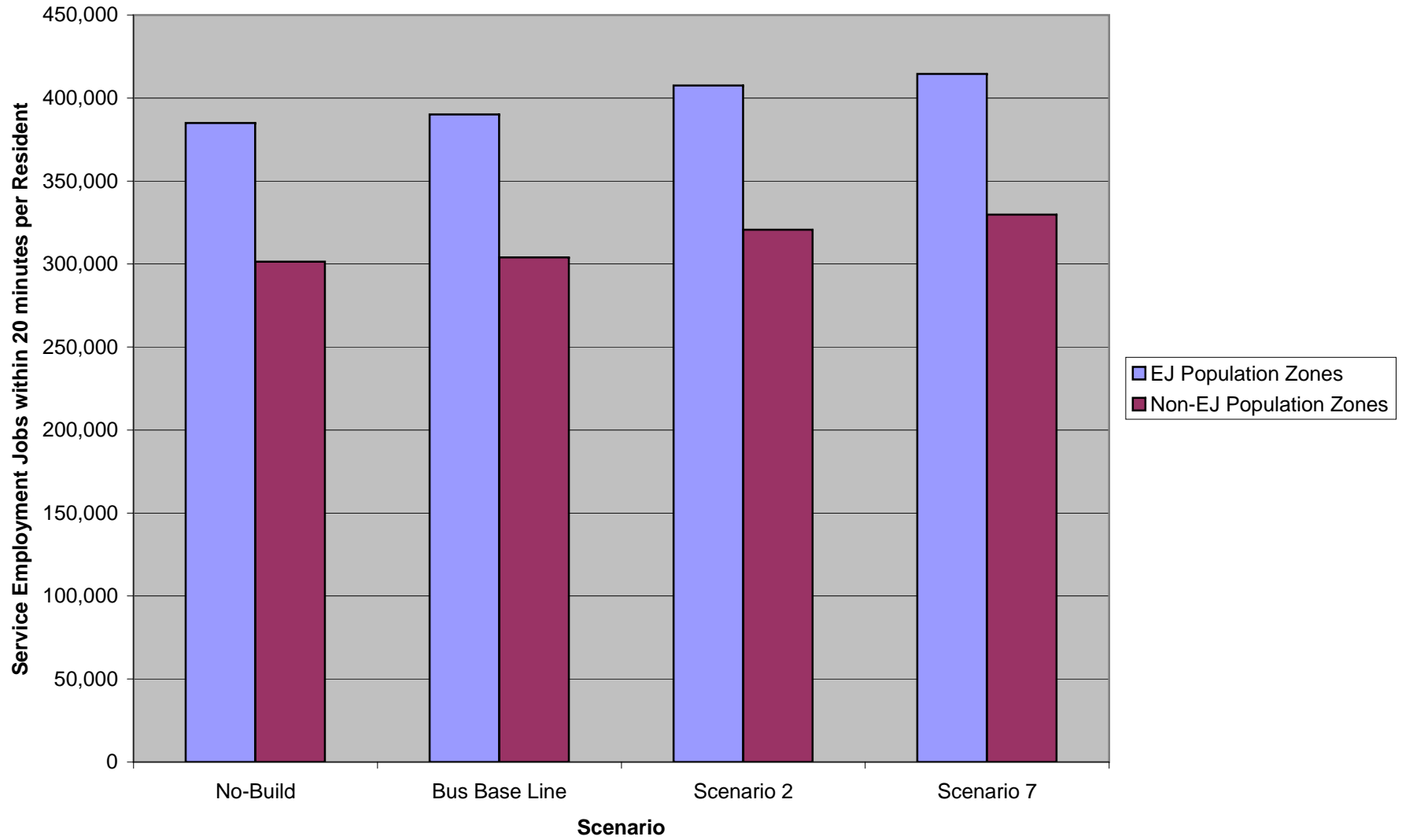


Figure 5: Transit Time to Accessible Basic Employment Jobs

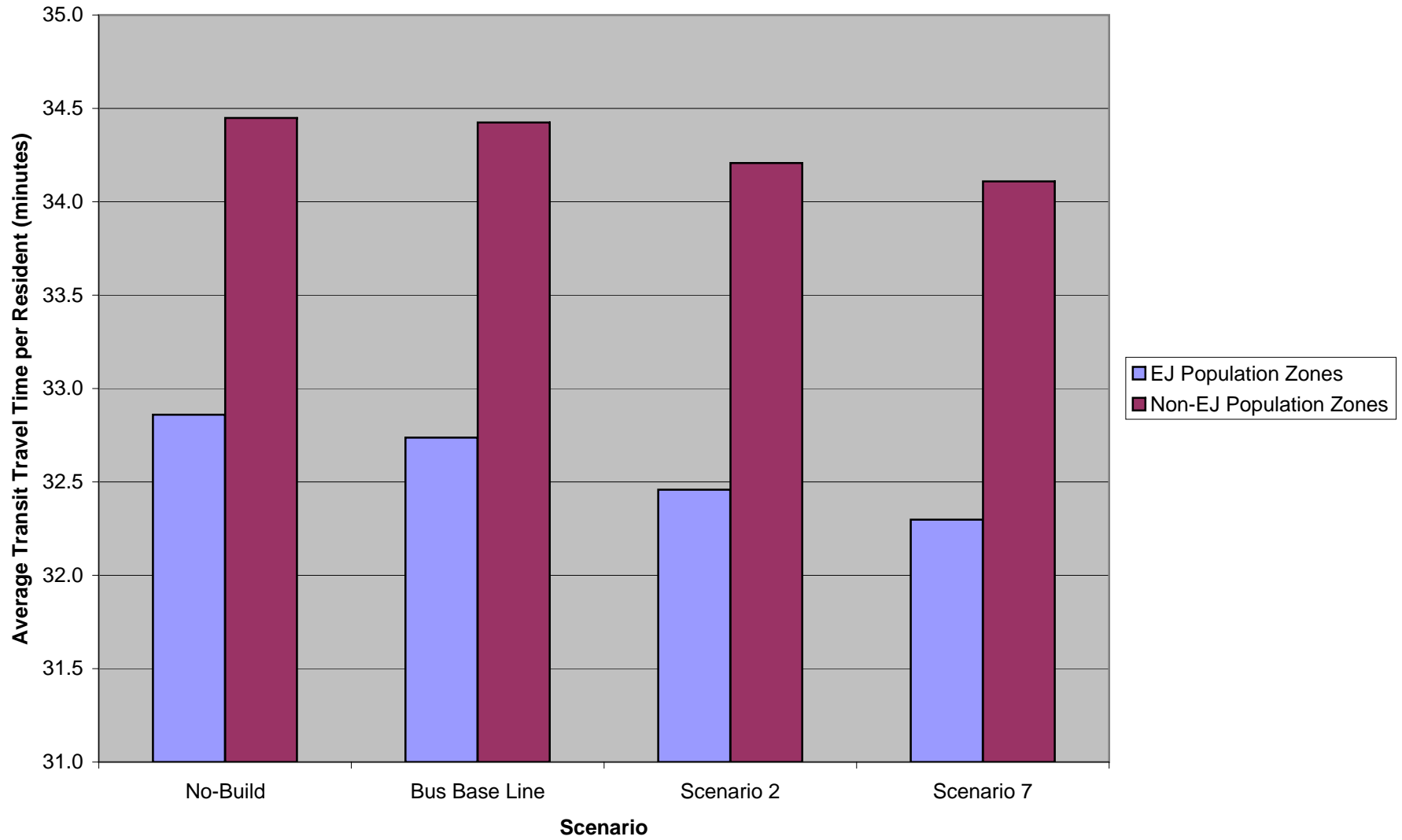


Figure 6: Transit Time to Accessible Retail Employment Jobs

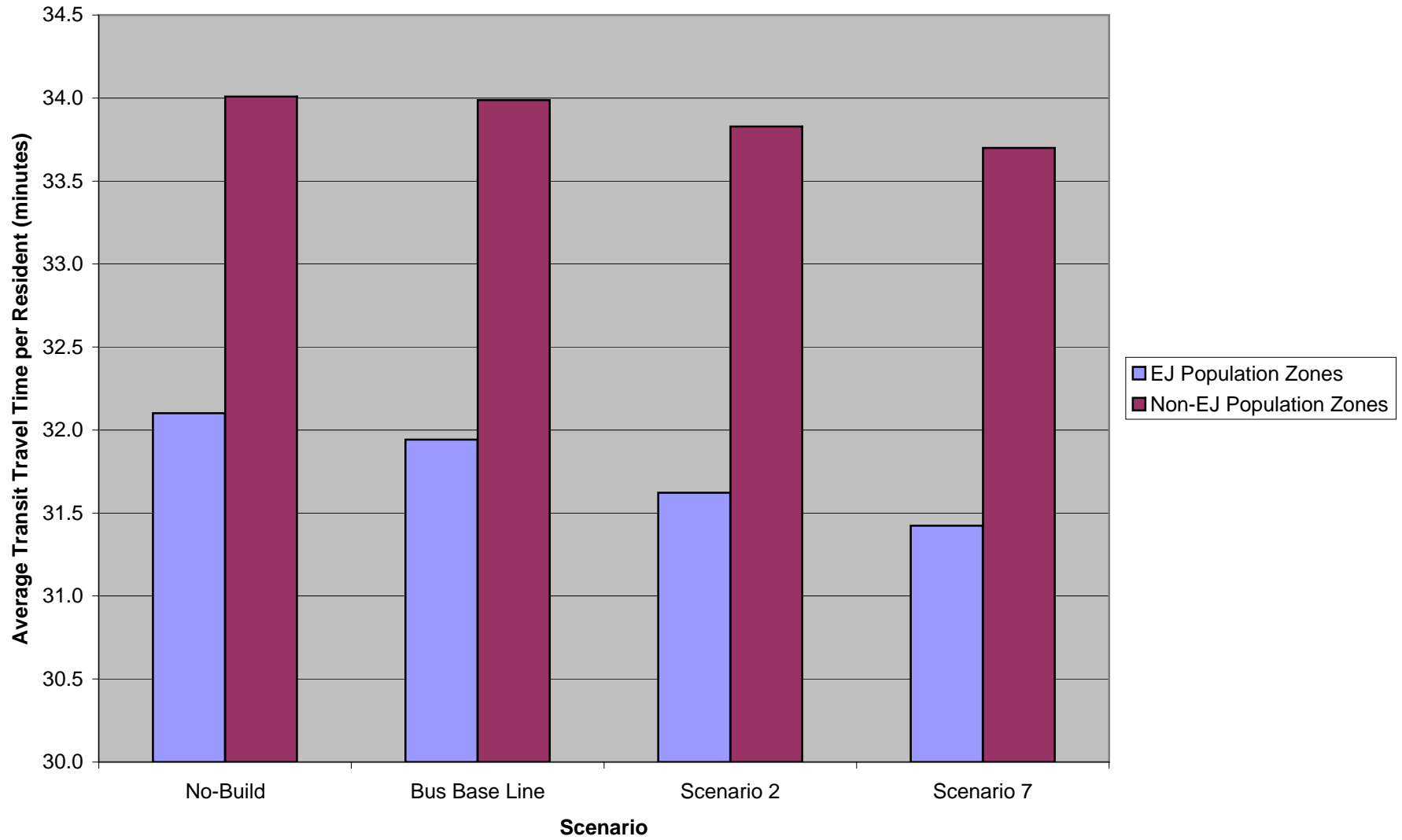


Figure 7: Transit Time to Accessible Service Employment Jobs

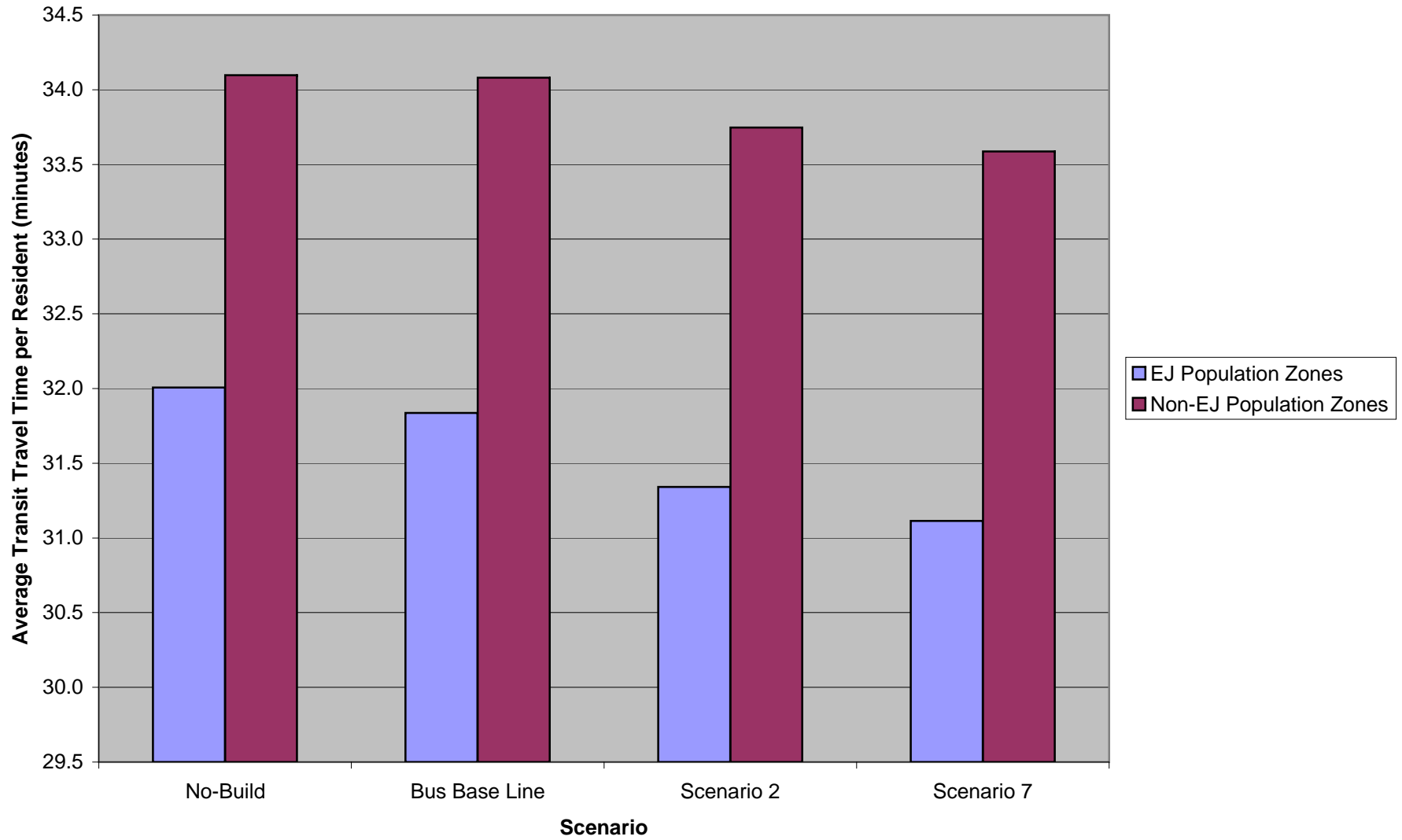


Figure 8: Transit Access to Colleges

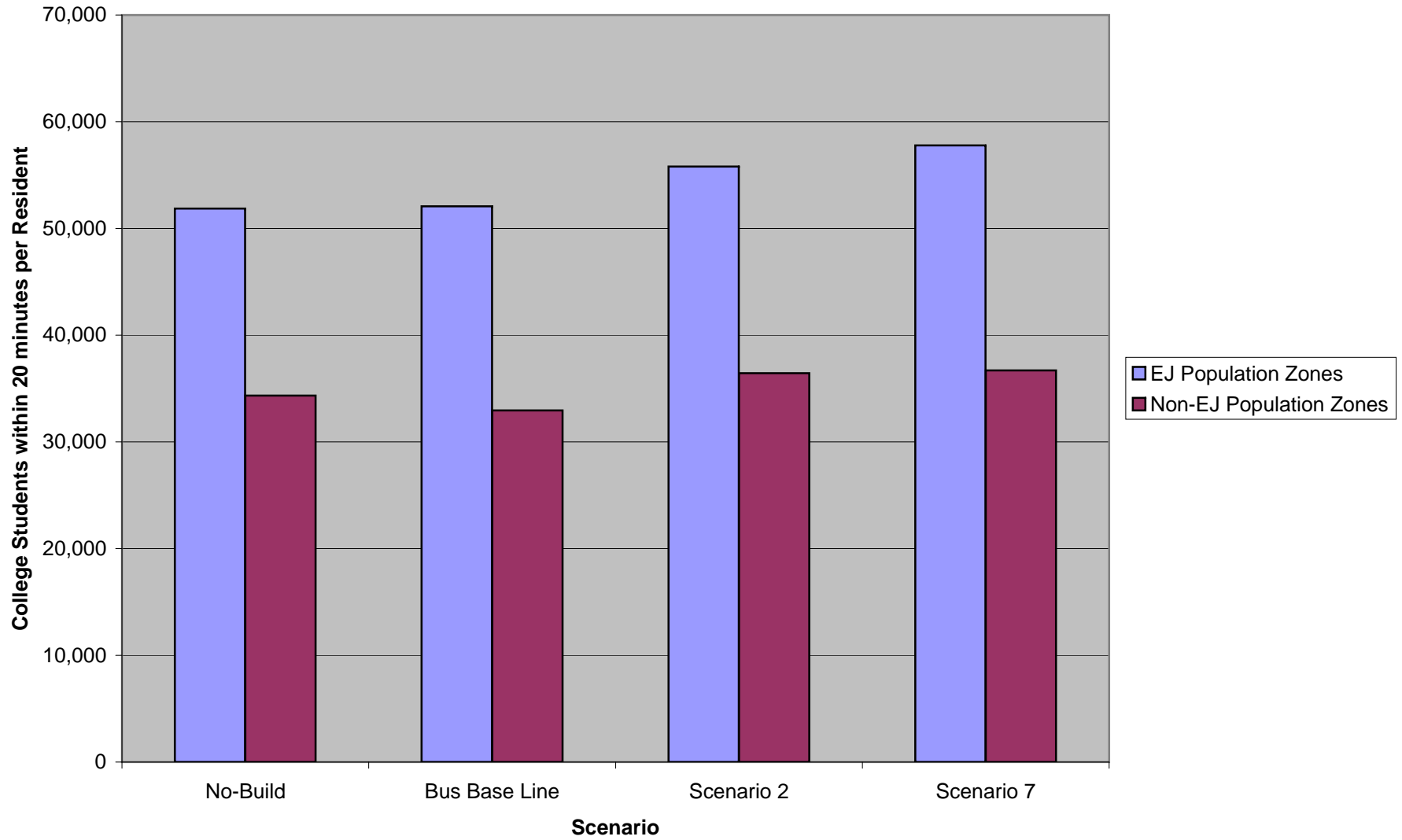


Figure 9: Transit Access to Hospitals

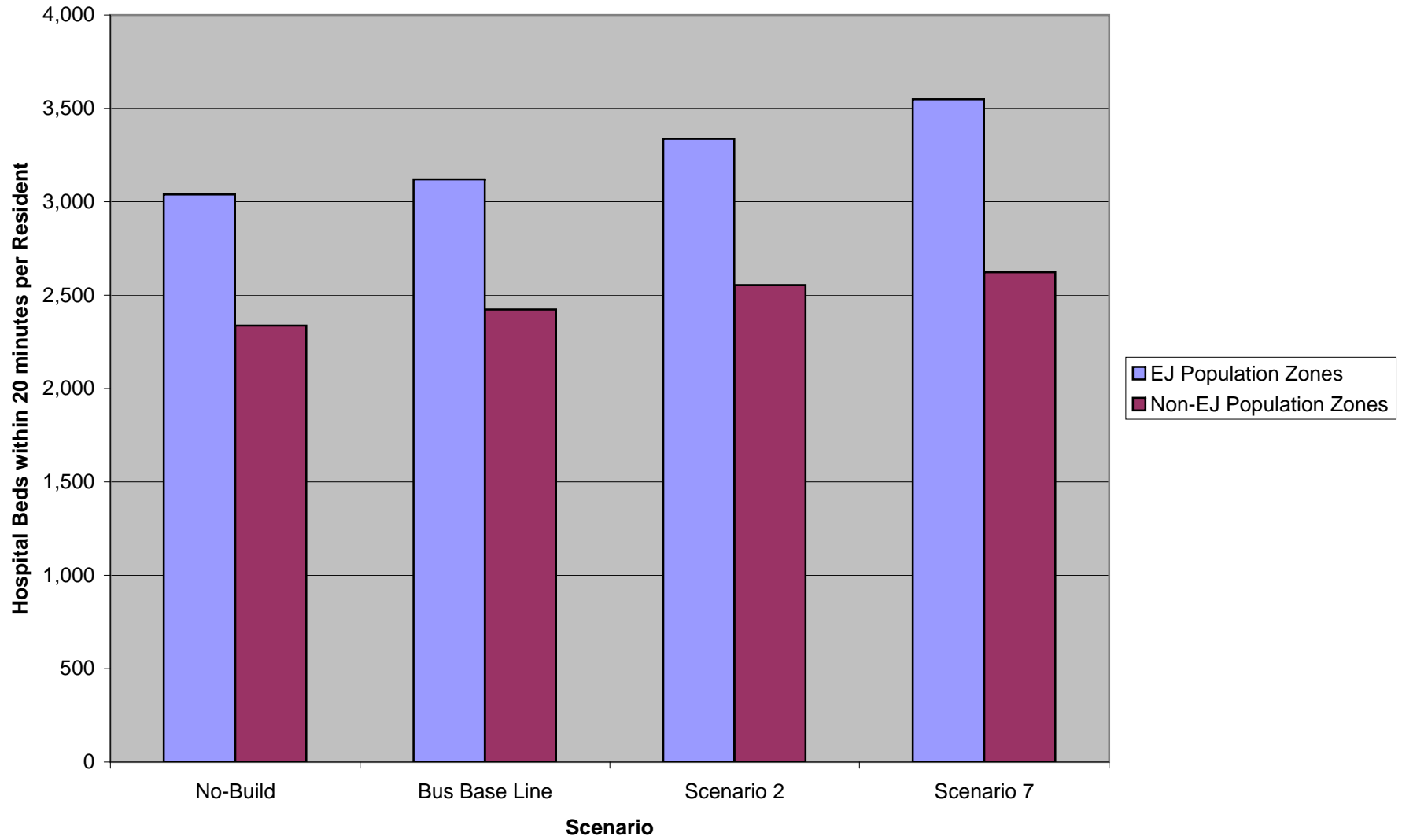


Figure 10: Transit Time to Accessible Colleges

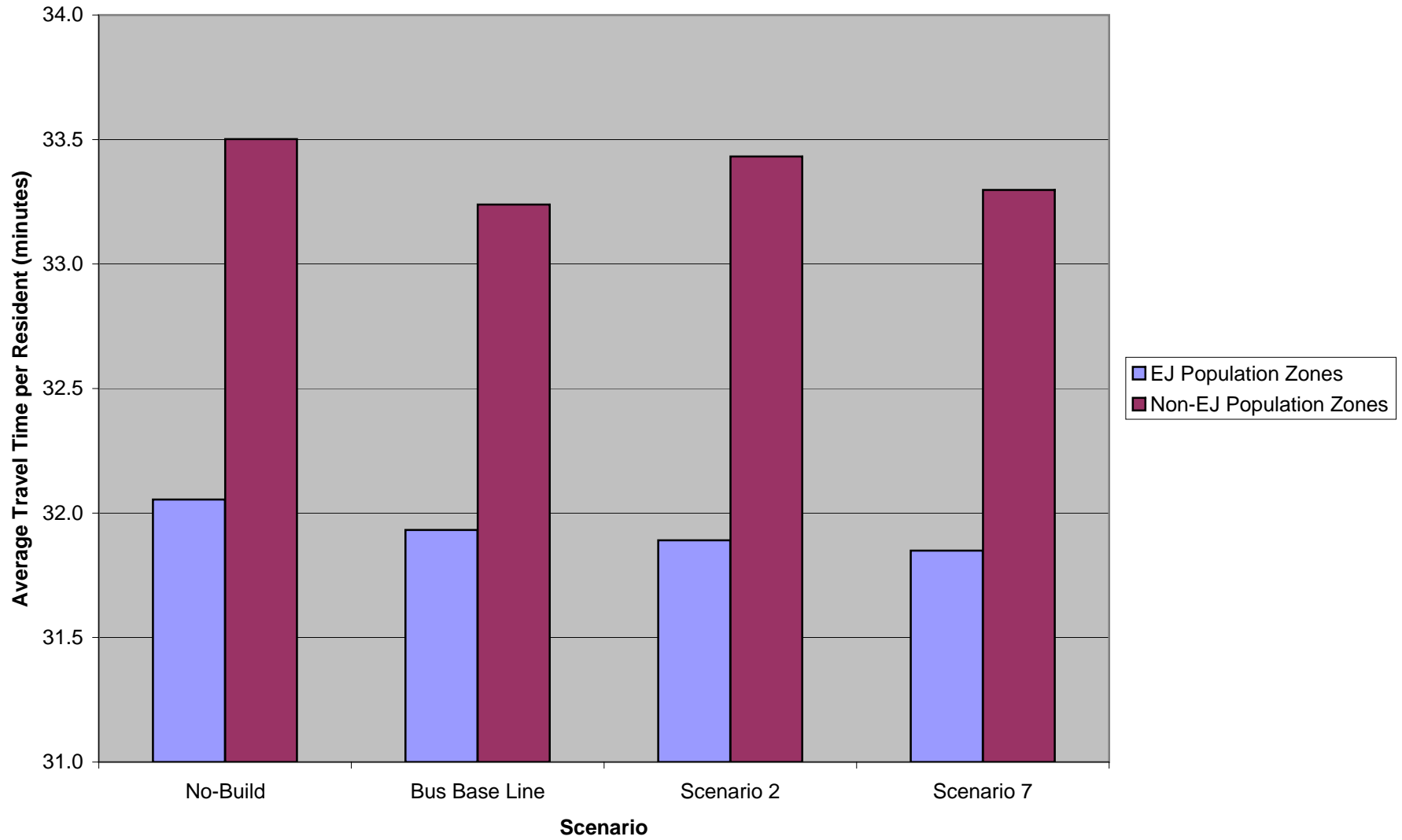


Figure 11: Transit Time to Accessible Hospitals

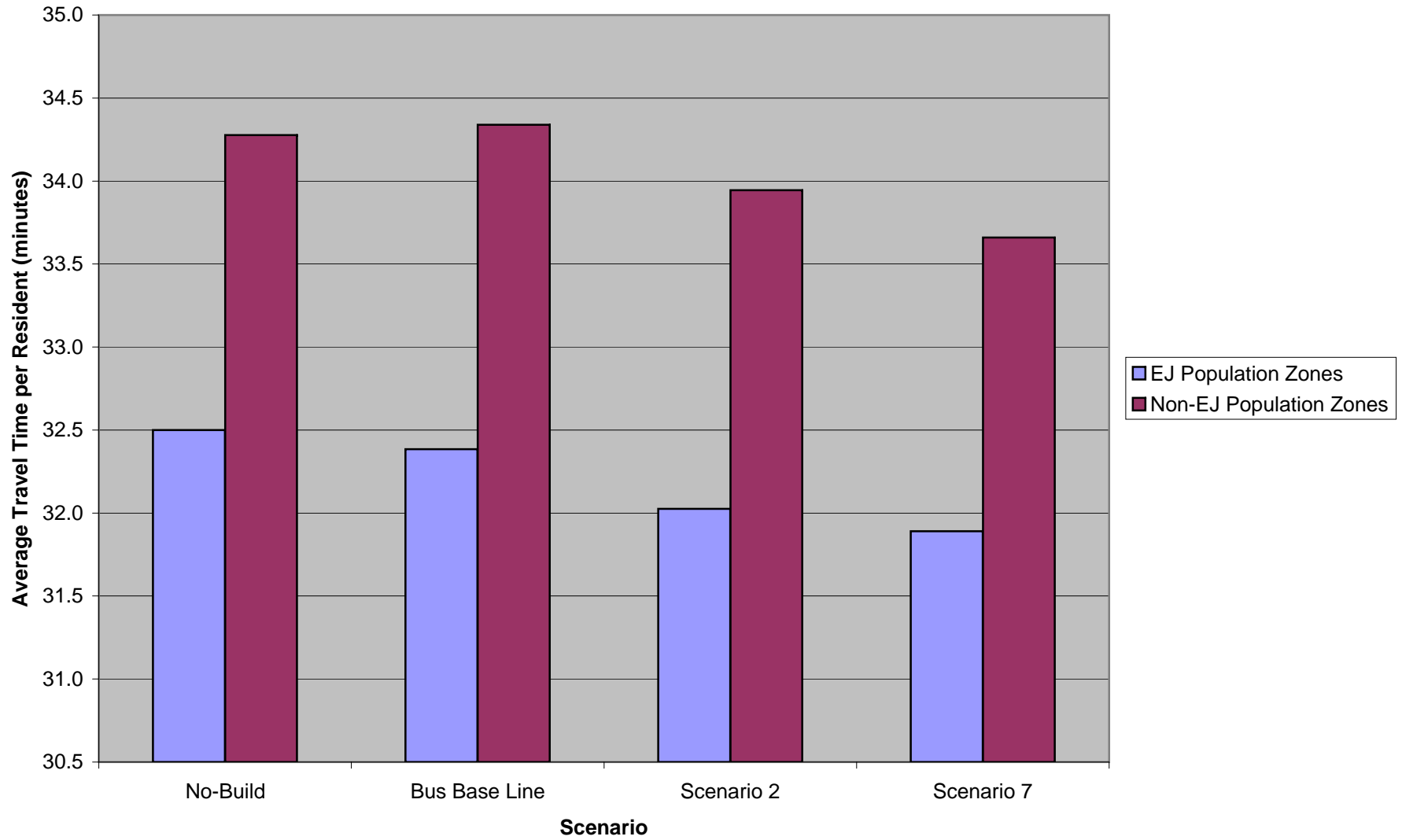


Figure 12: Transit Trip Production Times

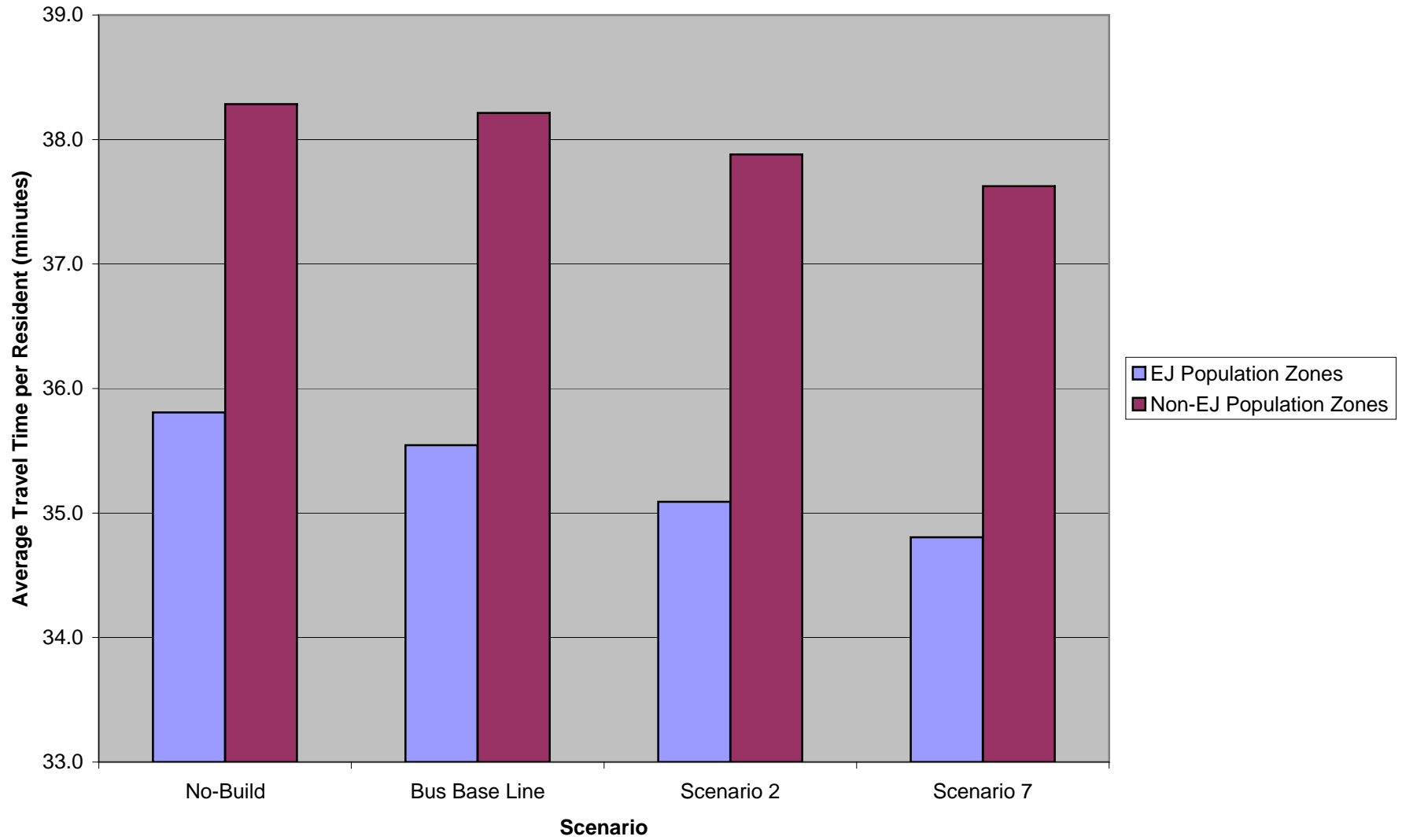


Figure 13: Transit Trip Attraction Times

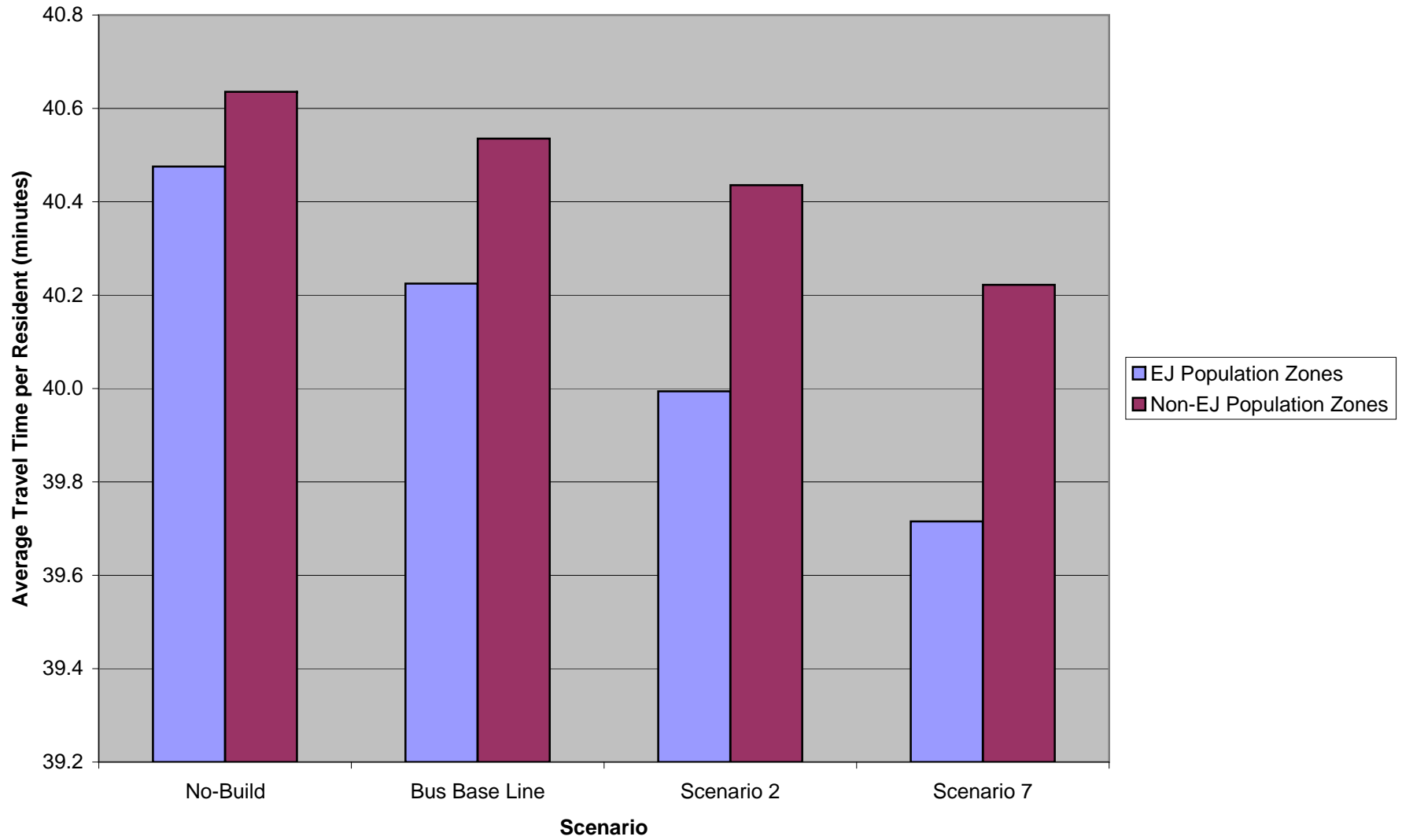


Figure 14: Highway Traffic Density

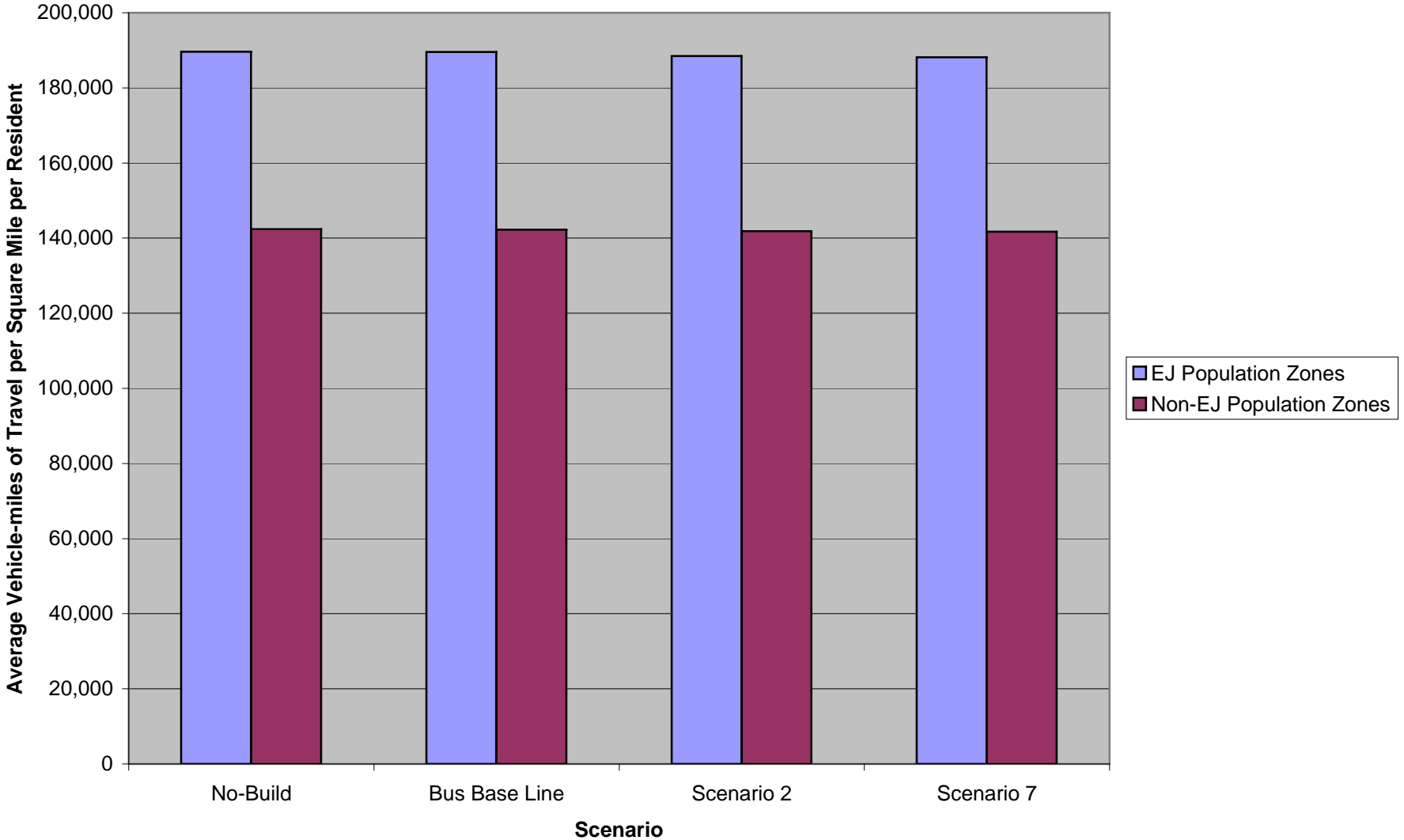
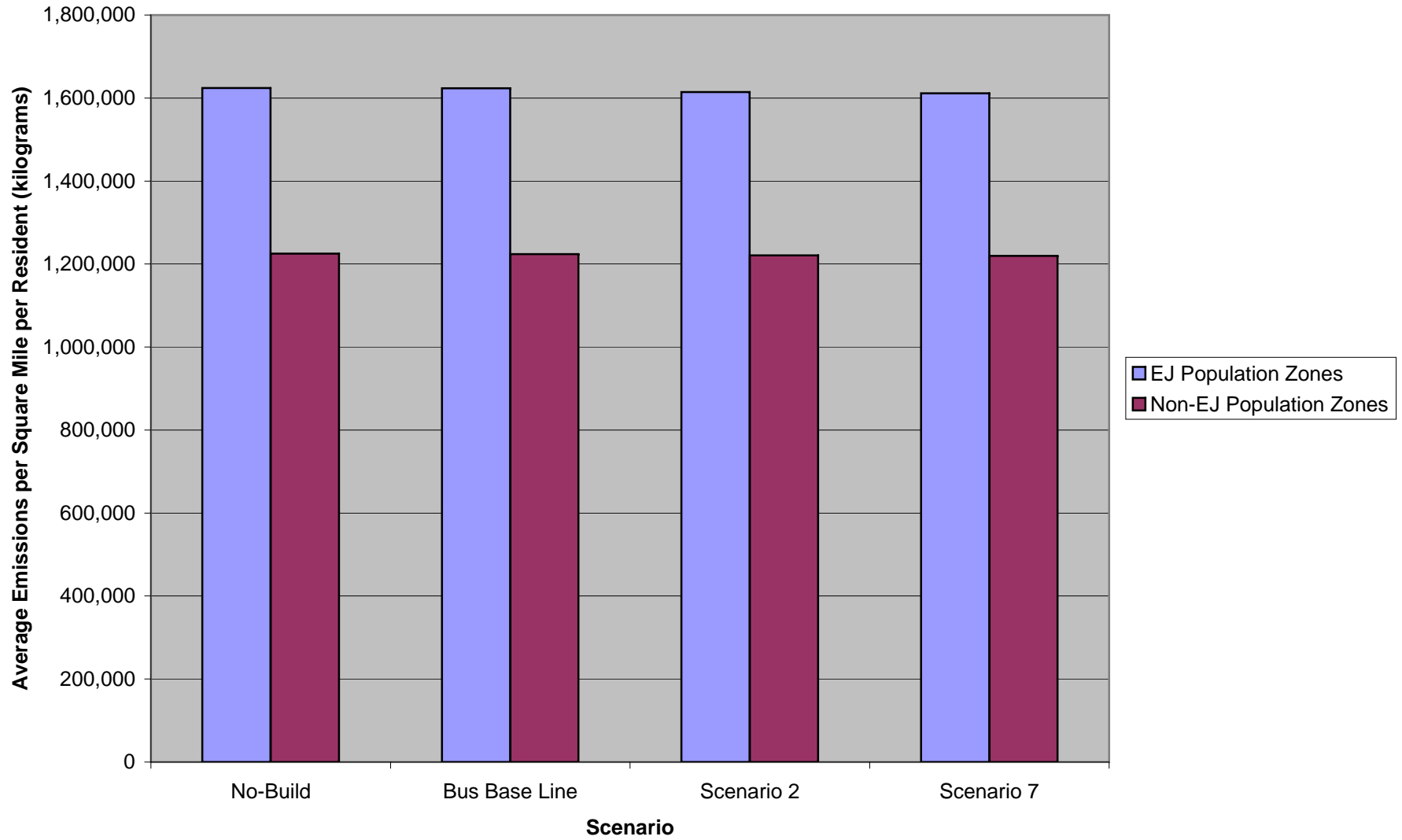


Figure 15: CO Emissions Density



Green Line Extension Disability Impact Analysis

**Green Line Extension EIR Analysis:
Environmental Justice Analysis for
Disabled Populations**

**DRAFT Prepared by
Central Transportation Planning Staff
November 26, 2008**

As part of the Boston Metropolitan Planning Organization (MPO) regional equity program, an examination was conducted of the impacts of the Green Line Extension, including the distribution of the transportation system's benefits and burdens among environmental justice population zones. (These types of zones are defined in the section below.) The study's performance measures focus on mobility, accessibility, and environmental impact concerns.

Environmental justice areas are geographic regions determined by the demographics of the people living in a transportation analysis zone (TAZ). A TAZ is an aggregation of census geography based on population and estimated trip volumes. According to the definition used for the Boston MPO's regional equity program, "A TAZ will be considered an Environmental Justice Area if it is over 50 percent minority or has a median household income at or below 60 percent of the region's median" (60 percent of the region's median household income of \$55,800 is \$33,480). The TAZ's total minority population must be at least 200.

This environmental justice analysis does not include an explicit estimate of the relative burdens experienced by the disabled populations within the Green Line Extension project area. In order to provide such information, an analysis of the impacts of the proposed Green Line Extension upon the disabled populations in the project area was performed, using a set of disability population zones and the same tests as used for the Boston MPO environmental justice analysis. The threshold for these disability population zones is as follows:

- Approximately 17.6 percent of all Eastern Massachusetts residents over 5 years old reported themselves as having a disability in the 2000 US Census. A disability TAZ was thus defined as having a portion of its over-five-years-old population reporting themselves as having a physical or sensory disability at or below this level (17.6%).

The resulting disability population zones in the Green Line Extension project area are shown in Figure 1.

The 2030 demographic forecasts used for this study assumed the attributes of the residential populations in the project area TAZs remain the same as they were observed in the 2000 US Census. The Build, Bus Base Line, and No-Build scenarios used the same demographic forecasts.

Performance Measures

Performance measures were used as indicators of benefits and burdens for disability and non-disability population zones' populations. These measures fall into three categories:

- Accessibility to needed services and jobs
- Mobility and congestion
- Environment

Accessibility Analysis

This study analyzed access to needed services and jobs in terms of average transit and highway travel times from disability population zones to industrial, retail, and service employment opportunities; health care; and institutions of higher education. The accessibility analysis featured an examination of the number of destinations within a 40-minute transit trip and a 20-minute auto trip. The analysis of transit travel times included destinations within a 40-minute transit trip, and the analysis of highway travel times included destinations within a 20-minute auto trip.

Differences were calculated between the No-Build, Bus Base Line, and Build scenarios (Scenario 2 – the Riverside Branch is extended to Mystic Valley and the Heath Street Branch is extended to Union Square - and Scenario 7 – the Riverside and Heath Street Branches are extended to Mystic Valley) for disability and non-disability population zone residents. Results are aggregated for each type of population zone, and the reported averages are weighted by the number of residents in each disability or non-disability population zone.

The examined accessibility performance measures were:

- The average number of industrial, retail, and service jobs within a 40-minute transit trip and a 20-minute auto trip.
- The average travel time to industrial, retail, and service jobs within a 40-minute transit trip and a 20-minute auto trip.
- The average number of hospital beds within a 40-minute transit trip and a 20-minute auto trip.
- The average travel time to a hospital, weighted by the number of hospital beds, within a 40-minute transit trip and a 20-minute auto trip.
- The average number of students at facilities of two- and four-year institutions of higher education within a 40-minute transit trip and a 20-minute auto trip.

- The average travel time to facilities of two- and four-year institutions of higher education, weighted by enrollment, within a 40-minute transit trip and a 20-minute auto trip.

Mobility, Congestion, and Environmental Analysis

The mobility, congestion, and environmental impacts were analyzed by comparing performance measures for disability population zones to those for non-disability population zones. As in the accessibility analysis, differences between the average levels of these performance measures within the two types of zones were calculated for the No-Build, Bus Base Line, and Build scenarios. The results are aggregated in the same manner.

The examined mobility, congestion, and environmental performance measures were:

- VMT per square mile – the number of vehicle-miles traveled (VMT) per square mile of dry land within a TAZ.
- CO per square mile – the number of kilograms of carbon monoxide emitted per square mile of dry land within a TAZ.
- Transit production time – the average door-to-door travel time for all transit trips produced in the TAZ.
- Highway production time – the average door-to-door travel time for all highway trips produced in the TAZ.
- Transit attraction time – the average door-to-door travel time for all transit trips attracted to the TAZ.
- Highway attraction time – the average door-to-door travel time for all highway trips attracted to the TAZ.

Summary of Green Line Extension Results

The disability analysis determined that while the Green Line Extension Build scenarios improve accessibility, mobility, congestion, and environmental conditions relative to the No-Build and Bus Base Line scenarios for both disability population zones and non-disability population zones, in most cases disability population zones benefit significantly more.

Accessibility Analysis Results

Results from the accessibility analysis show the following for trips from disability population zones to nearby jobs, colleges, and hospitals (Tables 1 and 2):

- People in disability population zones will be able to access more area destinations within a 40-minute transit ride in the Build scenarios than in the No-Build and Bus Base Line scenarios. This change is more pronounced under Scenario 7 than under Scenario 2.
- Travel times to area destinations are less for disability population zones in the Build scenarios when compared to those in the No-Build and Bus Base Line scenarios. This trend is stronger with Scenario 7 than with Scenario 2.

Since the highway impedances were assumed to remain the same for all scenarios, the accessibility by highway travel does not change between the four scenarios.

Mobility, Congestion, and Environmental Analysis Results

Results from the mobility, congestion, and environmental analysis show the following for trips within disability population zones (Tables 3 and 4):

- Travel times are slightly less for disability population zones in the Build scenarios than in the No-Build and Bus Base Line scenarios. Scenario 7 produces more significant changes than does Scenario 2.
- VMT per square mile is less for disability population zones in the Build scenarios compared to the No-Build and Bus Base Line scenarios. This difference is expected to be larger with Scenario 7 than with Scenario 2.
- The Build scenarios yield less CO emissions per square mile for disability population zones when compared to the No-Build and Bus Base Line scenarios. This change is expected to be more pronounced under Scenario 7 than under Scenario 2.

More Detailed Results from the Accessibility, Mobility, Congestion, and Environmental Analyses

MPO staff compared model results for the 2030 No-Build, Bus Base Line, and Build scenarios to see how conditions are estimated to change for disability population zones. The results of these comparisons are summarized below.

Other Accessibility Analysis Results

Figures 2-4 show that the average non-disability population zone resident has transit access to notably more jobs than the average disability population zone resident. These figures also show that the Build scenarios bring about a larger increase in accessibility to jobs for residents of the disabled population zones than with the No-Build and Bus Base Line scenarios – more so with Scenario 7 than with Scenario 2.

Figures 5-7 show that average transit travel times to area jobs are notably more for disability population zones than for non-disability population zones. These figures also show that all average travel times are expected to become smaller in the Build scenarios compared with the No-Build and Bus Base Line scenarios – to a greater extent for the disabled population zones and with Scenario 7 than with Scenario 2.

Figures 8-9 show that the average disability population zone resident has transit access to notably fewer two- and four-year colleges and hospital beds than the average non-disability population resident. This pattern is expected to become less evident with the Build scenarios – especially with Scenario 7.

Figures 10-11 show that average transit travel times to area colleges and hospitals are notably more for disability population zones than for non-disability population zones. These figures also show that all average travel times are expected to become smaller with the Build scenarios than with the No-Build and Bus Base Line scenarios – to a greater extent for the disabled population zones and with Scenario 7 than with Scenario 2.

Other Mobility, Congestion, and Environmental Analysis Results

Figures 12-13 show that average transit travel times for attractions and productions are longer for disability population zone residents than for non-disability population zone residents, with reductions (larger for Scenario 7 than for Scenario 2) under the Build scenarios relative to the No-Build and Bus Base Line scenarios.

Figure 14 shows that average VMT per square mile is greater for disability population zone residents than for non-disability population zone residents. However, the difference is less with the Build scenarios (more so with Scenario 7 than with Scenario 2) than the No-Build and Bus Base Line scenarios, meaning that the disparity decreases with the Green Line Extension.

Figure 15 shows that average CO emissions are greater for disability population zone residents than for non-disability population zone residents. However, both of the Build scenarios improve conditions over the No-Build and Bus Base Line scenarios (Scenario 7 to a greater extent than Scenario 2), meaning that the disparity decreases with the Green Line Extension.

Conclusion

The disability analysis indicates that while the 2030 Green Line Extension Build scenarios improve accessibility, mobility, congestion, and environmental conditions relative to the No-Build and Bus Base Line scenarios for both disability population zones and non-disability population zones, it benefits disability population zones slightly more.

Figure 1 Green Line Extension Study Area

Disabled Population TAZs

Legend

Rapid Transit

- Blue Line
- Green Line
- Orange Line
- Red Line

Town Boundaries

Commuter Rail

- Disabled Population Zones
- Other Study Area Zones

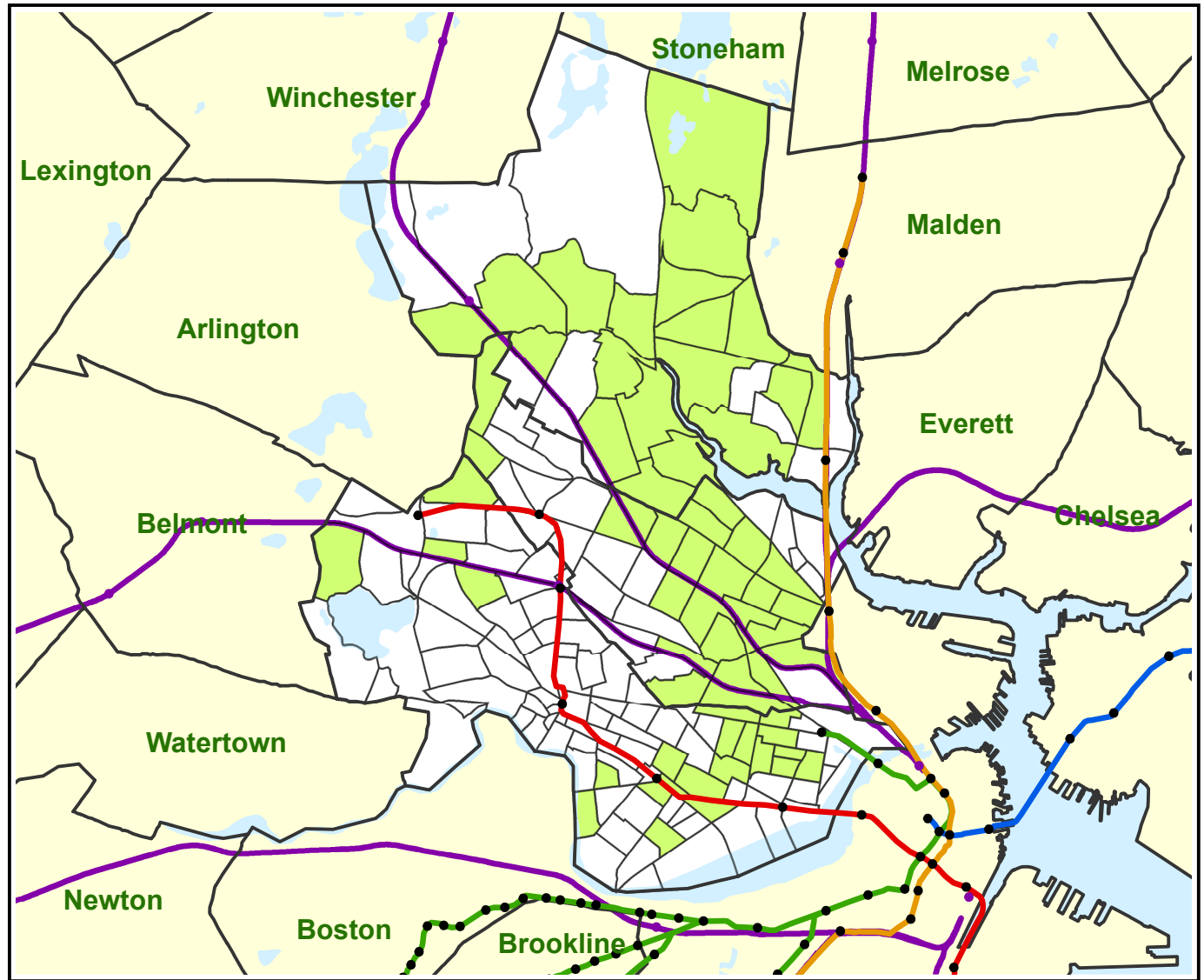
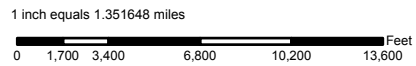


Table 1

	<u>Basic Employment</u>				<u>Retail Employment</u>				<u>Service Employment</u>			
	<u>Transit Access</u>		<u>Transit Time</u>		<u>Transit Access</u>		<u>Transit Time</u>		<u>Transit Access</u>		<u>Transit Time</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
No-Build	44,718	59,788	34.2	33.0	40,259	53,018	33.8	32.1	296,392	396,302	34.0	31.9
Bus Base Line	45,513	60,371	34.0	32.9	41,266	53,441	33.6	32.0	302,516	398,811	33.8	31.8
Scenario 2	49,501	61,530	33.6	32.8	45,026	55,054	33.2	32.0	329,022	408,314	33.1	31.6
Scenario 7	51,449	62,376	33.4	32.7	46,500	55,819	32.9	31.9	340,010	413,492	32.8	31.5
Bus BL vs No-Build	1.8%	1.0%	-0.4%	-0.2%	2.5%	0.8%	-0.5%	-0.2%	2.1%	0.6%	-0.4%	-0.3%
Scen 2 vs NB	10.7%	2.9%	-1.5%	-0.6%	11.8%	3.8%	-1.9%	-0.4%	11.0%	3.0%	-2.5%	-0.9%
Scen 7 vs NB	15.1%	4.3%	-2.1%	-0.8%	15.5%	5.3%	-2.6%	-0.7%	14.7%	4.3%	-3.4%	-1.3%
Scen 2 vs Bus BL	8.8%	1.9%	-1.2%	-0.4%	9.1%	3.0%	-1.4%	-0.2%	8.8%	2.4%	-2.1%	-0.7%
Scen 7 vs Bus BL	13.0%	3.3%	-1.8%	-0.7%	12.7%	4.4%	-2.2%	-0.5%	12.4%	3.7%	-3.0%	-1.0%
Scen 7 vs 2	3.9%	1.4%	-0.6%	-0.3%	3.3%	1.4%	-0.8%	-0.3%	3.3%	1.3%	-0.9%	-0.4%
	<u>Highway Access</u>		<u>Highway Time</u>		<u>Highway Access</u>		<u>Highway Time</u>		<u>Highway Access</u>		<u>Highway Time</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
All Scenarios	159,161	147,308	13.6	13.5	119,085	114,389	12.9	12.7	697,522	701,665	12.7	12.7

Table 2

	<u>College Enrollment</u>				<u>Hospital Beds</u>			
	<u>Transit Access</u>		<u>Transit Time</u>		<u>Transit Access</u>		<u>Transit Time</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
No-Build	36,284	51,802	33.9	31.6	2,284	3,143	34.0	32.5
Bus Base Line	36,584	50,757	33.8	31.3	2,440	3,168	34.0	32.5
Scenario 2	41,481	53,370	33.6	31.6	2,735	3,255	33.4	32.3
Scenario 7	43,943	53,686	33.5	31.5	2,896	3,406	33.1	32.2
Bus BL vs No-Build	0.8%	-2.0%	-0.2%	-0.9%	6.8%	0.8%	-0.2%	-0.1%
Scen 2 vs NB	14.3%	3.0%	-0.8%	0.0%	19.8%	3.6%	-1.9%	-0.7%
Scen 7 vs NB	21.1%	3.6%	-1.0%	-0.3%	26.8%	8.3%	-2.9%	-1.0%
Scen 2 vs Bus BL	13.4%	5.1%	-0.6%	0.9%	12.1%	2.8%	-1.7%	-0.6%
Scen 7 vs Bus BL	20.1%	5.8%	-0.8%	0.6%	18.7%	7.5%	-2.7%	-0.9%
Scen 7 vs 2	5.9%	0.6%	-0.2%	-0.3%	5.9%	4.6%	-1.0%	-0.2%
	<u>Highway Access</u>		<u>Highway Time</u>		<u>Highway Access</u>		<u>Highway Time</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
All Scenarios	91,767	99,120	13.0	12.1	8,439	8,814	12.6	13.1

Table 3

	<u>Production Times</u>		<u>Attraction Times</u>	
	<u>Transit</u>		<u>Transit</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
No-Build	39.2	34.9	41.6	39.7
Bus Base Line	38.9	34.7	41.3	39.6
Scenario 2	38.2	34.6	41.0	39.5
Scenario 7	37.7	34.5	40.6	39.3
Bus BL vs No-Build	-0.7%	-0.4%	-0.6%	-0.3%
Scen 2 vs NB	-2.6%	-0.7%	-1.4%	-0.5%
Scen 7 vs NB	-3.6%	-1.2%	-2.3%	-0.9%
Scen 2 vs Bus BL	-1.9%	-0.4%	-0.8%	-0.1%
Scen 7 vs Bus BL	-3.0%	-0.8%	-1.7%	-0.6%
Scen 7 vs 2	-1.1%	-0.5%	-0.9%	-0.4%
	<u>Highway</u>		<u>Highway</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
All Scenarios	12.0	11.5	14.0	14.5

Table 4

	<u>VMTperSqMi</u>		<u>COperSqMi</u>	
	<u>Dis</u>	<u>NonDis</u>	<u>Dis</u>	<u>NonDis</u>
No-Build	185,946	158,003	1,598,700	1,352,455
Bus Base Line	185,836	157,930	1,597,629	1,351,912
Scenario 2	184,891	157,294	1,589,598	1,346,358
Scenario 7	184,530	157,133	1,586,447	1,344,802
Bus BL vs No-Build	-0.1%	0.0%	-0.1%	0.0%
Scen 2 vs NB	-0.6%	-0.4%	-0.6%	-0.5%
Scen 7 vs NB	-0.8%	-0.6%	-0.8%	-0.6%
Scen 2 vs Bus BL	-0.5%	-0.4%	-0.5%	-0.4%
Scen 7 vs Bus BL	-0.7%	-0.5%	-0.7%	-0.5%
Scen 7 vs 2	-0.2%	-0.1%	-0.2%	-0.1%

Figure 2: Transit Access to Basic Employment Jobs

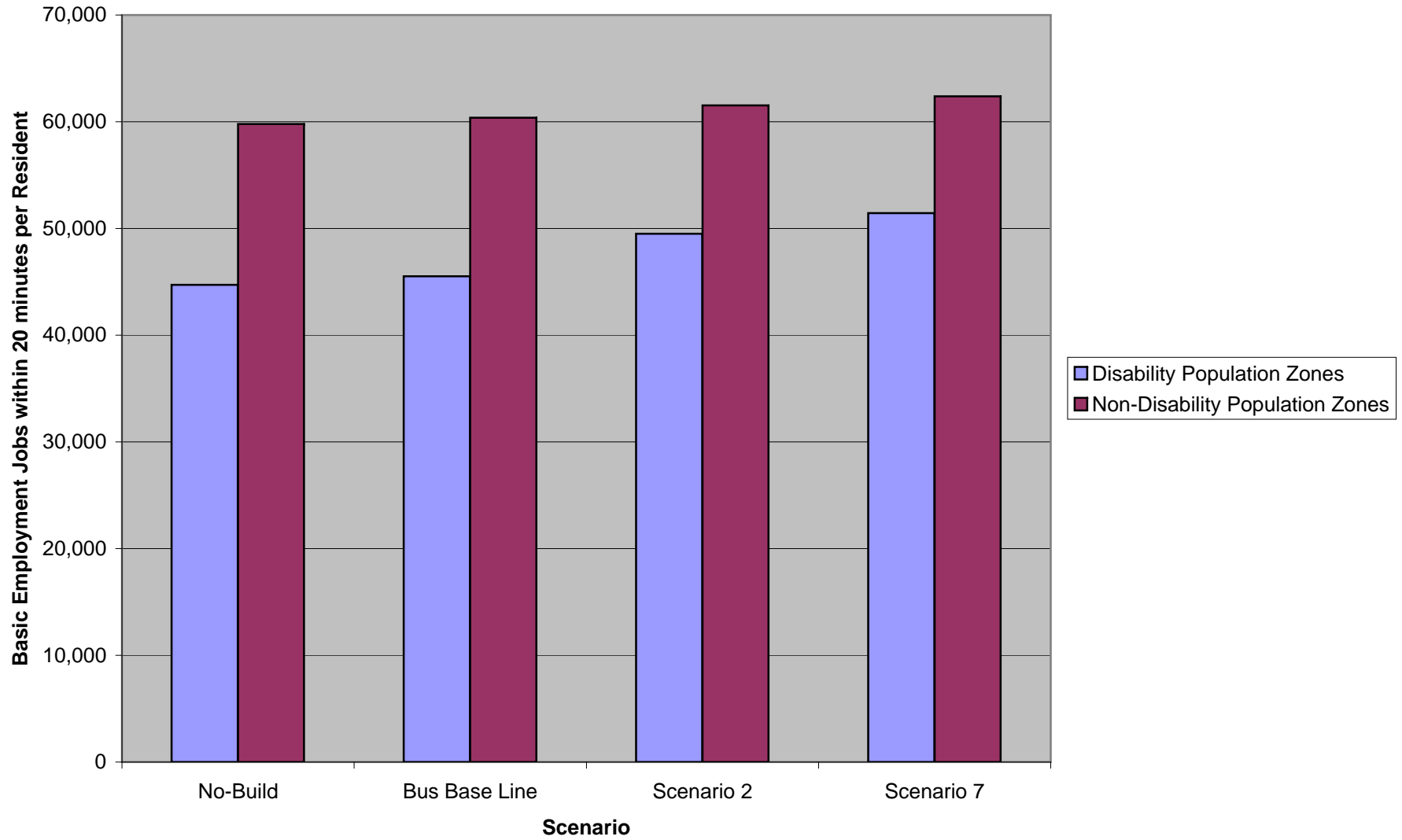


Figure 3: Transit Access to Retail Employment Jobs

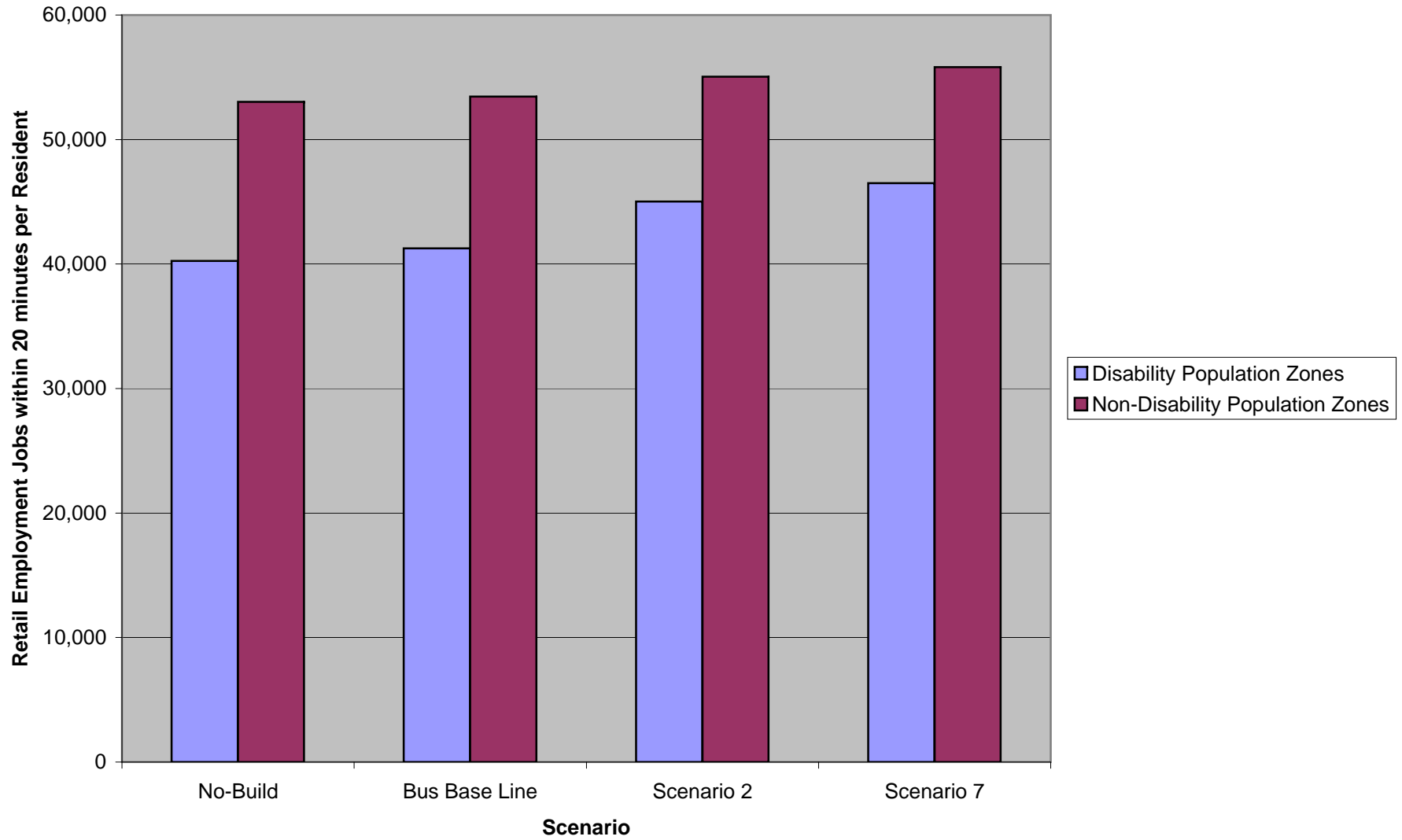


Figure 4: Transit Access to Service Employment Jobs

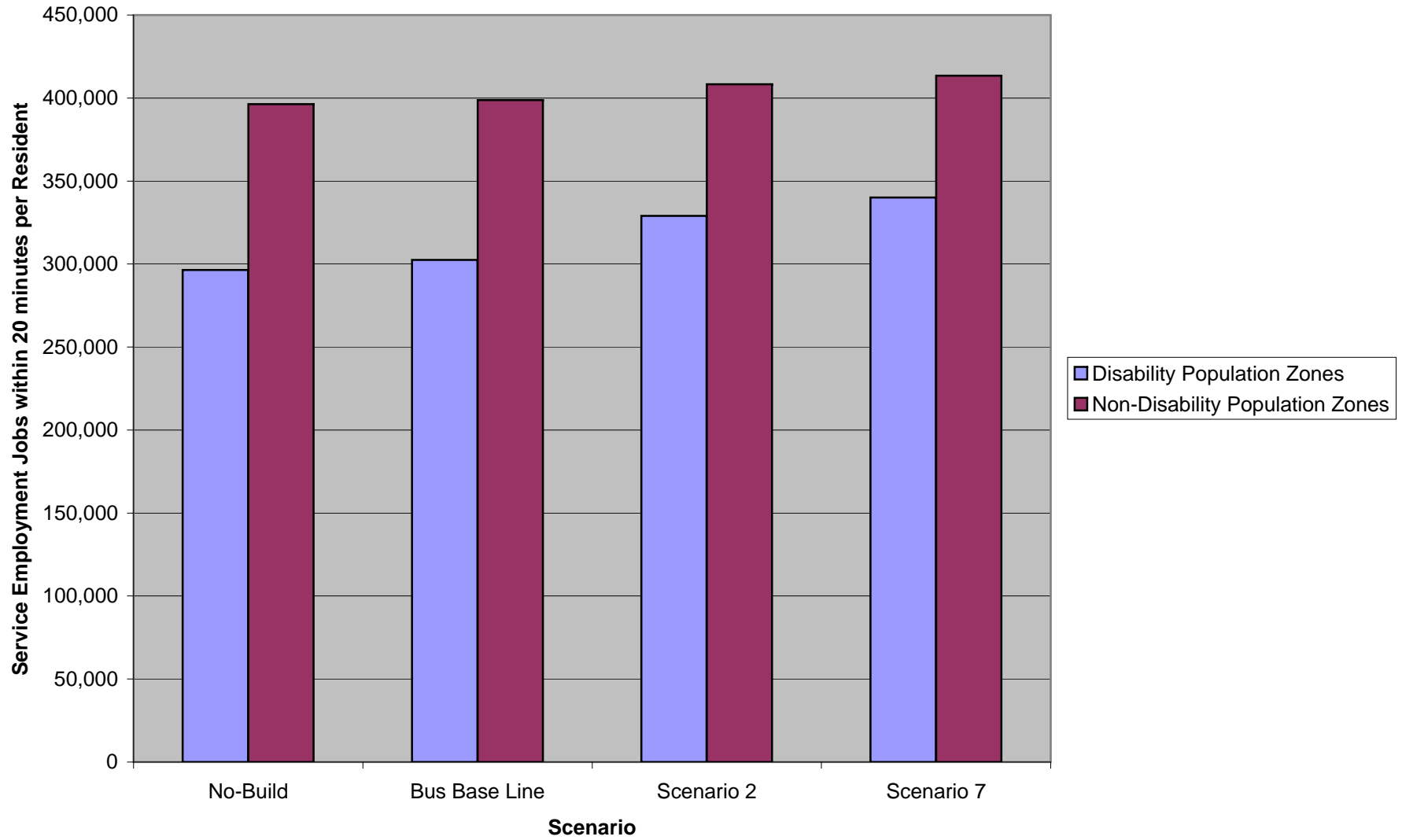


Figure 5: Transit Time to Accessible Basic Employment Jobs

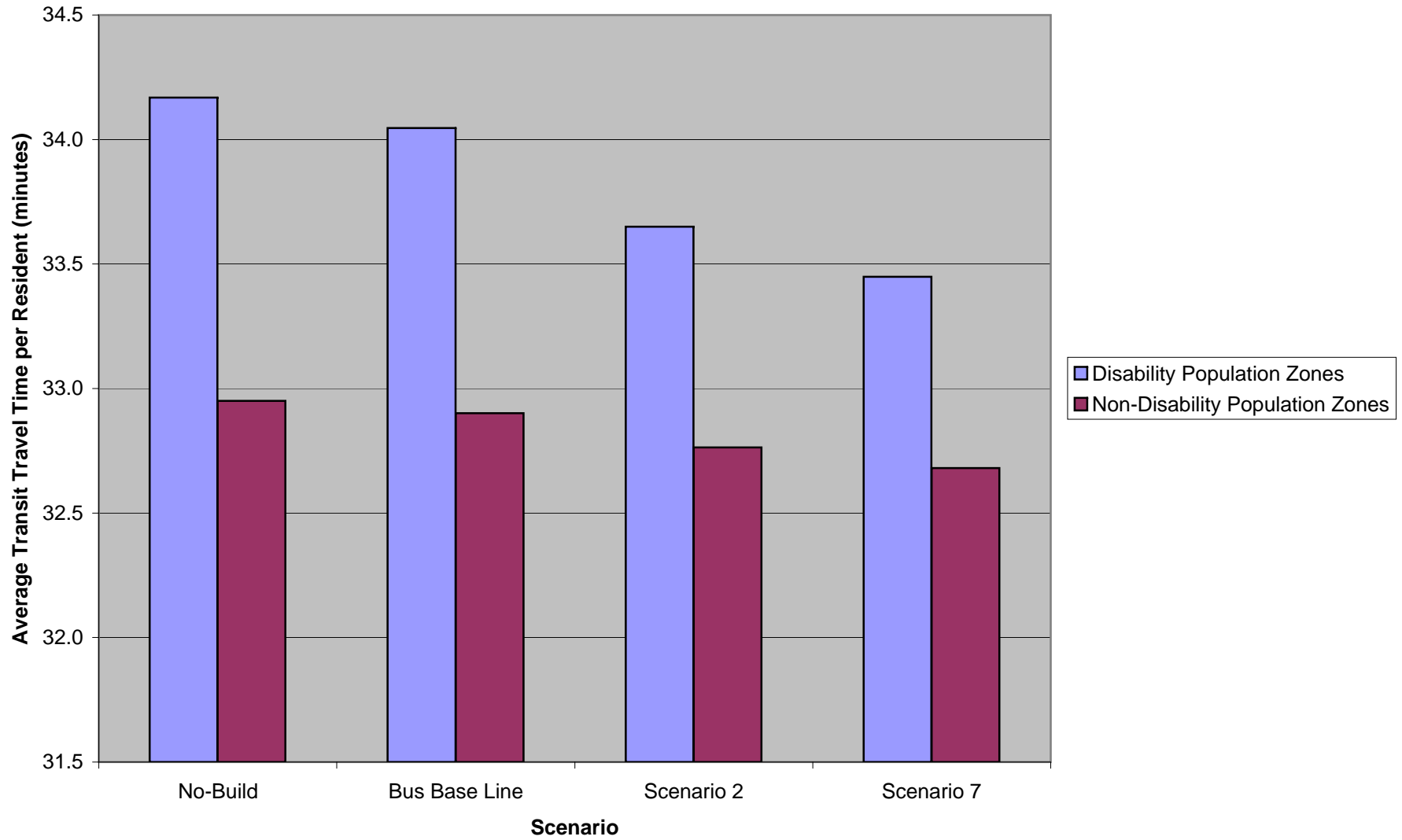


Figure 6: Transit Time to Accessible Retail Employment Jobs

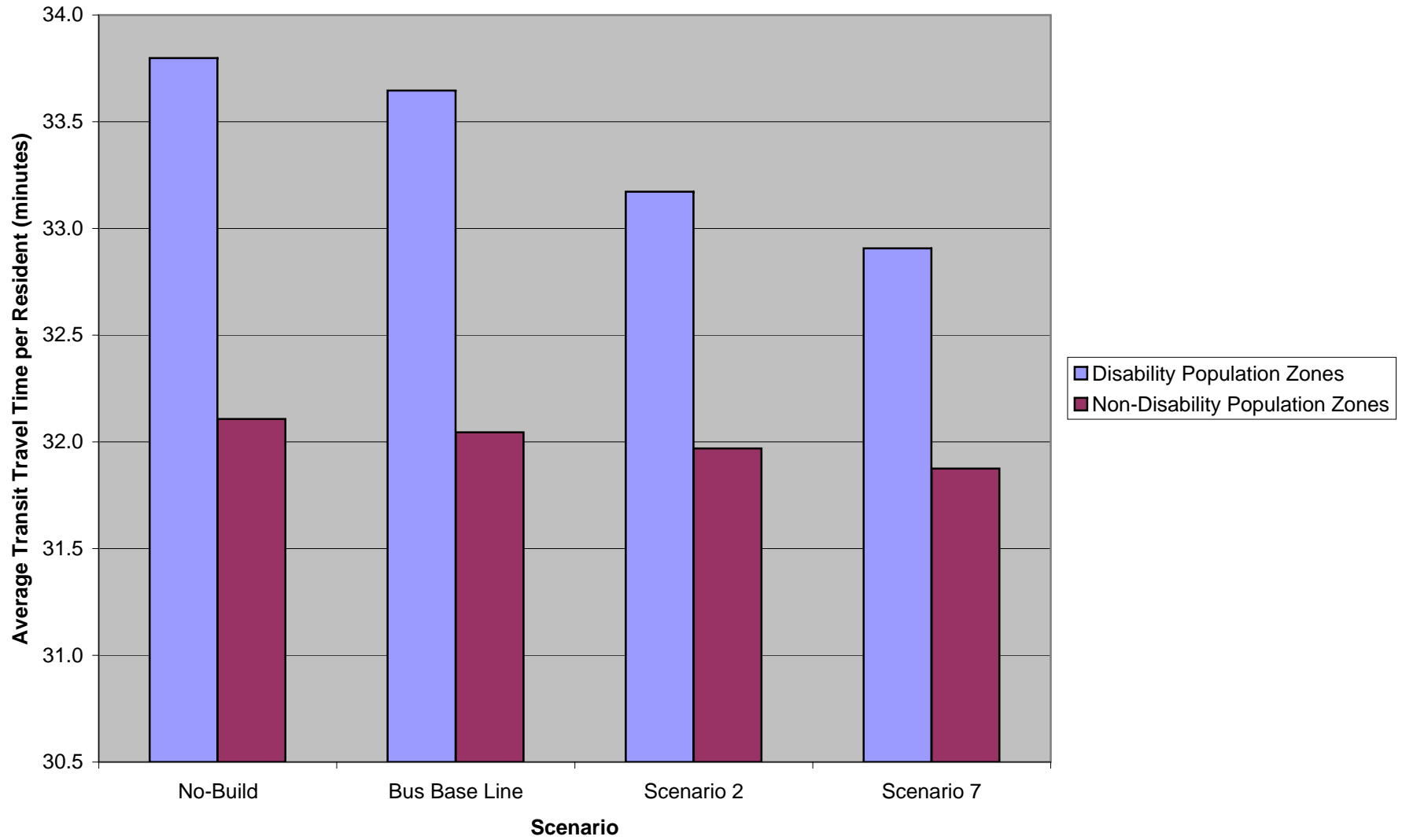


Figure 7: Transit Time to Accessible Service Employment Jobs

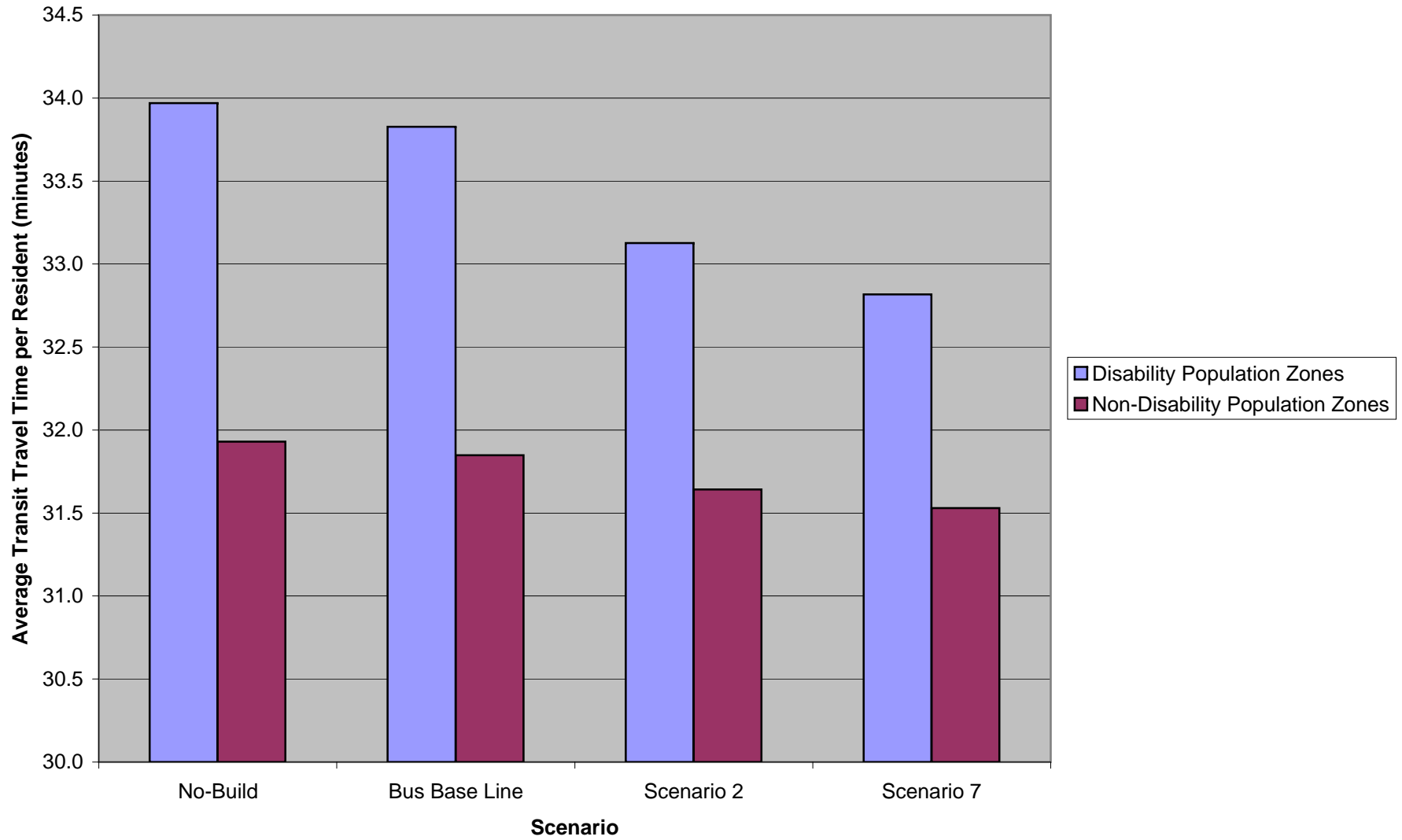


Figure 8: Transit Access to Colleges

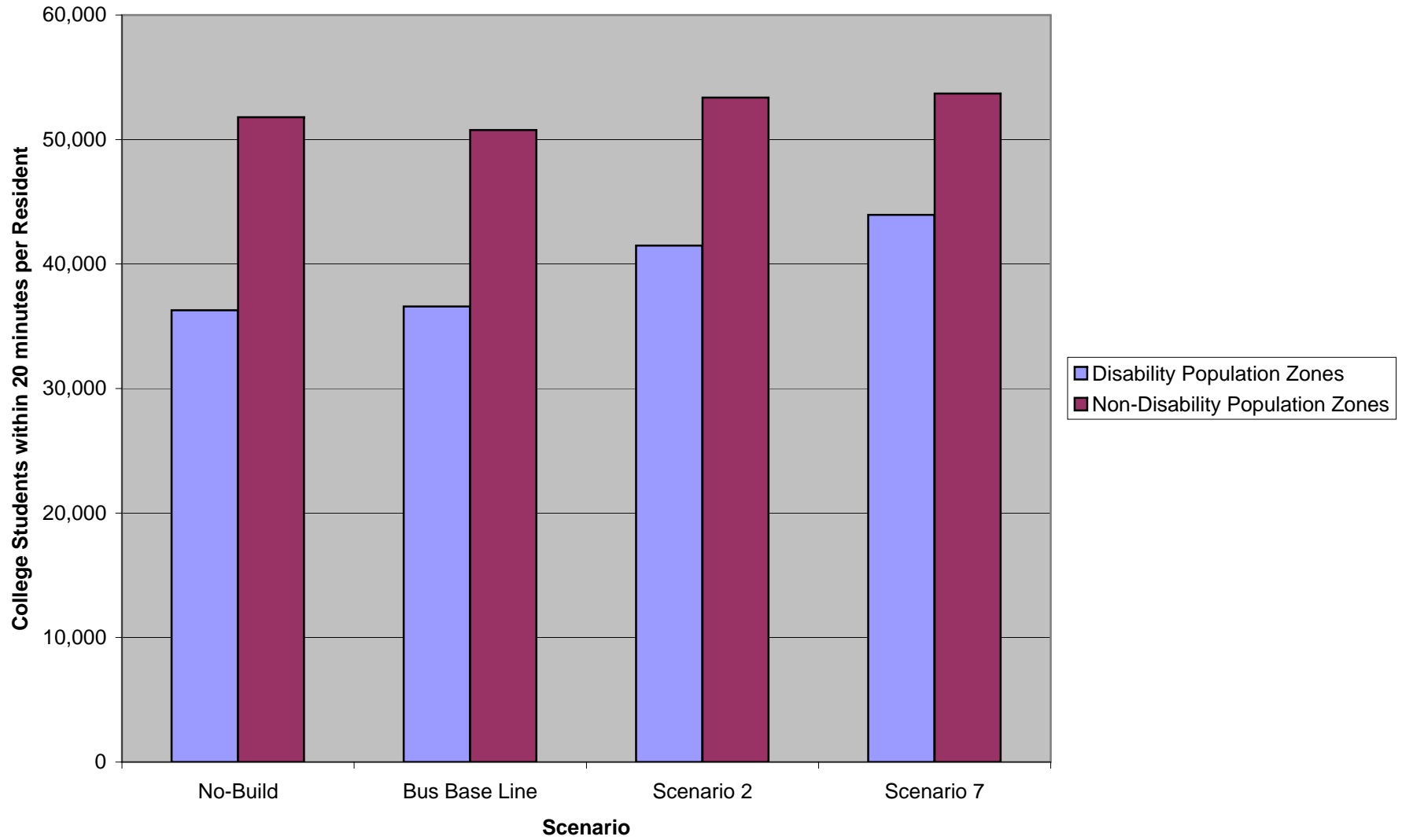


Figure 9: Transit Access to Hospitals

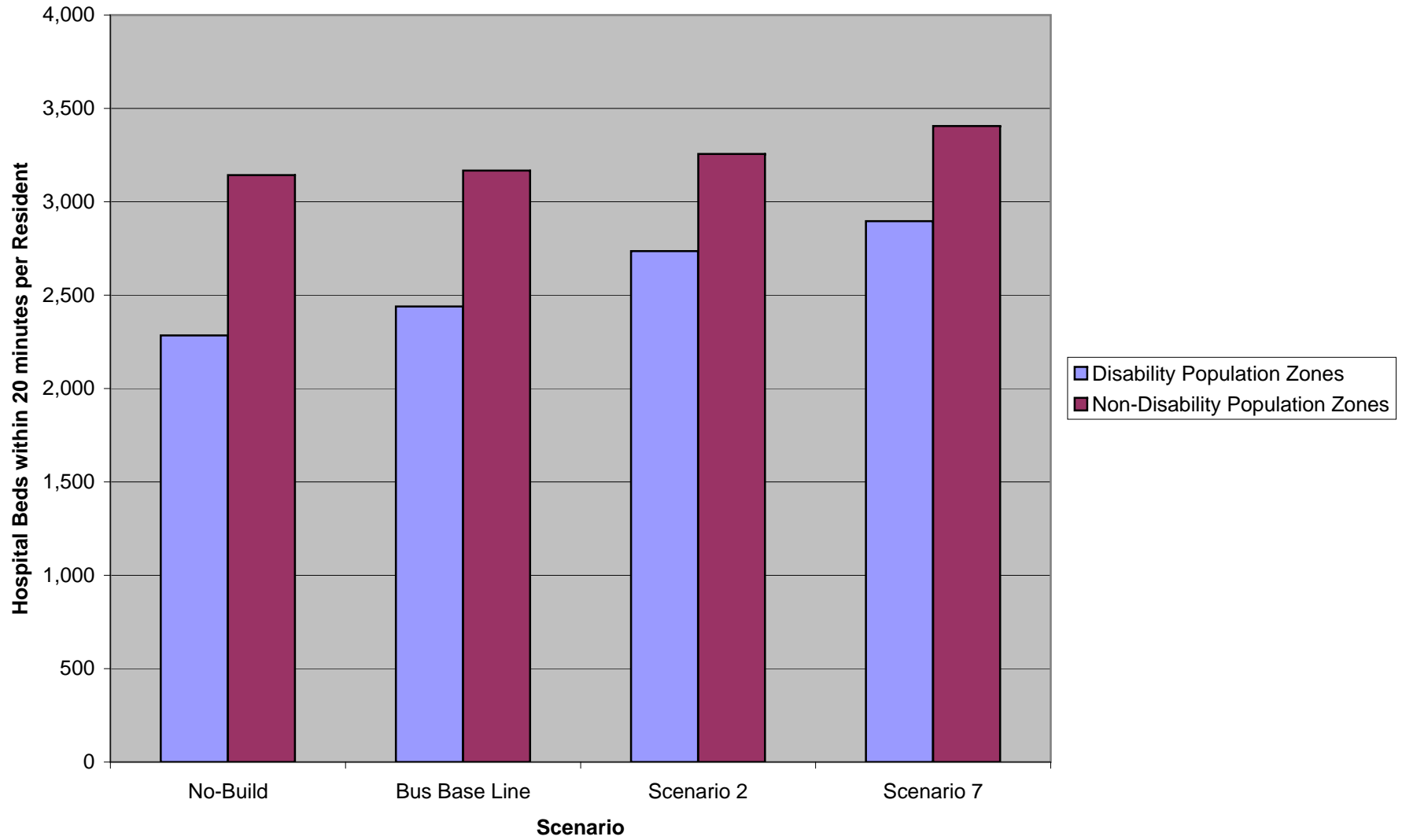


Figure 10: Transit Time to Accessible Colleges

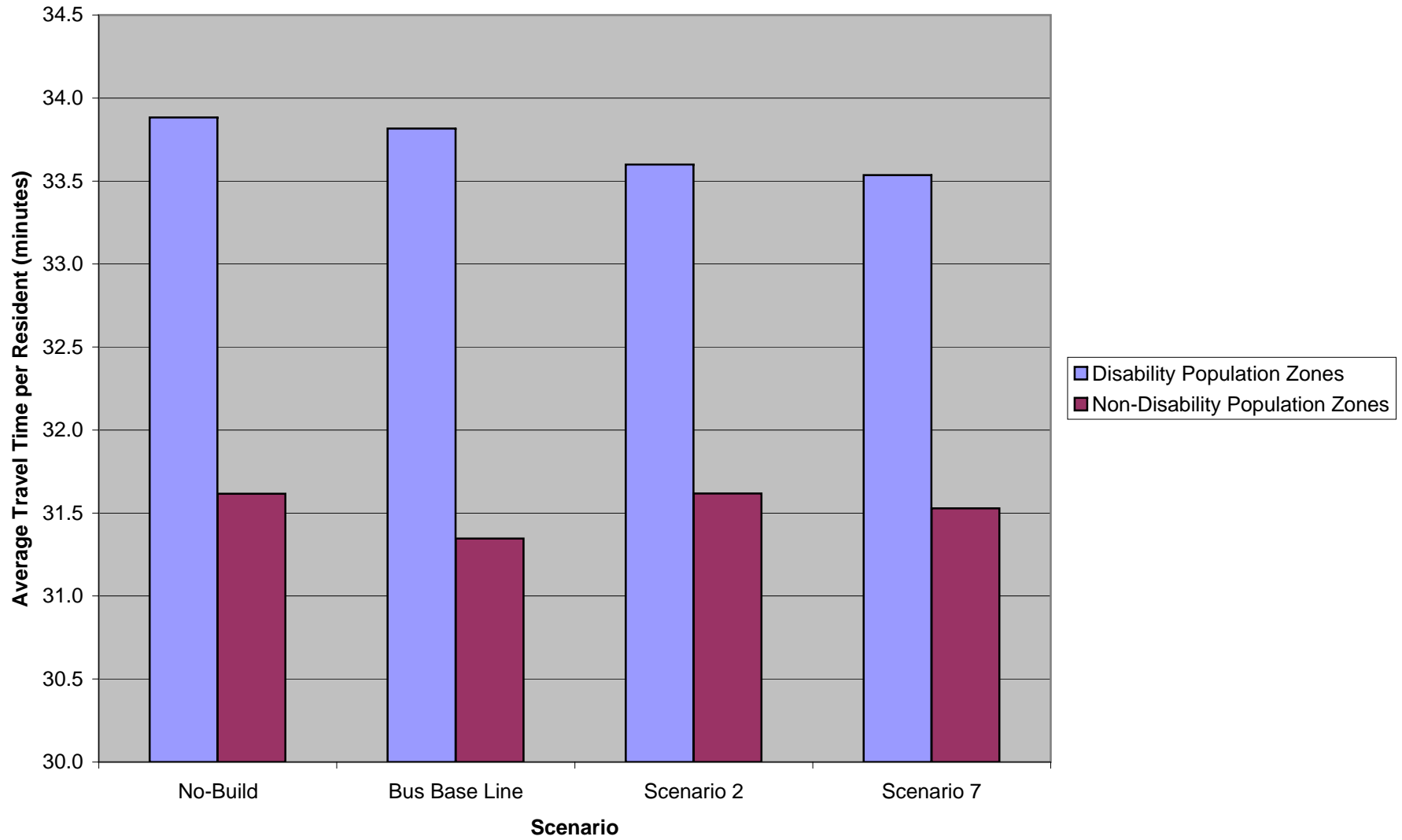


Figure 11: Transit Time to Accessible Hospitals

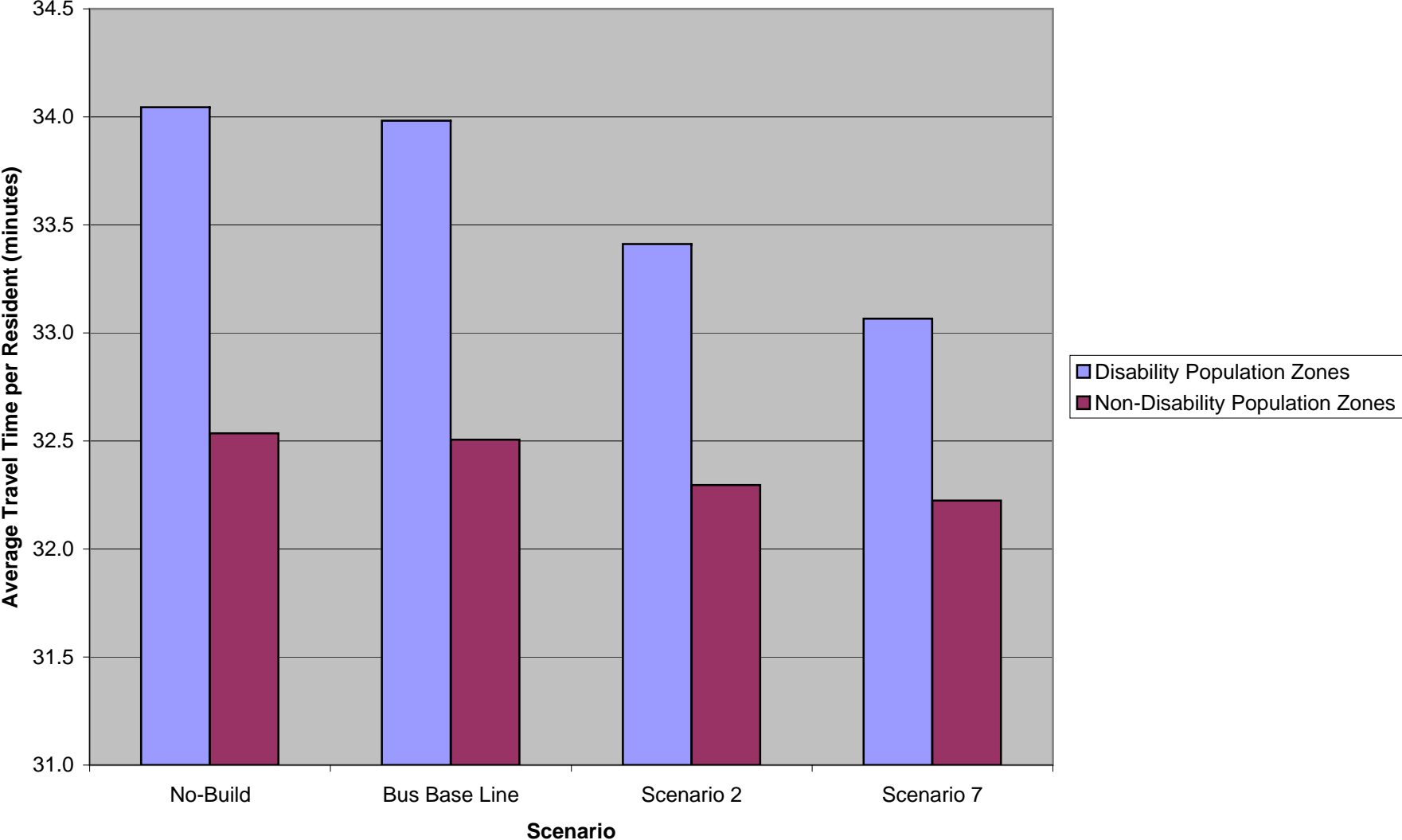


Figure 12: Transit Trip Production Times

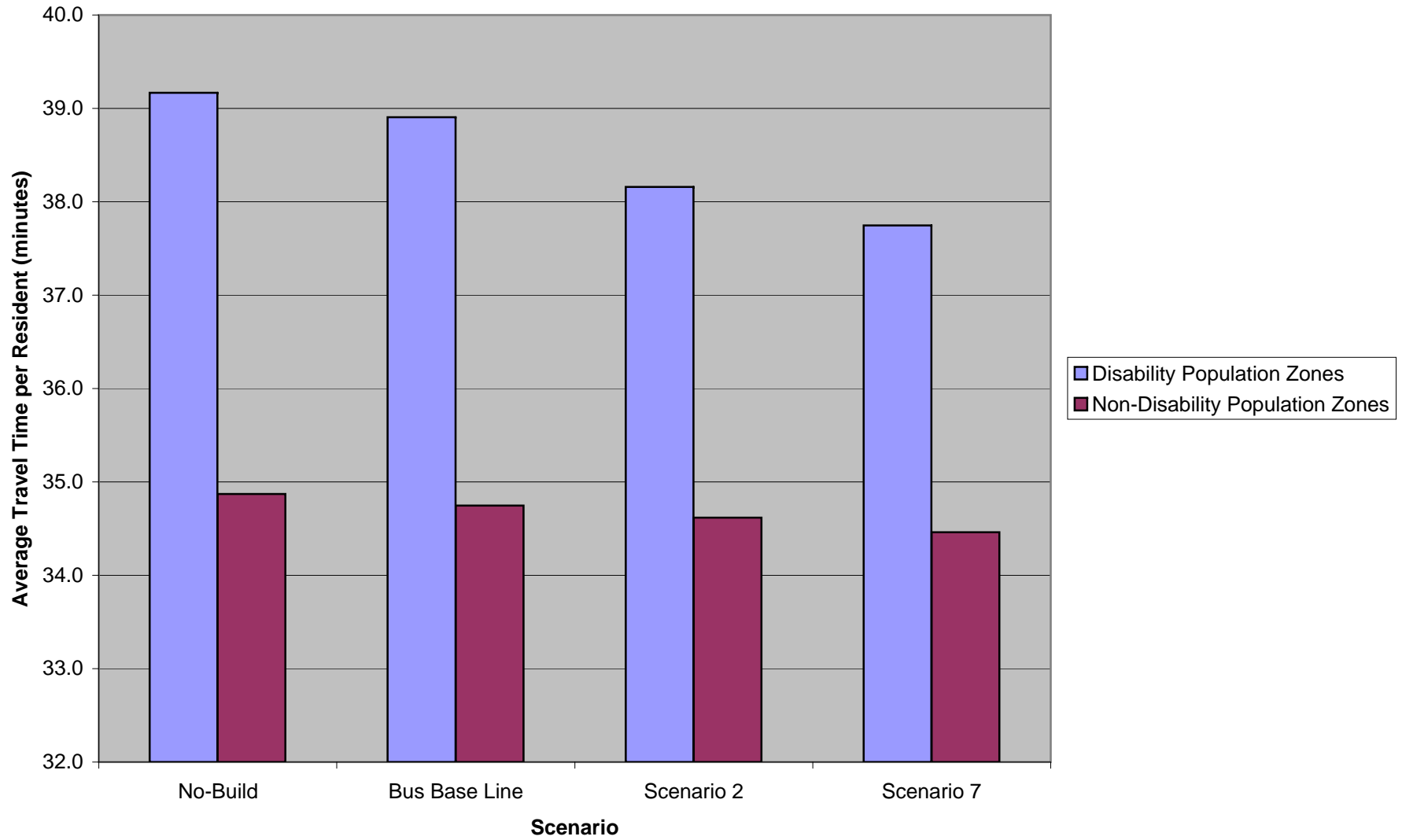


Figure 13: Transit Trip Attraction Times

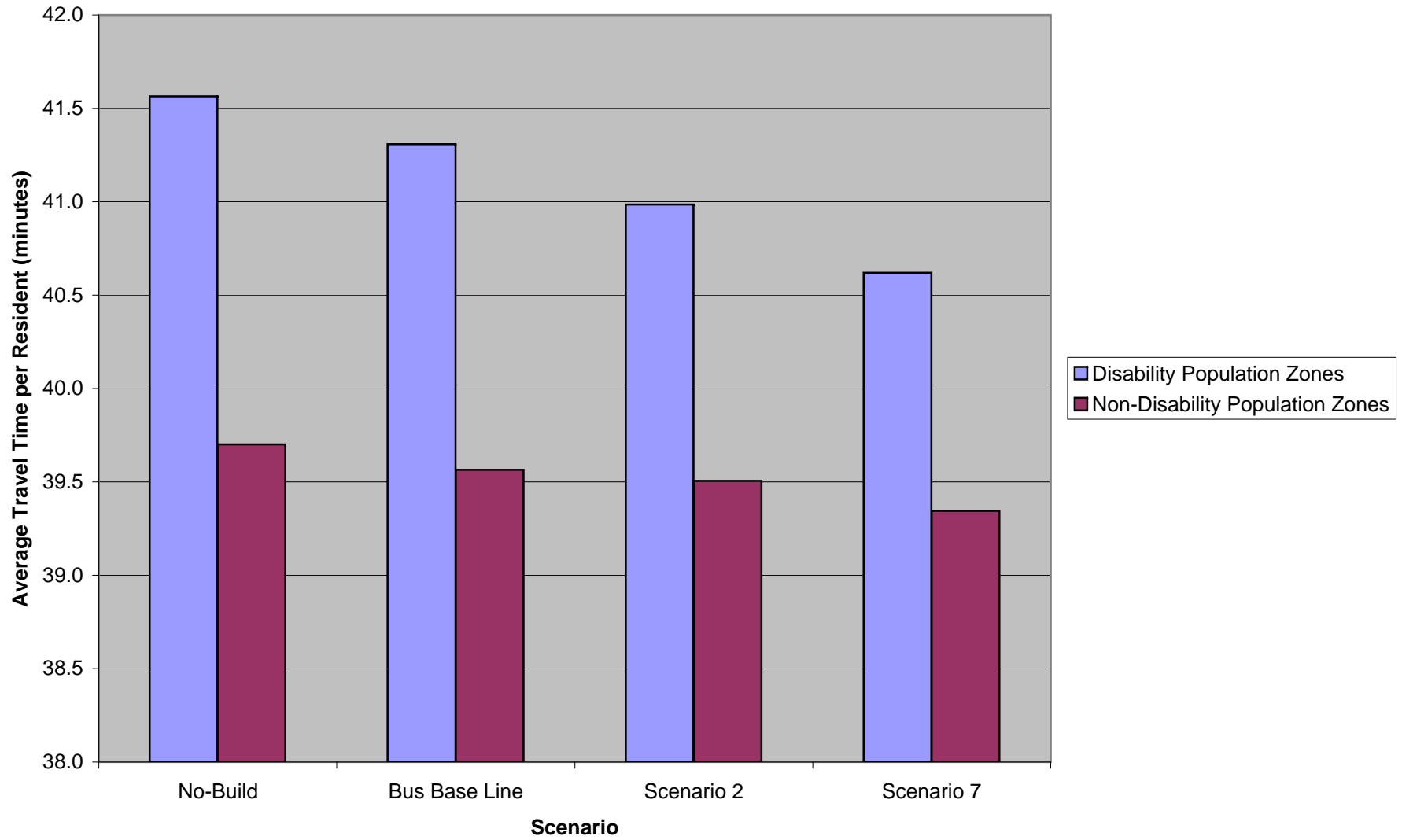


Figure 14: Highway Traffic Density

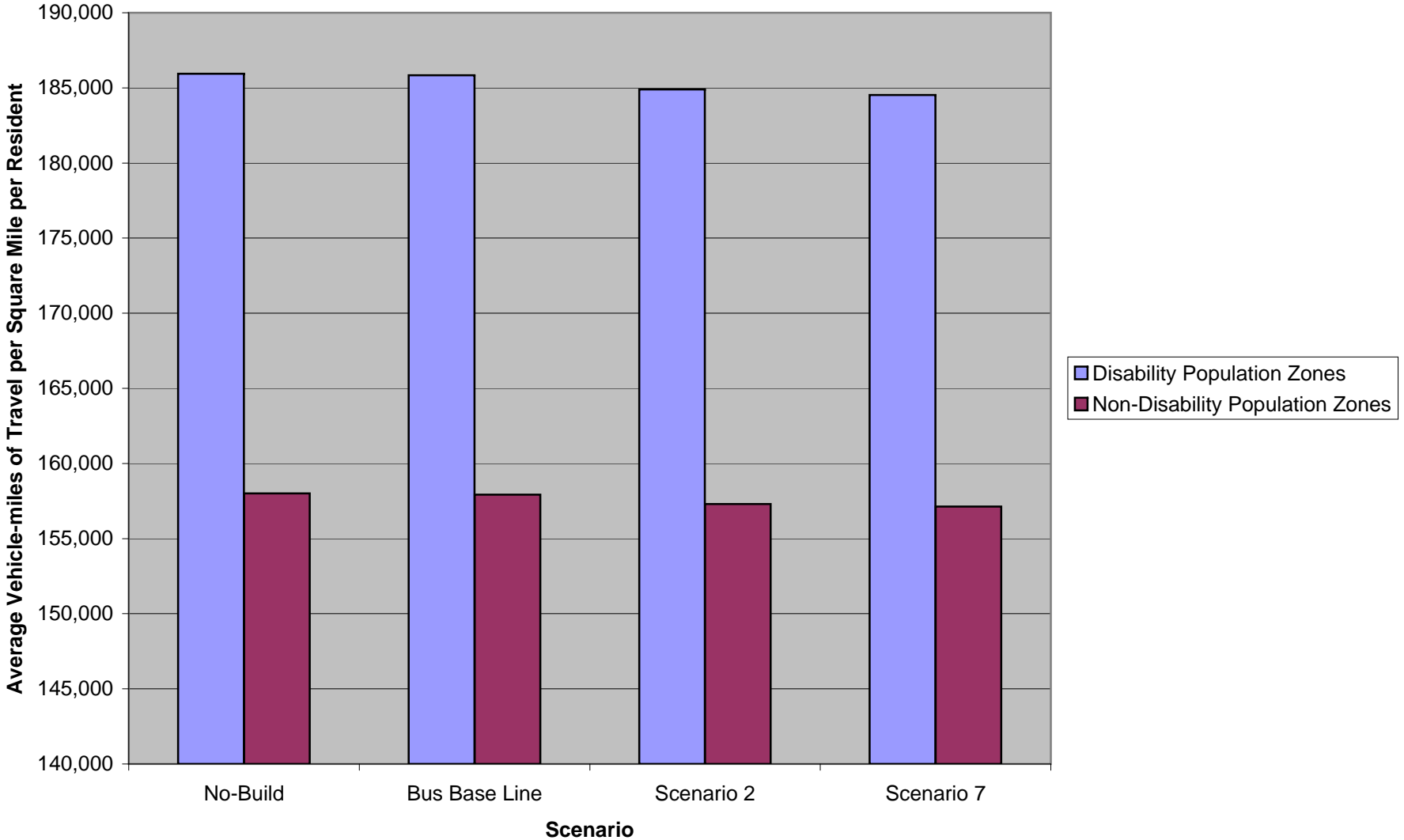


Figure 15: CO Emissions Density

