Final Report

William Carey International University

Traffic and Parking Study

Prepared for:
William Carey International University

99187000

Recd 10/20/05

Kimley-Horn and Associates, Inc.

ATTACHMENT F

FINAL REPORT
TRAFFIC AND PARKING STUDY

WILLIAM CAREY
INTERNATIONAL UNIVERSITY

Prepared for:
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1539 East Howard Street
Pasadena, California 91104

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September 15, 2005
99187000

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EXECUTIVE SUMMARY

William Carey International University (WCIU) located at 1539 East Howard Street in Pasadena hosts two churches with services on Sunday mornings. The City of Pasadena is concerned about the potential impact of church traffic and parking on the surrounding neighborhood. This traffic and parking study report compares the operation of intersections and roadways on Saturdays and Sundays to assess church service traffic. A comparison of on-street parking between Saturday and Sunday is also analyzed in this report, and several options for on-site parking enhancements are also provided. Based on the traffic and parking analyses documented in this report, Sunday campus activities have a greater impact on parking than on traffic in the surrounding neighborhood.

Based upon the analysis documented in this report, the following conclusions and recommendations are made.

- On Saturday, one of the six intersections studied operates at LOS B and the remaining intersections operate at LOS A.
- On Sunday, two of the six intersections studied operate at LOS B and the remaining intersections operate at LOS A. The intersection that had a degraded LOS B was Howard Street/Wesley Avenue.
- The roadway analysis indicates that most roadway segments analyzed have less daily traffic on Sunday than on Saturday.
- The parking analysis revealed that many more vehicles are parked on the neighborhood streets on Sunday between 9am and 1pm than on Saturday during the same time period. During the peak hour identified between 9am and 1pm, the number of on-street parked vehicles was 140 on Saturday and 302 on Sunday.
- The City of Pasadena may desire to provide on-street parking striping similar to metered space striping and red curb near driveways in order to provide better guidance on where and how to park to avoid blocking driveways or otherwise impacting neighbors.
- Figures 7 through 14 illustrate options for accommodating more parked vehicles on the campus during Sunday church services. The number of spaces that could be provided by implementing the most enhanced options would provide 126 additional parking spaces for use on Sunday.

INTRODUCTION

William Carey International University (WCIU) located at 1539 East Howard Street in Pasadena hosts two churches with services on Sunday mornings. The City of Pasadena is concerned about the potential impact of church traffic and parking on the surrounding neighborhood. This traffic and parking study report compares the operation of intersections and roadways on Saturdays and Sundays to assess church service traffic. A comparison of on-street parking between Saturday and Sunday is also analyzed in this report, and several options for on-site parking enhancements are also provided.

Figure 1 illustrates the WCIU campus location and the study area intersections, and **Figure 2** illustrates the campus site plan.

The study area includes 6 intersections that were analyzed between 9 a.m. and 1:30 p.m. on Saturday and Sunday. Intersection level of service, roadway level of service, on-street parking utilization, and on-site parking enhancement options were also evaluated.

The study area intersection traffic conditions were analyzed under the following two scenarios.

- Saturday (2005)
- Sunday (2005)

The study area intersections and roadways were defined in coordination with City of Pasadena staff. Six intersections and 2 roadway segments were analyzed for Saturday and Sunday mid-day operations in order to assess the comparative operation with and without Sunday church traffic and associated on-street parked vehicles. **Table 1** presents the study area intersections, their control, and jurisdiction.

STUDY AREA

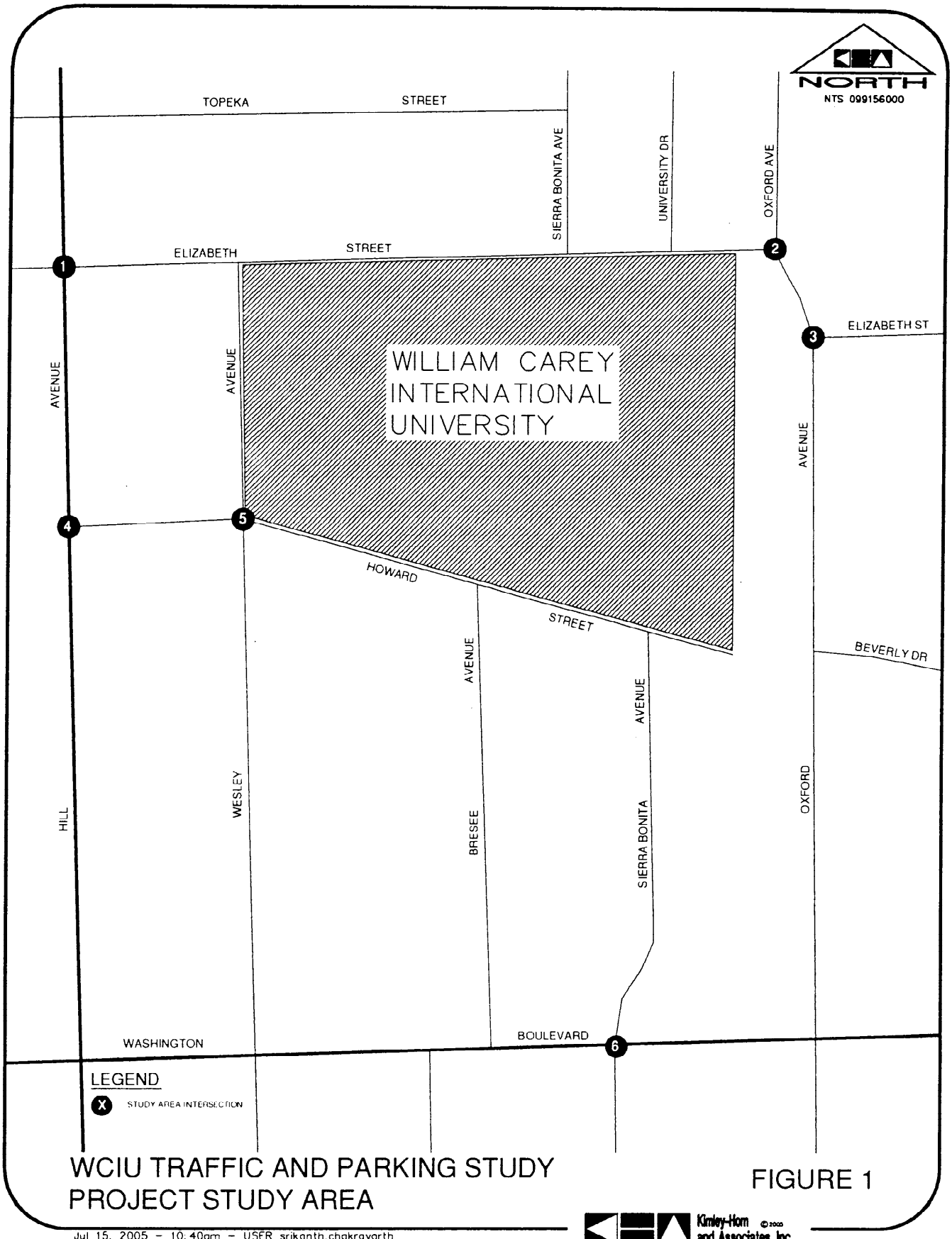
A description of study area roadways and analysis of existing intersection operating conditions is provided in the following paragraphs.

Washington Boulevard is located ½ mile south of the campus. Washington Boulevard is an east-west arterial roadway with two travel lanes in each direction and provides for local travel in the northern part of Pasadena.

Elizabeth Street is located adjacent to and north of the campus. It is an east-west neighborhood street with one travel lane in each direction with provision for on-street parking. Elizabeth Street provides access to the campus from Hill Avenue.

Howard Street is located adjacent to and south of the campus. It is an east-west neighborhood street with one travel lane in each direction with provision for on-street parking. Howard Street provides primary access to the campus from Hill Avenue.

Hill Avenue is located one block west of the campus. This roadway is a north-south collector that provides access to the Foothill (I-210) Freeway to the south. Hill Avenue has one lane in each direction with a center turn lane and provision for on-street parking.



WCIU TRAFFIC AND PARKING STUDY
PROJECT STUDY AREA

FIGURE 1

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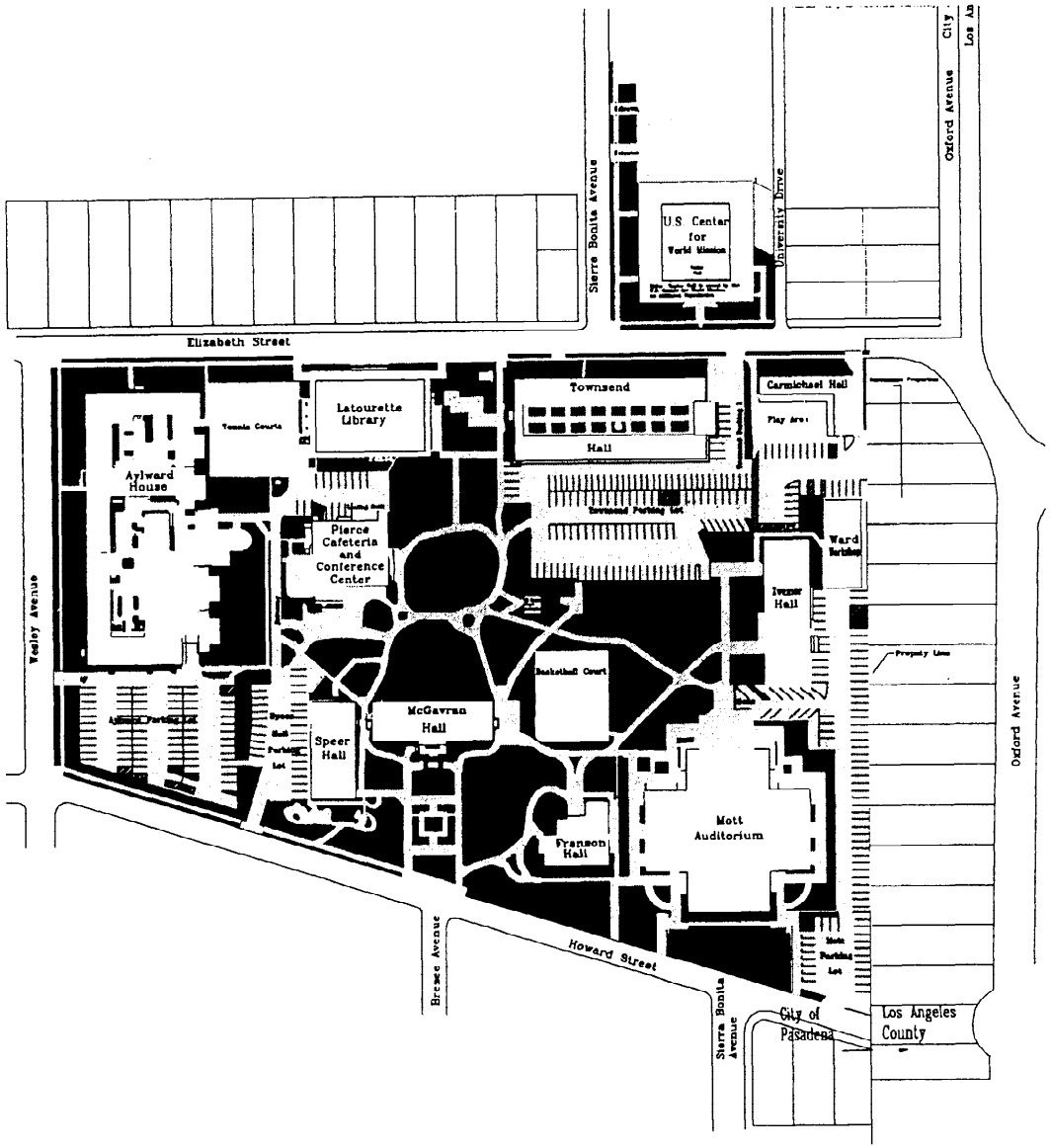
NORTH

NTS 099156000



WCIU TRAFFIC AND PARKING STUDY
CAMPUS SITE PLAN

FIGURE 2

Source: William Carey International University
Engineering Department

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Wesley Avenue is located adjacent to and west of the campus. It is a north-south neighborhood street with one travel lane in each direction with provision for on-street parking. Wesley Avenue provides access to the campus from Washington Boulevard.

Bresee Avenue is located adjacent to and south of the campus. It is a north-south neighborhood street with one travel lane in each direction with provision for on-street parking. Bresee Avenue provides access to the campus from Washington Boulevard.

Sierra Bonita Avenue is located adjacent to, north of, and south of the campus. It is a north-south neighborhood street with one travel lane in each direction with provision for on-street parking. Sierra Bonita Avenue provides access to the campus from Washington Boulevard.

Oxford Avenue is located east of the campus. It is a north-south neighborhood street with one travel lane in each direction with provision for on-street parking. Oxford Avenue provides access to the campus via Elizabeth Street.

The existing study area intersection approach lane configurations utilized for all analysis scenarios are illustrated in **Figure 3**.

TABLE 1
STUDY AREA INTERSECTIONS

	Intersection	Control	Jurisdiction
1	Elizabeth St/Hill Ave	2-way stop	City of Pasadena
2	Elizabeth St/Oxford Ave (north)	3-way stop	City of Pasadena
3	Elizabeth St/Oxford Ave (south)	3-way stop	Los Angeles County
4	Howard St/Hill Ave	1-way stop	City of Pasadena
5	Howard St/Wesley Ave	2-way stop	City of Pasadena
6	Washington Blvd/Sierra Bonita Ave	signal	City of Pasadena

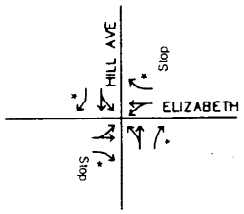
Source: Kimley-Horn and Associates. September, 2005

NORTH

NTS 099156000

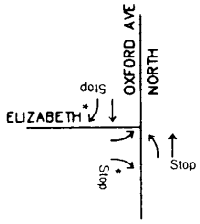
EXISTING LANE CONFIGURATION

1. ELIZABETH ST/HILL AVE



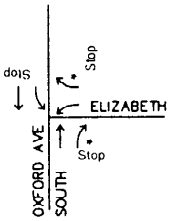
EXISTING LANE CONFIGURATION

2. ELIZABETH ST/OXFORD AVE NORTH

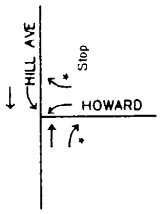


EXISTING LANE CONFIGURATION

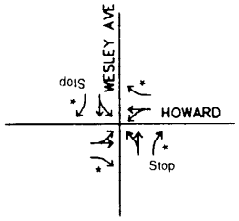
3. ELIZABETH ST/OXFORD AVE SOUTH



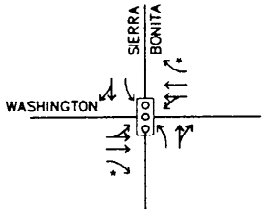
4. HOWARD ST/HILL AVE



5. HOWARD ST/WESLEY AVE



6. WASHINGTON BLVD/SIERRA BONITA AVE



LEGEND

- Lane Use
- * Functional, Not striped
- Intersection Control

WCIU TRAFFIC AND PARKING STUDY
EXISTING LANE CONFIGURATIONS

FIGURE 3

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STUDY METHODOLOGY

The Los Angeles County Congestion Management Program (CMP) traffic analysis guidelines require the use of the Intersection Capacity Utilization (ICU) method to calculate intersection level of service (LOS). **Table 2** presents the capacity utilization ratio and the corresponding LOS, using the ICU method. TRAFFIX software was utilized in the analysis using the ICU and HCM methodologies.

TABLE 2
ICU LEVEL OF SERVICE (LOS) DEFINITIONS

ICU / Delay Value	Level of Service (LOS)
0 to 60% / <10 seconds	A
>60% to 70% / >10 to 15 seconds	B
>70% to 80% / >15 to 25 seconds	C
>80% to 90% / >25 to 35 seconds	D
>90% to 100% / >35 to 50 seconds	E
>100% to 110% / >50 seconds	F

Source: Trafficware, Intersection Capacity Utilization 2000 Guidelines.

Analysis of traffic conditions is based upon new Saturday and Sunday mid-day turning movement counts and daily (ADT) traffic counts obtained by William Carey International University for this study. The traffic count worksheets are provided in **Appendix A**. The Saturday and Sunday intersection traffic counts were conducted between the hours of 9 a.m. and 1 p.m. on typical weekend days during May and June 2005.

SATURDAY INTERSECTION ANALYSIS

Saturday mid-day peak-hour traffic analysis was performed at the 6 intersections. **Table 3** presents the results of the Saturday intersection analysis. Saturday peak mid-day traffic volumes at each study area intersection are illustrated in **Figure 4**. Table 3 indicates that all of the study area intersections currently operate at LOS B or better. Traffix analysis worksheets for the existing conditions scenario are provided in **Appendix B.**

TABLE 3
SUMMARY OF INTERSECTION ANALYSIS
SATURDAY LEVEL OF SERVICE

	Intersection	LOS Analysis Results Saturday Peak Hour	
	Signalized Intersection	V/C	LOS
6	Washington Blvd/Sierra Bonita Ave	0.171	A
	Unsignalized Intersection	Delay (sec)	LOS
1	Elizabeth St/Hill Ave	9.8	A
2	Elizabeth St/Oxford Ave (north)	7.6	A
3	Elizabeth St/Oxford Ave (south)	7.3	A
4	Howard St/Hill Ave	10.6	B
5	Howard St/Wesley Ave	9.2	A

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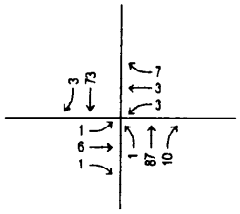
TRAFFIC VOLUMES
PEAK HOUR

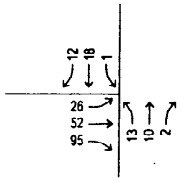
NORTH
NTS 099156000

SATURDAY

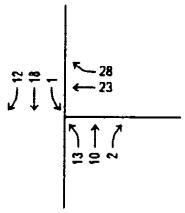
1. ELIZABETH ST/HILL AVE



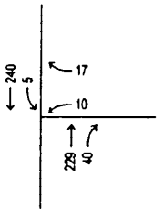
2. ELIZABETH ST/OXFORD AVE NORTH



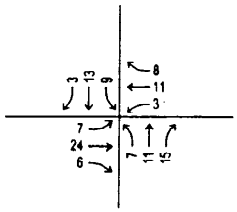
3. ELIZABETH ST/OXFORD AVE SOUTH



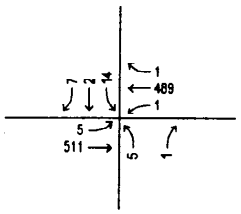
4. HOWARD ST/HILL AVE



5. HOWARD ST/WESLEY AVE



6. WASHINGTON BLVD/SIERRA BONITA AVE



LEGEND

← XX Peak Hour Traffic Volumes

WCIU TRAFFIC AND PARKING STUDY
EXISTING SATURDAY TURN MOVEMENT VOLUMES

FIGURE 4

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EXISTING SUNDAY CONDITIONS

Sunday mid-day peak-hour traffic analysis was performed at the 6 intersections. **Table 4** presents the results of the Sunday intersection analysis. Sunday peak mid-day traffic volumes at each study area intersection are illustrated in **Figure 5**. Table 3 indicates that all of the study area intersections currently operate at LOS B or better. Only one intersection—Howard Street/Wesley Avenue—had an increase in delay that changed the LOS from A to B, which is an acceptable level of service. Traffix analysis worksheets for the existing conditions scenario are provided in **Appendix C.**

TABLE 4
SUMMARY OF INTERSECTION ANALYSIS
SUNDAY LEVEL OF SERVICE

	Intersection	LOS Analysis Results Sunday Peak Hour		
	Signalized Intersection	**V/C**	**LOS**	**Change***
6	Washington Blvd/Sierra Bonita Ave	0.145	A	**-0.026**
	Unsignalized Intersection	**Delay (sec)**	**LOS**	**Change***
1	Elizabeth St/Hill Ave	9.9	A	**0.1**
2	Elizabeth St/Oxford Ave	7.9	A	**0.3**
3	Elizabeth St/Oxford Ave (south)	7.9	A	**0.6**
4	Howard St/Hill Ave	10.9	B	**0.3**
5	Howard St/Wesley Ave	12.4	B	**3.2**

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*Change compared to the Saturday analysis.

TRAFFIC VOLUMES
PEAK HOUR

NORTH
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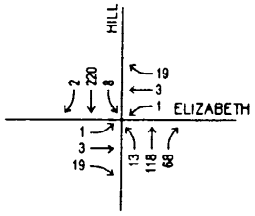
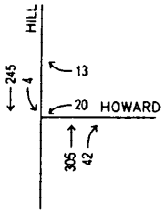
SUNDAY

1. ELIZABETH ST/HILL AVE

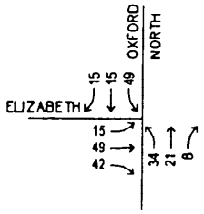


4. HOWARD ST/HILL AVE

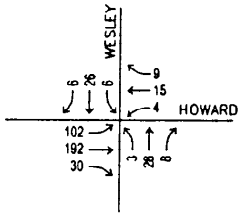


SUNDAY

2. ELIZABETH ST/OXFORD AVE NORTH

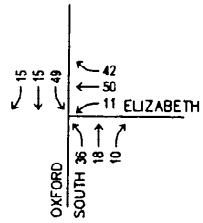


5. HOWARD ST/WESLEY AVE

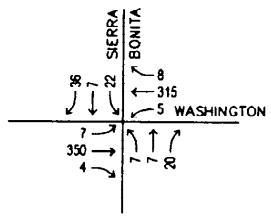


SUNDAY

3. ELIZABETH ST/OXFORD AVE SOUTH



6. WASHINGTON BLVD/SIERRA BONITA AVE



LEGEND

← XX Peak Hour Traffic Volumes

WCIU TRAFFIC AND PARKING STUDY
EXISTING SUNDAY TURN MOVEMENT VOLUMES

FIGURE 5

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ROADWAY ANALYSIS

Roadway analysis is based upon 24-hour traffic counts taken during April-June 2005 by WCIU staff. Seven roadway segments were analyzed for differences in daily traffic volume between Saturday and Sunday. **Table 5** presents the results of the analysis. Most roadway segments had lower traffic volumes on Sunday than on Saturday.

TABLE 5
SUMMARY OF ROADWAY ANALYSIS
SATURDAY AND SUNDAY COMPARISON

	Street	Segment	Saturday		Sunday		Difference
			Date	ADT	Date	ADT	
1	Howard St	Wesley Ave to Bresee Ave	4/9/2005	1,108	4/10/2005	1,102	-6
			4/16/2005	824	4/17/2005	980	156
2	Howard St	Hill Ave to Wesley Ave	4/23/2005	865	4/24/2005	730	-135
			4/30/2005	594	5/1/2005	571	-23
3	Bresee Ave	Howard St to Washington Blvd	4/9/2005	984	4/10/2005	1,042	58
			4/16/2005	526	4/17/2005	530	4
			4/23/2005	591	4/24/2005	534	-57
			4/30/2005	639	5/1/2005	383	-256
			5/7/2005	657	5/8/2005	706	49
4	Sierra Bonita Ave	Howard St to Washington Blvd	4/9/2005	501	4/10/2005	372	-129
			4/16/2005	594	4/17/2005	581	-13
			4/23/2005	580	4/24/2005	514	-66
			4/30/2005	588	5/1/2005	548	-40
			5/7/2005	381	5/8/2005	365	-16
5	Elizabeth St	Oxford Ave to Sinaloa Ave	4/16/2005	1,289	4/17/2005	1,106	-183
			4/23/2005	1,363	4/24/2005	1,091	-272
6	Elizabeth St	Hill Ave to Wesley Ave	4/16/2005	1,483	4/17/2005	1,525	42
			4/23/2005	1,424	4/24/2005	1,396	-28
			4/30/2005	1,461	5/1/2005	1,587	126
7	Wesley Ave	Howard St to Washington Blvd	6/4/2005	625	6/5/2005	612	-13
			6/11/2005	663	6/12/2005	626	-37

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PARKING ANALYSIS

On-Street Parking Analysis

A survey of on-street parking utilization was performed by WCIU staff on the streets surrounding the WCIU campus. The streets surveyed included the following:

- Elizabeth Street between Hill Avenue and Oxford Avenue
- Howard Street between Hill Avenue and Sierra Bonita Avenue
- Wesley Avenue between Elizabeth Street and Washington Boulevard
- Bresee Avenue between Howard Street and Washington Boulevard
- Sierra Bonita Avenue between Howard Street and Washington Boulevard

The number of on-street parked vehicles was counted between 9am and 2pm to identify the anticipated peak on-street parking usage on Sundays. The City of Pasadena has requested that the comparison between Saturday and Sunday be made to determine the relative impact of church parking on the neighborhood streets surrounding the WCIU campus. On-street parking utilization was surveyed on both Saturdays and Sundays to compare the two days' parking demand. It was anticipated that a large number of people attending church services on Sunday at the WCIU campus are parking on the streets surrounding the campus. This section of the report documents the results of the on-street parking survey. The subsequent section of this report introduces several options for providing additional parking on the campus. The on-street parking survey was performed on the following days:

- Saturday, June 4, 2005
- Sunday, June 5, 2005

Table 6 presents a summary of the on-street parking survey, and **Figure 6** illustrates the locations of the on-street parking survey. The table is organized to display the following information:

- Street block
- Side of the street surveyed
- Number of parking spaces available based upon a typical on-street parking space length of 20 feet
- The number of vehicles parked
- The percentage of vehicles parked given the estimated number of spaces available

The table indicates that the peak number of vehicles parked on neighborhood streets is higher on every street segment on Sundays than on Saturdays during the times surveyed (9am-2pm). The total peak number of parked vehicles for all of the streets surveyed was 140 on Saturday and 302 on Sunday.

On-street parking for the Victory Church located on Hill Avenue south of Howard Street occurs on Howard Street in the WCIU neighborhood. Some of the on-street parking occurring close to Hill Avenue could be at least partially attributable to this church's services on Sundays.

TABLE 6
SUMMARY OF ON-STREET PARKING ANALYSIS

Street	Block	Side of Street	Parking Spaces Available	Peak Parking Occupancy	
				Saturday	Sunday
Elizabeth St	Hill Ave to Sierra Bonita Ave	North	27	15% 4	52% 14
Elizabeth St	Hill Ave to Wesley Ave	South	11	36% 4	91% 10
Elizabeth St	Sierra Bonita Ave to Oxford Ave	North	12	25% 3	117% 14
Elizabeth St	Wesley Ave to Oxford Ave	South	41	59% 24	90% 37
Howard St	Hill Ave to Wesley Ave	North	10	40% 4	120% 12
Howard St	Hill Ave to Wesley Ave	South	7	71% 5	143% 10
Howard St	Wesley Ave to Oxford Ave	North	40	15% 6	100% 40
Howard St	Wesley Ave to Bresee Ave (Sunday only)	South	1	N/A	500% 5
Howard St	Bresee Ave to Sierra Bonita Ave (Sunday only)	South	7	N/A	100% 7
Wesley Ave	Elizabeth St to Howard St	West	23	26% 6	57% 13
Wesley Ave	Elizabeth St to Howard St	East	19	21% 4	79% 15
Wesley Ave	Howard St to Washington Blvd	West	32	53% 17	56% 18
Wesley Ave	Howard St to Washington Blvd	East	27	30% 8	59% 16
Bresee Ave	Howard St to Washington Blvd	West	20	55% 11	90% 18
Bresee Ave	Howard St to Washington Blvd	East	27	52% 14	63% 17
Sierra Bonita Ave	Topeka St to Elizabeth St	West	10	40% 4	90% 9
Sierra Bonita Ave	Topeka St to Elizabeth St	East	10	10% 1	100% 10
Sierra Bonita Ave	Howard St to Washington Blvd	West	26	31% 8	69% 18
Sierra Bonita Ave	Howard St to Washington Blvd	East	16	106% 17	119% 19

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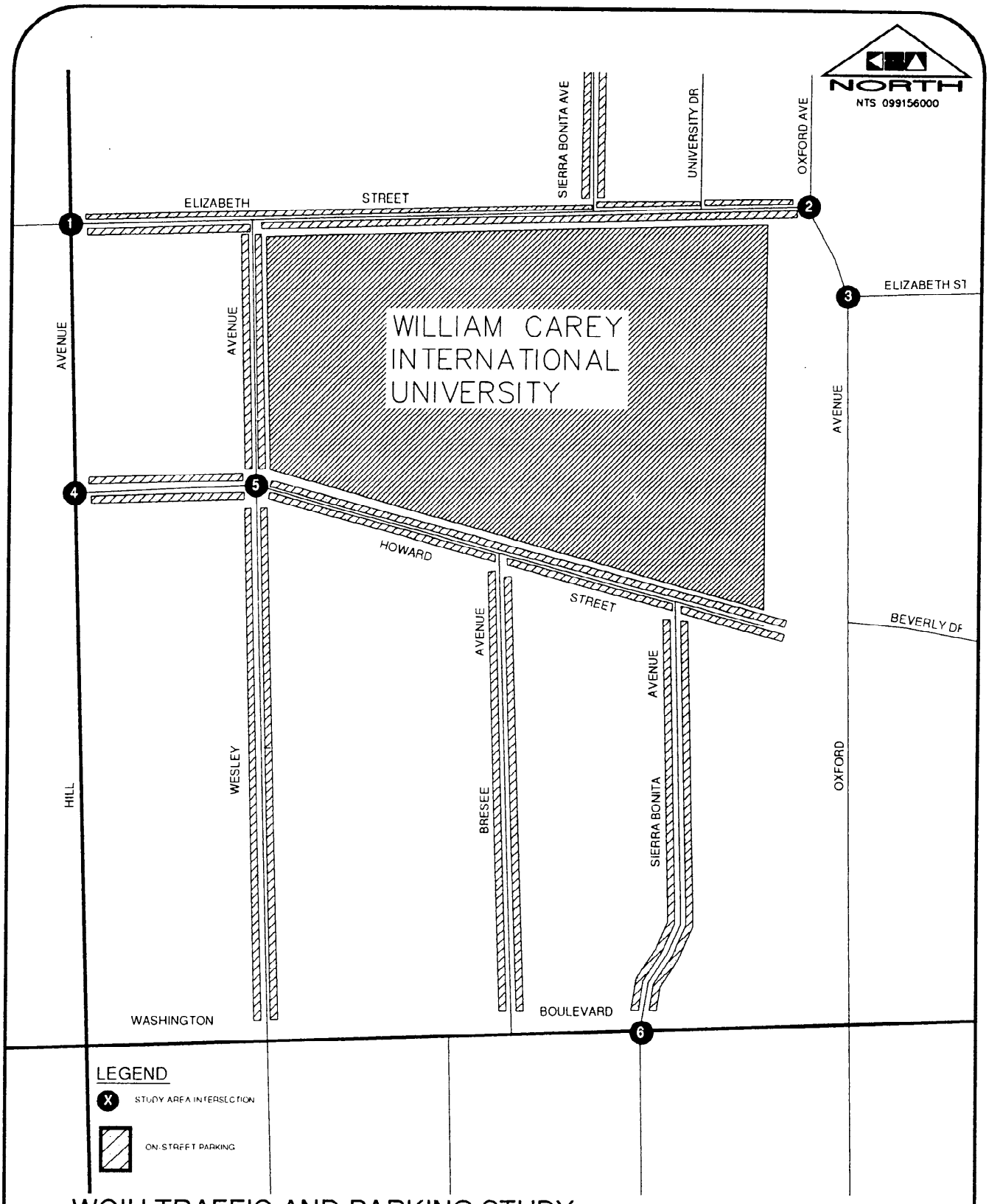
The City of Pasadena may desire to provide on-street parking striping similar to metered space striping and red curb near driveways along the streets of the neighborhood. Such striping and red curb would provide users of on-street parking with better guidance on where and how to park so as not to block driveways or otherwise impact neighbors.



WCIU TRAFFIC AND PARKING STUDY
ON-STREET PARKING

FIGURE 6

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On-Site Parking Enhancement Alternatives

As a part of the previous Transportation Assessment Report performed by Kimley-Horn in 2004, the Townsend parking lot of the WCIU campus was analyzed for potential restriping to provide additional parking that might reduce the need for church parking to occur on neighborhood streets. The Townsend, Spear, and Mott on-site parking lots were analyzed in this study, and several options for accommodating more parked vehicles on the campus have been identified.

WCIU campus staff will also instruct church pastors to make announcements regarding circulation and parking matters to try to reduce conflict and encourage more people to park on-site rather than on neighborhood streets.

Townsend Lot

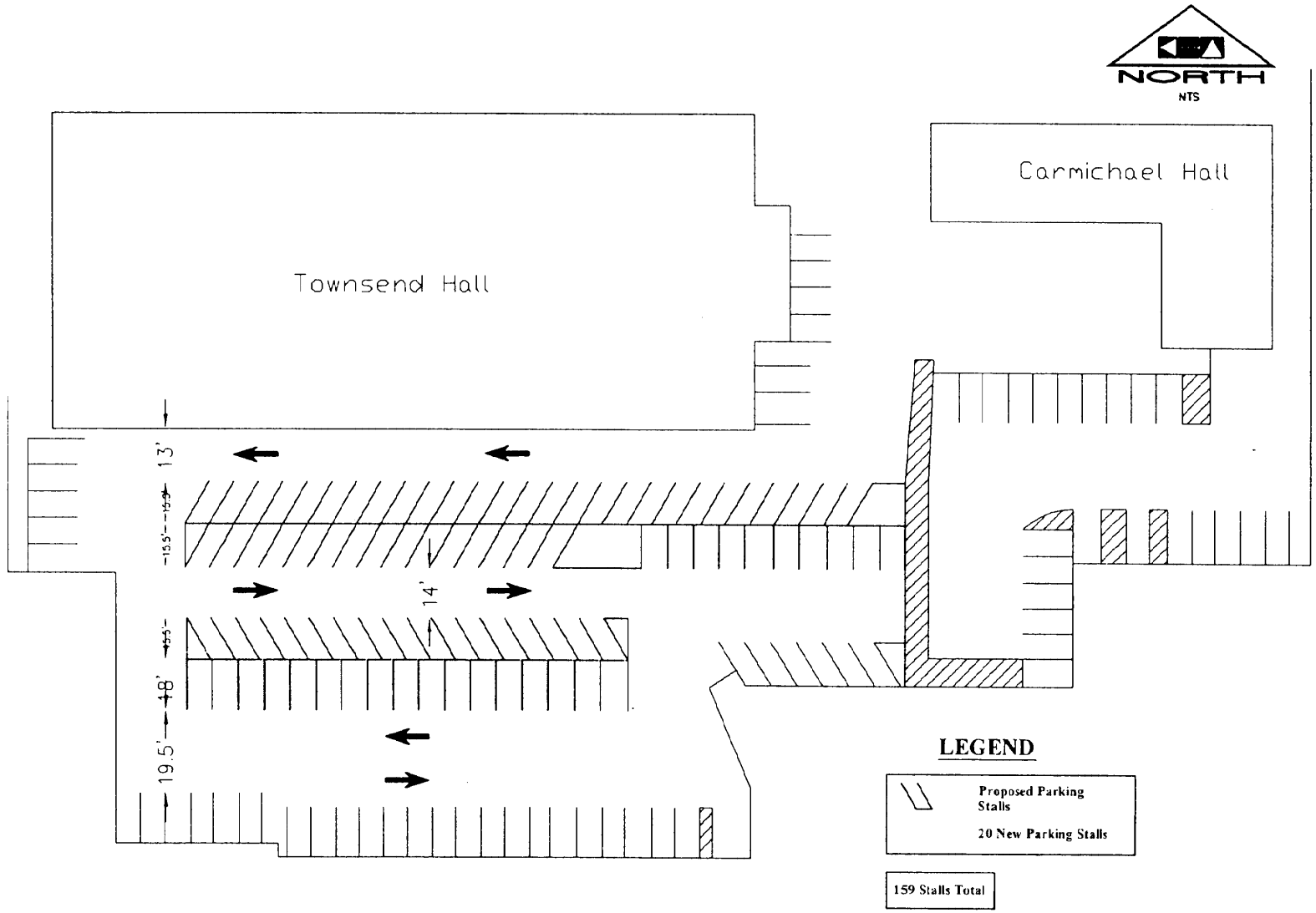
Two parking enhancement options are provided for the Townsend lot. The first option illustrated in **Figure** 7 is the option depicted in the previous Transportation Assessment Report. This would provide for the restriping of the northernmost two rows of parking from perpendicular to angle parking. A new row of angled parking spaces would be created by narrowing the middle drive aisle, which would be converted from two-way to one-way traffic. The parking lot would be able to accommodate an additional 20 parking spaces with this option.

The second option introduces a stacked parking concept in addition to diagonal parking. Stacked parking is most often utilized at large events where a large number of vehicles arrive and depart at the same time, such as at the Hollywood Bowl or at the Greek Theater. The basic concept of stacked parking is to maximize parking by placing vehicles next to each other as they enter without regard for any individual vehicle's exit on its own. On the WCIU campus, there is a distinct phenomenon witnessed by campus staff where many church-goers arrive late to services and leave early. Campus staff believes that these late-arrivers/early departers could utilize the stacked parking because they would create minimal impact to other vehicles that they would be temporarily blocking. Staff would direct traffic and ask late-comers if they are planning to leave early, and if so, they would be directed to park in the stacked parking spaces.

Figure 8 illustrates the stacked parking option. The illustration is an estimate of the number of vehicles that could be accommodated. A default dimension of 18 feet by 9 feet was used to represent the space that a parked vehicle would typically occupy under this concept. The figure shows that an additional 38 parked vehicles could be accommodated with the implementation of a combination of diagonal and stacked parking in the Townsend parking lot.

Spear Lot

Two options for maximizing parking in the Spear lot are presented in **Figures 9** and **10**. Option 1 in Figure 9 would restripe the existing parking stalls for diagonal parking. Six parallel spaces could be located in the middle of the drive aisle between the two rows of diagonal parking stalls. This would add 8 spaces to the lot. Option 2 would add the parallel spaces in back of the existing perpendicular stalls located on the east side of the lot. This would add 7 spaces to the lot on Sundays. In both options, the new spaces would be reserved for late-comers/early departers to church services.



WCIU TRAFFIC AND PARKING STUDY
TOWNSEND PARKING OPTION 1

FIGURE 7

Jul 21, 2005 - 4:55pm - USER srikanth.chakravarth
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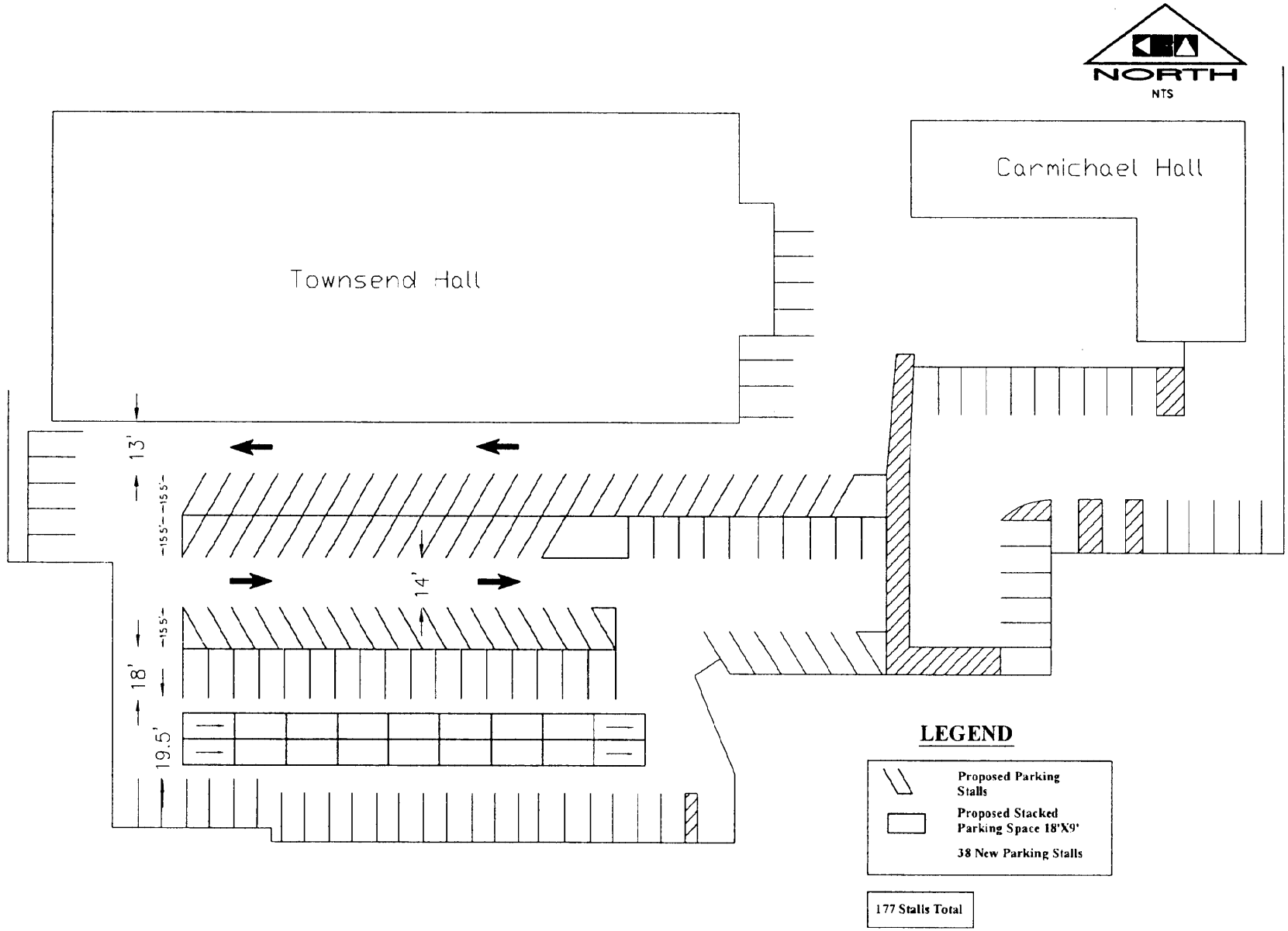

WCIU TRAFFIC AND PARKING STUDY
TOWNSEND PARKING OPTION 2
DIAGONAL AND STACKED

FIGURE 8

Sep 15, 2005 - 1:15pm - USER Mark.Brown
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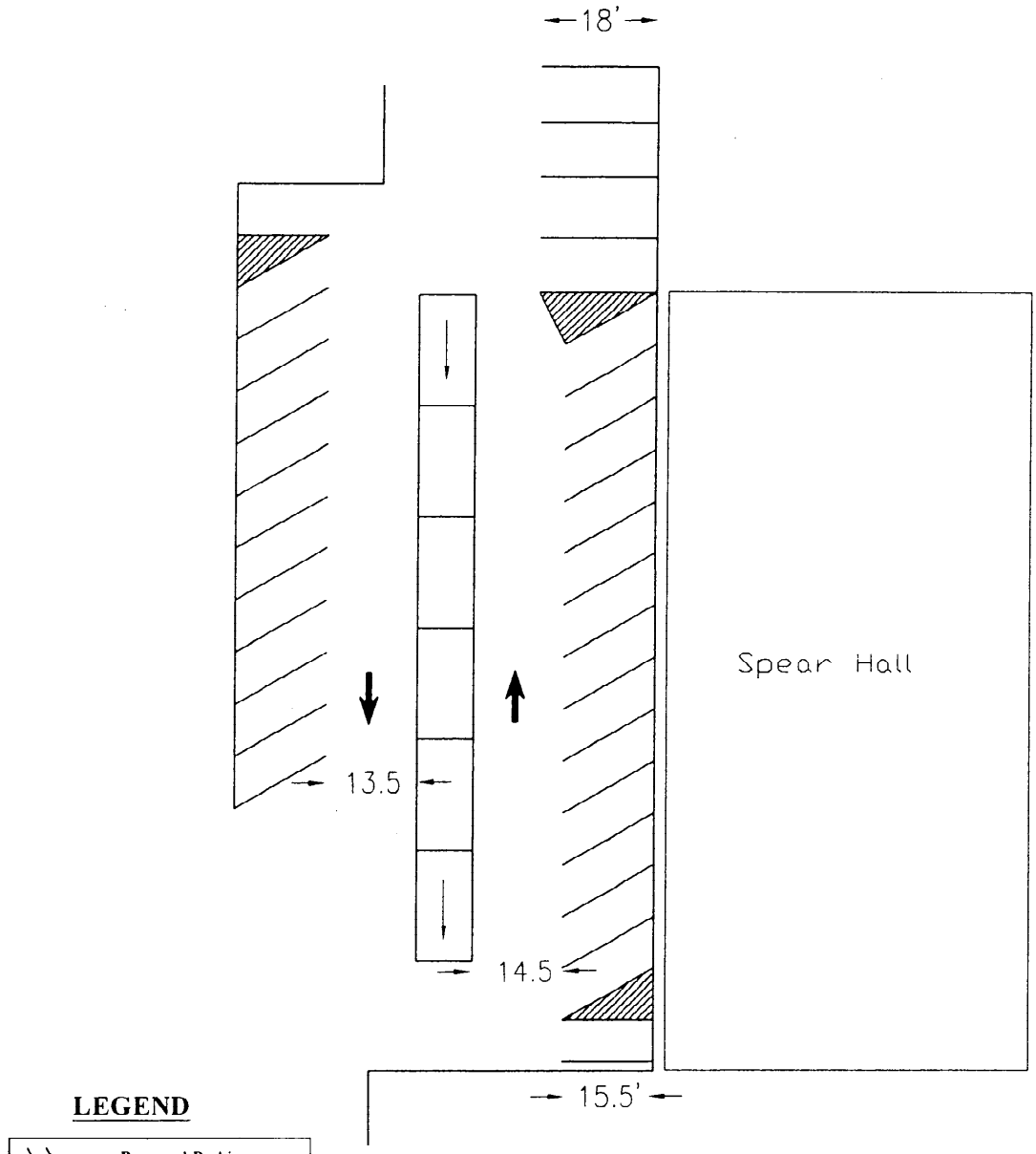


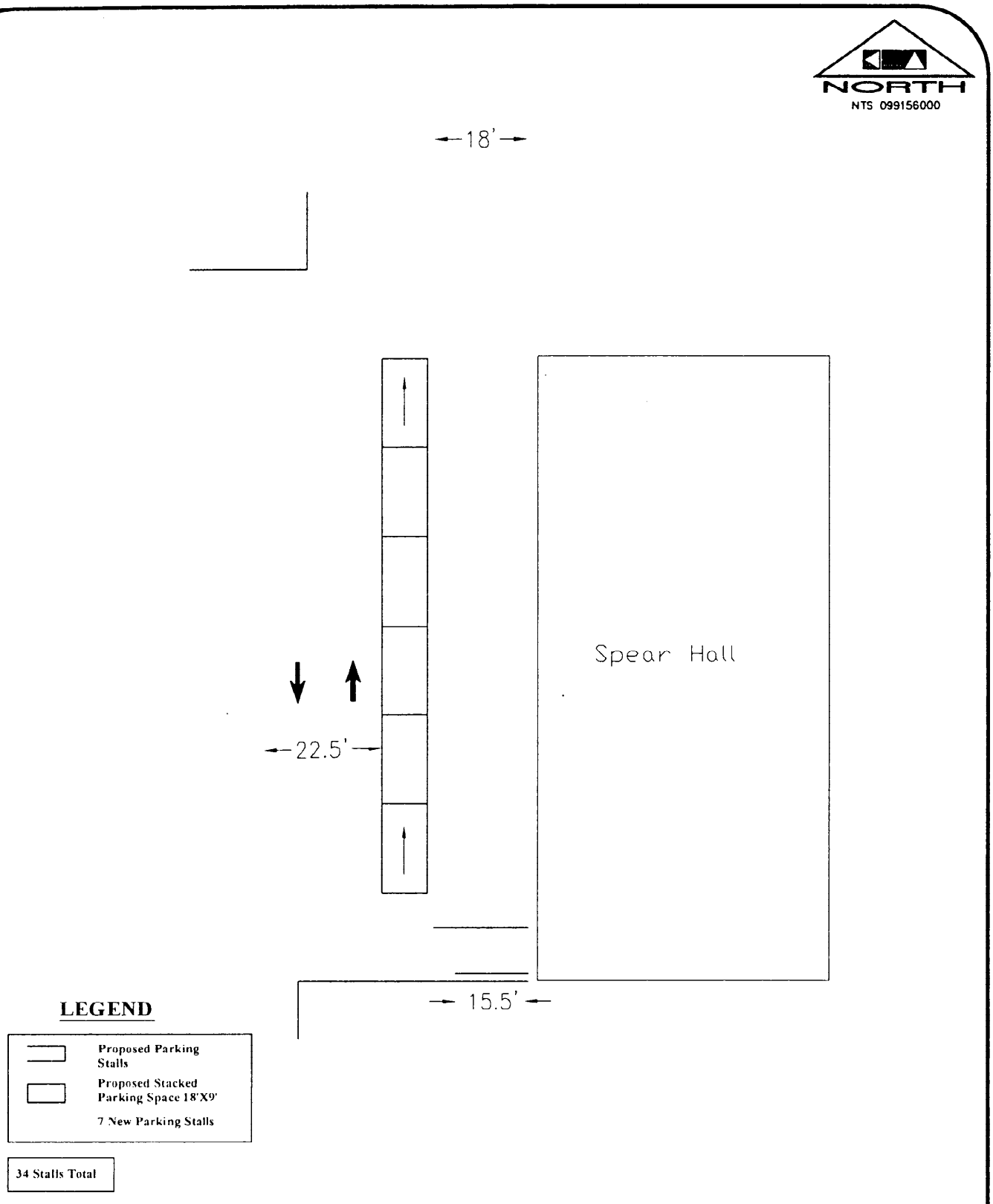
LEGEND

	Proposed Parking Stalls
	Proposed Stacked Parking Space 18'X9'
	8 New Parking Stalls

35 Stalls Total

WCIU TRAFFIC AND PARKING STUDY
SPEAR HALL PARKING OPTION 1

FIGURE 9



WCIU TRAFFIC AND PARKING STUDY
SPEER HALL PARKING OPTION 2

FIGURE 10

Sep 15, 2005 - 10:21am - USER Mark.Brown
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