HOLLERING PLACE

TRAFFIC IMPACT STUDY

COOS BAY, OREGON

PREPARED BY
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FEBRUARY 2007

LANCASTER
engineering

HOLLERING PLACE

Traffic Impact Study

Coos Bay, Oregon

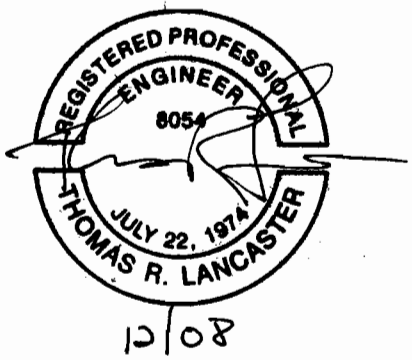

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. There is a proposal to develop a site along the waterfront with a mixture of retail, commercial, residential and wayside uses. The site is located on the northwest side of Empire Boulevard between Newmark Avenue and Holland Avenue. Access to the site will be via Newmark Avenue and Michigan Avenue with separate access from Empire Boulevard to a viewing/services/parking area.

2. Based on the potential uses for the site, the site is expected to generate between 113 trips and 176 trips during the weekday evening peak hour. During the Saturday peak hour, the site is expected to generate between 145 trips and 232 trips.

3. Both the intersection of Newmark Avenue at Empire Boulevard and Michigan Avenue at Empire Boulevard currently operate acceptably during the Saturday peak hour, which is the period with the highest traffic volumes. The intersections will continue to operate acceptably through 2011. If there are no access restrictions, the delay becomes marginally unacceptable after 2011 with site development. If traffic exiting the site is limited to Michigan Avenue, the Michigan Avenue/Empire Boulevard intersection becomes unacceptable after 2011 with the Newmark Avenue/Empire Boulevard intersection operating satisfactorily.

4. The traffic signal warrants were examined at the intersection of Newmark Avenue and Empire Boulevard in order to determine if a traffic signal would be an appropriate mitigation for the delay at the Newmark Avenue/Empire Boulevard intersection. The signal warrants were not met. A traffic signal is not recommended.

5. It is not desirable to have traffic exit the site on Newmark Avenue due to the significant upgrade of the street at the Empire Boulevard intersection. Michigan Avenue will have the capacity to carry the site traffic if the road is widened. Currently, the road width is only appropriate for two-way travel at very low volumes. Because the site will add a considerable amount of traffic, the travel lanes will need to be widened to at least 10 feet each, preferably 11 to 12 feet each in order to support two-way travel on Michigan Avenue with the volumes generated by the site. As an alternative to road-widening, Michigan Avenue could become a one-way street from Mill Street to Empire Boulevard. Only eastbound traffic would be allowed on that section of road.

6. The left-turn lane warrants were marginally met for a northbound left-turn lane on Empire Boulevard at Michigan Avenue. The warrants were developed for the 30th highest hour of traffic, which means the warrants will be met for a very small portion of the year and not met for most of the remaining time, including weekdays and Saturdays during non-peak months. In addition, site traffic will have the opportunity to enter the site at Newmark Avenue. For these reasons, a northbound left-turn lane is not recommended.

INTRODUCTION

A site located on the west side of Empire Boulevard between Newmark Avenue and Holland Avenue is proposed to be developed with a mixture of residential, commercial, and wayside uses. The site is expected to have a significant retail component, but will also have tourist attractions. Access to the site will be via Newmark Avenue and Michigan Avenue.

The purpose of this study is to assess the traffic impact of the proposed development on the nearby street system and to recommend any required mitigative measures. The analysis will include level of service calculations, an evaluation of left-turn lane warrants and a discussion of site access.

Detailed information on traffic counts, trip generation calculations, and level of service calculations is included in the appendix to this report.

LOCATION DESCRIPTION

An industrial/commercial/waterfront area in Coos Bay, Oregon is proposed to be developed with residential, commercial and wayside attractions. Approximately 40,800 square feet will be available for the retail and commercial uses, 30,000 square feet for residential and/or commercial uses, and 28,750 square feet for the wayside, which could include a retail use, post office and/or café along with a viewing area.

The site is bounded by Newmark Avenue, Empire Boulevard, Holland Avenue, and Coos Bay. There is a dock near the site that is accessed via Newmark Avenue or Michigan Avenue. Figure 1 on page 8 is a vicinity map showing the study intersections and traffic control devices.

Newmark Avenue east of Empire Boulevard is under the jurisdiction of and maintained by the City. The section of Newmark Avenue between Broadway Avenue and Empire Boulevard (also known as Cape Arago Highway) was formerly under the jurisdiction of the Oregon Department of Transportation (ODOT) until March 2000, when it was transferred to the City of Coos Bay. It is generally a three- to five-lane facility through the City, narrowing to a two-lane roadway near the site. The posted speed is 30 mph in the vicinity of the site. The section of Newmark Avenue east of Empire Boulevard has sidewalks and on-street parking, although the section of roadway fronting the site has shoulders on the south side and curbs on the north side. There are no bicycle facilities along the road. Newmark Avenue is approximately 60 feet wide east of Empire Boulevard and approximately 20 feet wide west of Empire Boulevard.

Empire Boulevard south of the site was also previously under the jurisdiction of the ODOT until March 2000, when it was transferred to the City. It is a two-lane facility in the vicinity of the site with shoulders on both sides of the road and a posted speed of 30 mph. There is a 20-mph school zone between Michigan Avenue and Newmark Avenue. There are no bike lanes on either side.

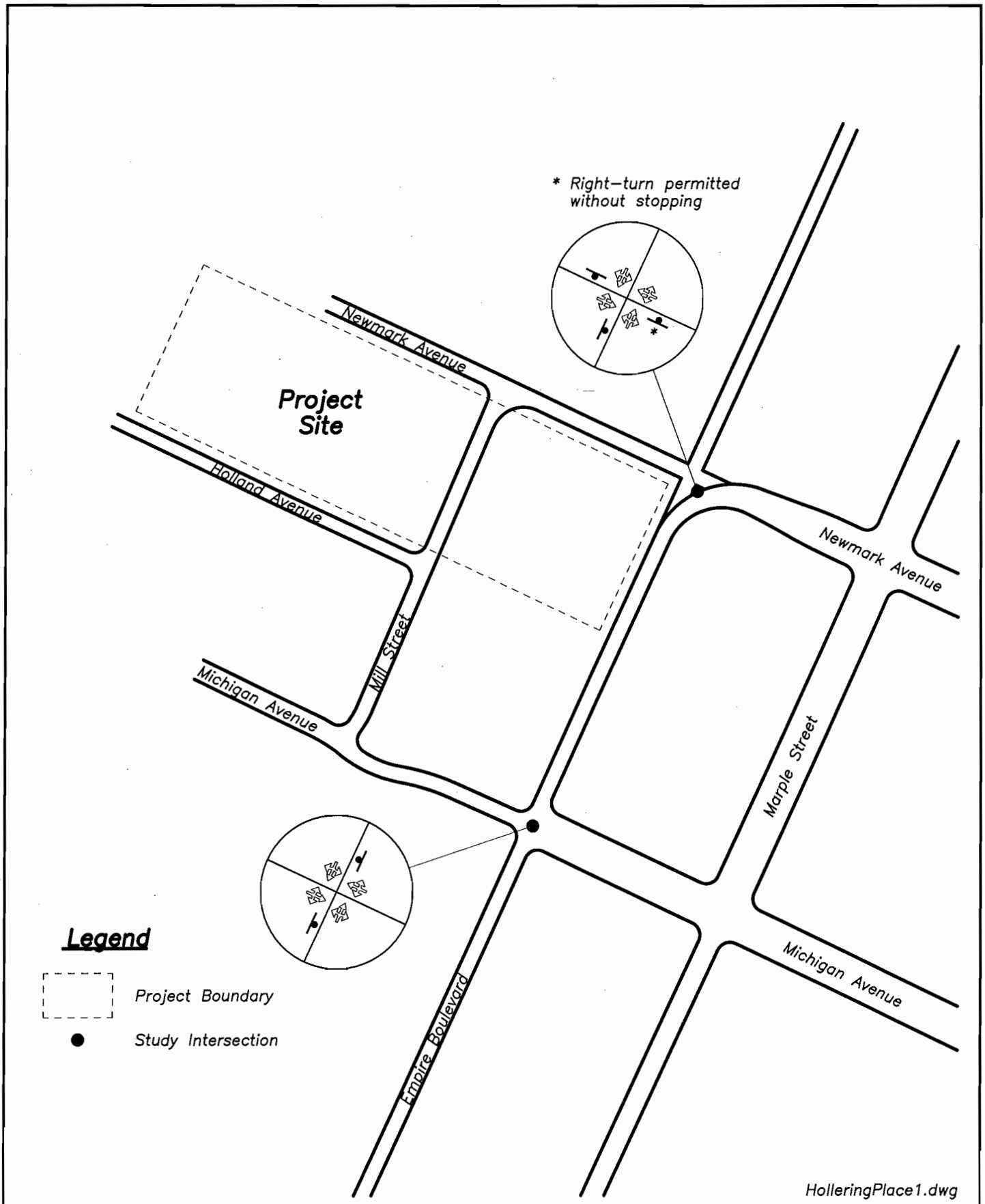
The intersection of Newmark Avenue and Empire Boulevard is a non-standard four-legged intersection. Nearly all of the traffic travels from S Empire Boulevard to east Newmark Avenue or vice versa. There are STOP signs on the eastbound Newmark Avenue and southbound Empire Boulevard approaches. The westbound approach is free-flowing and the sign on the northbound approach indicates "RIGHT TURN PERMITTED WITHOUT STOPPING." All approaches are single-lane.

The intersection of Michigan Avenue and Empire Boulevard is a standard four-legged intersection that is stop-controlled on the Michigan Avenue approaches. All approaches are single-lane.

Currently access is available to the dock adjacent to the site via either Newmark Avenue or Michigan Avenue. Both roads have a significant upgrade on the approach to Empire Boulevard. Drivers on Newmark Avenue trying to enter or cross Empire Boulevard would be waiting on a hill facing upwards. The hill on Michigan Avenue levels out before the driver reaches the Empire Boulevard intersection. The upgrade on Newmark Avenue makes it difficult for drivers leaving the dock to accelerate into traffic on Empire Boulevard or Newmark Avenue. For this reason, most of the dock traffic enters the dock from Newmark Avenue and exits via Michigan Avenue. Michigan Avenue is roughly 16 to 18 feet wide.

Manual turning movement counts were made at the study intersections on a Saturday during December 2006 from 2:00 to 4:00 p.m. The peak hours occurred from 2:35 to 3:35 p.m. Saturday traffic volumes are higher than weekday traffic volumes, so the Saturday peak hour was used as the critical period for analysis.

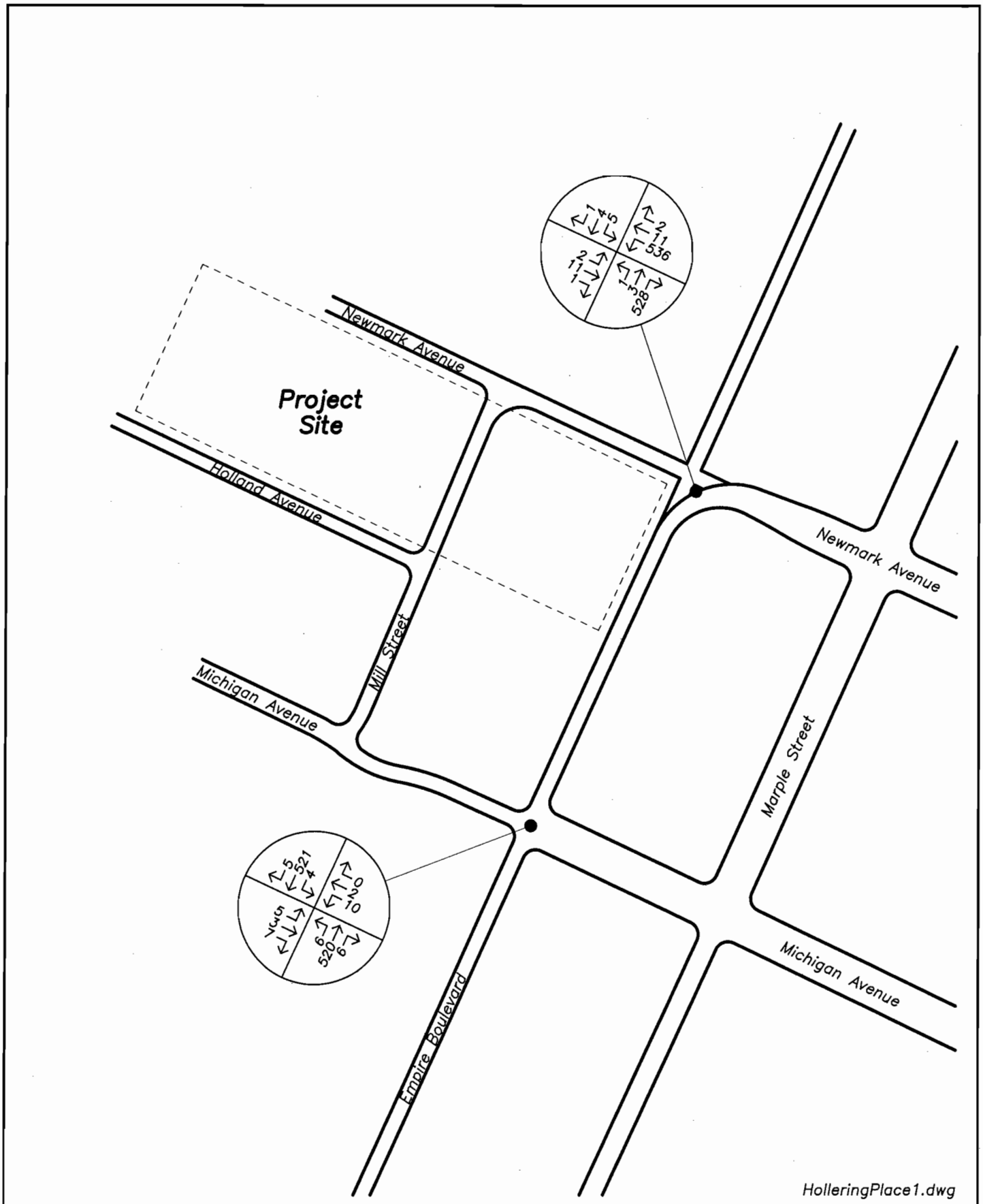
The traffic counts were seasonally adjusted to reflect the time of year with the highest potential traffic (the 30th Highest Hour). The seasonally adjusted volumes were derived using ODOT's method described in the Analysis Procedures Manual, published in April 2006. The adjustment factors were calculated from the Seasonal Factor table and assumed Newmark Avenue would be considered a Coastal Destination. The adjusted volumes for the Saturday afternoon peak hours are shown in Figure 2 on page nine.



AREA MAP
Existing and Potential Alignments

no scale

FIGURE 1



TRAFFIC VOLUMES
Existing Conditions (Seasonally Adjusted)
Saturday Peak Hour

no scale

FIGURE 2

TRIP GENERATION

In order to determine the amount of traffic that will be added to the roadway system as a result of this development, a trip generation was prepared for the site. The trip generation is a measure of how many trips a site would create for various types of development that could be built. For instance, a store adds traffic to the street system because people who would otherwise have gone somewhere else (or not gone shopping at all) will now be traveling to the new store. It is calculated from data that has been gathered from existing developments of various land uses, including different types of residential, commercial, office, medical, recreational, and other uses. The data has been put together in a manual, *TRIP GENERATION*, published by the Institute of Transportation Engineers (ITE). Trip rates are calculated from the data, which are then used to calculate the number of trips expected to be added to the roadway system when a site is developed.

A trip is a single direction of travel. For example, going to a store would be counted as one trip and coming home from the store would be counted as a second trip. Therefore, going to a store and back is two trips.

The proposal for this project outlined 40,800 square feet of commercial/retail uses, 30,000 square feet of commercial/residential uses, and 28,750 square feet of wayside uses. The 40,800 square feet of commercial/retail use could include stores or office space. The 30,000 square feet of commercial/residential use could have several potential development scenarios, including office, motel, or residential developments. The wayside uses could include a museum, post office and/or café. Since specific developments are unknown, the trip generation discusses the worst-case development scenarios.

The *TRIP GENERATION* manual separates the land-uses into categories, such as retail or office. Each category is further broken into individual uses, such as *Grocery*, *Building Supply*, etc for retail uses. There are also trip rates for a shopping center in the retail category. The *Shopping Center* rates are used when there are multiple stores on a site because the *Shopping Center* rates include the reduction in trips resulting from patrons visiting more than one store during a single visit to the shopping center.

For the commercial/retail portion of the site, trip rates from land-use code 820, *Shopping Center*, were used. However, the ITE description of a shopping center includes an anchor store along with several outlying pads that are typically built with high trip generation uses.

The data used in the ITE manual to calculate trips for a shopping center results in a rate that has been averaged from studies of multiple large and small shopping centers throughout the nation. While this is sufficient to determine the number of trips for an average shopping center, if there are any unusual circumstances at the site, the trip rates become less accurate. Based on the anticipated retail uses, it is expected that the actual trip generation of the site would be less than the calculated rates. There are no ITE land-use descriptions that fit the development potential of the site; *Shopping Center* trip rates were used as the closest approximation. The proposal for the project indicated that 40,800 square feet of retail/commercial uses were possible.

Because the site will be developed with retail uses, a portion of traffic entering and exiting the site will be pass-by trips. Pass-by trips are trips that are already on the roadway adjacent to the site, but leave the road to patronize the site and then continue in the original direction of travel. An example is stopping by a store on the way home from work. The trip to the store would be a pass-by trip. Pass-by trips, because they are already on the roadway, do not add traffic to the system. They are included in the analysis because they change the travel patterns, particularly at the site driveways. Where normally a driver would drive past the driveway without the store, the driver now turns at the driveway to the store. The turns into and out of the store driveway have a greater impact on the operation of the driveway intersection than the through traffic going past the driveway.

It is not certain what types of residential uses will be developed on the site. Much of the residential uses surrounding the site are multi-family dwellings and motels. It is possible that a motel would be a development scenario. Because a motel generates the highest number of trips, it represents a conservative scenario. A motel development was included in the trip generation. Land-use code 320, *Motel*, was used. The trip rates are based on the number of rooms and were calculated for a total of 27 rooms.

There is the possibility that commercial uses would be developed rather than residential uses. A total of 30,000 square feet of commercial space could be constructed. Commercial uses could include office space as well as retail space. Land-use code 710, *General Office*, was used to represent the office space and land-use code 820, *Shopping Center*, was used to represent the retail space.

Because the ITE trip rates likely overestimate the trip generation of the retail uses, no trips were added to represent the trips from the wayside use. It was assumed instead that the overestimation of the retail trips roughly approximated the actual retail plus wayside trips.

If the site is developed with the 30,000 square feet of motel use, the site would generate approximately 113 trips during the weekday peak hour and 149 trips during the Saturday peak hour. If the 30,000 square-foot area is developed as office space, the site would generate approximately 146 weekday evening peak hour trips and 145 Saturday peak hour trips. If the

30,000 square-foot space is used for retail, the site would generate about 176 weekday evening peak hour trips and 260 Saturday peak hour trips.

Because the closest transit services are greater than one-mile from the site, no reduction was made for transit use.

A summary of the trip generation calculations for the Hollering Place development is shown in the following table. Detailed trip generation calculations are included in the appendix to this report.

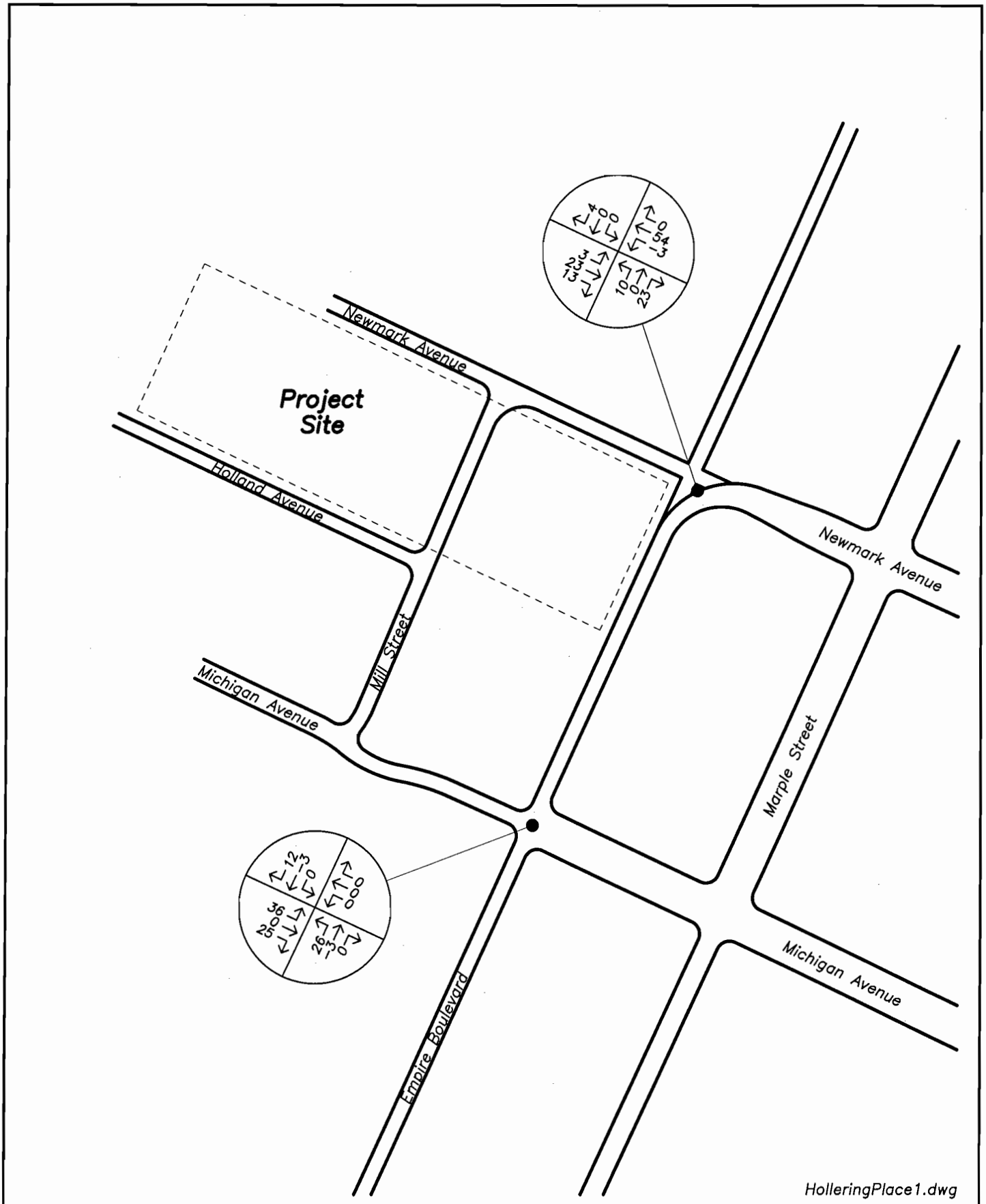
TRIP GENERATION SUMMARY
Hollering Place

	Entering Trips	Exiting Trips	Total Trips
Shopping Center (40,800 sq ft) and Motel			
PM Peak Hour	53	60	113
Saturday Peak Hour	78	71	149
Shopping Center (40,800 sq ft) and Office			
PM Peak Hour	55	91	146
Saturday Peak Hour	77	68	145
Shopping Center (70,800 sq ft)			
PM Peak Hour	83	93	176
Saturday Peak Hour	137	123	260

TRIP DISTRIBUTION

The trips that have been calculated for the site have to be assigned to the street system in order to analyze their impact on the nearby intersections. The distribution of the site trips was derived from an analysis of the locations and destinations of patrons of the site. Most of the trips are expected to originate or terminate in Coos Bay with some trips from the residential areas to the south. Therefore, the majority of the trips were assigned to east Newmark Avenue while the minority were assigned to S Empire Boulevard. It is expected that people living on N Empire would also visit the site and a few trips were assigned to N Empire Boulevard.

Figures 3 and 4 show the distribution and assignment of the site trips from the proposed wayside development. Figure 3 on page 14 shows the trip distribution and assignment of the trips as calculated based on the potential development scenario. Figure 4 on page 15 shows the trip distribution and assignment of the trips as calculated based on the development scenario assuming ingress at Newmark Avenue/Michigan Avenue and egress at Michigan Avenue.

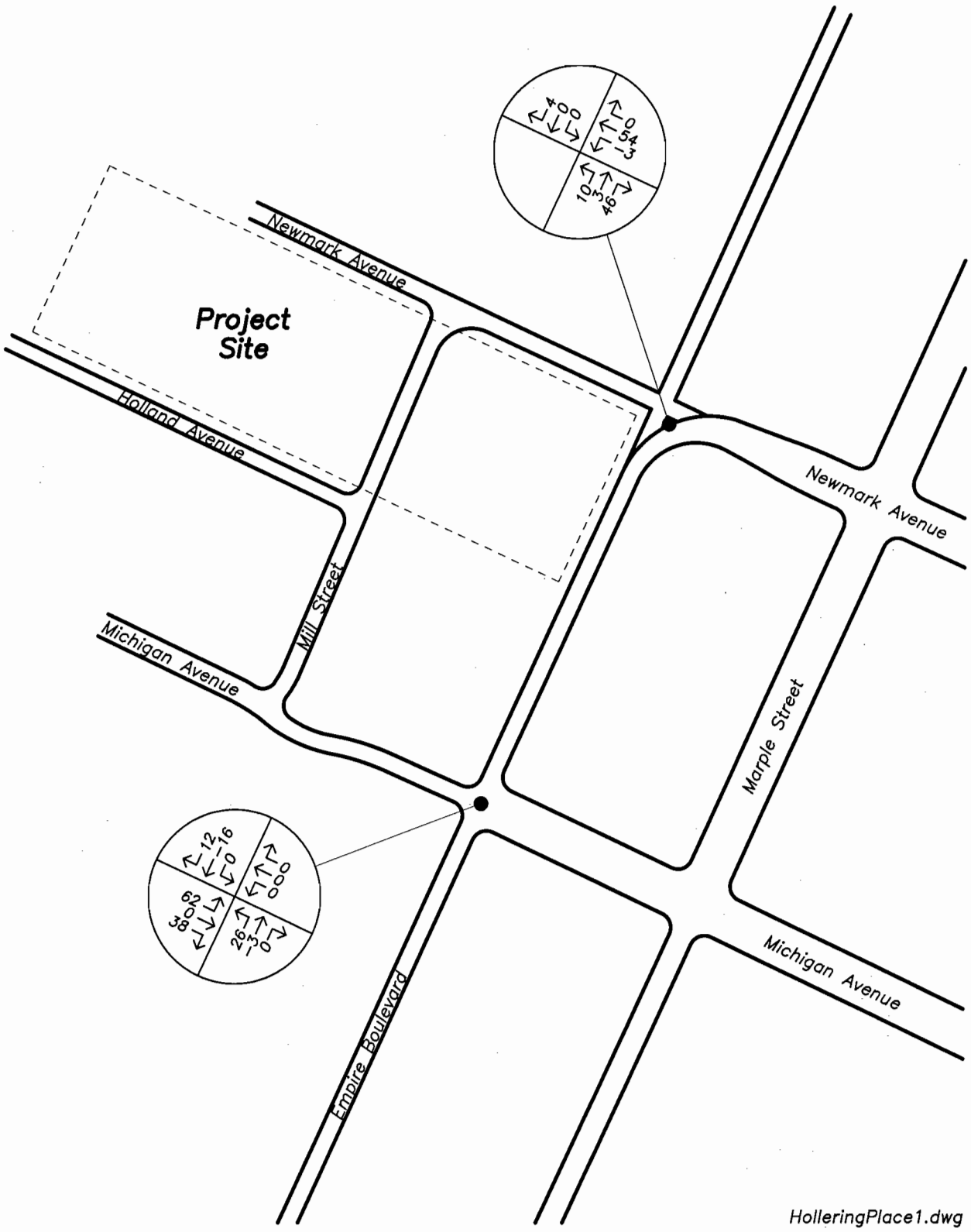


TRAFFIC VOLUMES
Potential Development Plan
Saturday Peak Hour

no scale

FIGURE 3

PAGE 14



TRAFFIC VOLUMES
Potential Development Plan (Michigan Egress)
Saturday Peak Hour

no scale

FIGURE 4

PAGE 15

OPERATIONAL ANALYSIS

Background Traffic

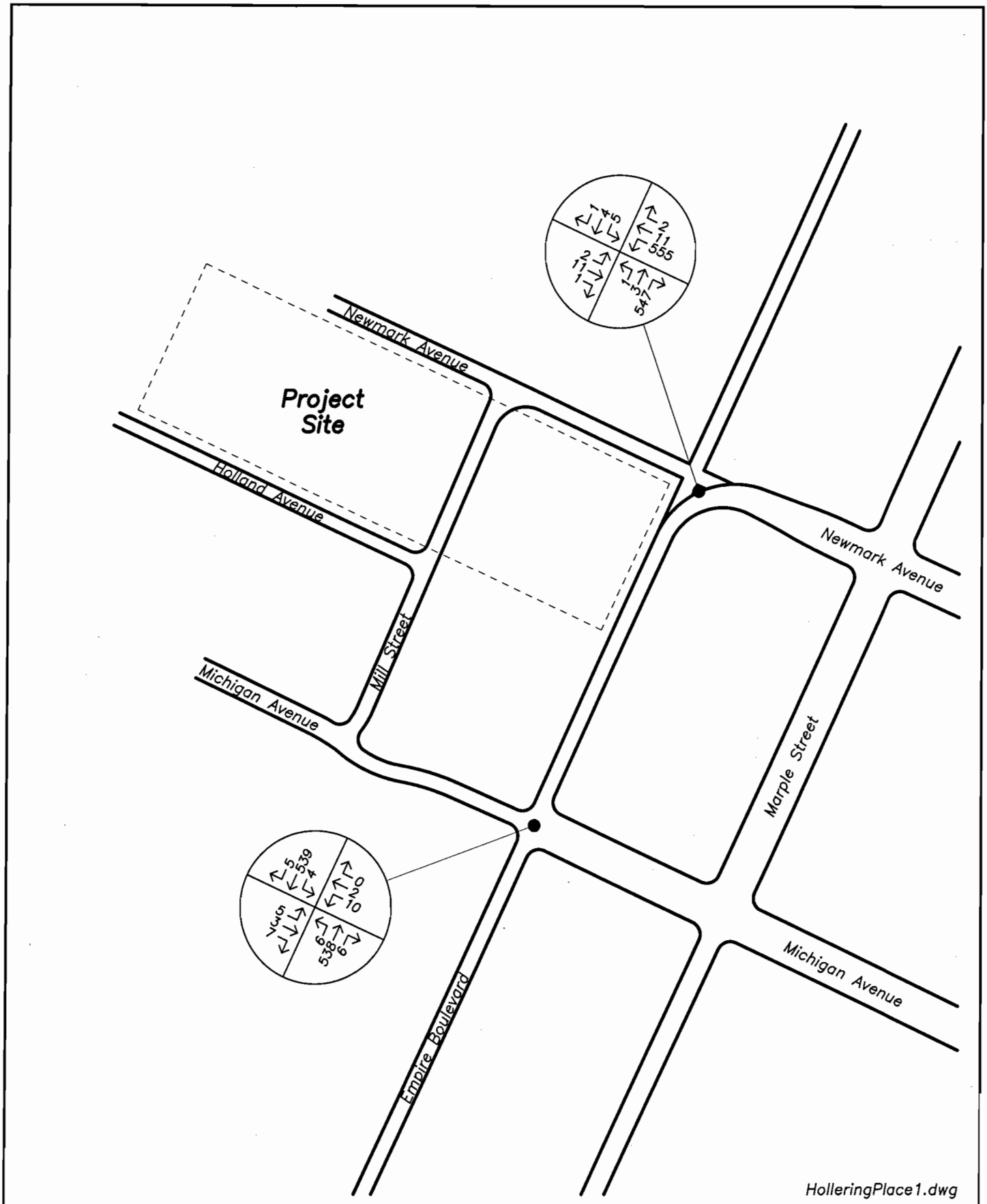
Traffic is expected to increase in the area as other sites are built and add traffic to the roadway system. Some of these developments may have been approved for construction, but not have been built at the time of this report. These projects will be finished by the time of site development. The trips from these other developments will add traffic to the roadways between the time the counts were taken and the time of the build-out analysis. These other development trips need to be included for an accurate analysis of traffic conditions at the time of site development.

No specific developments have been identified near the site that would contribute to the traffic volumes at the study area intersections. Therefore, a growth rate was applied to the traffic volumes on Newmark Avenue and Empire Boulevard.

Since the jurisdiction of the road was transferred to the City in 2000, the most recent historical data in ODOT's records was the period from 1994 to 1999. ODOT's ATR (Automatic Traffic Recorder) Characteristic Table, published in 2005, shows three ODOT facilities that fit the characteristics of the study roads. Growth rates were developed for each of these similar roadways.

Both the older historical data and the data from roadways with similar characteristics showed growth rates less than 0.5 percent. For a conservative analysis, a 0.7-percent growth rate was applied, which is the growth rate identified in the City's Transportation System Plan. It is not certain when the site will be developed. In order to ensure a functioning road system for the future, a five-year analysis period was chosen. The growth rate was applied for a period of five years.

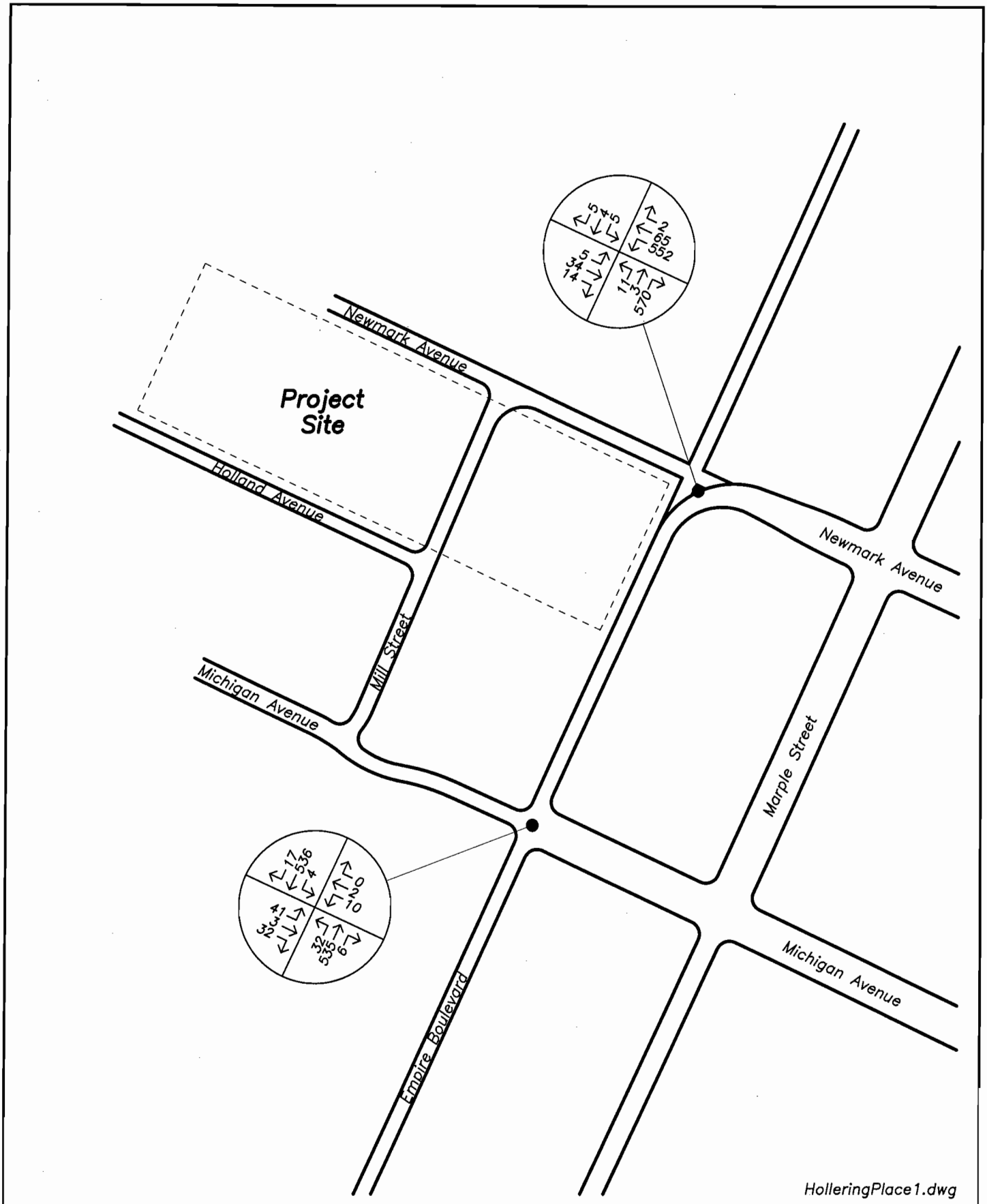
The background traffic volumes comprise the existing traffic volumes with the growth rate applied. Figure 5 on page 17 shows the background traffic volumes during the Saturday afternoon peak hour. Figure 6 on page 18 shows the background plus site trips as calculated from the City's potential development scenario. Figure 7 on page 19 shows the background plus site trips as calculated based on the City's development model and assuming ingress at Newmark Avenue and egress at Michigan Avenue.



TRAFFIC VOLUMES
Year 2011 Background Conditions
Saturday Peak Hour

no scale

FIGURE 5

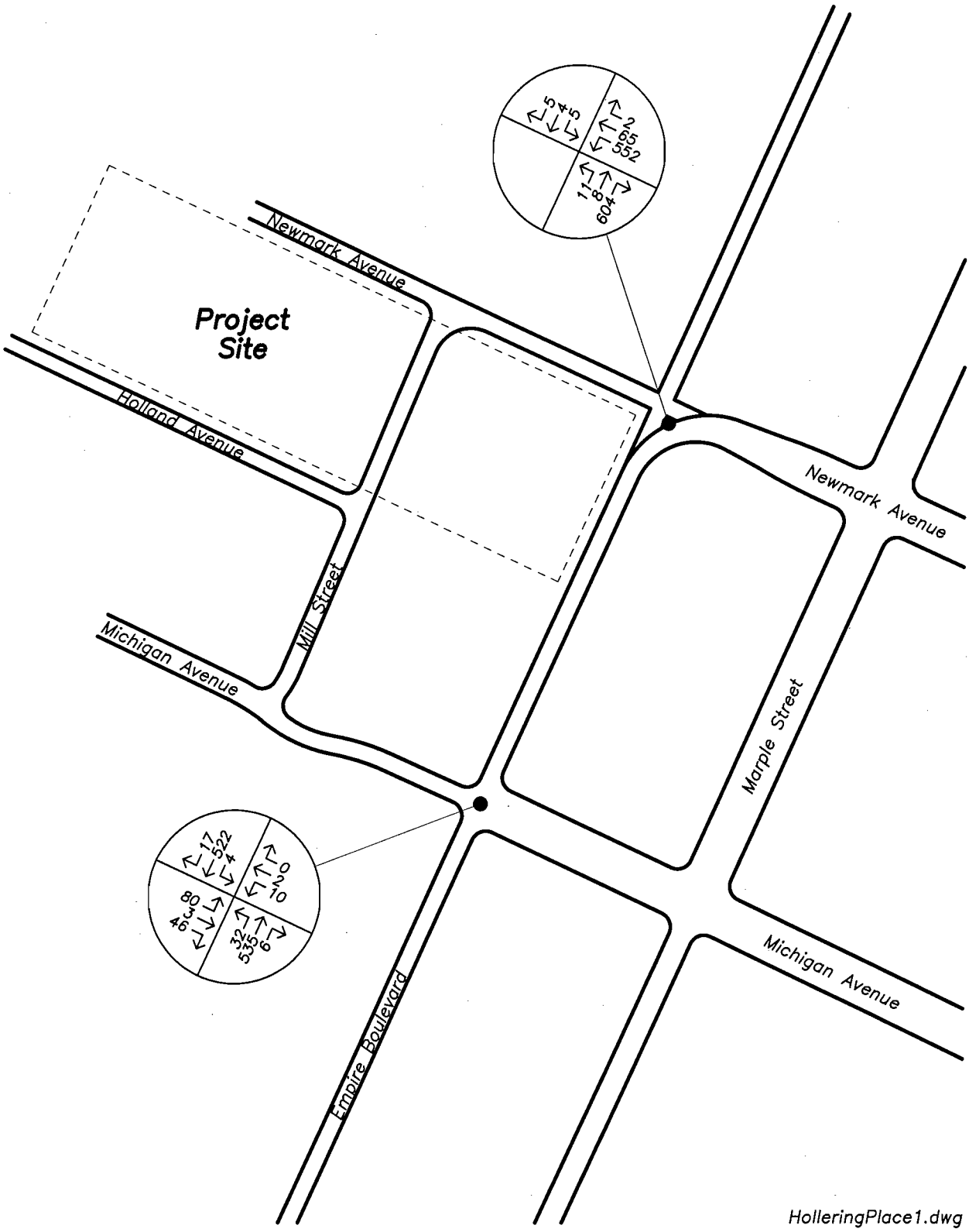


TRAFFIC VOLUMES
Year 2011 Background + Site Conditions
Saturday Peak Hour

no scale

FIGURE 6

PAGE 18



TRAFFIC VOLUMES
Year 2011 Background plus Site Trips Conditions (Michigan Egress)
Saturday Peak Hour

no scale

FIGURE 7

Capacity Analysis

To determine the level of service at the study intersections, a capacity analysis was conducted. The study intersections were analyzed using the unsignalized intersection analysis method in the *2000 HIGHWAY CAPACITY MANUAL (HCM2000)*, published by the Transportation Research Board. The analysis was made for the existing, background, and background plus site conditions during the morning and evening peak hours.

The level of service can range from A, which indicates very little or no delay, to level F, which indicates a high degree of congestion and delay. Both study intersections are under the jurisdiction of the City of Coos Bay and therefore must operate at level of service D or better (Article 3.11, Section 2.4).

Because the configuration of the Newmark Avenue/Empire Boulevard is non-standard, the analysis method had to be adjusted to approximate existing conditions. The unsignalized intersection of Newmark Avenue and Empire Boulevard was calculated to be D during the Saturday peak hour. The level of service describes the delay experienced by traffic on the eastbound approach of Newmark Avenue. The level of service is forecast to remain D through the year 2011. The level of service becomes E by 2011 after site development.

The unsignalized intersection of Michigan Avenue and Empire Boulevard is currently operating at level of service D during the Saturday peak hour. The level of service refers to the delay for the westbound traffic on Michigan Avenue. The level of service is forecast to remain D under background conditions. The level of service becomes E in 2011 after development of the site.

It bears repeating that the analysis was prepared for the 30th highest hour of traffic. The results of the capacity analysis show that the peak hour on Saturdays during the summer months will likely operate at level of service E. Outside of this period—during weekdays and Saturdays in non-peak months—the level of service will be better. It is likely the level of service would be D or better.

The eastbound approach of the Newmark Avenue/Empire Boulevard intersection has a steep upgrade, including the section of road approaching the stop bar where a driver waits before entering the intersection. This lack of a level section on the approach means drivers will require a larger gap in traffic on the major street due to the slower acceleration of the entering vehicle. This will further increase the delays that drivers experience at the intersection. In order to reduce the unnecessary delays at Newmark Avenue/Empire Boulevard, traffic could be diverted to Michigan Avenue since that intersection has a normal configuration.

Although there is an upgrade eastbound on Michigan Avenue, the grade levels out at the stop bar. Assuming traffic can enter the site from either Newmark Avenue or Michigan Avenue, but must exit the site at Michigan Avenue results in a level of service D for the Newmark Avenue/Empire Boulevard intersection and F for the Michigan Avenue/Empire Boulevard intersection.

The results of the capacity analysis, along with the Levels of Service (LOS) and delay are shown in the following table. Tables showing the relationships between delay and level of service are included in the appendix to this report.

LEVEL OF SERVICE SUMMARY

Hollering Place

	Saturday Peak Hour	
	LOS	Delay
Newmark Avenue & Empire Boulevard		
Existing Conditions	D	27
Year 2011 Background Conditions	D	29
Year 2011 Background + Site Trips[1]	E	40
Year 2011 Background + Site Trips[2]	D	28
Michigan Avenue & Empire Boulevard		
Existing Conditions	D	28
Year 2011 Background Conditions	D	29
Year 2011 Background + Site Trips[1]	E	40
Year 2011 Background + Site Trips[2]	F	59

LOS = Level of Service
Delay = Average Delay per Vehicle in Seconds
[1] with ingress and egress at Newmark Boulevard
[2] with egress at Michigan Avenue

Traffic Signal Warrants

Because the level of service at the study intersections was shown to be E or F, the traffic signal warrants were examined to determine if a traffic signal would be warranted. A traffic signal would mitigate the level of service at the intersections. Typically, a traffic signal is war-

ranted when volumes at the unsignalized intersection have become high enough that most of its available capacity is being used or when the major-street volumes are so high that minor-street traffic is unable to enter the intersection due to an insufficient number of gaps in the traffic flow.

The warrants used were from the *MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES*, published in 2003 by the *Federal Highway Administration*. The major warrant generally used to justify the installation of a traffic signal is the *Eight-Hour Vehicular Volume Warrant*. There are two conditions to this warrant. The first condition addresses the total volumes of the intersection. The second condition addresses the ability of the minor-street traffic to enter the intersection. If the traffic volumes exceed a certain level for either condition, the traffic signal is warranted.

Typically, the traffic signal warrants are examined for the eight highest hours of weekday traffic because there has been enough analysis to correlate the weekday peak hour volumes with the eighth highest hour volumes, so the evening peak hour volumes can be converted into the eighth highest hour volumes. There is insufficient data to correlate peak Saturday volumes to the eighth highest hour. Since only Saturday traffic counts were available, the warrants were examined for Saturday conditions.

The traffic signal warrants were not met for Saturday traffic volumes. Since the Saturday volumes are higher than the weekday volumes, it is unlikely that the traffic signal warrants would be met for weekday conditions. A traffic signal is not recommended.

Site Access

In either scenario—exiting the site traffic onto Newmark Avenue and Michigan Avenue or only onto Michigan Avenue—development of the site will result in level of service E. Level of service D is considered the maximum acceptable delay at unsignalized intersections within the City.

The analysis of the study intersections was a worst-case scenario. The traffic volumes had been seasonally adjusted to represent the peak hour during the peak months of traffic. In essence, the report analyzed the delay for the Saturday peak period during July and August, which are the peak months of the year. During the remainder of the time—weekdays as well as Saturdays during the off-peak months—the operation is reasonably expected to show decreased delays, very likely D or better.

There is a difficulty in using Michigan Avenue for exiting site traffic. The road is very narrow and could only handle two-directional travel if the volumes are very low. If Michigan

Avenue is to be used to accommodate all of the exiting site traffic, the road would need to be widened. Since the site would produce a considerable volume on the roadway, it is suggested the travel lanes be at least 10 feet in width and preferably 11 to 12 feet.

If the necessary road widening cannot be achieved for Michigan Avenue, it would be preferable to use both Newmark Avenue and Michigan Avenue for exiting site traffic. Another option could be to make Michigan Avenue a one-way street from Mill Street to Empire Boulevard and allow only eastbound traffic in that section.

IMPROVEMENTS ANALYSIS

Access Spacing

The concept plan for Hollering Place shows a viewing/parking area adjacent to Empire Boulevard between Newmark Avenue and Holland Avenue. The parking area will have separate access to Empire Boulevard with an entrance just south of Newmark Avenue and exit roughly aligned with Holland Avenue.

The grade of the site prevents access to the viewing/parking area from Newmark Avenue. Although the access point nearest to Newmark Avenue will be an entrance only, the concept plan suggests the entrance will include vehicles turning left from Empire Boulevard. There would be approximately 100 feet between the entrance to the viewing/parking area and Newmark Avenue.

There is roughly 210 feet of sight distance for the left-turning vehicles on Empire Boulevard in which to view the oncoming traffic on Newmark Avenue in order to determine acceptable gaps in the traffic flow for the left-turning maneuver. This distance is sufficient to provide satisfactory sight distance for speeds up to 25 mph on Newmark Avenue. The actual travel speeds are not expected to exceed 25 mph due to the radius of the curve; therefore, the sight distance should be adequate. The entrance could be restricted to right-turn only if the left-turning maneuvers become problematic.

Bicycle and Pedestrian Facilities

The proposed development contains several pedestrian-oriented uses, such as the viewing area and retail stores. The concept plan shows sidewalks on one side of Newmark Avenue and pedestrian pathways throughout the site.

The concept plan also shows the pedestrian pathways surfaced with a different material than the roadway. This helps to delineate the pedestrian crosswalks at the locations where the pathway crosses the roadway. Traffic volumes and speeds are expected to be relatively low throughout the site and conflicts are not expected to be an issue. However, the marked crossing delineated by the surface treatment will serve to channel pedestrian traffic into a single area, thereby reducing the number of areas where pedestrians and vehicles could conflict. In areas where the pedestrian travel path crosses the vehicular travel path and there is no surface treat-

ment, striped crosswalks should be provided in order to channel the pedestrian traffic into a limited area.

Turn Lane Warrants

Left-turn lane warrants were evaluated for a northbound left-turn lane on Empire Boulevard at Michigan Avenue and Newmark Avenue under the year 2011 background plus site trips during the Saturday peak hour conditions. The warrants used were those from the *Highway Research Record, number 211*. The warrants take into account left-turning volumes, through volumes and travel speeds. The warrants were examined during the Saturday peak hour in 2011 after site development.

The left-turn lane warrants were not met for a northbound left-turn lane on Empire Boulevard at Newmark Avenue. The warrants were met for a northbound left-turn lane on Empire Boulevard at Michigan Avenue.

It should again be emphasized that the analysis for this project was based on a worst-case scenario. The methods used to develop the traffic volumes correspond to the 30th highest hour for design. This means that these conditions would be met for about 30 hours of the year. The remainder of the time, traffic volumes will be less. The need for the left-turn lane will not be met outside of Saturdays during July and August. In addition, traffic would be able to enter the site via Newmark Avenue, which could further decrease the need for a left-turn lane by reducing the number of vehicles that make the turn at Michigan Avenue. For these reasons, a northbound left-turn lane on Empire Boulevard at Michigan Avenue is not recommended.

Conclusions

The road system near the site is functioning adequately at present. Adding the site traffic will degrade the system, although the delays will not be excessive. The analysis was performed for a worst-case traffic volume scenario, so the system is expected to continue functioning adequately during the majority of the year even with development of the site.

The eastbound Newmark Avenue approach to the Newmark Avenue/Empire Boulevard intersection has an upgrade significant enough to affect the operation of the intersection. To avoid the operational issues presented by the approach grade, traffic exiting the site could be diverted to Michigan Avenue, which does not have the same grade issues as Newmark Avenue. If traffic is diverted to Michigan Avenue, the delays at Newmark Avenue/Empire Boulevard become acceptable, although the delays at Michigan Avenue/Empire Boulevard would be high. It should be noted that the analysis was prepared for worst-case traffic volumes, so the general operation of the intersection will be better than the analysis results.

The pavement width on Michigan Avenue is very narrow. The width is sufficient for the very low volumes currently found on the road, but would not be sufficient for the higher volumes generated by the site. If traffic is to be diverted to Michigan Avenue, the pavement would need to be widened in order to safely accommodate two-way traffic. Travel lanes are typically 11 to 12 feet in width, although the low speeds on the road could support travel lane widths of 10 feet, if necessary. An alternative to the road widening that could be considered would be to make Michigan Avenue a one-way eastbound street between Mill Street and Empire Boulevard.

The left-turn lane warrants were examined at the proposed site access points. The only warrants that were met were on Empire Boulevard at Michigan Avenue. Because the analysis represents the worst-case traffic volumes and does not represent typical conditions, a left-turn lane was not recommended.

APPENDIX

1e

LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (Seconds)
A	< 10
B	10-20
C	20-35
D	35-55
E	55-80
F	> 80

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (Seconds)
A	< 10
B	10-15
C	15-25
D	25-35
E	35-50
F	> 50

LEVEL OF SERVICE

Level of service is used to describe the quality of traffic flow. Levels of service A to C are considered good, and rural roads are usually designed for level of service C. Urban streets and signalized intersections are typically designed for level of service D. Level of service E is considered to be the limit of acceptable delay. For unsignalized intersections, level of service E is generally considered acceptable. Here is a more complete description of levels of service:

Level of service A: Very low delay at intersections, with all traffic signal cycles clearing and no vehicles waiting through more than one signal cycle. On highways, low volume and high speeds, with speeds not restricted by other vehicles.

Level of service B: Operating speeds beginning to be affected by other traffic; short traffic delays at intersections. Higher average intersection delay than for level of service A resulting from more vehicles stopping.

Level of service C: Operating speeds and maneuverability closely controlled by other traffic; higher delays at intersections than for level of service B due to a significant number of vehicles stopping. Not all signal cycles clear the waiting vehicles. This is the recommended design standard for rural highways.

Level of service D: Tolerable operating speeds; long traffic delays occur at intersections. The influence of congestion is noticeable. At traffic signals many vehicles stop, and the proportion of vehicles not stopping declines. The number of signal cycle failures, for which vehicles must wait through more than one signal cycle, are noticeable. This is typically the design level for urban signalized intersections.

Level of service E: Restricted speeds, very long traffic delays at traffic signals, and traffic volumes near capacity. Flow is unstable so that any interruption, no matter how minor, will cause queues to form and service to deteriorate to level of service F. Traffic signal cycle failures are frequent occurrences. For unsignalized intersections, level of service E or better is generally considered acceptable.

Level of service F: Extreme delays, resulting in long queues which may interfere with other traffic movements. There may be stoppages of long duration, and speeds may drop to zero. There may be frequent signal cycle failures. Level of service F will typically result when vehicle arrival rates are greater than capacity. It is considered unacceptable by most drivers.

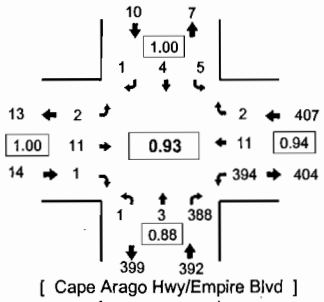
Type of peak hour being reported: System Peak

Method for determining peak hour: Total Entering Volume

INTERSECTION: Cape Arago Hwy/Empire Blvd--Newmark Ave/Cape Arago Hwy
WEATHER:

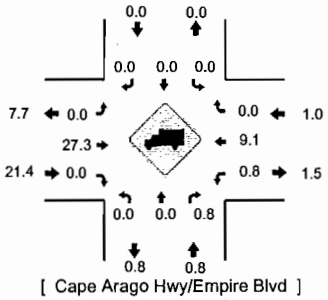
QC JOB #: 10218802
DATE: 12/9/2006

Peak-Hour: 2:35 PM -- 3:35 PM

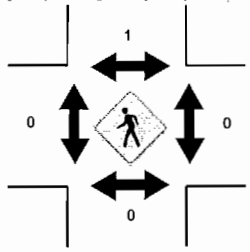


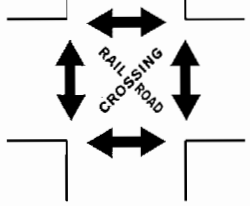
[Cape Arago Hwy/Empire Blvd]

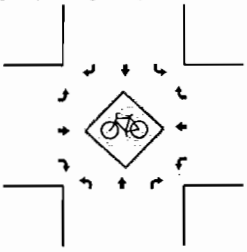
[Newmark Ave/Cape Arago Hwy]

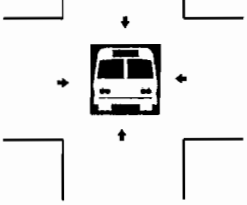


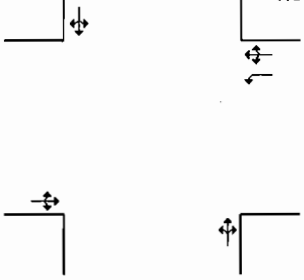
[Cape Arago Hwy/Empire Blvd]











*SEE LEGEND SHEET

5-MIN COUNT PERIOD BEGINNING AT	Cape Arago Hwy/Em... (Northbound)				Cape Arago Hwy/Em... (Southbound)				Newmark Ave/Cape ... (Eastbound)				Newmark Ave/Cape ... (Westbound)				TOTAL	HOURLY TOTALS
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	0	0	35	0	0	0	0	0	0	3	0	0	42	0	1	0	81	787
2:05 PM	1	1	37	0	0	0	0	0	0	0	0	0	32	0	1	0	72	784
2:10 PM	0	1	33	0	2	1	0	0	0	0	0	0	31	1	0	0	69	783
2:15 PM	0	0	27	0	0	0	0	0	0	1	0	0	37	0	0	0	65	779
2:20 PM	0	0	19	0	1	0	0	0	0	1	0	0	33	0	0	0	54	768
2:25 PM	0	1	24	0	0	0	0	0	0	0	0	0	21	1	0	0	47	753
2:30 PM	0	0	27	0	1	0	0	0	0	2	0	0	23	4	0	0	57	743
2:35 PM	0	1	45	0	1	0	0	0	0	0	0	0	41	1	0	0	89	784
2:40 PM	0	1	29	0	1	0	0	0	0	0	0	0	28	2	0	0	61	785
2:45 PM	0	0	27	0	0	1	0	0	1	3	0	0	38	0	0	0	70	799
2:50 PM	0	0	31	0	0	0	0	0	0	3	1	0	28	1	0	0	64	792
2:55 PM	0	1	24	0	0	0	0	0	0	0	0	0	22	0	0	0	47	776
3:00 PM	0	0	28	0	0	0	0	0	0	0	0	0	32	0	1	0	61	756
3:05 PM	0	0	47	0	0	0	0	0	0	1	0	0	39	2	0	0	89	773
3:10 PM	0	0	22	0	1	0	0	0	1	2	0	0	32	0	0	0	58	762
3:15 PM	0	0	34	0	0	0	0	0	0	0	0	0	34	2	0	0	70	767
3:20 PM	1	0	39	0	1	0	0	0	0	1	0	0	34	1	0	0	77	790
3:25 PM	0	0	37	0	1	0	0	0	0	0	0	0	35	1	1	0	75	818
3:30 PM	0	0	25	0	0	3	1	0	0	1	0	0	31	1	0	0	62	823
3:35 PM	1	0	33	0	0	0	0	0	0	2	0	0	27	2	0	0	65	799
3:40 PM	0	0	33	0	1	0	0	0	0	2	0	0	26	1	0	0	63	801
3:45 PM	0	2	25	0	0	0	0	0	0	1	0	0	41	0	0	0	69	800
3:50 PM	0	0	21	0	1	0	0	0	1	3	0	0	32	0	0	0	58	794
3:55 PM	0	0	31	0	0	0	0	0	0	1	0	0	28	0	2	0	62	809

PEAK 15-MIN FLOW RATES	Northbound				Southbound				Eastbound				Westbound				TOTAL
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	0	440	0	8	0	0	0	0	4	0	0	412	16	4	0	888
Heavy Trucks	0	0	0		0	0	0		0	0	0		4	0	0		4
Pedestrians		0				0				0				0			0
Bicycles																	
Railroad																	
Stopped Buses																	

Counter Comments:

Report generated on 12/20/2006

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

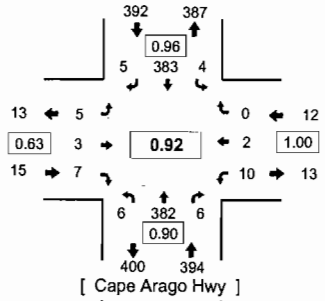
Type of peak hour being reported: System Peak

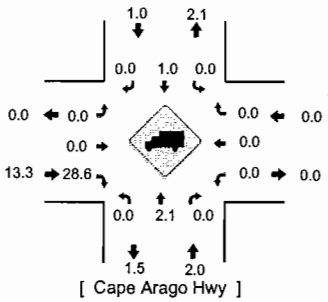
Method for determining peak hour: Total Entering Volume

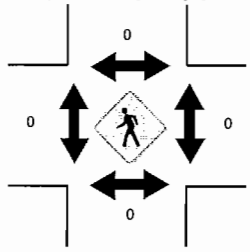
INTERSECTION: Cape Arago Hwy--Michigan Ave
WEATHER:

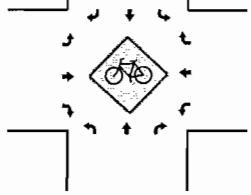
QC JOB #: 10218801
DATE: 12/9/2006

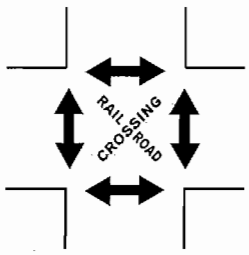
Peak-Hour: 2:35 PM -- 3:35 PM

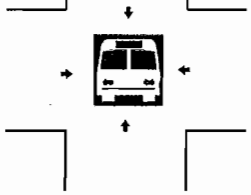












NORTH

*SEE LEGEND SHEET

5-MIN COUNT PERIOD BEGINNING AT	Cape Arago Hwy (Northbound)				Cape Arago Hwy (Southbound)				Michigan Ave (Eastbound)				Michigan Ave (Westbound)				TOTAL	HOURLY TOTALS
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	0	37	2	0	0	42	0	0	0	0	1	0	0	1	0	0	83	765
2:05 PM	0	33	1	0	0	34	1	0	0	0	0	0	0	0	1	0	70	764
2:10 PM	0	34	0	0	0	34	1	0	0	2	0	0	0	1	0	0	72	771
2:15 PM	0	25	0	0	1	33	0	0	1	0	1	0	0	0	0	0	61	769
2:20 PM	0	18	0	0	0	33	1	0	1	1	0	0	2	0	1	0	57	760
2:25 PM	1	25	0	0	0	24	0	0	1	0	1	0	3	1	0	0	56	762
2:30 PM	1	28	2	0	0	20	1	0	0	1	0	0	2	0	0	0	55	743
2:35 PM	0	45	0	0	1	39	2	0	1	0	0	0	1	0	0	0	89	786
2:40 PM	0	27	1	0	0	28	0	0	0	0	1	0	0	0	0	0	57	787
2:45 PM	1	26	0	0	0	39	0	0	0	1	0	0	0	0	0	0	67	798
2:50 PM	0	31	0	0	1	27	0	0	1	0	0	0	1	0	0	0	61	787
2:55 PM	0	28	1	0	0	21	0	0	0	0	1	0	1	0	0	0	52	780
3:00 PM	0	25	1	0	0	29	0	0	0	0	0	0	1	0	0	0	56	753
3:05 PM	0	43	1	0	0	34	3	0	1	0	1	0	1	0	0	0	84	767
3:10 PM	2	23	1	0	0	29	0	0	0	0	0	0	3	0	0	0	58	753
3:15 PM	0	31	0	0	0	35	0	0	1	1	0	0	1	0	0	0	69	761
3:20 PM	1	43	0	0	0	33	0	0	1	0	0	0	0	2	0	0	80	784
3:25 PM	1	32	1	0	1	33	0	0	0	1	2	0	0	0	0	0	71	799
3:30 PM	1	28	0	0	1	36	0	0	0	0	2	0	1	0	0	0	69	813
3:35 PM	0	36	1	0	0	28	0	0	1	0	0	0	0	0	0	0	66	790
3:40 PM	0	36	0	0	0	27	0	0	0	0	1	0	0	0	0	0	64	797
3:45 PM	0	24	4	0	0	38	0	0	0	0	2	0	1	0	1	0	70	800
3:50 PM	1	22	0	0	0	34	1	0	1	0	1	0	1	0	0	0	61	800
3:55 PM	0	32	0	0	0	26	0	0	1	0	1	0	2	0	0	0	62	810

PEAK 15-MIN FLOW RATES	Northbound				Southbound				Eastbound				Westbound				TOTAL
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	424	4	0	4	404	0	0	8	8	8	0	4	8	0	0	880
Heavy Trucks	0	4	0		0	4	0		0	0	0		0	0	0		8
Pedestrians		0				0				0				0			0
Bicycles																	
Railroad Stopped Buses																	

Counter Comments:

Report generated on 12/20/2006

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

ATR 29-001

	2005	2004	2003	2002	2001	avg
Aug	133	131	137	137	136	135
Dec	76	79	71	70	71	73
					seasonal factor	1.86

ATR 36-006

	2005	2004	2003	2002	2001	avg
Aug	108	108	109	109	110	109
Dec	88	90	86	87	85	87
					seasonal factor	1.25

ATR 08-005

	2005	2004	2003	2002	2001	avg
Aug	122	119	124	123	122	122
Dec	91	96	94	89	89	91
					seasonal factor	1.34

total average seasonal factor **1.48**

	9-Dec	peak	factor
Coast Dest	1.1541	0.8472	1.36
Summer	1.14195	0.8378	1.36
	average seasonal factor		**1.36**

1e

TRIP GENERATION SUMMARY

Hollering Place

(Table 1 of 2)

	Entering Trips	Exiting Trips	Total Trips
Shopping Center (40,800 sq ft)			
PM Peak Hour	73	80	153
Weekday	876	876	1,752
Saturday Peak Hour	106	97	203
Saturday	1,019	1,019	2,038
Pass-By Trips at 34%			
PM Peak Hour	-26	-26	-52
Weekday	-298	-298	-596
Saturday Peak Hour	-35	-35	-70
Saturday	-346	-346	-692
Total Shopping Center Trips			
PM Peak Hour	47	54	101
Weekday	578	578	1,156
Saturday Peak Hour	71	62	133
Saturday	673	673	1,346
Motel (27 rooms)			
PM Peak Hour	6	6	12
Weekday	59	59	118
Saturday Peak Hour	7	9	16
Saturday	93	93	186

1e

TRIP GENERATION SUMMARY

Hollering Place

(Table 2 of 2)

	Entering Trips	Exiting Trips	Total Trips
Shopping Center (30,000 sq ft)			
PM Peak Hour	54	59	113
Weekday	644	644	1,288
Saturday Peak Hour	77	72	149
Saturday	750	750	1,500
Pass-By Trips at 34%			
PM Peak Hour	-19	-19	-38
Weekday	-219	-219	-438
Saturday Peak Hour	-25	-25	-50
Saturday	-255	-255	-510
Total Shopping Center Trips			
PM Peak Hour	35	40	75
Weekday	425	425	850
Saturday Peak Hour	52	47	99
Saturday	495	495	990
General Office (30,000 sq ft)			
PM Peak Hour	8	37	45
Weekday	165	165	330
Saturday Peak Hour	6	6	12
Saturday	36	36	72

TRIP GENERATION CALCULATIONS

Land Use: Shopping Center
Land Use Code: 820
Variable: 1000 Sq Ft Gross Leasable Area
Variable Value: 40.8

AM PEAK HOUR

Trip Rate: 1.03

	Enter	Exit	Total
Directional Distribution	61%	39%	
Trip Ends	**26**	**16**	**42**

PM PEAK HOUR

Trip Rate: 3.75

	Enter	Exit	Total
Directional Distribution	48%	52%	
Trip Ends	**73**	**80**	**153**

WEEKDAY

Trip Rate: 42.94

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**876**	**876**	**1,752**

SATURDAY

Trip Rate: 49.97

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**1019**	**1019**	**2,038**

SATURDAY

Trip Rate: 4.97

	Enter	Exit	Total
Directional Distribution	52%	48%	
Trip Ends	**106**	**97**	**203**

Source: TRIP GENERATION, Seventh Edition

TRIP GENERATION CALCULATIONS

Land Use: Motel
Land Use Code: 320
Variable: Occupied Rooms
Variable Value: 21

AM PEAK HOUR

Trip Rate: 0.64

	Enter	Exit	Total
Directional Distribution	36%	64%	
Trip Ends	5	8	13

PM PEAK HOUR

Trip Rate: 0.58

	Enter	Exit	Total
Directional Distribution	53%	47%	
Trip Ends	6	6	12

WEEKDAY

Trip Rate: 5.63

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	59	59	118

SATURDAY PEAK HOUR

Trip Rate: 0.76

	Enter	Exit	Total
Directional Distribution	45%	55%	
Trip Ends	7	9	16

SATURDAY

Trip Rate: 8.84

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	93	93	186

Source: Trip Generation, Seventh Edition

1c

TRIP GENERATION CALCULATIONS

Land Use: Shopping Center
Land Use Code: 820
Variable: 1000 Sq Ft Gross Leasable Area
Variable Value: 30.0

AM PEAK HOUR

Trip Rate: 1.03

	Enter	Exit	Total
Directional Distribution	61%	39%	
Trip Ends	**19**	**12**	**31**

PM PEAK HOUR

Trip Rate: 3.75

	Enter	Exit	Total
Directional Distribution	48%	52%	
Trip Ends	**54**	**59**	**113**

WEEKDAY

Trip Rate: 42.94

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**644**	**644**	**1,288**

SATURDAY

Trip Rate: 49.97

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**750**	**750**	**1,500**

SATURDAY PEAK HOUR

Trip Rate: 4.97

	Enter	Exit	Total
Directional Distribution	52%	48%	
Trip Ends	**77**	**72**	**149**

Source: TRIP GENERATION, Seventh Edition

1c

TRIP GENERATION CALCULATIONS

Land Use: General Office Building
Land Use Code: 710
Variable: 1000 Sq Ft Gross Floor Area
Variable Value: 30.0

AM PEAK HOUR

Trip Rate: 1.55

	Enter	Exit	Total
Directional Distribution	88%	12%	
Trip Ends	**41**	**6**	**47**

PM PEAK HOUR

Trip Rate: 1.49

	Enter	Exit	Total
Directional Distribution	17%	83%	
Trip Ends	**8**	**37**	**45**

WEEKDAY

Trip Rate: 11.01

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**165**	**165**	**330**

SATURDAY PEAK HOUR

Trip Rate: 0.41

	Enter	Exit	Total
Directional Distribution	54%	46%	
Trip Ends	**6**	**6**	**12**

SATURDAY

Trip Rate: 2.37

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**36**	**36**	**72**

Source: TRIP GENERATION, Seventh Edition

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Newmark/Empire*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Existing (2006)*
Analysis Time Period	*Saturday Peak*		

Project Description	*Newmark Avenue Redevelopment - 06214*
East/West Street: *Newmark Avenue*	North/South Street: *Empire Boulevard*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*4*	*528*	*0*	*11*	*536*	*2*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*4*	*567*	*0*	*11*	*576*	*2*
Percent Heavy Vehicles	*0*	--	--	*9*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*2*	*11*	*1*	*5*	*4*	*1*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*2*	*11*	*1*	*5*	*4*	*1*
Percent Heavy Vehicles	*0*	*27*	*0*	*0*	*0*	*0*
Percent Grade (%)		*10*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*4*	*11*		*14*			*10*	
C (m) (veh/h)	*1004*	*971*		*175*			*181*	
v/c	*0.00*	*0.01*		*0.08*			*0.06*	
95% queue length	*0.01*	*0.03*		*0.26*			*0.17*	
Control Delay (s/veh)	*8.6*	*8.7*		*27.4*			*26.0*	
LOS	*A*	*A*		*D*			*D*	
Approach Delay (s/veh)	--	--	*27.4*			*26.0*		
Approach LOS	--	--	*D*			*D*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Newmark/Empire*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Background (2011)*
Analysis Time Period	*Saturday Peak*		

Project Description *Newmark Avenue Redevelopment - 06214*

East/West Street: *Newmark Avenue*	North/South Street: *Empire Boulevard*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*4*	*547*	*0*	*11*	*555*	*2*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*4*	*588*	*0*	*11*	*596*	*2*
Percent Heavy Vehicles	*0*	--	--	*9*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*2*	*11*	*1*	*5*	*4*	*1*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*2*	*11*	*1*	*5*	*4*	*1*
Percent Heavy Vehicles	*0*	*27*	*0*	*0*	*0*	*0*
Percent Grade (%)		*10*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*4*	*11*		*14*			*10*	
C (m) (veh/h)	*987*	*954*		*164*			*170*	
v/c	*0.00*	*0.01*		*0.09*			*0.06*	
95% queue length	*0.01*	*0.03*		*0.28*			*0.19*	
Control Delay (s/veh)	*8.7*	*8.8*		*29.0*			*27.5*	
LOS	*A*	*A*		*D*			*D*	
Approach Delay (s/veh)	--	--	*29.0*			*27.5*		
Approach LOS	--	--	*D*			*D*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Newmark/Empire*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Back + Site (2011)*
Analysis Time Period	*Saturday Peak*		

Project Description *Newmark Avenue Redevelopment - 06214*

East/West Street: *Newmark Avenue* | North/South Street: *Empire Boulevard*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*14*	*580*	*0*	*65*	*552*	*2*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*15*	*623*	*0*	*69*	*593*	*2*
Percent Heavy Vehicles	*0*	--	--	*9*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*24*	*14*	*5*	*4*	*5*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*5*	*25*	*15*	*5*	*4*	*5*
Percent Heavy Vehicles	*0*	*27*	*0*	*0*	*0*	*0*
Percent Grade (%)		*10*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*15*	*69*		*45*			*14*	
C (m) (veh/h)	*989*	*925*		*146*			*139*	
v/c	*0.02*	*0.07*		*0.31*			*0.10*	
95% queue length	*0.05*	*0.24*		*1.22*			*0.33*	
Control Delay (s/veh)	*8.7*	*9.2*		*40.3*			*33.8*	
LOS	*A*	*A*		*E*			*D*	
Approach Delay (s/veh)	--	--	*40.3*			*33.8*		
Approach LOS	--	--	*E*			*D*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Newmark/Empire*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Back + Site (2011)*
Analysis Time Period	*Saturday Peak*		

Project Description *Newmark Avenue Redevelopment - 06214 (Michigan Egress)*

East/West Street: *Newmark Avenue*	North/South Street: *Empire Boulevard*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*19*	*604*	*0*	*65*	*552*	*2*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*20*	*649*	*0*	*69*	*593*	*2*
Percent Heavy Vehicles	*0*	--	--	*9*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*5*	*4*	*5*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*5*	*4*	*5*
Percent Heavy Vehicles	*0*	*27*	*0*	*0*	*0*	*0*
Percent Grade (%)		*10*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*1*	*0*
Configuration					*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*					*LTR*	
v (veh/h)	*20*	*69*					*14*	
C (m) (veh/h)	*989*	*904*					*174*	
v/c	*0.02*	*0.08*					*0.08*	
95% queue length	*0.06*	*0.25*					*0.26*	
Control Delay (s/veh)	*8.7*	*9.3*					*27.5*	
LOS	*A*	*A*					*D*	
Approach Delay (s/veh)	--	--				*27.5*		
Approach LOS	--	--				*D*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Empire/Michigan*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Existing (2006)*
Analysis Time Period	*Saturday Peak*		

Project Description *Newmark Avenue Redevelopment - 06214*

East/West Street: *Michigan Avenue*	North/South Street: *Empire Boulevard*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*6*	*520*	*6*	*4*	*521*	*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*6*	*565*	*6*	*4*	*566*	*5*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*3*	*7*	*10*	*2*	*0*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*5*	*3*	*7*	*10*	*2*	*0*
Percent Heavy Vehicles	*0*	*0*	*29*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*6*	*4*		*12*			*15*	
C (m) (veh/h)	*1012*	*1012*		*172*			*253*	
v/c	*0.01*	*0.00*		*0.07*			*0.06*	
95% queue length	*0.02*	*0.01*		*0.22*			*0.19*	
Control Delay (s/veh)	*8.6*	*8.6*		*27.5*			*20.1*	
LOS	*A*	*A*		*D*			*C*	
Approach Delay (s/veh)	--	--	*27.5*			*20.1*		
Approach LOS	--	--	*D*			*C*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Empire/Michigan*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Background (2011)*
Analysis Time Period	*Saturday Peak*		

Project Description	*Newmark Avenue Redevelopment - 06214*
East/West Street: *Michigan Avenue*	North/South Street: *Empire Boulevard*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*6*	*538*	*6*	*4*	*539*	*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*6*	*584*	*6*	*4*	*585*	*5*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*3*	*7*	*10*	*2*	*0*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*5*	*3*	*7*	*10*	*2*	*0*
Percent Heavy Vehicles	*0*	*0*	*29*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*6*	*4*		*12*			*15*	
C (m) (veh/h)	*995*	*995*		*162*			*240*	
v/c	*0.01*	*0.00*		*0.07*			*0.06*	
95% queue length	*0.02*	*0.01*		*0.24*			*0.20*	
Control Delay (s/veh)	*8.6*	*8.6*		*29.0*			*21.0*	
LOS	*A*	*A*		*D*			*C*	
Approach Delay (s/veh)	--	--	*29.0*			*21.0*		
Approach LOS	--	--	*D*			*C*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Empire/Michigan*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Back + Site (2011)*
Analysis Time Period	*Saturday Peak*		

Project Description *Newmark Avenue Redevelopment - 06214*

East/West Street: *Michigan Avenue* | North/South Street: *Empire Boulevard*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*32*	*535*	*6*	*4*	*536*	*17*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*34*	*581*	*6*	*4*	*582*	*18*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*51*	*3*	*32*	*10*	*2*	*0*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*55*	*3*	*34*	*10*	*2*	*0*
Percent Heavy Vehicles	*0*	*0*	*29*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*34*	*4*		*12*			*92*	
C (m) (veh/h)	*987*	*998*		*132*			*193*	
v/c	*0.03*	*0.00*		*0.09*			*0.48*	
95% queue length	*0.11*	*0.01*		*0.29*			*2.31*	
Control Delay (s/veh)	*8.8*	*8.6*		*35.0*			*39.6*	
LOS	*A*	*A*		*D*			*E*	
Approach Delay (s/veh)	--	--	*35.0*			*39.6*		
Approach LOS	--	--	*D*			*E*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*C Sumrain*	Intersection	*Empire/Michigan*
Agency/Co.	*Lancaster*	Jurisdiction	*Coos Bay*
Date Performed	*1/2/2007*	Analysis Year	*Back + Site (2011)*
Analysis Time Period	*Saturday Peak*		

Project Description *Newmark Avenue Redevelopment - 06214 (Michigan Egress)*

East/West Street: *Michigan Avenue* | North/South Street: *Empire Boulevard*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*32*	*535*	*6*	*4*	*522*	*17*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*34*	*581*	*6*	*4*	*567*	*18*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*80*	*3*	*46*	*10*	*2*	*0*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*86*	*3*	*49*	*10*	*2*	*0*
Percent Heavy Vehicles	*0*	*0*	*29*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*34*	*4*		*12*			*138*	
C (m) (veh/h)	*1000*	*998*		*130*			*194*	
v/c	*0.03*	*0.00*		*0.09*			*0.71*	
95% queue length	*0.11*	*0.01*		*0.30*			*4.50*	
Control Delay (s/veh)	*8.7*	*8.6*		*35.5*			*59.4*	
LOS	*A*	*A*		*E*			*F*	
Approach Delay (s/veh)	--	--	*35.5*			*59.4*		
Approach LOS	--	--	*E*			*F*		

TRAFFIC SIGNAL WARRANT CALCULATIONS

Major Street: Newmark Avenue Minor Street: Empire Boulevard

Existing Conditions

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1					
CONDITION A					
Major St.	Minor St.	100% Warrants	70% Warrants	100% Warrants	70% Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

Warrant Used

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

	Number of Lanes	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1				
Condition A: Minimum Vehicular Volume				
Major Street	1	10,810	8,850	
Minor Street*	1	130	2,650	**No**
Condition B: Interruption of Continuous Traffic				
Major Street	1	10,810	13,300	
Minor Street*	1	130	1,350	**No**
Warrant 3: Peak Hour Warrant - AM Peak Hour				
Major Street	1	0		
Minor Street*	1	0	120	**No**
Warrant 3: Peak Hour Warrant - PM Peak Hour				
Major Street	1	1,081		
Minor Street*	1	13	180	**No**

* Minor street right-turning traffic volumes reduced by 25%

TRAFFIC SIGNAL WARRANT CALCULATIONS

Major Street: Newmark Avenue Minor Street: Empire Boulevard

Background Conditions

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1					
CONDITION A					
Major St.	Minor St.	100% Warrants	70% Warrants	100% Warrants	70% Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

Warrant Used

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

	Number of Lanes	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1				
Condition A: Minimum Vehicular Volume				
Major Street	1	11,190	8,850	
Minor Street*	1	130	2,650	**No**
Condition B: Interruption of Continuous Traffic				
Major Street	1	11,190	13,300	
Minor Street*	1	130	1,350	**No**
Warrant 3: Peak Hour Warrant - AM Peak Hour				
Major Street	1	0		
Minor Street*	1	0	180	**No**
Warrant 3: Peak Hour Warrant - PM Peak Hour				
Major Street	1	1,119		
Minor Street*	1	13	170	**No**

* Minor street right-turning traffic volumes reduced by 25%

TRAFFIC SIGNAL WARRANT CALCULATIONS

Major Street: Newmark Avenue Minor Street: Empire Boulevard

Background + Site Trips Conditions

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1					
CONDITION A					
Major St.	Minor St.	100% Warrants	70% Warrants	100% Warrants	70% Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

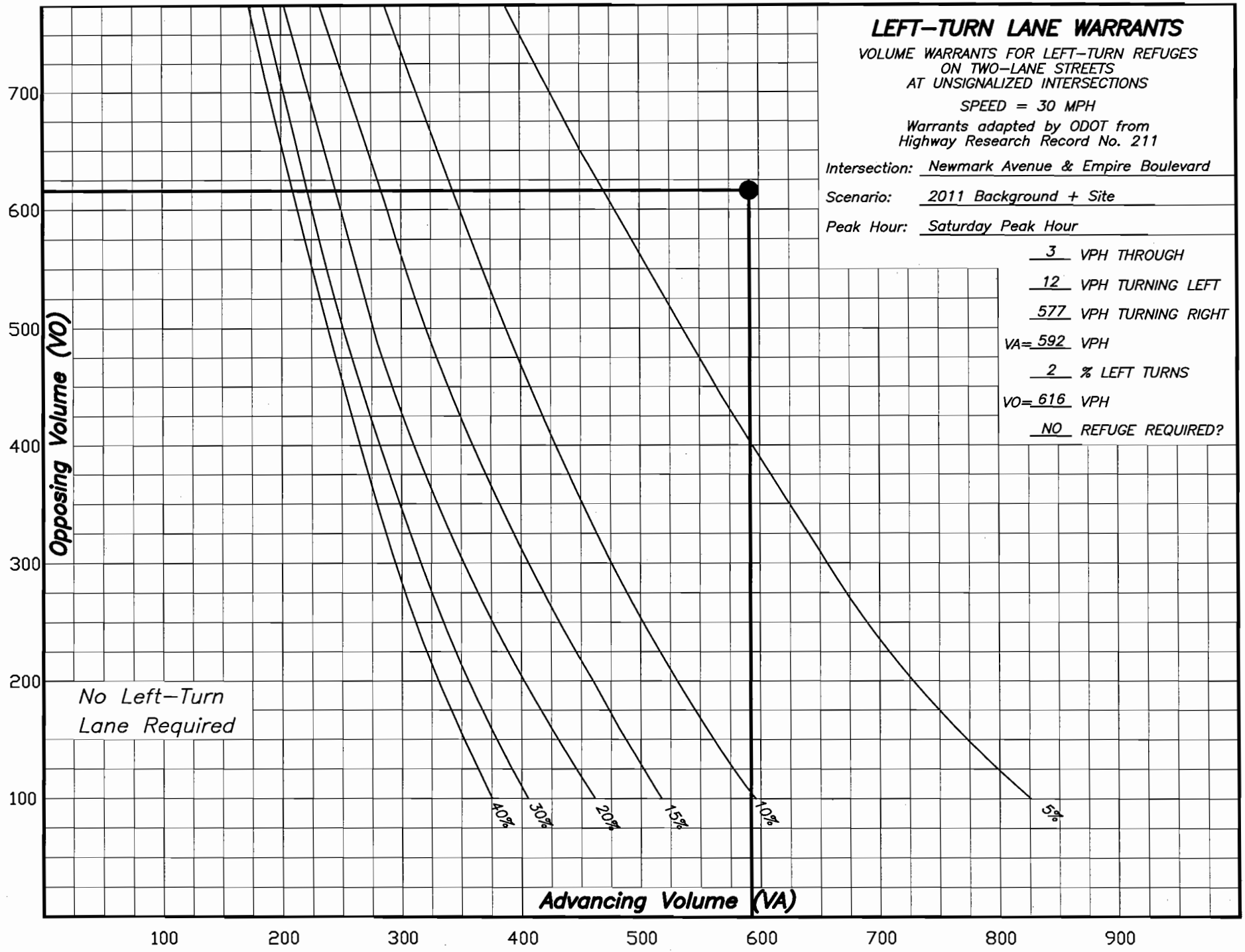
Warrant Used

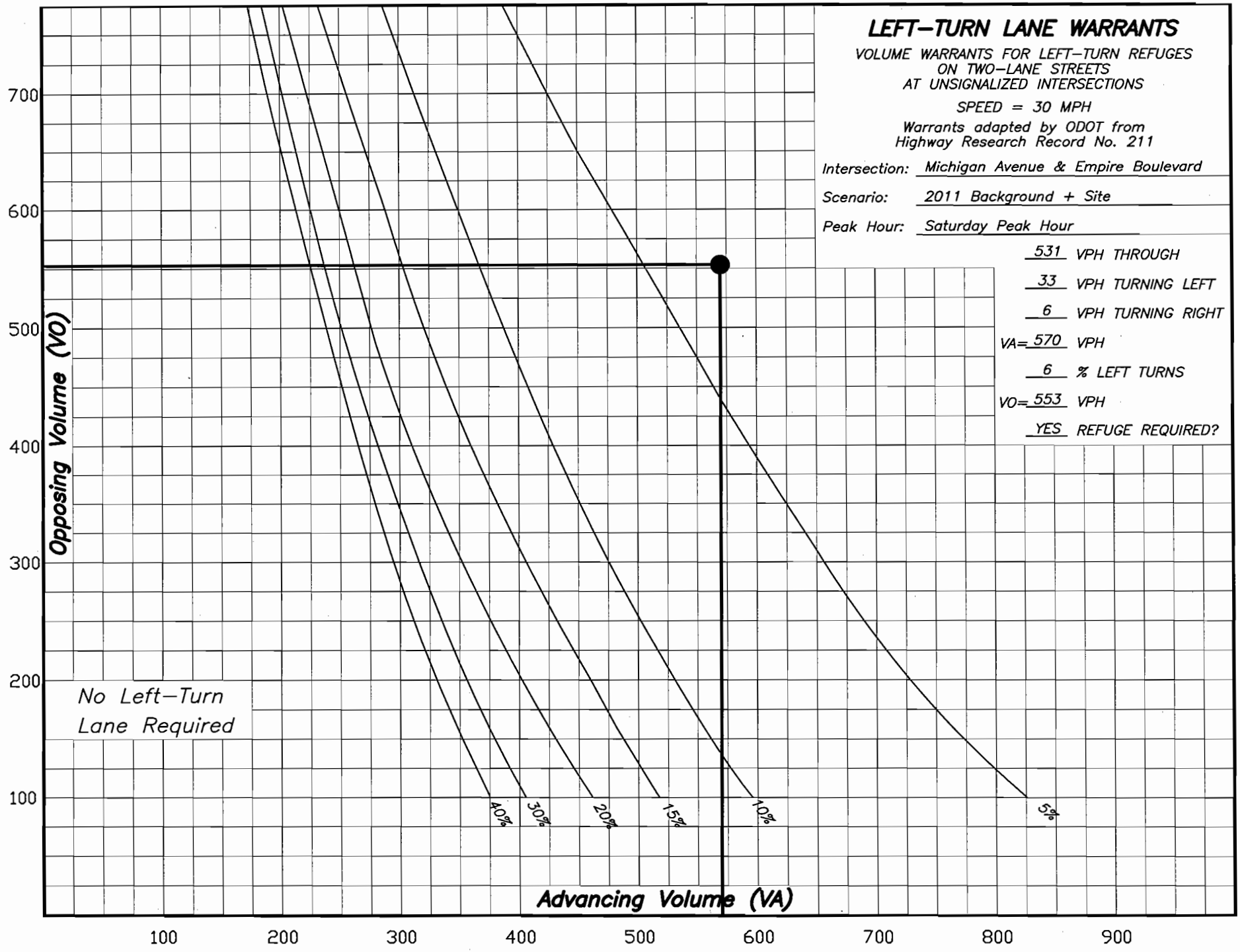
X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

	Number of Lanes	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1				
Condition A: Minimum Vehicular Volume				
Major Street	1	12,030	8,850	
Minor Street*	1	430	2,650	**No**
Condition B: Interruption of Continuous Traffic				
Major Street	1	12,030	13,300	
Minor Street*	1	430	1,350	**No**
Warrant 3: Peak Hour Warrant - AM Peak Hour				
Major Street	1	0		
Minor Street*	1	0	180	**No**
Warrant 3: Peak Hour Warrant - PM Peak Hour				
Major Street	1	1,203		
Minor Street*	1	43	150	**No**

* Minor street right-turning traffic volumes reduced by 25%


LEFT–TURN LANE WARRANTS
VOLUME WARRANTS FOR LEFT–TURN REFUGES
ON TWO–LANE STREETS
AT UNSIGNALIZED INTERSECTIONS
SPEED = 30 MPH
Warrants adapted by ODOT from
Highway Research Record No. 211
Intersection: Newmark Avenue & Empire Boulevard
Scenario: 2011 Background + Site
Peak Hour: Saturday Peak Hour
3 VPH THROUGH
12 VPH TURNING LEFT
577 VPH TURNING RIGHT
VA= 592 VPH
2 % LEFT TURNS
VO= 616 VPH
NO REFUGE REQUIRED?
Opposing Volume (VO)
Advancing Volume (VA)
No Left–Turn
Lane Required
40%
30%
20%
15%
10%
5%
100
200
300
400
500
600
700
800
900


LEFT–TURN LANE WARRANTS
VOLUME WARRANTS FOR LEFT–TURN REFUGES
ON TWO–LANE STREETS
AT UNSIGNALIZED INTERSECTIONS
SPEED = 30 MPH
Warrants adapted by ODOT from
Highway Research Record No. 211
Intersection: Michigan Avenue & Empire Boulevard
Scenario: 2011 Background + Site
Peak Hour: Saturday Peak Hour
531 VPH THROUGH
33 VPH TURNING LEFT
6 VPH TURNING RIGHT
VA= 570 VPH
6 % LEFT TURNS
VO= 553 VPH
YES REFUGE REQUIRED?
Opposing Volume (VO)
Advancing Volume (VA)
No Left–Turn
Lane Required
40%
30%
20%
15%
10%
5%
100
200
300
400
500
600
700
800
900