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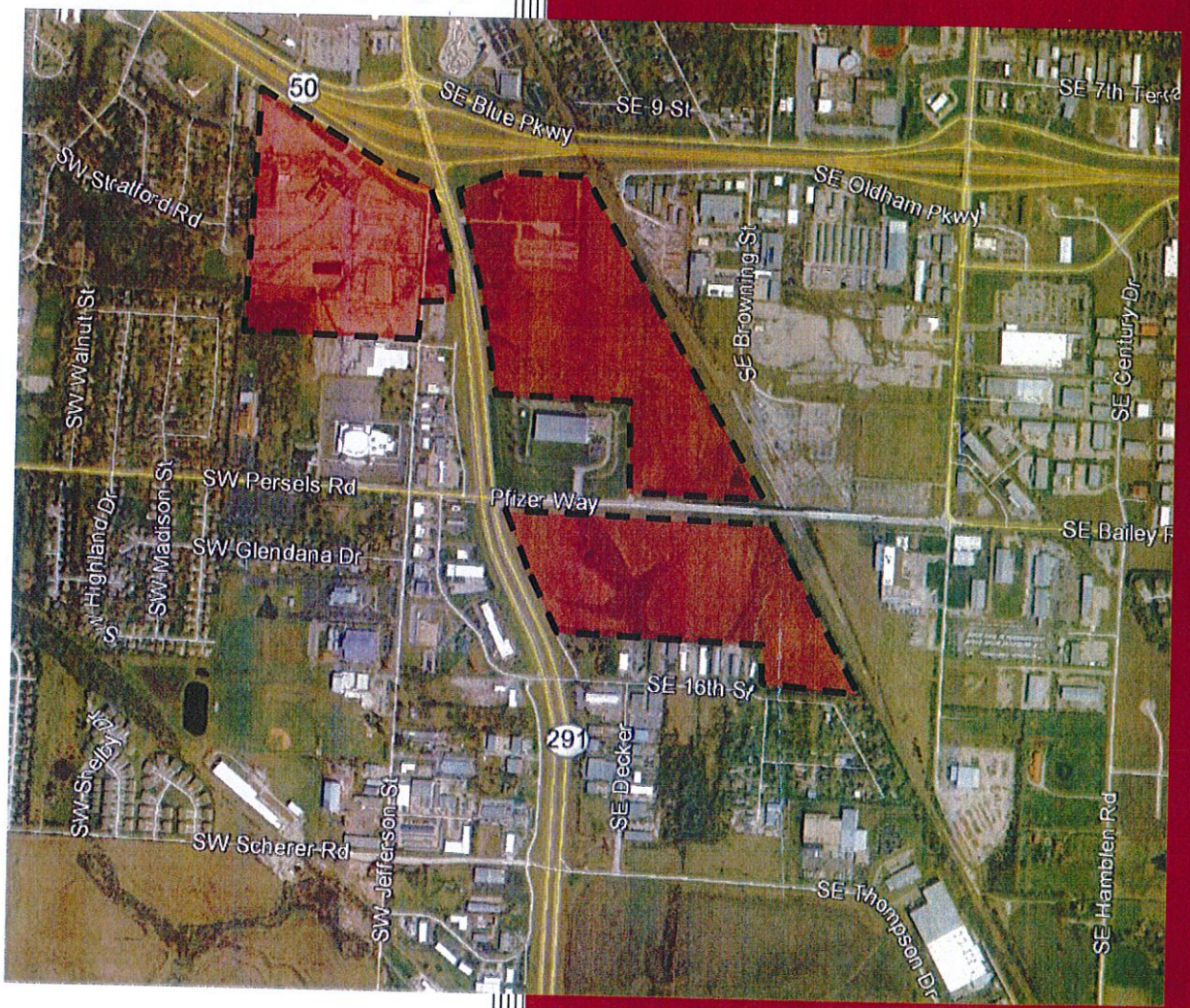
The Grove Traffic Impact Study

US-50 and M-291 Highway
Lee's Summit, Missouri



Prepared for:

BHC Rhodes

TranSystems

EXPERIENCE | Transportation

Prepared by TranSystems

August 2016

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August 30, 2016

Mr. Ryan A. Elam, PE
BHC Rhodes
7101 College Blvd., Suite 400
Overland Park, KS 66210

RE: The Grove Traffic Impact Study
Us-50 and M-291 Highways
Lee's Summit, Missouri

Dear Mr. Elam:

In response to your request and authorization, TranSystems has completed a traffic impact study for the proposed development master plan for several sites generally located to the south of the US-50 Highway and M-291 Highway interchange in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

Included in this study is a discussion of the anticipated impact of the proposed development on the adjacent street network and identified improvements to mitigate deficiencies for the following scenarios:

- Existing Conditions
- Existing plus Phase 1A Conditions
- Existing plus Phase 1A & 1B Conditions
- Existing plus Phase 2 Conditions
- Existing plus Phase 3 Conditions
- Existing plus Phase 4 Conditions

We trust that the enclosed information proves beneficial to you and the City of Lee's Summit in this phase of the development process. We appreciate the opportunity to be of service to you and will be available to review this study at your convenience.

Sincerely,
TRANSYSTEMS

By: _____
Jeffrey J. Wilke, PE, PTOE

JJW/jw/P101150282
Enclosure

Introduction

TranSystems has completed a traffic impact study for the proposed development master plan for a large site generally located to the south of the US-50 Highway and M-291 Highway interchange in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The location of the development site relative to the major streets in the area is shown on ***Figure A-1*** in ***Appendix A***. This study also contains a description of the proposed development and the surrounding transportation infrastructure along with trip generation estimates, trip distribution estimates, capacity analyses, and a summary of the findings.

Proposed Development Plan

The proposed development master plan encompasses several parcels with a number of different land uses. The development is to occur in phases, starting with the industrial and business park land uses along Bailey Road. Along the east and west sides of M-291 Highway there are commercial, office, and residential land uses proposed. A copy of the proposed site plan is included on ***Figure A-2*** in ***Appendix A*** for reference.

The main access point to the commercial, office, and residential portions of the development will be from the M-291 Highway and Oldham Parkway intersection. Oldham Parkway will remain a public street bisecting the western portion of the development. Another driveway is to be provided on M-291 Highway approximately 750 feet north of the Persels Road / Bailey Road intersection. This driveway is to be restricted to right-turn movements only and will be called Holloway Lane. Two driveways are to be provided on Bailey Road, providing access to the industrial and business park sites. A driveway connection will also be made to 16th Street at the far southeastern corner of the site.

Study Area

To assess the impacts of the proposed development, the intersections listed below were identified for study during the A.M. and P.M. periods.

- M-291 Highway and Oldham Parkway
- M-291 Highway and Persels Road/Bailey Road
- M-291 Highway and SE 16th Street
- M-291 Highway and Scherer Road/Thompson Road
- Ward Road and Oldham Parkway
- Jefferson Street and Persels Road
- Bailey Road and Hamblen Road

Area Improvement Projects

There are several improvement projects that are being designed, constructed, or have recently been completed in the study area. The most significant project is the reconstruction of the US-50 Highway and M-291 Highway interchange. This project includes replacement of the existing interchange with a diverging diamond interchange (DDI). The DDI includes a dual-lane roundabout at the crossover on the north side of US-50 Highway, which will also control the Blue Parkway movements. As part of the

project, M-291 Highway will be widened to six through lanes from the DDI south to the Persels Road / Bailey Road intersection. The intersection with Oldham Road will be relocated to the south and include a number of auxiliary turn lanes. Construction of the project is scheduled to begin in 2017.

The City of Lee's Summit completed the Bailey Road bridge project in Spring of 2016. The project connected Bailey Road from the intersection with Hamblen Road to the M-291 Highway and Persels Road intersection by bridging over the Union Pacific Railroad.

Work is currently underway on the City's Jefferson Street improvements project. This project includes widening Jefferson Street to the south of Persels Road to three-lanes. At the Persels Road and Jefferson Street intersection, a traffic signal is to be installed in conjunction with several auxiliary turn lane improvements on Persels Road, which have not been completed at the time of this study. At the south end of the project, Scherer Road has recently been extended from Jefferson Street to M-291 Highway.

Traffic Counts

As part of the design process for the interchange improvements, the Missouri Department of Transportation (MoDOT) collected peak traffic counts at many of the intersections along the M-291 corridor. The counts were adjusted to balance the volumes between adjacent intersections. None of the area improvement projects were completed when MoDOT collected their counts.

Turning-movement traffic volume counts were collected at several of the study intersections on Tuesday, July 12, 2016 through Thursday, July 14, 2016. These counts provide an indication of how traffic patterns have been affected by the Bailey Road bridge project and Scherer Road extension. The City of Lee's Summit provided a count for Persels Road and Jefferson Street which was collected on Thursday, April 25, 2012. For this traffic impact study, all of the count data was compiled and balanced to account for the street network changes. The existing lane configurations, traffic control devices, and balanced peak hour traffic volumes have been illustrated on ***Figures A-3*** through ***A-5***.

Surrounding Street Network and Land Uses

According to MoDOT's functional classification map, M-291 Highway is a principal arterial. The route is currently a four-lane divided arterial with paved shoulders along each side of the roadway. The posted speed limit on M-291 Highway is 55 mph from 16th Street to the south. Between 16th Street and the future location of Holloway Lane, the speed limit is 45 mph. The remainder of the route north to the US-50 Highway has a posted speed limit of 35 mph. M-291 Highway provides access to the regional highway system via the interchange with US-50 Highway.

There are several city streets adjacent to the site. Bailey Road and Persels Road are classified as minor arterials. Both streets have curbs and gutters with sidewalks along each side of the streets. The posted speed limit for both streets is 35 mph. Oldham Parkway is classified as commercial collector street. The street currently has two lanes with paved shoulders and a posted speed limit of 35 mph. There are no curbs or sidewalks along either side of the street. Jefferson Street is a two-lane unimproved commercial collector street. Between Persels Road and Oldham Parkway, the street is roughly 18 feet wide, and

does not have any shoulders, curbs, or sidewalks. At the far south end of the development site, 16th Street is an unimproved local street which is approximately 20 feet wide.

The development site itself currently consists of undeveloped and vacant land. The northern portions of the site formerly had a manufacturing plant and an auto auction facility, but they have since been demolished. The site is bounded on the north by US-50 Highway, and on the east by the Union Pacific Railroad. There are businesses and single-family homes adjacent to the southeastern side of the site. Several businesses, manufacturing uses, and a church are adjacent to the southwestern side of the site. To the west of the site there are single-family neighborhoods. The site wraps around the existing Zoetis manufacturing facility, which is located in the northeast corner of the M-291 Highway and Bailey Road intersection.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their Traffic Engineering Handbook. ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors. The analysis of the proposed development's impact included development of trip generation and trip distribution estimates as well as a traffic operations assessment for each study scenario. Each of the analysis methodologies and findings are described in the subsequent sections.

Trip Generation

Trip generation estimates for the proposed development were prepared using the Institute of Transportation Engineer's Trip Generation, 9th Edition. ***Table 1*** on the following page shows the expected trips to be generated by the proposed development.

The proposed development includes a wide variety of land uses. It can be assumed that there will be trips made between different land uses within the development itself. These trips are said to be internal trips, because they will stay within the development site and not use the external street system. The ITE internal capture methodology was used to determine the number of trips internal to the site for the Phase 3, Phase 4A and Phase 4B portions of the development. Internal trips were not applied to the external street system for the analysis of the development scenarios.

Pass-by traffic occurs when drivers stop at the proposed development, in route to their final destination. Pass-by traffic is common for retail land uses. For the proposed development, pass-by traffic would consist of drivers on M-291 Highway stopping at the site to shop, then continuing along M-291 Highway. The formulas in the trip generation handbook estimate a pass-by trip rate of roughly 33 percent for similar size shopping centers during the P.M. peak hour.

Table 1
Trip Generation for Proposed Development

Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Phase 1A									
Industrial Park	200,000 sf	130	**1,677**	**164**	**134**	**30**	**187**	**39**	**148**
Phase 1B									
Business Park	220,000 sf	770	**3,052**	**306**	**260**	**46**	**301**	**78**	**223**
Phase 2									
Business Park	200,000 sf	130	**2,840**	**279**	**237**	**42**	**276**	**72**	**204**
Phase 3									
General Office	120,100 sf	710	1,509	222	195	27	213	36	177
Shopping Center	100,050 sf	820	6,793	156	133	23	600	288	312
Apartments	370 du	220	2,366	186	37	149	222	144	78
Subtotal Phase 3 Development Trips			*10,668*	*564*	*365*	*199*	*1,035*	*468*	*567*
Phase 3 Internal Development Trips			---	---	---	---	(158)	(79)	(79)
Phase 3 External Development Trips			*10,668*	*564*	*365*	*199*	877	389	488
Phase 3 Retail Pass-By Trips (33% of PM)			---	---	---	---	(162)	(81)	(81)
Total Phase 3 External Development Trips			***10,668***	***564***	***365***	***199***	***715***	***308***	***407***
Phase 4A									
Theater	44,100 sf	444	3,442	10	8	2	168	108	60
General Office	113,900 sf	710	1,449	213	187	26	207	35	172
Shopping Center	177,200 sf	820	9,850	221	188	33	879	422	457
Subtotal Phase 4A Development Trips			*14,741*	*444*	*383*	*61*	*1,254*	*565*	*689*
Phase 4A Internal Development Trips			---	---	---	---	(38)	(19)	(19)
Phase 4A External Development Trips			*14,741*	*444*	*383*	*61*	1,216	546	670
Phase 4A Retail Pass-By Trips (33% of PM)			---	---	---	---	(274)	(137)	(137)
Total Phase 4A External Development Trips			***14,741***	***444***	***383***	***61***	***942***	***409***	***533***
Phase 4B									
General Office	105,800 sf	710	1,370	201	177	24	197	33	164
Shopping Center	165,700 sf	820	9,430	213	132	81	841	404	437
Hotel	270 rm	310	2,043	144	85	59	162	83	79
Assisted Living	100 bed	251	293	18	12	6	29	15	14
Senior Adult Housing	16 du	252	68	4	1	3	6	3	3
Apartments	229 du	220	1,511	116	23	93	144	94	50
Subtotal Phase 4B Development Trips			*14,715*	*696*	*430*	*266*	*1,379*	*632*	*747*
Phase 4B Internal Development Trips			---	---	---	---	(150)	(75)	(75)
Phase 4B External Development Trips			*14,715*	*696*	*430*	*266*	1,229	557	672
Phase 4B Retail Pass-By Trips (33% of PM)			---	---	---	---	(242)	(121)	(121)
Total Phase 4B External Development Trips			***14,715***	***696***	***430***	***266***	***987***	***436***	***551***
Total External Development Trips			***47,693***	***2,453***	***1,809***	***644***	***3,408***	***1,342***	***2,066***

Missouri Department of Transportation (MoDOT) staff performed the traffic analysis for the US-50 Highway and M-291 Highway interchange improvements. As part of the traffic analysis, future commercial and residential development was assumed for the parcels in the southwest and southeast

quadrants of the interchange. These same areas are included in the proposed development site. ***Table 2*** shows the development intensity and trip generation assumed by MoDOT for their analysis.

Table 2
MoDOT Trip Generation Assumptions

Land Use	Intensity	ITE Code	A.M. Peak Hour			P.M. Peak Hour		
			Total	In	Out	Total	In	Out
East of M-291 Highway								
Shopping Center	526,000 sf	820	410	250	160	1,934	948	986
East Retail Pass-By Trips (24% of PM)			(99)	(60)	(39)	(467)	(229)	(238)
Total East Development Trips			***311***	***190***	***121***	***1,467***	***719***	***748***
West of M-291 Highway								
Apartments	150 du	220	83	24	59	105	64	41
Senior Adult Housing	150 du	251	59	25	33	55	19	36
Shopping Center	149,000 sf	820	195	119	76	830	407	423
Subtotal West Development Trips			*336*	*168*	*168*	*990*	*490*	*500*
West Retail Pass-By Trips (35% of PM)			(67)	(41)	(26)	(289)	(142)	(147)
Total West Development Trips			***269***	***127***	***142***	***701***	***348***	***353***
Total Assumed Development Trips			***580***	***317***	***263***	***2,168***	***1,067***	***1,101***

The development intensity that was assumed by MoDOT is less than what is shown in the proposed development master plan. It should also be noted that development was not assumed for the parcels south of Bailey Road (Phases 1A and 1B) in the MoDOT analysis.

Trip Distribution

The estimated trips generated by the proposed development were distributed onto the surrounding grid street network based on the trip distributions summarized in ***Table 3***. These distributions are based on existing travel patterns, expected service area of the development, and engineering judgment. The distributions vary by phase, due to the different types of land uses in each phase and variations in the most convenient routes to different portions of the development site. The detailed distribution patterns through the study intersections are shown in ***Appendix B***.

Table 3
Trip Distribution

Direction To/From	Phase 1 Percentage	Phase 2 Percentage	Phase 3 Percentage	Phase 4A Percentage	Phase 4B Percentage
East on US-50 Highway	5%	5%	25%	30%	30%
West on US-50 Highway	40%	40%	33%	33%	26%
North on Jefferson Street	---	---	4%	4%	4%
West on Oldham Parkway	---	---	3%	3%	10%
East on Bailey Road	25%	25%	8%	3%	3%
West on Persels Road	---	---	2%	2%	2%
South on M-291 Highway	30%	30%	25%	25%	25%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below. These scenarios allowed for comparison of the before and after impacts of the proposed development on the street network.

- Existing Conditions
- Existing plus Phase 1A Development
- Existing plus Phase 1A and 1B Development
- Existing plus Phase 2 Development
- Existing plus Phase 3 Development
- Existing plus Phase 4 Development

The study intersections were evaluated using the Synchro traffic analysis software package. Calculations were performed based on the methodologies outlined in the Highway Capacity Manual (HCM), 2000 Edition, which is published by the Transportation Research Board. The operating conditions at an intersection are graded by the "level of service" experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from "A" to "F". LOS A represents the least congested condition with free-flow movement of traffic and minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. ***Table 4*** shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 4
Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Unsignalized
A	≤ 10 Seconds	≤ 10 Seconds
B	≤ 20 Seconds	≤ 15 Seconds
C	≤ 35 Seconds	≤ 25 Seconds
D	≤ 55 Seconds	≤ 35 Seconds
E	≤ 80 Seconds	≤ 50 Seconds
F	> 80 Seconds	> 50 Seconds

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative paths to avoid the longer delays. Other times the volumes on the

unsignalized approaches are relatively minor when compared to the major street traffic, and traffic signal installation may increase the average delay to all users of the intersection.

Traffic queues are also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues are analyzed to ensure the analyses are reflective of the physical constraints of the study intersections and to identify if additional storage is needed for turn lanes.

The LOS rating deemed acceptable varies by community, facility type and traffic control device. The City of Lee's Summit has designated LOS C and the Missouri Department of Transportation (MoDOT) has designated LOS D as the minimum desirable standard for signalized intersections. At unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Existing Conditions

The results of the Existing Conditions intersection analyses are summarized on the next page in ***Table 5***. All of the recent improvement projects for the area, including the interchange project, are assumed to be completed for the purposes of this scenario. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-3*** through ***A-5***. The Synchro output files are included in ***Appendix C***.

As shown in ***Table 5***, most movements at the study intersections currently operate within acceptable levels of service during the peak hours. The exception is the stop-controlled eastbound and westbound movements at the M-291 intersections with 16th Street and with Scherer Road / Thompson Drive. These movements operate at LOS F with lengthy delays during both peak hours. The side-street volumes at these intersections do not satisfy the minimum warranting volumes for traffic signal installation; therefore, traffic signal installation is likely not warranted.

To achieve acceptable operations for these movements, other access management strategies should be considered for the corridor. Left-turn and through movements from the side-streets could be eliminated at the 16th Street intersection. This would increase traffic volumes at the Scherer Road / Thompson Drive intersection. Higher traffic volumes would increase the likelihood of satisfying the minimum warranting volumes. Alternative intersection designs, such as median u-turns (MUT) or restricted crossing u-turns (RCUT) may also be effective strategies to improve existing operations.

The improvement alternatives for the M-291 intersections with 16th Street and with Scherer Road / Thompson Drive must also take into account the Market Street intersections. Market Street is a frontage road parallel to M-291 Highway that creates intersections within 150 feet to the west of the highway. This short spacing results in the Market Street intersections being within the functional area of the M-291 Highway intersections.

The intersection of M-291 Highway and Bailey Road / Persels Road operates at LOS D during the P.M. peak hour. Some long queues also occur at the intersection during the P.M. peak hour. The 95th percentile queue length for the eastbound and westbound left-turn movements exceed the available storage. Long queues of southbound through traffic also occur. Microsimulation in the SimTraffic analysis program verifies these long queues. Eastbound queues regularly block the Persels Road intersections with Market Street. To address these blockages, a raised median could be installed on Persels Road, thereby restricting side street movements to right-turns only. There may also be an opportunity to eliminate the Market Street connection north of Persels Road if redevelopment occurs in the area.

Table 5
Intersection Operational Analysis
Existing Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Oldham Parkway				
Traffic Signal	B	12.6	B	13.4
M-291 Highway and Bailey Road / Persels Road				
Traffic Signal	C	27.5	D	43.9
M-291 Highway and 16th Street				
Eastbound	**F**	**>100**	**F**	**>100**
Westbound	**F**	**>100**	**F**	**>100**
Northbound Left-Turn	B	10.3	C	23.0
Southbound Left-Turn	C	15.6	B	12.1
M-291 Highway and Scherer Rd / Thompson Dr				
Eastbound	**F**	**>100**	**F**	**>100**
Westbound	**F**	**>100**	**F**	**>100**
Northbound Left-Turn	B	10.2	C	19.2
Southbound Left-Turn	C	16.0	B	12.3
Ward Road and Oldham Parkway				
Traffic Signal	B	13.4	C	21.4
Jefferson Street and Oldham Parkway				
Northbound	B	10.9	A	9.9
Jefferson Street and Persels Road				
Traffic Signal	C	23.9	C	24.6
Bailey Road and Hamblen Road				
Eastbound	A	9.6	B	11.4
Westbound	B	11.6	B	14.3
Northbound	A	9.8	B	10.3
Southbound	A	9.4	B	13.1

1 – Level of Service
2 – Delay in seconds per vehicle

Existing plus Phase 1A Development Conditions

The results of the Existing plus Phase 1A Development conditions intersection analyses are summarized on the following page in ***Table 6***. This study scenario assessed the street system with the additional traffic generated by the 200,000 square foot industrial park portion of the proposed development. The

study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-6*** through ***A-8***. The Synchro output files are included in ***Appendix C***.

Table 6
Intersection Operational Analysis
Existing plus Phase 1A Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Oldham Parkway				
Traffic Signal	B	11.7	B	14.1
M-291 Highway and Bailey Road / Persels Road				
Traffic Signal	C	31.4	D	51.4
M-291 Highway and 16th Street				
Eastbound	**F**	**>100**	**F**	**>100**
Westbound	**F**	**>100**	**F**	**>100**
Northbound Left-Turn	B	10.3	C	24.1
Southbound Left-Turn	C	16.1	B	12.2
M-291 Highway and Scherer Rd / Thompson Dr				
Eastbound	**F**	**>100**	**F**	**>100**
Westbound	**F**	**>100**	**F**	**>100**
Northbound Left-Turn	B	10.2	C	19.9
Southbound Left-Turn	C	16.5	B	12.4
Ward Road and Oldham Parkway				
Traffic Signal	B	13.4	C	21.4
Jefferson Street and Oldham Parkway				
Northbound	B	10.9	A	9.9
Jefferson Street and Persels Road				
Traffic Signal	C	23.9	C	24.4
Bailey Road and Decker Street				
Westbound Left-Turn	A	8.1	A	8.0
Northbound Right-Turn	B	14.3	C	18.4
Northbound Left-Turn	B	10.0	B	10.3
Bailey Road and Hamblen Road				
Eastbound	A	9.8	B	12.3
Westbound	B	11.7	B	14.8
Northbound	A	9.7	B	10.5
Southbound	A	9.5	B	13.5

1 – Level of Service
2 – Delay in seconds per vehicle

As shown in the table, most movements at the study intersections are projected to operate at an acceptable LOS with the addition of traffic generated by the Phase 1A portion of the development. The side street movements at the M-291 intersections with 16th Street and with Scherer Road / Thompson Drive are projected to continue operating at LOS F with lengthy delays during both peak hours.

Existing plus Phases 1A and 1B Development Conditions

The results of the Existing plus Phases 1A and 1B Development conditions intersection analyses are summarized on the next page in ***Table 7***. This study scenario assessed the street system with the

additional traffic generated by the Phase 1A and 1B portions of proposed development which are the proposed industrial and business parks to the south of Bailey Road. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-9*** through ***A-11***. The Synchro output files are included in ***Appendix C***.

Table 7
Intersection Operational Analysis
Existing plus Phases 1A and 1B Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Oldham Parkway				
Traffic Signal	B	12.4	B	13.8
M-291 Highway and Bailey Road / Persels Road				
Traffic Signal	C	32.1	D	42.2
M-291 Highway and 16th Street				
Eastbound	**F**	**>100**	**F**	**>100**
Westbound	**F**	**>100**	**F**	**>100**
Northbound Left-Turn	B	10.4	D	26.0
Southbound Left-Turn	C	18.2	B	12.5
M-291 Highway and Scherer Rd / Thompson Dr				
Eastbound	**F**	**>100**	**F**	**>100**
Westbound	**F**	**>100**	**F**	**>100**
Northbound Left-Turn	B	10.3	C	21.1
Southbound Left-Turn	C	17.7	B	12.6
Ward Road and Oldham Parkway				
Traffic Signal	B	13.4	C	21.4
Jefferson Street and Oldham Parkway				
Northbound	B	10.9	A	9.9
Jefferson Street and Persels Road				
Traffic Signal	C	24.0	C	24.4
Bailey Road and site driveway				
Northbound Right-Turn	A	9.5	A	9.3
Bailey Road and Decker Street				
Westbound Left-Turn	A	8.5	A	8.2
Northbound Left-Turn	C	17.4	**E**	**41.2**
Northbound Right-Turn	A	9.8	B	10.8
Bailey Road and Hamblen Road				
Eastbound	B	10.5	B	14.3
Westbound	B	13.9	C	15.7
Northbound	B	10.3	B	10.8
Southbound	B	10.5	B	14.3

1 – Level of Service
2 – Delay in seconds per vehicle

To accommodate Phase 1A and 1B development traffic, several improvements are identified, which are listed on the next page and reflected in the analysis results shown in ***Table 6***.

M-291 Highway and Bailey Road / Persels Road

- Construct dual southbound left-turn lanes with a minimum 300 feet of storage plus appropriate taper.
- Construct dual westbound left-turn lanes with a minimum 250 feet of storage plus appropriate taper.
- Lengthen the northbound right-turn lane to provide a minimum 350 feet of storage plus appropriate taper.
- Construct a second eastbound through lane on Bailey Road east of M-291 Highway to terminate as a right-turn lane at the Decker Street intersection.

The northbound left-turn movement at the Bailey Road and Decker Street intersection is projected to operate at LOS E during the P.M. peak hour. The traffic volumes at this intersection are not projected to satisfy the peak hour traffic signal warrant. Therefore, no further improvements are identified for this intersection in this scenario.

All other study intersections are projected to operate at an acceptable LOS with the addition of Phases 1A and 1B development traffic, with the exception of the M-291 Highway intersections with 16th Street and Scherer Road / Thompson Drive.

Existing plus Phase 2 Development Conditions

The results of the Existing plus Phase 2 Development conditions intersection analyses are summarized in ***Table 8***. This study scenario assessed the street system with the additional traffic generated by the Phases 1 and 2 portions of the proposed development. This includes full build out of the industrial park and business park land uses. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-12*** through ***A-14***. The Synchro output files are included in ***Appendix C***.

Table 8
Intersection Operational Analysis
Existing plus Phase 2 Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Oldham Parkway				
Traffic Signal	B	11.5	B	14.4
M-291 Highway and Bailey Road / Persels Road				
Traffic Signal	D	35.3	D	47.9
M-291 Highway and 16th Street				
Eastbound	***F***	***>100***	***F***	***>100***
Westbound	***F***	***>100***	***F***	***>100***
Northbound Left-Turn	B	10.5	D	27.9
Southbound Left-Turn	C	19.4	B	12.6

Table 8 – Continued
Intersection Operational Analysis
Existing plus Phase 2 Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Scherer Rd / Thompson Dr				
Eastbound	***F***	***>100***	***F***	***>100***
Westbound	***F***	***>100***	***F***	***>100***
Northbound Left-Turn	*B*	*10.3*	*C*	*22.2*
Southbound Left-Turn	*C*	*18.9*	*B*	*12.8*
Ward Road and Oldham Parkway				
Traffic Signal	*B*	*13.4*	*C*	*21.4*
Jefferson Street and Oldham Parkway				
Northbound	*B*	*10.9*	*A*	*9.9*
Jefferson Street and Persels Road				
Traffic Signal	*C*	*23.5*	*C*	*24.1*
Bailey Road and site driveway				
Northbound Right-Turn	*B*	*10.8*	*A*	*10.0*
Bailey Road and Decker Street				
Eastbound Left-Turn	*A*	*8.6*	*A*	*8.3*
Westbound Left-Turn	*A*	*8.5*	*A*	*8.2*
Northbound Left-Turn	***F***	***57.4***	***F***	***>100***
Northbound Right-Turn	*A*	*10.0*	*B*	*11.3*
Southbound Left-Turn	***E***	***47.9***	***E***	***39.4***
Southbound Right-Turn	*A*	*9.5*	*B*	*10.7*
Bailey Road and Hamblen Road				
Eastbound	*B*	*11.2*	*C*	*17.6*
Westbound	*B*	*15.0*	*C*	*16.6*
Northbound	*B*	*10.5*	*B*	*11.1*
Southbound	*B*	*11.9*	*C*	*15.2*

1 – Level of Service
2 – Delay in seconds per vehicle

To accommodate Phase 2 development traffic, several improvements are identified, which are listed below and reflected in the analysis results shown in the table.

Bailey Road and Decker Street

- Construct an eastbound left-turn lane to provide a minimum 300 feet of storage plus appropriate taper.
- Construct a second westbound through lane on Bailey Road to terminate as a right-turn lane at the M-291 Highway intersection.

These improvements will impact the existing full access driveway to the Zoetis facility on Bailey Road. This driveway is to be closed in this phase. Access to the Zoetis facility will be provided from a new driveway to the north, along Decker Street.

The results in ***Table 8*** indicate that most study intersections are projected to operate at an acceptable LOS. The side-street left-turn movements at the Bailey Road and Decker Street intersection are

projected to operate at LOS E and F during the peak hours. Traffic volumes indicate the intersection nearly satisfies the peak hour warrant. The Decker Street intersection is located approximately 1,000 feet east of M-291 Highway, which provides ample spacing from the adjacent signal. Decker Street will function similarly to a collector street through the development. For these reasons, the intersection is a candidate for signalization, and should be monitored for traffic signal installation. Traffic signals are typically installed based on field-measured traffic volumes, therefore the intersection should be regularly monitored as development continues in the area. A full warrant study should be conducted using the eight-hour signal warrants.

Existing plus Phase 3 Development Conditions

The results of the Existing plus Phase 3 Development conditions intersection analyses are summarized in ***Table 9***. This study scenario assessed the street system with the additional traffic generated by the Phase 1 through Phase 3 portions of the proposed development. This includes a portion of the commercial, office, and residential land uses planned for the east side of M-291 Highway. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-15*** through ***A-17***. The Synchro output files are included in ***Appendix C***.

Table 9
Intersection Operational Analysis
Existing plus Phase 3 Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Oldham Parkway				
Traffic Signal	B	15.6	C	22.9
M-291 Highway and Holloway Lane				
Westbound Right-Turn	B	10.4	B	10.5
M-291 Highway and Bailey Road / Persels Road				
Traffic Signal	D	36.0	D	48.7
M-291 Highway and 16th Street				
Eastbound	***F***	***>100***	***F***	***>100***
Westbound	***F***	***>100***	***F***	***>100***
Northbound Left-Turn	B	10.7	D	31.6
Southbound Left-Turn	C	21.3	B	13.3
M-291 Highway and Scherer Rd / Thompson Dr				
Eastbound	***F***	***>100***	***F***	***>100***
Westbound	***F***	***>100***	***F***	***>100***
Northbound Left-Turn	B	10.6	C	24.4
Southbound Left-Turn	C	20.6	B	13.5
Ward Road and Oldham Parkway				
Traffic Signal	A	9.8	C	22.1
Jefferson Street and Oldham Parkway				
Northbound	B	11.0	B	10.1
Jefferson Street and Persels Road				
Traffic Signal	C	23.0	C	21.6
Bailey Road and site driveway				
Northbound Right-Turn	B	10.8	A	10.0

Table 9 – Continued
Intersection Operational Analysis
Existing plus Phase 3 Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
Bailey Road and Decker Street				
Eastbound Left-Turn	A	8.7	A	8.4
Westbound Left-Turn	A	8.5	A	8.2
Northbound Left-Turn	**F**	***61.1***	**F**	***>100***
Northbound Right-Turn	A	10.0	B	11.3
Southbound Left-Turn	**F**	***60.4***	**F**	***57.1***
Southbound Right-Turn	A	9.7	B	11.1
Bailey Road and Hamblen Road				
Eastbound	B	11.6	C	19.7
Westbound	B	16.2	C	18.0
Northbound	B	10.7	B	11.3
Southbound	B	12.7	C	17.7

1 – Level of Service
2 – Delay in seconds per vehicle

Several improvements are identified for this scenario, which are listed below and included in the analysis results shown in the table:

M-291 Highway and Holloway Lane

- Construct a northbound right-turn lane to provide a minimum 350 feet of storage plus appropriate taper.

M-291 Highway and Oldham Parkway

- Construct a westbound right-turn lane to provide a minimum 350 feet of storage plus appropriate taper.
- Construct a westbound shared right-turn/through lane to provide dual-right turn movements.
- Construct dual westbound left-turn lanes to provide a minimum 250 feet of storage plus appropriate taper.

The results in ***Table 9*** indicate that most study intersections are projected to operate at an acceptable LOS. The side-street left-turn movements at the Bailey Road and Decker Street intersection are projected to operate at LOS F during both peak hours. Traffic volumes indicate the intersection nearly satisfies the peak hour warrant. As indicated in the previous scenario, the intersection is a candidate for signalization and should be monitored for a traffic signal installation. The intersection is projected to operate at LOS C and LOS D, with 23.5 and 37.4 seconds of delay during the A.M. and P.M. peak hours, respectively, if a traffic signal is installed.

Existing plus Phase 4 Development Conditions

The results of the Existing plus Phase 4 Development conditions intersection analyses are summarized in ***Table 10***. This study scenario assessed the street system with the additional traffic generated by all phases of the proposed development master plan. This includes the remaining commercial, office, and residential land uses planned for the east and west sides of M-291 Highway. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-18*** through ***A-20***. The Synchro output files are included in ***Appendix C***.

Table 10
Intersection Operational Analysis
Existing plus Phase 4 Development Conditions

Intersection / Movement	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
M-291 Highway and Oldham Parkway				
Traffic Signal	C	28.1	E	**55.1**
M-291 Highway and Holloway Lane				
Eastbound Right-Turn	A	9.1	A	9.9
Westbound Right-Turn	B	11.5	B	11.0
M-291 Highway and Bailey Road / Persels Road				
Traffic Signal	D	44.6	E	**58.4**
M-291 Highway and 16th Street				
Eastbound	F	**>100**	F	**>100**
Westbound	F	**>100**	F	**>100**
Northbound Left-Turn	B	11.2	E	**46.4**
Southbound Left-Turn	D	26.7	B	15.3
M-291 Highway and Scherer Rd / Thompson Dr				
Eastbound	F	**>100**	F	**>100**
Westbound	F	**>100**	F	**>100**
Northbound Left-Turn	B	11.1	D	31.1
Southbound Left-Turn	D	25.6	C	15.7
Ward Road and Oldham Parkway				
Traffic Signal	B	14.5	B	15.7
Jefferson Street and Oldham Parkway				
Northbound Right-Turn	A	9.0	B	10.1
Jefferson Street and Persels Road				
Traffic Signal	C	22.6	B	15.4
Bailey Road and site driveway				
Northbound Right-Turn	B	10.9	A	10.0
Bailey Road and Decker Street				
Traffic Signal	C	22.9	C	37.0
Bailey Road and Hamblen Road				
Eastbound	B	11.8	B	13.4
Westbound	C	18.2	C	18.5
Northbound	B	10.8	B	11.0
Southbound	B	13.0	B	14.9

1 – Level of Service
2 – Delay in seconds per vehicle

Several improvements are identified for this scenario, which are listed below and included in the analysis results shown in ***Table 10***:

M-291 Highway and Holloway Lane

- Construct a southbound right-turn lane to provide a minimum 200 feet of storage plus appropriate taper.

M-291 Highway and Oldham Parkway

- Construct an eastbound right-turn lane to provide a minimum 400 feet of storage plus appropriate taper.
- Construct dual eastbound left-turn lanes to provide a minimum 400 feet of storage plus appropriate taper.
- Extend the southbound right-turn lane to provide the maximum possible storage plus appropriate taper.

Oldham Parkway, west of M-291 Highway

- Construct Oldham Parkway with two through lanes in each direction.
- Construct a raised median on Oldham Parkway through the Jefferson Street intersection, thereby restricting left-turn movements.
- The first full access intersection on Oldham Parkway west of M-291 Highway should be located approximately 700 feet west of M-291 Highway. This intersection will be a candidate for traffic signal installation.

As shown in the table, the M-291 Highway intersections with Oldham Parkway and with Bailey Road / Persels Road are projected to operate at LOS E during the P.M. peak hour. Microsimulation indicates that lengthy queues will form in the southbound direction that do not clear during each cycle. To alleviate the queuing and achieve LOS D operations at these intersections, M-291 Highway would need to be widened to include three through lanes for northbound and southbound traffic through the intersection with Persels Road / Bailey Road.

Summary

TranSystems has completed a traffic impact study for the proposed development master plan for a large site generally located to the south of the US-50 Highway and M-291 Highway interchange in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

A number of improvement projects are being designed, constructed, or have recently been completed in the study area. These improvements projects are included in the analysis results for all scenarios of this study.

Several improvements are identified to accommodate traffic generated by **Phases 1A and 1B** of the proposed development, which are listed below. All turn lanes are to be constructed to include an appropriate taper in addition to the minimum storage length.

M-291 Highway and Bailey Road / Persels Road

- Construct dual southbound left-turn lanes with a minimum 300 feet.
- Construct dual westbound left-turn lanes with a minimum 250 feet of storage.
- Lengthen the northbound right-turn lane to provide a minimum 350 feet of storage.
- Construct a second eastbound through lane on Bailey Road east of M-291 Highway to terminate as a right-turn lane at the Decker Street intersection.

The following improvements are identified to accommodate traffic generated by **Phase 2** of the proposed development. All turn lanes are to be constructed to include an appropriate taper in addition to the minimum storage length.

Bailey Road and Decker Street

- Construct an eastbound left-turn lane to provide a minimum 300 feet of storage.
- Construct a second westbound through lane on Bailey Road to terminate as the right-turn lane at the M-291 Highway intersection.
- Monitor the intersection for traffic signal installation.

The following improvements are identified to accommodate traffic generated by **Phase 3** of the proposed development. All turn lanes are to be constructed to include an appropriate taper in addition to the minimum storage length.

M-291 Highway and Holloway Lane

- Construct a northbound right-turn lane to provide a minimum 350 feet of storage.

M-291 Highway and Oldham Parkway

- Construct a westbound right-turn lane to provide a minimum 350 feet of storage.
- Construct a westbound shared right-turn/through lane to provide dual-right turn movements.
- Construct dual westbound left-turn lanes to provide a minimum 250 feet of storage.

The following improvements are identified to accommodate traffic generated by **Phase 4** of the proposed development. All turn lanes are to be constructed to include an appropriate taper in addition to the minimum storage length.

M-291 Highway and Holloway Lane

- Construct a southbound right-turn lane to provide a minimum 200 feet of storage.

M-291 Highway and Oldham Parkway

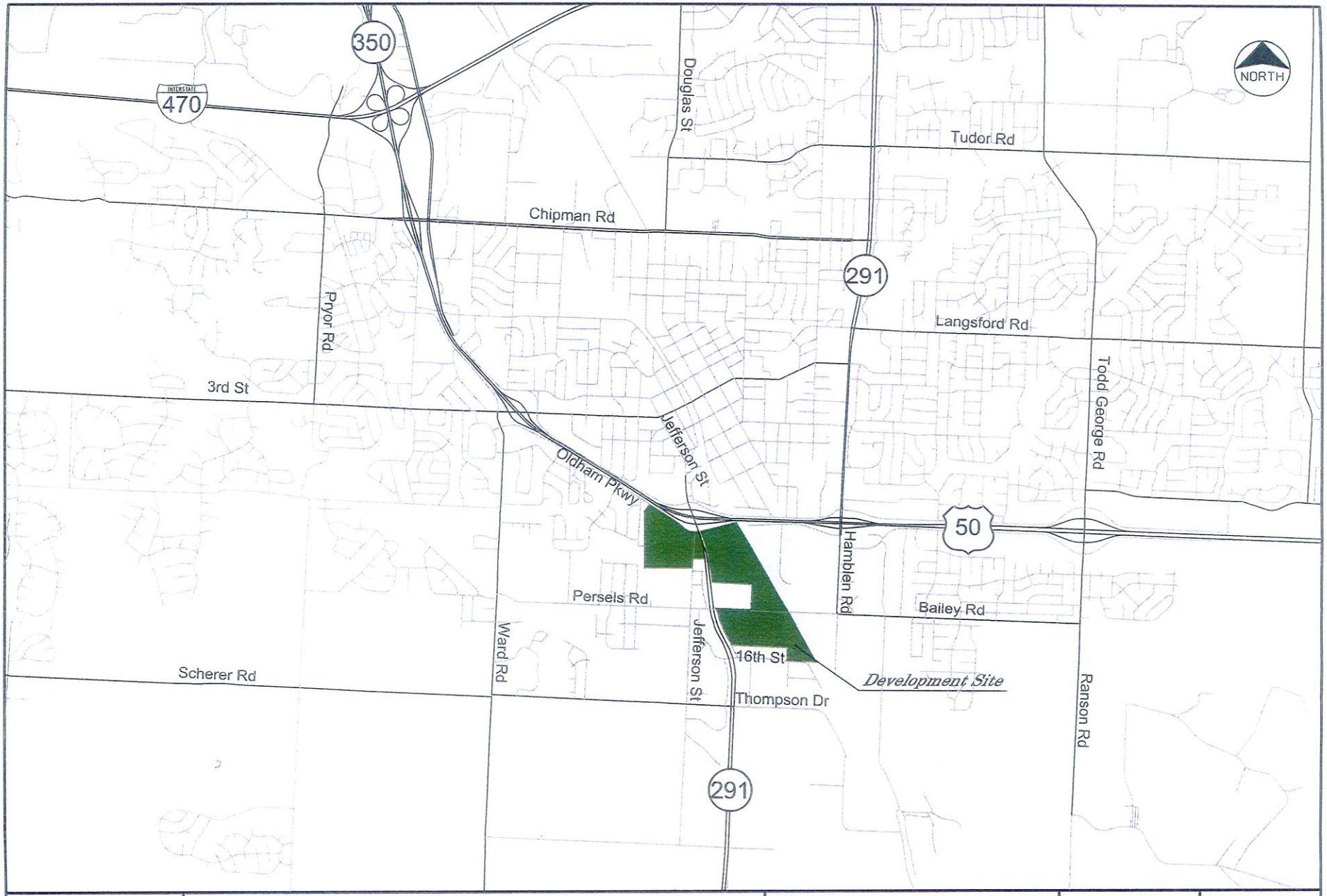
- Construct an eastbound right-turn lane to provide a minimum 400 feet of storage.
- Construct dual eastbound left-turn lanes to provide a minimum 400 feet of storage.

Oldham Parkway, west of M-291 Highway

- Construct Oldham Parkway with two through lanes in each direction.
- Construct a raised median on Oldham Parkway through the Jefferson Street intersection, thereby restricting left-turn movements.
- The first full access intersection on Oldham Parkway west of M-291 Highway should be located approximately 700 feet west of M-291 Highway. The intersection will be a candidate for traffic signal installation.

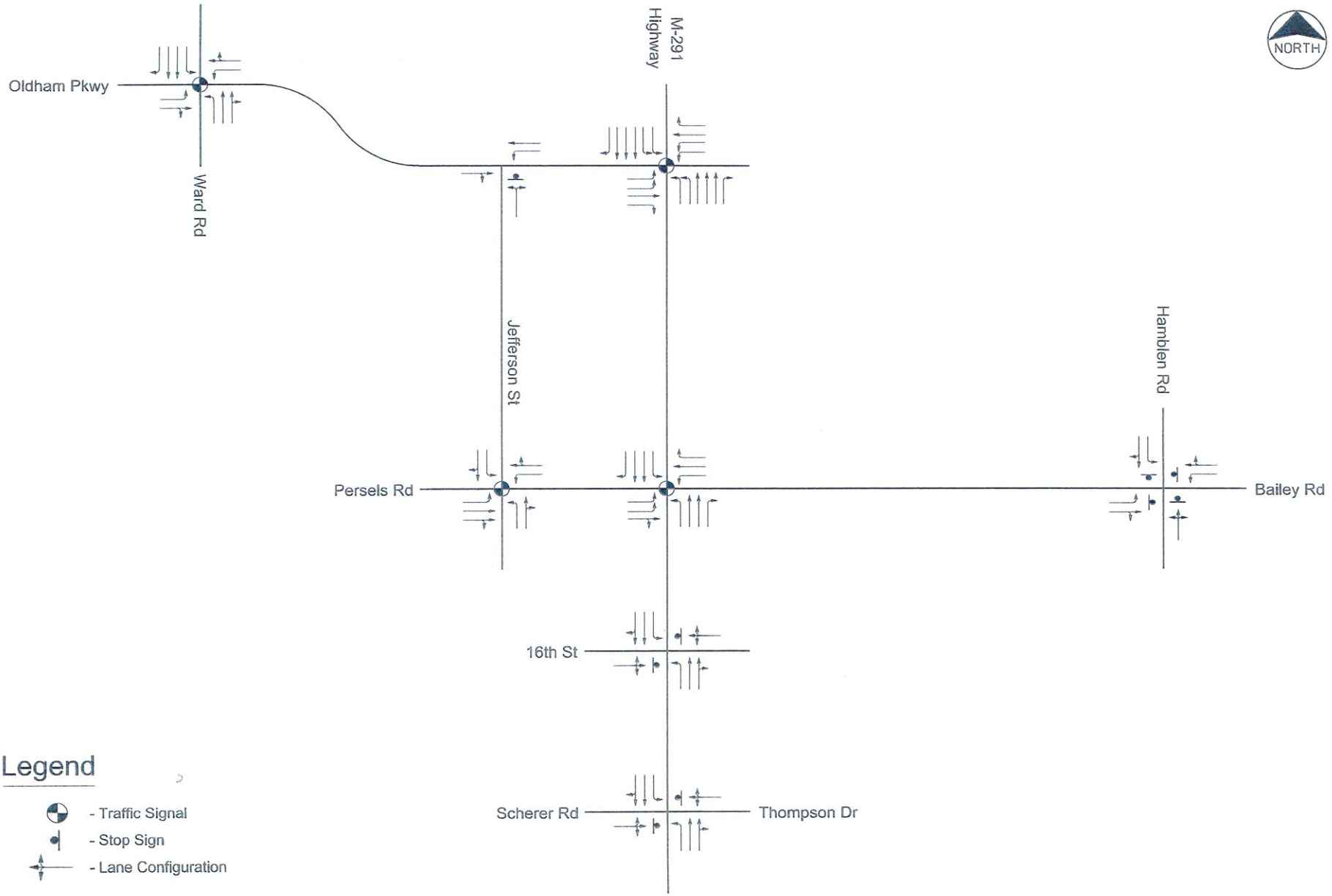
To achieve acceptable operations and minimize queue lengths along the M-291 corridor, consider widening M-291 Highway to include three through lanes for northbound and for southbound traffic through the intersection with Persels Road / Bailey Road.

Appendix A - Figures

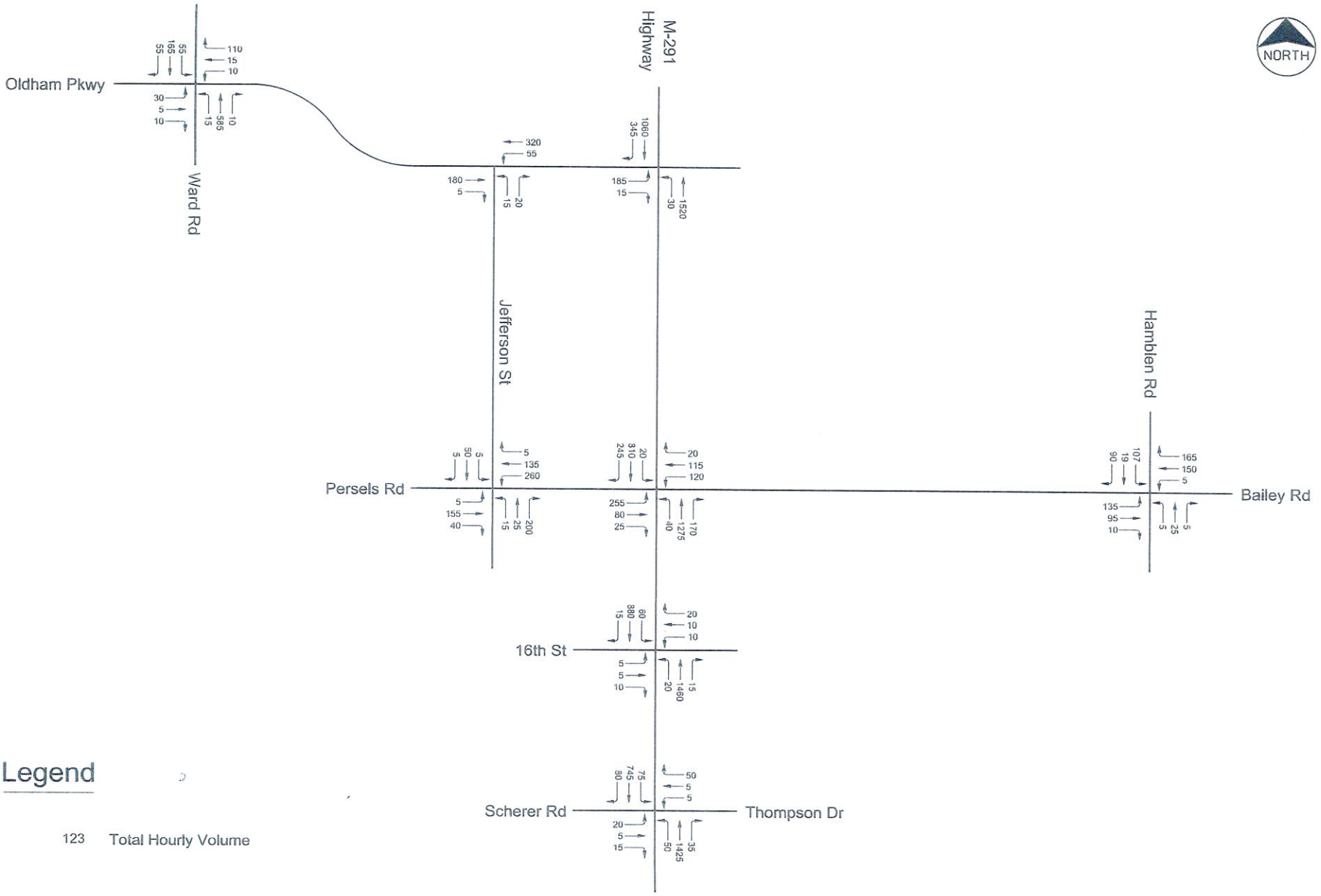


TranSystems	LOCATION MAP	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-1

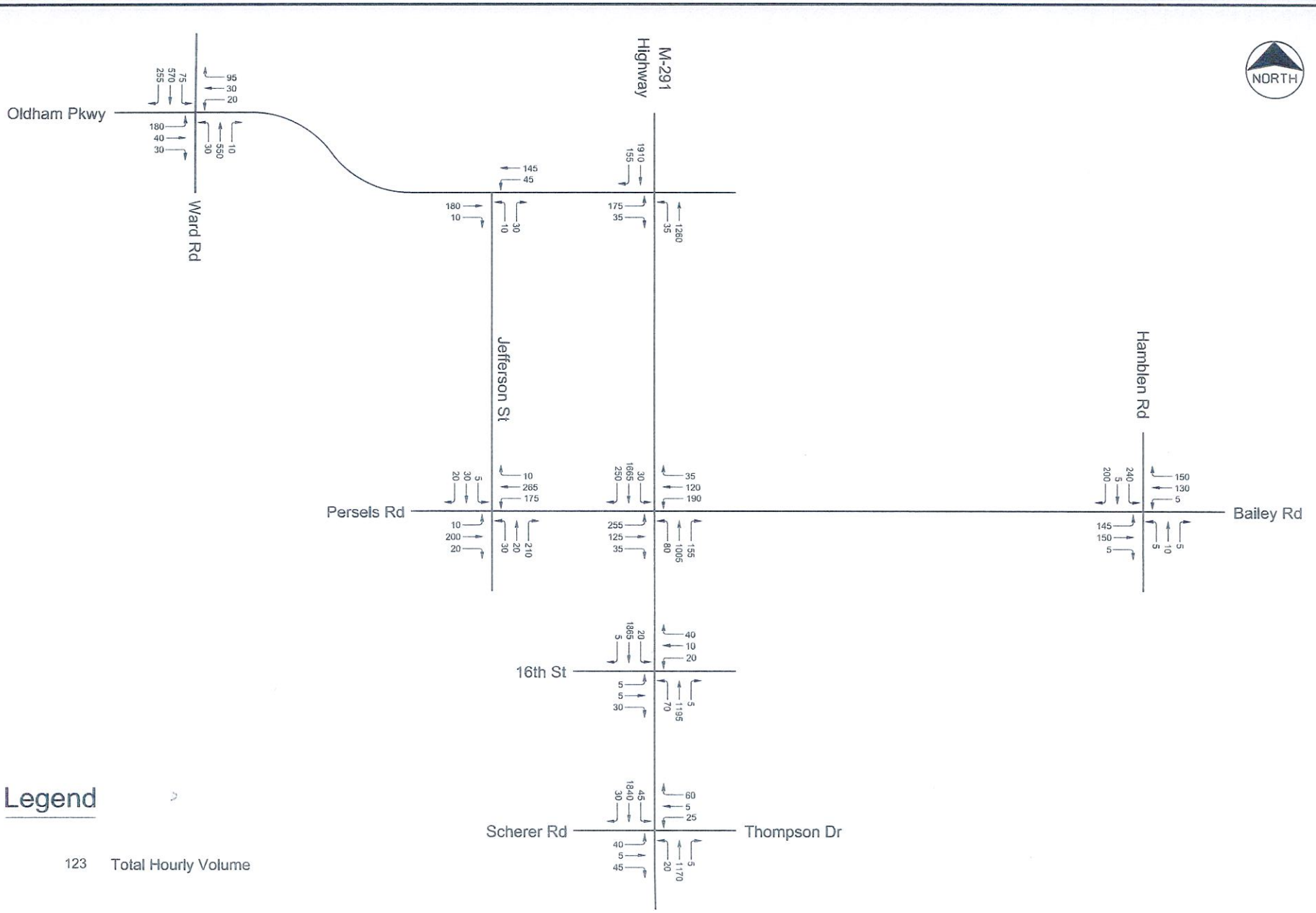
TranSystems	SITE PLAN	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-2



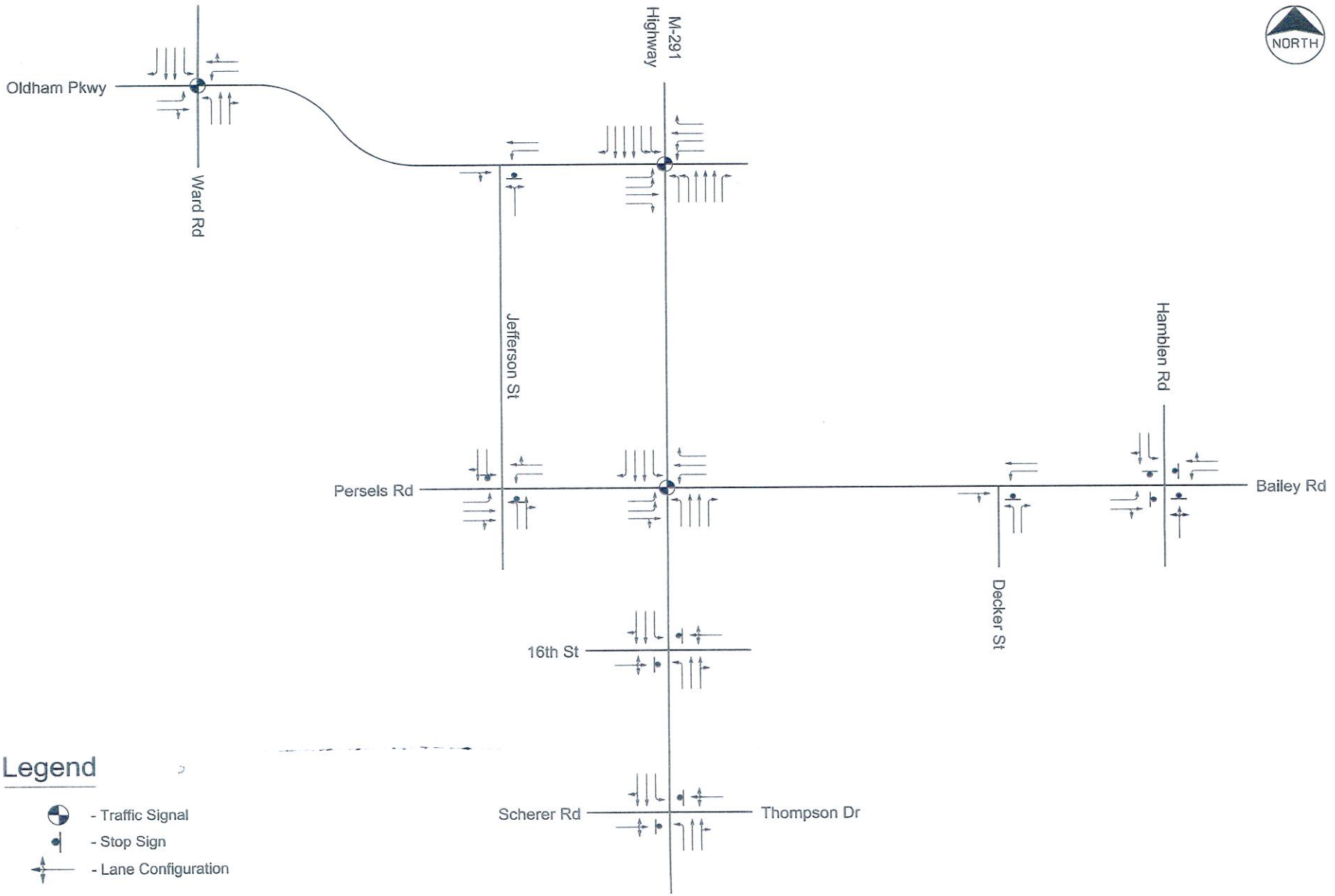
TranSystems	EXISTING LANE CONFIGURATIONS	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-3



TranSystems	EXISTING A.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-4



TranSystems	EXISTING P.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-5



TranSystems

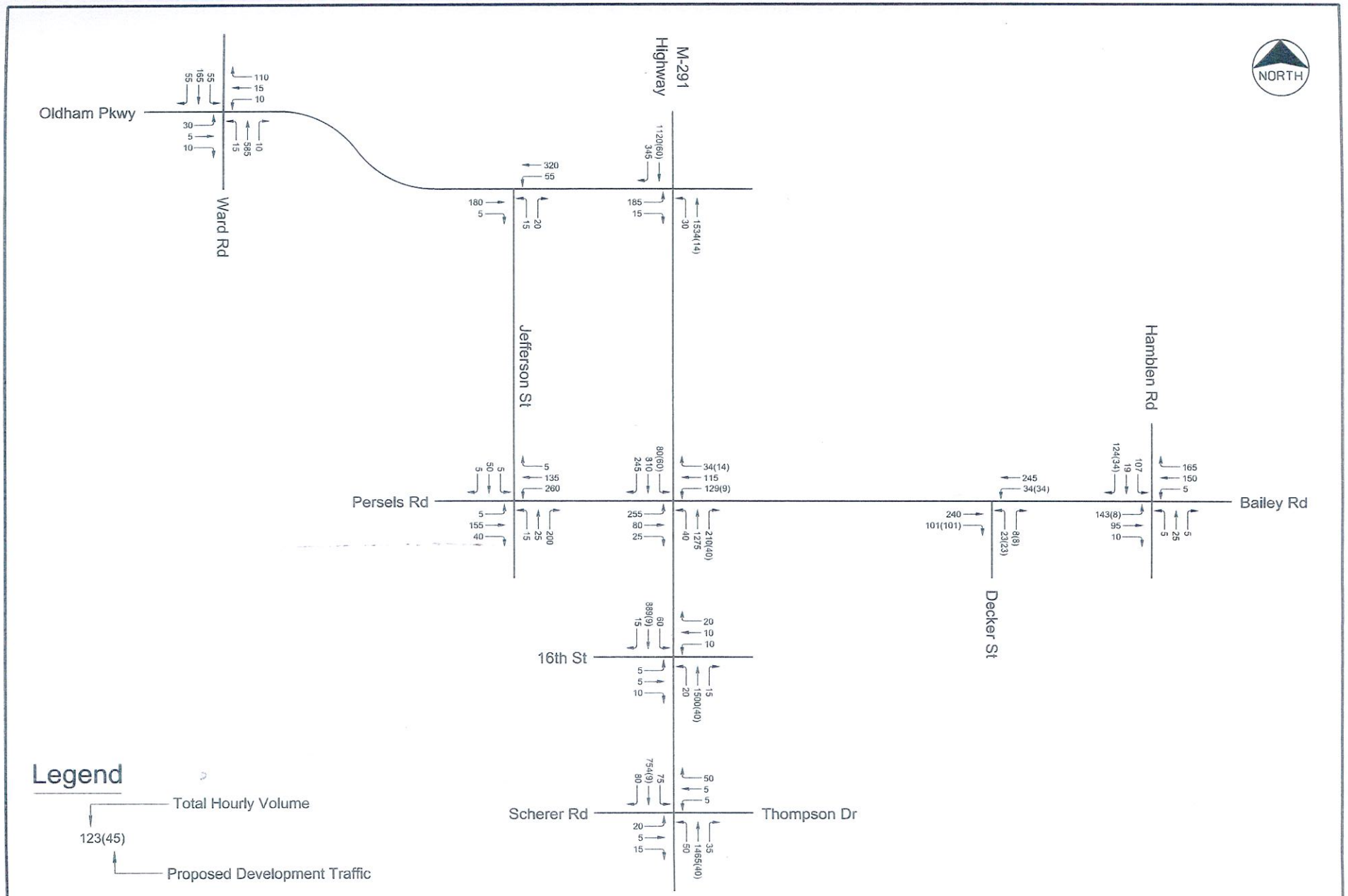
EXISTING PLUS PHASE 1A DEVELOPMENT
LANE CONFIGURATIONS

The Grove
Traffic Impact Study
Lee's Summit, Missouri

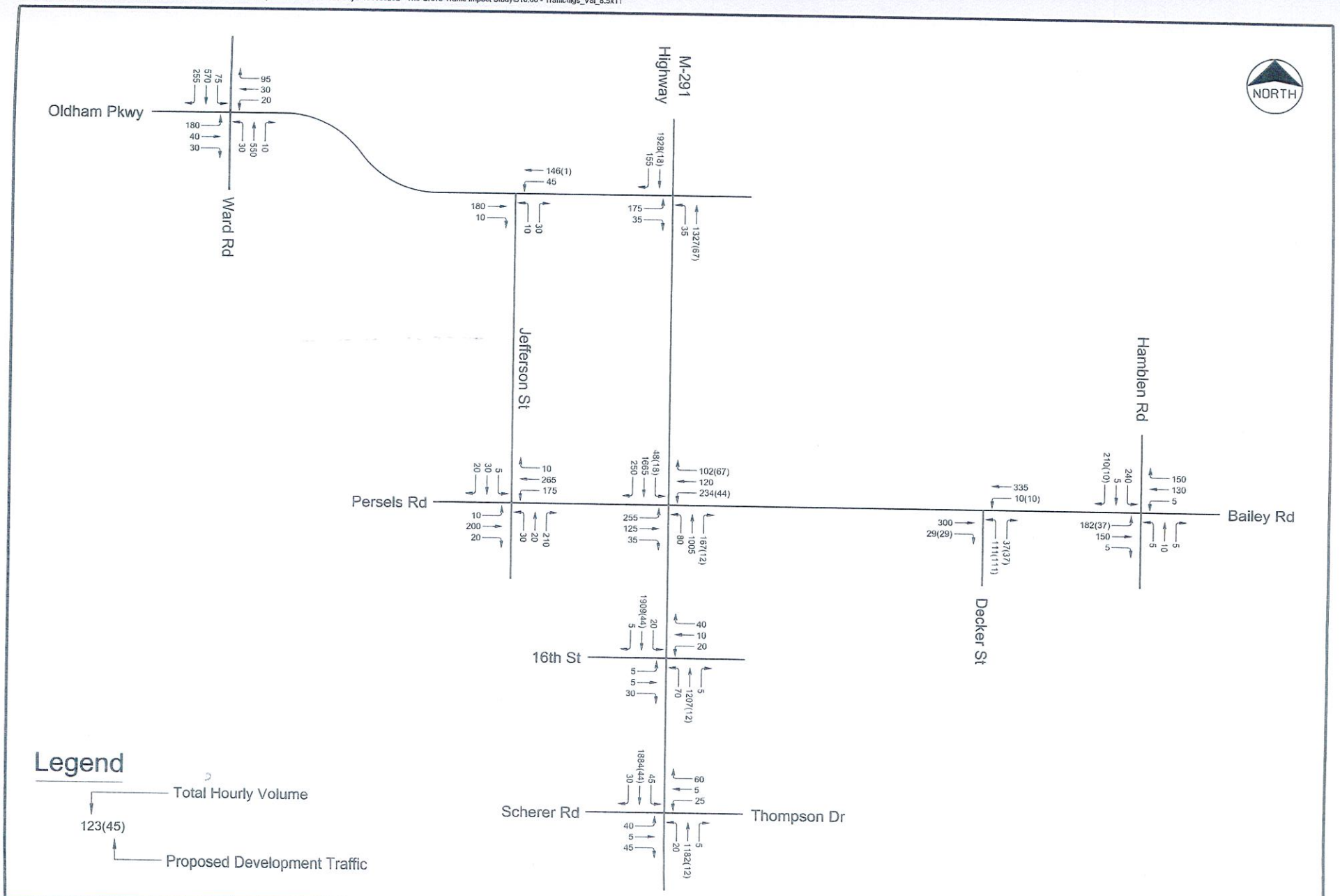
August 2016

No Scale

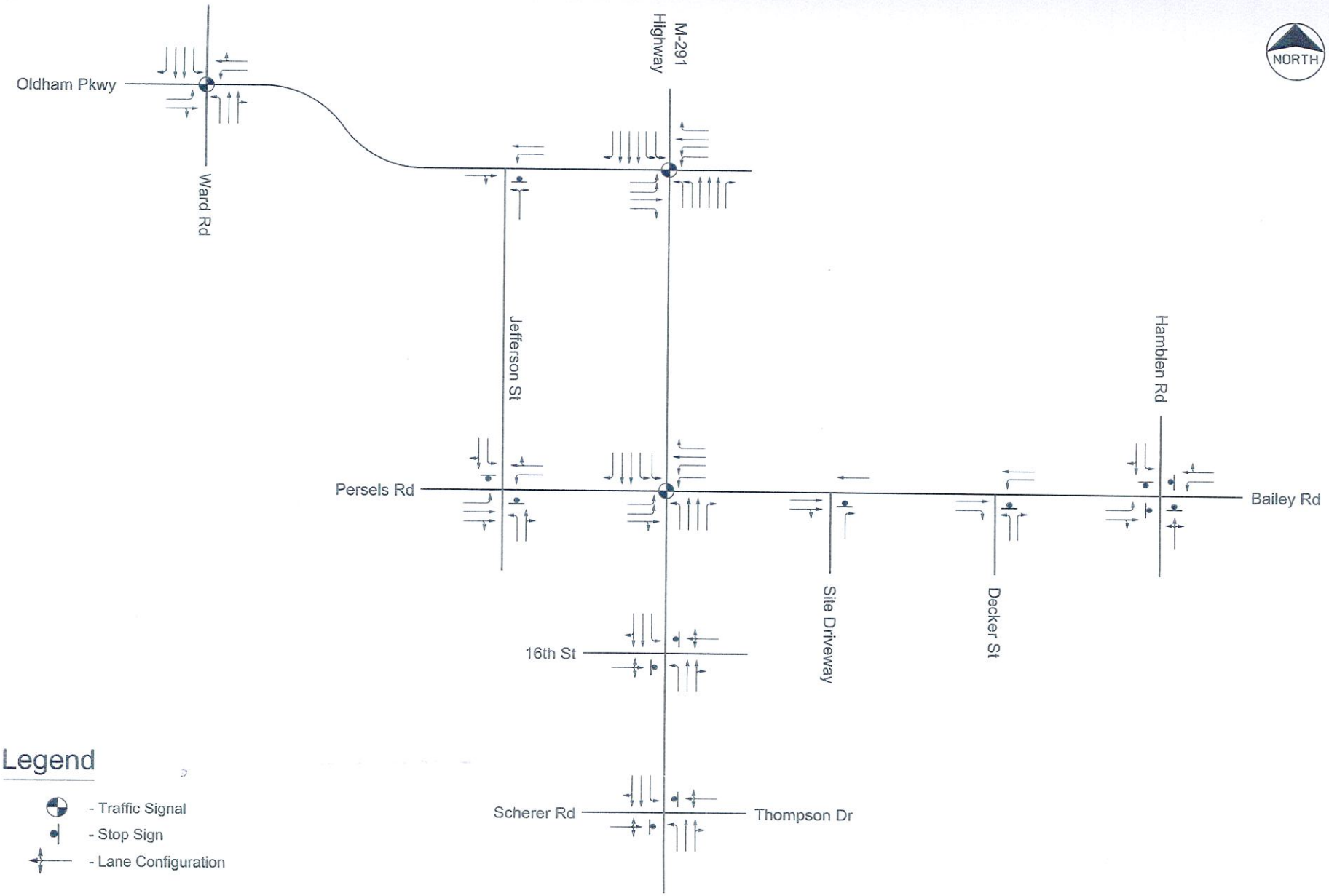
Figure A-6



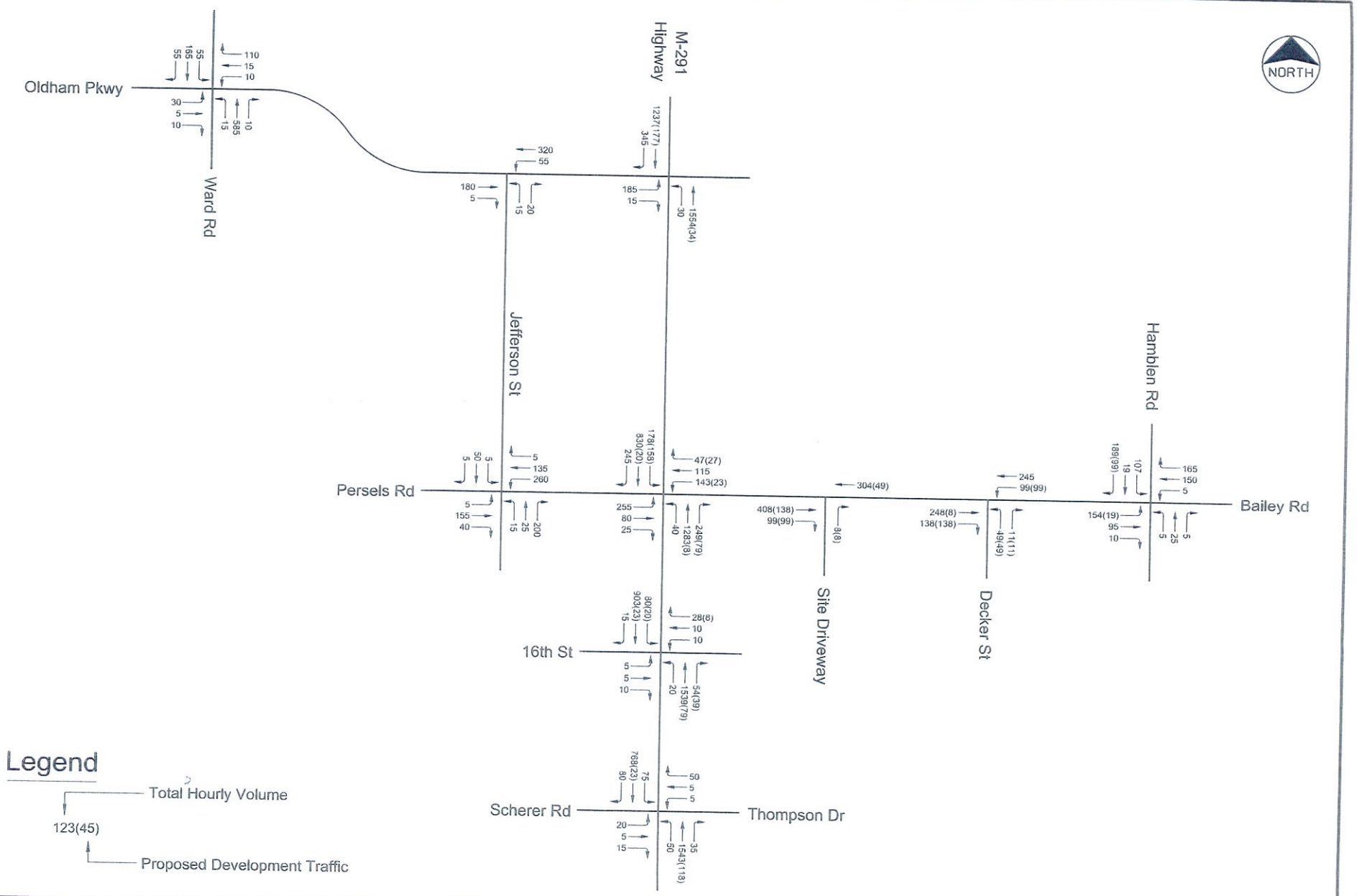
TranSystems	EXISTING PLUS PHASE 1A DEVELOPMENT A.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-7



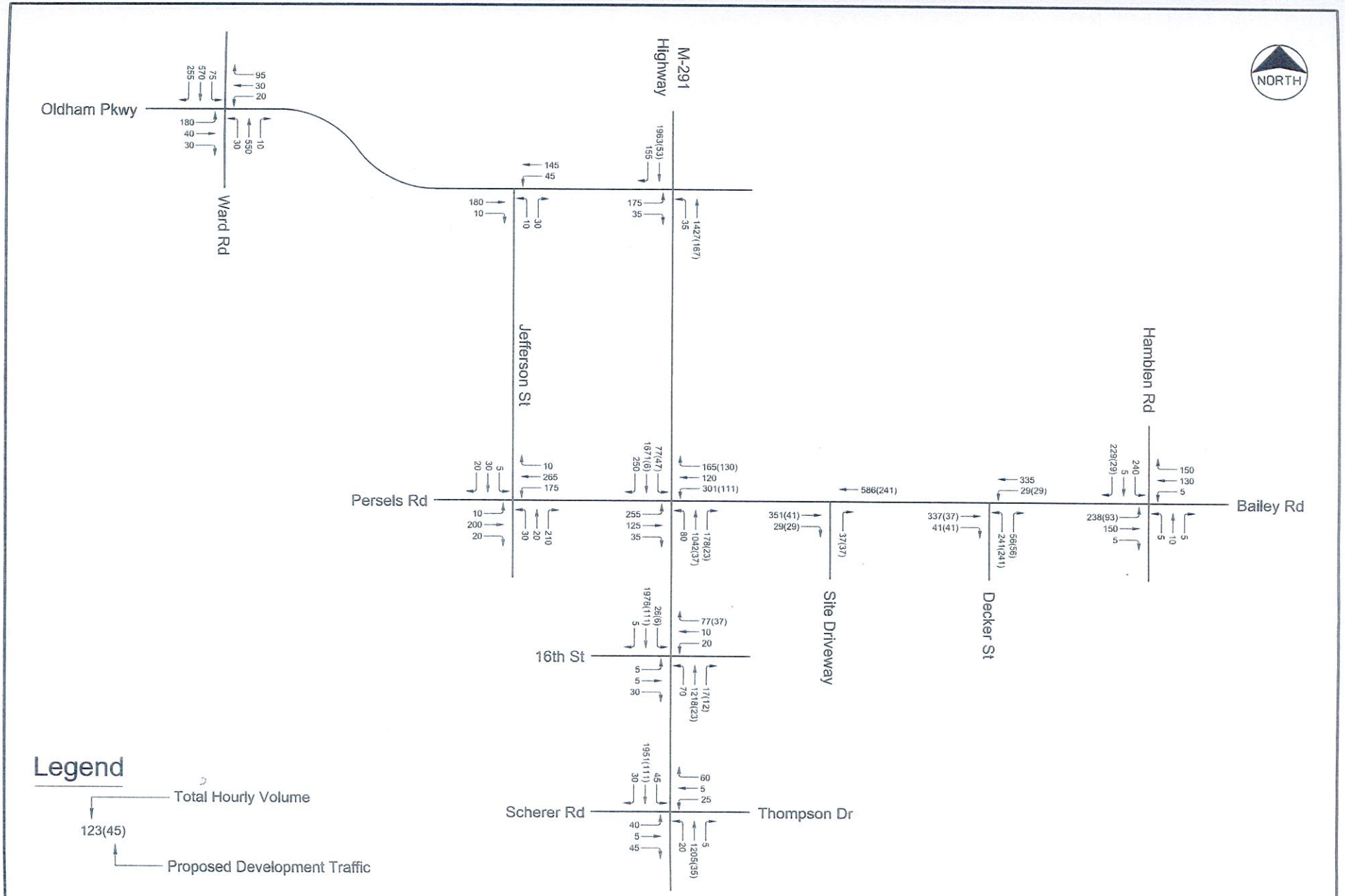
TranSystems	EXISTING PLUS PHASE 1A DEVELOPMENT P.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-8



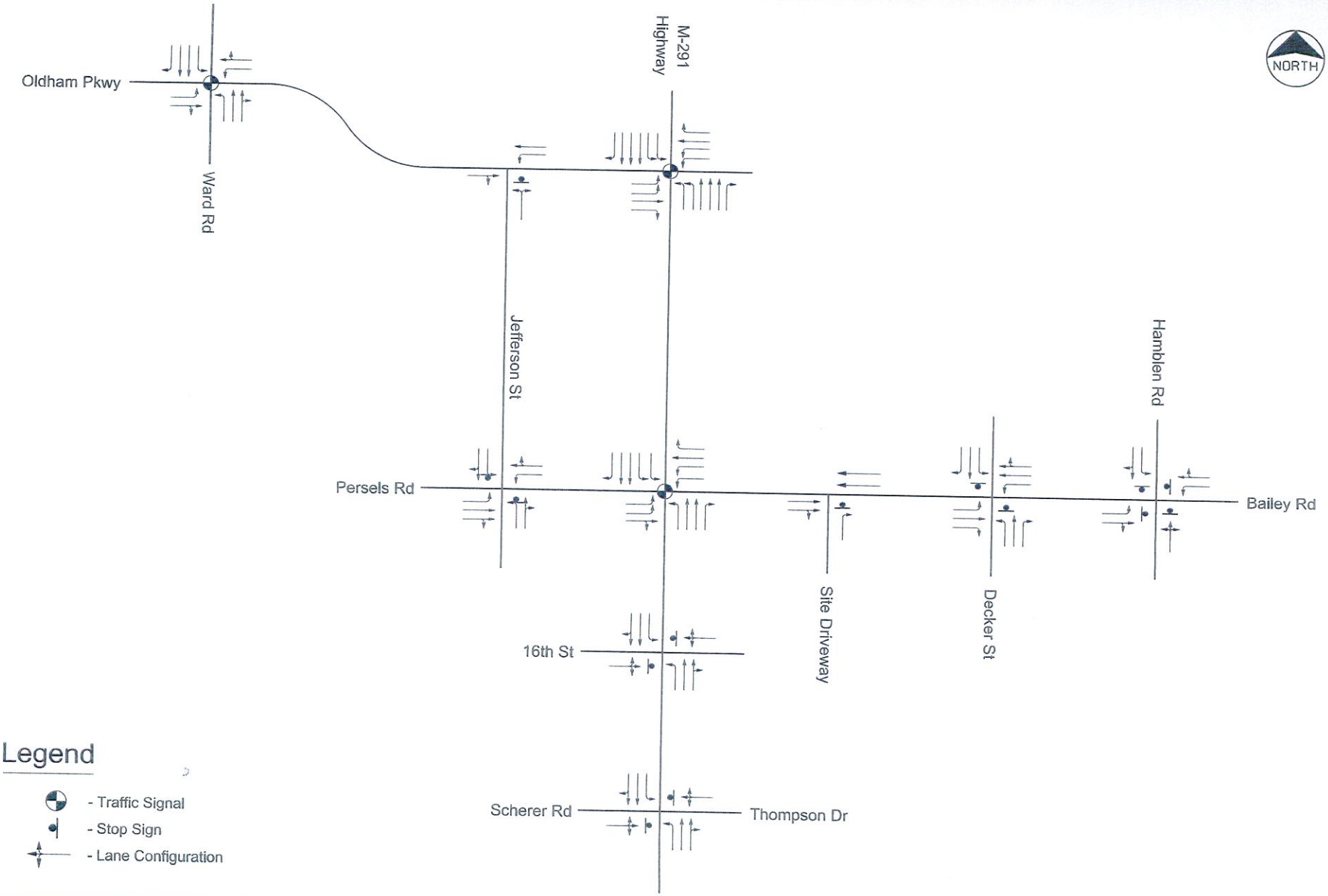
TranSystems	EXISTING PLUS PHASE 1A & 1B DEVELOPMENT LANE CONFIGURATIONS	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 / No Scale	Figure A-9



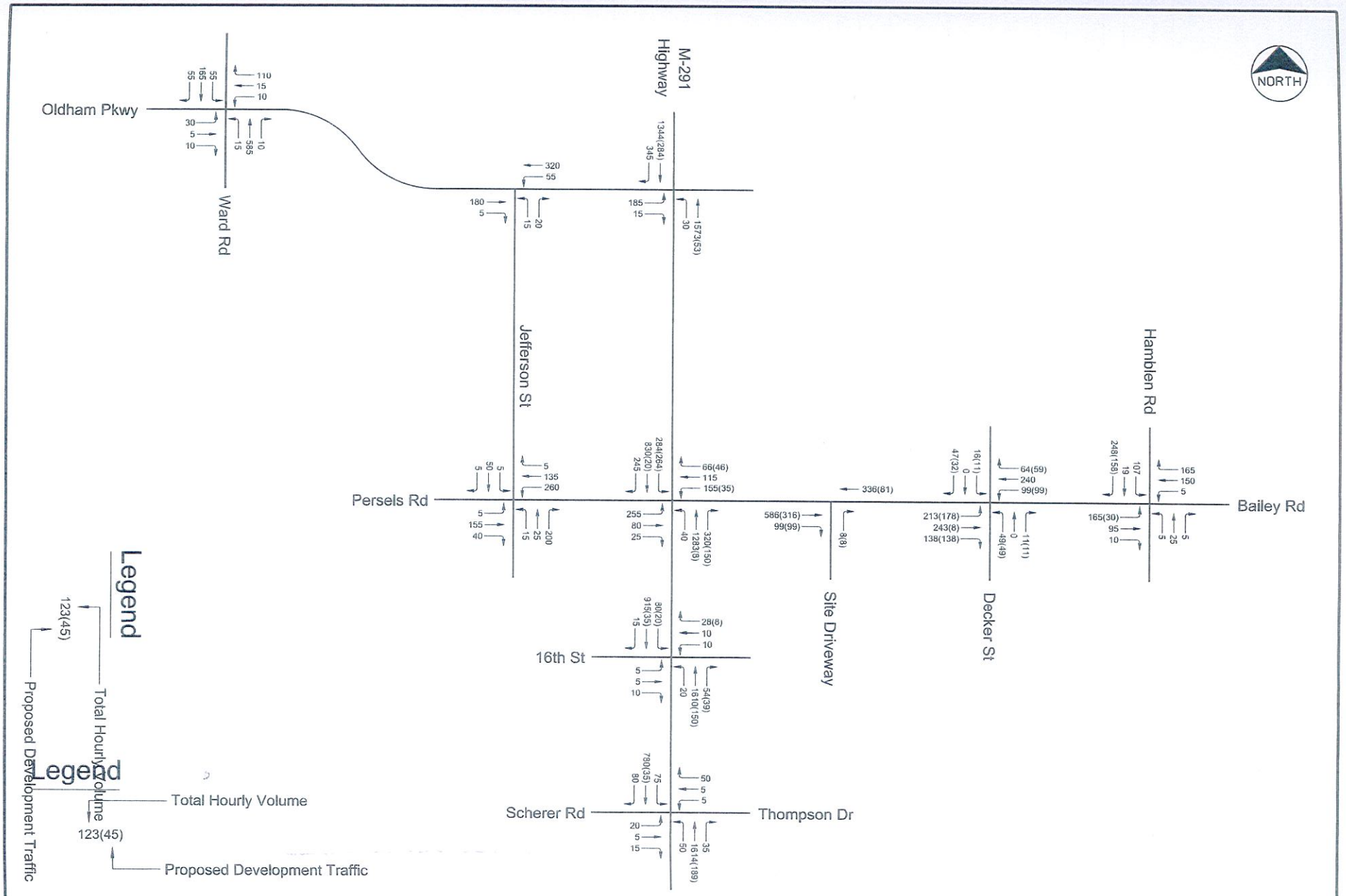
TranSystems	EXISTING PLUS PHASE 1A & 1B DEVELOPMENT A.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-10



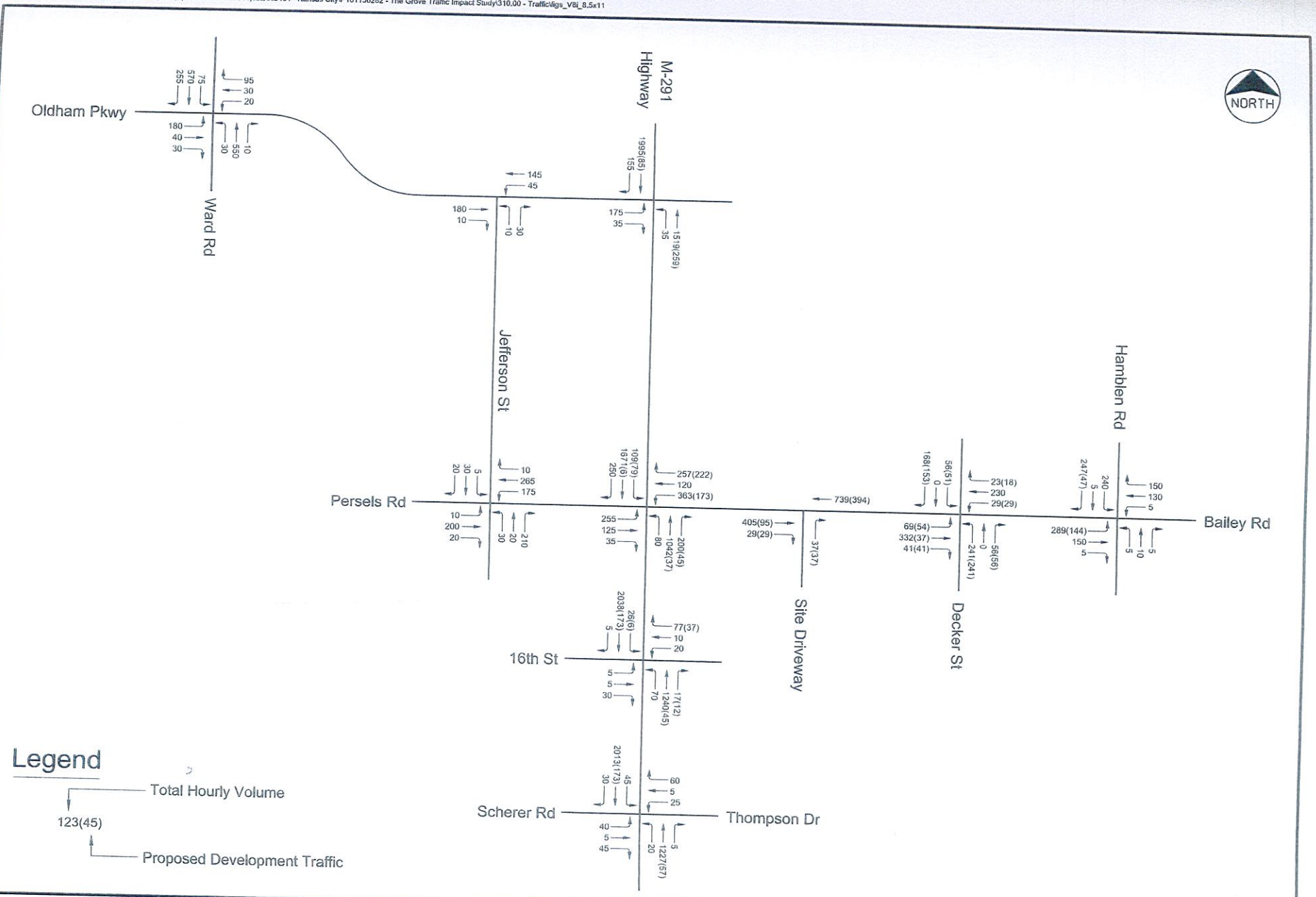
TranSystems	EXISTING PLUS PHASE 1A & 1B DEVELOPMENT P.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-11



TranSystems	EXISTING PLUS PHASE 2 DEVELOPMENT LANE CONFIGURATIONS	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 / No Scale	Figure A-12



TranSystems	EXISTING PLUS PHASE 2 DEVELOPMENT A.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-13



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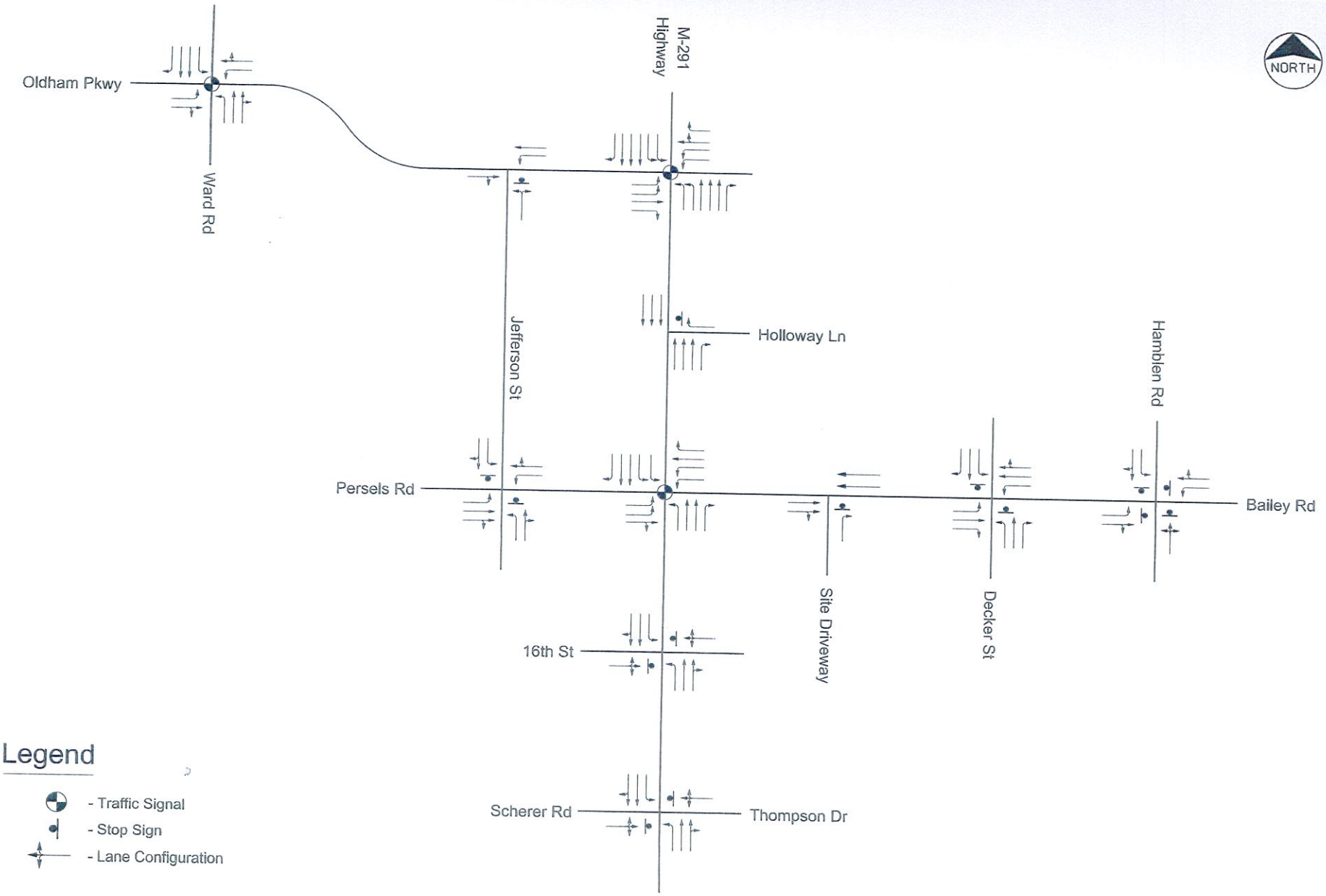


TranSystems

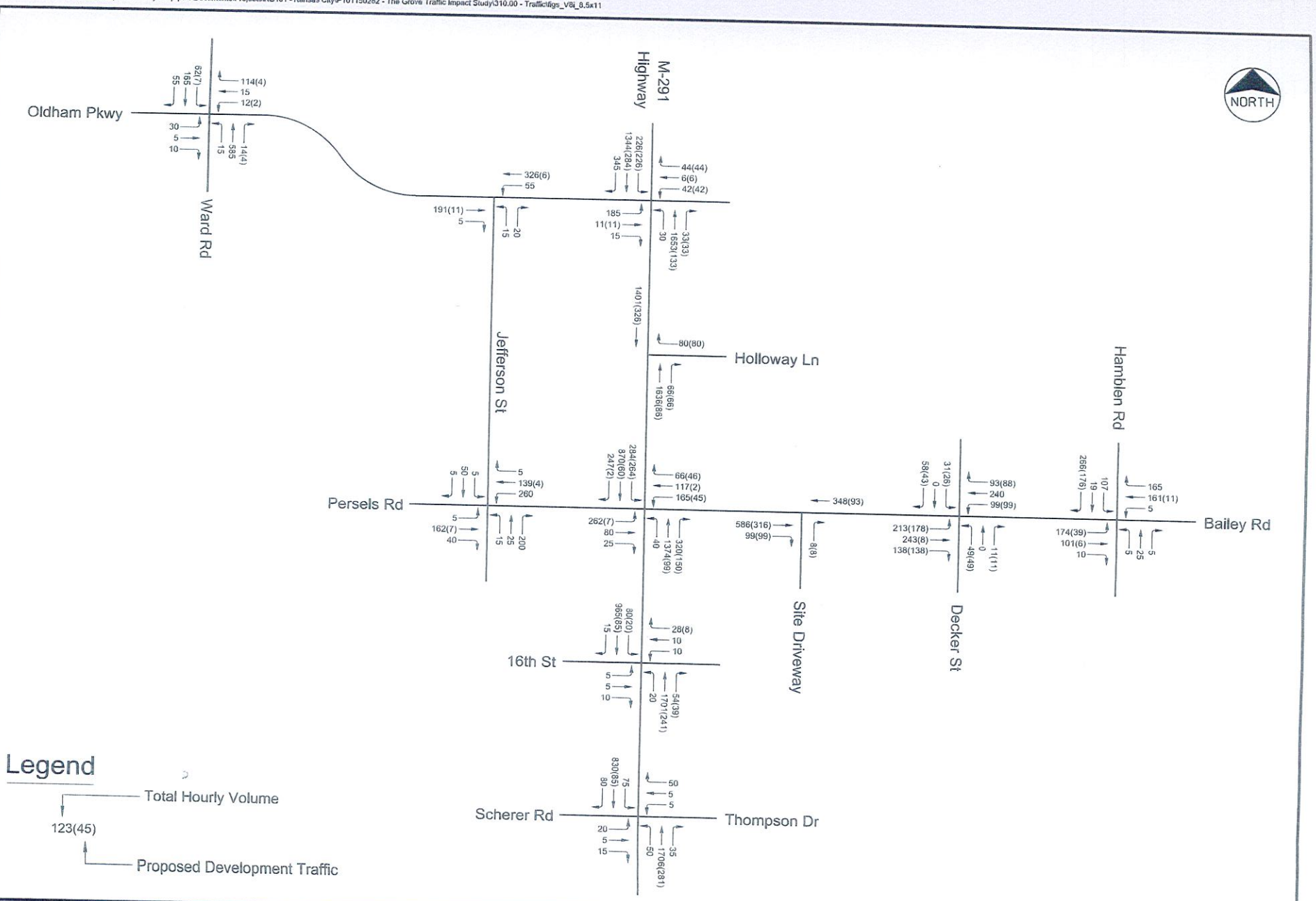
EXISTING PLUS PHASE 3 DEVELOPMENT
LANE CONFIGURATIONS

The Grove
Traffic Impact Study
Lee's Summit, Missouri

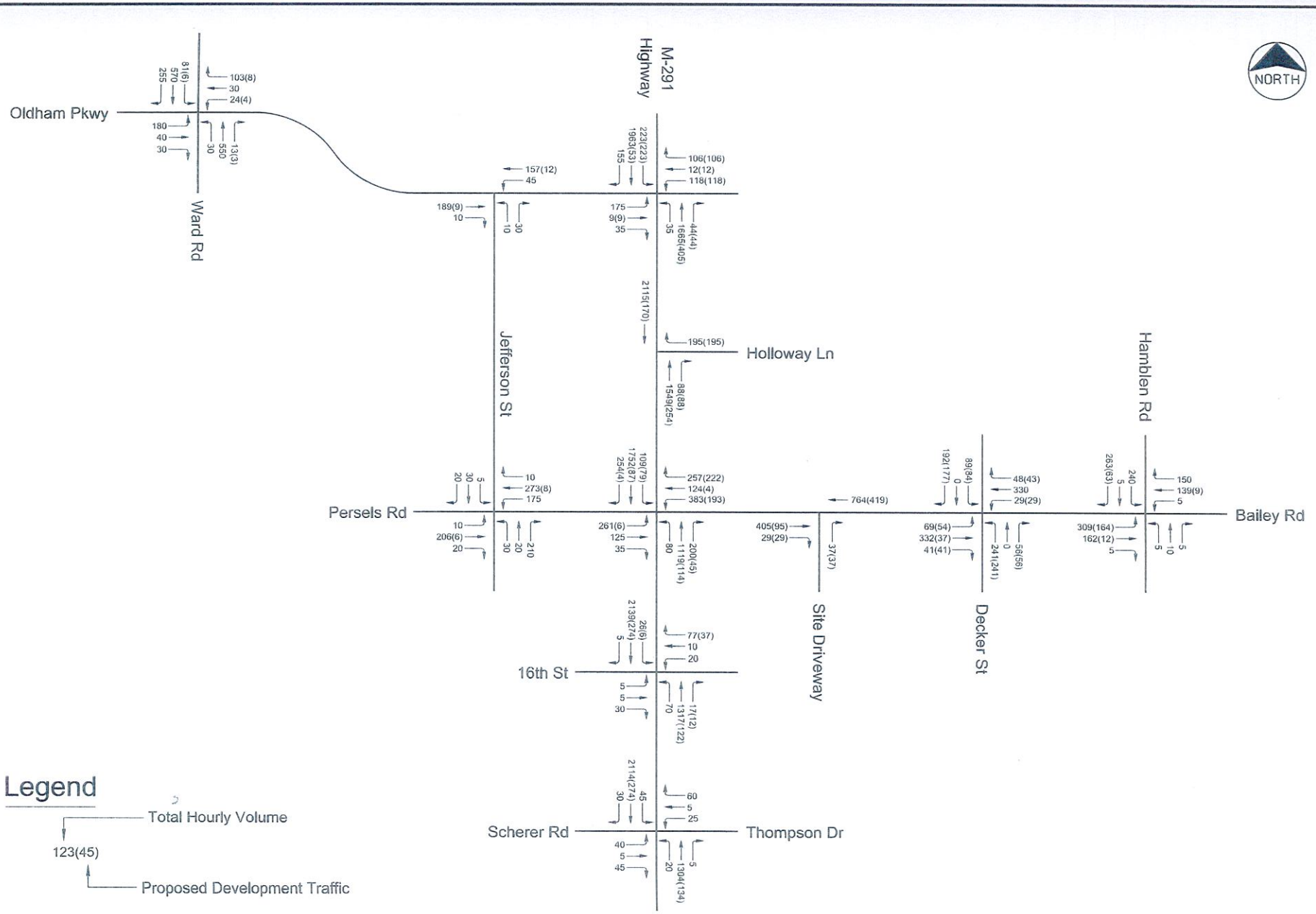
August 2016

No Scale

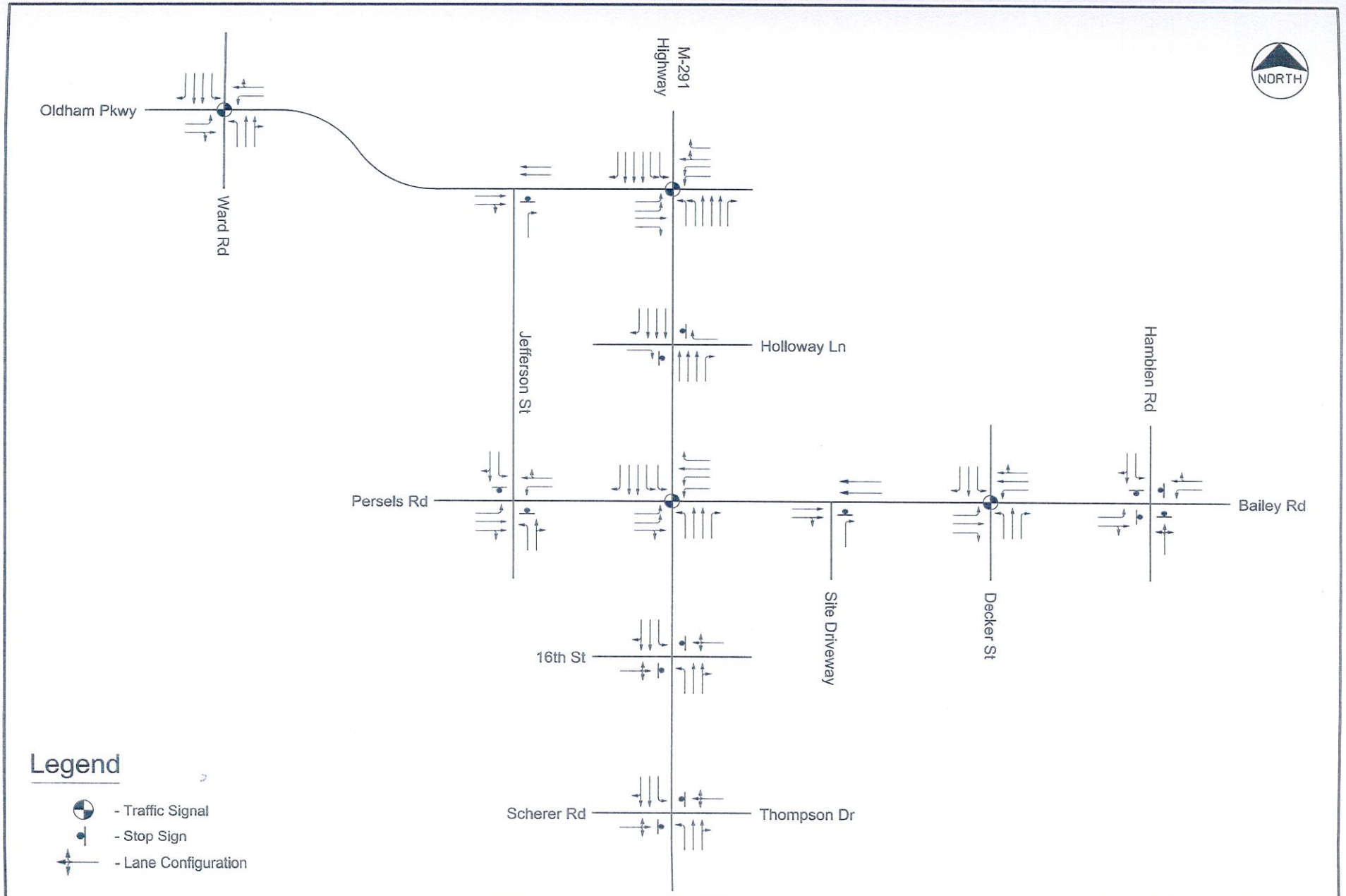
Figure A-15



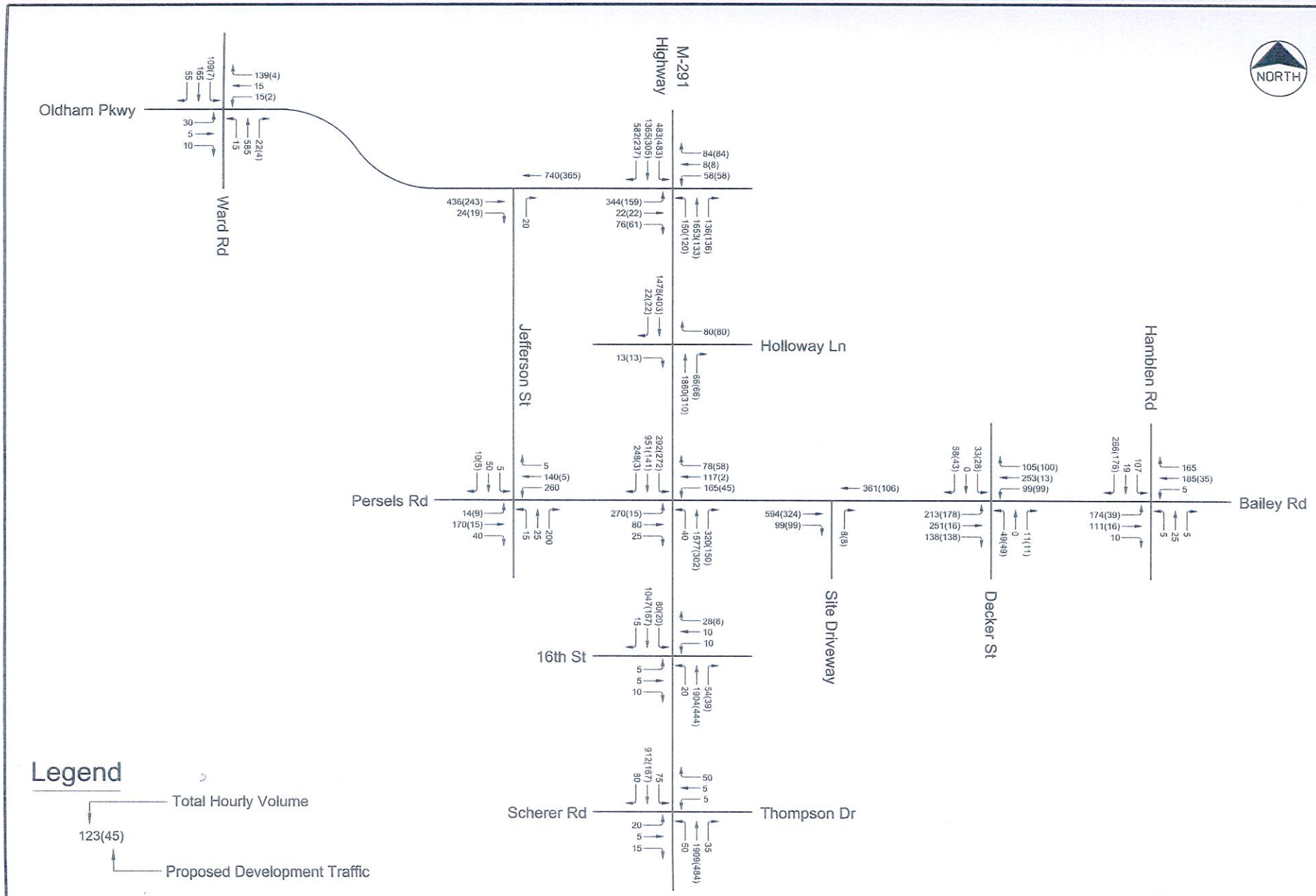
TranSystems	EXISTING PLUS PHASE 3 DEVELOPMENT A.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-16



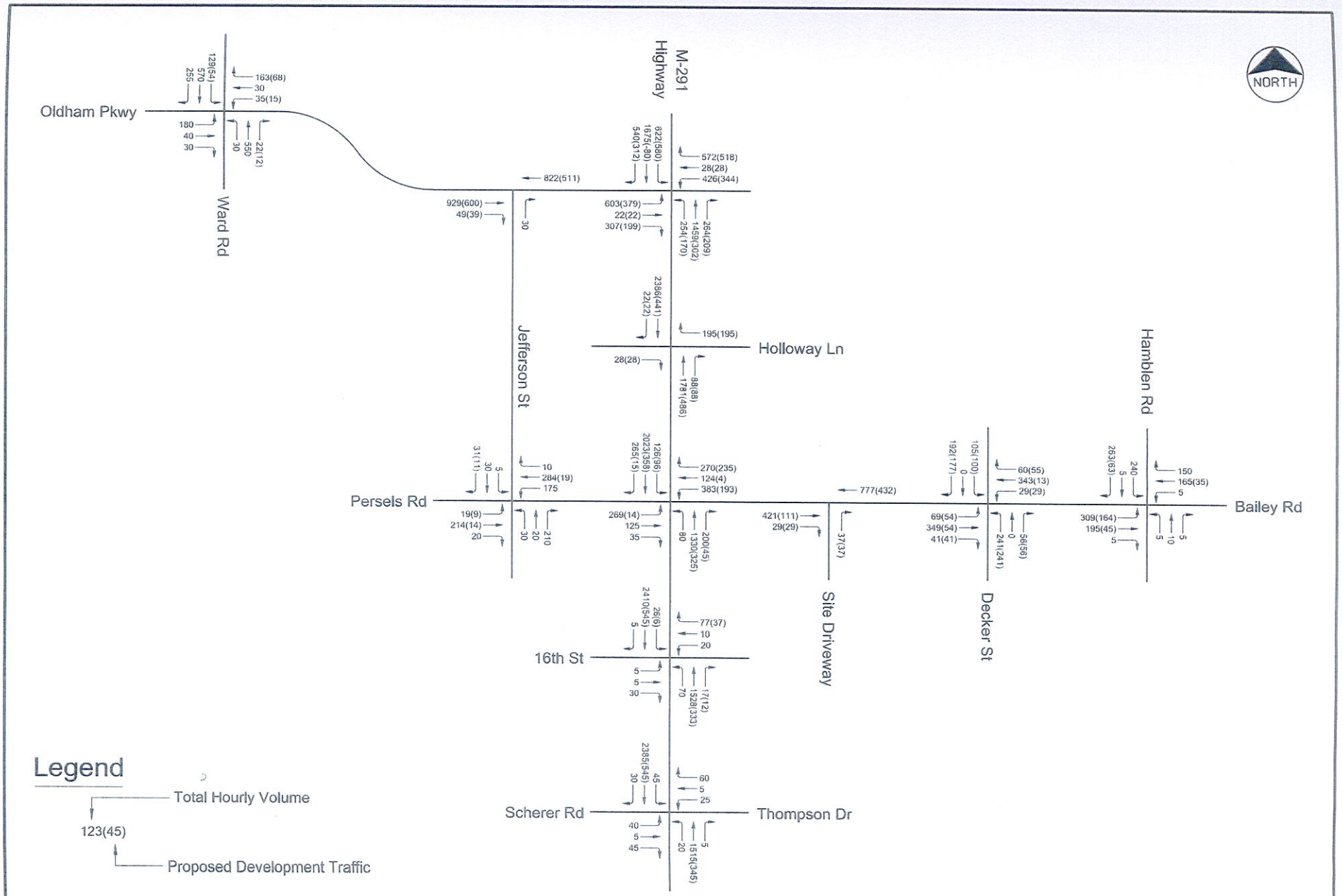
TranSystems	EXISTING PLUS PHASE 3 DEVELOPMENT P.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-17



TranSystems	EXISTING PLUS PHASE 4 DEVELOPMENT LANE CONFIGURATIONS	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 / No Scale	Figure A-18



TranSystems	EXISTING PLUS PHASE 4 DEVELOPMENT A.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale
			Figure A-19



TranSystems	EXISTING PLUS PHASE 4 DEVELOPMENT P.M. PEAK HOUR TRAFFIC VOLUMES	The Grove Traffic Impact Study Lee's Summit, Missouri	August 2016 No Scale	Figure A-20

Appendix B – Trip Generation and Distribution

See attached worksheets.

The Grove TIS
Lee's Summit, Missouri
Trip Generation

PHASE 1A

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
Industrial Park	200,000 sf	130	1,677	164	82%	18%	134	30	187	21%	79%	39	148
Total Phase 1A Development Trips			*1,677*	*164*			*134*	*30*	*187*			*39*	*148*

PHASE 1B

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
Business Park	220,000 sf	770	3,052	306	85%	15%	260	46	301	26%	74%	78	223
Total Phase 1A & 1B Development Trips			*3,052*	*306*			*260*	*46*	*301*			*78*	*223*

PHASE 2

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
Business Park	200,000 sf	770	2,840	279	85%	15%	237	42	276	26%	74%	72	204
Total Phase 2 Development Trips			*2,840*	*279*			*237*	*42*	*276*			*72*	*204*

PHASE 3

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
General Office	120,100 sf	710	1,509	222	88%	12%	195	27	213	17%	83%	36	177
Shopping Center	100,050 sf	820	6,793	156	62%	38%	133	23	600	48%	52%	288	312
Apartments	370 du	220	2,366	186	20%	80%	37	149	222	65%	35%	144	78
Subtotal Phase 3 Development Trips			*10,668*	*564*			*365*	*199*	*1,035*			*468*	*567*
Internal Proposed Trips			---	---			---	---	*158*			*79*	*79*
External Proposed Trips			---	*564*			*365*	199	*877*			*389*	*488*
Pass-By Proposed Trips (33% of External Retail Trips)			---	---			---	---	*162*			*81*	*81*
Total Non Pass-By External Phase 3 Development Trips			*10,668*	*564*			*365*	*199*	*715*			*308*	*407*

PHASE 4A (Calmar)

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
Theater	44,100 sf	444	3,442	10	94%	6%	9	2	168	64%	36%	108	60
General Office	113,900 sf	710	1,449	213	88%	12%	187	26	207	17%	83%	35	172
Shopping Center	177,200 sf	820	9,850	221	62%	38%	188	33	879	48%	52%	422	457
Subtotal Phase 4A Development Trips			*14,741*	*444*			*383*	*61*	*1,254*			*565*	*689*
Internal Proposed Trips			---	---			---	---	*38*			*19*	*19*
External Proposed Trips			---	*444*			*383*	61	*1,216*			*546*	*670*
Pass-By Proposed Trips (33% of External Retail Trips)			---	---			---	---	*274*			*137*	*137*
Total Non Pass-By External Phase 4A Development Trips			*14,741*	*444*			*383*	*61*	*942*			*409*	*533*

PHASE 4B (Adessa)

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
Shopping Center	165,700 sf	820	9,430	213	62%	38%	132	81	841	48%	52%	404	437
General Office	105,800 sf	710	1,370	201	88%	12%	177	24	197	17%	83%	33	164
Hotel	270 rm	310	2,043	144	59%	41%	85	59	162	51%	49%	83	79
Assisted Living	100 bed	254	293	18	68%	32%	12	6	29	50%	50%	15	14
Senior Adult Housing - Attached	16 du	252	68	4	34%	66%	1	3	6	54%	46%	3	3
Apartments	229 du	220	1,511	116	20%	80%	23	93	144	65%	35%	94	50
Subtotal Phase 4B Development Trips			*14,715*	*696*			*430*	*266*	*1,379*			*632*	*747*
Internal Proposed Trips			---	---			---	---	*150*			*75*	*75*
External Proposed Trips			---	*696*			*430*	266	*1,229*			*557*	*672*
Pass-By Proposed Trips (33% of External Retail Trips)			---	---			---	---	*242*			*121*	*121*
Total Non Pass-By External Phase 4B Development Trips			*14,715*	*696*			*430*	*266*	*987*			*436*	*551*
TOTAL OF ALL NON-PASSBY EXTERNAL DEVELOPMENT TRIPS			*47,693*	*2,453*			*1,809*	*644*	*3,408*			*1,342*	*2,066*

Notes -

- Trip generation estimates were developed using ITE's Trip Generation, 9th Edition.

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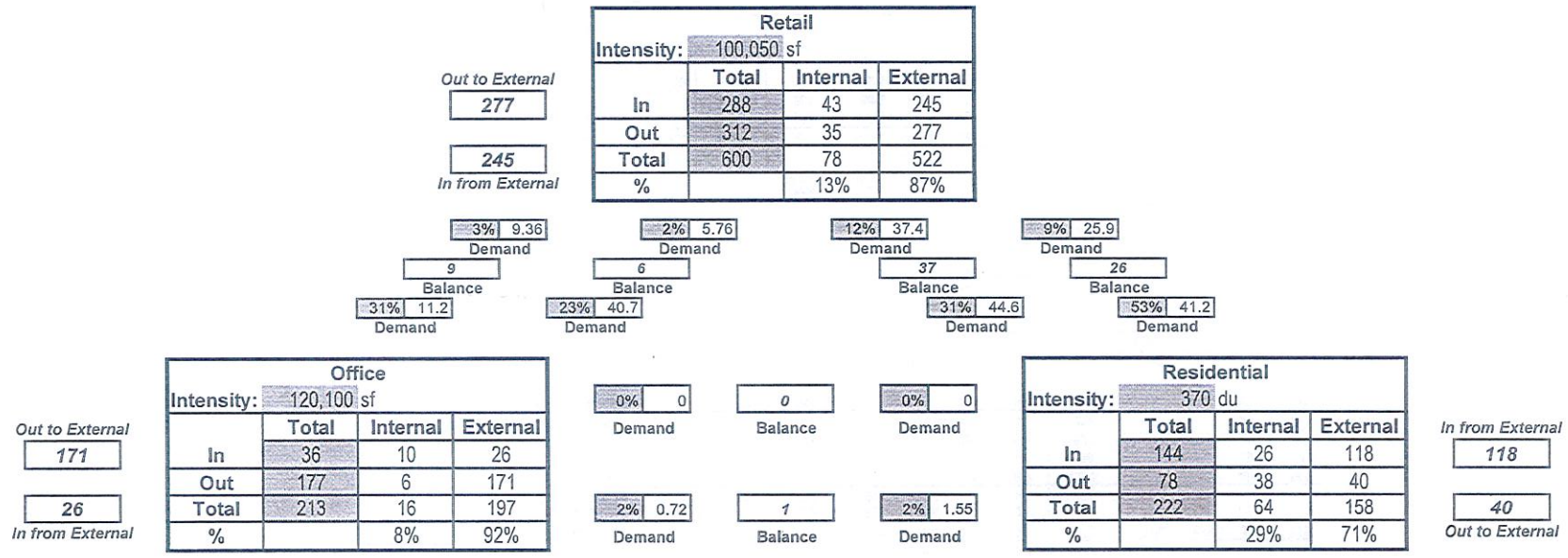
The Grove TIS
Lee's Summit, Missouri

Internal Trip Capture for Multi-Use Development
P.M. Peak Hour - Phase 3 Area



Net External Trips for Multi-Use Development				
	Retail	Office	Residential	Total
Inbound	245	26	118	389
Outbound	277	171	40	488
Total	*522*	*197*	*158*	*877*
Single-Use Trip Gen Estimate	*600*	*213*	*222*	*1035*
Reduction in External Trips	*13%*	*8%*	*29%*	*15.3%*

The Grove TIS
Lee's Summit, Missouri

Internal Trip Capture for Multi-Use Development
P.M. Peak Hour - Phase 4A Area

Retail — Intensity: 177,200 sf

	Total	Internal	External
In	422	8	414
Out	457	11	446
Total	879	19	860
%		2%	98%

Out to External: 446

In from External: 414

3% 13.7 Demand → 11 Balance

2% 8.44 Demand → 8 Balance

12% 54.8 Demand → 0 Balance

9% 38 Demand → 0 Balance

31% 10.9 Demand

23% 39.6 Demand

31% 0 Demand

53% 0 Demand

Office — Intensity: 113,900 sf

	Total	Internal	External
In	35	11	24
Out	172	8	164
Total	207	19	188
%		9%	91%

Out to External: 164

In from External: 24

0% 0 Demand → 0 Balance

0% 0 Demand

2% 0.7 Demand → 0 Balance

2% 0 Demand

Residential — Intensity: 0 du

	Total	Internal	External
In	0	0	0
Out	0	0	0
Total	0	0	0
%		0%	0%

In from External: 0

Out to External: 0

Net External Trips for Multi-Use Development

	Retail	Office	Residential	Total
Inbound	414	24	0	438
Outbound	446	164	0	610
Total	*860*	*188*	*0*	*1048*
Single-Use Trip Gen Estimate	*879*	*207*	*0*	*1086*
Reduction in External Trips	*2%*	*9%*	*0%*	*3.5%*

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The Grove TIS
Lee's Summit, Missouri

Internal Trip Capture for Multi-Use Development
P.M. Peak Hour - Phase 4B Area

Retail — Intensity: 165,700 sf

	Total	Internal	External
In	404	37	367
Out	437	37	400
Total	841	74	767
%		9%	91%

Out to External: 400

In from External: 367

3% 13.1 Demand	2% 8.08 Demand	12% 52.4 Demand	9% 36.4 Demand
10 Balance	8 Balance	29 Balance	27 Balance
31% 10.2 Demand	23% 37.7 Demand	31% 29 Demand	53% 26.7 Demand

Office — Intensity: 105,800 sf

	Total	Internal	External
In	33	11	22
Out	164	8	156
Total	197	19	178
%		10%	90%

Out to External: 156

In from External: 22

0% 0 Demand — 0 Balance — 0% 0 Demand

2% 0.66 Demand — 1 Balance — 2% 1.01 Demand

Residential — Intensity: 229 du

	Total	Internal	External
In	94	27	67
Out	50	30	20
Total	144	57	87
%		40%	60%

In from External: 67

Out to External: 20

Net External Trips for Multi-Use Development

	Retail	Office	Residential	Total
Inbound	367	22	67	456
Outbound	400	156	20	576
Total	*767*	*178*	*87*	*1032*
Single-Use Trip Gen Estimate	*841*	*197*	*144*	*1182*
Reduction in External Trips	*9%*	*10%*	*40%*	*12.7%*