

# **50 S. Liberty Street Traffic Study**

Prepared for:

**3 Pillar Homes**

Prepared By:

**TRAFFIC ENGINEERING  
SERVICES, INC.**

**July 2004**

## **TABLE OF CONTENTS**

Executive Summary	1
Proposed Site Development	3
Area Conditions	3
Existing Traffic	3
Trip Generation and Distribution	8
Site Generated and Opening Day Traffic	12
Traffic Analyses	24
Conclusions and Recommendations	26

## **TECHNICAL APPENDIX** (Bound Separately)

## EXECUTIVE SUMMARY

3 Pillar Homes is proposing to develop a site on South Liberty Street in the City of Powell just south of the “Four Corners” intersection. The site is approximately 3.75 acres and will be developed with the following office and retail uses:

15,400 SF of Specialty Retail  
4,000 SF of Quality Restaurant  
16,300 SF of General Office Building

There are two proposed site access points on South Liberty Street. The southern access will have potential connectivity to adjacent undeveloped properties.

The City of Powell Development Commission has requested a traffic study for the subject property. The purpose of this study is to examine the development’s impact on the “Four Corners” intersection and South Liberty Street. Several off-site roadway improvements are being considered that will impact traffic at the “Four Corners.” As a result, the study is considering the impact of the site for the following cases:

Case 1: Existing Network  
Case 2: Murphy Parkway Extension to S. Liberty St.  
Case 3: Olentangy Street widening at Liberty St.  
Case 4: Southeast Quadrant Connector  
Case 5: Cases 2-3 Combined

As part of this study, a 24-hour machine counts were taken on all four legs of the “Four Corners” intersection. Also, a turning movement count was performed at the “Four Corners” in the PM peak hour. The 24 hour counts were compared with counts taken in 1998. Olentangy Street traffic has increased 19% since 1998. Traffic on South Liberty Street has increased by 4% since 1998 and traffic on North Liberty Street has declined 12% since 1998. Overall traffic has increased 8.4% since 1998.

The site traffic was computed using *Trip Generation, 7th Edition*, published by the Institute of Transportation Engineers (ITE). The land use categories assumed were Specialty Retail (814), Quality Restaurant (931), and General Office Building (710). In the PM peak hour the site will generate approximately 169 trips.

The site traffic will increase traffic going through the intersection of Olentangy Street and Liberty Road by about 7.6% based on existing conditions. When Murphy Parkway is extended or if other roadway improvements are made, the percentage will change slightly.

A PM peak hour capacity analysis was performed at the "Four Corners" intersection for each of the cases that were previously described. The analysis was performed using "Existing" traffic and the "Existing plus Site" traffic. For some of the scenarios the "Existing" traffic consisted of redistributed traffic since the Murphy Parkway extension will reduce traffic through the intersection and the introduction of left turn lanes on Olentangy Street will permit traffic movements that currently are prohibited.

Under all the scenarios using existing traffic the intersection operated at Level of Service (LOS) "B" or "C". With the site traffic added the LOS varied from "B" to "D". The traffic diverted away from the "Four Corners" intersection by the Murphy Parkway extension (Case 2) had the largest impact on the analysis. Both the "Existing" and the "Existing plus Site" for that case operated at LOS B. The Murphy Parkway extension combined with left turn lanes on Olentangy Street (Case 5) produced the lowest delays (LOS "B") for both "Existing" traffic" and "Existing Plus Site" traffic.

A left turn warrant study was performed at the site entrances on Liberty Street using the procedures outlined in the ODOT *State Highway Access Management Manual*. The analysis shows that left turn lanes are not warranted.

The analysis conducted in this study indicates that the traffic generated by the proposed development is about 169 trips in the PM peak hour. Traffic at the "Four Corners" intersection has grown about 8.4% since 1998. The analysis in this report also shows that left turn lanes on Olentangy Street combined with the Murphy Parkway extension will provide the best traffic flow through the "Four Corners" intersection.

The construction of left turn lanes on Olentangy Street will benefit the developer as well as the City. If the City decides to pursue this project, the developer has expressed a willingness to assist the City in this process. The terms of this assistance are in preliminary discussion stages.

## **PROPOSED SITE DEVELOPMENT**

3 Pillar Homes is proposing to develop a site on South Liberty Street in the City of Powell just south of the "Four Corners" intersection. Figure 1 shows the location of the site. The site is approximately 3.75 acres and will be developed with office and retail uses. There are two proposed site access points on South Liberty Street. The southern access will have potential connectivity to adjacent undeveloped properties. Figure 2 shows a layout of the proposed development.

The City of Powell Development Commission has requested a traffic study for the subject property. The purpose of this study is to examine the development's impact on the "Four Corners" intersection and South Liberty Street. Several off-site roadway improvements are being considered that will impact traffic at the "Four Corners." As a result, the study is considering the impact of the site for the following cases:

- Case 1: Existing Network
- Case 2: Murphy Parkway Extension to S. Liberty St.
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- Case 4: Southeast Quadrant Connector
- Case 5: Cases 2-3 Combined

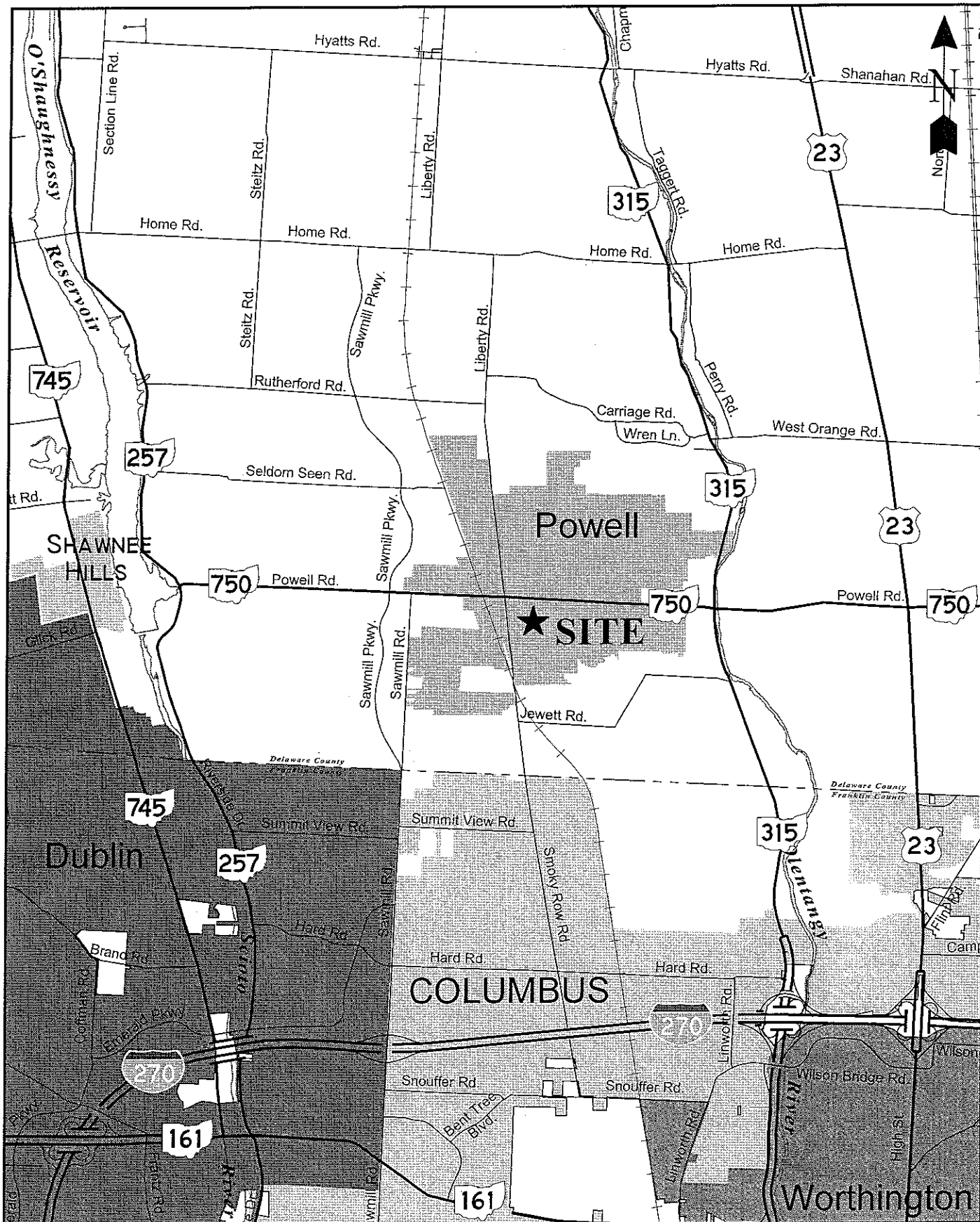
Traffic Engineering Services, Inc. has been retained by the developer to prepare a traffic impact study for this development. This report outlines the findings of that traffic study.

## **AREA CONDITIONS**

The site is located in the Historic District of the City of Powell. It is within walking distance to other businesses in the area. The speed limit on both Liberty Street and Olentangy Street is 25 MPH. Both Liberty Street and Olentangy Street are two lanes wide. There are no turn lanes at the intersection of Liberty Street and Olentangy Street. The intersection is controlled by a traffic signal.

## **EXISTING TRAFFIC**

As part of this study, 24-hour machine counts were taken on all four legs of the "Four Corners" intersection. Also, a turning movement count was performed at the "Four Corners" in the PM peak hour. Figure 3 shows a summary of the PM peak hour counts as well as a summary of some historical counts that TES performed in previous years. The counts show that traffic has increased about 19% along Olentangy Street since 1998. Traffic on South Liberty Street has increased by 4% since 1998 and traffic on North Liberty Street has declined 12% since 1998. Overall traffic has increased 8.4% since 1998. Figure 4 shows the PM existing traffic for the entire study area.



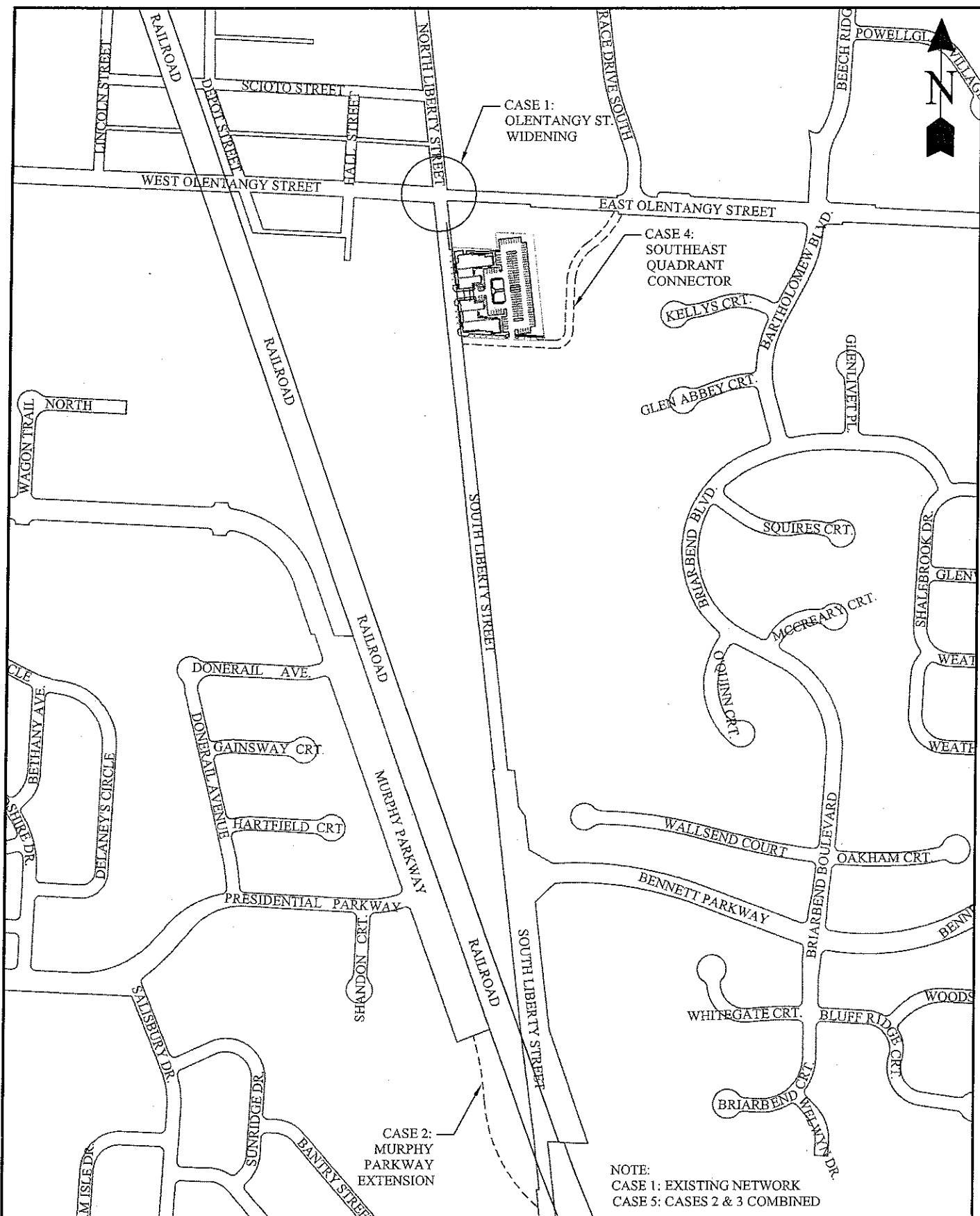
**50 SOUTH LIBERTY STREET  
TRAFFIC STUDY**

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**FIGURE 1**

**SITE LOCATION**



**50 SOUTH LIBERTY STREET  
TRAFFIC STUDY**

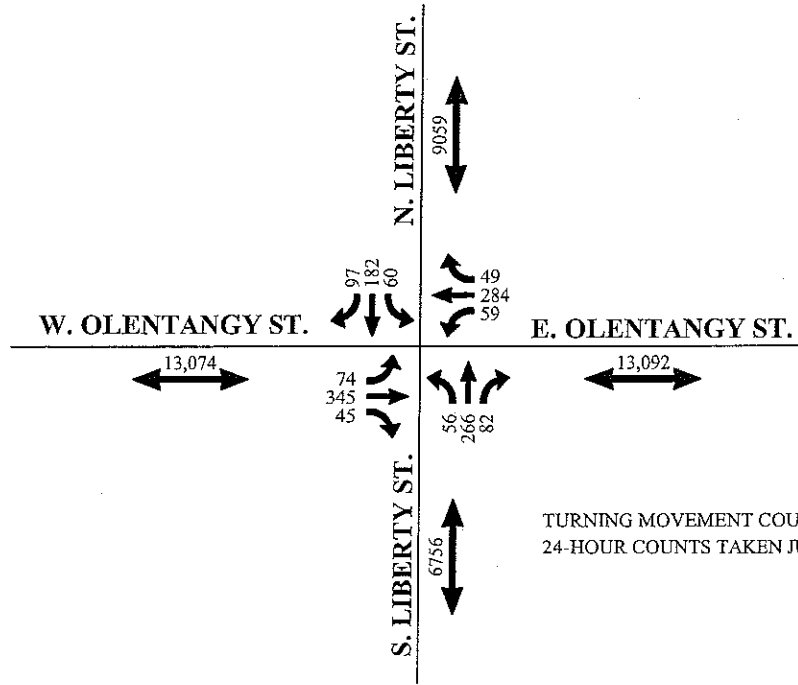
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**FIGURE 2**

**SITE LAYOUT**

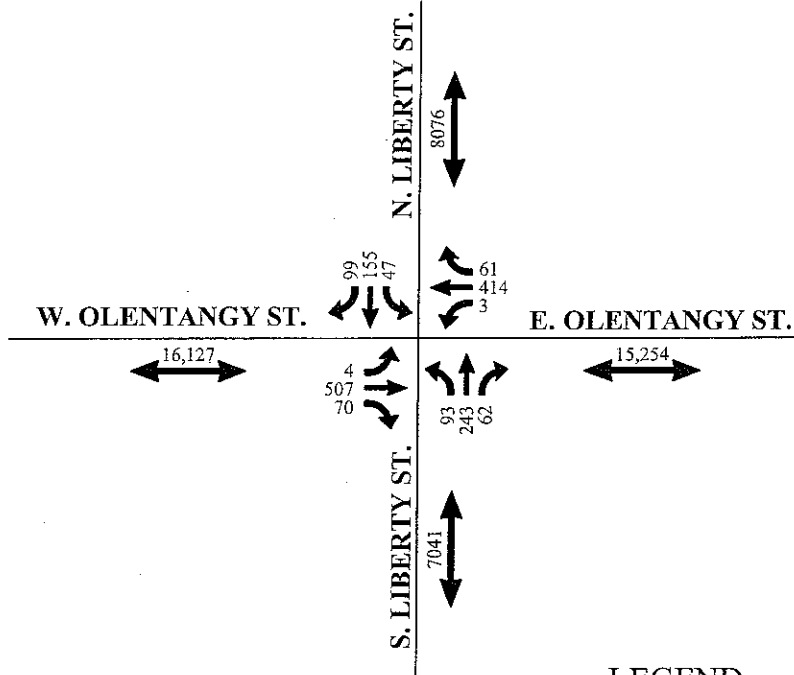
NOTE:  
CASE 1: EXISTING NETWORK  
CASE 5: CASES 2 & 3 COMBINED

### HISTORICAL TRAFFIC DATA



TURNING MOVEMENT COUNTS TAKEN SEPTEMBER 2001  
24-HOUR COUNTS TAKEN JUNE 1998

### EXISTING TRAFFIC DATA

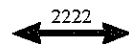


#### LEGEND

PM PEAK HOUR  
TURNING MOVEMENT



24 HOUR VOLUME



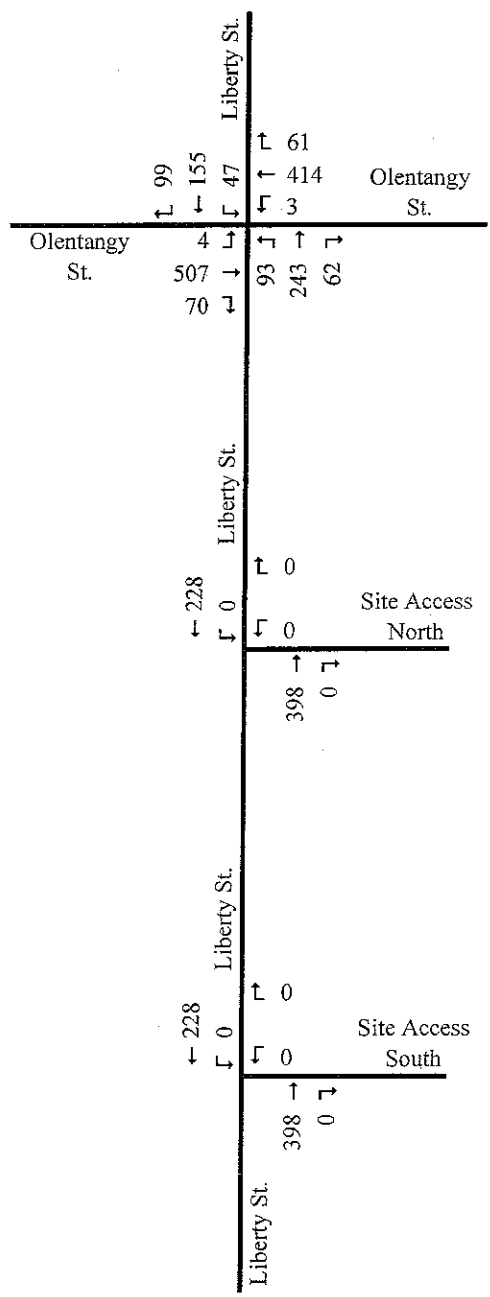
## 50 SOUTH LIBERTY STREET TRAFFIC STUDY

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## FIGURE 3

"FOUR CORNERS"  
COUNT COMPARISON



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**FIGURE 4**

**EXISTING TRAFFIC (CASE 1) -PM PEAK**

## TRIP GENERATION AND DISTRIBUTION

The site traffic was computed using *Trip Generation, 7th Edition*, published by the Institute of Transportation Engineers (ITE). The land use categories assumed were Specialty Retail (814), Quality Restaurant (931), and General Office Building (710). A summary of the trip generation calculations are shown in Tables 1A, 1B, and 1C. The rates in the table are a result of using the formulas where appropriate.

Because there will be some trips that will enter the development and have destinations within the site, an internal capture percentage can be computed and applied to the trips. This was computed according to the procedure shown in Chapter 7 of the *Trip Generation Handbook* also published by ITE. An internal capture rate was computed based on three groups of uses. The three groups were the Specialty Retail, Quality Restaurant, and the Office Uses. Table 1 also shows the internal capture percentage. The worksheet used to compute this is found in the Technical Appendix. Pass-by trips were not considered.

The distribution was assumed to be the following:

- 20% to the north on Liberty St.
- 20% to the south on Liberty St.
- 50% to the west on Olentangy St.
- 20% to the east on Olentangy St.

It is noted that the left turn restriction that is in place at the "Four Corners" intersection prevents entering site traffic from the east to use the east leg of that intersection. Therefore, for this case it was assumed that 10% of this traffic would enter via S. Liberty St. from the south and 10% of this traffic would enter via N. Liberty Street.

The site traffic distribution is shown in Figures 5 and 6.

Traffic Study Sub Area	ITE Land Use #	Description
1	814	15400 SF Gross Floor Area of Specialty Retail
2	931	4000 SF Gross Floor Area of Quality Restaurant
3	710	16300 SF Gross Floor Area of General Office Building

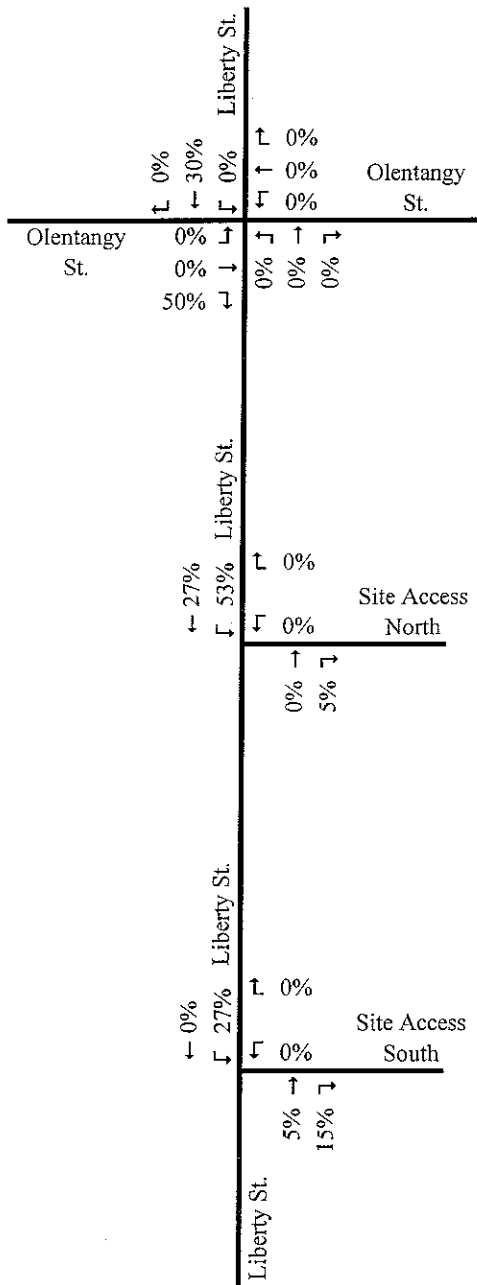
TABLE 1A -LAND USE SUMMARY

Traffic Study Sub Area	Rate (Trips/Ind Var.)	Total (Trips)	Internal Capture (%)	Pass-By (%)	Entering					Exiting						
					%	Total Trips	Internal Capture	Sub Total	Pass-By Trips	Primary Trips	%	Total Trips	Internal Capture	Sub Total	Pass-By Trips	Primary Trips
1	44.32	683	0.00%	0%	50%	341	0	341	0	341	50%	341	0	341	0	341
2	89.95	360	0.00%	0%	50%	180	0	180	0	180	50%	180	0	180	0	180
3	20.25	330	0.00%	0%	50%	165	0	165	0	165	50%	165	0	165	0	165
<b>TOTALS</b>		<b>1372</b>				<b>686</b>	<b>0</b>	<b>686</b>	<b>0</b>	<b>686</b>		<b>686</b>	<b>0</b>	<b>686</b>	<b>0</b>	<b>686</b>

TABLE 1B -TRIP GENERATION SUMMARY (DAILY)

Traffic Study Sub Area	Rate (Trips/Ind Var.)	Total (Trips)	Internal Capture (%)	Pass-By (%)	Entering					Exiting						
					%	Total Trips	Internal Capture	Sub Total	Pass-By Trips	Primary Trips	%	Total Trips	Internal Capture	Sub Total	Pass-By Trips	Primary Trips
1	2.71	42	9.19%	0%	44%	18	2	17	0	17	56%	23	2	21	0	21
2	7.49	30	9.19%	0%	67%	20	2	18	0	18	33%	10	1	9	0	9
3	5.95	97	9.19%	0%	17%	17	2	15	0	15	83%	81	7	73	0	73
<b>TOTALS</b>		<b>169</b>				<b>55</b>	<b>5</b>	<b>50</b>	<b>0</b>	<b>50</b>		<b>114</b>	<b>10</b>	<b>103</b>	<b>0</b>	<b>103</b>

TABLE 1C -TRIP GENERATION SUMMARY (PM PEAK)



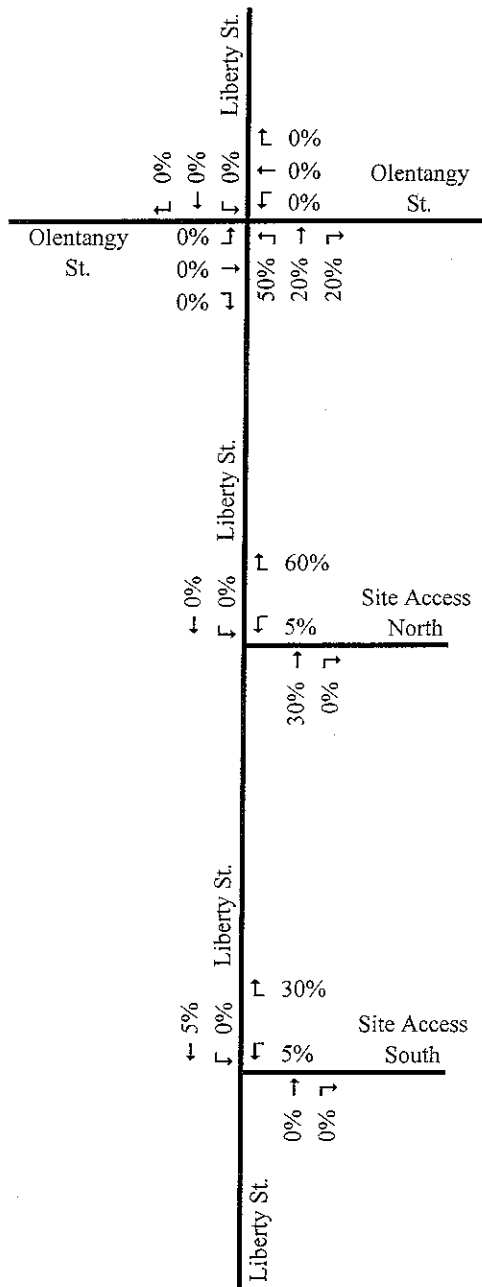
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TRAFFIC STUDY**

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**FIGURE 5**

**SITE TRAFFIC DISTRIBUTION (ENTERING)**



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**FIGURE 6**

**SITE TRAFFIC DISTRIBUTION (EXITING)**

## **SITE GENERATED AND OPENING DAY TRAFFIC**

### Case 1: Existing Network

Figure 7 shows the Case 1 Site Generated Traffic. Figure 8 shows the Opening Day traffic for Case 1 which is the Existing traffic plus the Site generated traffic.

### Case 2: Murphy Parkway Extension to S. Liberty St.

Murphy Parkway is planned to be extended south to S. Liberty Street in the future. The connection will occur just south of the at-grade railroad crossing on S. Liberty Street. Some traffic modeling of the impact of this connection was performed by TES in the past. Based on this data it is estimated that the Murphy Parkway extension will reduce the PM peak hour traffic on S. Liberty Street in front of the sit by approximately 190 vehicles.

From the turning movement count at the "Four Corners", the directional distribution in the PM Peak Hour is 60% northbound and 40% southbound. Therefore, it was assumed that 30% was diverted from the northbound left turn movement and 30% was diverted from the northbound through movement, 20% diverted from the eastbound right turn movement and 20% diverted from the southbound through movement. The diverted volumes are shown in Figure 9. Figure 10 shows the Opening Day traffic for Case 2 which is the Case 1 Existing Traffic plus the Case 1 Site Generated Traffic plus the Murphy Parkway Diverted Traffic.

### Case 3: Olentangy Street widening at Liberty St.

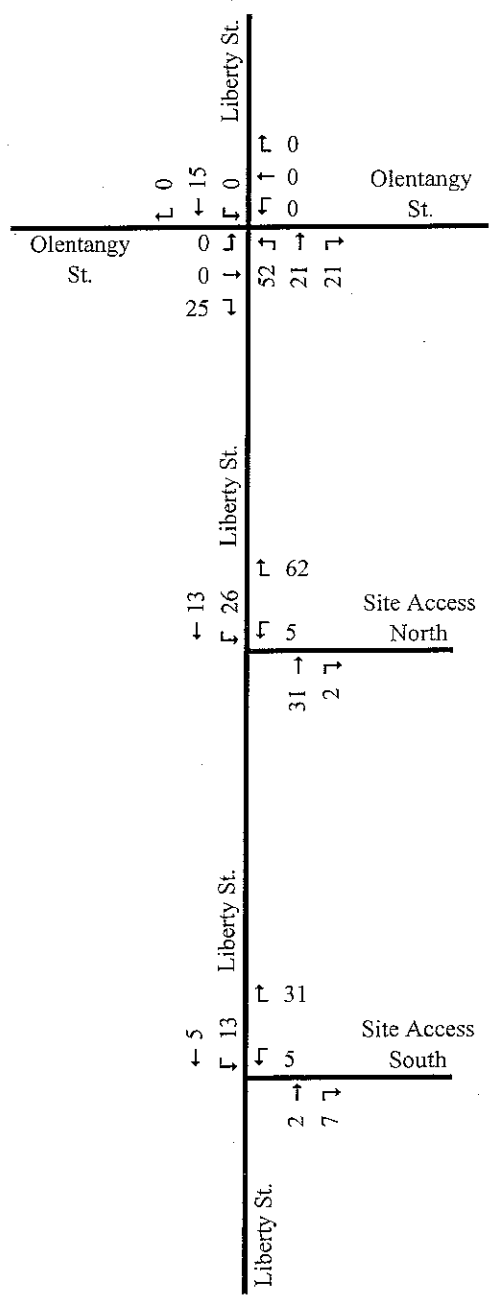
Some discussion has begun to take place about the possibility of widening Olentangy Street for left turn lanes. If left turn lanes are installed on Olentangy Street, the existing PM peak hour turn restriction will be removed. Because the turn restriction is in place during the peak hour, the existing demand for these turning movements was based on the historical information. Figure 11 shows the existing traffic modified to include an estimate of the turn lane traffic. If turns were permitted at the four corners, site traffic from the east could access the site from the east leg of the "Four Corners" intersection. Figure 12 shows the Case 3 site generated traffic with no turn restriction at the "Four Corners". Figure 13 shows the Opening Day traffic for Case 3 which is the Case 3 existing traffic plus the Case 3 site generated traffic.

### Case 4: Southeast Quadrant Connector

Property outside the control of the developer of the proposed site has potential to create a connection from S. Liberty St. to E. Olentangy Street. On E. Olentangy Street, the only location to feasibly having a full movement intersection is if this connector is opposite Grace Drive. This connection would lessen the impact of the site on the "Four Corners" intersection because traffic oriented to and from the east would use this connector. Figure 14 shows the Case 4 site generated traffic assuming a connector in the southeast quadrant. Figure 15 shows the Case 4 Opening Day Traffic which is the Case 1 Existing Traffic plus the Case 4 Site Generated Traffic.

Case 5: Cases 2-3 Combined

The Case 5 Opening Day Traffic, which is the Case 3 Existing traffic plus the Case 3 site generated traffic plus the Case 2 Diverted Traffic, is shown in Figure 16

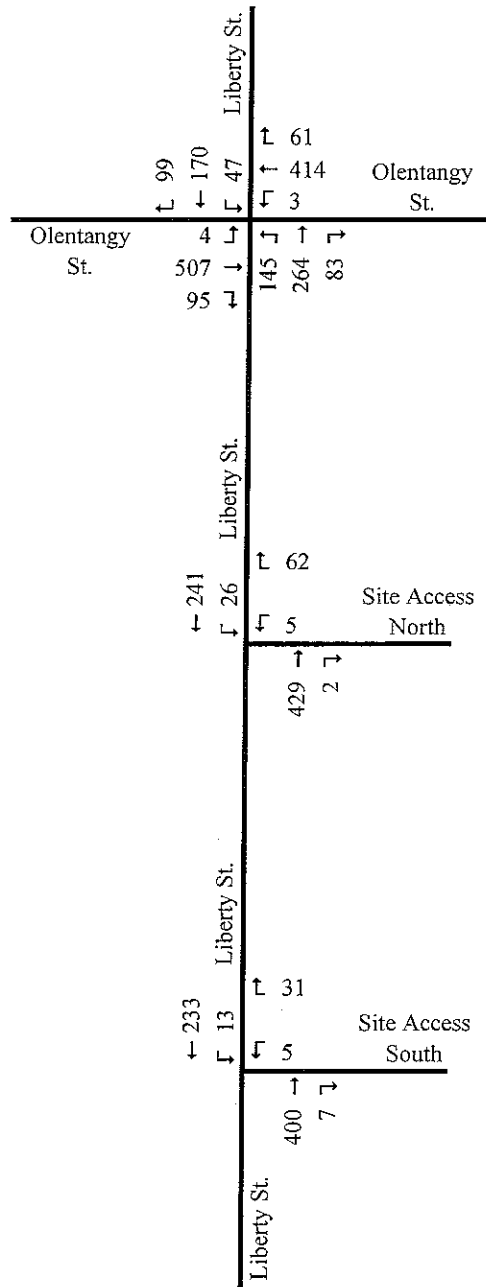


**50 SOUTH LIBERTY STREET  
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**FIGURE 7**

**SITE TOTAL TRAFFIC (CASE 1)-PM PEAK**



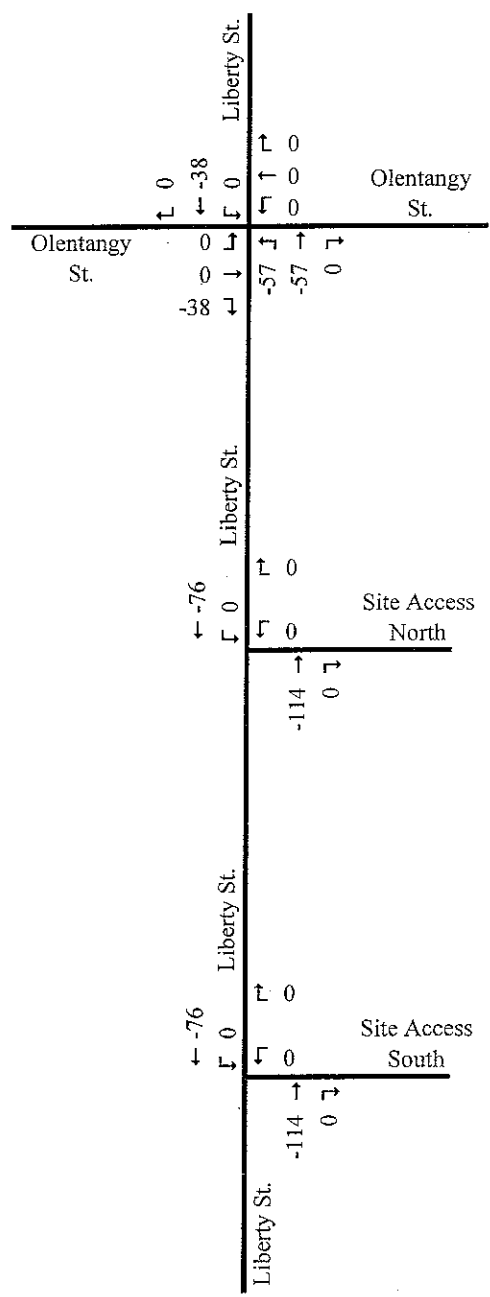
**50 SOUTH LIBERTY STREET  
TRAFFIC STUDY**

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**FIGURE 8**

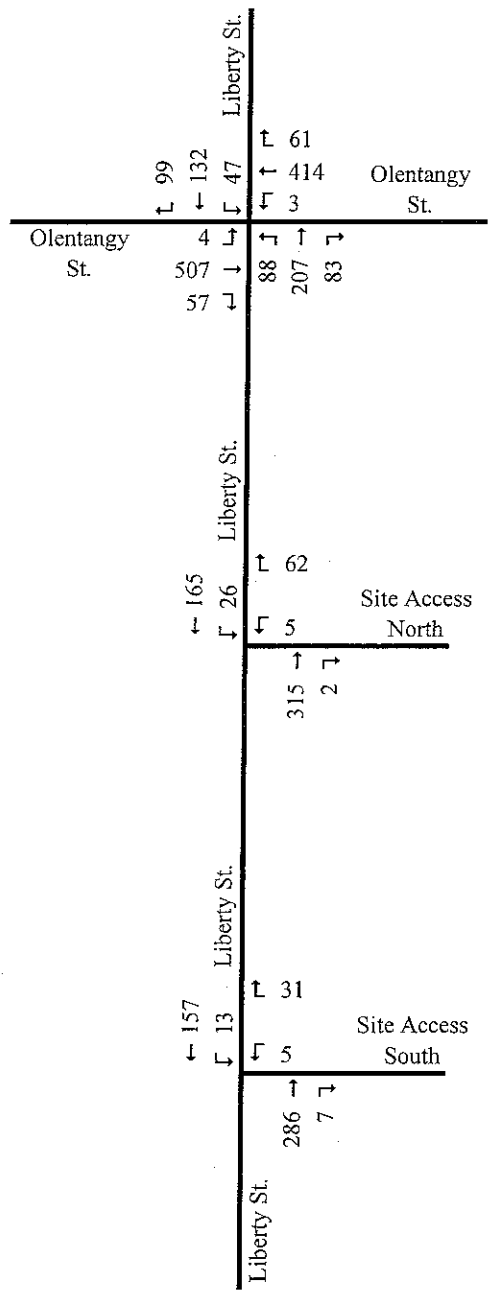
OPENING DAY (2004) (CASE 1) TRAFFIC-PM  
PEAK



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TRAFFIC STUDY**

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**FIGURE 9**  
DIVERTED TO MURPHY PKWY. (CASE 2)  
TRAFFIC-PM PEAK

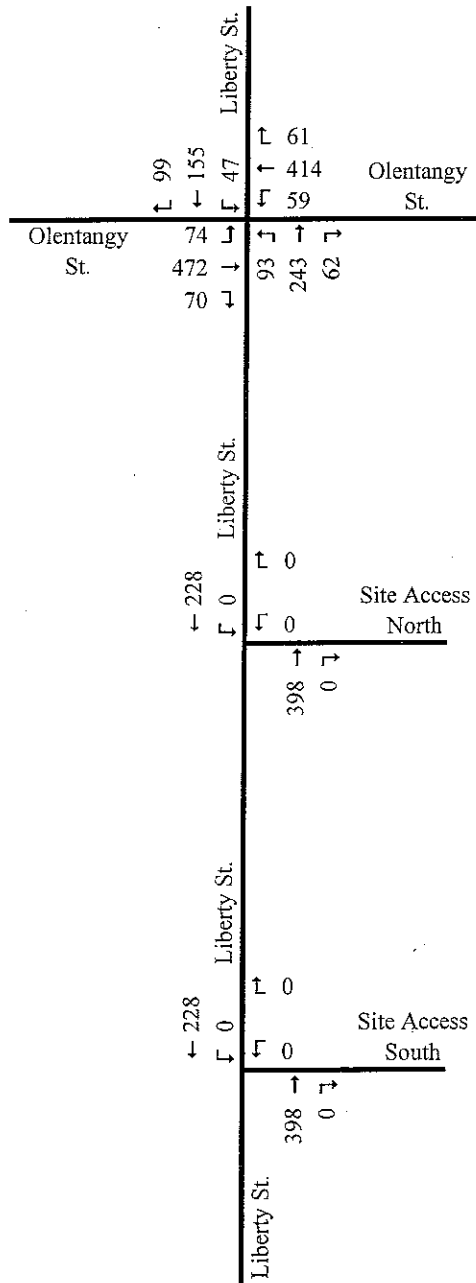


**50 SOUTH LIBERTY STREET  
TRAFFIC STUDY**

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**FIGURE 10**

OPENING DAY (2004) W/ DIVERTED TO  
MURPHY PKWY. (CASE 2) TRAFFIC-PM PEAK

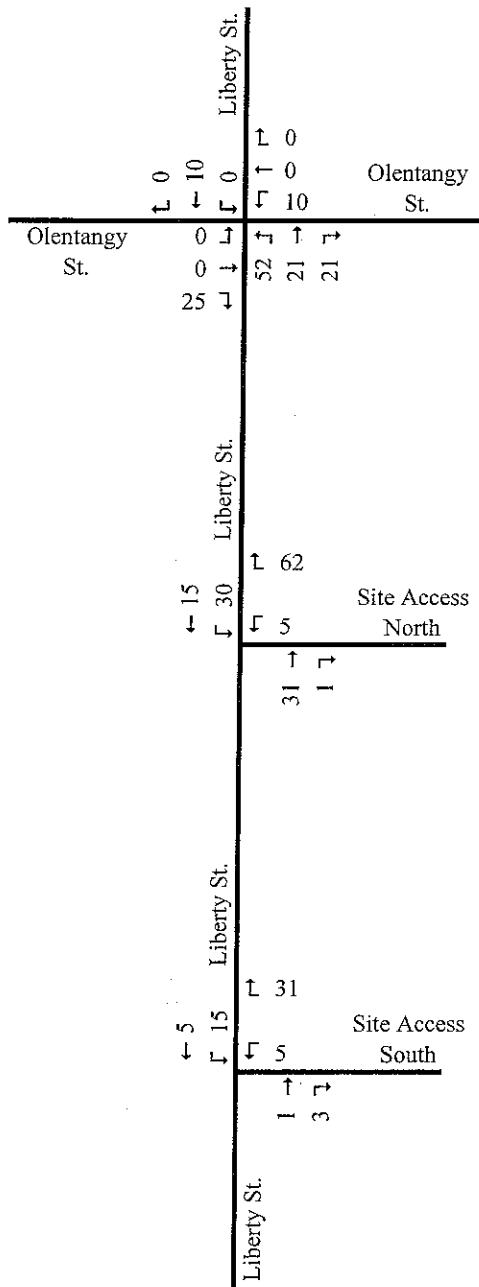


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**FIGURE 11**

**EXISTING TRAFFIC (CASE 3) -PM PEAK**



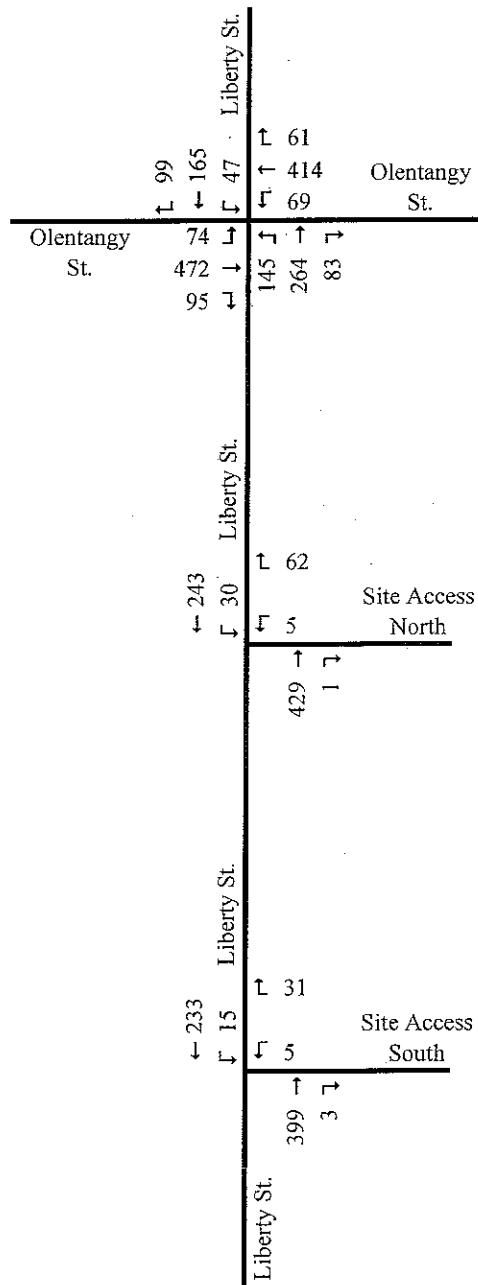
**50 SOUTH LIBERTY STREET  
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**FIGURE 12**

**SITE TOTAL TRAFFIC (CASE 3)-PM PEAK**

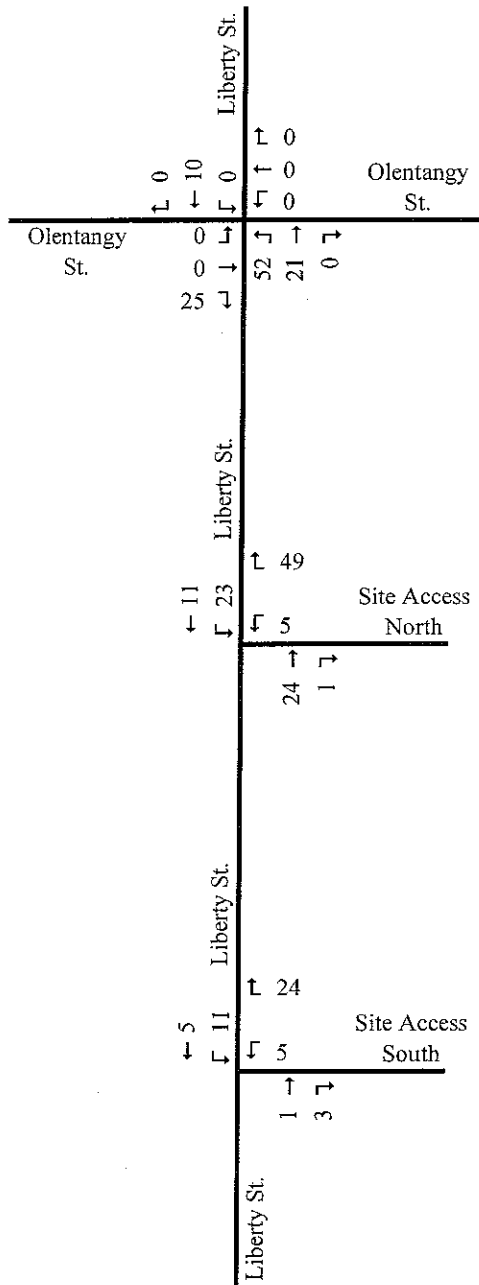


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**FIGURE 13**

**OPENING DAY (2004) TRAFFIC (CASE 3)-PM  
PEAK**



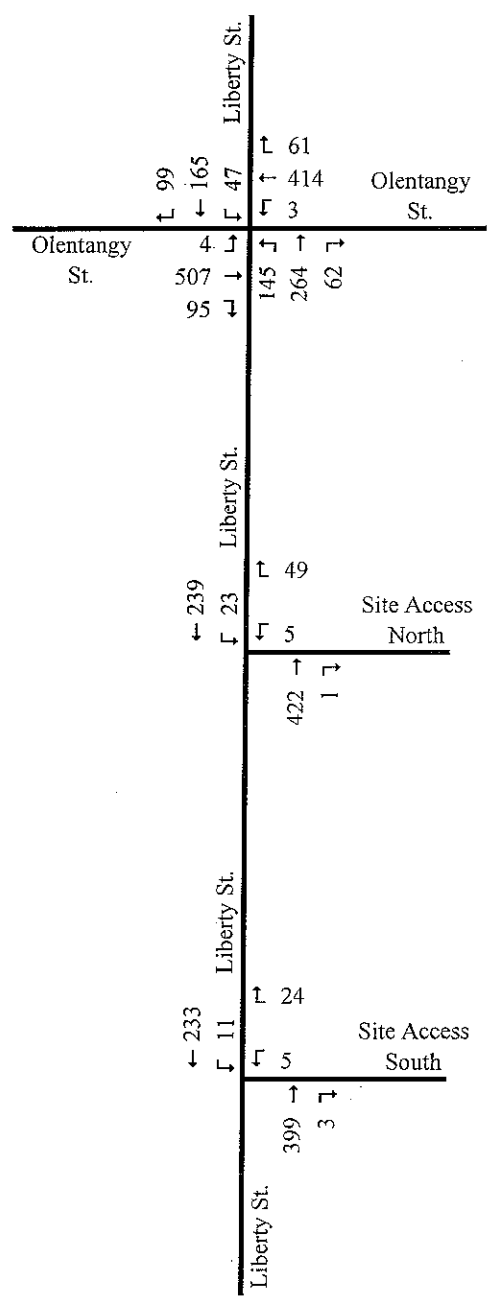
**50 SOUTH LIBERTY STREET  
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**FIGURE 14**

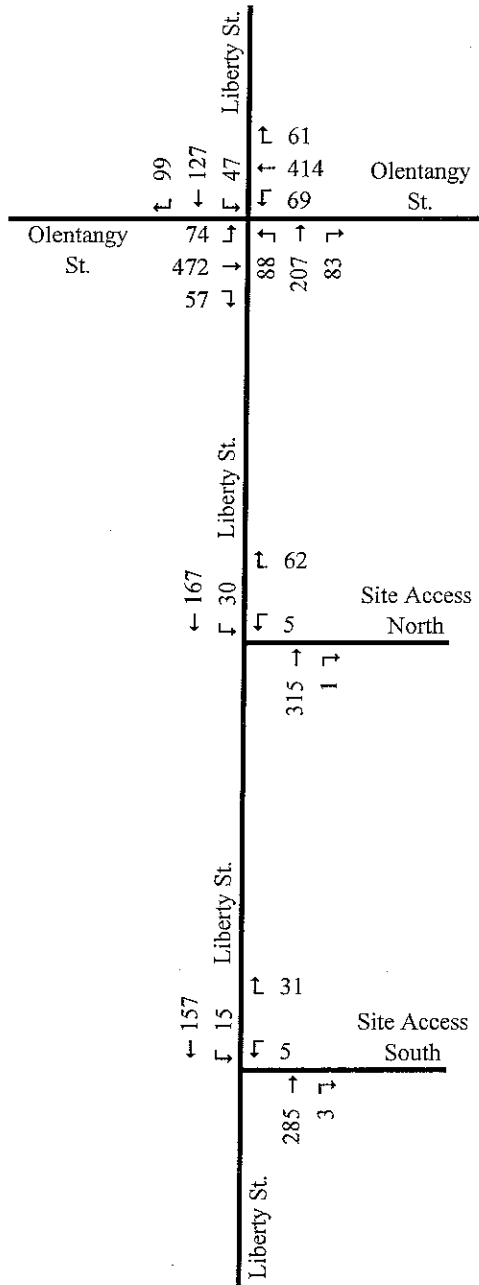
**SITE TOTAL TRAFFIC (CASE 4)-PM PEAK**



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**FIGURE 15**  
OPENING DAY (2004) TRAFFIC (CASE 4)-PM  
PEAK



**50 SOUTH LIBERTY STREET  
TRAFFIC STUDY**

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**FIGURE 16**

**OPENING DAY (2004) TRAFFIC (CASE 5)-PM  
PEAK**

## TRAFFIC ANALYSES

### Left Turn Lane Warrant Analysis

Left turn lanes warrants were examined at both site access points on S Liberty Street. The procedure for the turn lane warrant analysis is found in the *State Highway Access Management Manual (AMM)* published by the Ohio Department of Transportation. The results of the analysis show that a left turn lane is not warranted at either site access.

### Capacity Analyses

Capacity analyses were performed at the intersection of Olentangy Street & Liberty Street. For each case a “base” capacity and a capacity analysis that included the site traffic were performed. In the analyses, delays are computed which correspond to a Level of Service (LOS) “A” through “F”. In an urban area, Level of Service is D is generally considered an acceptable. Since driver expectations are different for various types of traffic control, there are different LOS criteria for unsignalized intersections versus signalized intersections. The LOS criteria for signalized intersections are shown in Table 2.

Level of Service	Delay Range (seconds/vehicle)
A	$\leq 10$
B	$> 10$ and $\leq 20$
C	$> 20$ and $\leq 35$
D	$> 35$ and $\leq 55$
E	$> 55$ and $\leq 80$
F	$> 80$

Source: *Highway Capacity Manual 2000*  
Table 2 – LOS for Signalized Capacity

Signalized capacity was performed using the computer software *Synchro 5.0*. The existing cycle length and phasing was used in every case but the splits were optimized. In the capacity analysis, the delays are computed which correspond to a Level of Service (LOS) “A” through “F”. Under all the scenarios using existing traffic the intersection operated at Level of Service (LOS) “B” or “C”. With the site traffic added the LOS varied from “B” to “D”. The traffic diverted away from the “Four Corners” intersection by the Murphy Parkway extension (Case 2) had the largest impact on the analysis. Both the “Existing” and the “Existing plus Site” for that case operated at LOS B. The Murphy Parkway extension combined with left turn lanes on Olentangy Street (Case 5) produced the lowest delays (LOS “B”) for both “Existing” traffic” and “Existing Plus Site” traffic. Table 3 shows a summary of the capacity analyses as well as the percent increase in traffic through the intersection as a result of the site for each case. Detailed reports of the capacity analyses can be found in the Appendix.

	LOS Base Condition (Delay – Sec/Veh)	LOS Base Condition + Site (Delay – Sec/Veh)
Case 1	<b>C</b> (20.7)	<b>D</b> (37.5)
Case 2	<b>B</b> (13.5)	<b>B</b> (18.2)
Case 3	<b>B</b> (18.1)	<b>C</b> (31.3)
Case 4	<b>C</b> (20.7)	<b>C</b> (34.6)
Case 5	<b>B</b> (12.4)	<b>B</b> (16.4)

*Table 3 – Intersection Capacity Analysis Summary at “Four Corners”*

## CONCLUSIONS AND RECOMMENDATIONS

The analysis conducted in this study indicates that the traffic generated by the proposed development is about 169 trips in the PM peak hour. Traffic at the "Four Corners" intersection has grown about 8.4% since 1998. The analysis in this report also shows that left turn lanes on Olentangy Street combined with the Murphy Parkway extension will provide the best traffic flow through the "Four Corners" intersection.

The construction of left turn lanes on Olentangy Street will benefit the developer as well as the City. If the City decides to pursue this project, the developer has expressed a willingness to assist the City in this process. The terms of this assistance are in preliminary discussion stages. The City requested that a percentage of increased traffic in the "Four Corners" intersection be provided for use in these discussions. Table 4 shows a summary of this for each case.

	% Increase in Traffic through Intersection as a result of the Site
Case 1	7.6%
Case 2	8.5%
Case 3	7.5%
Case 4	6.9%
Case 5	8.4%

*Table 4 – Site Traffic Increases at "Four Corners"*