Traffic Impact Study
Village at Grand Traverse
Acme Township, Michigan

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Executive Summary

A multi-phase mixed use lifestyle development to be called The Village at Grand Traverse is proposed for a 182-acre site located along the south side of M-72 west of the M-72/Lautner Road intersection in Acme Township, Michigan. The first of two or more proposed phases calls for the development of a 192,000 square-foot Meijer store to be located on the eastern end of the overall site. Subsequent phases currently call for the development of a wide variety of uses including an additional 765,500 square feet of retail/commercial, approximately 1044 residential units of various types, a 250-room hotel, 40,000 square feet for civic offices/uses, and 28,000 square feet set aside for clubhouse/recreational use.

This revised impact study was completed to recognize the township's and MDOT's desire to define future roadway cross section alternatives on M-72 that better fit "complete streets" tenets in terms of aesthetics and overall corridor efficiency. Two general intersection/corridor alternatives were identified by the agencies for M-72; a boulevard/indirect left-turn cross section with a 30-foot median, and a roundabout alternative with a 15-foot median (links between roundabouts).

Also, per initial discussions and comments by the Township and agencies related to a 2009 study, an expanded study area was analyzed that included the intersections of M-72/Lautner Road, M-72/Mt. Hope Road, M-72/US-31, US-31/Mt. Hope Road, US-31/Bunker Hill Road, and Lautner Road/Bunker Hill Road. In addition, all site access points and three internal intersections were analyzed to provide an overall forecast of potential future impacts to the roadway system.

The analyses summarized in this report identify current seasonally adjusted traffic conditions within the study area and an estimate of the conditions that can be expected with future growth, including the phased development of the proposed project. These analyses take into account the highest peak traffic periods that typically occur during the week along the study area corridors.

Chapter 1 briefly summarizes the proposed project and explains the analyses and process that are used to define the potential project impacts.

Chapter 2 summarizes the "existing" or expected 2012 background conditions within the study area without Phase 1 of the proposed development in place. The findings of this chapter are used as a basis for subsequent analysis of the proposed project's impacts. Based upon this set of analyses, the study area intersections function within acceptable levels except for two locations; the westbound left turn from Bunker Hill to southbound US-31 currently operates at a level of service (LoS) of F during both peak hours, and the two Lautner Road approaches to M-72 operate at LoS E or F during the afternoon peak hour.

Chapter 3 summarizes the projected 2012 future conditions that include 2012 background traffic plus the proposed Phase 1 project traffic. The project is expected to generate approximately 203 new trips onto the surrounding roadway system during the morning peak hour and 559 new trips during the afternoon peak hour. Level of service analyses indicate that project traffic will contribute to the deterioration of the peak-hour operations at three public roadway intersections; US-31/M-72, M-72/Lautner Road, and US-31/Bunker Hill. Although not required for this study but done as an accommodation to analyze these three public intersections, improvements were identified that would bring all movements at these intersections back to within the required LoS D or better. Those included:

- **M-72/Lautner Rd** area – reconstruct this intersection and the adjacent M-72 segments to the east and west as either a high-volume/multi-lane roundabout with 15-foot medians on M-72 or as a full boulevard indirect left-turn facility. For the segments that need improving for Phase 1, the reconstruction on M-72 near Lautner Road should provide the framework/cross section needed to encompass eventual Phase 2 traffic needs.

- **US-31/M-72** - revise/adjust signal operations to provide a short southbound permissive/protected left-turn phase (completed by MDOT/others).

- **US-31/Bunker Hill** - construct a separate northbound right-turn lane on US-31 and revise/adjust signal operations (completed by MDOT/others).

Chapter 4 summarizes the projected Phase 2 conditions with all of the proposed Village at Grand Traverse (VGT) uses completed and fully occupied. The proposed Phase 2 land uses are expected to generate approximately 1,023 new weekday morning peak-hour trips and approximately 2,271 new afternoon peak-hour vehicle trips onto the study area roadway system. As might be expected, significant roadway improvements will be needed to improve the main study area intersections, largely by expanding upon the two cross section alternatives at the M-72 intersections. Those include:

- **M-72**: Expand either of the two cross section alternatives developed in Phase 1 along the site frontage to the west. The boulevard alternative would result in all site access points to M-72 functioning as right-in/right-out driveways with signalization utilized at several of the key median crossovers and at the M-72/Lautner and M-72/Drive 2 (main driveway) intersections.

  With the exception of a multi-lane roundabout at the M-72/Drive 2 intersection, all the site access points would operate as right-in/right-out driveways under the roundabout alternative as well.

- **US-31/M-72**. Reconstruct this intersection with a multi-lane, high-volume roundabout with right-turn bypass lanes on the northbound and westbound approaches, or reconstruct the intersection as a boulevard facility on US-31 with indirect left turns occurring north and south of the primary intersection (westbound left turns would continue to operate as a direct left).

- **US-31/Bunker Hill Road**: add a second westbound left-turn lane.

With these improvements in place, all of the movements at the study area intersections are projected to operate within acceptable levels except the low-volume left-turn movements from the two minor street Mount Hope intersections.

Chapter 5 summarizes the projected 2022 conditions that include full development of the VGT site plus completion of four other approved background projects in the vicinity. Those projects are expected to generate approximately 1,593 new morning peak-hour trips and 2,522 new afternoon peak hour trips. Analyses of projected 2022 conditions with this traffic added to the improved Phase 2 roadway network results in numerous individual movements at an expected LoS of F. This indicates that additional improvements may be needed if/when those four projects develop.

The following chapters summarize the above findings and conclusions in more detail.

Chapter 1
Introduction

Progressive AE was retained to complete this traffic impact study for the proposed Village at Grand Traverse development in Acme Township, Michigan. As shown in Figure 1, the proposed 182-acre development site is located on the south side of M-72 immediately west of Lautner Road. It is our understanding that the current site plan is in many ways the culmination of an ongoing process to identify a location and design of a mixed-use town center that could encompass a variety of uses.

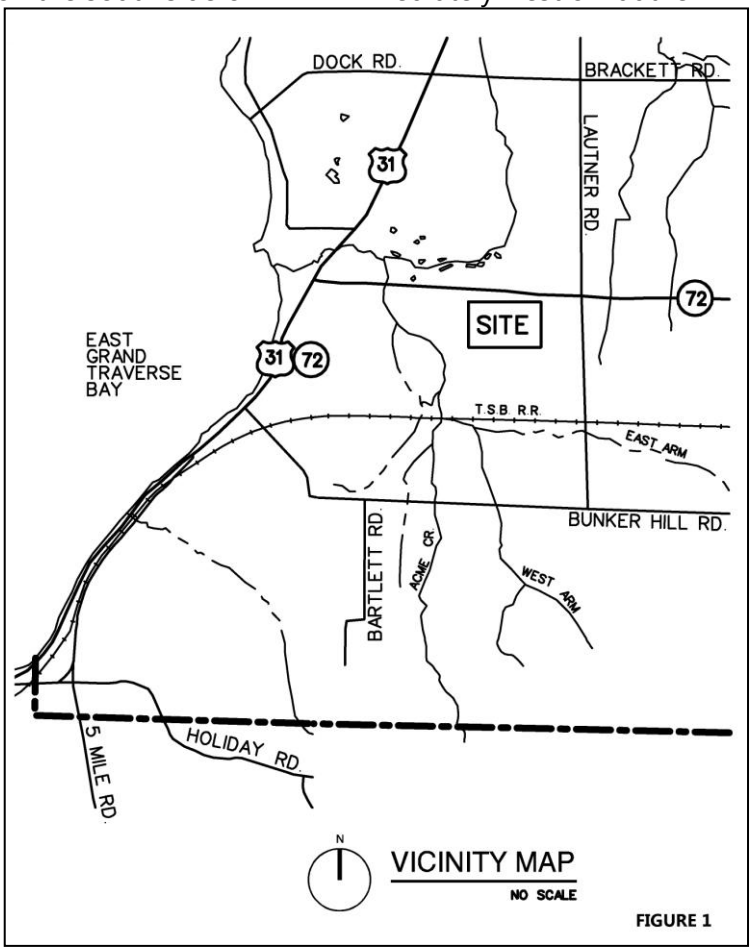


FIGURE 1

Development Description

Current plans call for the development of the Village at Grand Traverse to occur over a period of years. For the purposes of this study, it is expected that development will be in two phases.

Phase 1 of development is expected to be completed by 2012 and would be limited to:

- 192,000 square-foot Meijer store.

Phase 2, the remainder of the site uses, may not be completed for 10-15 years. For the purposes of this study, however, it was determined that a full buildout analysis should be done based upon 2012 background conditions. Currently proposed uses for Phase 2 are:

- 765,500 square feet of retail/commercial;
- 250 room hotel;
- 90 single family homes;
- 430 multi-family units;

- 228 mixed-use residential units;
- 146 row house/townhouse units
- 150 senior living residential units;
- 40,000 square feet of civic use; and
- 28,000 square foot clubhouse.

As proposed, access to the site will be provided by four driveways to M-72 and two driveways to Lautner Road. Under a roundabout alternative, three of these driveways, one to M-72 and two to Lautner Road, are proposed to function as full movement driveways while the other three driveways to M-72 are proposed to operate as right-in/right-out driveways. Under the M-72 boulevard alternative, the four proposed M-72 driveways would function as right-in/right-out drives, while the two to Lautner road would function as standard driveway intersections.

Study Tasks

The purpose of this traffic impact study was to analyze the potential impacts of each phase of the proposed development and to identify what physical and/or operational roadway system improvements may be necessary to mitigate those impacts. As noted, the potential improvements to M-72 were focused on either a boulevard cross section or use of roundabouts at key locations. The tasks undertaken to complete the analyses include:

1. ***Data Collection.*** Applicable information regarding the existing operating conditions of the adjacent roadways was obtained. This included completion of peak-hour turning movement counts (done in May 2010), as well as obtaining information regarding lane configurations, speed limits, traffic control, signal timing, seasonal traffic volume variations, and other related data for the study area roadways.

2. ***Background Growth.*** Traffic expected to be generated from several large approved/ under construction developments within the general area were taken into account for the last stage of this set of analyses.

3. ***Trip Generation/Distribution.*** The number of trips the proposed development is expected to generate in each phase during peak hours was identified. These trips were then assigned to the adjacent roadways based upon the expected market area and patterns followed by existing traffic and approved by the township.

4. ***Levels of Service.*** Capacity calculations were completed at the study area's key intersections to identify existing and expected future peak-hour operational characteristics.

5. ***Mitigation.*** Roadway/intersection improvements were identified, where applicable, that will enable the adjacent roadways and nearby intersections to maintain acceptable levels of operation under projected future conditions and upon completion of the proposed project phases. Per input by review agencies, individual movements need to operate at an LoS of D or better during both peak hours with volume-to-capacity ratios (v/c) less than 1.0.

The above tasks were started after significant input was provided by Acme Township and other the reviewing entities to ensure study completeness and to address specific concerns regarding the existing and future conditions of the roadways in the study area. In addition to the two required intersection/cross section alternatives and an expanded study area, the input items

included the appropriate background growth factor and developments, seasonal traffic volume variation factors, and trip generation criteria requirements.

Per discussions with the township and review agencies, five primary sets of analyses were completed for this study. Those include:

- 2012 "Existing" Roads and Traffic (termed as 2012 Existing/Background in this report);
- 2012 Existing Roads + VGT (Village at Grand Traverse) Traffic Phase 1;
- 2012 Existing Roads + VGT Traffic Full Buildout (also termed as Phase 2);
- 2012 Suitable Improvements for VGT Traffic Full Buildout; and
- 2022 VGT + Nearby Developments on Phase 2 Improved Roadway Network

The following chapters outline the results of analyses completed during this study for existing/background 2012 conditions, the two project phases, and the projected 2022 overall conditions.

Chapter 2
2012 Existing/Background Conditions

The first step in the identification of potential traffic impacts is to determine how well the adjacent roadways are operating under pre-development conditions. These base conditions then provide a comparison to subsequent future conditions analyses. This chapter summarizes the data collection and expected 2012 operating conditions analysis procedures.

STUDY AREA ROADWAYS

M-72

M-72 is an east/west oriented state trunkline and serves as a regional arterial roadway throughout the Grand Traverse area. It currently has a two to three lane cross section with shoulders adjacent to the site, with wider cross sections further west as it nears and is combined with US-31. The speed limit is 55 miles per hour adjacent to the site. According to recent data, M-72 carries approximately 16,000-17,000 vehicles per day adjacent to the site. Its intersection with US-31 is traffic signal controlled, while its intersections with Lautner Road and Mt. Hope Road are stop sign controlled (side street stops).

US-31

US-31 is also under the jurisdiction of MDOT and is co-designated with M-72 south of the US-31/M-72 intersection. It serves as a regional and statewide north/south highway in addition to serving as a major arterial within the Grand Traverse area. US-31 has a five-lane cross section and a 45 mile-per-hour speed limit within this study area. US-31/M-72 carries approximately 30,000-33,000 vehicles per day within the study area. In addition to its intersection with M-72, the US-31/Bunker Hill Road intersection is signalized, while Mt Hope Road at US-31 is stop sign controlled.

Lautner Road

Lautner Road is a north/south two-lane local collector roadway under GTCRC jurisdiction. It is stop sign controlled at its intersections with M-72 and Bunker Hill Road. Based upon recent count data, it appears Lautner Road carries approximately 700-800 vehicles per day adjacent to the proposed site. It has a 55 mile-per-hour speed limit in this area.

Bunker Hill Road

Bunker Hill Road is also a two-lane local collector roadway within the GTCRC system. It is signal controlled and has a three-lane cross section at its intersection with US-31/M-72. Recent counts indicate that daily traffic volumes near the east end of the study area are approximately 900-1,000 vehicles and approximately 3,500-4,000 vehicles at the west end at/near US-31/M-72. Bunker Hill has a 55 mile per hour speed limit in the area close to the proposed project.

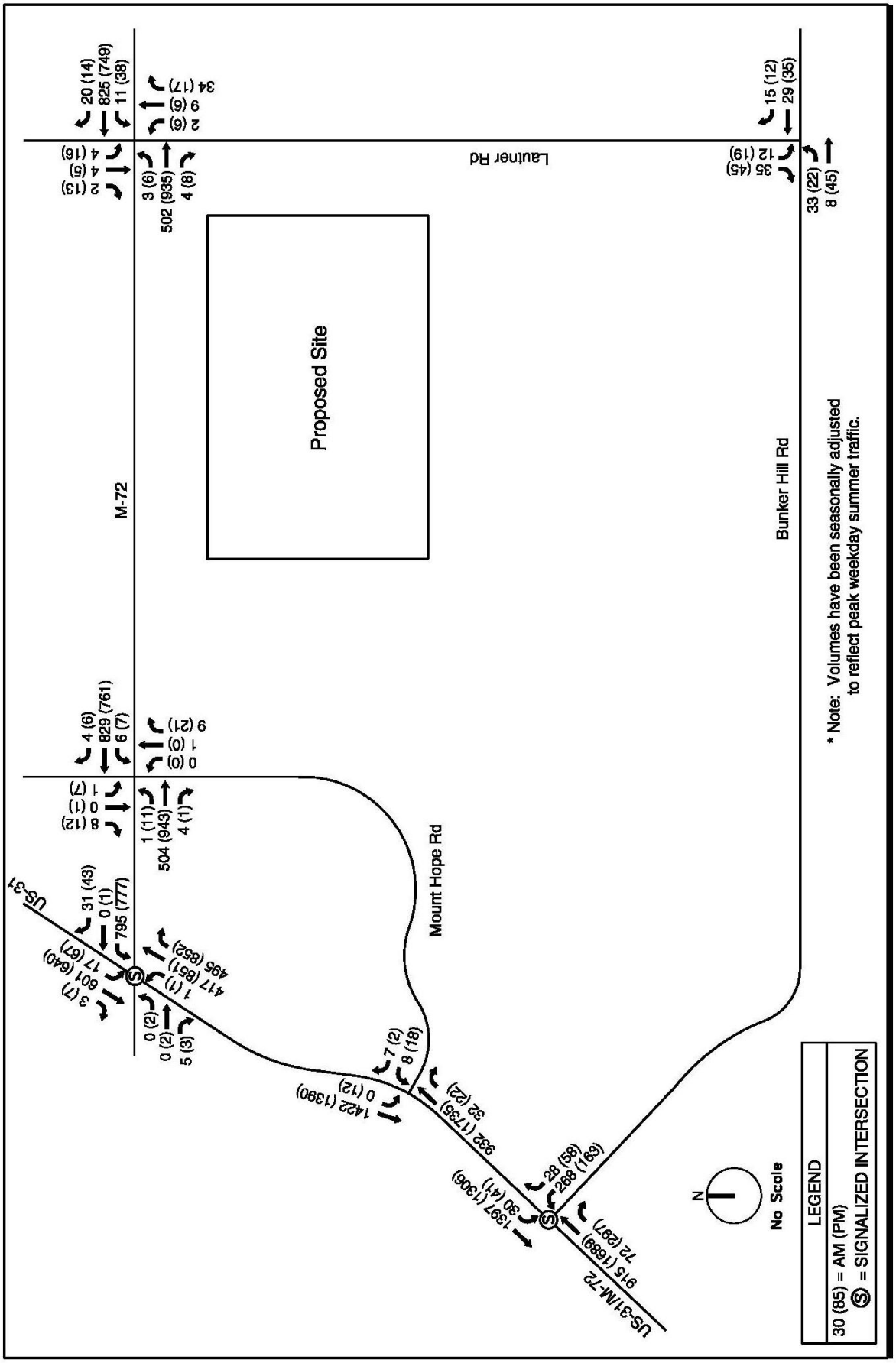
Mt. Hope Road

Mt. Hope Road is a minor two-lane collector facility that loops from M-72 southwesterly to US-31/M-72. Its cross section provides additional turn lanes at the intersections with M-72 and US-31. It is stop sign controlled at both intersections with those highways.

2012 TRAFFIC VOLUMES

Morning and afternoon peak-hour counts were completed in May 2010 from 7:00-9:00 AM and 4:00-6:00 PM at the six existing public street intersections. These counts indicated that the weekday morning peak hour generally occurs from 7:15-8:15 and the afternoon peak hour generally occurs from 4:30-5:30 PM. Copies of these counts are included in the appendix.

Based upon the typical seasonal variation of traffic volumes in an area like the Grand Traverse region, a factor that was developed by MDOT data bases was applied to the May traffic volumes to help depict existing worse-case summer traffic volume conditions. The input provided by MDOT resulted in the use of a 30 percent factor (May 2010 volumes x 1.30). In addition, a 0.7 percent annual growth factor was applied to these 2010 counts to provide the 2012 base data to which "existing" and subsequent analyses will be based. Figure 2 on the next page illustrates the expected 2012 seasonally-adjusted peak-hour volumes at the study area intersections.



2012 EXISTING / BACKGROUND PEAK-HOUR TRAFFIC VOLUMES *
VILLAGE AT GRAND TRAVERSE T.I.S.

* Note: Volumes have been seasonally adjusted to reflect peak weekday summer traffic.

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Figure 2

EVALUATION OF 2012 EXISTING/BACKGROUND CONDITIONS

Intersection "level of service" calculations were completed to evaluate the current operational efficiency of the study area intersections. These calculations were completed using techniques outlined in the 2000 Highway Capacity Manual by the Transportation Research Board.

Level of service (LOS) at signalized and unsignalized intersections relates to the delay, traffic volumes, and intersection geometry. Levels of service are expressed in a range from "A" to "F", with "A" denoting the highest or best operating conditions. Generally, a Level of Service "D" is considered the minimum acceptable service level for signalized and unsignalized intersections in suburban areas. This minimum level of acceptable operations was confirmed by the Township as part of pre-study correspondence. The criteria for determining the levels of service at signalized and unsignalized intersections are outlined in the appendix.

The adjusted 2012 morning and afternoon peak hours were analyzed at the study area intersections. The results of the level of service analyses are summarized in Table 1. Copies of the computer analyses are included in the appendix of this report.

The analyses indicate that most of the turning movements at the six existing intersections currently operate at a level of service D or better even during summer weekday peaks. The exceptions are:

- the westbound left-turn movement on Bunker Hill Road to southbound US-31, with levels of service of F and E during the morning and afternoon peak hours, respectively; and
- the northbound and southbound Lautner Road approaches to M-72 during the afternoon peak hour are calculated to experience an LoS of F.

These results indicate that, at the least, signal timing/operations adjustments may be needed at the US-31/Bunker Hill intersection in order to provide acceptable peak-hour operations for the side street. As for M-72/Lautner Road, on-site observations and simulations of these two low-volume approaches indicate the actual delays may not be as long as calculations indicate. In any case, improvements outlined in the next chapter will address these existing deficiencies.

Table 1

2012 Existing/Background[1] Peak-Hour Levels of Service

Intersection	Movement		AM Peak Hour[2] Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
US-31/M-72	Eastbound	left	-	-	37.3	D
(signalized)		thru/right	36.2	D	38.1	D
	Westbound	left	30.0	C	33.0	C
		thru/right	17.0	B	19.6	B
	Northbound	left	10.8	B	14.4	B
		through	13.3	B	18.7	B
		right	7.1	A	8.1	A
	Southbound	left	14.4	B	22.7	C
		thru/right	18.0	B	15.6	B
US-31/Bunker Hill Rd.	Westbound	left	165.6	F	64.9	E
(signalized)		right	24.2	C	29.8	C
	Northbound	thru/right	8.2	A	16.2	B
	Southbound	left	5.4	A	17.5	B
		through	11.0	B	8.0	A
M-72/Lautner Rd.	Eastbound	left/thru/rt.	0.1	A	0.3	A
(unsignalized)	Westbound	left/thru/rt.	0.4	A	1.8	A
	Northbound	left/thru/rt.	23.5	C	91.8	F
	Southbound	left/thru/rt.	48.6	E	195.7	F
Lautner Rd/Bunker Hill	Eastbound	left	6.0	A	2.5	A
(unsignalized)	Southbound	left/right	9.2	A	9.3	A
M-72/Mt Hope Rd	Eastbound	left	10.1	B	9.4	A
(unsignalized)	Westbound	left	8.8	A	10.3	B
	Northbound	left	0.0	A	0.0	A
		thru/right	11.2	B	12.5	B
	Southbound	left	19.7	C	18.6	C
		thru/right	12.9	B	11.9	B
US-31/Mt Hope Rd	Westbound	left	15.9	C	22.1	C
(unsignalized)		right	15.9	C	22.1	C
	Southbound	left	-	-	12.5	B

Notes: 1. Adjusted seasonal volumes and 0.7% annual background growth (2010 to 2012) used in calculations.
2. Delays/LoS denoted by "-" resulted from zero volume during peak hour.

Chapter 3
Future Phase 1 Conditions

The purpose of this chapter is to summarize the expected 2012 future traffic conditions within the study area with Phase 1 of the proposed Village at Grand Traverse development in place. This chapter also will outline roadway improvements that will be needed to accommodate Phase 1 project traffic during peak hours.

SITE ACCESS

Current plans propose to complete three driveways from the site to/from the adjacent public roadway system in Phase 1. Those include one full movement driveway onto Lautner Road ("Drive 5") and a right-in/right-out driveway to M-72 ("Drive 4"). These two access points are expected to be those primarily used by the proposed Phase 1 use. In addition, a third access point ("Drive 2") is expected/required to be developed in Phase 1 although it is not projected to be used much in this initial phase. The initial distribution and analyses shown in this chapter for this Drive 2 intersection assumes a full movement drive, but subsequent mitigated analyses define/recommend that this driveway function as a right-in/right-out only.

These proposed driveways easily meet current MDOT driveway spacing standards based upon its current 55 mile-per-hour speed limit and potential signalization at Lautner Road. The proposed access points also meet the guidelines outlined in the 2001 M-72 Access Management Plan.

PHASE 1 PROJECT TRIP GENERATION

Trip Generation, Eighth Edition, by the Institute of Transportation Engineers was used to calculate the projected traffic based on the proposed project components. The proposed project is expected to generate approximately 203 new weekday morning peak-hour trips and approximately 559 new afternoon peak-hour vehicle trips onto the study area roadway system. It should be noted that trips are measured individually for inbound and outbound movements. Therefore, a visit to the site by a patron generates two trips, one inbound and one outbound.

Per discussions with the review agencies, pass-by trips and diverted-linked trips were also taken into account that add up to the overall projected traffic volumes at the site access points. Pass-by trips are those drawn from the adjacent roadway's traffic streams (M-72 in this case, Lautner volumes too low) that stop into the site on their way to/from another origin or destination. Diverted-linked trips are much like pass-by trips as they are drawn from existing traffic volumes, but from nearby roadways. In this case the diverted-linked trips were drawn from the US-31 corridor and use other public roadways to get to/from the site access points.

Table 2 summarizes the vehicle trip generation analyses based upon the proposed uses.

Table 2
Phase 1 Peak-Hour Trip Generation

Land Use	ITE Code	Size	AM Peak		PM Peak	
			In	Out	In	Out
Meijer store	813	192,000 s.f.	180	141	434	451
less diverted linked trips[(2)]			27	27	75	75
Net new Trips:			**121**	**82**	**271**	**288**

Notes: 1. 20% pass-by trip percentage used per review agency discussions (compared to ITE average of 28%).
2. 17% diverted-linked trip percentage used per review agency discussions.

PHASE 1 PROJECT TRIP DISTRIBUTION

The directional distribution of the project-generated new trips was based upon the expected market area of the proposed retail use and current traffic patterns. The expected directional distribution to/from the proposed development for new trips is expected to be approximately as follows:

- North: 30% (25% on US-31, 5% on Lautner Rd./other)
- Southwest: 40% (to/from US-31 - 30% via M-72, 10% via Bunker Hill Rd.)
- East: 27%
- South (local): 3%

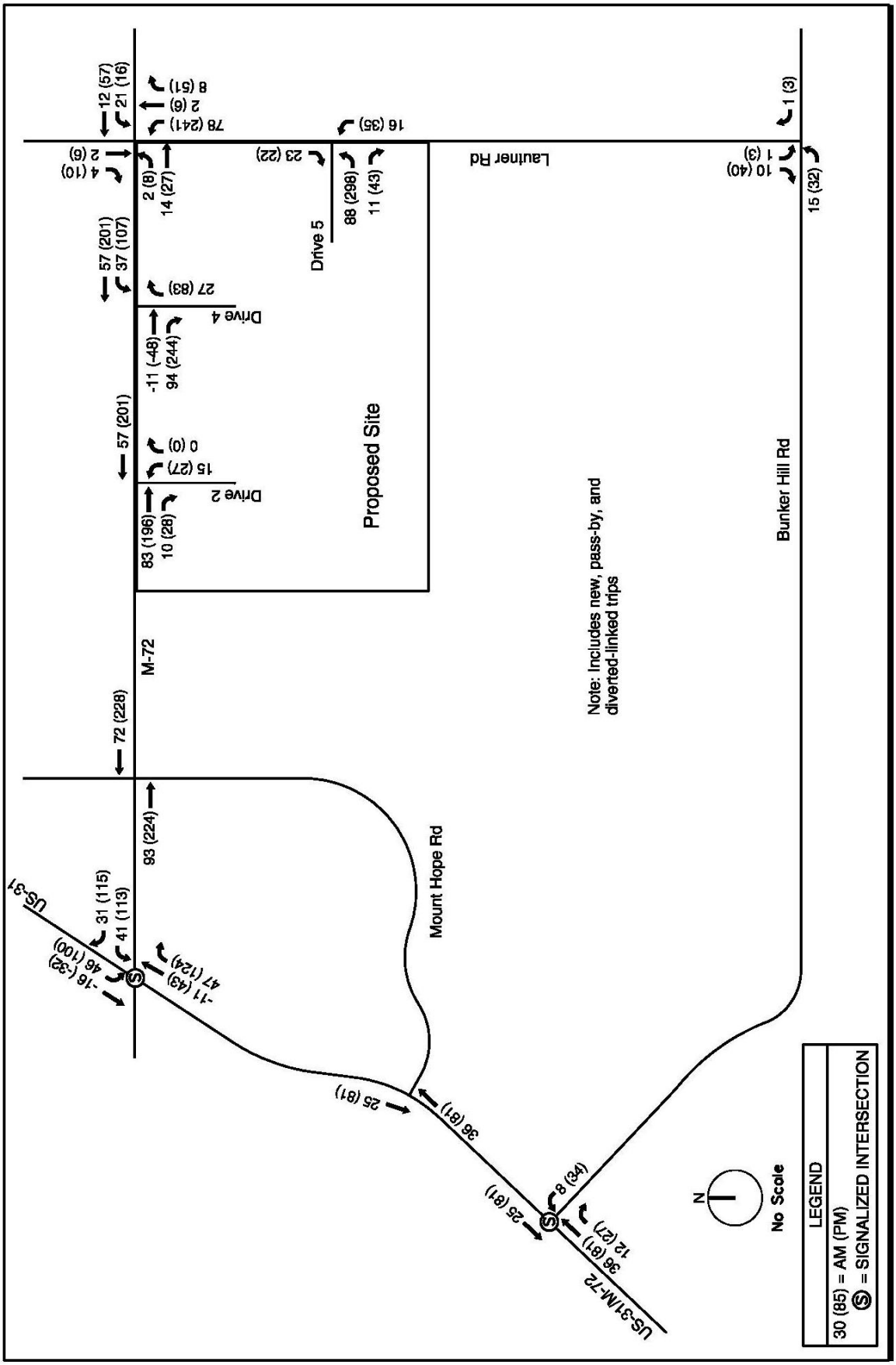
100%

Based upon the above new trips distribution pattern, expected distribution of pass-by and diverted link trips, and the current site plan layout, the forecast peak-hour project traffic was assigned to the proposed site access points and the existing adjacent roadway system. As is standard practice, pass-by and diverted link trip distributions are based upon current traffic patterns on the applicable roadway (Lautner Road for pass-by trips and US-31 for diverted link trips), so those distributions will not typically match the new trips/market area distribution percentages. Figure 3 shows the initial expected trip assignment of all site-generated traffic (new, pass-by, and diverted-linked trips combined) without either of the two M-72 improvement alternatives in place. Note that site driveway "names" are based upon full buildout with numbering from west to east – Drives 1, 3, and 6 will not be developed until Phase 2.

EVALUATION OF 2012 PHASE 1 FUTURE CONDITIONS

The forecast Phase 1 project trips were added to the expected 2012 base peak-hour volumes to depict the estimated total future 2012 Phase 1 volumes during the two peak periods. These total volumes are illustrated in Figure 4.

Level of service analyses were completed for the study area intersections and proposed driveway intersections for these projected pre-mitigation future conditions. The results of those analyses are shown in Table 3. Copies of the computer analyses are included in the appendix of this report.



PROJECTED PHASE 1 TOTAL TRIP DISTRIBUTION
VILLAGE AT GRAND TRAVERSE T.I.S.

Figure 3

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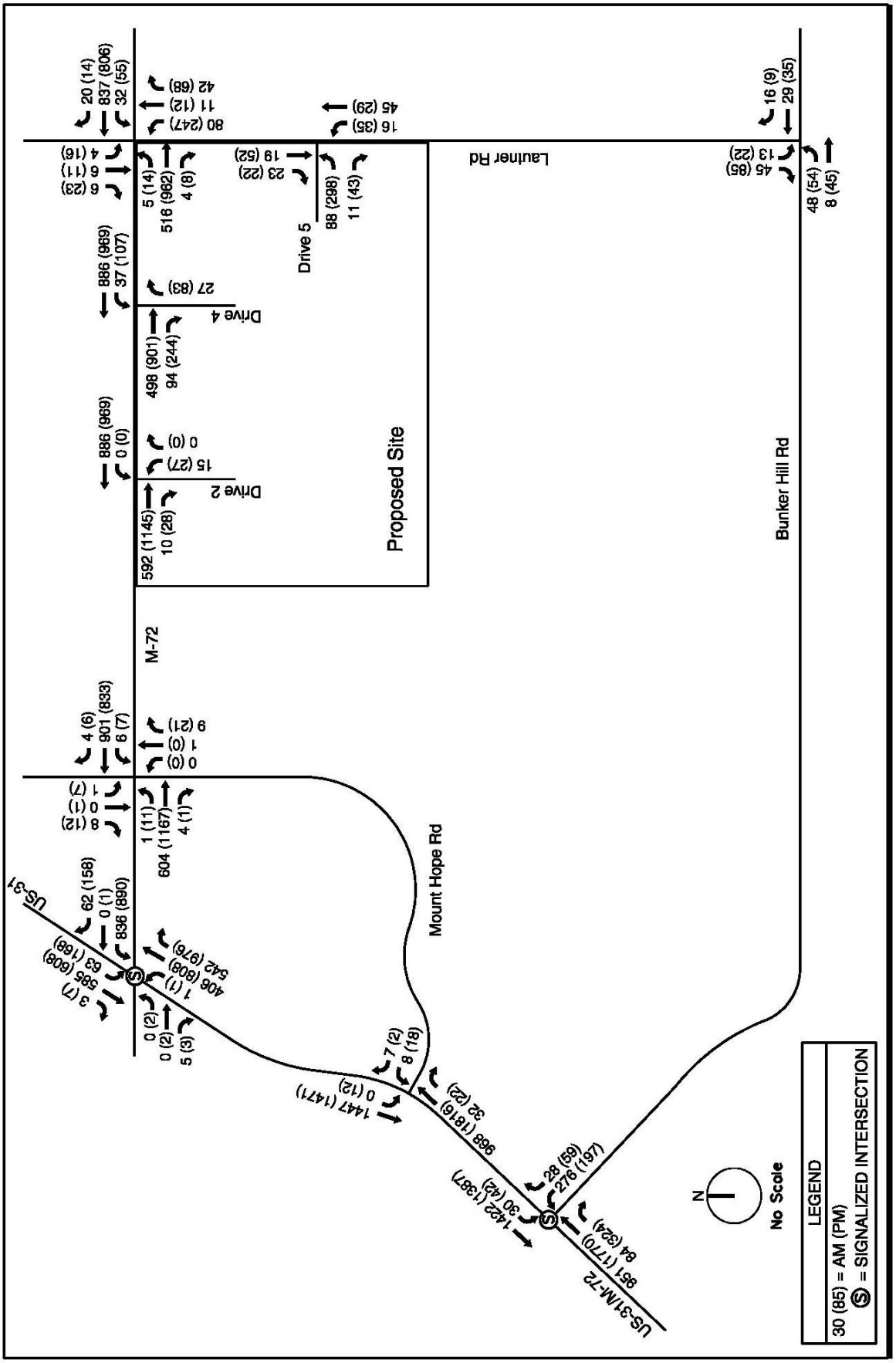

Figure 4

PROJECTED 2012/PHASE 1 PEAK-HOUR TRAFFIC VOLUMES
VILLAGE AT GRAND TRAVERSE T.I.S.

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Table 3
2012 Phase 1 Peak-Hour Levels of Service (no improvements)

Intersection	Movement		AM Peak Hour[1] Delay	AM Peak Hour[1] LoS	PM Peak Hour Delay	PM Peak Hour LoS
US-31/M-72	Eastbound	left	-	-	37.3	D
(signalized)		thru/right	36.2	D	37.8	D
	Westbound	left	32.3	C	47.3	D
		thru/right	17.0	B	19.9	B
	Northbound	left	10.9	B	14.5	B
		through	13.4	B	18.9	B
		right	12.4	B	24.1	C
	Southbound	left	16.5	B	79.4	E
		thru/right	18.1	B	15.6	B
US-31/Bunker Hill Rd.	Westbound	left	180.9	F	103.6	F
(signalized)		right	24.2	C	30.0	C
	Northbound	thru/right	8.5	A	22.2	C
	Southbound	left	5.6	A	16.9	B
		through	11.1	B	9.1	A
M-72/Lautner Rd. [2]	Eastbound	left	10.0	A	9.7	A
(unsignalized)	Westbound	left	9.0	A	11.2	B
	Northbound	left	33.2	D	526.8	F
		thru/right	15.7	C	28.8	D
	Southbound	left	22.1	C	70.6	F
		thru/right	18.5	C	21.7	C
Lautner Rd/Bunker Hill	Eastbound	left	6.4	A	4.3	A
(unsignalized)	Southbound	left/right	9.4	A	9.7	A
M-72/Mt Hope Rd	Eastbound	left	10.5	B	9.7	A
(unsignalized)	Westbound	left	9.2	A	11.5	B
	Northbound	left	0.0	A	0.0	A
		thru/right	11.8	B	14.1	B
	Southbound	left	21.7	C	21.0	C
		thru/right	12.5	B	12.6	B
US-31/Mt Hope Rd	Westbound	left	16.1	C	23.2	C
(unsignalized)		right	16.1	C	23.2	C
	Southbound	left	-	-	13.0	B
M-72/Drive 2	Westbound	left	-	-	-	-
(unsignalized)	Northbound	left	52.0	F[3]	339.9	F[3]
		Right	-	-	-	-
M-72/Drive 4	Westbound	left	9.1	A	13.5	B
(unsignalized)	Northbound	right	12.2	B	22.9	C
Lautner Rd/Drive 5	Eastbound	left	9.4	A	12.0	B
(unsignalized)		right	9.4	A	12.0	B
	Northbound	left	7.3	A	7.4	A

Notes:
1. Delays/LoS denoted by "-"resulted from zero volume during peak hour.
2. As test, these analyses included separate left-turn lanes on all four approaches.
3. Projected left-turn volumes are only 15 and 27 vehicles for the morning and afternoon peak hours. – subsequent M-72 mitigation measures analyses include constructing this drive as right-in/right-out only.

It should be noted that new separate left-turn lanes were assumed as an underlying improvement for all four approaches at the M-72/Lautner Road intersection. However, as discussed later, these left-turn lanes used for this initial analysis will not be needed as part of either of the two defined cross section alternatives. It also should be noted that the above results (and subsequent analyses) take into account revised truck percentages, specifically at the US-31/M-72 intersection. Four of the percents were revised during the PM peak hour analyses (none in the AM analysis). Two of those four currently experience very low volumes (eastbound through/right and northbound left). The northbound left traffic count of one vehicle happened to be a truck, so the factor used in the earlier background analyses was a 100% heavy vehicle movement – not very realistic under average conditions. Those factors were adjusted down in the these analyses to reflect closer to normal conditions, but still use extremely high percentages (25% and 50% respectively).

The other two movements were adjusted to reflect the type of traffic that would be generated by the proposed Phase 1 use during peak hours. For example, the current southbound left turn volume during the PM peak hour is approximately 68 vehicles, with approximately 8% trucks counted that day. Phase 1 is expected to add approximately 100 vehicles to that movement, with only 2% of those expected to be trucks during the PM peak hour. Combining those provided the 4% used for this movement in these Phase 1 analyses.

As shown, the analyses indicate that the addition of Phase 1 project generated traffic is expected to contribute to or create delays and/or a deficient volume-to-capacity ratio for one or more movements at several of the existing study area intersections as follows:

- US-31/M-72 – southbound left-turn movement, LoS E/F during the afternoon peak
- M-72/Lautner Road – northbound and southbound lefts, LoS F's during afternoon peak
- US-31/Bunker Hill Road – northbound through movement v/c over 0.99.

The current LoS of F at the westbound left-turn at the US-31/Bunker Hill Road intersection will be exacerbated by the addition of project traffic as indicated by the projected longer delays.

DISCUSSION - POTENTIAL 2012 PHASE 1 ROADWAY IMPROVEMENTS

Although identifying mitigation measures for Phase 1 impacts was not initially required for the impact study per pre-study discussions, iterative tests of potential mitigation measures were completed in case such information would be helpful during site plan review deliberations. For the M-72/Lautner intersection area, the aforementioned boulevard and roundabout alternatives were analyzed to define the extent of the improvements needed to meet traffic demands and encompass longer term corridor goals.

In addition to the M-72/Lautner area alternatives, the following improvements would bring the movements at the study area intersections back to within the minimum LoS D level (or better) defined by the township and address existing deficiencies.

1. **US-31/M-72**: Revise/adjust signal operations to provide a short southbound permissive/protected left-turn phase (by MDOT/others).

2. **US-31/Bunker Hill**: Construct a separate northbound right-turn deceleration lane on US-31 and revise/adjust signal operations (by MDOT/others).

3. **Lautner Road/Drive 5**: Construct a northbound center left-turn lane (or passing flare) and a southbound right-turn lane.

Conceptual sketches of the recommended M-72/Lautner area roadway improvements (two alternatives) are included in the appendix of this report.

TRIP RE-DISTRIBUTION

The Phase 1 site-generated traffic was redistributed to the adjacent roadway network based upon the two M-72 alternatives. Figures 5 and 6 illustrate the overall trip distributions for the boulevard and roundabout alternatives, respectively. Individual graphics identifying new, pass-by, and diverted link assignments are included in the appendix.

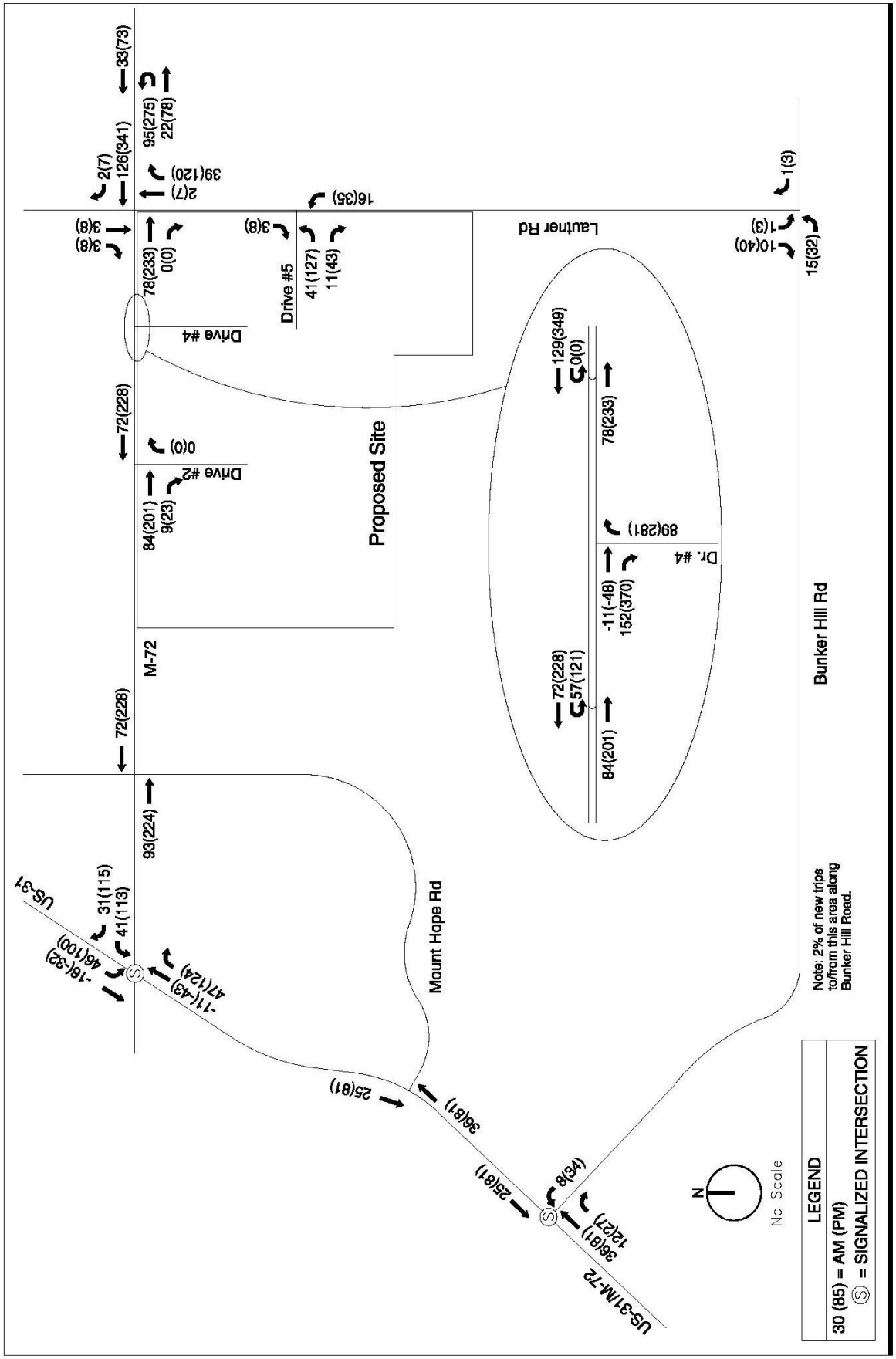
It should be noted that the closer proximity of Drive 4 (and the main parking area) to the M-72/Lautner intersection and ability to complete a eastbound-to-westbound "u-turn" under either alternative is expected to reduce the use of Drive 5 in comparison to earlier analyses. Also note that there are no outbound (northbound) left turns expected at the M-72/Drive 2 intersection with the M-72 improvements in place.

The forecast project traffic was added to the 2010 base year volumes to define expected total 2012 Phase 1 peak-hour traffic. The total volumes for the boulevard and roundabout alternatives are shown on Figures 7 and 8, respectively.

EVALUATION OF 2012 PHASE 1 FUTURE CONDITIONS – WITH IMPROVEMENTS

New level of service analyses were completed for the study area intersections and proposed driveway intersections for these projected future conditions. The results of those analyses are shown in Table 4. Copies of the computer analyses are included in the appendix of this report.

These future conditions analyses take into account consistent peak hour factors as discussed with review staff. As discussed, peak-hour factors (PHF's) at site driveways and M-72 crossovers use the factors derived from the nearest counted intersection as is standard practice. For instance, the M-72 through and turn movements at proposed site driveways on M-72 for the PM peak hour are based upon the factors derived from the M-72/Lautner data (PHF of 0.89 eastbound, PHF of 0.95 westbound). Given that the westbound PHF of 0.95 is very high and not deemed as sustainable it was arbitrarily reduced it to 0.92 for the future conditions to reflect more conservative (slightly worse) conditions. On Lautner Road the current volumes are currently very low and that is in part reflected by the very low PHF's – even small variations in volume per 15 minutes can create large shifts in PHF's. As a largely commercial site develops, peak hour factors tend to increase to reflect typical steadier flows (as opposed to sharper peaking characteristics of, say, office or industrial uses), especially on low volume streets. We therefore used a 0.92 PHF at Lautner Road driveway intersections such as at Drive 5.



PROJECTED PHASE 1 TOTAL TRIP DISTRIBUTION - BOULEVARD ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

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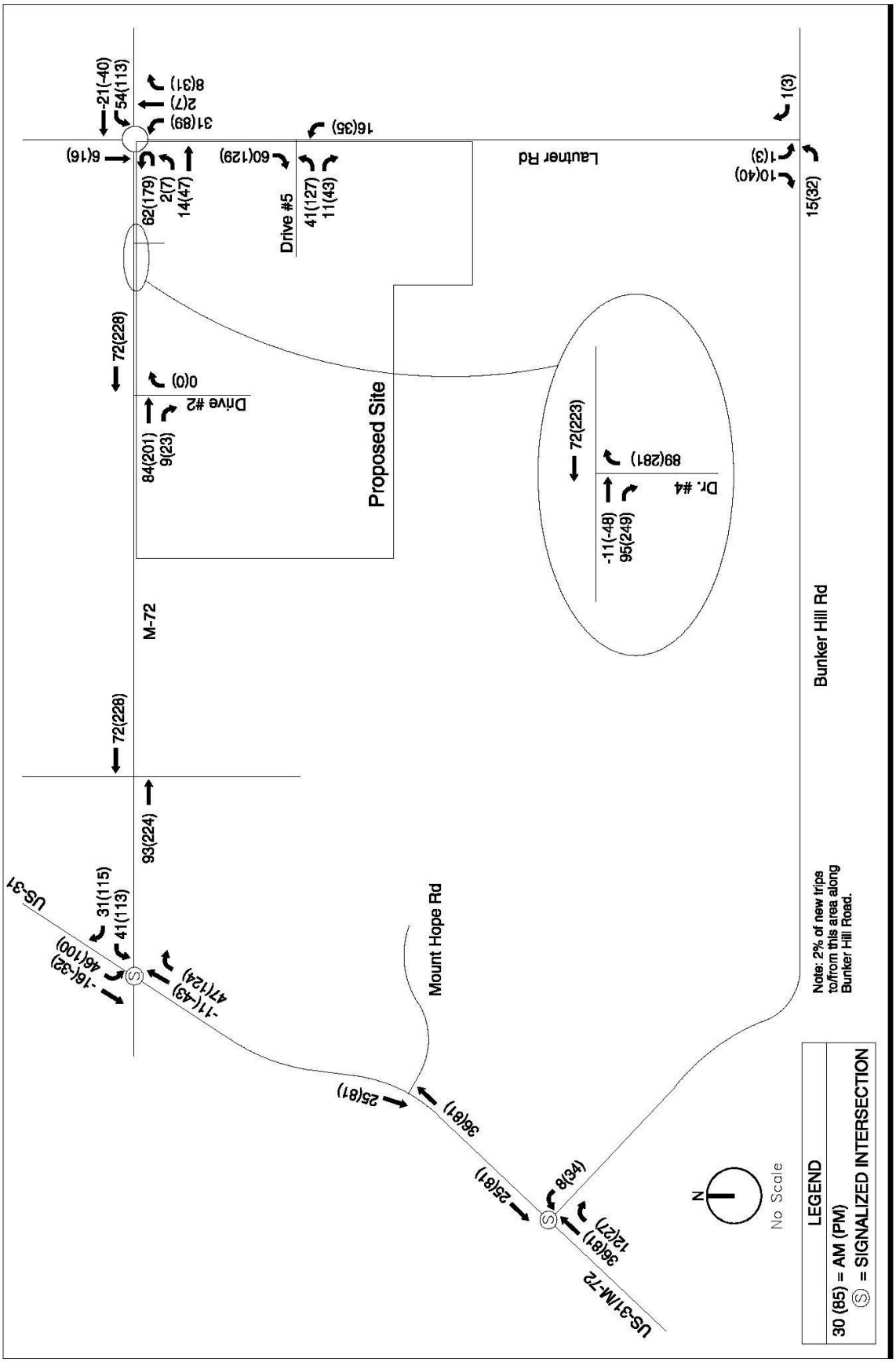
Figure 5



PROJECTED PHASE 1 TOTAL TRIP DISTRIBUTION - ROUNDABOUT ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

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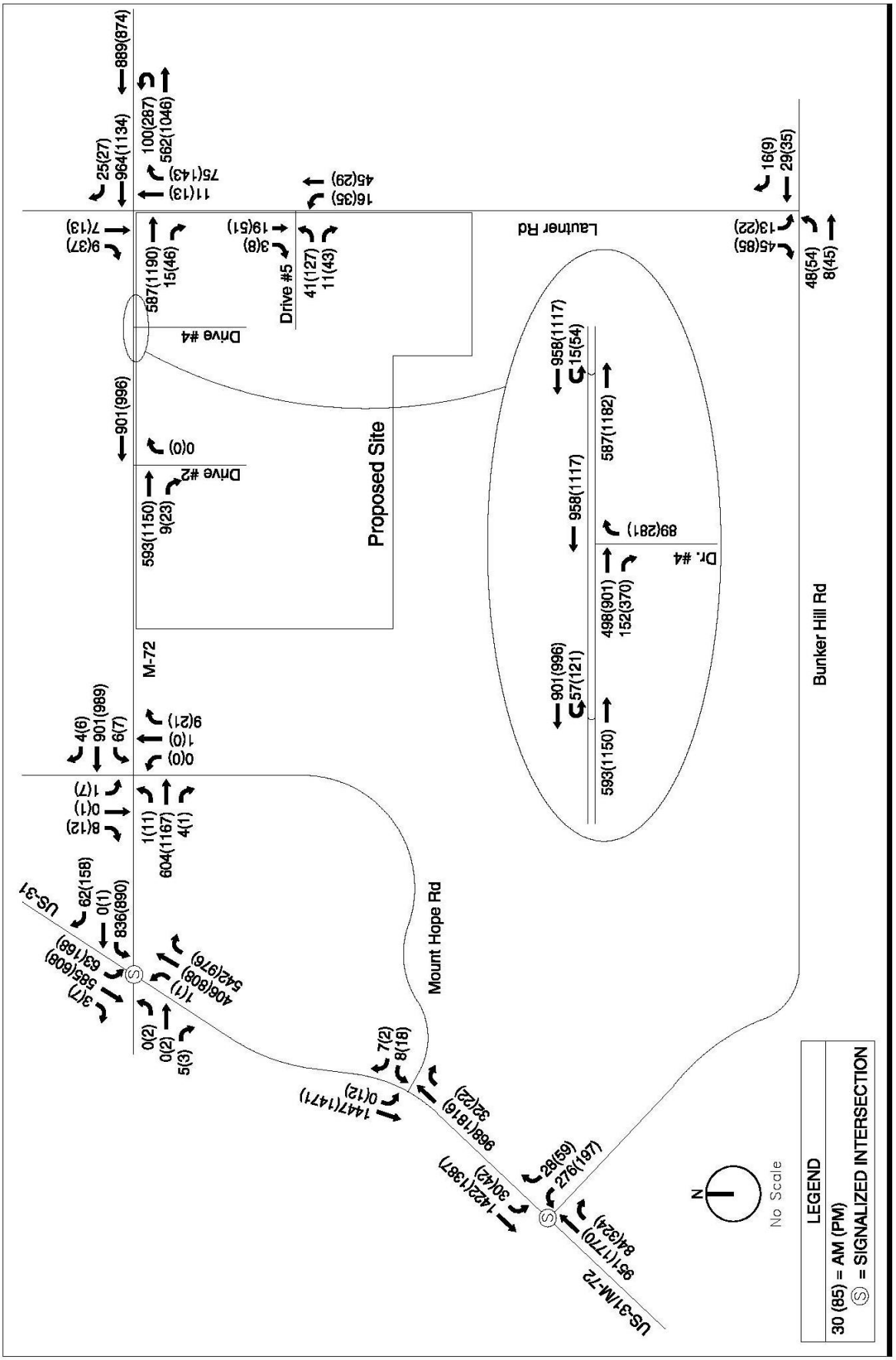
Figure 6



TOTAL PROJECTED 2012 PHASE 1 PEAK-HOUR VOLUMES - BOULEVARD ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

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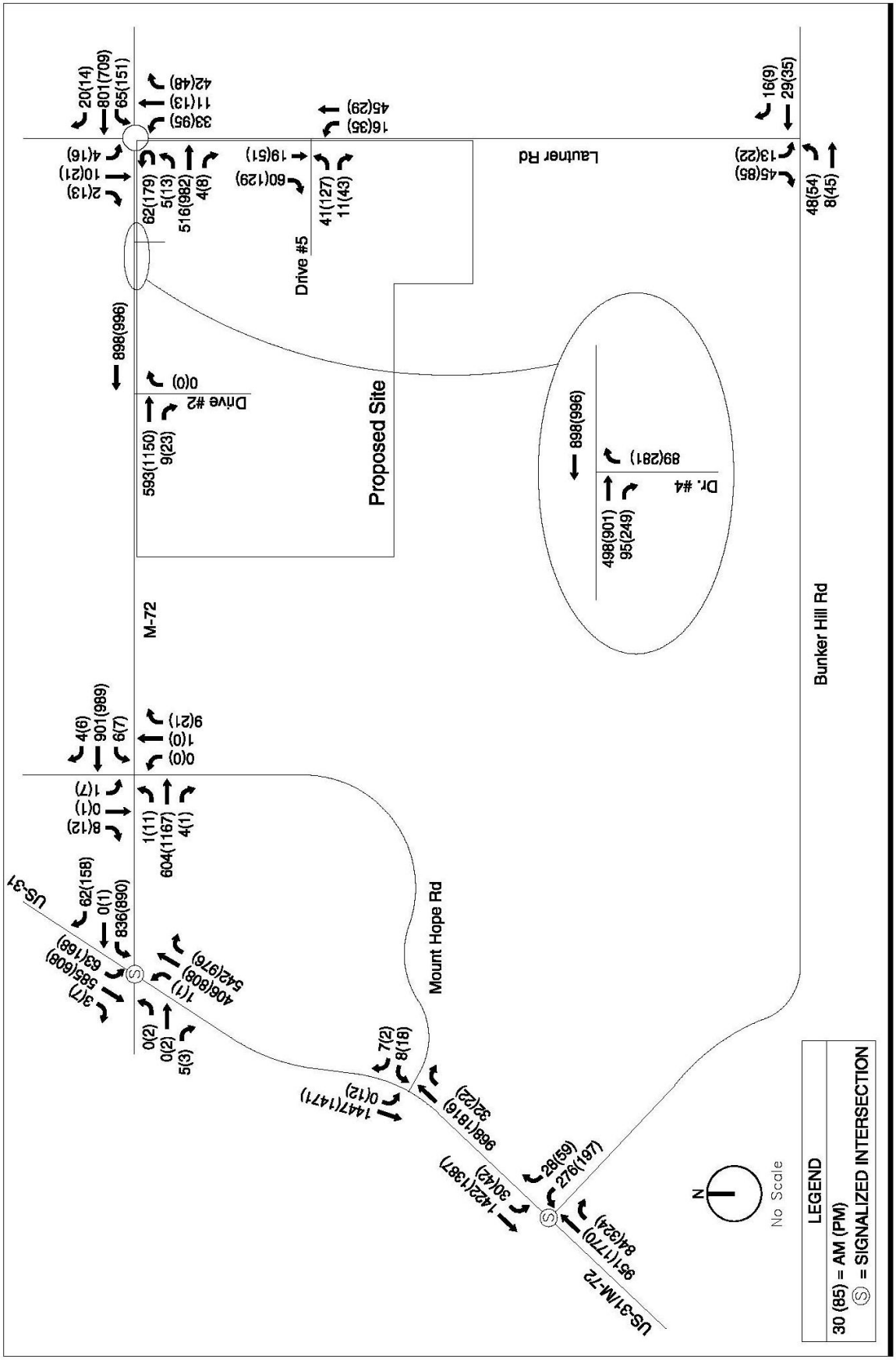
Figure 7



TOTAL PROJECTED 2012/PHASE 1 PEAK-HOUR VOLUMES - ROUNDABOUT ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

Figure 8

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Table 4

2012 Phase 1 Peak-Hour Levels of Service (with improvements[1])

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
US-31/M-72	Eastbound	left	-	-	40.0	D
(signalized)		thru/right	38.7	D	40.4	D
	Westbound	left	36.4	D	43.9	D
		thru/right	18.5	B	20.8	B
	Northbound	left	20.9	C	19.6	C
		through	25.9	C	33.7	C
		right	8.6	A	21.5	C
	Southbound	left	16.9	B	42.8	D
		thru/right	17.8	B	15.9	B
US-31/Bunker Hill Rd.	Westbound	left	54.5	D	52.2	D
(signalized)		right	19.6	B	26.8	C
	Northbound	thru	11.9	B	14.2	B
		right	7.5	A	5.6	A
	Southbound	left	10.0	B	21.5	C
		through	17.7	B	9.6	A
M-72/Lautner Rd.						
Blvd. (unsignalized)	Northbound	thru/right	11.7	B	21.9	C
	Southbound	thru/right	16.9	C	18.6	C
Roundabout[2]	overall intersection		2.7	A	3.9	A
Blvd intersections:						
EB M-72/west Lautner x-over	Southbound left		10.8	B	15.7	C
WB M-72/east Lautner x-over	Northbound left		13.9	B	21.9	C
EB M-72/x-over west of Dr. 4	Southbound left		11.3	B	18.1	C
EB M-72/Drive 4	Northbound right		10.8	B	21.9	C
Lautner Road/Drive 5	Eastbound left, right		9.1	A	10.0	A
	Northbound left		1.9	A	4.0	A

Notes: 1. Results are the same within study area for the two alternatives except for the M-72/Lautner intersection and immediate M-72 area.

2. Per discussions, assumed Phase 2 level of design for Phase 1, 85% confidence result shown.

Recommended Turn Lane Storage

Recommended turn lane storage lengths were identified for 2012 Phase 1 conditions for the key mitigated intersections and/or movements based upon the above analyses and related Synchro output regarding 95% queue needs. Table 5 on the next page summarizes those storage lengths (rounded up to nearest 10 feet) that will provide adequate storage for the higher/worst peak hour (AM or PM).

Table 5

Recommended Phase 1 Turn Lane Length
Key/Improved Intersection Movements

Intersection	Movement		Minimum Lane Length[1]
US-31/M-72	Westbound	left/thru-right	540/280
	Northbound	right	180
	Southbound	left	260
US-31/Bunker Hill Rd.	Westbound	left/right	240/70
	Northbound	right	80
WB M-72/Lautner Rd. (unsignalized/blvd.)	Southbound	thru/right	40/50
EB M-72/Lautner Rd. (unsignalized/blvd.)	Northbound	thru/right	40/140
EB M-72/Drive 4	Northbound	right	160
Lautner/Drive 5	Eastbound	left/right	60/40
	Northbound	left	20
EB M-72/Drive 4 West crossover	Southbound	left	80
EB M-72/Lautner West crossover	Southbound	left	60
WB M-72/Lautner East crossover	Northbound	left	90

Note: 1. Lengths rounded up to nearest 10 feet.

Chapter 4
Future Phase 2 Conditions

The purpose of this chapter is to summarize the expected future traffic conditions within the study area with Phase 2 of the proposed Village at Grand Traverse development in place. For this study, Phase 2 is essentially the remainder of the overall development and includes a wide variety of land uses. Per pre-study and subsequent discussions, this Phase 2 set of analyses uses the 2012 base conditions (plus Phase 1 traffic) to help differentiate VGT impacts from other long-term development's impacts.

This chapter also will outline roadway improvements that will be needed to accommodate both Phase 1 and Phase 2 project traffic during peak hours. The improvements along the M-72 corridor within the study area will again focus on the two cross section alternatives identified by the review agencies; a 30-foot boulevard cross section with indirect lefts (with "loons" for larger vehicle turns), and a roundabout alternative that would include a narrow median between major intersections.

Currently proposed Phase 2 uses include:

- 765,500 square feet of retail/commercial
- 250 room hotel
- 90 single-family homes
- 430 multi-family units
- 228 mixed use residential units
- 146 townhouse/row house units
- 150 senior housing units
- 40,000 square feet civic use
- 28,000 square feet clubhouse/recreational use

SITE ACCESS

Current plans propose to construct two additional restricted driveways onto M-72 and one additional full-movement driveway to Lautner Road. As with Drive 4 noted in the last chapter, the two additional Phase 2 driveways to M-72 will operate as right-in/right-out driveways. Overall, spacing between the proposed site driveways along M-72 will vary from approximately 750-800 feet, so will easily meet MDOT and township access criteria.

PHASE 2 PROJECT TRIP GENERATION

Trip Generation, Eighth Edition, by the Institute of Transportation Engineers was used to calculate the projected traffic based on the proposed Phase 2 project components. The currently proposed components are expected to generate approximately 1,023 new weekday morning peak-hour trips and approximately 2,271 new afternoon peak-hour vehicle trips onto the study area roadway system. As noted previously, trips are measured individually for inbound and outbound movements. Therefore, a visit to the site by a patron generates two trips, one inbound and one outbound.

Per discussions with the review agencies, pass-by trips and diverted-linked trips were also taken into account that add up to the overall projected traffic volumes at the site access points. Pass-by trips are those drawn from the adjacent roadway's traffic streams (M-72 in this case) that stop into the site on their way to/from another origin or destination. Diverted-linked trips are much like pass-by trips as they are drawn from existing traffic volumes, but from nearby roadways. In this case the diverted-linked trips were drawn from the US-31 corridor and use other public roadways to get to the site access points. Internal captured trips are those that occur between uses within the overall development so do not utilize the external public road system. An example may be a homeowner living on the west end of the site driving to one of the commercial entities on the east end of the site.

Table 6 summarizes the vehicle trip generation analyses based upon the proposed uses.

Table 6
Phase 2 Peak-Hour Trip Generation

Land Use	ITE Code	Size	AM Peak		PM Peak	
			In	Out	In	Out
Retail/comm	820	765,500 s.f.	312	200	1,219	1,268
Hotel	310	250 rooms	96	69	78	82
Single-family residential	210	90 homes	21	62	65	39
Multi-family residential	220	430 units	43	175	177	95
Mixed-use residential	220	228 units	24	96	104	56
Townhouse/row house res.	230	146 units	14	65	62	30
Senior housing	252	150 units	4	5	9	8
Civic use	733	40,000 s.f.	78	10	35	79
Clubhouse/recreational	495	28,000 s.f.	27	18	23	40
		Total trips:	**619**	**700**	**1,772**	**1,697**
less internal capture trips (8%):			50	56	142	136
		Total external trips:	**569**	**644**	**1,630**	**1,561**
less pass-by trips[1]:			51	51	249	249
less diverted linked trips[2]			44	44	211	211
		Net New Trips:	**474**	**549**	**1,170**	**1,101**

Notes:
1. 20% pass-by trip percentage applied to retail/commercial uses per review agency discussions (compared to ITE average of 28%).
2. 17% diverted-linked trip percentage applied to retail/comm. per review agency discussions.

PHASE 2 PROJECT TRIP DISTRIBUTION

The trip distribution for the Phase 2 new trips is expected to be largely the same as that used for Phase 1. The only exception is an expected slight shift of traffic from US-31 to/from the north to parallel north routes such as Lautner Road (combined with other roads) – a conservative 3% shift was utilized. Expected distribution of pass-by and diverted link trips are based upon current travel patterns in the area and peak-hour volume splits.

Based upon the projected distribution patterns and the general site plan layout, the forecast peak-hour project traffic was assigned to the proposed site access points, adjacent roadway system, and key internal intersections. In regards to the roadways immediately adjacent to the site, the distribution/assignment of project traffic was completed for each of the required boulevard and roundabout alternatives for the M-72 corridor. Figures 9 and 10 show the expected trip assignment of site-generated traffic (new, pass-by, and diverted-linked trips combined) for those two alternatives, respectively. Separate illustrations of the trip assignments for each of those three trip types are included in the appendix.

EVALUATION OF 2012 PHASE 2 FUTURE CONDITIONS

Given the amount of traffic that would be generated by proposed Phase 2 uses, an expanded version of the two M-72 cross section alternatives was assumed for the initial Phase 2 analyses. For this initial analysis the cross sections were expanded across the entire frontage of the site to incorporate all site driveways to M-72. The analyses also assume a channelized eastbound right turn lane into each drive, and dual northbound right-turn lanes on Lautner Road at eastbound M-72. Improvement measures for non-adjacent locations are discussed in a subsequent section.

The forecast Phase 2 project trips were added to the expected 2012 base year and Phase 1 peak-hour volumes to depict the estimated total future 2012 Phase 2 volumes during the two peak periods. These total volumes are illustrated in Figures 11 and 12 for the boulevard and roundabout alternatives, respectively.

New level of service analyses were completed for the study area intersections and proposed driveway intersections for these projected future conditions. The analyses assume the Phase 1 "mitigation" measures are in place, along with turn lanes that would be required at the site driveways. The results of those analyses are shown in Table 7 for the improved intersections and access points adjacent to the site, and in Table 8 for the "non-adjacent" intersections within the study area. Copies of the computer analyses are included in the appendix of this report.

As shown in Table 7, the analyses indicate that both of the roadway cross section alternatives will function well for the intersections adjacent to the intersection (preliminary sketches of the two alternatives are included in the appendix). One potential exception is the Lautner Road/Drive 5 intersection during the afternoon peak hour as indicated by the Delay of 35.4 seconds and LoS E. Given the very low volumes projected for the through movements on Lautner Road, this intersection was analyzed as unsignalized. With those low volumes and the borderline LoS E results (almost LoS – 35 seconds is threshold), it does not appear applicable to analyze this intersection as signalized (as no signal warrants would be met).

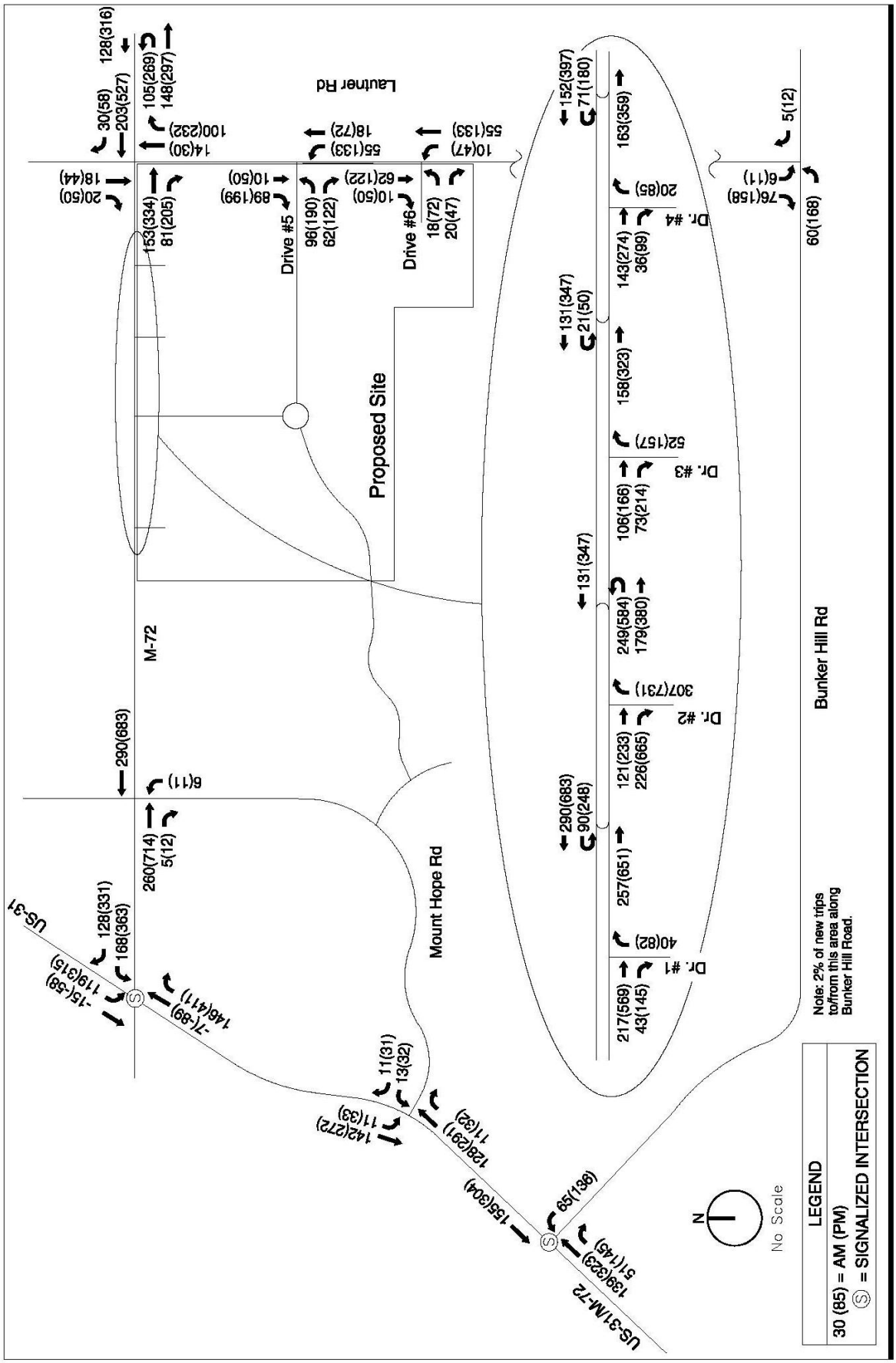

Figure 9

PROJECTED PHASE 2 TOTAL TRIP DISTRIBUTION - BLVD ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

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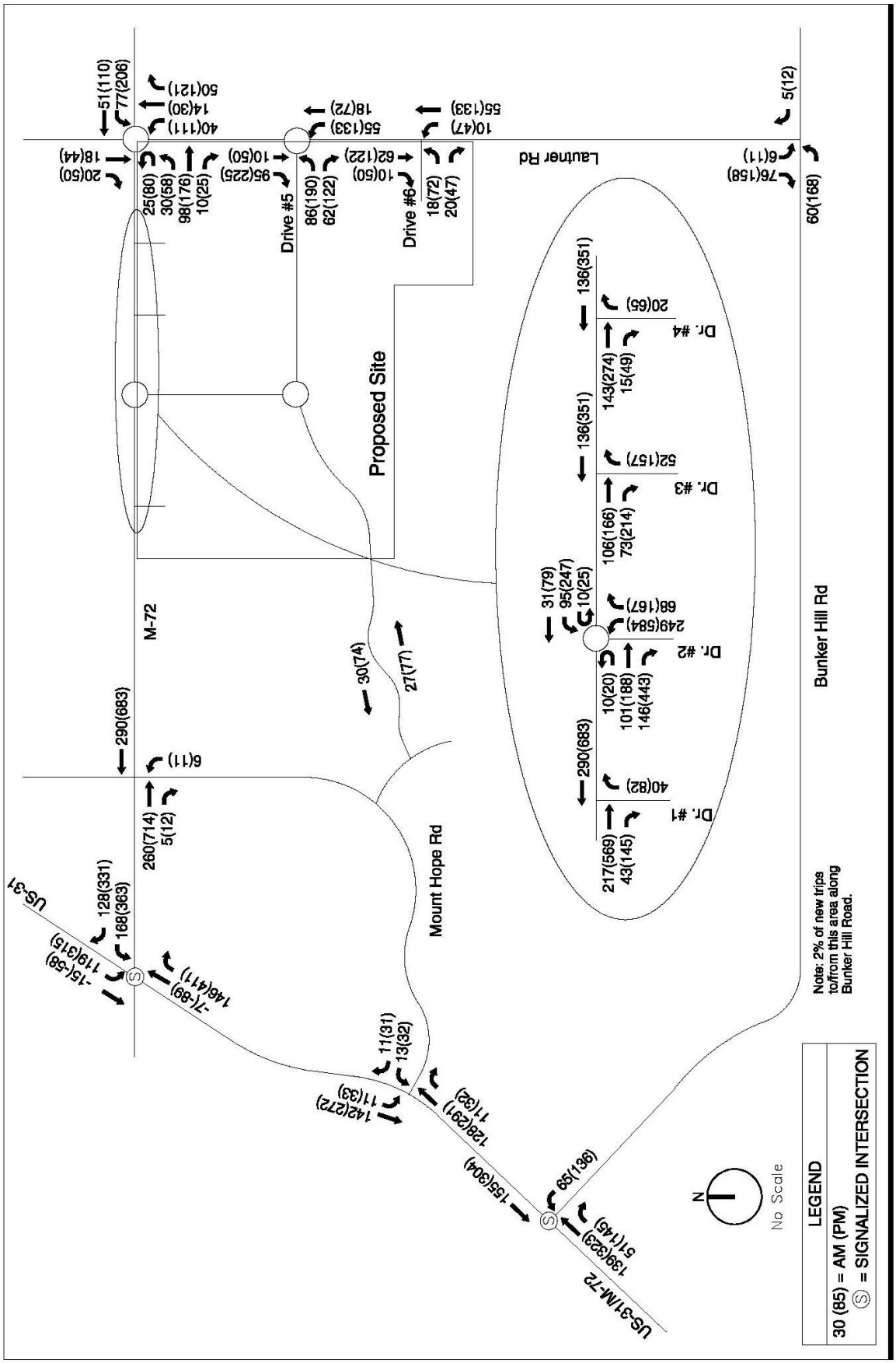

PROJECTED PHASE 2 TOTAL TRIP DISTRIBUTION - ROUNDABOUT ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

Figure 10

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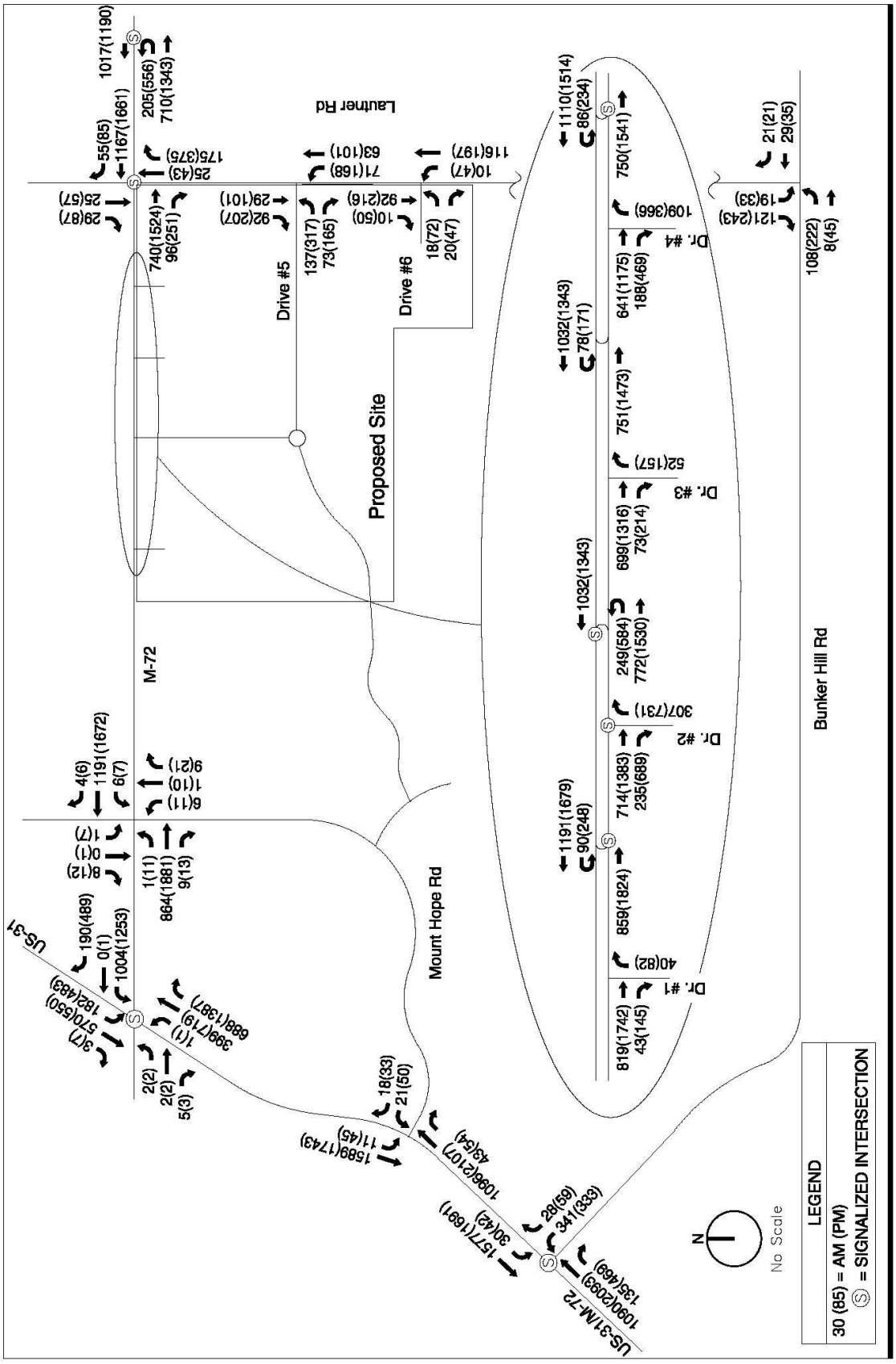

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TOTAL PROJECTED 2012/PHASE 2 PEAK HOUR VOLUMES (W/ PROJECT BUILDOUT) - BLVD ALTERNATIVE

VILLAGE AT GRAND TRAVERSE T.I.S.

Figure 11

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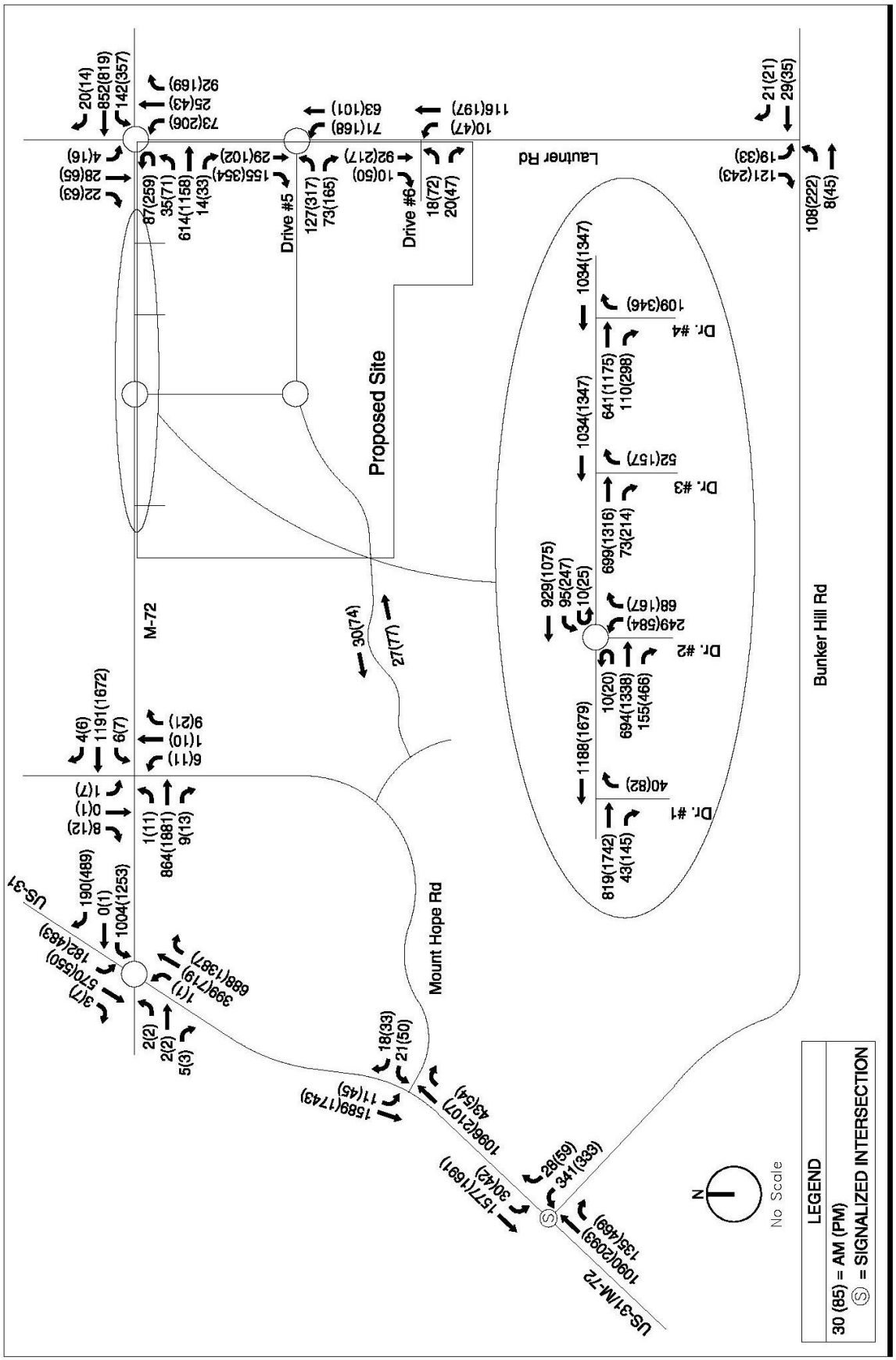

Figure 12

TOTAL PROJECTED 2012 PHASE2 PEAK-HOUR VOLUMES (W/ PROJECT BUILDOUT) - ROUNDABOUT ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

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Table 7a

Phase 2 Peak-Hour Levels of Service – Adjacent Intersections[1, 2]

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
Boulevard Alternative:						
EB M-72/Lautner Rd.	Eastbound	through	4.8	A	14.0	B
(signalized)		right	3.7	A	6.6	A
	Northbound	through	32.3	C	27.1	C
		right	31.8	C	41.5	D
	Southbound	through	0.2	A	0.2	A
WB M-72/Lautner Rd.	Westbound	thru/right	6.5	A	17.9	B
(signalized)	Northbound	through	0.2	A	0.2	A
	Southbound	through	32.6	C	27.8	C
		right	31.6	C	29.2	C
EB M-72/Lautnr west x-over	Eastbound	through	3.3	A	12.2	B
(signalized)	Southbound	left	32.4	C	36.4	D
WB M-72/Lautnr east x-over	Westbound	through	3.7	A	9.2	A
(signalized)	Northbound	left	31.1	C	30.1	C
EB M-72/Drive 1	Northbound	right	12.0	B	25.7	D
EB M-72/Drive 2	Eastbound	through	3.5	A	9.0	A
(signalized)		right	3.1	A	13.0	B
	Northbound	right	31.1	C	35.0	D
EB M-72/Drive 3	Northbound	right	11.6	B	11.3	B
EB M-72/Drive 4	Northbound	right	11.2	B	22.7	C
Lautner Rd/Drive 5	Eastbound	left	10.6	B	36.4	E[3]
		right	10.6	B	36.4	E
	Northbound	left	7.6	A	5.3	A
Lautner Rd/Drive 6	Eastbound	left	10.0	B	14.1	B
		right	8.9	A	9.8	A
	Northbound	left	7.5	A	7.9	A
EB M-72/Dr. 2 west x-over	Eastbound	through	1.4	A	14.5	B
(signalized)	Southbound	left	34.9	C	32.2	C
WB M-72/Dr. 2 east x-over	Westbound	through	4.1	A	10.9	B
(signalized)	Northbound	left	27.7	C	15.4	B
EB M-72/Dr. 4 west x-over	Southbound	left	12.6	B	33.9	D
Roundabout Alternative[4]:						
M-72/Lautner Rd.	(roundabout)	Overall	3.2	A	11.6	B
M-72/Drive 2	(roundabout)	Overall	3.2	A	9.2	A
Lautner Rd/Drive 5	(roundabout)	Overall	5.1	A	13.5	B
EB M-72 Drive 1[5]	Northbound	right	11.0	B	18.4	C
EB M-72 Drive 3[5]	Northbound	right	10.6	B	16.7	C
EB M-72 Drive 4[5]	Northbound	right	10.9	B	25.8	D

Notes:
1. Assumes expanded improvements are in place along M-72 frontage.
2. Adjacent = all site access points, the M-72/Lautner intersection, and blvd alternative crossovers.
3. Analyzed as unsignalized – low "major street" volumes would not meet any standard signal warrants.
4. Results shown are for 85% confidence level.
5. Results from HCS software analysis.

Table 7b[1]

Phase 2 Peak-Hour Levels of Service by Movement – Adjacent Roundabouts[2]

Intersection	Movement	AM Peak Hour Ave. Delay	AM Peak Hour LoS	PM Peak Hour Ave. Delay	PM Peak Hour LoS
M-72/Lautner Rd[3]	Northbound	2.4	A	4.8	A
	Westbound	3.0	A	5.4	A
	Southbound	2.4	A	3.6	A
	Eastbound	2.4	A	8.4	A
M-72/Drive 2[4]	Northbound	2.4	A	6.6	A
	Westbound	3.0	A	6.6	A
	Eastbound	2.4	A	4.2	A
Lautner Rd/Drive 5	Northbound	3.6	A	4.8	A
	Southbound	3.6	A	6.0	A
	Eastbound	3.6	A	6.0	A

Notes:

1. Shows refined results for three "adjacent" intersections noted in Table 7a.
2. As requested, results shown are for each approach at 50% confidence level at external roundabout locations. Average delay is in seconds, with related level of service (LoS) based upon HCM unsignalized thresholds.
3. Phase 1 results indicated delays less than 5 seconds for all four approaches during both peak hours.
4. Includes eastbound right-turn bypass lane.

Table 8

Phase 2 Peak-Hour LoS[1] – Non-Adjacent Intersections (no Ph. 2 improvements)

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
US-31/M-72	Eastbound	left	-	-	40.0	D
(signalized)		thru/right	38.7	D	40.4	D
	Westbound	left	133.7	F	181.9	F
		thru/right	21.2	C	24.4	C
	Northbound	left	19.6	B	19.5	B
		through	24.0	C	29.7	C
		right	10.5	B	189.7	F
	Southbound	left	18.0	B	468.2	F
		thru/right	15.6	B	15.5	B
US-31/Bunker Hill Rd.	Westbound	left	113.5	F	122.2	F
(signalized)		right	19.6	B	24.3	C
	Northbound	through	13.3	B	57.4	E
		right	7.8	A	7.9	A
	Southbound	left	12.3	B	22.9	C
		through	23.8	C	17.9	B
Lautner Rd/Bunker Hill	Eastbound	left	7.3	A	7.3	A
	Southbound	left/right	10.2	A	17.3	C
M-72/Mt Hope Rd	Eastbound	left	12.4	B	15.4	C
	Westbound	left	10.6	B	18.1	C
	Northbound	left	24.0	C	104.1	F
		thru/right	14.2	B	47.5	E
	Southbound	left	32.3	D	64.5	F
		thru/right	14.8	B	21.7	C
US-31/Mt Hope Rd	Westbound	left	19.1	C	142.3	F
		right	19.1	C	142.3	F
	Southbound	left	10.8	B	29.7	D

Notes: 1. Assumes Phase 1 "mitigation" is in place.

The addition of Phase 2 project generated traffic is expected to create or increase significant delays for one or more movements at four of the five non-adjacent study area intersections without additional mitigation. Most of these impacts are projected to occur during the afternoon peak hour, as expected. Calculated poor levels of service include:

- US-31/M-72 – Levels of service of F for the southbound left-turn, westbound left turn, and northbound right-turn movements during the morning and/or afternoon peak hours;
- US-31/Bunker Hill – LoS F for the westbound left movement during both peak hours and an LoS E for the northbound through movement during the afternoon peak hour; and
- Mount Hope intersections with US-31 and M-72 – LoS F for several side street movements.

DISCUSSION - RECOMMENDED PHASE 2 ROADWAY IMPROVEMENTS

Given the potential impacts of the Phase 2 traffic, iterative tests of potential mitigation measures were completed to identify a set of recommended improvements. These improvements include both intersection improvement measures as well as roadway section improvements. Based upon those analyses, the following improvements, along with previous Phase 1 improvements, would bring the movements at the study area intersections back to within the minimum LoS D level defined by the review agencies (with v/c's under 1.00) with the exception of the very low volume movements from the Mount Hope Road approaches.

- **US-31/M-72**. Following the M-72 corridor goals stated by the review agencies, both a boulevard cross section and a multi-lane roundabout were analyzed as potential improvement measures at this intersection.

  The boulevard alternative would place the indirect movements on US-31, although westbound left turns would be retained as a direct movement given the high volume and the very low opposing volumes from the eastbound approach. Also, with the projected high northbound right-turn volume during the afternoon peak hour, a separate channelized dual right lane movement was needed in the analyses. The operational layout of this potential improvement is depicted in the Synchro model provided along with this report.

  Based upon iterative testing of various geometry and lane configurations, the roundabout layout that is summarized in the LoS results below retains two-lane approaches on the three main legs but includes separate by-pass right-turn lanes for the northbound and westbound right-turn movements.

- **US-31/Bunker Hill Road**: A second westbound left-turn lane was added along with revised signal operations (includes new northbound right-turn lane that was recommended for Phase 1 improvements).

A summary of the projected conditions for the improved US-31/M-72 and US-31/Bunker Hill intersections is shown in Table 9. Copies of the computer analyses are included in the appendix of this report).

Table 9

Phase 2 Peak-Hour Levels of Service – Non-Adjacent Intersections (w/ improvements)

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
US-31/M-72						
Boulevard Alt.						
NB US-31/M-72	Westbound	through	23.5	C	23.1	C
(signalized)		right	15.0	B	21.7	C
	Northbound	through	15.3	B	17.5	B
SB US-31/M-72	Eastbound	right	0.0	A	0.0	A
(signalized)	Westbound	left	0.8	A	3.0	A
	Southbound	thru/right	19.0	B	28.3	C
NB US-31/M-72 south x-over	Northbound	through	2.9	A	9.8	A
(signalized)	Eastbound	left	39.1	D	31.3	C
SB US-31/M-72 north x-over	Westbound	left	11.4	B	13.0	B
(unsignalized)						
Roundabout Alt.[1,2]	Northbound		1.8	A	3.0	A
	Westbound		3.6	A	6.6	A
	Southbound		4.2	A	12.0	B
	Eastbound		3.6	A	6.0	A
US-31/Bunker Hill Rd.	Westbound	left	33.8	C	40.6	D
(signalized)		right	22.6	C	28.3	C
	Northbound	through	10.2	B	28.2	C
		right	6.1	A	6.0	A
	Southbound	left	8.8	A	21.1	C
		through	15.7	B	12.2	B

Note: 1. As requested, results shown are for each approach at 50% confidence level at external roundabout locations. Average delay is in seconds, with related level of service (LoS) based upon HCM unsignalized thresholds.

2. Includes northbound and westbound right-turn bypass lanes.

Mitigation measures were not defined for the westbound left turn from Mount Hope onto US-31 or the northbound/southbound left turns from Mount Hope onto M-72 due to the very low volumes at those locations. Measures that would improve those calculated levels of service (such as a signal) may be warranted once the approved Acme Village development is generating traffic.

Recommended Turn Lane Storage

Recommended turn lane storage lengths were identified for Phase 2 conditions for the key intersections based upon the above analyses and related Synchro output regarding 95% queue needs. Table 10 summarizes those storage lengths (rounded up to nearest 10 feet) that will provide adequate storage for the higher/worst peak hour (AM or PM).

Table 10

Recommended Phase 2 Turn Lane Length - Key/Improved Intersection Movements[1]

Intersection	Movement		Minimum Lane Length[2]
US-31 NB/M-72	Westbound	"thru"	610
		right	460
US-31 NB/South X-over (at M-72)	Eastbound	left	40
US-31 SB/North X-over (at M-72)	Westbound	left	20
US-31/Bunker Hill Rd.	Westbound	left (dual)	150
	Northbound	right	130
M-72 WB/Lautner Rd.	Southbound	right	110
M-72 EB/Lautner Rd.	Northbound	right (dual)	280
M-72 EB/Drive 1	Northbound	right	240
M-72 EB/Drive 2	Northbound	right (dual)	250
M-72 EB/Drive 3	Northbound	right	120
M-72 EB/Drive 4	Northbound	right (dual)	280
Lautner/Drive 5	Eastbound	left/right	250/130
	Northbound	left	80
Lautner/Drive 6	Eastbound	left/right	50/50
	Northbound	left	30
M-72 EB/Drive 2 West crossover	Southbound	left	100
M-72 WB/Drive 2 East crossover	Northbound	left (dual)	110
M-72 EB/Drive 4 West crossover	Southbound	left	110
M-72 EB/Lautner West crossover	Southbound	left	90
M-72 WB/Lautner East crossover	Northbound	left	110

Notes: 1. For boulevard alternative where applicable
2. Lengths rounded up to nearest 10 feet.
3. Dual left turn lanes.

Internal Site Intersections

In addition to the public street intersections, three key internal intersections were analyzed along the two main "spines" of the currently proposed internal circulation system; Drive 2 and the southern main east/west collector that connects to Drive 5.

Projections were completed to distribute expected Phase 1 and Phase 2 traffic through these three intersections and are illustrated in Figure 13. Levels of service analyses were completed for the intersections for both the morning and afternoon peak hours. The two internal intersections on Drive 2 were analyzed under a standard stop/yield controlled configuration and a roundabout configuration. The levels of service results are summarized in Table 11.

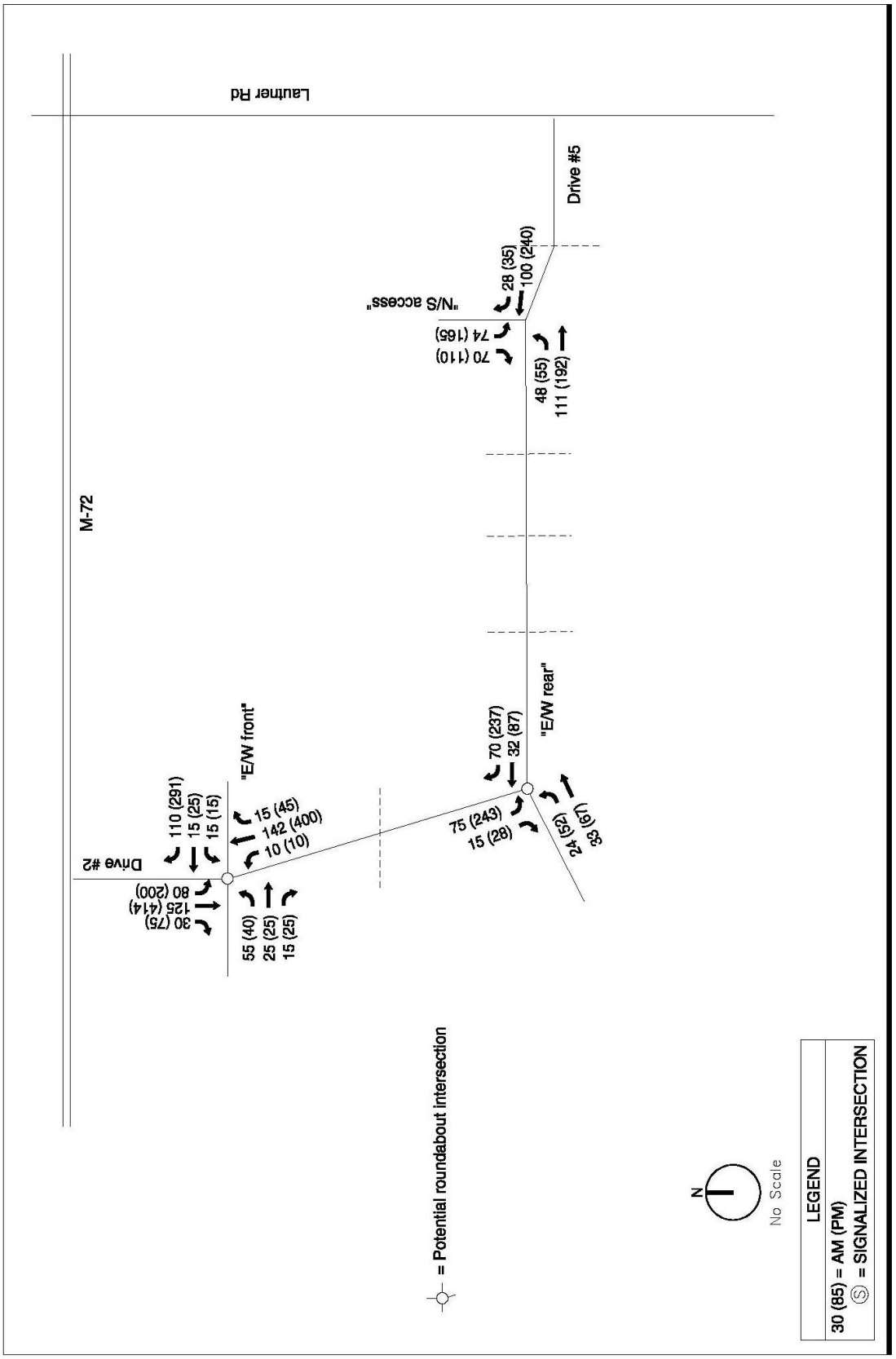
As shown, all of the movements at the internal intersections will function well within acceptable levels under either intersection control type except for the low-volume left turn movements from the "side street" with stop-sign control. It appears from these results that, regardless of which cross section alternative is eventually chosen for the M-72 corridor, the roundabout alternative may be a slightly better choice for at least one of the internal intersections.

Table 11

Phase 2 Peak-Hour Levels of Service – Internal Intersections

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
Standard layout						
Drive 2 @ E/W front (east/west stops)	Eastbound	left	15.7	C	211.7	F
	Eastbound	thru/right	12.4	B	34.9	D
	Westbound	left	13.9	B	55.5	F
		thru/right	9.9	A	16.9	C
	Northbound	left	7.6	A	8.6	A
	Southbound	left	7.8	A	9.4	A
Drive 2 @ E/W rear (all-way stop)	Eastbound	left	7.4	A	8.9	A
		through	6.9	A	8.5	A
	Westbound	through	6.9	A	8.4	A
		right	6.4	A	9.4	A
	Southbound	left	8.0	A	13.1	B
		right	6.1	A	7.0	A
E/W rear @ NS access	Eastbound	left	7.6	A	8.0	A
	Southbound	left	11.5	B	18.3	C
		right	9.1	A	10.5	B
Roundabout layout[1]						
Drive 2 @ E/W front		Overall	3.1	A	4.5	A
Drive 2 @ E/W rear		Overall	3.5	A	4.4	A

Note: 1. Results shown are for 85% confidence level.



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2012 PHASE 2 PEAK HOUR VOLUMES (FULL BUILDOUT) - KEY INTERNAL INTERSECTIONS
VILLAGE AT GRAND TRAVERSE T.I.S.

Figure 13

Chapter 5
2022 Future Conditions

The purpose of this chapter is to summarize the projected 2022 future traffic conditions within the study area with the proposed project in place plus background developments assumed completed.

BACKGROUND GROWTH

Discussions with review staff were held regarding the need for an annual growth factor to be applied. Initial discussions identified an annual growth factor of 0.7% may be applicable. However, subsequent discussions noted that the "known" background growth that will arise from the four projects discussed later in this chapter would encompass what is normally arrived at through an annual factor. Given that those projects will result in an overall background growth of roughly 20-30% (varies depending upon the road section/intersection) versus an 8% growth from an annual factor, it was decided that applying an additional annual factor was not appropriate.

BACKGROUND PROJECTS TRIP GENERATION

Traffic volumes expected to be generated by the uncompleted portions of four other nearby approved projects were included as summarized in Table 12. Information regarding the background project's location, access, and land-use/density was provided by the Township. As shown, the four "background" projects are expected to generate approximately 1,593 new morning peak-hour trips and 2,522 new afternoon peak hour trips.

BACKGROUND PROJECTS TRIP DISTRIBUTION

Based upon site location and expected travel patterns and/or market areas, the background projects new trips were added to the roadway system. Of those, approximately 1,131 morning and 1,763 afternoon peak hour trips are expected to utilize the study area intersections. Figure 14 illustrates the projected general distribution of the background project's traffic.

Those volumes were then added to the 2022 background growth volumes to determine the projected overall 2022 peak-hour traffic volumes. Figures 15 and 16 illustrate those projected total 2022 traffic volumes for the boulevard and roundabout M-72 alternatives, respectively.

Table 12
Background Projects Peak-Hour Trip Generation

Project and Land Use	ITE Code	Size	AM Peak		PM Peak	
			In	Out	In	Out
Turtle Creek [(1)]						
Retail/restaurant		254,000 s.f	**2**	**1**	**217**	**211**
LochenHeath						
Single-family residential	210	494 homes	**89**	**267**	**278**	**164**
Grand Traverse Resort						
Single family residential	210	617 units	*111*	*331*	*340*	*200*
Condominium	230	882 units	*50*	*245*	*240*	*118*
		subtotal:	**161**	**576**	**580**	**318**
Acme Village						
Retail/comm. [(2)]	820	28,900 s.f.	*34*	*22*	*102*	*106*
General Office	710	68,800 s.f.	*122*	*17*	*27*	*129*
Office/R&D	760	64,000 s.f.	*76*	*15*	*14*	*76*
Post office	732	3,200 s.f.	*14*	*12*	*18*	*18*
Bank/office	912/710	41,000/4000 sf	*32*	*23*	*53*	*57*
Single-family residential	210	24 homes	*7*	*20*	*18*	*11*
Multi-family residential	220	96 units	*10*	*41*	*46*	*24*
Townhouse	230	10 units	*1*	*3*	*3*	*2*
Civic use	733	44,000 s.f.	*86*	*11*	*39*	*88*
Church	560	12,000 s.f.	*4*	*3*	*3*	*4*
		subtotal:	*386*	*167*	*323*	*515*
less internal capture trips (10%):			*39*	*17*	*32*	*52*
		new trips:	**347**	**150**	**291**	**463**
		Net New Trips:	**599**	**994**	**1,366**	**1,156**

Notes: 1. Source – Turtle Creek Retail Development TIS, URS, October 2007
2. 25% pass-by trip percentage applied to small retail/commercial uses

EVALUATION OF 2022 CONDITIONS

New level of service analyses were completed for the study area intersections for these projected 2022 conditions. Per discussions, these analyses assumed the Phase 2 improvements were in place. Tables 13a and 13b show the results of the levels of service analyses. Copies of the computer analyses are included in the appendix of this report.

As shown, the analyses indicate that the addition of background traffic through 2022 and traffic from the four approved projects have considerable impacts to the study area intersections. The US-31/M-72 intersection alone is expected to experience an additional 1,100+ vehicles during the afternoon peak hour. The results indicate that one or more movements at several of the study area intersections are expected to degenerate to an LoS F. Per discussions with the review agencies, identifying additional improvement measures to address potential/projected 2022 conditions was not considered as part of this study.

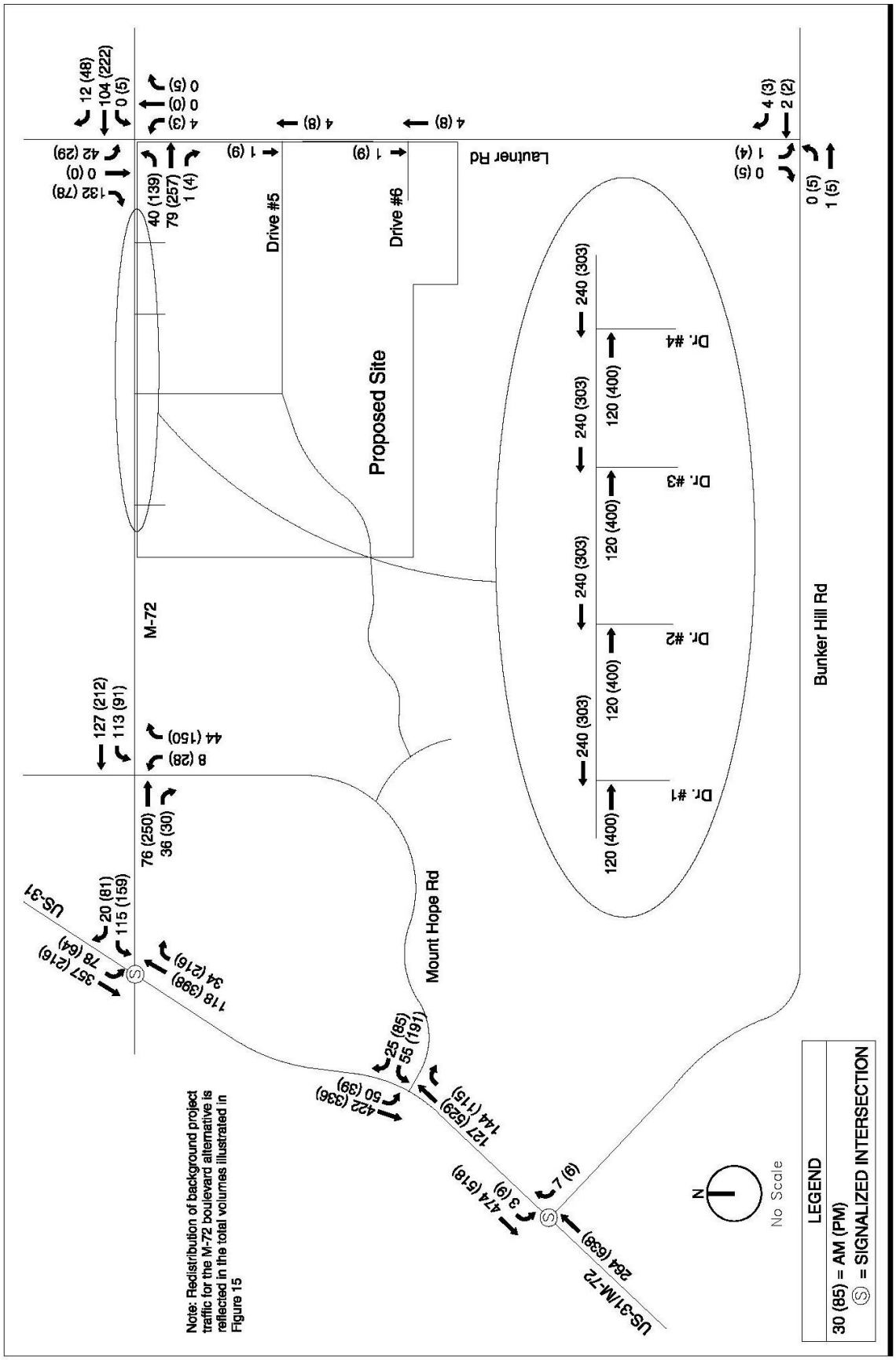

Figure 14

2022 BACKGROUND PROJECTS TRIP DISTRIBUTION
VILLAGE AT GRAND TRAVERSE T.I.S.

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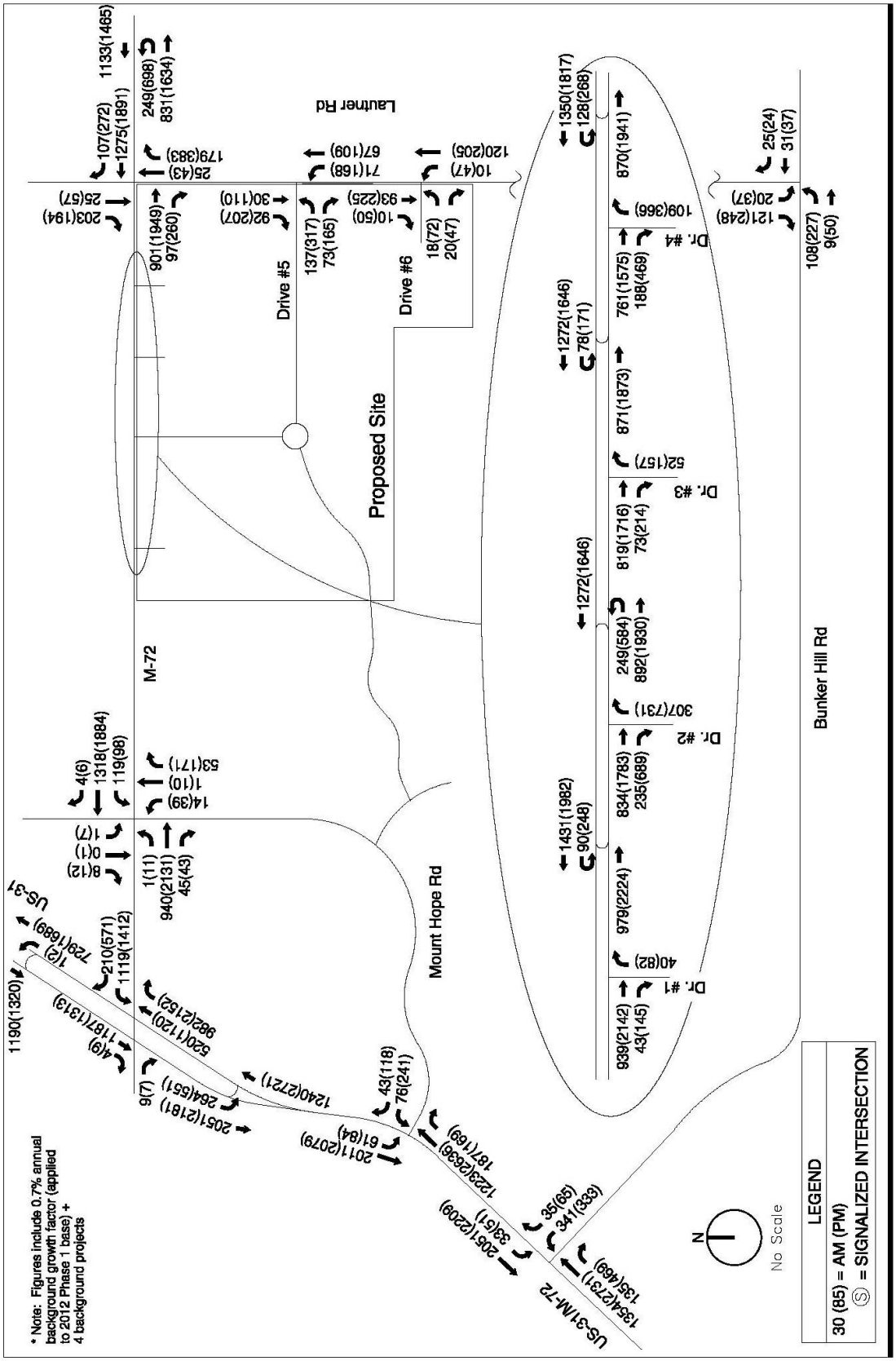

TOTAL PROJECTED 2022 PEAK HOUR VOLUMES* - BLVD ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

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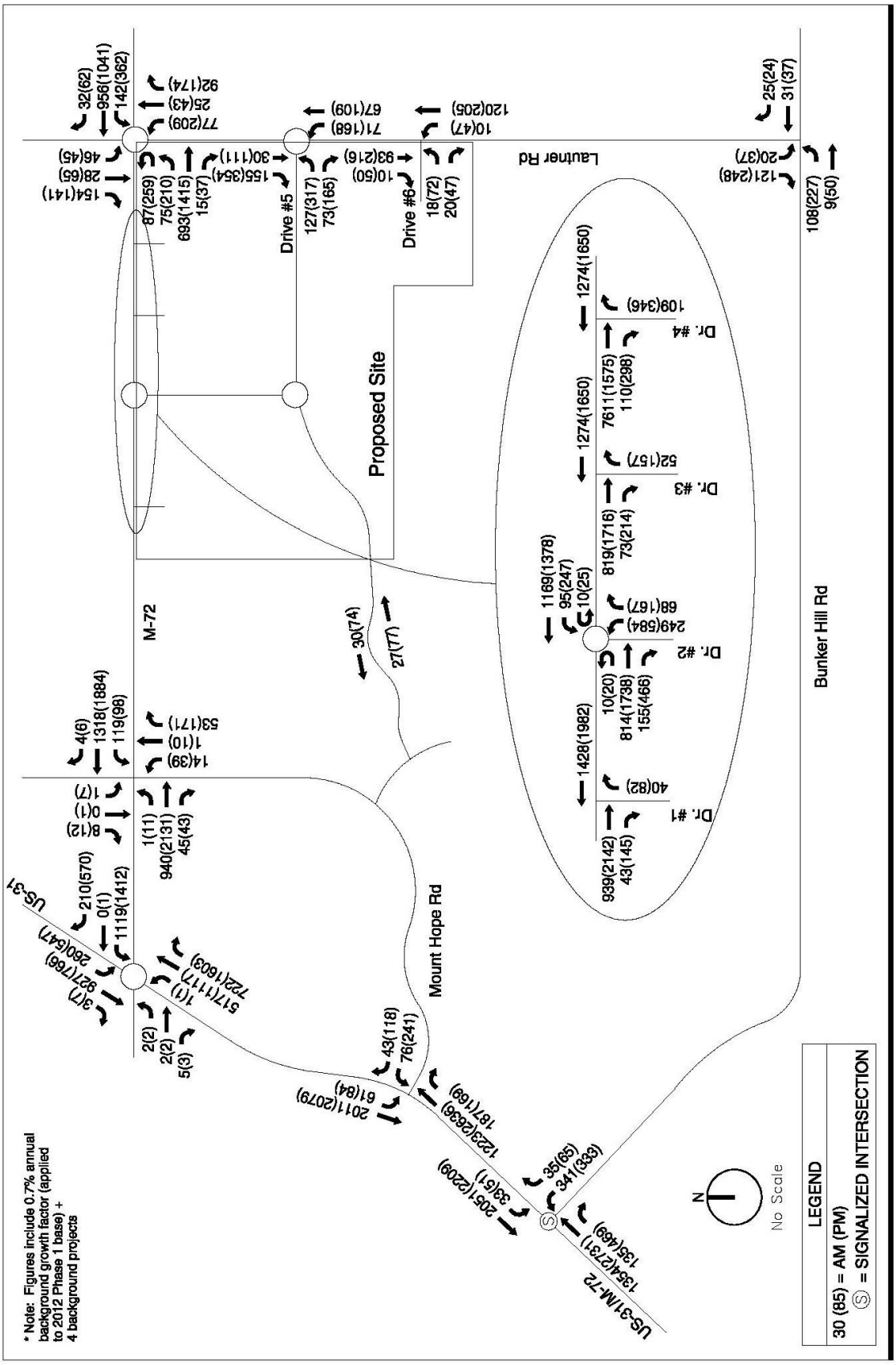
Figure 15



TOTAL PROJECTED 2022 PEAK-HOUR VOLUMES* - ROUNDABOUT ALTERNATIVE
VILLAGE AT GRAND TRAVERSE T.I.S.

Figure 16

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Table 13a

Projected 2022 Levels of Service – Boulevard Alternative[1]

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
NB US-31/M-72	Westbound	through	23.9	C	26.3	C
(signalized)		right	14.7	B	27.8	C
	Northbound	through	18.6	B	28.2	C
SB US-31/M-72	Eastbound	right	0.0	A	0.0	A
(signalized)	Westbound	left	1.1	A	4.6	A
	Southbound	thru/right	38.4	D	88.2	F
NB US-31/M-72 south x-over	Northbound	through	3.8	A	18.5	B
(signalized)	Eastbound	left	29.8	C[2]	29.2	C[2]
SB US-31/M-72 north x-over (unsignalized)	Westbound	left	14.0	B	15.1	C
EB M-72/Lautner Rd.	Eastbound	through	8.0	A	33.5	C
(signalized)		right	5.6	A	6.4	A
	Northbound	through	27.2	C	27.7	C
		right	27.1	C	57.3	E
	Southbound	through	0.1	A	0.3	A
WB M-72/Lautner Rd.	Westbound	thru/right	11.2	B	59.4	E
(signalized)	Northbound	through	0.2	A	0.2	A
	Southbound	through	27.4	C	28.4	C
		right	80.1	F	100.1	F
EB M-72/Lautnr west x-over	Eastbound	through	4.0	A	24.4	C
(signalized)	Southbound	left	32.0	C	41.1	D
WB M-72/Lautnr east x-over	Westbound	through	4.2	A	13.7	B
(signalized)	Northbound	left	31.8	C	36.4	D
EB M-72/Drive 1	Northbound	right	12.7	B	40.5	E
EB M-72/Drive 2	Eastbound	through	3.7	A	47.5	D
(signalized)		right	3.1	A	9.3	A
	Northbound	right	33.0	C	37.2	D
M-72/Drive 3	Northbound	right	12.0	B	14.4	B
M-72/Drive 4	Northbound	right	12.0	B	43.3	E
Lautner Rd/Drive 5	Eastbound	left	10.6	B	39.5	E
		right	10.6	B	39.5	E
	Northbound	left	7.6	A	5.2	A
Lautner Rd/Drive 6	Eastbound	left	10.1	B	14.3	B
		right	8.9	A	9.8	A
	Northbound	left	7.5	A	8.0	A
EB M-72/Dr. 2 west x-over	Eastbound	through	1.8	A	47.6	D
(signalized)	Southbound	left	34.9	C	33.0	C
WB M-72/Dr. 2 east x-over	Westbound	through	4.8	A	14.9	B
(signalized)	Northbound	left	25.8	C	16.8	B
EB M-72/Dr. 4 west x-over	Southbound	left	13.5	B	75.7	F
US-31/Bunker Hill Rd.	Westbound	left	33.8	C	40.6	D
(signalized)		right	22.9	C	29.0	C
	Northbound	through	13.0	B	146.9	F
		right	6.1	A	6.3	A
	Southbound	left	18.8	B	28.2	C
		through	67.1	E	51.3	D
Lautner Rd/Bunker Hill	Eastbound	left	7.1	A	7.0	A
	Southbound	left/right	10.5	A	16.0	C

Table 13a (cont'd)

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
M-72/Mt Hope Rd	Eastbound	left	13.5	B	17.8	C
(unsignalized)	Westbound	left	13.2	B	36.4	E
	Northbound	left	39.2	E	648.6	F
		thru/right	15.8	C	487.7	F
	Southbound	left	72.2	F	*	F
		thru/right	16.1	C	1608.3	F
US-31/Mt Hope Rd	Westbound	left	139.1	F	*	F
(unsignalized)		right	139.1	F	*	F
	Southbound	left	14.0	B	1056.3	F

Note: 1. Assumes all Phase 2 improvements in place.
2. Includes slight shift in signal operations.

Table 13b

Projected 2022 Levels of Service – Roundabout Alternative[1]

Intersection	Movement		AM Peak Hour Delay	AM Peak Hour LoS	PM Peak Hour Delay	PM Peak Hour LoS
US-31/M-72	Overall		26.7	C/D	69.0	E/F
M-72/Lautner Rd.	Overall		3.8	A	100.6	F
M-72/Drive 2	Overall		4.1	A	136.1	F
Lautner Rd/Drive 5	Overall		5.6	A	14.3	B
EB M-72 Drive 1[5]	Northbound	right	11.0	B	18.4	C
EB M-72 Drive 3[5]	Northbound	right	10.6	B	16.7	C
EB M-72 Drive 4[5]	Northbound	right	10.9	B	25.8	D

Results for other intersections are the same as shown in Table 13a.

Note: 1. Results shown are for 85% confidence level.
2. Results from HCS software analysis.