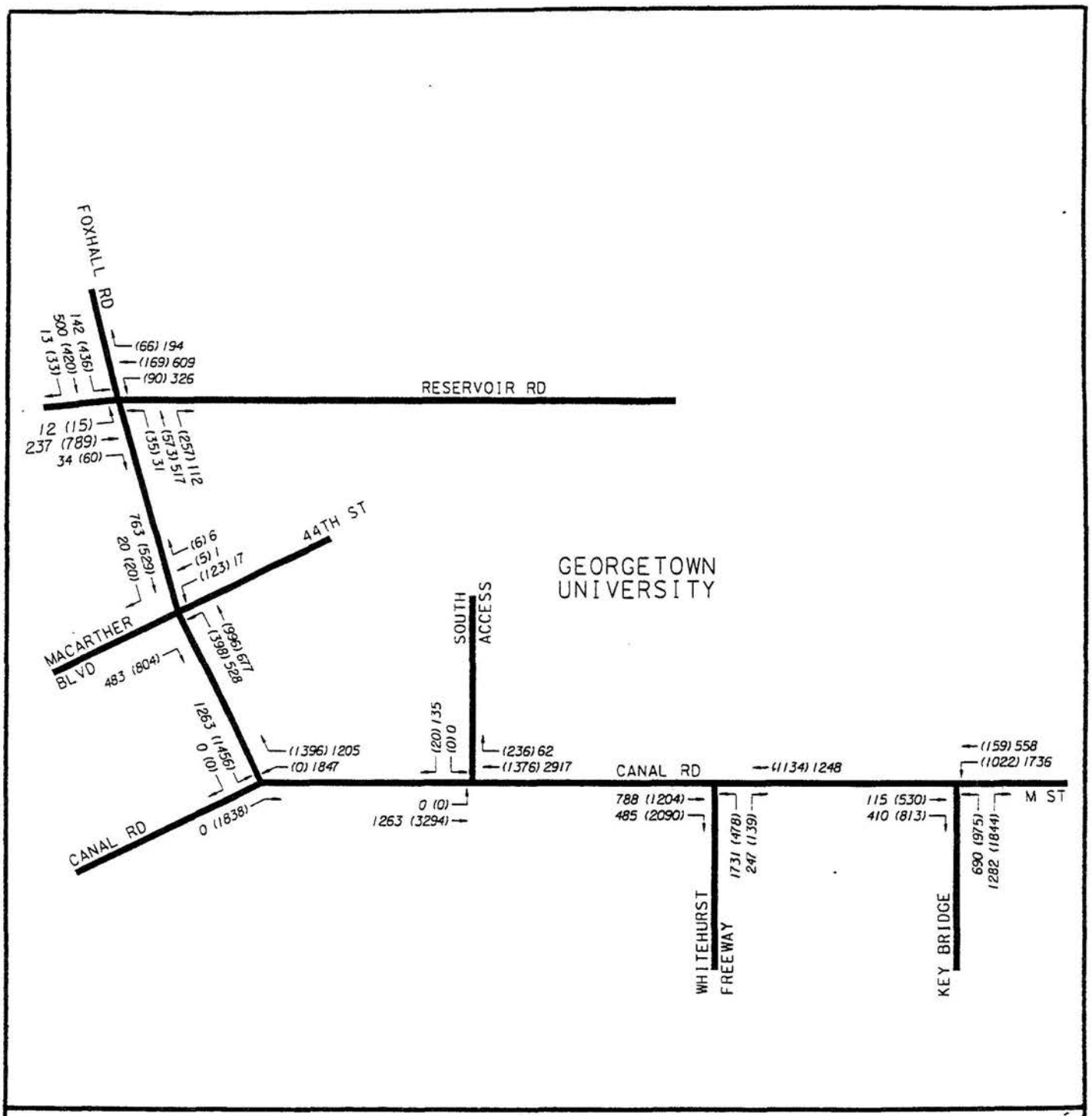


LEGEND

(00) - Morning Peak Hour

00 - Afternoon Peak Hour

1993 Peak-Hour Traffic

Board of Zoning Adjustment
District of Columbia
CASE NO.16566
EXHIBIT NO.7A3

initiation of the FEIS process). For traffic planning purposes, **a twenty year project design period is typically applied**; for this project, 2016 **was maintained** as the Design Year **to provide consistency with the DEIS.**

Traffic counts for the years 1988 through 1993, indicate that the changes in traffic volumes on the streets near the University have varied by time period. For the immediate area, daily traffic volume has decreased about 0.5 percent annually. However, Canal Road average daily traffic grew at an annual increase of 1.6 percent during the period 1982 to 1993. Canal Road peak hour traffic grew only one percent overall. For streets in the area, the morning peak-hour average increased about 0.3 percent annually, while the afternoon peak-hour average decreased about 1.2 percent annually. These trends are consistent with other parts of the metropolitan area, which show a lower rate of increase in traffic during the peak hours than throughout the day. This is because without new road capacity, traffic growth during the peak hours is very limited. Thus, the time period for peak conditions has expanded into adjacent hours and has made the peak periods become longer.

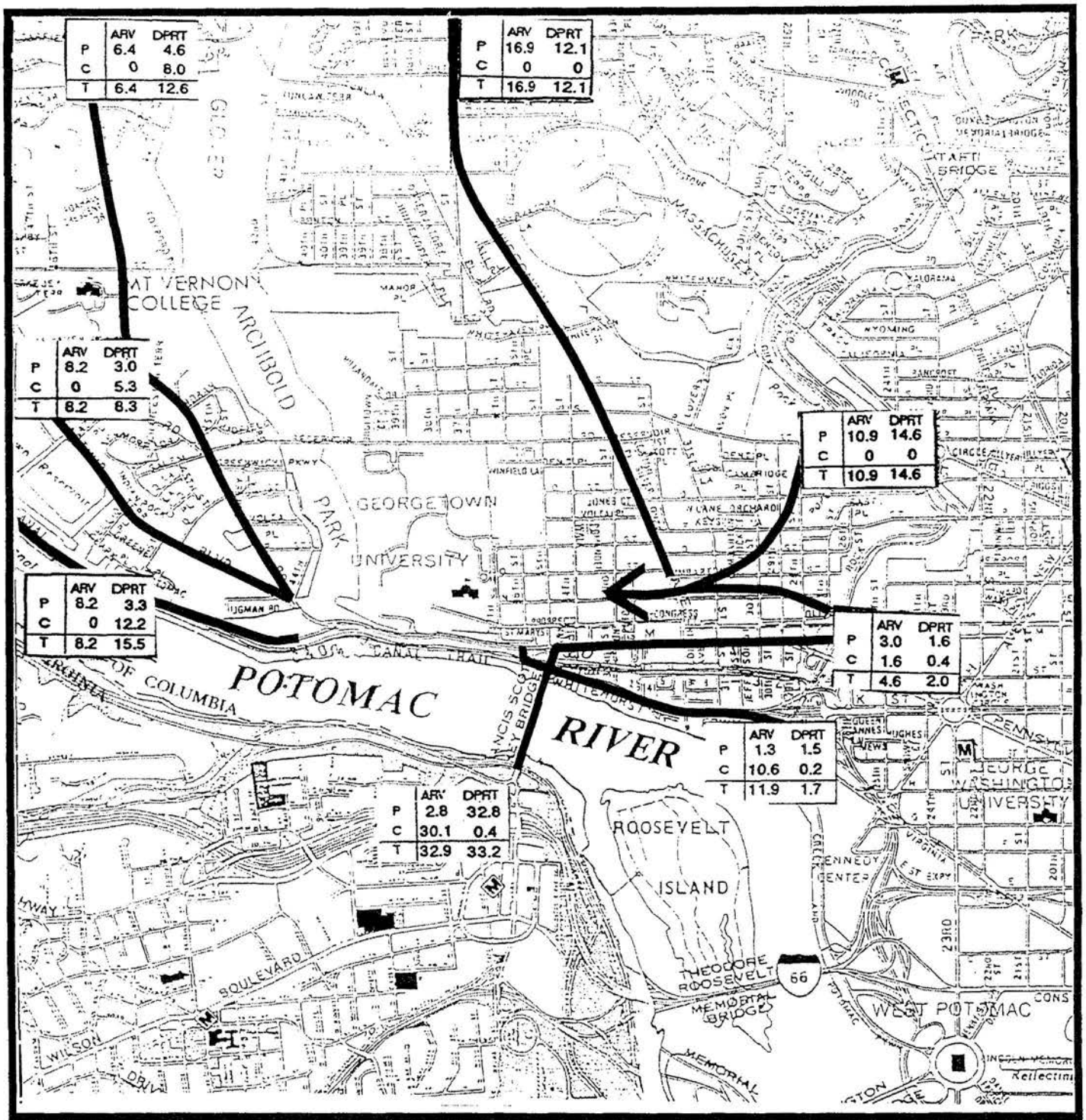
The District of Columbia has estimated an average growth rate in traffic for the area to be 0.75 percent per year. Compounding this growth factor annually through the Design Year of 2016, the **background** traffic estimates used for this study would have "grown" by 18.75 percent from 1993 levels.

Travel Patterns and Traffic to the Main Academic Campus

Access patterns to and from the University's Main Academic Campus were determined by a survey of origins of vehicles entering the University on a typical weekday via the Canal Road and Prospect Street gates. To analyze the results, the metropolitan area was divided into five zones. From the survey, the number and percentage of vehicles that use the major routes to arrive to and depart from the University were identified, as shown in **Table 3-5.** The distribution is illustrated generally on **Figure 3-17.**

There is a major difference in the traffic split between arrivals and departures at the two entrances to the Main Academic Campus parking area. The Prospect Street entrance has a greater percentage of both arrivals and departures. However, the Prospect-Canal split is only 58-42 percent for arrivals, but 73-27 percent for departures. The primary component of the difference is traffic using the Key Bridge, which accounts for about one-third of the total trips to and from the academic campus of the University. Most Key Bridge University-related traffic enters from Canal Road **but** departs via Prospect Street. Much of the traffic from the north and west, about 25 percent of the total, uses Prospect Street to enter the campus and Canal Road to depart.

Traffic from local streets east of the University makes up about 15% of the trips to the Main Academic Campus parking lot, with another almost 17% coming from Wisconsin Avenue. Most of this traffic uses the Prospect Street entrance to the Main Academic Campus parking area for both arrivals and departures. Traffic arriving from the Whitehurst Freeway and using the Canal Road entrance yields about 10% of the parking lot users. Because this traffic cannot easily access the Whitehurst Freeway from either exit, most of it finds other routes home than eastbound Canal



Data show percentage of arriving and departing trips that use each access rout.

P - Prospect Street entrance
C - Canal Road Entrance
T - total, both entrance
ARV - arriving
DPRT - departing

Distribution of Commuter Trips

Georgetown University Entrance Road ● Environmental Impact Statement **Figure 3-17**

Federal Highway Administration

Road.

The peak hours for the University-related traffic are between 8:00 and 9:00 a.m., and between 5:00 and 6:00 pm. These time periods coincide with the peak hour traffic for Canal Road and Prospect Street. During the morning peak hour, the entering volumes at the two entrances are similar while in the afternoon more vehicles depart from the Prospect Street entrance than the Canal Road entrance. The unbalanced percentage of commuters entering and exiting through the two gates is related to the lack of eastbound access and egress movements to and from Canal Road as discussed previously with regard to travel patterns.

TABLE 3-5

Commuter Trips Distributed By
Major Routes Used By Main Academic Campus Entrance
In Percent By Arrival and Departure

	ARRIVALS			*DEPARTURES*		
	Canal Road	*Prospect Street*	*Total*	*Canal Road*	*Prospect Street*	*Total*
ROUTE						
Wisconsin Ave	0.0	16.9	16.9	0.0	12.1	12.1
Streets NE of GU	0.0	10.9	10.9	0.0	14.6	14.6
M Street	1.6	3.0	4.6	0.4	1.6	2.0
Whitehurst Fwy	10.6	1.4	12.0	0.2	1.5	1.7
Key Bridge	30.2	2.7	32.9	0.4	32.8	33.2
Canal Road	0.0	8.2	8.2	12.2	3.3	15.5
MacArthur Blvd	0.0	8.2	8.2	5.3	3.0	8.3
Foxhall Road	0.0	6.4	6.4	8.0	4.6	12.6
Unspecified	0.0	0.0	0.0	0.0	0.0	0.0
Total	42.3	57.7	100.0%	26.5	73.5	100.0 %

During February and March of 1996, morning and afternoon turning movement counts were taken at various intersections east of the University (*see Table 3-6*). The February counts occurred while the University was in session whereas the March counts occurred while the University was on break. The results indicate that there are no significant volume changes at the intersections that were counted, regardless of whether the University is in session.

TABLE 3-6

PEAK HOUR TURNING MOVEMENT COUNTS
UNIVERSITY IN SESSION AND OUT OF SESSION

INTERSECTION LOCATION	TIM	IN SESSION	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			TOTAL
			RT.	TH.	LT.	RT.	TH.	LT.	RT.	TH.	LT.	RT.	TH.	LT.	
WISCONSIN AVE. AND PROSPECT ST.	AM	IN	68	790	0	0	0	0	0	408	35	90	0	52	1443
		OUT	52	770	0	0	0	0	0	350	42	76	0	32	1322
		DIFF.	16	20	0	0	0	0	0	58	-7	14	0	20	
			36			0			51			34			121
	PM	IN	98	472	0	0	0	0	0	580	54	68	0	62	1334
		OUT	52	446	0	0	0	0	0	702	52	76	0	48	1376
		DIFF.	46	26	0	0	0	0	0	-122	2	-8	0	14	
			72			0			-120			6			-42
34TH ST. AND PROSPECT ST.	AM	IN	4	461	34	0	262	29	0	0	0	288	120	0	1198
		OUT	10	479	13	0	221	40	0	0	0	302	106	0	1171
		DIFF.	-6	-18	21	0	41	-11	0	0	0	-14	14	0	
			-3			30			0			0			27
	PM	IN	6	284	11	0	185	110	0	0	0	362	78	0	1036
		OUT	4	338	10	0	136	124	0	0	0	378	34	0	1024
		DIFF.	2	-54	1	0	49	-14	0	0	0	-16	44	0	
		TOTAL	-51			35			0			28			12
35TH ST. AND RESERVOIR ST.	AM	IN	33	294	9	6	162	4	9	175	180	570	372	83	1897
		OUT	37	311	5	6	173	1	4	207	180	622	371	88	2005
		DIFF.	-4	-17	4	0	-11	3	5	-32	0	-52	1	-5	
			-17			-8			-27			-56			-108
	PM	IN	37	243	10	4	243	3	7	228	274	294	236	52	1631
		OUT	42	226	4	8	180	2	10	230	214	292	210	46	1464
		DIFF.	-5	17	6	-4	63	1	-3	-2	60	2	26	6	
			18			60			55			34			167
37TH ST. AND PROSPECT ST.	AM	IN	35	1	28	32	122	1	2	1	0	0	56	13	291
		OUT	31	0	15	18	98	2	1	1	2	1	53	10	232
		DIFF.	4	1	13	14	24	-1	1	0	-2	-1	3	3	
			18			37			-1			5			59
	PM	IN	34	1	36	62	80	2	2	1	0	1	182	72	473
		OUT	18	0	21	34	40	3	1	0	2	0	166	52	337
		DIFF.	16	1	15	28	40	-1	1	1	-2	1	16	20	
			32			67			0			37			136

Note: This table is new to the FEIS.

3.2.3 Traffic Operations

Traffic operations were evaluated for **Foxhall Road between Reservoir Road and Canal Road, and** for Canal Road between Foxhall Road and Key Bridge. Several measures of effectiveness were evaluated individually and in combination, including Level of Service, travel time, and queuing. The *Traffic & Transportation Technical Report* **and *Network Simulation Traffic Operations Analysis Memoranda*** provide details of these evaluations with the results **presented in Chapter 5, "Additional Traffic Analysis of the Preferred Alternative".**

Georgetown University's Canal Road entrance is about 330 meters (1,100 feet) from the Foxhall Road intersection and about 450 meters (1,500 feet) from the intersection with the Whitehurst Freeway. The two intersections are controlled by traffic signals that are part of the District's computerized system.

Eastbound in the morning peak hour and westbound in the afternoon peak hour are the most critical traffic directions on Canal Road. Eastbound morning peak-hour traffic experiences backups at the intersection with the Whitehurst Freeway. The right lane of two eastbound lanes on Canal Road at Whitehurst Freeway is restricted to turning onto the freeway and the left lane can either turn or continue straight to M Street or Key Bridge. Thus traffic heading to Virginia via the Key Bridge must stay in the left lane at this intersection. This causes a queue for traffic in the left lane while traffic in the right lane moves more freely. At Key Bridge, the right lane and middle lane must turn right, and through traffic stays in the left lane.

Travel conditions on Canal Road were observed during the peak hours and during the day. Eastbound traffic on Canal Road was observed to back up from the Whitehurst signal to east of the University entrance during the morning peak hour. In some cases, eastbound traffic from Foxhall Road attempting to enter Canal Road was blocked during the green cycle of their signal. During the non-peak hours of the day, traffic flowed evenly and constantly along Canal Road in both directions. Westbound traffic was observed to be slowing down during the afternoon peak hour; however, the queue was rarely noticed to block the University exit or to remain backed up to the exit from the Foxhall Road intersection for any appreciable time. Eastbound traffic in the afternoon peak was observed to queue from the Whitehurst Freeway intersection to east of the University entrance.

Traffic using the entrance at Prospect Street contributes to congestion and backups on streets east of the campus during both the morning and afternoon peak hours. On a daily basis, approximately 1,943 and 2,385 vehicles enter and exit through the Prospect Street entrance, respectively.

3.3 PHYSICAL AND NATURAL ENVIRONMENT

This section discusses existing conditions of air quality, noise levels, and the natural environment. Components of the natural environment include geology and soils, hydrology, water resources, wetlands, general ecology, and wildlife, including threatened and endangered species. The investigation of the existing baseline conditions included site visits by qualified geologists and

biologists, the use of secondary source documents, and telephone and written contacts with knowledgeable resource agencies. **More details of existing conditions and source materials are provided in the appropriate technical reports, listed at the front of this document, and also in the bibliography.**

3.3.1 Air Quality

The U.S. Environmental Protection Agency (EPA) has set standards for certain "criteria" air pollutants. These standards were set to protect human health, welfare and property. They are referred to as the National Ambient Air Quality Standards (NAAQS), and cover the following pollutants: carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 microns (PM-10), and lead (Pb). The primary and secondary NAAQS for these six pollutants are presented in **Table 3-7**.

In July 1997, the EPA adopted revised ozone and particulate matter standards, which are also presented in Table 3-7 on the NAAQS. The EPA is phasing out and replacing the 1-hour primary ozone standard with a new 8-hour standard to protect against longer exposure periods. The new 8-hour ozone standard is 0.08 ppm. The existing 1-hour ozone standard will not be revoked in a given area until that area has achieved three consecutive years of air quality data meeting the 1-hour standard.

Carbon monoxide (CO) is the predominant pollutant associated with motor vehicles, and is found in highest concentration near highways and busy intersections. Carbon monoxide standards are typically only exceeded in urban downtown areas during the winter months and under congested traffic conditions. Carbon monoxide emissions are higher during the winter months as colder temperatures reduce fuel combustion efficiency which increases exhaust emissions. In addition, stable atmospheric conditions that often occur during colder temperatures reduce pollutant dispersion which can contribute to NAAQSs violations.

Ozone O_3 is a secondary pollutant formed by the reaction of precursor emissions (e.g., nitrogen oxides and hydrocarbons) in the presence of sunlight. It is primarily a summer time pollutant.

Particulate matter less than 10 microns (PM-10) is the third pollutant associated with motor vehicle operations. Nitrogen dioxide, sulfur dioxide and lead will not be analyzed for this project because they are not associated with transportation projects.

Consultation was carried out with the District of Columbia Department of Consumer and Regulatory Affairs, Air Resources Management Division, to identify CO concentrations in the area.

"Attainment" Status

The term "non-attainment" defines an area designated by EPA where the NAAQS's have been exceeded. **A "maintenance area" is defined as any geographic region of the United States**

Table 3-7
National Ambient Air Quality Standards

Pollutant	Primary[a]	Secondary[a]
Total Suspended Particulates		
Annual geometric mean **24-hour average**	No standard No standard	No standard No standard
Lead (Pb)		
Quarterly average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Particulate Matter ($PM_{2.5}$)		
Annual arithmetic mean **24-hour average**	15 $\mu g/m^3$ 65 $\mu g/m^3$	15 $\mu g/m^3$ 65 $\mu g/m^3$
Particulate Matter (PM_{10})		
Annual arithmetic mean **24-hour average**	50 $\mu g/m^3$ 150 $\mu g/m^3$	50 $\mu g/m^3$ 150 $\mu g/m^3$
Sulfur Dioxide (SO_2)		
Annual average **24-hour average** **3-hour average** **1-hour average**	0.03 ppm 0.14 ppm No standard No standard	No standard No standard 0.50 ppm No standard
Carbon Monoxide (CO)		
8-hour average **1-hour average**	9 ppm 35 ppm	9 ppm 35 ppm
Ozone (O_3)		
1-hour average[b]	0.12 ppm	0.12 ppm
8-hour average[c]	.08 ppm	.08 ppm
Nitrogen Dioxide (NO_2)		
Annual average	0.05 ppm	0.05 ppm

Notes: **Entire table has been updated to the 1997 standards.**
Annual standards never to be exceeded. Short-term standards not to be exceeded more than once per year unless noted.

a Primary standards are set to protect public health. Secondary standards are based on other factors (e.g., protection of crops and materials, avoidance of nuisance conditions).
b Not to be exceeded on more than 1 day per calendar year.
c Concentration-based form, 3 year average of the annual 4th highest daily 8-hour maximum ozone concentration

ppm = parts per million
PM_{10} = particles 10 or less microns in size
$\mu g/m^3$ = micrograms per cubic meter

Source: U.S. Environmental Protection Agency, 1997.

previously designated non-attainment pursuant to the Clean Air Act Amendments of 1990 and subsequently redesignated to attainment subject to the requirement to develop a maintenance plan.

While the Metropolitan Washington area has been designated an ozone non-attainment area, ozone is addressed as a regional pollutant rather than at the project level. **A maintenance plan has been prepared for the Metropolitan Washington area for carbon monoxide. The area meets attainment for all other pollutants.**

Conformity Requirements

Under the 1990 Clean Air Act conformity requirement, transportation activities cannot be federally funded or approved if they involve a regionally significant roadway unless they are consistent with state air quality goals. This means that conformity with 40 CFR 51 and 93 (i.e., conformity rule) be demonstrated as part of the project approval process. To meet conformity, the proposed project must meet the following provisions:

- **Must not cause or contribute to any new violations of the NAAQSs,**
- **Must not increase the frequency or severity of existing NAAQS violations, or**
- **Must not delay timely attainment of the NAAQSs.**

The proposed project would be federally funded and is within a CO maintenance area. In addition, because the project site is within the Metropolitan Washington ozone non-attainment area, it must conform to the State Implementation Plan (SIP) and be included within a conforming transportation plan and Transportation Improvement Plan (TIP) for the region. The project is included within an approved plan and TIP, and the Federal Highway Administration has determined that both the Plan and TIP conform to the SIP.

The FHWA, in accordance with Federal air quality standards, has set forth a policy to examine potential air quality impacts of proposed transportation projects in order to ensure the preservation and enhancement of air quality. As part of this environmental impact statement, an air quality evaluation was conducted for the proposed project. The findings of the analysis are summarized in Chapter 4 - Affected Environment, Section 4.3.1.

3.3.2 Noise

In accordance with the Federal-Aid Highway Act of 1970, the Federal Highway Administration has established noise standards to protect public health and welfare. The standards include noise abatement criteria, which are noise levels that represent a balancing of desirable noise levels with achievable noise levels. The criteria apply only to areas having regular human use and where lowered noise levels are desirable. They apply to that portion of the tract where the activity occurs. The standards set a limit on traffic related noise levels, above which abatement must be

considered. These noise limits are called the noise abatement criteria (NAC). These limits vary based on the types of activities at a particular site.

Sound travels through the air as waves of minute air pressure fluctuations caused by some type of vibration. In general, sound waves travel away from the noise source as an expanding spherical surface. Thus, the energy contained in a sound wave is spread over an increasing area as it travels away from the source, resulting in a decrease in loudness at greater distances from the noise source. Sound-level meters measure the actual pressure fluctuations caused by sound waves, with separate measurements made for different sound frequency ranges. The decibel (dB) scale used to describe sound is a logarithmic scale, which accounts for the large range of audible sound intensities.

One decibel represents roughly the smallest change in loudness that can be perceived by the human ear. An increase of ten decibels corresponds to a doubling of perceived loudness. Because the human ear is most sensitive to frequencies in the middle and upper audible range, these frequencies must be given greater weight than others in averaging sound contributions from all audible frequency bands to arrive at a total noise level value. Sound level values adjusted in this manner are designated "A-weighted". Sound levels measured in decibels and A-weighted are denoted db(A) or dBA.

Noise abatement criteria are given as equivalent noise levels measured in units of decibels. The equivalent noise level (L_{eq}) is defined as a constant level of sound which would generate the same amount of energy as the varying levels recorded over a specified period of time. It can be considered the average hourly sound level.

Table 3-8 shows the noise abatement criteria for various land uses. Federal Highway Administration regulations require that noise abatement measures be considered if a proposed project causes criteria to be exceeded substantially (by 10 decibels or more) from existing noise levels.

The FHWA noise abatement criteria are based on peak-hour L_{eq} noise levels. The peak 1-hour L_{eq} criterion for residential, educational, and healthcare facilities is 67 dBA outdoors. This criterion assumes a 25-dBA attenuation at locations indoors with windows closed. The peak 1-hour L_{eq} criterion for commercial and industrial areas is 72 dBA (outdoors).

This Project lies in an area which has an NAC of 67 dBA. Existing noise levels within the project area are approximately 3 to 4 dBA below NAC. A large portion of this noise can be attributed to aviation noise from Washington National Airport because the Potomac River is used as a flight path for arriving and departing aircraft.

Potential receptors for analysis are identified based on the following criteria:

- Proximity to the new alignment locations
- Sensitivity of the site to noise impacts

- Frequency of usage

Some potential sensitive receptors are located near the project area. University dormitories and parkland; the C&O Canal National Historic Park, south of the project site; and, Glover-Archbold Park is to the west. West of Glover-Archbold Park are single family residential units. The area east and north of the University is also occupied predominantly by single family housing, with some multi-family housing along MacArthur Boulevard.

TABLE 3-8

FHWA Noise Abatement Criteria

ACTIVITY CATEGORY	L_{eq} NOISE LEVELS	DESCRIPTION OF ACTIVITY
A	57 dBA (Exterior)	**Lands on which serenity and quiet are of extraordinary significance** and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 dBA (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 dBA (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	No Limit	Undeveloped Lands.
E	52 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

L_{eq} = Equivalent sound level.
SOURCE: Federal-Aid Policy Guide, Federal Highway Administration, 23 CFR, Part 772.

Based upon a field reconnaissance and application of the above criteria and background conditions, only one identified noise sensitive site is contained within the project area. The site is the towpath/trail south of the Chesapeake & Ohio (C&O) Canal for the same length as the proposed improvement. **(This site is discussed further in Section 4.3.2.)**

Areas that would have the potential of being sensitive receptors like Glover-Archbold Park, the residential area near the MacArthur Boulevard and Foxhall Road intersection, and the University dorms are all distanced too far (approximately 400 meters or a quarter mile) from the proposed improvement. The increase in traffic **due to any of the Build Alternatives** would be too small within the Project Area to affect these potential receptors.

The noise analysis for improvements to the Georgetown University Canal Road entrance is described in Chapter 4 - Affected Environment, Section 4.3.2.

3.3.3 Land Form, Geology, and Soils

The Washington area contains parts of two distinctly different geologically designated areas or provinces, the Piedmont Province to the northwest and the Coastal Plain to the southwest. The Fall Line separating the two provinces bisects the area diagonally from northeast to southwest. The Piedmont Province northwest of the Fall Line has deeply weathered igneous and metamorphic rocks, which are exposed; in the Coastal Plain to the southeast, these rocks are covered by Coastal Plain sediments, which include gravel, sand, and clay ranging in age from Cretaceous to Recent (Johnston, 1964).

The Georgetown University area is located adjacent to and northwest of the Fall Line on the banks of the Potomac River in the Piedmont Province. The geology of the Piedmont Province generally consists of hard igneous and metamorphic rocks derived from sedimentary and older igneous rocks by dynamic and contact metamorphism. Rocks that outcrop and underlie Georgetown University and the immediate vicinity belong to a group designated as mafic rocks by Johnston (1964). The mafic rocks encompass a variety of types, including tonalite, coarse black gabbro, chlorite schist and chlorite quartz schist, biotite schist, talc schist and soapstone. Mafic rocks at Georgetown are exposed in the bluff for about 2.0 kilometers (1-1/4 miles) along the river.

Soil types in the Georgetown area in the vicinity of the project include predominantly Udorthents, and largely are not original to the site. This soil is very mixed, earthy fill material that has been placed on poorly drained to somewhat excessively drained soils on uplands, terraces, and flood plains of the Coastal Plain and Piedmont Province to provide sites for buildings, roads, railroads, recreation areas and other uses. The source of the fill material is a mixture of organic and inorganic material from human activity and sandy, gravelly, clayey, silty and micaceous soil material. Slopes are very complex and irregular, ranging from nearly level to steep, but are dominantly nearly level to moderately sloping. Permeability and available water capacity is variable.

Soils classified as the Neshaminy-Urban land complex are also present along Canal Road, consisting of strongly sloping to steep, well-drained soils, most areas of which have been graded, cut, filled or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau.

3.3.4 Water Resources

The water supply for the District of Columbia is obtained from the Potomac River, upstream of the project area. An agency of the U. S. Army Corps of Engineers (COE), known as the

Washington Aqueduct, has had the responsibility for supplying water to the District since 1867. The supply system consists of facilities to collect water from its Great Falls and Little Falls intakes above Washington, DC, to convey it to the city for the necessary treatments, and to pump a portion of the water into the distribution system. The system includes dams, conduits, reservoirs, filtration plants, pumping stations, and transmission mains (USDA, 1976).

Groundwater in the Washington DC area is present in both consolidated crystalline rocks of the Piedmont and unconsolidated sedimentary rocks of the Coastal Plain. In the Piedmont area, which includes Georgetown University, groundwater occurs almost exclusively in the fractures, joints, and faults of crystalline rocks, or in the residual materials developed upon them. Groundwater in the Piedmont rocks is usually thought of as unconfined, though some wells drilled in the Piedmont were observed as artesian (Johnston, 1964). Well yields in the Piedmont are usually low, and are used primarily for irrigation (USDA, 1976).

In the Coastal Plain, groundwater occurs under confined and unconfined conditions (Johnston, 1964). Within the District of Columbia, there are several very high yielding private wells in Coastal Plain formations that supply water for a variety of commercial establishments (USDA, 1976). The water in the Piedmont area of the District, and from the shallow water-table sediments in the Coastal Plain, originates as precipitation in or near the local watershed or basin. Recharge to artesian Coastal Plain aquifers is from the outcrop area of the aquifer involved. There are no known potable water groundwater wells in the project area.

3.3.5 Wetlands

Site visits and a review of maps revealed no wetlands in the area that would be affected by construction of the project alternatives. The extreme relief of the bluff on the north side of Canal Road, along with the proximity of the C&O Canal, which limits development on the south side, prevent the presence or development of jurisdictional wetlands in the area of the project alternatives.

Just south of the project area, the C&O Canal supports a very limited 0.3 to 0.6 meter (1-2 feet) littoral zone of vegetation along its southern bank. Plant species are identified in **Table 3-9**. The Canal and its vegetated fringe would be considered "waters of the United States", and the vegetated fringe would be regulated as a jurisdictional wetland. These classifications are pursuant to Section 404 of the Clean Water Act, as amended, and as identified by the U.S. Army Corps of Engineers (COE) "*Wetlands Delineation Manual*" (Technical Report Y-87-1, 1987). Impacts are identified in Chapter 4.

TABLE 3-9

Plants of the Littoral Shelf, C&O Canal

Scientific Name	Common Name	FWS Classification*
Peltandra virginica	Arrow arum	OBL
Polygunum spp.	Smartweed	---
Commelina virginica	Dayflower	FACW
Iris virginica	Iris	OBL
Impatiens capensis	Spotted Touch-me-not	FACW
Hydrocotyle spp.	Penney-wort	OBL
Myriophyllum sp.	Water-milfoil	OBL
Juncus effusus	Soft rush	FACW+

* From National List of Plant Species That Occur in Wetlands: Northeast (Region 1), Fish and Wildlife Service Biological Report 88(26.1), May 1988. OBL denotes obligate wetland vegetation species which always (>99%) occur in wetlands; FACW denotes facultative wetland vegetation species which usually (67% - 99%) occur in wetlands; a "+" indicates a frequency toward the higher end of the category.

3.3.6 General Ecology/Wildlife and Habitat

The project area is in the Piedmont Province in the western part of the District of Columbia. Streams and tributaries drain into the Potomac River, which flows southeasterly. The project area is bounded to the west by Glover-Archbold Park and to the south by the Chesapeake and Ohio Canal National Historic Park, two relatively large natural areas within the urban setting. Glover-Archbold Park and C&O Canal Historic Park are among the few areas in the District of Columbia where native vegetation still grows, since many parks in the city contain trees and shrubs brought in from other countries.

The vegetation is a mixture of natural native vegetation and planted native and exotic species. **Table 3-10** presents a list of the common flora in the project area.

The District of Columbia offers a diversity of wildlife for an urban area. Approximately 35 mammal species and 175 bird species occur within the District boundaries, primarily within the parklands that include Glover-Archbold Park, C&O Canal National Historic Park, and the Potomac Palisades park. Small mammals such as gray squirrels, raccoon and opossum are abundant in areas providing food and cover. The parklands also support a wide variety of birds including permanent residents and migratory species. **Table 3-11** presents a list of wildlife species in the project area.

The southern boundary of the project area includes a section of the 184-mile C&O Canal. This man-made canal is bounded to the north by a concrete retaining wall (which runs along the south edge of Canal Road) and to the south by a hiking trail. This open-water system is a remnant of a navigable canal system of the past. The plant species along the upland bank are limited to lawn-

grass and other upland herbs. A trail is cut across the top of the bank. The northeastern deciduous floodplain forest and Potomac River lie to the south of the canal bank.

TABLE 3-10

Common Flora of Georgetown University Entrance Project Area

TREES	
Scientific Name	**Common Name**
Acer negundo	Box elder
Acer saccharinum	Silver maple
Cornus florida	Dogwood
Fraxinus spp.	Ash
Gleditsia tricanthus inermis	Thornless honey locust
Juglans spp.	Walnut
Morus alba	Common mulberry
Platanus occidentalis	Sycamore
Quercus spp.	Oak
Ulmus americana	American elm
Ulmus rubra	Slippery elm
SHRUBS	
Scientific Name	**Common Name**
Gaylussacoa spp.	Huckleberry
Rhus spp.	Sumac
Rubus spp.	Blackberry
GROUNDCOVER	
Scientific Name	**Common Name**
Commelina communis	Dayflower
Hedera spp.	Ivy
Lonicera maacki	Honeysuckle
Toxicodendron radicans	Poison ivy

3.3.7 Floodplains and Hydrology

The proposed improvement would be located just north of the Potomac River and the Chesapeake and Ohio (C&O) Canal, both of which run parallel to Canal Road. The Federal Emergency Management Agency (FEMA) has delineated the base floodplain for both waterways in Flood Insurance Rate Maps for Washington, DC, dated November 15, 1985. Detailed methods have been used to delineate the base and 500-year floodplain (flood hazard area) of the Potomac River, while approximate methods have been used for the C&O Canal.

TABLE 3-11

Expected Wildlife Species In The Georgetown Project Area

BIRDS	
Scientific Name	**Common Name**
Turdus migratorius	American robin
Tyto alba	Barn owl
Cyanocitta cristata	Blue jay
Molothrus ater	Brown-headed cowbird
Richmondena cardinalis	Cardinal
Chaetura pelagica	Chimney swift
Corvus brachyrhynchos	Common crow
Quiscalus quiscula	Common grackle
Dendropcopos pubescens	Downy woodpecker
Corvus ossifragus	Fish crow
Larus argentatus	Herring gull
Passer domesticus	House sparrow
Mimus polyglottos	Mocking bird
Zenaidura macroura	Mourning dove
Chordeiles minor	Nighthawk
Agelaius phoeniceus	Red-winged blackbird
Larus delawarensis	Ring-billed gull
Columbia spp.	Rockdove (pigeon)
Sturnus vulgaris	Starling
MAMMALS	
Scientific Name	**Common Name**
Sylvilagus floridanus mallurus	Cottontail rabbits
Vulpes vulpes fulva	Red Fox
Sciurus carolinensis pennsylvanicus	Gray squirrels
Peromyscus spp.	Mice
Didelphis marsupialis virginiana	Opossum
Procyon lotor lotor	Raccoon

The base flood elevation of the Potomac River in the vicinity of the Georgetown University Canal Road entrance is 5.8 meters (19 feet) and the 500-year flood elevation is 7.6 meters (25 feet) based on National Geodetic Vertical Datum. No flood elevations are available for the C&O Canal, but the overflow elevation of the canal bank adjacent to the Potomac River is approximately 11.2 meters (36.8 feet). The existing roadway elevation of Canal Road at the Georgetown University entrance is approximately 14.9 meters (49 feet), well above the 500-year

flood level.

Based on available topographic maps, Canal Road in the vicinity of the Project does not cross any existing watercourses. Runoff flowing onto the site consists primarily of sheet flow and some small gully flow from the adjacent hillside. The stormwater collection system at the Georgetown University's Main Academic Campus entrance drains into a combined sewer system connecting at Canal Road. There are also approximately 10 catch basins along Canal Road for roadway runoff which drain through five outfalls into the C&O Canal.

3.3.8.a. Wild and Scenic Rivers

There are no designated wild and scenic rivers within in the proposed project area and therefore there will be no impacts to such rivers.

3.3.8.b. American Heritage Rivers Initiative

***Executive Order titled, Federal Support of Community Efforts Along American Heritage Rivers, dated September 11, 1997*, created the American Heritage Rivers Initiative. This initiative has three objectives: natural resource and environmental protection, economic revitalization, and historic and cultural preservation. Build alternatives should not conflict with the Community Action Plan of an American Heritage River.**

The Potomac River in the District of Columbia, Maryland, and Virginia was designated as an American Heritage River. The Community Action Plan for the Potomac River has three broad goals: continued improvement in water quality and environmental restoration along with development of effective flood control plans; promotion of the region's rich historical heritage and recreational opportunities; and involvement of citizens at local levels.

3.3.9 Coastal Barriers and Coastal Zones

The tidal limits of the Potomac River are just south of the Project vicinity. This Project is exempt from Coastal Zone Consistency Review by agreement between the Office of the Mayor, Office of Planning, Office of Budget, District of Columbia Department of Consumer and Regulatory Affairs, and District of Columbia Department of Public Works.

3.3.10 Threatened or Endangered Species

Coordination occurred with the Chesapeake Bay Field Office of the United States (US) Fish and Wildlife Service in Annapolis, Maryland (See Appendix B). Information was requested

regarding the occurrence of threatened, endangered and candidate wildlife and plant species, as well as the presence of critical habitat. The US Fish and Wildlife Service has indicated that no Federally-listed or candidate threatened or endangered species are known to exist in the project area.

Contact was also made with the National Park Service concerning threatened and endangered species and wildlife habitat. The Resource Management Specialist with the C&O Canal National Historic Park supplied records of 10 rare plant species with historic occurrences adjacent to the study area, south of the C&O Canal. A field investigation was conducted to determine if any of these species exist in the project area. No rare plant species were found in the project area.

CHAPTER 4.

ENVIRONMENTAL CONSEQUENCES

Note: Highlighted text indicates substantive information different from the Draft Environmental Impact Statement (DEIS) or new to this Final Environmental Impact Statement.

The purpose of this chapter is to provide an overview of probable beneficial and adverse social, economic, and environmental effects of the alternatives under consideration. Technical sections for this chapter are organized in a manner consistent with FHWA Technical Advisory T6640.8A. In addition, several *Technical Reports* have been prepared which provide more detailed information in the areas of Traffic and Transportation, Air Quality, Noise, the C&O Canal Wall, and Archaeology.

As described in Chapter 2 "Alternatives", Alternative 2A-Modified is the Preferred Alternative.

4.1 COMMUNITY IMPACTS

4.1.1 Land Use

The additional land required for the construction of the Build Alternatives is currently undeveloped. As such, there would be no displacements of residents or businesses.

The undeveloped land needed for **all of the** Build Alternatives is both publicly and privately owned. Private land would be required from Georgetown University **for all of the Build Alternatives. All Build Alternatives except the Preferred Alternative also require land from the parcel identified as Lot 822[1] (now WMATA property)**. Lot 822 is located along the top of a bluff westward of the project. Although zoned R-3, the land use map for the DC Comprehensive Plan designates this land as remaining in use for parks, recreation and open space.

The land needed from the University surrounds the transit property, and varies in amount by alternative. This property would be part of an **equal value exchange with** the National Park Service (NPS), which would also be provided with suitable adjacent replacement property for any of its land needed for the project. Georgetown University has also agreed to provide 1.01 hectares

[1] This property was originally part of the right-of-way for a trolley which ran from the District of Columbia to Glen Echo, and was owned by the D.C. Transit System, Inc., as the operating company for the trolley. It was acquired **by a Court-appointed trustee** on behalf of a group titled the Washington Metropolitan Area Riders' Fund (Riders' Fund) at a foreclosure sale. **On May 31, 1996 this property was transferred by order of the U.S. District Court to the Washington Metropolitan Area Transit Authority (WMATA). WMATA is still investigating the issue of title.**

(2.5 acres) of land for a scenic easement as their contribution to the project for the local match. **Figure 4-0 illustrates the property parcels and ownership.** Estimated right-of-way requirements from these properties for each of the Build Alternatives **under discussion is shown in Table 4-1.**

TABLE 4-1

Right-of-Way Requirements

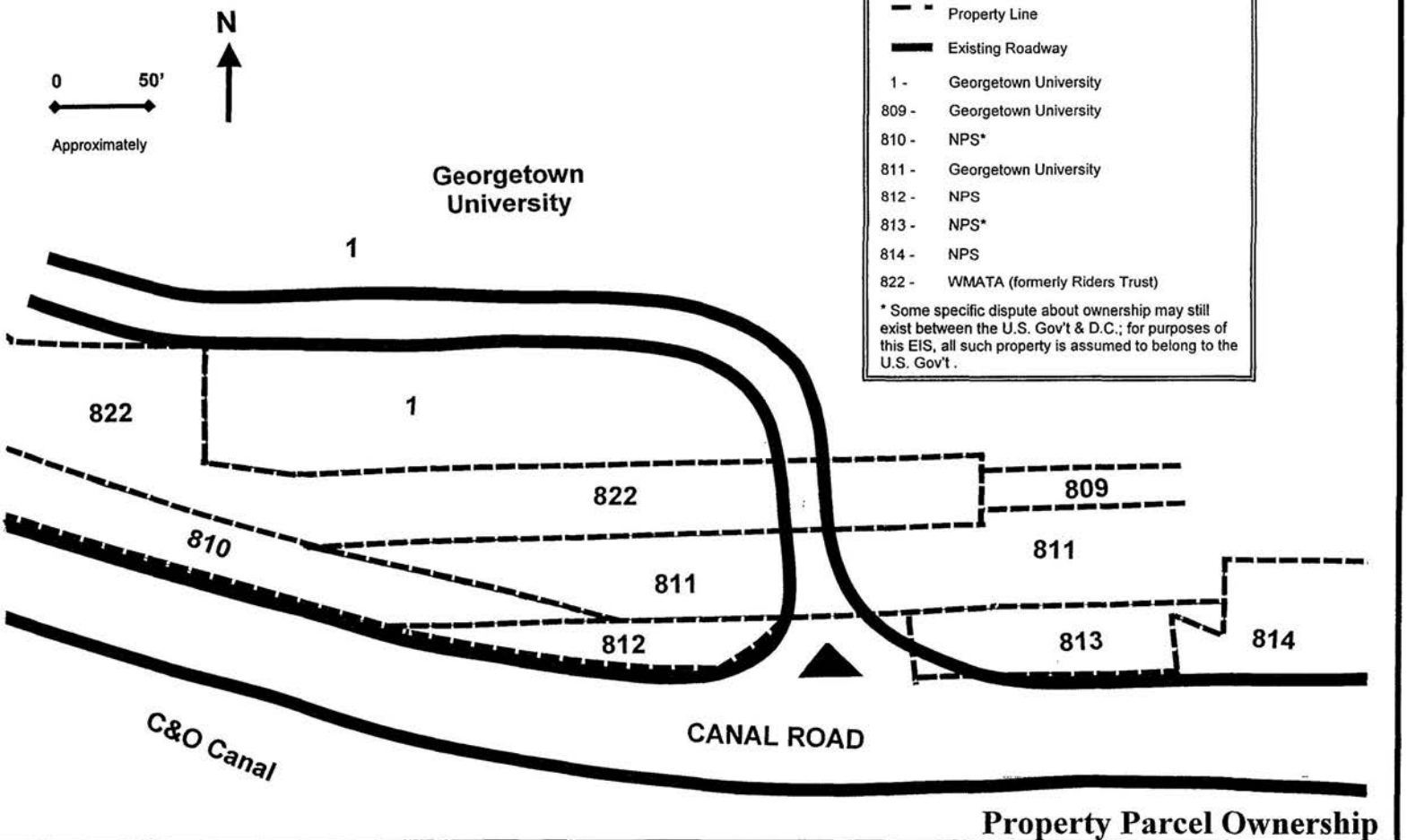
ALTERNATIVE	PROPERTY, in Square Meters (Feet)			
	Georgetown University*	National Park Service	Lot 822 (WMATA)	TOTAL
Alternatives 2/2A	2,494 (26,850)	3,929 (42,175)	439 (4,725)	6,852 (73,750)
Alternative 3B	2,889 (31,100)	2,980 (32,075)	397 (4,275)	6,266 (67,450)
Alternative 3H	2,947 (31,725)	6,921 (74,500)	1,164 (12,525)	11,032 (118,750)
Preferred Alternative, Alternative 2A-Mod.	**896 (9,642)**	**2,116 (22,740)**	**0 (0)**	**3,012 (32,282)**

Note: Numbers may not add because of rounding.
*** Does not include in-kind replacement required by law.***

None of the Project Alternatives would result in any secondary development by the University. Consolidating the access to the Main Academic Campus at the Canal Road entrance is part of the campus master plan to improve vehicular circulation. The Project is not being proposed to allow the development of new University facilities. There are restrictions on parking capacity on campus.

However, secondary development could potentially occur on the Lot 822 **property for all of the Build Alternatives except for Alternative 2A-Modified**. Currently this property has no roadway access and future access provisions are uncertain. **At the Public Hearing, representatives of the then-property owners of the Rider's Fund tract** indicated an interest in developing the property, and requested that right-of-access be provided as a part of this proposed project. If access were allowed to this property, residential development of approximately 40 townhouses could potentially occur. **However, WMATA, the new owner, has to date indicated no interest in developing the property.**

The development of the **WMATA (Lot 822) property, if it occurred,** would result in impacts to both traffic in the area and visual impacts to the Potomac Palisades area. **These impacts would be considered as secondary impacts of the proposed traffic improvement project, if the selected alternative provides such access.** The traffic impacts would include adding several hundred vehicle trips into and out of the new entrance serving the new development. These extra trips



Property Parcel Ownership

Georgetown University Entrance Road ● Environmental Impact Statement

Figure 4-0

Federal Highway Administration

would likely occur during peak periods and add to the traffic impacts. Secondary visual impacts could also occur since the property is currently wooded and would be replaced with a roadway network and structures. Considering the aesthetic features of the rolling Potomac Palisades, this type of residential development **on the WMATA property** may not be compatible with the surrounding natural setting.

Table 4-1 shows that the Preferred Alternative requires no taking of the WMATA (Lot 822) parcel.

The issue of whether access must be provided to this parcel is dependent in part upon physical characteristics of the different project alternatives. Build Alternative 2A-Modified has reduced geometrics that limit all construction to south of Lot 822. No construction will occur on the entrance road where it currently crosses Lot 822. Therefore, access to Lot 822, and secondary development, is not an issue for the Preferred Alternative.

4.1.2 Social Impacts

Relocation

Social impacts are not anticipated for this project. None of the Build Alternatives would have an impact on any particular ethnic or low-income population nor would they result in any displacements or relocation of residences or businesses.

Accessibility

Build Alternatives 2, 3B and 3H would change traffic patterns and accessibility in the study area. By removing some traffic from the residential streets of Georgetown, these Build Alternatives would have a positive impact on neighborhood cohesion. The No Build Alternative and Build Alternatives 2A **and 2A-Modified** would maintain Georgetown University traffic use of the residential streets of Georgetown.

All Build Alternatives would improve accessibility to Georgetown University, by permitting vehicle access at all times from an arterial street instead of **only** from local neighborhood streets. **In addition, Build Alternatives 2, 3B and 3H would remove University traffic from the residential streets.** Residents of the Georgetown neighborhood would still have access through the eastern entrances to the campus by walking or bicycling. The No Build Alternative and Build Alternatives 2A **and 2A-Modified** would retain access through the local Georgetown streets, **although some of the traffic would be diverted to Canal Road**.

Environmental Justice

Environmental Justice issues are regulated by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations* (February 11, 1994). Executive Order 12898 was created to provide guidance on identifying and addressing disproportionately high and adverse human health and environmental impacts on low income and minority populations. The U.S. Department of Transportation (DOT) issued DOT Order 5680.1 on April 15, 1997 to ensure that each modal agency within the DOT complies with Executive Order 12898.

As indicated in the Population and Housing section (Section 3.1.2) the project area is predominately Caucasian. The percentage of non-white population in the five 1990 census tracts that encompass the project area is below the average of Washington, DC. (See Table 3-1.)

The percentage of persons with 1990 median incomes below poverty level is lower for 1990 Census Tracts 1.0 and 8.2 compared to the District average. 1990 Census Tracts 2.1, 2.2, and 3.1 indicate the percent of persons below poverty level is higher than the District average. The data is skewed by the large number of students living in these tracts. Additionally, the median home value (owner-occupied) and the median household income are both higher than the District average.

There will be no persons or businesses displaced or relocated as part of this project under any Build Alternative. Furthermore, census data shows no disproportionate concentrations of minority or low income groups that could be affected by the Build Alternatives. Thus, the Improvements to the Canal Road Entrance of Georgetown University project will not disproportionately adversely impact low income and minority populations.

4.1.3 Economic Impacts/Joint Development

None of the alternatives would have any foreseeable economic impacts either locally or regionally. The project would not have any direct impact on development, tax revenues or public expenditures, or employment opportunities. No joint use developments are anticipated with the project.

4.1.4 Community Facilities and Services

Institutional and Emergency Facilities

No institutional facilities would be affected by any of the alternatives. Access to the University by emergency services such as police, fire and ambulances would be improved **by all of the Build Alternatives,** since congestion on Prospect Street would be reduced. Emergency access to the

University also would be improved because access would be possible from both the eastbound and westbound lanes on Canal Road.

Parks and Recreational Facilities

A portion of the land to be used for any of the five Build Alternatives is National Park Service (NPS) property. This parkland is not in active use for recreation. The NPS would provide an easement for use of this property adjacent to Canal Road. In return for providing this easement, the NPS would obtain from Georgetown University interest in land with an equal value. In addition, in a separate transaction, the NPS would obtain a scenic easement on 1.01 hectare (2.5 acres) of land on the south and west sides of the University, which is to serve as the local matching share for Federal funding for the project.

Under Section 4(f) of the US Department of Transportation Act of 1966, the use of any publicly-owned park land for a Federally-funded transportation project is only permitted if it has been demonstrated that there is no "feasible and prudent" alternative to the project. **That determination has been made.** The Section 4(f) Evaluation for this project is presented as a separate section, Chapter 9, of this FEIS.

Utilities

Build Alternatives 2, 2A and 3B have **moderate** impacts to utilities, and would require relocations of surface utilities, but would not disrupt the water or sewer lines in the corridor. **Alternative 2A-Modified has the fewest impacts. In addition to the smallest footprint for construction, and the associated reduced impact on underground utilities, the Preferred Alternative, 2-A Modified, would require no blasting. Blasting was of concern to Agencies and the Public because of the possible negative effects on old utility pipes. This concern was accentuated with the main water line break at the existing entrance along Canal Road in October 1997.**

The relative impacts to utilities are summarized in Table 4-2.

Table 4-2

Impacts to Utilities

No Build	None
Alternatives 2/2A	Moderate
Alternative 3B	Moderate
Alternative 3H	High
Preferred Alternative 2A-Modified	Minor

Alternative 3H would require the relocation of major utilities. Relocated utilities include: two electrical lines, three water lines (48", 36" and 30" diameter pipes), two gas lines (2" and 12"), and two large storm sewers (84" and 72" reinforced concrete pipes).

4.1.5 Visual Context

Actions that directly remove vegetation along the bluffs or physically modify the bluffs by excavation or construction of walls would impact the visual context of the area. The impacts would generally increase as larger areas are altered. The discussion of the visual impacts of the project can be divided into two parts--the view from the road and the view of the road. In the following evaluation, both cross sections and elevations of Canal Road are used to identify the impacts. These figures are referenced to the plan drawings of each of the alternatives provided in Chapter 2.

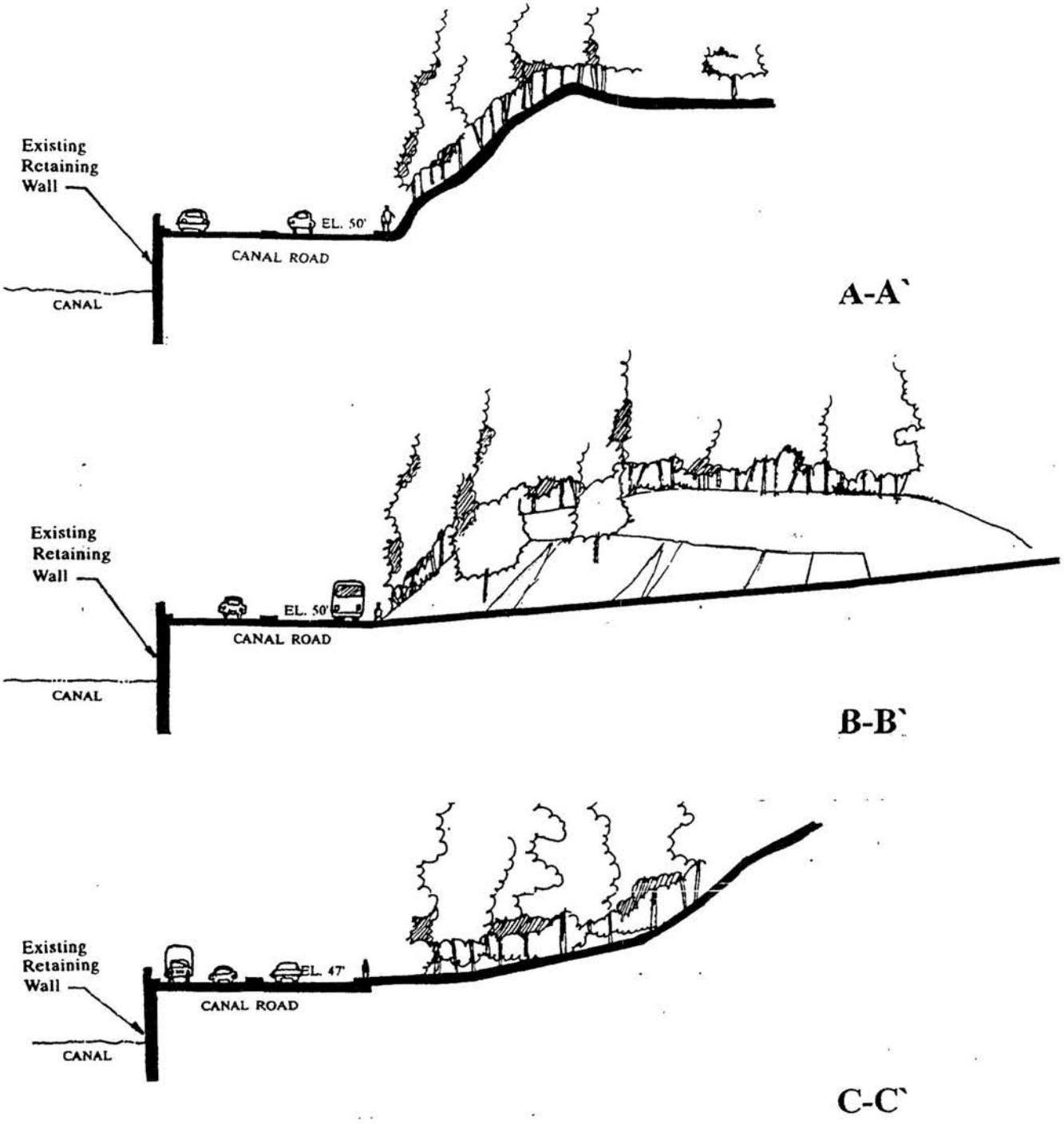
View from the Road

Alternative 1, the No-Build Alternative, would not cause any change in the existing visual experience from Canal Road. **Figure 4-1** shows three cross sections of Canal Road--one at the existing entrance and one each to the east and west.

Alternatives 2 and 2A would have the least visual impact **of the original four Build Alternatives** for drivers along Canal Road. (See **Figure 4-2.**) The views from the road of the C&O Canal, the Potomac River, and Virginia would remain unchanged. The primary change would occur in the view of the Palisades caused by the widening of Canal Road for a length of about 230 meters (750 feet) along the north side of the roadway. This widening would take place in the existing grassy berm east of the present entrance road and in the wooded area to the east of it. A retaining wall about 35 meters (115 feet) long would be built in the area east of the existing entrance where the bluff comes closest to Canal Road. Thus the current cover of vegetation would be changed to a retaining wall for this distance. This is illustrated in the East Section on Figure 4-2.

Alternative 2A-Modified would have similar but reduced effects than Alternatives 2 and 2A. (See Figure 4-3). The retaining wall along the northern edge of the entrance road is shorter in length, approximately 31 meters (100 feet). The height of the retaining wall is also reduced to 3 meters (10 feet). Alternative 2A-Modified does not disturb any of the heavily vegetated Riders' Fund property directly west of the existing entrance. A larger landscaped median with a sidewalk would be constructed between the entrance road and Canal Road adding to the natural features of the Palisades. The construction takes place on the existing grassy berm east of the present entrance road.

Alternative 3B, with the westbound lanes elevated, would have different changes for the eastbound and the westbound drivers. This is shown in **Figure 4-4.** This alternative would widen the Canal Road right of way for a length of about 460 meters (1,500 feet). A retaining wall--shown in the West Section on Figure 4-4--approximately 130 meters (430 feet) in length would be built on the



Alternative 1 - No Build

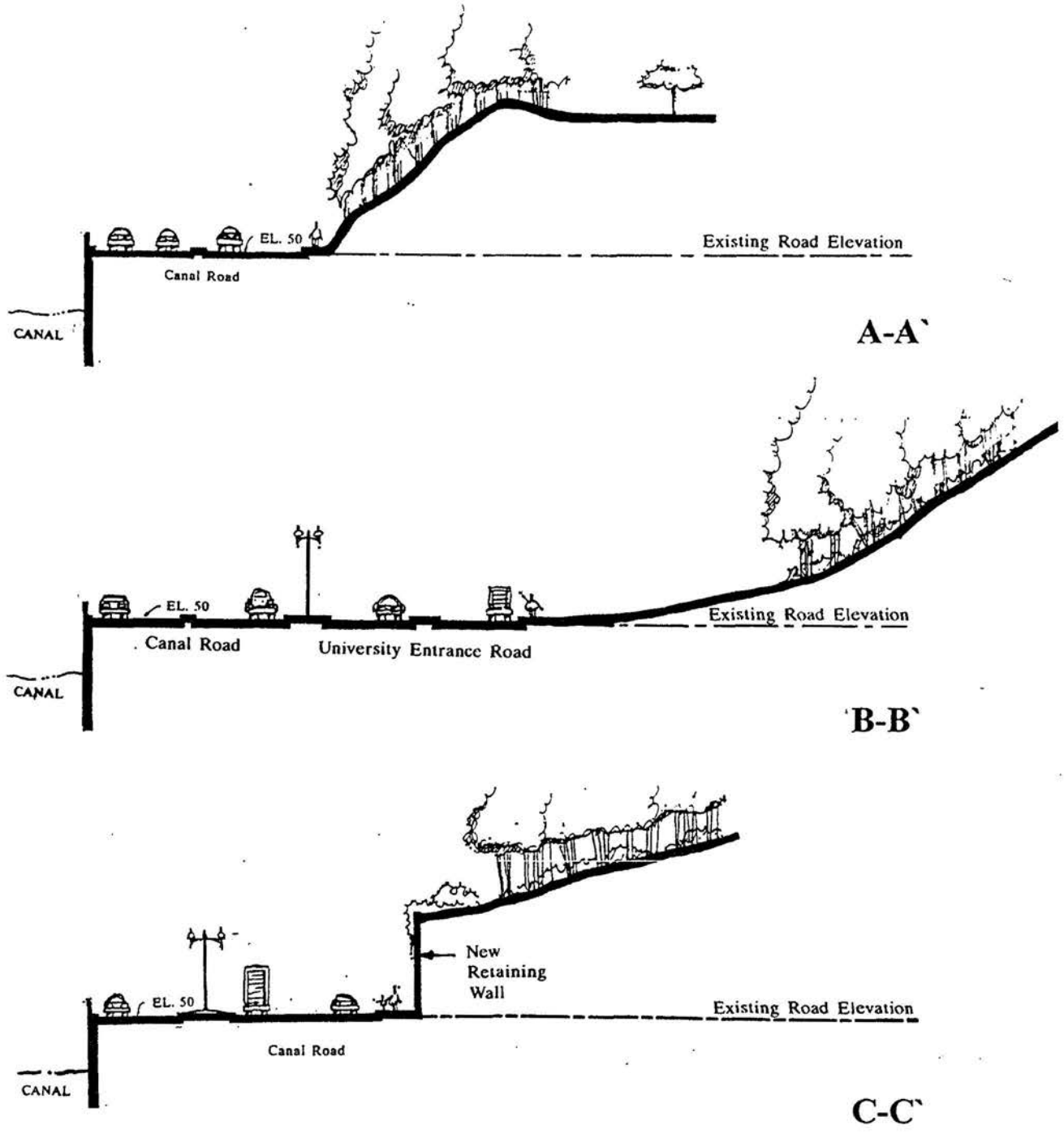
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Cross Sections of Alternative 1

Georgetown University Entrance Road ● Environmental Impact Statement

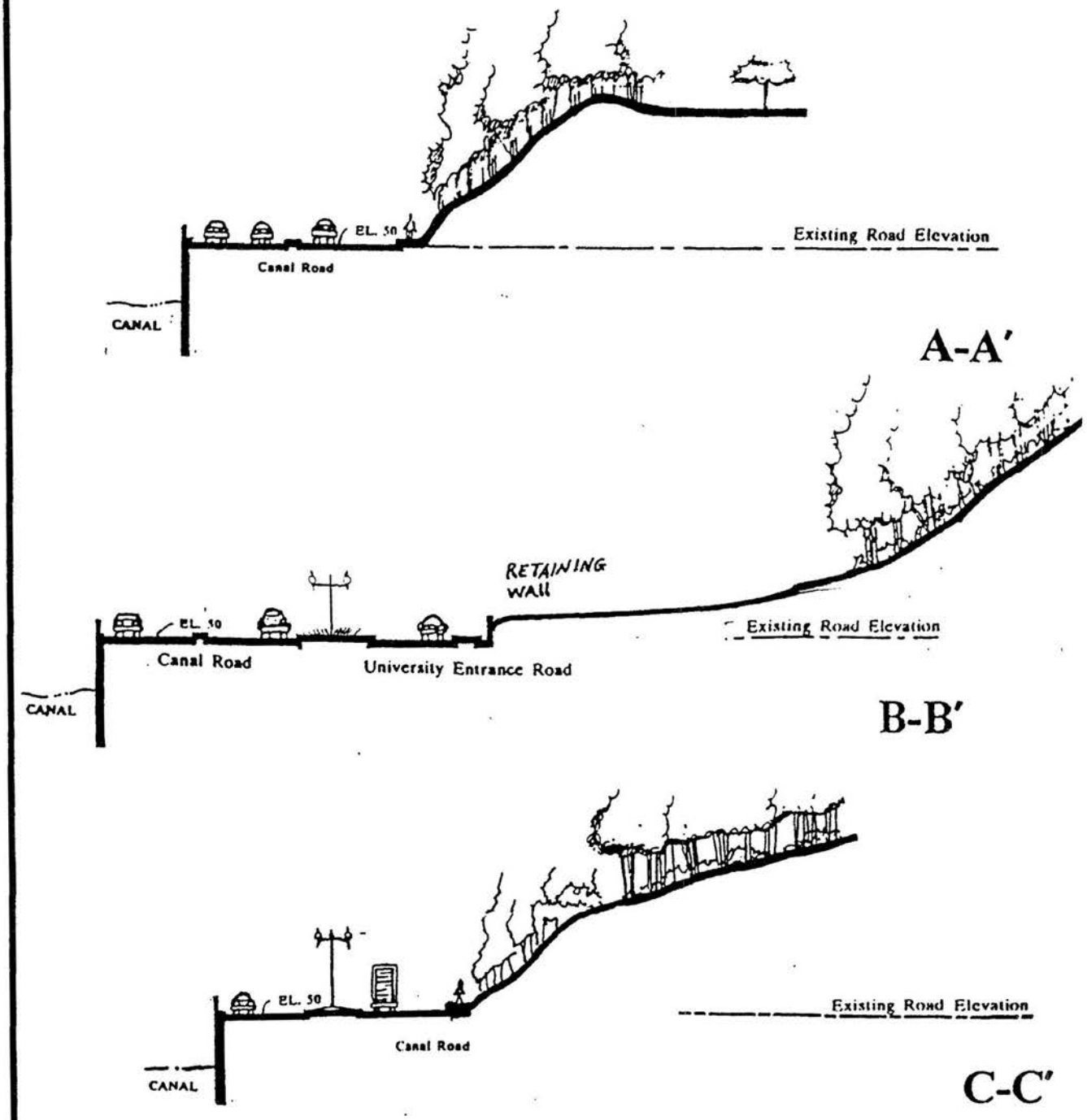
Figure 4-1

Federal Highway Administration



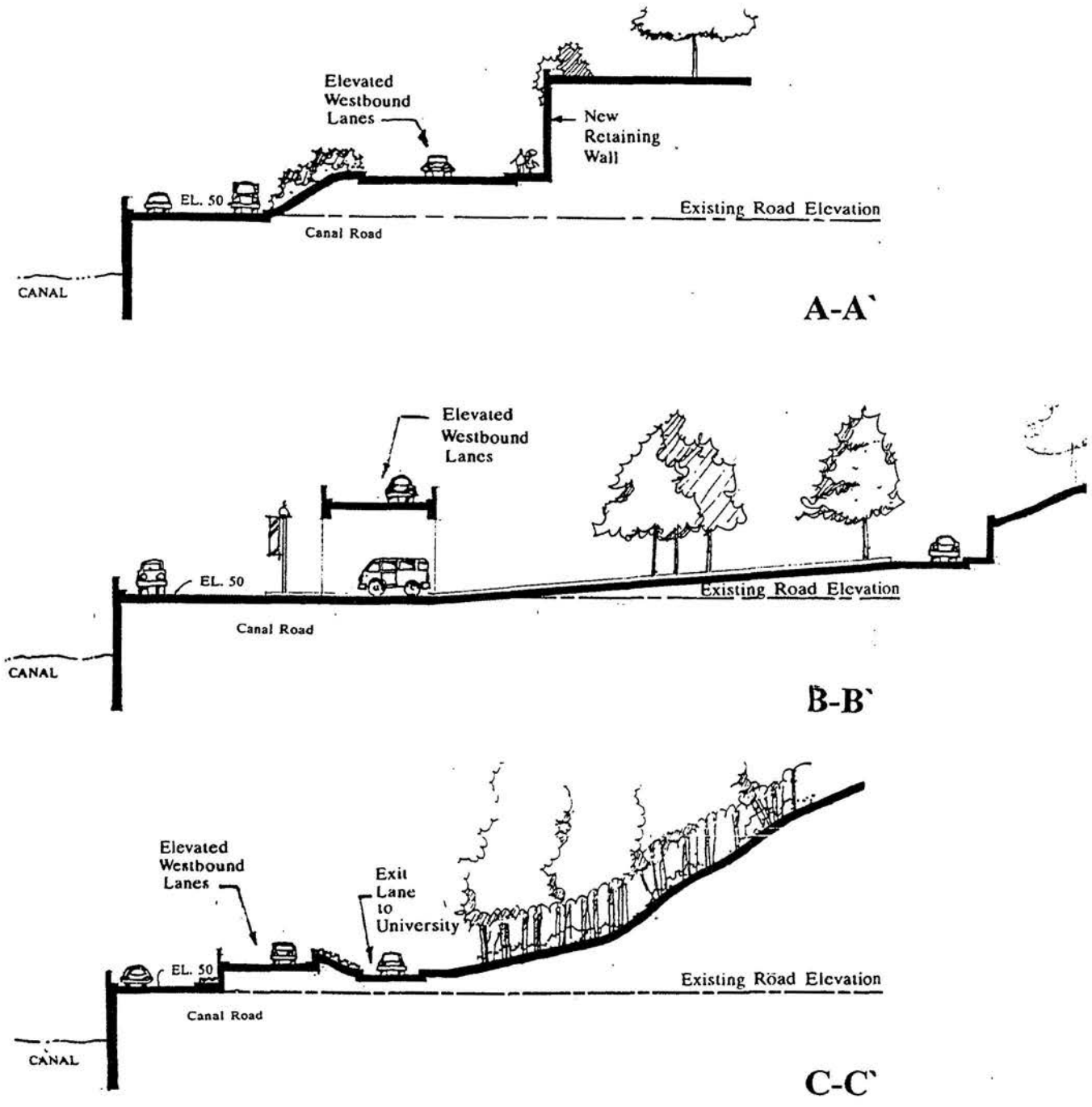
Alternative 2 - At-Grade Intersection
Alternative 2A - At-Grade Intersection with Prospect Street Open

Cross Sections of Alternative 2A
Cross Sections of Alternative 2



Preferred Alternative 2A – Modified – New Entrance

Cross Sections of Preferred Alternative 2A - Modified



Alternative 3B - Westbound Canal Road Elevated

Cross Sections of Alternative 3B

north side of the right of way to the west of the existing entrance, where excavation of the steep hillside would be required.

With Alternative 3B, the westbound lanes of Canal Road would be elevated as much as six meters (20 feet) above the existing grade. From the eastbound lanes of Canal Road, the elevated roadway would replace the view of the Palisades. From eastbound Canal Road, views toward the south over the C&O Canal and the Potomac River would remain unchanged. From the elevated westbound lanes, the view toward the south of the canal and the river would be extended because of the higher elevation.

Alternative 3H would depress both the eastbound and the westbound lanes of Canal Road approximately 25 feet below the existing grade level for a distance of about 490 meters (1,600 feet). (See **Figure 4-5**.) It would require the shifting of the Canal Road right-of-way to the north for about 670 meters (2,200 feet). Views from vehicles traveling in both directions would be blocked along most of the distance where the roadway would be depressed. The through lanes would be open to the sky, except where they passed under a bridge about nine meters (30 feet) wide carrying the entrance road to the eastbound exit and entrance ramps.

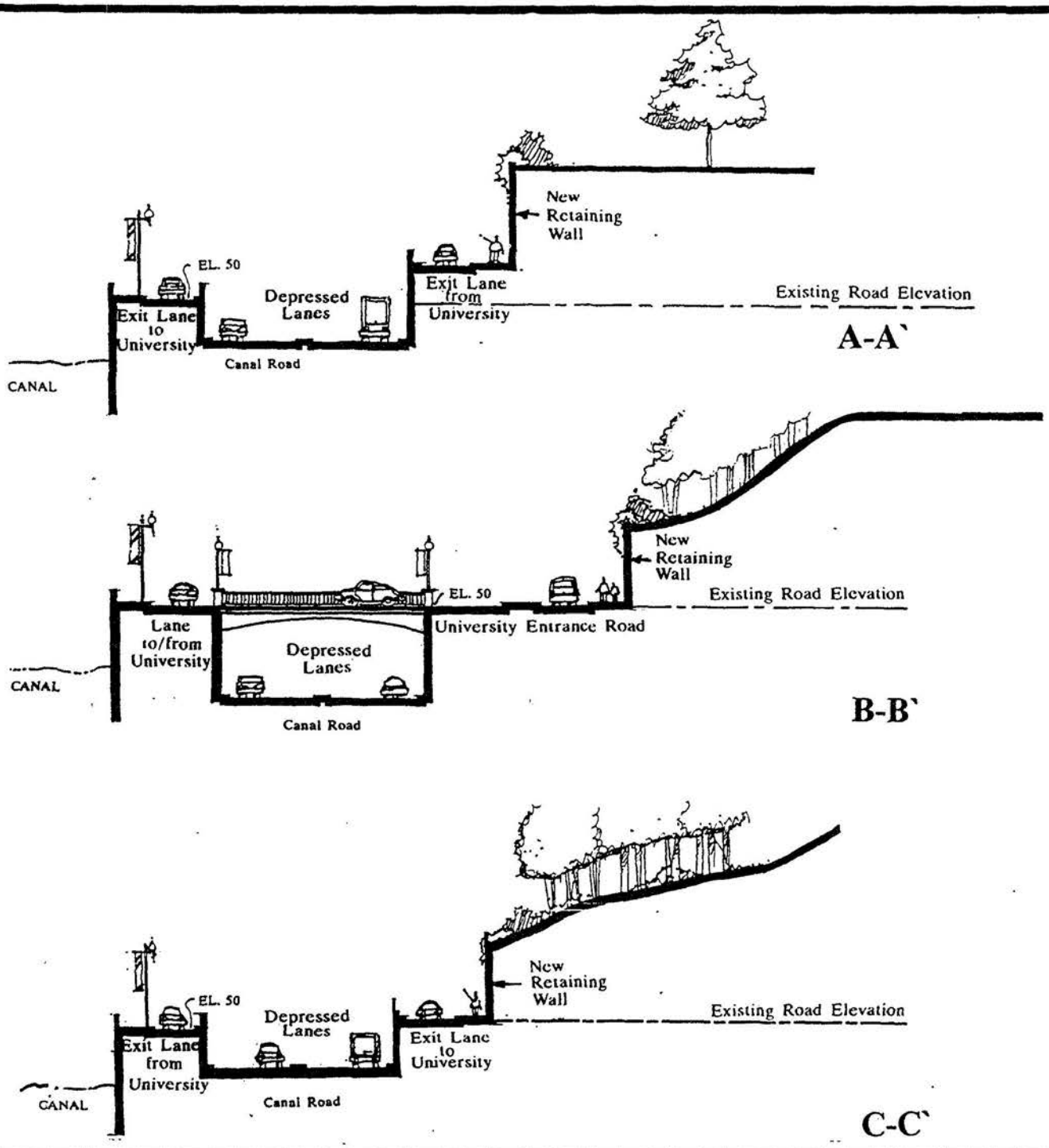
The retaining walls noted for all the Build Alternatives are also visible in the renderings of the elevations, depicted in **Figures 4-6a, 4-6b, and 4-6c.**

View of the Road

Alternative 1, the No-Build Alternative, would cause no change in the view of the Palisades or of Canal Road. **Figure 4-6a** illustrates the view from the C&O Canal footpath. This is also the view from the Potomac River.

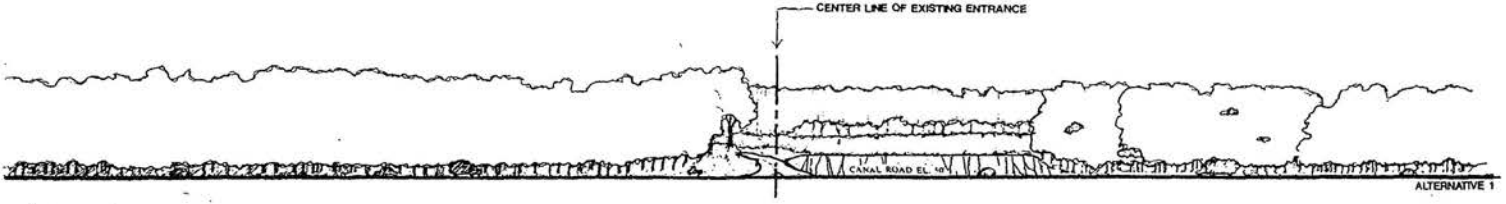
Alternatives 2 and 2A would require a retaining wall about 35 meters (115 feet) in length and up to six meters (20 feet) high along the north side of Canal Road just to the east of the existing grassy area. See **Figure 4-6a.** This wall would be visible from the C&O Canal towpath. From the Potomac River, Key Bridge and the Virginia side of the river, the view would be partially screened during the spring and summer, and the degree of impact would diminish with distance.

Alternative 2A-Modified reduces construction activities as compared to Alternatives 2 and 2A. Alternative 2A-Modified would minimize the visual intrusion of the proposed improvements on the surrounding area. See Figure 4-6b. The estimated three meter (ten foot) high retaining wall and the roadway improvements may be visible from the C&O Canal towpath, the Potomac River, and Key Bridge. A sidewalk and island (width of +/- 6 meters or about 20 feet) would separate westbound Canal Road from the new entrance/exit. The island would be landscaped to help visually offset the entrance/exit drive.

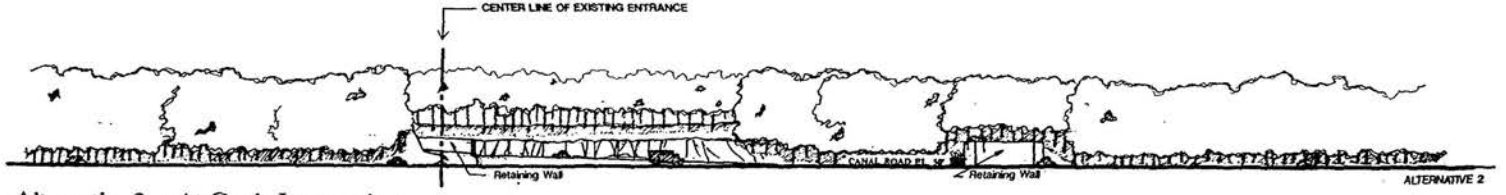


Alternative 3H - Canal Road Underpass

Cross Sections of Alternative 3H



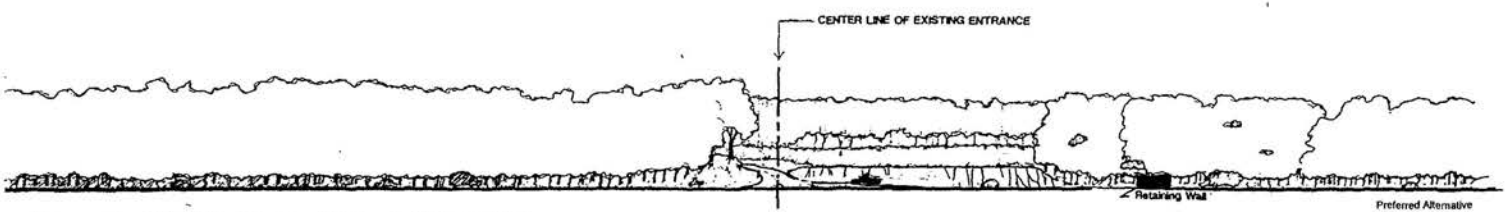
Alternative 1 - No Build.



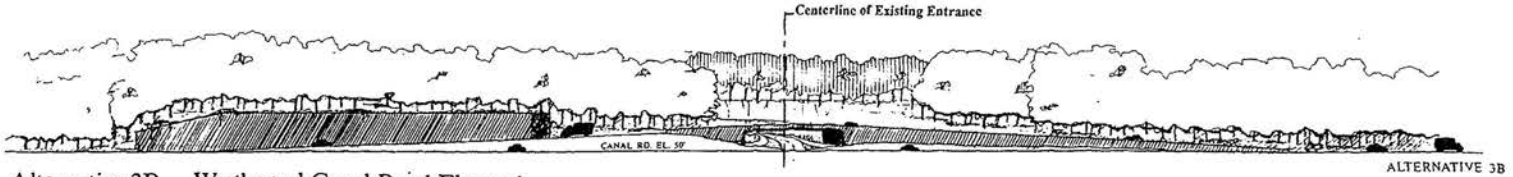
Alternative 2 - At-Grade Intersection.

Elevations of Alternatives

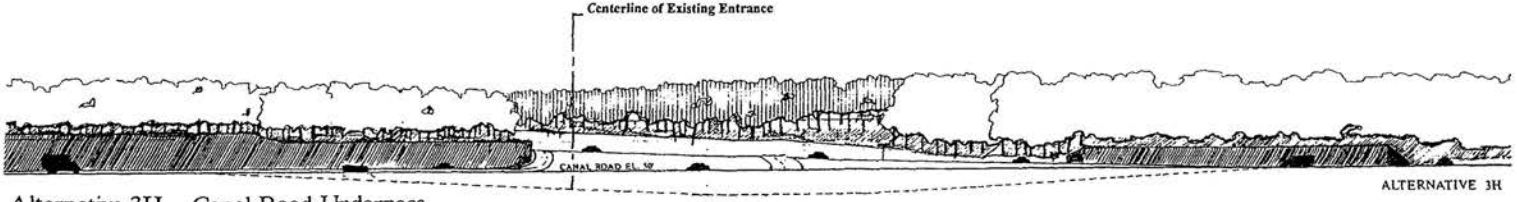
Figure 4-6a



Alternative 2A- Modified – At-Grade Intersection



Alternative 3B - Westbound Canal Road Elevated.



Alternative 3H - Canal Road Underpass.

The visual perspective would not be substantially altered from the existing condition. This applies both to the location of the entrance and the mitigation measure at the Whitehurst Freeway intersection. The travelers along Canal Road eastbound will notice a third lane available, by the proposed widening (approximately two meters or six feet) of Canal Road at that intersection. The existing retaining wall at Whitehurst Freeway will be reconstructed towards the C&O Canal. The access drive for the National Park Service to the north side of the C&O Canal will also be reconstructed. Landscaping design details will address appropriate visual treatments in character with the area.

Alternative 3B would produce noticeable changes in view of the road by two elements--the elevated lanes and a retaining wall. See **Figure 4-6c**. The westbound lanes of Canal Road would be elevated for a distance of about 490 meters (1,600 feet). About 180 meters (600 feet) of this elevated roadway would be placed on structure; the rest would be on fill. This would affect the view toward the Palisades from the C&O Canal towpath. The elevated roadway would also be visible from the Potomac River, from the George Washington Parkway in Virginia and from the Key Bridge and Rosslyn. With the appropriate use of materials and landscaping, however, the stepping-back of the westbound lanes could give them the appearance as a part of the hillside.

There would also be about 130 meters (430 feet) of retaining wall west of the entrance on the north side of Canal Road. Its visibility would be lessened during the spring and summer when trees are in leaf but would still be noticeable. During the fall and winter these changes would be most visible. While the buildings and spires atop the hill attract the eye, the steep Palisades that define the river corridor have an attraction of their own and any alteration of consequence would be noted.

Alternative 3H would have the most visual impact from the C&O Canal, the Potomac River, and Virginia. While this alternative is depressed, major excavation of the hillside and retaining walls would be required. These walls would be visible from the George Washington Parkway, from Rosslyn, and, to a lesser degree due to the oblique angle from the Key Bridge. Though they would be partially hidden during spring and summer, they would be visible in fall and winter.

As seen in Figure 4-6c, these retaining walls would extend both east and west of the existing entrance. The most noticeable element would be the wall required for the westbound exit from the University. The walls and ramps would be higher on the hillside than Alternative 3B and would have a noticeable impact on the slopes and the existing vegetation. The wall would extend some 230 meters (750 feet) to the west of the entrance and would be noticed due to its location, height and length.

Mitigation for Visual Impacts

Mitigation for the visual impacts can be achieved in a variety of ways. Two principle options include architectural treatment of the various structures and landscaping/reforestation.

The opportunity exists to improve the landscaping and plant materials in the area with any of the Build Alternatives. Generally the existing vegetation on the bluffs and between the towpath and the Potomac River is evolutionary. There is noticeable lack of evergreen materials, which would help greatly where screening would be desirable.

Some of the observed varieties of trees include black locust, mulberry, box elder, sycamore, oak (few), ash (few), black cherry, osage orange, and tree of heaven (ailanthus). These are not among the best plant materials for urbanized areas and some are considered to be "trash trees". Many of these existing trees are most likely in their waning years and some introduction of better varieties would seem advisable in order to preserve and extend the present woodland cover and provide adequate screening.

Architectural treatments offer opportunities to reduce the visual impact of walls and elevated roadway structures through the introduction of appropriate materials, colors, textures, detailing, and lighting for nighttime effects. Many of these options can significantly reduce the visual scale and bulk, especially of long and high retaining walls. Specific aesthetic recommendations for the recommended alternative will be developed in cooperation with the Commission of Fine Arts. The following are among the options that would be considered:

- New landscaping/reforestation designed to blend the improvements with the existing context.
- Sympathetic design of new walk/bike ways with appropriate access.
- Retaining walls in an appropriate color with architectural treatment and the application of climbing and hanging plantings at the bottom and top of the walls. Stone facing could be considered for the retaining walls.
- Stone faced supporting walls and piers for elevated roadway sections, with stone type, color and sizing consistent with that used elsewhere on the project.
- Traditional railings, incorporating lights, on elevated sections.
- Treatment of walls along the depressed roadway sections with stone facing or vertical fenestration.

Landscape treatment for all the alternatives should focus on two primary objectives--first, selecting and locating materials to most effectively and appropriately enhance the road improvements, and second, effectively blending the new improvements into the existing landscape context. Materials will be chosen with proper concern for survivability and minimum maintenance requirements.

4.1.6 Historic and Archaeological

The Section 106 process (compliance with Section 106 of the National Historic Preservation Act of 1966, as amended) has been **satisfied for purposes of this Final Environmental Impact Statement**. Coordination with the SHPO has proceeded throughout this process to determine the eligibility for the National Register of Historic Places, adverse effects, and potential mitigation.

Activities have been completed in accordance with Executive Order 11593, *Protection and Enhancement of the Cultural Environment* (May 13, 1971).

Historic Resources

The Proposed Action is located within the Georgetown Historic District and adjacent to the C&O Canal Historic District. Both are Category II landmarks and are listed individually in the National Register of Historic Places. Historic and archeological resources were described in Chapter 3.

Each of the Build Alternatives would require the use of property within the Georgetown Historic District, as estimated **in Table 4-3.** The amounts are in addition to the land that is used now for the existing entrance road. **Only the Preferred Alternative, Alternative 2-A Modified,** would take any land from the C&O Canal Historic District, in the amount of 66 square meters (715 square feet).

TABLE 4-3

Historic Property Required
In Hectares (Acres)

ALTERNATIVE	GEORGETOWN HISTORIC DISTRICT	C & O CANAL HISTORIC DISTRICT
No Build	0	0
Alternatives 2/2A	0.69 (1.69)	0
Alternative 3B	0.63 (1.55)	0
Alternative 3H	1.10 (2.73)	0
Preferred Alternative, Alternative 2A-Mod.	0.30 (0.73)	0.06 (0.16)

Note: This table is new to the FEIS.

Coordination with the DC Historic Preservation Office indicated that the Proposed Action will have an adverse effect on the Georgetown Historic District and the C&O Canal Historic District because of the minor taking of land. **The effects can be mitigated, as indicated in the Memorandum of Agreement among the SHPO, the National Park Service, and the Advisory Council on Historic Preservation. The MOA on historic resources is included in Appendix G.**

This MOA satisfies the Section 106 process. Continued discussion and approval of specific design and landscaping treatments by the SHPO and NPS, as required under the MOA, will be performed once the Preferred Alternative proceeds to that stage.

Archeological Resources

A Phase I archaeological survey (Identification) has been performed. Over 6,000 artifacts were recovered in a systematic investigation of the study area. Fieldwork consisted of 61 test pits, and 22 auger tests in six areas. It has been determined that one of the areas ("Site A") may be eligible for listing on the National Register of Historic Places. **(Due to concern for protecting archeological sites, maps are typically excluded from Environmental Impact Statements. Hence, no figure is provided.) This site is considerably impacted by Alternatives 3B and 3H, but only moderately by Alternatives 2 and 2A, and not at all by the Preferred Alternative. Table 4-4 provides the relative concerns.**

For most of the Build Alternatives other than the Preferred Alternative, it would be necessary to continue evaluation of archaeological resources discovered during Phase I with a Phase II field investigation (Evaluation). This would entail excavation of selected portions of archaeological sites to more surely determine the significance of the sites.

TABLE 4-4

Archeological Resource Concerns

ALTERNATIVE	IMPACTS	RECOMMENDED MITIGATION
No Build	None	None
Alternatives 2/2A	Moderate	Phase II & III on quarter of site
Alternative 3B	High	Phase II and III on entire site
Alternative 3H	High	Phase II and III on entire site
Preferred Alternative, Alternative 2A-Mod.	None	None

Note: Entire Table is new to FEIS

Assuming these archaeological resources are eligible for inclusion in the National Register of Historic Places by virtue of Phase I and Phase II investigations, a Phase III archaeological excavation (Mitigation) of such resources would be needed if they cannot be avoided during construction.

Coordination with the DC Historic Preservation Office (SHPO) confirmed that a Phase II archaeological field survey will not be necessary for the Preferred Alternative, Alternative 2A-Modified. (See *Appendix G.*) No mitigation is necessary for archeological resources under the Preferred Alternative.

4.1.7 *Conformance with NCPC's Comprehensive Plan*

Note: This section is new to the FEIS.

None of the alternatives would result in the modifications of any buildings that front identified Special Streets and Places in the NCPC's Comprehensive Plan. For all alternatives, the design will be prepared to reflect the importance of the junctures and to respect the historic plans. All elements of each alternative will be designed to avoid adverse impact. NCPC will review the design if any build alternative is selected.

None of the alternatives would have an adverse impact on the preservation of the C&O Canal National Historical Park as a legacy of inland waterway development. Also, there will be no adverse impact to the recreational aspect of the park and no adverse impact to the preservation of the park's historic resources.

Alternatives 3B and 3H would result in conspicuous man-made forms upstream of Key Bridge. However, none of the signalized alternatives (Alternatives 2, 2A, or 2A-Modified) would result in conspicuous man-made forms.

The Preferred Alternative would result in the least amount of aesthetic impacts to the historic and contemporary urban design aspects of the Canal Road, the C&O Canal and the Palisades scenic environment. There is no construction impact to the Palisades scenic environment with the Preferred Alternative. The impacts to the C&O Canal only consist of moving an existing Whitehurst Freeway wall 6.5 feet toward the Canal. There is no impact to the C&O Canal wall. The Preferred Alternative only impacts Canal Road by adding one 250-300 foot left turn lane (for about 12 vehicles) at the University entrance intersection and by adding one 120 foot auxiliary lane at the Whitehurst Freeway intersection. The roadway alignment of Canal Road is not significantly changed.

Due to minimal impacts to Canal Road and adjacent C&O Canal, the Preferred Alternative would maintain the elements that contribute to the Gateway and Special Street designations of Canal Road, in the NCPC Comprehensive Plan.

4.2 TRAFFIC AND TRANSPORTATION

Reconstruction of the Canal Road entrance, and closing the Prospect Street entrance **as proposed by Alternatives 2, 3B and 3H**, would cause a redistribution of traffic entering and leaving Georgetown University's Main Academic Campus parking lot. **Alternatives 2A and 2A-Modified also present shifts in traffic patterns, but not as significantly as Alternatives 2, 3B or 3H, since Prospect Street would remain open.** This section evaluates the impacts these changes would have on the transportation system and its operation.

The discussion of transportation impacts concentrates on peak-period traffic conditions, since that is when the impacts to the roadway operation are the greatest. In the off-peak hours, area traffic generally moves without congestion and any changes in the University's parking lot's traffic patterns are not expected to have noticeable impacts.

4.2.1 Transportation Facilities and Services

4.2.1.a Regional and Local Roads

The primary change to traffic patterns would occur on Canal Road. Alternatives 2, 2A, and 2A-Modified would place an additional traffic signal along Canal Road at the Georgetown University entrance, approximately midway between the Foxhall Road and the Whitehurst Freeway intersections. **For Alternatives 2A and 2A-Modified, left turns out of the University would not be allowed in the a.m. peak period. All of** these alternatives would also add a left turn lane from the eastbound lanes at the new entrance, **and would also add left turn capability from the University onto eastbound Canal Road.**

Alternatives 3B and 3H would maintain the through lanes of Canal Road at the University entrance, but would change their configuration. Alternative 3B would elevate the westbound lanes and add an off and on ramp to the north side of the westbound lanes. Alternative 3H would depress both the eastbound and westbound lanes of Canal Road and would add off and on ramps to the south side of the eastbound lanes.

4.2.1.b Public Transportation System

At present, all of the G.U.T.S. routes except for the Dupont Circle shuttle, use the Canal Road entrance on their return to campus. The Dupont Circle shuttle now uses the Prospect Street entrance. This route would have a nominal increase in travel length **under Build Alternatives 2, 3B or 3H. For Build Alternatives 2A and 2A-Modified, Prospect Street remains open, thus no route changes would occur, unless G.U.T.S. decided that the Canal Road entrance provided better service.** No other impact to public transportation would occur.

4.2.1.c Pedestrian and Bicycle Facilities

With any of the alternatives, there would be no impacts to the existing bicycle and pedestrian pathways along the C&O Canal towpath or along the Glover-Archbold Parkway. Pedestrian and bicycle routes along Canal Road would also be retained with the Build Alternatives. In addition, the sidewalks within the project area would be improved and thus provide better access to the University from the south for pedestrians and bicyclists.

With the Build Alternatives 2, 3B or 3H, the University would close the Prospect Street entrance to its Main Academic Campus, except for service and emergency vehicles. It would remain open to

bicycles and pedestrians. This would reduce pedestrian/vehicular conflicts and increase safety on Prospect Street. This entrance would be of particular benefit to students and faculty who bicycle or walk to the University.

With Build Alternatives 2A **and 2A-Modified,** the Prospect Street entrance to the University's Main Academic Campus would remain open, in order to permit egress of eastbound traffic during morning peak conditions. No left turns at the signalized intersection of Canal Road and the south entrance would be permitted from the campus during morning peak hours. These Alternatives maintain Prospect Street as an access and egress opportunity for vehicular traffic.

4.2.1.d Access to Georgetown University

With any of the Build Alternatives, access to the University would be improved for drivers from Virginia. These drivers--who account for one-third of all trips to the academic campus of Georgetown University--would be able to use either the Key or Chain Bridges for their trips because of the full access at Canal Road. This would make their trips more direct and would remove many of them from the residential Georgetown streets. With the No Build Alternative, the existing travel patterns for these drivers would remain.

Similar improvements would occur for drivers to Georgetown University coming from the Whitehurst Freeway. In the afternoon peak hour, with the new eastbound exit onto Canal Road, drivers could easily access Whitehurst for their return. Drivers from the northwest similarly would experience direct access to the University in the morning peak hour because of the new eastbound entrance from Canal Road.

Those driving to the Georgetown Main Academic Campus Parking Lot from other directions also are expected to shift their access. **Those from the east or northeast may continue, under either Alternative 2A or 2A-Modified, to use Canal Road.** For those who live west of the University campus, Build Alternatives 2, 3B and 3H would provide for similar improvements to those who live to the northwest. They would be able to use MacArthur Boulevard or Foxhall Road to get to the University in the morning peak hour. However, those who live east would experience some problems with the closing of the Prospect Street entrance. They would have to drive further to the Canal Road entrance through a somewhat circuitous route. These drivers account for about 10 to 15 percent of all drivers to the Main Academic Campus. Under Alternatives 2A **and 2A-Modified**, motorists who live to the east would still have access to campus via Prospect Street.

4.2.2 Travel and Traffic Characteristics

This section will assess the changes in travel patterns for traffic to the University and the resulting changes in traffic volumes on local streets. This will include a quantitative and qualitative review of these changes. The implications on roadway operations will be discussed in the Section 4.2.3 Traffic Operations by Alternative.

4.2.2.a Changes in Travel Patterns to the University

The changes in travel patterns would be essentially the same for the five Build Alternatives. **Figure 4 - 7** shows the Main Academic Campus Parking Lot-related generated traffic volumes for the No Build and Build Alternatives for the morning peak hours. **Figure 4 - 8** shows the same information for the afternoon peak hour. **Up to 228 vehicles in the PM peak hour are expected to use the new left turn exit under the Build Alternatives. Alternatives 2, 2A and 2A-Modified, which all keep Prospect Street open, are expected to have 166 vehicles use the new left turn exit at Canal Road during the evening peak hour.**

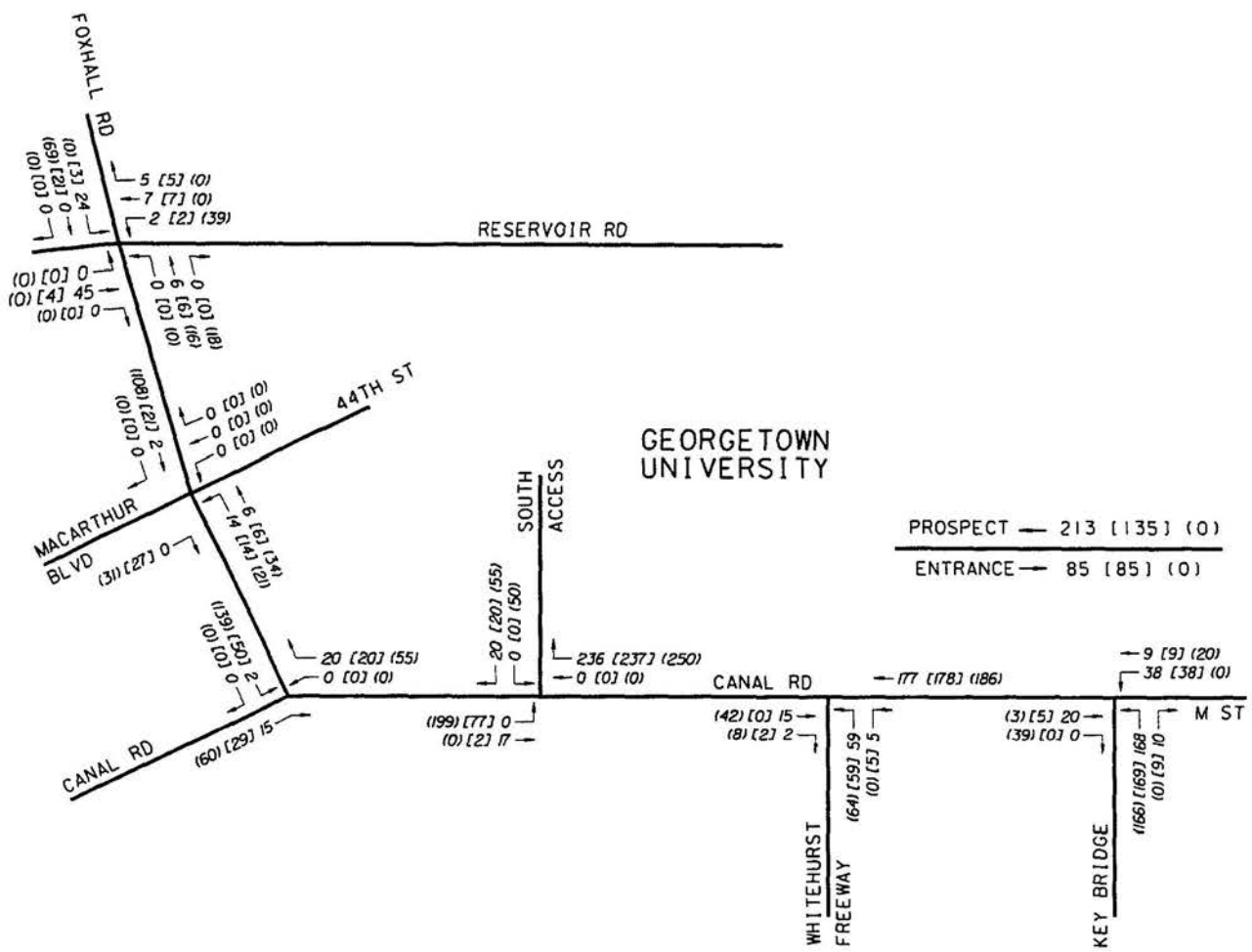
Drivers leaving the University parking lot who now use Prospect Street, 34th Street and M Street to reach Key Bridge for travel to Virginia would instead be able to make a left turn directly onto Canal Road and then turn right onto Key Bridge. Drivers could also use the Whitehurst Freeway by turning left onto Canal Road. These changes would remove an estimated 113 vehicles from Prospect Street in the PM peak hour under the Preferred Alternative.

Similarly, travel patterns would change during the AM peak hour under all Build Alternatives. All Build Alternatives allow left turns into the University at all times. Alternatives 2A and 2A – Modified would see 77 vehicles making a left turn at the Canal Road entrance in the morning peak hour, while Alternatives 2, 3B, and 3H would have 199 making the turn.

Vehicles from the west arriving from Canal Road or MacArthur Boulevard would travel east on Canal Road and make a left turn from Canal Road to enter the University. This would divert traffic from eastbound Reservoir Road. Some Virginia commuters presently utilizing the Key Bridge to the University would switch to Chain Bridge and eastbound Canal Road.

There would be no change in the access patterns or on University traffic volumes on the local streets with the No Build Alternative. Vehicles would continue to use the local streets east of the University and would continue to contribute to the congestion on these local streets.

The peak hour for the Main Academic Campus Parking Lot was assumed to be the average highest peak 60 minutes, typically 8:00 to 9:00 a.m. for the morning and 5:00 to 6:00 p.m. for the evening. Those hours also represent the highest volumes for background traffic. Although the current background traffic peak period extends for about three hours (7:00 to 10:00 a.m. and 4:00 to 7:00 p.m.), the traffic analysis assumed the highest concentrations for the peak hour. The "bell curve" of the entry and exit volumes of the Main Academic Campus Parking Lot was shown in Chapter 3.



LEGEND

ØØ - NO BUILD ALTERNATIVE 1998 AND 2016

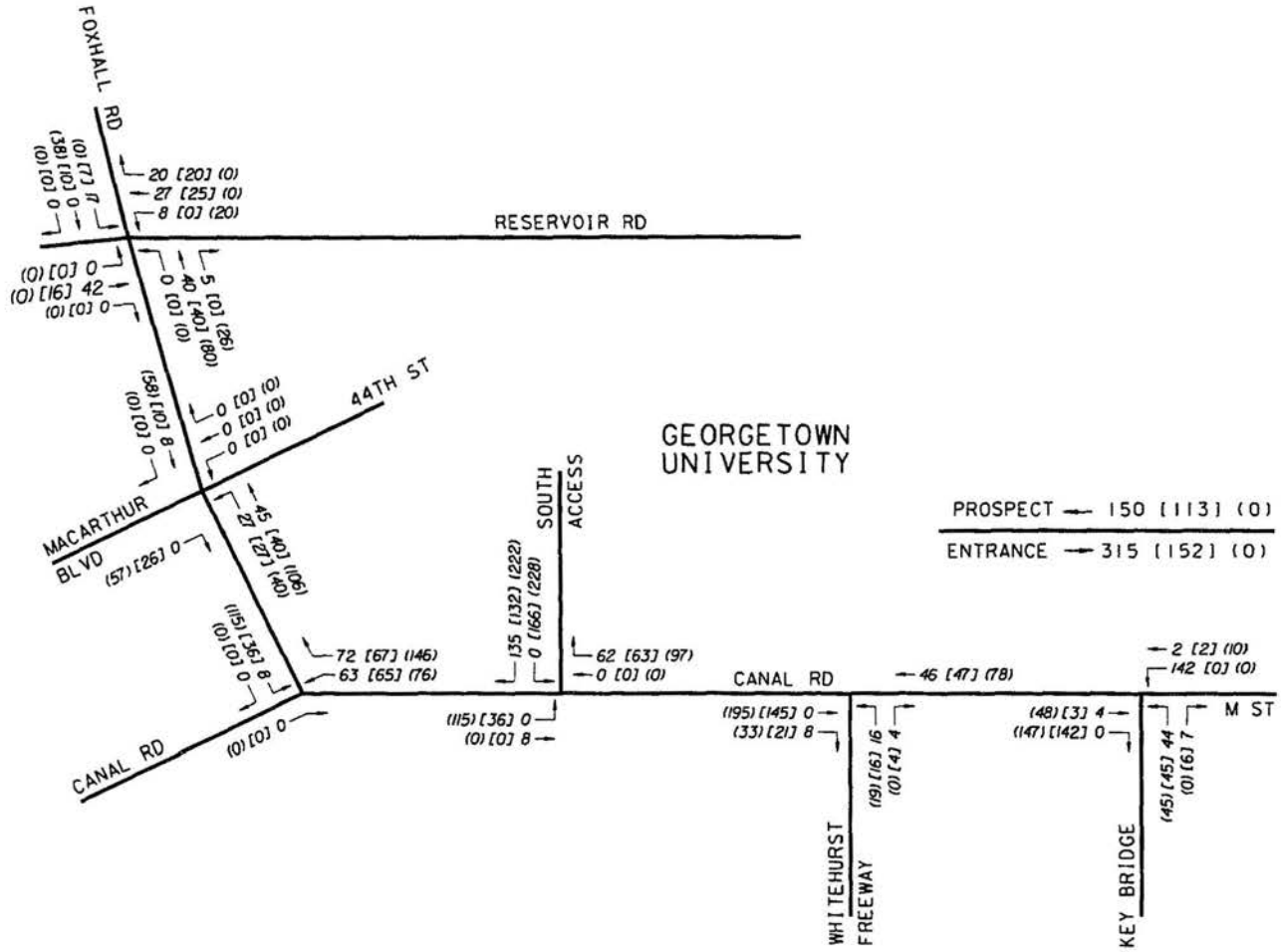
[ØØ] - BUILD ALTERNATIVES 2A / 2A-MODIFIED 1998 AND 2016

(ØØ) - BUILD ALTERNATIVES 2/3B/3H 1998 AND 2016

AM PEAK-HOUR UNIVERSITY-GENERATED* TRAFFIC

* MAIN ACADEMIC CAMPUS - PARKING LOT ONLY

Georgetown University Entrance Road ● Environmental Impact Statement **Figure 4-7**



LEGEND

00 - NO BUILD ALTERNATIVE 1998, AND 2016

[00] - BUILD ALTERNATIVES 2A / 2A-MODIFIED 1998 AND 2016

(00) - BUILD ALTERNATIVES 2/3B/3H 1998 AND 2016

PM PEAK-HOUR UNIVERSITY-GENERATED* TRAFFIC

* MAIN ACADEMIC CAMPUS - PARKING LOT ONLY

4.2.2.b Changes in Traffic Volumes on Local Streets

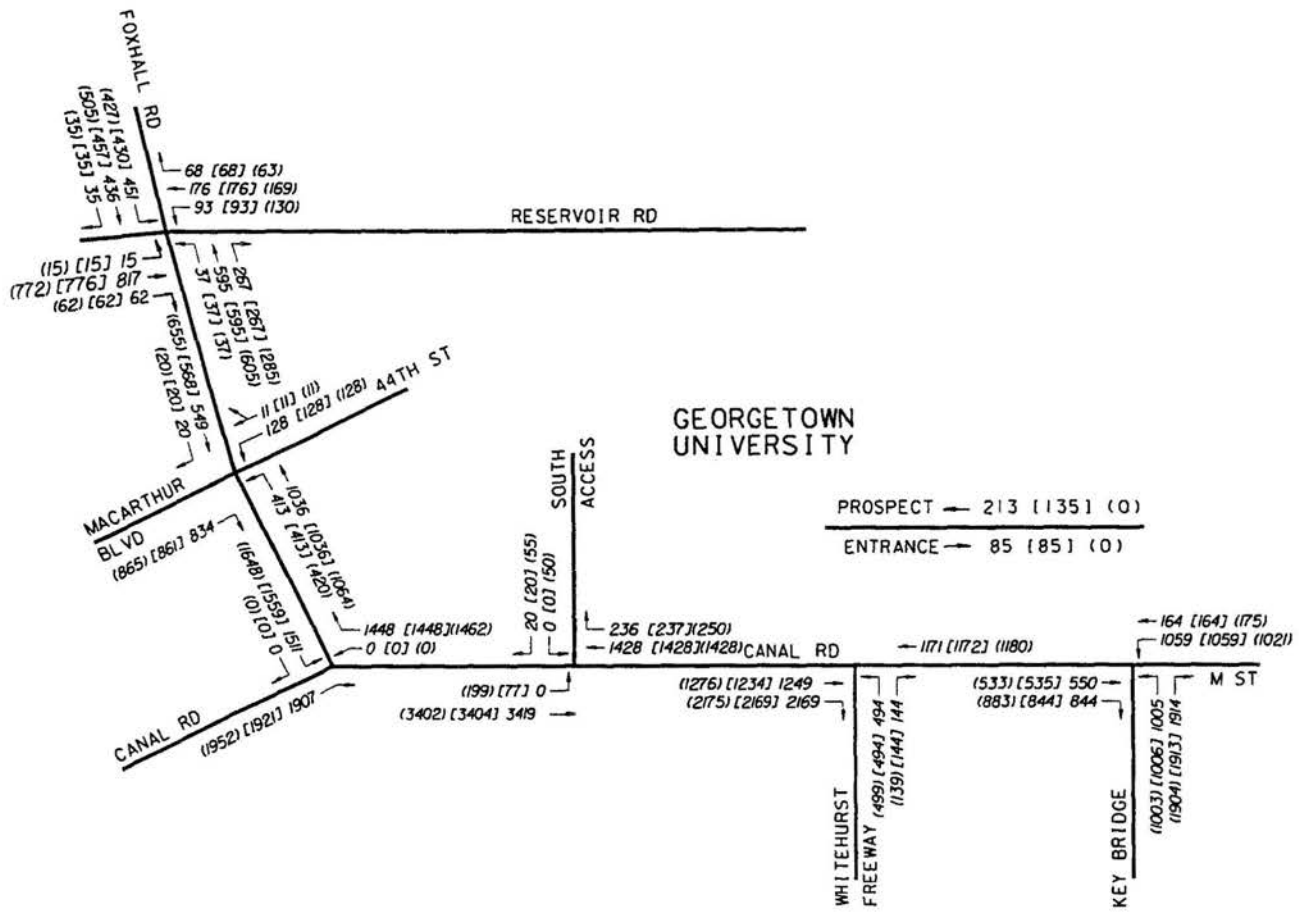
Any of the Build Alternatives would affect traffic volumes on local streets resulting from the change in travel patterns to the University. It should be remembered that with no increase in planned parking for the campus, and with the estimated similar enrollment conditions, no changes from the existing patterns or volumes or time-of-day access by users of the Main Academic Campus are assumed **for 1998 and 2016**. Therefore, the numbers in Figures 4-7 and 4-8 represent 1998 and 2016 volumes and associated redistribution of traffic between the Canal Road and Prospect Street entrances. **Figures 4 - 9** and **4 - 10** show the total morning and afternoon peak hour traffic volumes for the 1998 Build Alternatives and **Figures 4 - 11** and **4 - 12** show the same information for the 2016 Build Alternatives, which also include **a background increase in traffic. The DCDPW has estimated that background traffic will increase approximately 1.2 percent per year. All Alternatives were analyzed based on the same total traffic; only the distribution of traffic is different.**

For the background traffic, as with the ingress and egress to the Main Academic Campus Parking Lot, similar distribution about the peak hour occurs. Generally, the peak hour captures about 35-40% of the peak period, with the earlier hour about 30-35%, and the later hour about 25-30% for the Project Area. Traffic analysis for this study assumed the highest volumes for each peak hour.

There would be no change in the traffic patterns on the local streets or access with the No Build Alternative. Vehicles would continue to use the Prospect Street entrance and contribute to congestion of the local streets east of the University.

Under all Build Alternatives, traffic on local Georgetown residential streets would be reduced because of the diversion of vehicles from the Prospect Street entrance to Canal Road. The impact on traffic volumes on local roads in Georgetown would be the same for the three Build Alternatives 2, 3B & 3H since they all provide for the same changes in the entrances. Alternatives 2A **and 2A-Modified** would have lesser beneficial impact on local roads in Georgetown since Prospect Street would remain open. **Alternatives 2 or 2A-Modified would remove 78 vehicles from Prospect Street in the morning peak hour, and 200 in the evening peak hour.** In turn, traffic volumes on Canal Road would increase. The projected net peak hour shifts in traffic on Canal Road due to the Build Alternatives are as shown in **Table 4-5.**

The highest increases are in the eastbound direction **for any Build Alternative** because the Project would provide additional access to and from the eastbound lanes that is not now available. In the morning peak hour, traffic west of the entrance would increase by **62 vehicles under the Preferred Alternative**. However, on the section of Canal Road east of the entrance near the congested Whitehurst Freeway intersection, there would be a **slight decrease in net vehicles (15) due to the Preferred Alternative. This is because no left turn exits would be permitted in the morning**



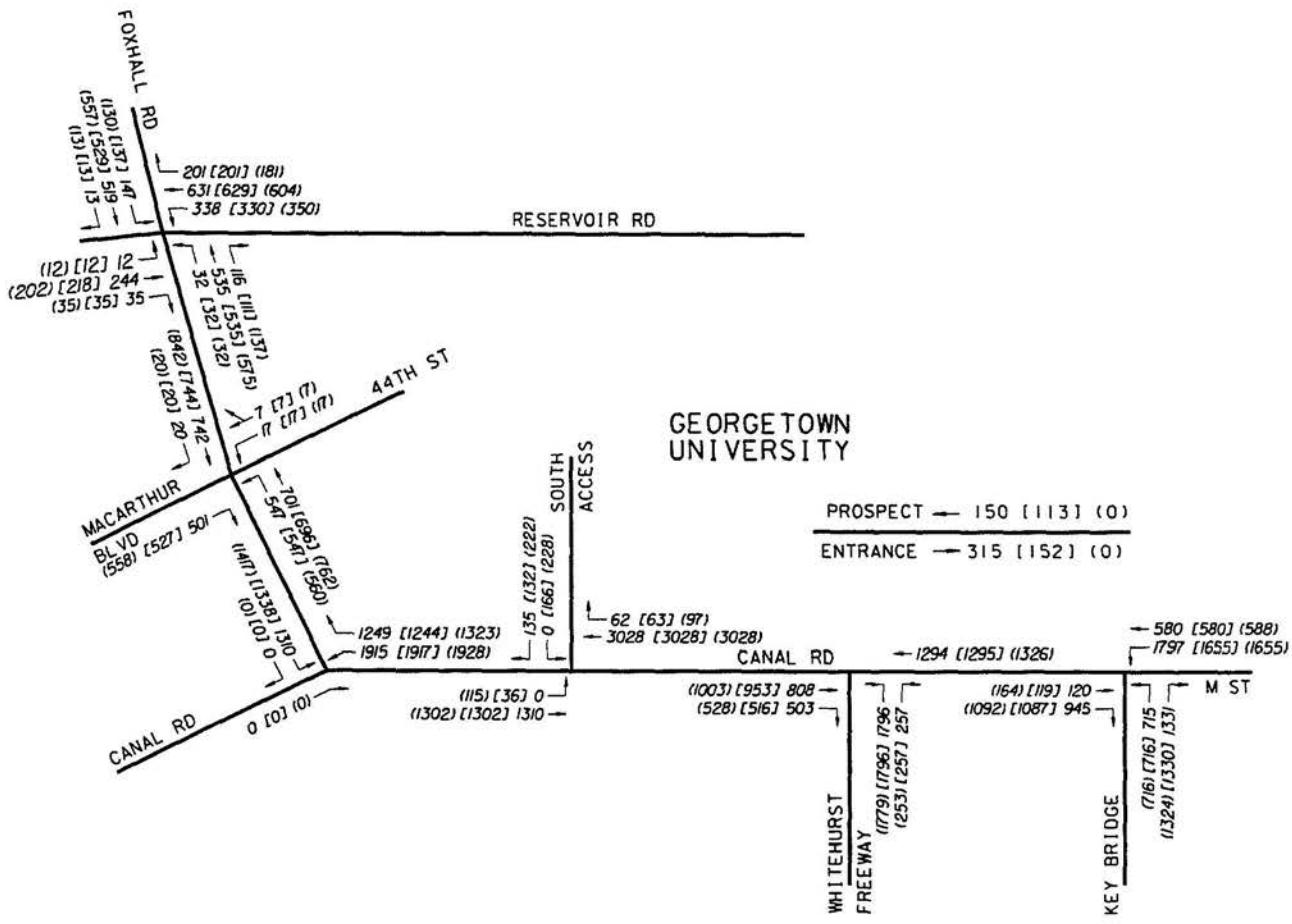
LEGEND

00 - NO BUILD ALTERNATIVE

[00] - BUILD ALTERNATIVES 2A / 2A MODIFIED

(00) - BUILD ALTERNATIVES 2/3B/3H

1998 AM PEAK HOUR TRAFFIC



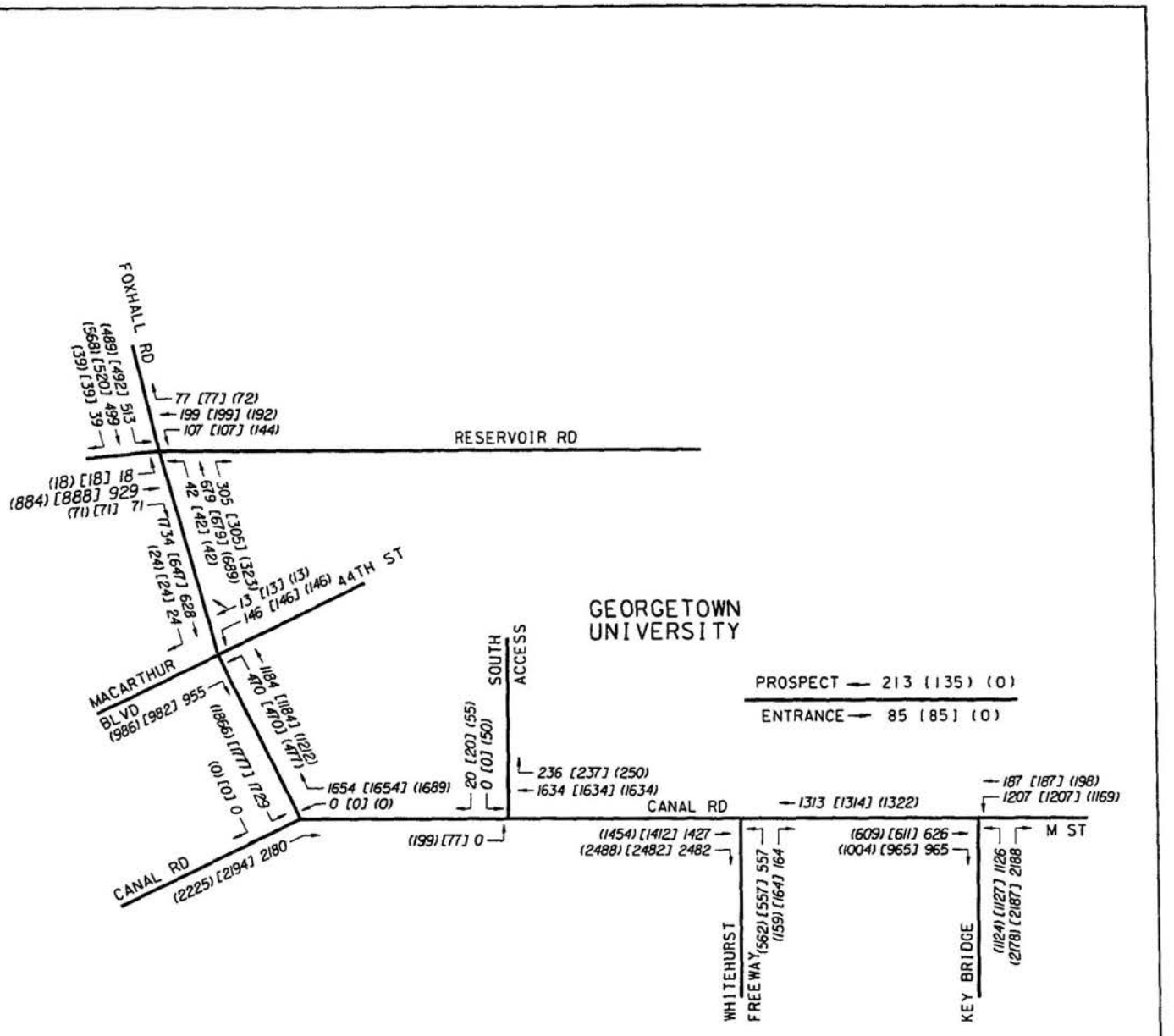
LEGEND

00 - NO BUILD ALTERNATIVE

[00] - BUILD ALTERNATIVES 2A / 2A- MODIFIED

(00) - BUILD ALTERNATIVES 2/3B/3H

1998 PM PEAK-HOUR TRAFFIC



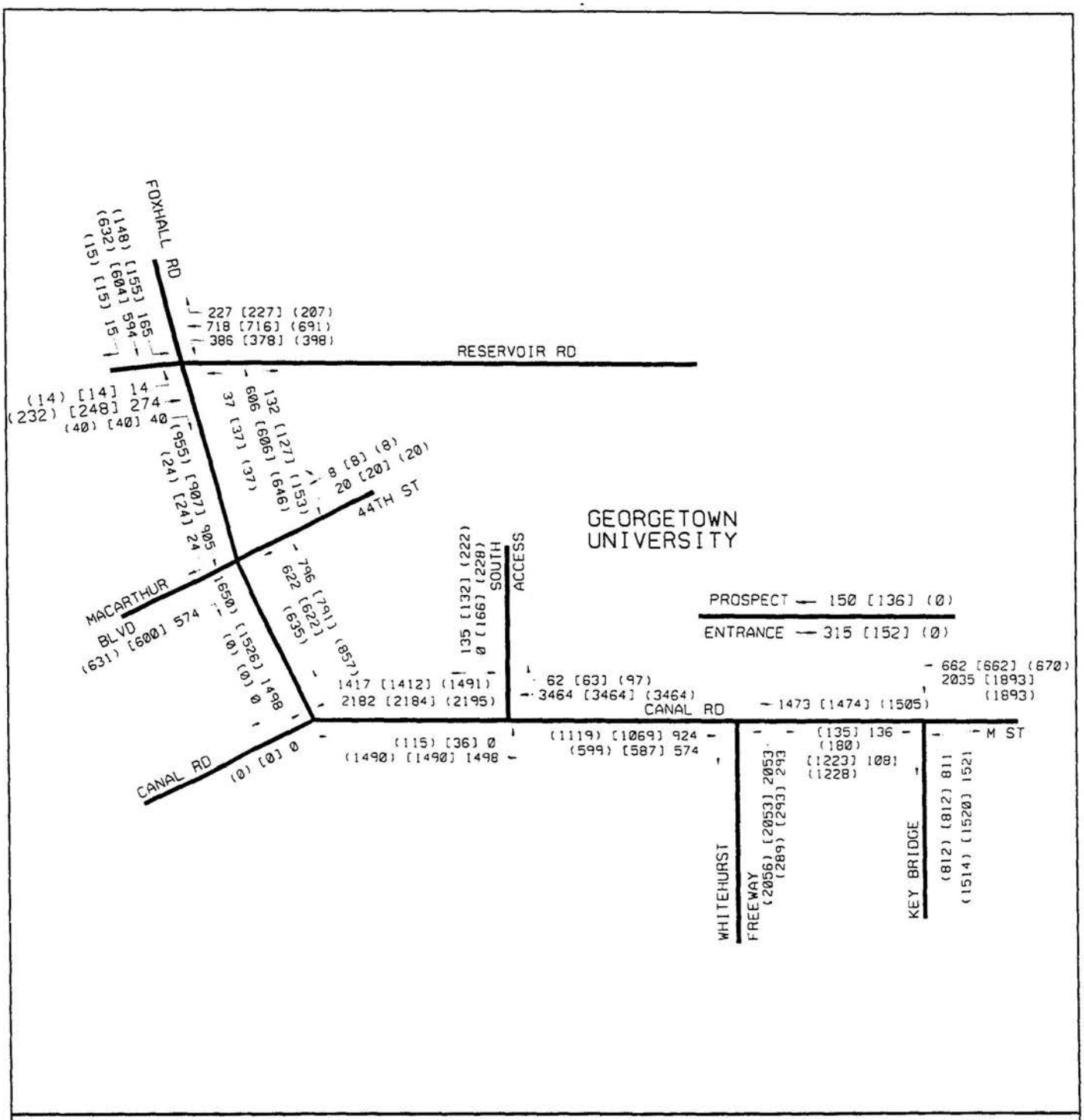
LEGEND

00 - NO BUILD ALTERNATIVE

[00] - BUILD ALTERNATIVES 2A / 2A-MODIFIED

(00) - BUILD ALTERNATIVES 2/3B/3H

2016 AM PEAK-HOUR TRAFFIC



LEGEND

00 - NO BUILD ALTERNATIVE

[00] - BUILD ALTERNATIVES 2A / 2A-MODIFIED

(00) - BUILD ALTERNATIVES 2/3B/3H

2016 PM PEAK-HOUR TRAFFIC

peak period and because some vehicles would no longer use Canal Road eastbound to access Prospect Street.

TABLE 4 – 5

Net Changes in Peak Hour Traffic

	MORNING PEAK HOUR		AFTERNOON PEAK HOUR	
	Alternative 2, 3B, 3H	Alternative 2A, 2A-Modified	Alternative 2, 3B, 3H	Alternative 2A, 2A-Modified
EASTBOUND CANAL ROAD				
East of Entrance	+33	-15	+220	+158
West of Entrance	+182	+62	+107	+28
WESTBOUND CANAL ROAD				
East of Entrance	+14	+1	+35	+1
West of Entrance	+35	+0	+87	+3

In the afternoon peak hour, the highest increase on eastbound Canal Road would be between the University entrance and the intersections with Key Bridge and the Whitehurst Freeway. This segment would increase **158** vehicles **under the Preferred Alternative**; west of the entrance the increase would be only **28** vehicles. These increases correspond with periods of lower traffic in the respective directions on Canal Road.

For westbound **Canal Road no noticeable difference in traffic volume would be incurred under Alternative 2A-Modified in either AM or PM peak hours.** For the other Build Alternatives, except 2A, the most measurable increase would occur in the afternoon. West of the entrance, approaching the Foxhall Road intersection, afternoon peak hour traffic under these alternatives would increase by 87 vehicles, or an average of one additional vehicle every minute.

Prospect Street

The Prospect Street entrance to the Main Academic Campus would see the greatest change in traffic for Alternatives 2, 3B and 3H because **this entrance would be closed for these Alternatives**. In the morning peak hour, traffic would decrease by 85 vehicles eastbound and 213 vehicles westbound. In the afternoon peak hour, the decrease would be 315 vehicles eastbound and 150 vehicles westbound. For Alternatives 2A **and 2A-Modified,** eastbound decreases are 0 and 163 and westbound decreases are 78 and 37 for the morning and afternoon peak hour respectively.

Reservoir Road

As shown in Figure 4-7, **all Build Alternatives decrease the morning peak hour eastbound traffic travelling on Reservoir Road to the Prospect Street entrance. Alternatives 2A and 2A-Modified decrease this movement by 62 vehicles, while Build Alternatives 2, 3B and 3H shift 51 vehicles off of Reservoir Road. Westbound traffic on Reservoir Road east of Foxhall Road in the morning peak hour does not change under Alternatives 2A and 2A-Modified, but is reduced by 25 vehicles for the other Build Alternatives.**

On Reservoir Road west of Foxhall Road, all Build Alternatives would shift traffic to MacArthur Boulevard to access the new Canal Road entrance. The change on this section of Reservoir Road in the morning peak hour would be a decrease of up to 45 vehicles in the eastbound direction and a decrease of up to seven vehicles westbound. In the afternoon peak hour, traffic would decrease 42 vehicles eastbound and 27 vehicles westbound. Alternatives 2A **and 2A-Modified** would shift traffic the least of the Build Alternatives.

Foxhall Road

Under all Build Alternatives, the traffic volume on Foxhall Road north of MacArthur Boulevard would increase slightly. The morning southbound peak hour would increase by 19 cars under Alternatives 2A and 2A-Modified, and by 106 vehicles for the other Alternatives. These increases are because vehicles going to the Main Academic Campus can access the new south entrance from Canal Road, rather than drive through Georgetown to Prospect Street. On Foxhall Road south of MacArthur Boulevard, the morning peak hour southbound increases are 48 and 137, respectively. The afternoon peak hour northbound volumes under Alternatives 2A and 2A-Modified does not change from the No Build.

4.2.3 Traffic Operations by Alternative

Calculation of traffic impacts is based on the changes in traffic volumes at intersections and on roadway segments caused by the redistribution of traffic from Prospect Street to the Canal Road entrance. The evaluation of traffic operations impacts **in the DEIS** considered Level of Service, travel time, queuing and weaving.

The assessments **in the DEIS** focused on the peak hour operations since these are most sensitive to changes in traffic volumes because of capacity constraints. During the off-peak hours, the traffic volumes are less and the addition of the lesser volumes of University-generated traffic would have less impact since the roadways operation at higher levels of service and congestion is less.

The DEIS, and the following sections, illustrate that none of the DEIS alternatives rendered significantly different results from a traffic flow perspective.

Subsequent to publication of the DEIS, additional analyses were undertaken for numerous additional alternatives. These alternatives were suggested by agencies and the public following the Public Hearing. These alternatives are discussed in Section 2.4. (The analyses of these alternatives may be found in the referenced documents.) To address concerns expressed by review agencies and the public regarding the traffic impacts on Canal Road by the Alternatives 2 and 2A, and numerous variations of Alternative 2A, a detailed network system-level traffic analysis was performed. The summary of the findings of this network simulation modeling for the Preferred Alternative can be found in Chapter 5 – Additional Traffic Analysis on the Preferred Alternative.

4.2.3.a Level of Service at Intersections

The LOS in the DEIS was calculated using the Highway Capacity Software (HCS). The HCS is based on the Highway Capacity Manual and is a widely accepted means to determine levels of service at signalized intersections.

HCS renders a general comparative measure of LOS. The LOS was calculated and compared for three years--1993, 1996, and 2016. The projected LOS at intersections in study area for the years 1993, 1996 and 2016 is presented in **Table 4-6. For comparison purposes, subsequent to the DEIS, the HCS methodology was applied for Alternative 2A-Modified. In order to maintain as similar comparisons to the DEIS as possible, the "build" year of 1996 was assumed for this table. However, existing signal timings were altered for this Alternative in order to accommodate the changes expected from the new (added) lane configuration on Canal Road at the Whitehurst Freeway.**

In the DEIS, the LOS for the intersection of Canal Road and the University entrance was calculated only for Alternatives 2 and 2A. This is because these **were** the only Alternatives that would make this a signalized intersection. At this intersection, the morning peak hour LOS would be D in 1996 for both alternatives. In the afternoon, the peak hour LOS would be D in 1996 for Alternative 2A. For other time periods for 1996 and for 2016, the LOS can not be calculated since traffic volumes exceed the intersection's capacity. This signal would be coordinated with other signals. Because of the queue that occurs at present on eastbound Canal Road in the morning and on westbound Canal Road in the afternoon, this signal would add no significant net additional delay to Canal Road vehicle travel. At present, there is a backup in the morning on the eastbound Canal Road from the Whitehurst Freeway to just east of the University entrance, and in the afternoon from just west of the University entrance.

For more accurate micro-level evaluation of the LOS for the Preferred Alternative and its comparison with the No Build, refer to the Chapter 5 discussion on the NETSIM analysis and results.