Point of Access Study
For
ROUTE 283/CLOVERLEAF ROAD INTERCHANGE IMPROVEMENTS

Mount Joy Township
Lancaster County, PA

Prepared For:

Commonwealth of Pennsylvania
Department of Transportation

PENNDOT

Prepared By:

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October 31, 2006
TPD # MJTO.A.00002

POINT OF ACCESS STUDY
for
ROUTE 283/CLOVERLEAF ROAD
INTERCHANGE IMPROVEMENTS
MOUNT JOY TOWNSHIP
LANCASTER COUNTY, PENNSYLVANIA

For Submission To
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

TPD # MJTO.A.00002
October 31, 2006

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Respectfully submitted,
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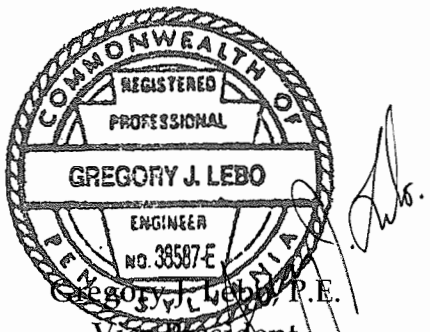

Gregory J. Lebo, P.E.
Vice President
Pennsylvania P.E. No. 038587-E

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I. EXECUTIVE SUMMARY

A. Project Background and Purpose

Considering the projected residential and commercial land development expected to occur in the area surrounding the Route 283/Cloverleaf Road interchange in Mount Joy Township, Lancaster County, this point of access study has been prepared to identify alternatives to help relieve traffic congestion in the project area.

Mount Joy Township enacted a traffic impact fee ordinance in June 2004, in compliance with the requirements of the Municipal Planning Code (MPC). As part of the impact fee process, a Roadway Sufficiency Analysis Report (RSA) and Capital Improvements Plan (CIP) were prepared. Both of these documents identify traffic operational deficiencies at the Route 283/Cloverleaf Road interchange under existing conditions, which will worsen with the projected development in the area surrounding the interchange. The RSA and CIP identified improvements to the interchange which would allow all movements to operate at the Township's preferred level of service. In order to implement improvements to the interchange which will result in changes to the existing access and possibly new access(es), a point of access study is required. This study has been prepared in accordance with point of access study requirements contained in PennDOT Publication 10A: Design Manual 1A Transportation Engineering Procedures.

The existing Route 283/Cloverleaf Road interchange is classified as a diamond interchange, with one-way diagonal ramps in each quadrant. The ramps are aligned to provide free-flow terminals on Route 283 and left turns are performed at-grade on Cloverleaf Road. The ramp terminals with Cloverleaf Road are currently STOP-controlled with separate the left turn and right turn lanes on the ramps. There are no left-turn lanes along Cloverleaf Road, and traffic turning left to enter Route 283 must block the through vehicles until a gap is available to complete the left turn.

As shown in Figure 1, the study area encompasses the Cloverleaf Road corridor between Route 230 and Mount Pleasant Road and the Route 230 corridor between Schwanger Road and Ridge Run Road. The study area encompasses a variety of land uses including single-family homes, commercial development, industrial development, and agricultural uses.

The purpose of this document is identify specific transportation deficiencies or issues within the study area, develop alternatives to correct them, and evaluate the feasibility of those alternatives. The alternatives were developed based upon input received by officials from PennDOT , Mount Joy Township, adjacent municipalities, and the public.

B. Methodology and Conclusions

The initial data collection efforts for the study area included collecting 24 hour traffic counts and peak hour turning movement counts. Crash data were also analyzed to identify problem areas. Capacity analyses were completed for the study area. The results of these analyses indicated the deficiencies in the study area, which are shown in the following photographs.

Queues on Ramp B (Route 283 westbound off-ramp) extend approximately 700 feet during the weekday P.M. peak hour under existing conditions.

The lack of left turning lanes on Cloverleaf Road at the intersections with the Route 283 ramps causes delay to through vehicles.

Excessive delay occurs on stop-controlled approaches of intersecting roadways with Cloverleaf Road.

Heavy traffic volumes along Cloverleaf Road and excessive delay on intersecting roadways cause drivers to pull out from stop-controlled approaches into small gaps, creating safety concerns.

Queues on southbound Cloverleaf Road extend beyond 1000 feet from the traffic signal at Route 230 to Andrew Avenue.

Queues on southbound Cloverleaf Road extend beyond view of the traffic signal and advance signage, causing safety concerns.

The following project needs have been developed based on the existing and future conditions analyses of the Route 283/Cloverleaf Road Interchange:

- Route 283 and Cloverleaf Road experience crash rates above the statewide averages for roads of the same functional classification and similar ADT. The above average crash rates appear to be caused by a high number of vehicle conflicts.
- A geometric review of the interchange shows that the deceleration lanes on Route 283 are of substandard length, and the intersection of Merts Drive with Cloverleaf Road is located within 200 feet of the eastbound off-ramp approach from Route 283.
- The stop-controlled off-ramp approaches to Cloverleaf Road currently operate at deficient levels of service during the peak hours of commuter traffic. The westbound off-ramp occasionally experiences vehicle queues that extend to the mainline of Route 283.
- The Route 283 Interchange provides direct access to an urban growth boundary designated by Lancaster County. Land within the urban growth boundary will experience intense development in the next 20 years that will significantly increase the amount of traffic using the interchange.
- In future conditions (2030), the off-ramp approaches to Cloverleaf Road will continue to operate at failing conditions with vehicle queues that extend to the Route 283 mainline.
- Local roads planned by Mount Joy Township near the interchange will require direct connections to the interchange in order to relieve traffic congestion on Cloverleaf Road.

The data were utilized to determine the necessary improvements to the study area roadway network. Mount Joy Township's Capital Improvements Plan identifies a network of parallel routes (including Merts Drive Extension and Ridge Road Extension) to Cloverleaf Road in order to improve traffic flow between Route 283 and Route 230. The location of these parallel routes created opportunities for relocation of ramps at the Route 283/Cloverleaf Road interchange. Four alternatives were developed as a result of several working sessions with the consultant team, Mount Joy Township, and PennDOT. These working sessions included future transportation improvements in the area, evaluation of right-of-way and environmental constraints, and their impacts on the feasibility of various alternatives. Public input was solicited through the Mount Joy Township newsletter and presentations by the consultant team at two Mount Joy Township Board of Supervisors meetings in 2005. Input was also sought from neighboring municipalities, affected municipal authorities, and school districts.

Conceptual designs for each of the alternatives were developed and are illustrated in Exhibits 1-4. Capacity analyses and preliminary cost estimates were developed for each alternative. Each of these alternatives achieves the desired level of service D or better for all movements in the interchange area. The range in costs is between $17,559,700 and $27,285,500. A portion of the project is listed as an "Eligible Reserve Project" in Lancaster County's *Long Range Transportation Plan 2005-2030* (LRTP). As described in the LRTP, the reserve projects can be funded in future TIP's using line items from the funded project list, such as the line item for miscellaneous capacity increases if the Route 283/Cloverleaf Road interchange improvements are considered a critical capacity enhancement during future TIP revisions. However, deficiencies determined the need to identify interim projects to be constructed in the next five years.

Therefore, the impact of constructing the interchange improvements in two phases was analyzed. The purpose of this two-phased approach is to identify short term solutions that will be usable and a reasonable expenditure even if no additional transportation improvements in the area are made. Also this interim improvement must not restrict consideration of alternatives for the second phase of improvements. The future year that was studied for Phase 1 of the interchange improvements is 2020. The phasing analysis will identify portions of the interchange improvements and/or interim improvements which will improve traffic operations and safety prior to the completion of the entire interchange project. Alternative 1 was not included in the phasing analysis since any improvements for Alternative 1 would require replacement of the Route 283 overpass of Cloverleaf Road, which was not considered a short-term improvement. The conceptual designs for Phase 1 improvements for Alternatives 2-4 were developed and are illustrated in Exhibits 5-7. Capacity analyses and preliminary cost estimates were developed for Alternatives 2-4. Each of the alternatives achieves the desired level of service of D or better for all movements in the interchange area. The range in costs for the Phase 1 improvements is between $5,140,800 and $5,511,800. This cost will be funded with a combination of local, state, and federal funding, with the local funding coming from a combination of traffic impact fees collected by Mount Joy Township and improvements required by developers in conjunction with land development projects. It is expected that the Phase 1 improvements will be constructed as a local match project.

Based on the results of the Point of Access Study, Mount Joy Township has expressed a preference for Alternative 4 with commencement of preliminary design work for Phase to begin in 2007, and construction anticipated for 2009. For the purposes of this study, full build-out of the interchange improvements was expected to occur in 2010, resulting in a design year of 2030 for the project. If full build-out of the project occurs after 2010, the design year analyses may need to be updated during the preliminary engineering phase of the project.

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
8-0	LANCASTER	0300		1 of 4
MOUNT JOY TOWNSHIP				

REVISION NUMBER	REVISIONS	DATE	BY

LEGEND:

- EXISTING WATER FEATURE
- EXISTING PROPERTY LINE
- DEVELOPMENT BY OTHERS
- PROPOSED IMPROVEMENTS
- PROPOSED BRIDGE/STRUCTURE
- HISTORIC BUILDING
- PROPOSED TRAFFIC SIGNAL
- EXISTING WETLANDS

Merts Drive Extension

Cloverleaf Road

Steel Way Drive

FARM

Cloverleaf Road

PENNDOT MAINTENANCE FACILITIES

Steel Way Drive

Cloverleaf Road

Ramp B

GREINER

FARM

Ramp A

Ramp B

Route 283

Ramp D

Ramp C

Merts Drive

TWP BLDG

HOLIDAY INN

RHEEMS MENNONITE MEETING HOUSE

FARM

Merts Drive Extension

Ridge Run Road Extension

FARM

Schwanger Road

Cloverleaf Road

Ramp C

HILSHER RAFFENSPERGER DEVELOPMENT (PROPOSED)

Merts Drive

Cloverleaf Road

Parkview Drive

Knoll Drive

Rob Drive

Sheri Lane

150' 75' 0' 150' 300'
SCALE IN FEET

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EXHIBIT 1 - ALTERNATIVE 1 CONCEPTUAL DESIGN

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MOUNT JOY TOWNSHIP				

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LEGEND:

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- HISTORIC BUILDING
- PROPOSED TRAFFIC SIGNAL
- EXISTING WETLANDS

N

Ramp A

Cloverleaf Road

FARM

Cloverleaf Road

Steel Way Drive

PENNDOT MAINTENANCE FACILITIES

Ramp D

FARM

Ramp A

Ramp B

Ramp B2

GREINER

Cloverleaf Road

Ramp B

Route 283

Ramp C

Ramp D

Merts Drive

TWP BLDG

HOLIDAY INN

RHEEMS MENNONITE MEETING HOUSE

FARM

Merts Drive Extension

Ridge Run Road Extension

FARM

Schwanger Road

Cloverleaf Road

Ramp C

Knoll Drive

Rob Drive

Ramp D Alternative Design

Ramp D

Collector

Road A

Merts Drive Extension

HILSHER RAFFENSPERGER DEVELOPMENT (PROPOSED)

Cloverleaf Road

Ridge Run Road

Parkview Drive

Sheri Lane

150' 75' 0' 150' 300'
SCALE IN FEET

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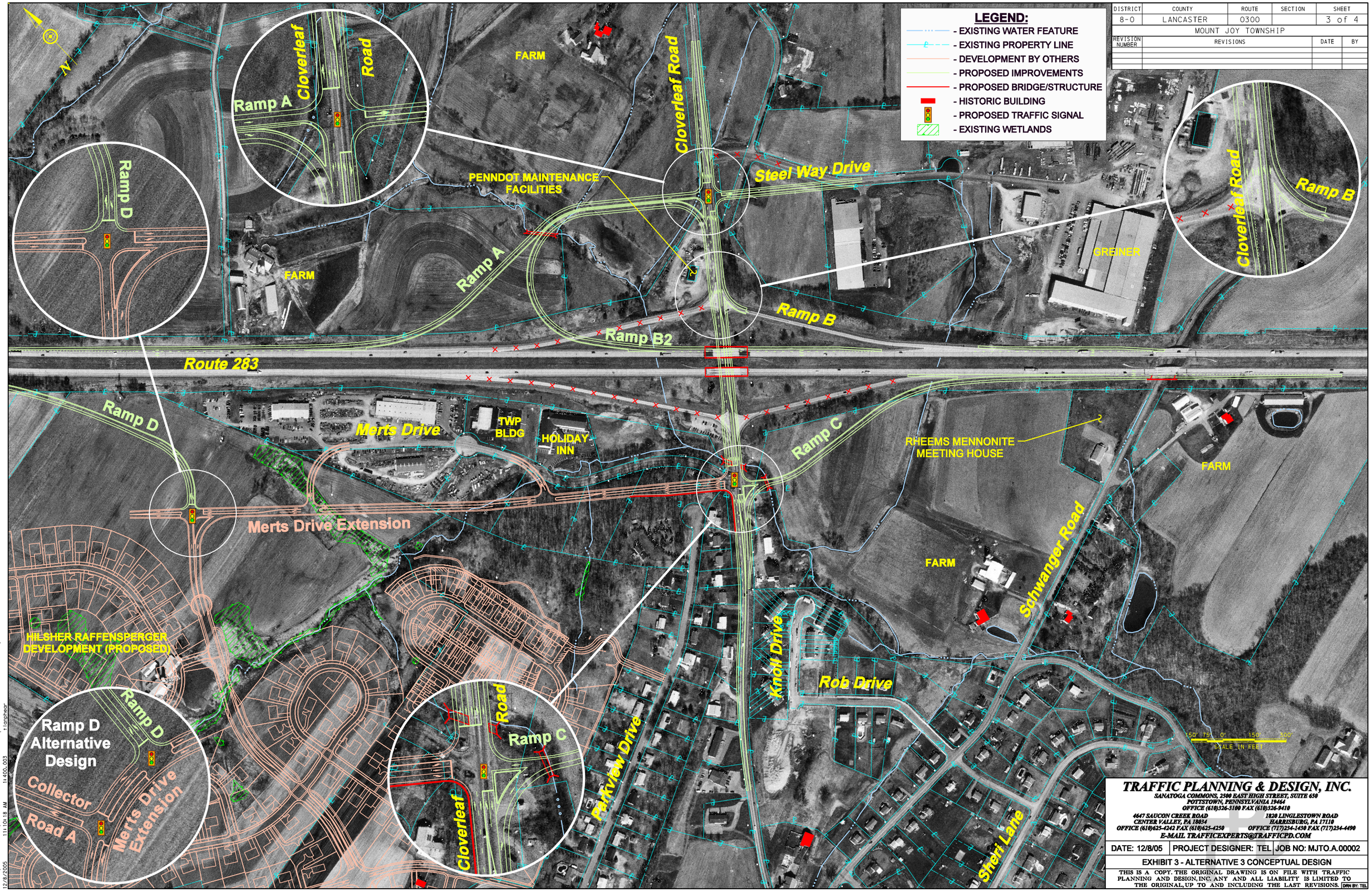
EXHIBIT 2 - ALTERNATIVE 2 CONCEPTUAL DESIGN



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- PROPOSED BRIDGE/STRUCTURE
- HISTORIC BUILDING
- PROPOSED TRAFFIC SIGNAL
- EXISTING WETLANDS

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
8-0	LANCASTER	0300		3 of 4

MOUNT JOY TOWNSHIP

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EXHIBIT 3 - ALTERNATIVE 3 CONCEPTUAL DESIGN

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- PROPOSED BRIDGE/STRUCTURE
- HISTORIC BUILDING
- PROPOSED TRAFFIC SIGNAL
- EXISTING WETLANDS

Ramp A Cloverleaf Road

Ramp D

FARM

Cloverleaf Road

PENNDOT MAINTENANCE FACILITIES

Steel Way Drive

Cloverleaf Road Ramp B

GREINER

FARM

Ramp A

Ramp B

Ramp B2

Route 283

Ramp D

Merts Drive

TWP BLDG

HOLIDAY INN

Ramp C

RHEEMS MENNONITE MEETING HOUSE

FARM

Schwanger Road

Merts Drive Extension

FARM

Ridge Run Road Extension

Cloverleaf Road

HILSHER RAFFENSPERGER DEVELOPMENT (PROPOSED)

Knoll Drive

Rob Drive

Ramp D Alternative Design

Ramp D

Collector

Road A

Merts Drive Extension

Cloverleaf Road

Ramp C

Parkview Drive

Sheri Lane

150' 75' 0' 150' 300'
SCALE IN FEET

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EXHIBIT 4 - ALTERNATIVE 4 CONCEPTUAL DESIGN

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- PROPOSED BRIDGE/STRUCTURE
- HISTORIC BUILDING
- PROPOSED TRAFFIC SIGNAL
- EXISTING WETLANDS

N

Cloverleaf Road

Steel Way Drive

FARM

PENNDOT MAINTENANCE FACILITIES

Ramp A

Ramp B

Ramp C

Ramp D

Route 283

GREINER

Merts Drive

TWP BLDG

HOLIDAY INN

Merts Drive Extension

RHEEMS MENNONITE MEETING HOUSE

Schwanger Road

Knoll Drive

Rob Drive

Parkview Drive

Sheri Lane

HILSHER RAFFENSPERGER DEVELOPMENT (PROPOSED)

Collector

Road A

150' 75' 0' 150' 300'
SCALE IN FEET

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EXHIBIT 5 - ALTERNATIVE 2 CONCEPTUAL DESIGN - PHASE 1

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- PROPOSED BRIDGE/STRUCTURE
- HISTORIC BUILDING
- PROPOSED TRAFFIC SIGNAL
- EXISTING WETLANDS

N

Cloverleaf Road

Steel Way Drive

FARM

PENNDOT MAINTENANCE FACILITIES

Steel Way Drive

Ramp A

Ramp B

Cloverleaf Road

GREINER

Ramp D

FARM

Ramp A

Ramp B

Route 283

Ramp D

Merts Drive

TWP BLDG

HOLIDAY INN

RHEEMS MENNONITE MEETING HOUSE

FARM

Merts Drive Extension

HILSHER RAFFENSPERGER DEVELOPMENT (PROPOSED)

FARM

Schwanger Road

Knoll Drive

Rob Drive

Parkview Drive

Sheri Lane

Ramp D Alternative Design

Ramp D

Collector

Road A

Merts Drive Extension

Cloverleaf Road

150' 75' 0' 150' 300'
SCALE IN FEET

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EXHIBIT 6 - ALTERNATIVE 3 CONCEPTUAL DESIGN - PHASE 1

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DISTRICT	COUNTY	ROUTE	SECTION	SHEET
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MOUNT JOY TOWNSHIP				

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- EXISTING WETLANDS

Cloverleaf Road
Steel Way Drive
FARM
PENNDOT MAINTENANCE FACILITIES
GREINER
Ramp A
Ramp B
Ramp C
Ramp D
Route 283
Merts Drive
TWP BLDG
HOLIDAY INN
Merts Drive Extension
RHEEMS MENNONITE MEETING HOUSE
HILSHER RAFFENSPERGER DEVELOPMENT (PROPOSED)
Schwanger Road
Knoll Drive
Rob Drive
Parkview Drive
Sheri Lane
Collector Road A

150' 75' 0' 150' 300'
SCALE IN FEET

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EXHIBIT 7 - ALTERNATIVE 4 CONCEPTUAL DESIGN - PHASE 1

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II. EXISTING CONDITIONS

A. Existing Roadway Network

Study Area Roadways

As shown in Figure 1, the study area includes the following roadways:

Route 283 (S.R. 0300) is a four-lane, east-west, urban limited-access highway with a posted speed limit of 65 mph. The roadway consists of two 12-foot wide lanes of travel in either direction with 10-foot paved shoulders. The pavement surface and lane markings are in good condition. Route 283 connects the Pennsylvania Turnpike, Interstate 283, and Route 30 to provide access to the Harrisburg and Lancaster metropolitan areas. Route 283 has a diamond interchange at its intersection with Cloverleaf Road.

Cloverleaf Road (S.R. 4025) is a two-lane, north-south, local roadway with a posted speed limit of 40 mph. Cloverleaf Road generally has 11-foot travel lanes with paved shoulders varying from 3 feet at the intersection with Mount Pleasant Road to 10 feet in the vicinity of the Route 283 ramps. The pavement surface and lane markings are in good condition. Cloverleaf Road provides a connection between Route 283 and Route 230, and is the primary north-south roadway in the study area.

Harrisburg Pike (Route 230, S.R. 0230) is a three-lane, east-west, minor arterial roadway with a posted speed limit of 45 mph. Route 230 has signalized intersections with Schwanger Road and Cloverleaf Road/Colebrook Road. The travel lanes on Route 230 are generally 10-feet wide with a 10-foot wide two-way center left turn lane. Paved shoulders varying between 6 and 8 feet exist on both sides of Route 230. The pavement surface and lane markings are in good condition.

Colebrook Road (S.R. 4025) is a two-lane, north-south, local roadway with a posted speed limit of 25 mph. Colebrook Road has 11-foot wide travel lanes with paved shoulders. The pavement surface and lane markings are in fair condition. Colebrook Road intersects Route 230 opposite Cloverleaf Road.

Mount Pleasant Road (S.R. 4010) is a two-lane, east-west, local roadway with a posted speed limit of 40 mph. The travel lanes on Mount Pleasant Road are 10-feet wide and there are 6-foot wide paved shoulders at the vicinity of Cloverleaf Road. The pavement surface and lane markings are in good condition.

Schwanger Road is a two-lane local roadway generally oriented in an east-west direction through the Township with a posted speed limit of 35 mph. For the purposes of this report, Schwanger Road was considered to be the north-south roadway at its intersection with Route 230. The travel lanes on Schwanger Road vary between 10-11 feet wide and there are no paved shoulders. The pavement surface and lane markings are in good condition.

Ridge Run Road is a two-lane, north-south, local roadway with a posted speed limit of 35 mph. Ridge Run Road generally has 10-foot wide travel lanes with no paved shoulder. The pavement surface and lane markings are in fair condition.

Jonlyn Drive is a two-lane, north-south, local roadway with no posted speed limit. Jonlyn Drive ends in a cul-de-sac north of Route 230. Jonlyn Drive has a paved cartway width of 44 feet. The pavement surface is in fair condition and there are no lane markings.

Andrew Avenue is a two-lane, east-west, local roadway with a posted speed limit of 25 mph. The pavement is in fair condition and there are no lane markings.

Merts Drive is a two-lane, east-west, local roadway with a posted speed limit of 25 mph. Merts Drive currently ends in a cul-de-sac west of Cloverleaf Road.

Steel Way Drive is a two-lane, east-west, local roadway with no posted speed limit. Steel Way Drive ends in a cul-de-sac east of Cloverleaf Road. The pavement surface and lane markings are in good condition.

Campus Road is a two-lane, east-west, local roadway with a posted speed limit of 35 mph. Campus Road has 11-foot wide travel lanes in the vicinity of Schwanger Road with no paved shoulders. The pavement and lane markings are in good condition.

The intersections indicated below are included in the study area. The primary intersections which will be affected by the interchange improvements are shown in **bold** print below. The remaining study area intersections were selected based on the potential for the re-routing of traffic as a result of the alternatives developed for the interchange reconfiguration.

- Route 230 & Schwanger Road;
- Route 230 & Jonlyn Drive;
- Route 230 & Cloverleaf Road/Colebrook Road;
- Route 230 & Ridge Run Road;
- Schwanger Road & Ridge Run Road;
- Schwanger Road & Campus Road;
- Cloverleaf Road & Andrew Avenue;
- Cloverleaf Road & Schwanger Road;
- **Cloverleaf Road & Merts Drive**;
- **Cloverleaf Road & Route 283 Ramps**;
- **Cloverleaf Road & Steel Way Drive**;
- Cloverleaf Road & Mount Pleasant Road.

Additionally, the Route 283 ramp merge and diverge areas at the Cloverleaf Road interchange were analyzed.

The lane configurations and traffic control for the study area intersections are shown in Figure 2.

Adjacent Interchanges

The nearest interchange to the west of Cloverleaf Road is at Route 743, located approximately 15,600 feet (3.0 miles) to the west from gore area to gore area. This is a diamond interchange, with STOP-control on all of the off-ramp approaches to Route 743. Route 743 has a five-lane cross-section through the interchange area, with two through lanes and left turn lanes for the Route 283 on-ramps.

The nearest interchange to the east of Cloverleaf Road is at Route 772, located approximately 25,000 feet (4.7 miles) to the east from gore area to gore area. This is a diamond interchange, with STOP-control on all of the off-ramp approaches to Route 772. Route 772 has a two-lane cross-section through the interchange area, with no turning lanes for the Route 283 on-ramps.

The developable land within Mount Joy Township's Urban Growth Boundary is located in close proximity to the Route 283/Cloverleaf Road interchange. Traveling between the adjacent Route 283 interchanges and the proposed development areas requires either traveling through Elizabethtown or Mount Joy Boroughs on Route 230 or traveling a circuitous route utilizing narrow rural roadways. Thus, considering the location of the projected future land development, and the area roadways, the existing, adjacent interchanges will not be able to adequately accommodate the future traffic volumes.

B. 24-Hour Traffic counts

24-Hour traffic count data were obtained from PennDOT and the Lancaster County Planning Commission. The roadway segments for which counts were obtained and the current estimate of average daily traffic (ADT) are as follows:

- Route 283 in the vicinity of the Cloverleaf Road interchange: 19,947 vehicles per day eastbound and 20,904 vehicles per day westbound;
- Cloverleaf Road between Route 230 and Route 283 Eastbound Ramps: 13,137 vehicles per day (total of both directions);
- Cloverleaf Road between Route 283 Eastbound Ramps and Mount Pleasant Road: 8,528 vehicles per day (total of both directions);
- Route 230 between Elizabethtown Borough and Cloverleaf Road: 15,705 vehicles per day (total of both directions);
- Route 230 between Cloverleaf Road and Mount Joy Borough: 14,584 vehicles per day (total of both directions).

The 24-hour traffic counts are included in Appendix A.

C. Peak Hour Manual Counts

Manual turning movement counts were obtained as shown in Table 1.

TABLE 1
MANUAL TRAFFIC COUNTS

Intersection	Date Counted	Source
Route 230 & Schwanger Road	Wed. 10/13/04	Pennmark TIS[1]
Route 230 & Jonlyn Drive	Wed. 10/13/04	Pennmark TIS
Route 230 & Cloverleaf Road	Tues. 1/20/04	Pennmark TIS
Route 230 & Ridge Run Road	Tues. 2/24/04	Pennmark TIS
Schwanger Road & Ridge Run Road	Thurs. 10/14/04	Pennmark TIS
Cloverleaf Road & Andrew Avenue	Tues. 1/20/04	Pennmark TIS
Cloverleaf Road & Schwanger Road	Tues. 1/20/04	Pennmark TIS
Cloverleaf Road & Merts Drive	Tues. 1/20/04	Pennmark TIS
Cloverleaf Road & Route 283 Ramps	Tues. 1/20/04	Pennmark TIS
Cloverleaf Road & Steel Way Drive	Tues. 4/12/05 (PM) Wed. 4/13/05 (AM)	Mount Joy Twp.[2]
Cloverleaf Road & Mount Pleasant Road	Thurs. 4/14/05	Mount Joy Twp.
Schwanger Road & Campus Road	Thurs. 9/11/03 (PM) Mon. 11/13/03 (AM)	Hillsher TIS[3]

1. Pennmark Property TIS, prepared by Lake Roeder Hillard and Associates, January 2005
2. Traffic counts performed by Mount Joy Township staff
3. Hillsher/Raffensperger Property TIS, prepared by Lake Roeder Hillard and Associates, December 2003

The Fall 2003 and Winter 2004 counts were adjusted to represent 2005 conditions by using a background growth factor developed based on information contained in the PennDOT publication, "Traffic Data Collection and Factor Development Report", 2003 data, published August, 2004. Table 371 in this publication suggests using a background growth trend factor of 1.01 (1.0%) per year in Lancaster County for Functional Class Group (FCG) 3, pertaining to urban minor arterials. Thus, existing condition traffic volumes were developed for 2005 using a background growth factor of 1.01 (1.0% per year increase for one year) to adjust the Fall 2003 and Winter 2004 volumes.

The manual turning movement count sheets are included in Appendix B. The 2005 condition traffic volumes for the weekday A.M. and P.M. peak hours are shown in Figures 3 and 4, respectively.

D. 2005 Levels of Service

Although traffic volumes provide a measure of the level of activity along a roadway, it is also important to determine whether the capacity of a roadway is sufficient to handle those volumes. Roadway capacity can be measured for intersections, arterials and highway and freeway segments. Capacity is defined as a maximum number of vehicles that can be accommodated given the constraints of the roadway geometry, traffic and physical characteristics.

Since it is generally unsatisfactory for a facility to operate at its maximum capacity, the level of service (LOS) classifications (A through F) were developed to provide a measure of operating conditions that can be utilized to determine if the operating conditions are acceptable. These classifications are reported in the Transportation Research Board's Highway Capacity Manual (HCM), 2000 Edition.

Although PennDOT does not have specific LOS criteria, a LOS D is generally considered acceptable operating conditions. Therefore, improvements to attain LOS D or better were identified.

Definition of Intersection Level of Service (LOS)

The level of service criteria for intersections were developed in terms of seconds of "control" delay that a driver will experience at an intersection. "Control" delay not only includes time spent stopped or in the queue at an intersection, but also the deceleration delay and the final acceleration delay that occurs before a vehicle exits the intersection. Intersection levels of service can be determined per movement, per approach, or for the entire intersection.

TABLE 2
INTERSECTION LOS CRITERIA*

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

* Obtained from the Transportation Research Board's Highway Capacity Manual, 2000 Edition, Exhibits 16-2 and 17-2

It is important to understand that the level of service criteria outlined in Table 2 represent merely a guideline for quantifying the acceptability of delay to drivers, which is highly subjective and varies from region to region, usually according to the intensity of development in an area. A more universal measure of acceptability to drivers is the number of cycles (the time it takes for the signal to go through all of its phases one time) through which they must wait before proceeding through an intersection. In general, if a driver is able to proceed through a signalized intersection within one complete cycle of the signal, the delay experienced is usually considered acceptable.

Definition of Merge and Diverge Level of Service (LOS)

For analysis of ramps and ramp junctures, level of service is defined in terms of density, which is a measure of passenger car equivalents/mile/per lane. Levels of service A through E assume stable operation while level of service F indicates that the influence area has reached capacity.

The "LOS Criteria for Ramp Freeway Junction Areas" are shown in Table 3. These classifications are reported in the HCM.

TABLE 3
MERGE AND DIVERGE AREAS LEVEL OF SERVICE CRITERIA*

Level of Service	Influence Area Density (pc/mi/ln)
A	< 10
B	> 10 and < 20
C	> 20 and < 28
D	> 28 and < 35
E	> 35
F	Demand exceeds capacity

* Obtained from the Transportation Research Board's Highway Capacity Manual, 2000 Edition, Exhibit 25-4

Levels of Service in the Study Area

Capacity analyses were conducted for the weekday A.M. and P.M. peak hours at the study area intersections and ramp influence areas. These analyses were conducted according to the methodologies contained in the HCM, 2000 edition.

The results of the 2005 capacity analyses for the study area locations are shown in Figures 5 and 6 for the weekday A.M. and P.M. peak hours, respectively. As shown in Figures 5 and 6, many of the study area intersections along the Cloverleaf Road corridor currently operate at deficient levels of service during the weekday A.M. and P.M. peak hours. At the Route 283 interchange, the STOP-controlled ramp approaches operate at failing levels of service, and the queues extend toward the Route 283 mainline. Other STOP-controlled approaches to Cloverleaf Road operate at failing levels of service, and the Route 230/Cloverleaf Road/Colebrook Road signalized intersection operates with deficient levels of service. The existing condition capacity analysis worksheets are contained in Appendix C.

E. Crash analysis

A crash analysis was completed for the Route 283/Cloverleaf Road interchange to determine if any portions of the interchange area experience crash rates that exceed statewide averages. The crash analysis methodology included the following:

- Crash data were obtained from PennDOT's database of reportable crashes. The data were analyzed for a five-year period from 1/1/1998 to 12/31/2003, excluding 2002. Data for 2002 was unavailable. Crash diagrams were prepared to graphically depict the crash types and locations. The crash details were reviewed to determine if there are any locations where crash patterns exist. PennDOT defines a reportable crash as follows: "A reportable crash is one in which an injury or fatality occurs or if at least one of the vehicles involved requires towing from the scene."
- Crash rates were calculated for sections of Route 283 (S.R. 0300) and Cloverleaf Road (S.R. 4025) in the vicinity of the interchange between Merts Drive and Steel Way Drive. A crash rate is defined as the crash count per million vehicle miles traveled and is calculated as follows:

$$\frac{\text{Crash Count x 1,000,000 miles x 5280 feet per mile}}{\text{Crash Cluster Length in feet x ADT in vehicles per day x 365 days per year x \# of years}}$$

- Crash rates were compared to the statewide average crash rates for specific categories of roads. The PennDOT Bureau of Highway Safety and Traffic Engineering releases statewide homogenous reports of average crash rates over the most recent 5 year period for various roadway categories. The roadway categories are established based on the roadway width, ADT, urban or local classification, access control, and whether the roadway is divided or undivided.

Summary of Results

Based on a review of the PennDOT crash data, the following crash clusters were identified and analyzed:

- Route 283 (S.R. 0300) was reviewed in the vicinity of the interchange with Cloverleaf Road (S.R. 4025) from segment 0081/1320 to segment 0090/1590.
- Cloverleaf Road (S.R. 4025) was reviewed from Merts Drive (segment 0040/0000) to Steel Way Drive (segment 0050/0940).

Based on the classification of the roadways in the study area, the statewide average crash rates for the 5 year period from 1997 to 2001 obtained from the 2001 homogenous report for these roadway sections are as follows:

- Combined Eastbound and Westbound Route 283 (S.R. 0300) = 0.24 crashes per million vehicle miles traveled.
- Cloverleaf Road (S.R. 4025) = 1.06 crashes per million vehicle miles traveled.

Route 283 (S.R. 0300) from segment 81/1320 to segment 90/1590.

This crash cluster extends 3,142 feet. Along this segment, there were 16 reportable crashes (11 eastbound and 5 westbound). The crash rate for this cluster is 0.3832 crashes per million vehicle miles traveled. The statewide average for an urban divided highway with the same ADT that has full access control is 0.24 crashes per million vehicle miles traveled. The crash data were reviewed to determine if there were any clear patterns of causation that point to a specific safety deficiency along this section of roadway.

The 11 crashes in the eastbound lanes along this section of Route 283 are composed largely of rear end crashes (64%) and vehicles that hit fixed objects (27%). The crashes were clustered in the eastbound off ramp diverge and the eastbound on ramp merge areas. Approximately 55% of the eastbound crashes involved tailgating, and 27% involved adverse conditions due to either sun glare or snow covered pavement. Although the crash rate for this section of roadway exceeds the statewide average, the crash data do not point to a specific roadway design deficiency that would be contributing to the crash rate. It appears that the above average crash rates result from the high volume conflict areas, which are typically associated with the merge and diverge areas near an interchange.

The 5 crashes in the westbound lanes along this section of Route 283 are composed of vehicles that hit fixed objects (40%), sideswipe crashes (40%) and rear end crashes (20%). The crashes were clustered near the westbound on ramp merge area. The review of crash data revealed that 80% of the westbound crashes involved adverse conditions due to either wet or snow covered pavement. In addition to the adverse conditions, 40% of the crashes involved tailgating and 40% of the crashes involved drivers traveling too fast. Although the crash rate for this section of roadway exceeds the statewide average, the crash data do not point to a specific roadway design deficiency that would be contributing to the crash rate. It appears that the above average crash rates result from the high volume conflict areas, which are typically associated with the merge and diverge areas near an interchange.

Cloverleaf Road (S.R. 4025): Merts Drive (segment 040/0000) to Steel Way Drive (segment 050/0940).

There have been a total of 6 reportable crashes over the past five (5) years within this segment. Five of the crashes occurred within a 444 foot section near the intersection of Cloverleaf Road with Ramps C and D for eastbound Route 283. Three crashes were angle crashes, one was a head on collision and one involved a fixed object. Although the crash rate for the 444 foot section is 2.976 crashes per million vehicle miles traveled for the 5 year period and exceeds the statewide average, it appears that there are no clear patterns of causation that indicate a safety deficiency that would be contributing to the crash rate. It appears that the crash rates are high due to conflict areas that occur at the various intersections along this segment.

F. Geometric Review

A geometric review was conducted for the existing Route 283/Cloverleaf Road interchange. The interchange is generally constructed to current PennDOT design standards, with the exception of the deceleration lanes for Ramps B and D. In conjunction with the rehabilitation of Route 283 which was completed in 2004, the deceleration lanes were extended via striping of the shoulder area. However, the deceleration lanes still do not meet current PennDOT design criteria, and the reduced shoulder widths also do not meet current design standards.

G. Summary of Existing Conditions

Based on the results of the capacity analysis, it was determined that the interchange currently operates at failing levels of service for the STOP-controlled off-ramp approaches to Cloverleaf Road. The interchange merge and diverge areas have sufficient capacity to accommodate the current traffic demand. In conjunction with the capacity analysis, a geometric review was performed for the interchange. It was determined that inadequate deceleration lane lengths currently exist for both exit ramps.

III. FUTURE NO-BUILD CONDITIONS

A. 2030 No-Build Traffic Volumes

Future no-build traffic volumes were developed by applying a growth factor to the existing volumes and projecting traffic for the 42 developments proposed in the vicinity of the interchange. Per PennDOT criteria, the future year to be studied (2030) is 20 years from the projected build-out year of 2010.

Background Growth Factor

A background growth factor was applied to existing volumes. The PennDOT Bureau of Planning and Research (BPR) suggests using a growth trend factor of 1.023 (2.3%) per year to project future traffic growth in Lancaster County for Functional Class Group (FCG) 3, pertaining to minor arterial roadways. However, since the future traffic volumes include 42 developments, using a background growth factor of 2.3% per year would represent an over estimate of future traffic due to double counting. Therefore, a background growth factor of 1.25 (0.5% per year for 25 years) was utilized to adjust existing volumes at the study area intersections in order to develop 2030 future conditions. For the mainline Route 283 through traffic at the Cloverleaf Road interchange, TPD applied a background growth factor of 1.575 (2.3% per year for 25 years) to adjust these existing volumes to account for development potential in nearby municipalities.

Trip Generation

Future traffic conditions may include traffic volumes from proposed developments, which, though not operating under existing conditions, might be operating by the time the proposed interchange improvements are completed. Mount Joy Township has projected future development for the adoption of its traffic impact fee ordinance by completing a Land Use Assumptions Report (LUAR). The projected development included in the LUAR is expected to occur by 2013. Therefore, it was assumed all of the developments in the LUAR would be built-out by the design year of 2030. Tables D-1 and D-2 from the LUAR (included in Appendix D) summarize all of the projected development which is expected to occur in the Township.

Trip generation rates for these projected developments were obtained from the Trip Generation manual, 7th Edition, 2003, an Institute of Transportation Engineers (ITE) informational report. For the purposes of this study, only new trips were considered unless a proposed development that typically has pass-by trips is located on a corner of an intersection that is included in the study. Pass-by trips were included for the corner sites because pass-by trips can affect turning volumes at intersections by providing a means for vehicles to "cut-through" the site. Pass-by trips were not treated as new trips for sites located mid-block or at intersections that were not included in the study, because volumes at the study intersections will not be affected by these trips. Table 4 summarizes the trip generation for the projected developments.

TABLE 4
PROJECTED DEVELOPMENT TRIP GENERATION

Land Use Code	Land Use	Total Units/Size	Weekday A.M. Peak Hour		
			Enter (pass-by)	Exit (pass-by)	Total (pass-by)
110	General Light Industrial	1,175,000 sq. ft.	951	130	1,081
140	Manufacturing	140,000 sq. ft.	79	24	103
210	Single Family Detached	1,086 units	228	673	901
220	Apartment	265 units	23	114	137
230	Townhouse/Condominium	863 units	83	405	488
252	Age-Qualified Apartments	300 units	11	13	24
710	General Office	110,000 sq. ft.	150	22	172
720	Medical/Dental Office	21,375 sq. ft.[1]	39	14	53
820	Shopping Center	980,700 sq. ft.	616	394	1,010
853	Convenience Store with Gasoline	12 v.f.p.	38 (65)	38 (65)	76 (130)
881	Pharmacy with Drive-Thru	13,013 sq. ft.	20	15	35
912	Drive-in Bank	6,200 sq. ft.	43	34	77
932	High Turnover (Sit-Down) Restaurant	7,300 sq. ft.	44	40	84
Total Projected Development Trips			**2,325 (65)**	**1,916 (65)**	**4,241 (130)**
Land Use Code	**Land Use**	**Total Units/Size**	**Weekday P.M. Peak Hour**		
			Enter (pass-by)	**Exit (pass-by)**	**Total (pass-by)**
110	General Light Industrial	1,175,000 sq. ft.	138	1,014	1,152
140	Manufacturing	140,000 sq. ft.	37	67	104
210	Single Family Detached	1,086 units	732	430	1,162
220	Apartment	265 units	115	61	176
230	Townhouse/Condominium	863 units	380	186	586
252	Age-Qualified Apartments	300 units	20	13	33
710	General Office	110,000 sq. ft.	29	136	165
720	Medical/Dental Office	21,375 sq. ft.[1]	38	67	105
820	Shopping Center	980,700 sq. ft.	1,326 (605)	1,489 (605)	2,815 (1,210)
853	Convenience Store with Gasoline	12 v.f.p.	38 (77)	39 (77)	77 (154)
881	Pharmacy with Drive-Thru	13,013 sq. ft.	27 (28)	29 (28)	56 (56)
912	Drive-in Bank	6,200 sq. ft.	74 (68)	73 (68)	147 (136)
932	High Turnover (Sit-Down) Restaurant	7,300 sq. ft.	31 (18)	12 (18)	43 (36)
Total Projected Development Trips			**2,985 (796)**	**3,616 (796)**	**6,601 (1,592)**

1. Trip Generation for Norlanco Expansion taken from TIS prepared by Rettew Associates, Inc.

Trip Distribution

The assumptions for the distribution and assignment of new and pass-by trips are discussed below:

Primary Trips

A distribution gravity model was completed for the proposed developments based on 2000 Census data. First, the destinations of commuters from Mount Joy Township for employment and the origins of commuters traveling to Mount Joy Township for employment were determined from the Census data. Next, travel routes were determined to/from each of the surrounding municipalities. Then, distribution percentages were calculated for each of the travel routes by determining the percentage of commuters using each route to/from the surrounding municipalities. The result of this analysis was the directional distribution chart shown in Table 5, which was used for the distribution of primary trips to/from the future developments. The trip distribution percentages for the retail/office/commercial developments were based on the Census data statistics for commuters destined for Mount Joy Township. The trip distribution percentages for the residential developments were based on the Census data statistics for commuters originating from Mount Joy Township. The trip distribution percentages for industrial developments were based on the Census data statistics for commuters destined for Mount Joy Township, and the close proximity of the industrial parcels to the Route 283/Cloverleaf Road interchange.

TABLE 5
PRIMARY TRIP DISTRIBUTION PERCENTAGES

Direction To/From	Trip Distribution Rates		
	Commercial	Industrial	Residential
North via Cloverleaf Road	18%	14%	17%
East via Mount Pleasant Road	3%	3%	2%
East via Route 283	17%	20%	26%
East via Route 230	17%	14%	15%
South via Colebrook Road	14%	14%	8%
West via Route 230	21%	12%	15%
West via Campus Road	4%	3%	4%
West via Route 283	6%	20%	13%
Total	**100%**	**100%**	**100%**

Pass-By Trips

Pass-by trips were established based on the existing traffic patterns in the vicinity of the proposed sites.

The trip distributions for the projected developments were entered into the volume development worksheets, which are included in Appendix E.

Volume Development

In order to simplify the trip distributions, trips were distributed to the road network assuming that all traffic originated from or was destined to locations outside of study area. Therefore, it was assumed that no one who lives in the study area would work or shop in the study area. Although this assumption may seem impractical, it was necessary to simplify the distributions since traffic had to be distributed for 42 developments. Also, it would be impossible to determine the exact locations where commuters would live and work within the study area. However, trips were overestimated as a result of this assumption. Therefore, in order to account for commuters living and working or shopping in the study area, reduction percentages were applied to the trip distributions in the volume worksheets in Appendix E. The reduction percentages were based on diverted-linked percentages contained in the Trip Generation Handbook. Based on the diverted-linked percentages, the office/industrial trips were reduced by 12%, the retail trips were reduced by 22%, and the office/mixed use developments were reduced by 10%.

The additional traffic volumes due to background growth and the 42 projected developments were added to the existing traffic volumes to produce 2030 condition traffic volumes for the weekday A.M. and P.M. peak hours, as shown in Figures 7 and 8, respectively.

B. Future Roadway Improvements

Programmed PennDOT Projects

There are no programmed improvements for the study area on the current Lancaster County Transportation Improvement Program (TIP) or the PennDOT Twelve Year Transportation Program. However, signalization of the Cloverleaf Road/Schwanger Road intersection with construction of left turn lanes on each approach is in the process of being added to the TIP. Since funding for this project will be included on the next revision to the TIP, this improvement was included in 2030 No-Build conditions.

Mount Joy Township Capital Improvements Plan

Mount Joy Township adopted a Capital Improvements Plan in June 2004 which identifies roadway improvements to be constructed in conjunction with projected development. The improvements were identified based on 2013 traffic conditions. Many roadway improvements are identified in the CIP within the study area, as shown in Table 6.

TABLE 6
CAPITAL IMPROVEMENTS AT STUDY AREA INTERSECTIONS

Intersection	Improvements[1]
Route 230 & Schwanger Road	Modify traffic signal timings Construct 2nd EB and WB thru lanes Construct WB right turn lane Construct SB left turn lane Construct SB right turn lane
Route 230 & Jonlyn Drive	Signalize intersection Construct 2nd EB and WB thru lanes
Route 230 & Merts Drive Extension	Construct Merts Drive Extension from Route 230 through Hernley Tract Signalize intersection Construct SB left turn lane
Route 230 & Cloverleaf Road/ Colebrook Road	Modify traffic signal timings Construct 2nd EB and WB thru lanes Construct NB right turn lane Construct WB right turn lane Construct SB right turn lane
Route 230 & Ridge Run Road	Signalize intersection Construct 2nd EB and WB thru lanes Construct SB left turn lane
Schwanger Road & Ridge Run Road	Signalize intersection
Schwanger Road/ Campus Road & Merts Drive	Construct SB right turn lane Construct Hoover Tract Extension
Cloverleaf Road & Andrew Avenue	Signalize intersection Construct WB left turn lane Construct SB left turn lane
Cloverleaf Road & Schwanger Road	Signalize intersection[2]
Cloverleaf Road & Merts Drive	Signalize intersection Construct 2nd NB thru lane Construct 2 EB left turn lanes Construct WB right turn lane Construct SB right turn lane Construct SB left turn lane
Cloverleaf Road & Route 283 EB Ramps	Signalize intersection Construct 2nd NB thru lane Construct 2nd SB thru lane Construct SB left turn lane
Cloverleaf Road & Route 283 WB Ramps	Signalize intersection Construct 2nd NB thru lane Construct 2nd SB thru lane Construct 2 WB left turn lanes
Cloverleaf Road & Steel Way Drive	Signalize intersection
Cloverleaf Road & Mount Pleasant Road	Construct WB left turn lane Signalize intersection
Merts Drive Extension & Route 283 EB Off-ramp	Construct Off-ramp between Route 283 EB and Merts Drive Construct left-turn lane from off-ramp onto Merts Drive Signalize intersection

1. Mount Joy Township is required to complete construction of the improvements by 2013 as identified in the Capital Improvements Plan. If construction is not completed by that time, the impact fee money must be returned to the developers.
2. Additional improvements at the Cloverleaf Road/Schwanger Road intersection are in the process of being added to the Lancaster County TIP.

Based on recent amendments to the MPC, impact fees can only be used to fund 50% of the cost of improvements on state-maintained roadways. The remaining funds must come from other sources, such as State or Federal funding. The majority of the study area intersections include at least one state highway. Since funding is not secured for these projects, the projects involving state highways have not been included in No-Build conditions. The CIP does include improvements that will be funded 100 percent by the Township's traffic impact fee funds, such as the extension of Merts Drive to Route 230. Therefore, it was assumed that these improvements will be constructed by 2013 and were included in the 2020 no-build volume development and capacity analyses.

Projected Development Improvement Projects

In conjunction with some of the projected developments which were included in the future conditions analysis, it was assumed certain improvements consistent with the Township Official Map will be constructed as "on-site" improvements for these developments. These improvements will be constructed and funded by the developers of these sites, and are shown in Table 7.

TABLE 7
DEVELOPER IMPROVEMENTS AT STUDY AREA INTERSECTIONS

Development Parcel[1]	Improvements
C-1	Construct Ridge Run Road Extension from Schwanger Road to Cloverleaf Road Access to development will be onto the Ridge Run Road Extension
D-1	Construct access to development as fourth leg of Route 230/Jonlyn Drive intersection
A-5	Construct access to development as fourth leg of the Cloverleaf Road/Mount Pleasant Road intersection

1. Parcels identified using key from Tables D-1 and D-2 (Appendix D).

C. 2030 No-Build Levels of Service

Capacity analyses were conducted for the weekday A.M. and P.M. peak hours at the study area intersections for 2030 No-Build conditions. These analyses were conducted according to the methodologies contained in the HCM, 2000 edition. The results of these analyses are shown in Figures 9 and 10.

The results of the capacity analyses indicate failing conditions will occur at the majority of the study area intersections under 2030 No-Build conditions. The capacity analysis worksheets are presented in Appendix F.

D. Project Needs

The following project needs have been developed based on the existing and future conditions analyses of the Route 283/Cloverleaf Road Interchange:

- Route 283 and Cloverleaf Road experience crash rates above the statewide averages for roads of the same functional classification and similar ADT. The above average crash rates appear to be caused by a high number of vehicle conflicts.

- A geometric review of the interchange shows that the deceleration lanes on Route 283 are of substandard length, and the intersection of Merts Drive with Cloverleaf Road is located within 200 feet of the eastbound off-ramp approach from Route 283.
- The stop-controlled off-ramp approaches to Cloverleaf Road currently operate at deficient levels of service during the peak hours of commuter traffic. The westbound off-ramp occasionally experiences vehicle queues that extend to the mainline of Route 283.
- The Route 283 Interchange provides direct access to an urban growth boundary designated by Lancaster County. Land within the urban growth boundary will experience intense development in the next 20 years that will significantly increase the amount of traffic using the interchange.
- In future conditions (2030), the off-ramp approaches to Cloverleaf Road will continue to operate at failing conditions with vehicle queues that extend to the Route 283 mainline.
- Local roads planned by Mount Joy Township near the interchange will require direct connections to the interchange in order to relieve traffic congestion on Cloverleaf Road.

IV. FUTURE BUILD CONDITIONS

A. Alternatives Development

The development of build alternatives consists of a combination of alternatives for the different quadrants of the interchange. Additionally, all of the build alternatives include the improvements outlined in the Mount Joy Township CIP, and other improvements identified in Table 7 are included in the future build alternatives.

The conceptual designs contained in Exhibits 1-4 for Alternatives 1, 2, 3, and 4, respectively, were developed using the design criteria shown in Table 8.

TABLE 8
DESIGN CRITERIA

Roadway	Design Speed
Route 283	70 mph
Cloverleaf Road	45 mph
Merts Drive	40 mph
Steel Way Drive	40 mph

Public Involvement

The following meetings were held during the process that contributed to the development of the build alternatives:

- Four status meetings were held with Mount Joy Township and PennDOT staff.
- TPD presented the preliminary alternatives at the June 20, 2005 Mount Joy Township Board of Supervisors meeting.
- TPD presented the final alternatives and the phasing analysis at the November 21, 2005 Mount Joy Township Board of Supervisors meeting.

Additionally, information pertaining to the POA was included in the Mount Joy Township newsletter, *The Township Times*, in the Summer 2005 edition. The public was invited to contact the project team with comments and/or questions following the meetings and in the newsletter.

A copy of the conceptual plans for the preliminary alternatives was sent to all of the neighboring municipalities, authorities, and school districts. Comments were received from Rapho Township and Elizabethtown Borough.

The information received in these meetings and working sessions was taken into account in refining the list of feasible interchange improvement alternatives. The minutes from the status meetings, the newsletter, and comments on the preliminary alternatives are contained in Appendix G.

2030 Build Condition Traffic Volumes

Future traffic volumes were developed by redistributing traffic movements from 2030 No-Build conditions as described in the alternatives development sections. These redistributions account for the relocation of various ramps within the interchange and construction of extensions to Merts Drive and Ridge Run Road to relieve traffic on Cloverleaf Road.

2030 Build Condition Levels of Service

Capacity analyses were conducted for the weekday A.M. and P.M. peak hours at the study area intersections for 2030 Build conditions for Alternatives 1, 2, 3, and 4. These analyses were conducted according to the methodologies contained in the HCM, 2000 edition. The 2030 Build condition capacity analysis worksheets are contained in Appendix H.

B. Build Alternative 1

Description of Alternative 1

The Alternative 1 conceptual design is shown in Exhibit 1. Alternative 1 maintains the existing diamond interchange configuration. The roadway improvements required to maintain a LOS D for all movements in the interchange area were evaluated.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive;
- Cloverleaf Road & Ramps A/B;
- Cloverleaf Road & Ramps D/C;
- Cloverleaf Road & Merts Drive/Ridge Run Road Extension.

Additionally, turning lanes would be constructed at each of these intersections, as shown in Exhibit 1.

This alternative requires a six-lane cross section on Cloverleaf Road underneath the Route 283 overpass and an eight-lane cross section between Ramps D/C and Merts Drive/Ridge Run Road Extension. Cloverleaf Road would also require widening for approximately 1,400 feet south of Merts Drive for additional southbound and northbound through lanes, and the tapers for turning lanes.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The existing ramp will be widened to accommodate an additional lane to provide for the dual northbound left turn lanes on Cloverleaf Road. In order to accomplish this, the additional lane on Ramp A must be extended up to the Route 283 mainline, and then each lane must have an appropriate acceleration area and taper. The total acceleration area for both lanes will extend to approximately the Ridge Road overpass.

Ramp B (Route 283 West off-ramp)

Ramp B will be widened to accommodate dual left turn lanes onto southbound Cloverleaf Road and an exclusive right turn lane onto northbound Cloverleaf Road. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp C (Route 283 East on-ramp)

No improvements are required for Ramp C other than relocating the Cloverleaf Road terminal due to the widening on Cloverleaf Road. The existing acceleration lane onto Route 283 meets current design criteria.

Ramp D (Route 283 East off-ramp)

Ramp D will be widened to accommodate a 600-foot right turn lane onto southbound Cloverleaf Road. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Although the improvements identified for Alternative 1 would enable all intersections and turning movements in the interchange area to operate at LOS D or better, the closely-spaced traffic signals will cause queues to extend through intersections along Cloverleaf Road between Ramps A/B and Merts Drive/Ridge Run Road Extension.

The 2030 Build Alternative 1 traffic volumes for the weekday A.M. and P.M. peak hour are shown in Figures 11 and 12, respectively. The 2030 Build Alternative 1 levels of service for the weekday A.M. and P.M. peak hour are shown in Figures 13 and 14, respectively. The capacity analysis worksheets are contained in Appendix H.

Right of Way Impacts of Alternative 1

Right of way impacts for this alternative are summarized as follows:

- Additional right-of-way will be required along Cloverleaf Road in the vicinity of Merts Drive in order to construct the additional lanes.
- Additional right-of-way will be required along Cloverleaf Road in the vicinity of Steel Way Drive in order to construct the additional lanes.
- The additional right-of-way required will affect 5 residential parcels and 10 commercial parcels.

Structural Impacts for Alternative 1

Structural impacts for this alternative are shown with heavy red lines on Exhibit 1 and are summarized as follows:

- The Route 283 overpass of Cloverleaf Road must be replaced in order to accommodate a six-lane cross section on Cloverleaf Road.
- A retaining wall will be necessary on the southwest corner of the Cloverleaf Road/Merts Drive intersection due to the steep grades which exist in this area.

- A retaining wall will be necessary on the western side of Cloverleaf Road approximately 1300 feet south of Merts Drive due to the steep grades which exist in this area.
- The culvert under Ramps A and D for an unnamed creek will need to be extended to accommodate additional lanes on the ramps.
- The culvert under Cloverleaf Road between Ramps D/C and Merts Drive will need to be extended to accommodate an eight-lane cross section on Cloverleaf Road.

These items were taken into consideration in the Preliminary Cost Estimates section.

Signing Plan for Alternative 1

TPD developed a preliminary signing plan for the Route 283/Cloverleaf Road interchange for the ramp configurations under Alternative 1. The signing plan was designed in accordance with PennDOT Publication 111M (TC-8700). The signing plan is shown in Exhibit 8.

C. Build Alternative 2

Description of Alternative 2

The Alternative 2 conceptual design is shown in Exhibit 2. Alternative 2 consists of relocations of Ramps A, C, and D, and an additional reverse loop ramp (Ramp B2). The roadway improvements required to maintain a LOS D for all movements in the interchange area were evaluated.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive/Ramps A/B2;
- Cloverleaf Road & Merts Drive/Ridge Run Road Extension;
- Merts Drive Extension & Ramp D.

Additionally, turning lanes would be constructed at each of these intersections and Ramps B and C, as shown in Exhibit 2.

This alternative requires a four-lane cross section on Cloverleaf Road underneath the Route 283 overpass and a five-lane cross section between Ramp C and Merts Drive/Ridge Run Road Extension. Cloverleaf Road would also require widening for approximately 700 feet south of Merts Drive for an additional northbound through lane, and the tapers for turning lanes.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The existing ramp will be relocated to intersect Cloverleaf Road approximately 500 feet north of the existing ramp terminal to allow for the construction of a reverse loop ramp in the northwest quadrant of the interchange. Steel Way Drive will also be relocated approximately 200 feet south, and will intersect Cloverleaf Road opposite Ramps A/B2. The relocated Ramp A will have a design speed of 30 mph for the first curve, and 50 mph for the second curve. The acceleration lane onto Route 283 westbound was designed for 50 mph.

Ramp B (Route 283 West off-ramp)

The existing Ramp B will remain at its current location but will be restricted to right turns only onto northbound Cloverleaf Road. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp B2 (Route 283 West off-ramp to southbound Cloverleaf Road)

Ramp B2 will be constructed as a new reverse loop ramp in the northwest quadrant of the interchange that would be restricted to right turns only for southbound traffic onto Cloverleaf Road. This ramp will intersect Cloverleaf Road opposite of Steel Way Drive. The curve on Ramp B2 will have a design speed of 30 mph, and the deceleration lane from Route 283 westbound was designed for this speed.

Ramp C (Route 283 East on-ramp)

The Cloverleaf Road terminal of Ramp C will be shifted approximately 125 feet north to allow for increased stacking space between Ramp C and the proposed traffic signal at Merts Drive/Ridge Run Road Extension. The shifted ramp will tie in the existing Ramp C prior to reaching Route 283, and will utilize the existing acceleration lane, which meets current design criteria. The curve on the relocated Ramp C where it ties into the existing ramp C has a design speed of 70 mph.

Ramp D (Route 283 East off-ramp)

Ramp D will be relocated approximately 3,000 feet to the west and will terminate at Merts Drive Extension at its intersection with Collector Road A to form the fourth leg of the intersection. A 350-foot left turn lane will be constructed on Ramp D approaching this intersection. The relocated Ramp D will have a design speed of 70 mph for the first curve, and 30 mph for the second curve. The deceleration lane from Route 283 eastbound was designed for 70 mph. An alternative design for the Ramp D intersection with Merts Drive has been proposed where both Ramp D and Collector Road A would intersect Merts Drive at signalized T-intersections. A roundabout could also be considered at this location during the final design phase of the project.

The improvements identified for Alternative 2 will enable all intersections and turning movements in the interchange area to operate at LOS D or better, and there will be no queuing problems between intersections along Cloverleaf Road.

The 2030 Build Alternative 2 traffic volumes for the weekday A.M. and P.M. peak hour are shown in Figures 15 and 16, respectively. The 2030 Build Alternative 2 levels of service for the weekday A.M. and P.M. peak hour are shown in Figures 17 and 18, respectively. The capacity analysis worksheets are contained in Appendix H.

Right of Way Impacts of Alternative 2

Right of way impacts for this alternative are summarized as follows:

- Additional right-of-way will be required in the northwest quadrant of the interchange to construct Ramp B2 and the relocated Ramp A.
- Additional right-of-way will be required along Cloverleaf Road in the vicinity of Merts Drive in order to construct additional lanes.
- The additional right-of-way will affect 3 residential parcels and 8 commercial parcels.

Structural Impacts for Alternative 2

Structural impacts for this alternative are shown with heavy red lines on Exhibit 2 and are summarized as follows:

- The Route 283 overpass of Cloverleaf Road must be replaced in order to accommodate a four-lane cross section on Cloverleaf Road.
- The westbound Route 283 overpass of Cloverleaf Road must be widened in order to accommodate the deceleration lane for Ramp B2.
- A retaining wall will be necessary on the southwest corner of the Cloverleaf Road/Merts Drive intersection due to the steep grades which exist in this area.
- A new culvert must be constructed under Ramps A/B2 for an unnamed creek.
- The culvert under Cloverleaf Road between Ramp C and Merts Drive will need to be extended to accommodate a five-lane cross section on Cloverleaf Road.

These items were taken into consideration in the Preliminary Cost Estimates section.

Signing Plan for Alternative 2

TPD developed a preliminary signing plan for the Route 283/Cloverleaf Road interchange for the ramp configurations under Alternative 2. The signing plan was designed in accordance with PennDOT Publication 111M (TC-8700). The signing plan in shown in Exhibit 9.

D. Build Alternative 3

Description of Alternative 3

The Alternative 3 conceptual design is shown in Exhibit 3. Alternative 3 consists of relocations of Ramps A, C, and D, and an additional reverse loop ramp (Ramp B2). The roadway improvements required to maintain a LOS D for all movements in the interchange area were evaluated.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive/Ramps A/B2;
- Cloverleaf Road & Merts Drive/Ramp C;
- Merts Drive Extension & Ramp D.

Additionally, turning lanes would be constructed at each of these intersections and Ramps B and C, as shown in Exhibit 3.

This alternative requires a four-lane cross section on Cloverleaf Road underneath the Route 283 overpass and a five-lane cross section between the Route 283 overpass and Merts Drive/Ramp C. Cloverleaf Road would also require widening for approximately 1,400 feet south of Merts Drive for an additional southbound through lane, a northbound right turn lane, and the tapers for turning lanes.

The relocation of Ramp C will prohibit the construction of the Ridge Run Road Extension between Schwanger Road and Cloverleaf Road. Therefore, the Ridge Run Road Extension was not included in this alternative. Also, since the Ridge Run Road Extension cannot be constructed, and since there is limited frontage along Cloverleaf Road for access to the parcel in the southeast quadrant of the interchange, it was assumed this parcel would not be developed as a commercial parcel under Alternative 3, and would remain an agricultural use.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The configuration of Ramp A under Alternative 3 will be the same as under Alternative 2. The existing ramp will be relocated to intersect Cloverleaf Road approximately 500 feet north of the existing ramp terminal to allow for the construction of a reverse loop ramp in the northwest quadrant of the interchange. Steel Way Drive will also be relocated approximately 200 feet south, and will intersect Cloverleaf Road opposite Ramps A/B2. The relocated Ramp A will have a design speed of 30 mph for the first curve, and 50 mph for the second curve. The acceleration lane onto Route 283 westbound was designed for 50 mph.

Ramp B (Route 283 West off-ramp)

The configuration of Ramp B under Alternative 3 will be the same as under Alternative 2. The existing Ramp B will remain at its current location but will be restricted to right turns only onto northbound Cloverleaf Road. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp B2 (Route 283 West off-ramp to southbound Cloverleaf Road)

The configuration of Ramp B2 under Alternative 3 will be the same as under Alternative 2. Ramp B2 will be constructed as a new reverse loop ramp in the northwest quadrant of the interchange that would be restricted to right turns only for southbound traffic on Cloverleaf Road. This ramp will intersect Cloverleaf Road opposite of Steel Way Drive. The curve on Ramp B2 will have a design speed of 30 mph, and the deceleration lane from Route 283 westbound was designed for this speed.

Ramp C (Route 283 East on-ramp)

Ramp C will be relocated to intersect Cloverleaf Road opposite Merts Drive, approximately 300 feet south of the current ramp terminal. The relocated Ramp C will have a design speed of 30 mph for the first curve and 50 mph for the second curve. The acceleration lane onto Route 283 eastbound was designed for 50 mph. The alignment of the relocated Ramp

C will require the acceleration lane to extend past the overpass for Schwanger Road to the east.

Ramp D (Route 283 East off-ramp)

The configuration of Ramp D under Alternative 3 will be the same as under Alternative 2. Ramp D will be relocated approximately 3,000 feet to the west and will terminate at Merts Drive Extension at its intersection with Collector Road A to form the fourth leg of the intersection. A 350-foot left turn lane will be constructed on Ramp D approaching this intersection. The relocated Ramp D will have a design speed of 70 mph for the first curve, and 30 mph for the second curve. The deceleration lane from Route 283 eastbound was designed for 70 mph. An alternative design for the Ramp D intersection with Merts Drive has been proposed where both Ramp D and Collector Road A would intersect Merts Drive at signalized T-intersections. A roundabout could also be considered at this location during the final design phase of the project.

The improvements identified for Alternative 3 will enable all intersections and turning movements in the interchange area to operate at LOS D or better, and there will be no queuing problems between intersections along Cloverleaf Road.

The 2030 Build Alternative 3 traffic volumes for the weekday A.M. and P.M. peak hour are shown in Figures 19 and 20, respectively. The 2030 Build Alternative 3 levels of service for the weekday A.M. and P.M. peak hour are shown in Figures 21 and 22, respectively. The capacity analysis worksheets are contained in Appendix H.

Right of Way Impacts of Alternative 3

Right of way impacts for this alternative are summarized as follows:

- Additional right-of-way will be required in the northwest quadrant of the interchange to construct Ramp B2 and the relocated Ramp A.
- Additional right-of-way will be required along Cloverleaf Road in the vicinity of Merts Drive in order to construct additional lanes.
- Additional right-of-way will be required in the southeast quadrant of the interchange to construct the relocated Ramp C. This will effectively eliminate Parcel C-1 from being developed with retail since the only feasible access to the parcel will be from Schwanger Road east of Cloverleaf Road.
- The additional right-of-way required will affect 3 residential properties and 10 commercial properties.

Structural Impacts for Alternative 3

Structural impacts for this alternative are shown with heavy red lines on Exhibit 3 and are summarized as follows:

- The Route 283 overpass of Cloverleaf Road must be replaced in order to accommodate a four-lane cross section on Cloverleaf Road.

- The westbound Route 283 overpass of Cloverleaf Road must be widened in order to accommodate the deceleration lane for Ramp B2.
- The eastbound Route 283 overpass of Schwanger Road must be widened in order to accommodate the acceleration lane for the relocated Ramp C.
- A retaining wall will be necessary on the southwest corner of the Cloverleaf Road/Merts Drive intersection due to the steep grades which exist in this area.
- A new culvert must be constructed under Ramps A/B2 for an unnamed creek.
- A new culvert must be constructed under Ramp C in the vicinity of Cloverleaf Road for an unnamed creek.
- The culvert under Cloverleaf Road between the Route 283 overpass and Merts Drive will need to be extended to accommodate a five-lane cross section on Cloverleaf Road.
- A jersey barrier will be necessary to separate opposing traffic on Ramps A and B2.

These items were taken into consideration in the Preliminary Cost Estimates section.

Signing Plan for Alternative 3

TPD developed a preliminary signing plan for the Route 283/Cloverleaf Road interchange for the ramp configurations under Alternative 3. The signing plan was designed in accordance with PennDOT Publication 111M (TC-8700). The signing plan in shown in Exhibit 10.

E. Build Alternative 4

Description of Alternative 4

The Alternative 4 conceptual design is shown in Exhibit 4. Alternative 4 consists of relocations of Ramps A and D, and an additional reverse loop ramp (Ramp B2). The roadway improvements required to maintain a LOS D for all movements in the interchange area were evaluated.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive/Ramps A/B2;
- Cloverleaf Road & Merts Drive/Ramp C;
- Cloverleaf Road & Ridge Run Road Extension;
- Merts Drive Extension & Ramp D.

Additionally, turning lanes would be constructed at each these intersections, as shown in Exhibit 4.

This alternative requires a five-lane cross section on Cloverleaf Road underneath the Route 283 overpass and between the Route 283 overpass and Merts Drive/Ramp C. Cloverleaf Road would also require widening for approximately 1,400 feet south of Merts Drive/Ramp C for an additional southbound through lane, a northbound right turn lane, and the tapers for turning lanes. The Ridge Run Road Extension intersects Cloverleaf Road approximately 675 feet south of Merts Drive/Ramp C under Alternative 4, and will be designed to prohibit left turns from Ridge Run Road Extension onto southbound Cloverleaf Road.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The configuration of Ramp A under Alternative 4 will be the same as under Alternative 2. The existing ramp will be relocated to intersect Cloverleaf Road approximately 500 feet north of the existing ramp terminal to allow for the construction of a reverse loop ramp in the northwest quadrant of the interchange. Steel Way Drive will also be relocated approximately 200 feet south, and will intersect Cloverleaf Road opposite Ramps A/B2. The relocated Ramp A will have a design speed of 30 mph for the first curve, and 50 mph for the second curve. The acceleration lane onto Route 283 westbound was designed for 50 mph.

Ramp B (Route 283 West off-ramp)

The configuration of Ramp B under Alternative 4 will be the same as under Alternative 2. The existing Ramp B will remain at its current location but will be restricted to right turns only onto northbound Cloverleaf Road. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp B2 (Route 283 West off-ramp to southbound Cloverleaf Road)

The configuration of Ramp B2 under Alternative 4 will be the same as under Alternative 2. Ramp B2 will be constructed as a new reverse loop ramp in the northwest quadrant of the interchange that would be restricted to right turns only for southbound traffic on Cloverleaf Road. This ramp will intersect Cloverleaf Road opposite of Steel Way Drive. The curve on Ramp B2 will have a design speed of 30 mph, and the deceleration lane from Route 283 westbound was designed for this speed.

Ramp C (Route 283 East on-ramp)

No improvements are required for Ramp C other than modifying the Cloverleaf Road terminal due to the widening on Cloverleaf Road. The existing acceleration lane onto Route 283 meets current design criteria. Merts Drive will be realigned to the north to intersect Cloverleaf Road opposite Ramp C.

Ramp D (Route 283 East off-ramp)

The configuration of Ramp D under Alternative 4 will be the same as under Alternative 2. Ramp D will be relocated approximately 3,000 feet to the west and will terminate at Merts Drive Extension at its intersection with Collector Road A to form the fourth leg of the intersection. A 350-foot left turn lane will be constructed on Ramp D approaching this intersection. The relocated Ramp D will have a design speed of 70 mph for the first curve, and 30 mph for the second curve. The deceleration lane from Route 283 eastbound was designed for 70 mph. An alternative design for the Ramp D intersection with Merts Drive has been proposed where both Ramp D and Collector Road A would intersect Merts Drive at signalized T-intersections. A roundabout could also be considered at this location during the final design phase of the project.

The improvements identified for Alternative 4 will enable all intersections and turning movements in the interchange area to operate at LOS D or better, and there will be no queuing problems between intersections along Cloverleaf Road.

The 2030 Build Alternative 4 traffic volumes for the weekday A.M. and P.M. peak hour are shown in Figures 23 and 24, respectively. The 2030 Build Alternative 4 levels of service for the weekday A.M. and P.M. peak hour are shown in Figures 25 and 26, respectively. The capacity analysis worksheets are contained in Appendix H.

Right of Way Impacts of Alternative 4

Right of way impacts for this alternative are summarized as follows:

- Additional right-of-way will be required in the northwest quadrant of the interchange to construct Ramp B2 and the relocated Ramp A.
- Additional right-of-way will be required along Cloverleaf Road in the vicinity of Merts Drive in order to construct additional lanes.
- The additional right-of-way will affect 3 residential properties and 8 commercial properties.

Structural Impacts for Alternative 4

Structural impacts for this alternative are shown with heavy red lines on Exhibit 4 and are summarized as follows:

- The Route 283 overpass of Cloverleaf Road must be replaced in order to accommodate a five-lane cross section on Cloverleaf Road.
- The westbound Route 283 overpass of Cloverleaf Road must be widened in order to accommodate the deceleration lane for Ramp B2.
- A new culvert must be constructed under Ramps A/B2 for an unnamed creek.
- The culvert under Cloverleaf Road south of the Merts Drive/Ramp C intersection will need to be extended to accommodate a five-lane cross section on Cloverleaf Road.
- A jersey barrier will be necessary to separate opposing traffic on Ramps A and B2.

These items were taken into consideration in the Preliminary Cost Estimates section.

Signing Plan for Alternative 4

TPD developed a preliminary signing plan for the Route 283/Cloverleaf Road interchange for the ramp configurations under Alternative 4. The signing plan was designed in accordance with PennDOT Publication 111M (TC-8700). The signing plan in shown in Exhibit 11.

F. Preliminary Traffic Signal Warrant Analysis

A preliminary traffic signal warrant analysis was conducted in accordance with PennDOT *Publication 201*, Engineering and Traffic Studies, Subchapter E, "Traffic Signals". Traffic volumes were examined at the study area intersections under each of the alternatives to determine if PennDOT Signal Warrant (xi), the Peak Hour Volume Warrant, would be satisfied.

The signal warrant analysis was performed utilizing the guidelines contained in the 1989 Federal Manual on Uniform Traffic Control Devices (MUTCD). The PennDOT traffic signal warrants (67 PA Code, Chapter 201, Subsection E) utilize the same criteria as the MUTCD guidelines.

The preliminary traffic signal warrant analysis indicates that Warrant (xi) is satisfied at all of the locations where traffic signals are proposed. The signal warrant worksheets are shown in Appendix I.

G. Preliminary Cost Estimates

Preliminary Cost Estimates were completed for all of the alternatives. The preliminary cost estimates include excavation, pavement, barrier, major structures, signalization, E&S control, MPT, mobilization, construction inspection, construction management, and cost escalation. The details of these cost estimates are included in Appendix J. The cost estimates are summarized in Table 9.

TABLE 9
PRELIMINARY COST ESTIMATES

Alternative	Roadway Cost	Right-of-Way Cost	Total Cost
1	$ 17,407,000	$152,700	$17,559,700
2	$22,351,000	$1,181,800	$23,532,800
3	$25,875,000	$1,410,500	$27,285,500
4	$22,796,000	$1,181,800	$23,997,800

The cost estimates do not include preliminary engineering or final design.

H. Preliminary Environmental Resource Analysis

Potential sensitive environmental resources were estimated based on cursory field views. Wetlands were identified through National Wetland Inventory mapping and additional wetlands were identified through aerial photo review and windshield survey. Productive farmlands were identified through aerial photography. Potential historic resources were identified through previous studies completed by Lancaster County. Unnamed tributaries to Donegal Creek were identified through field reconnaissance. Several potential waste sites were identified within the project area through database searches and windshield survey.

Relative estimates of wetland and farmland impacts were determined by alternative as exact extent of these resources are not known at this time. The number of new stream crossings was determined by number of crossings to probable jurisdictional stream channels. New stream crossings typically contain a high potential for prehistoric archaeological resources and the relative amount of potential prehistoric archeological impacts is directly proportional. In addition, for any alternative that is proposed adjacent to historic above ground resources, there is the potential for historical archaeology. The estimated amount of impacts to the resources by alternative considered is shown in Table 10.

Noise abatement will likely be warranted by all considered alternatives. However, at this cursory stage of study it is difficult to estimate which noise sensitive communities may be impacted by each alternative or where abatement may be reasonable/feasible.

I. Alternatives Evaluation

Each of the alternatives were compared with respect to project cost, environmental impacts, and corridor travel time impacts. The evaluation of alternatives is presented in Table 10.

TABLE 10
ALTERNATIVE EVALUATION MATRIX

Criteria	No-Build	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Project Cost					
Total Cost	$0	$17,559,700	$23,532,800	$27,285,500	$23,977,800
Residential Properties Impacted	0	5	3	3	3
Commercial Properties Impacted	0	10	8	10	8
Major Utility Impacts	None	None	None	None	None
Environmental Impacts					
Potential Wetland Impacts	0	Low	Moderate	Moderate	Moderate
Potential Historical Resource Impacts	0	1	1	2	1
New Stream Crossings	0	0	1	3	1
Widened Stream Crossings	0	2	1	1	1
Potential Waste Site Impacts	0	2	2	2	2
Potential Farmland Impacts	0	Low	High	High	High
Potential Archeological Impacts	0	Moderate	High	High	High
Corridor Travel Time Impacts					
Traffic signals on Cloverleaf Road (Merts Drive to Steel Way Drive)	0	4	2	2	2
Travel time (Rt. 283 to Rt. 230 & Ridge Run Road)	27:00+ (WB)[1] 27:00+ (EB)[1]	4:38 (WB) 3:59 (EB)	3:26 (WB) 3:53 (EB)	3:47 (WB) 4:33 (EB)	3:37 (WB) 4:36 (EB)
Travel time (Rt. 283 to Rt. 230 & Schwanger Road)	21:00+ (WB)[1] 21:00+ (EB)[1]	5:36 (WB) 4:58 (EB)	4:56 (WB) 3:38 (EB)	4:36 (WB) 3:41 (EB)	4:43 (WB) 3:48 (EB)

1. Delay too large for calculation at unsignalized locations; assumed 1000 seconds of delay.

V. PHASING ANALYSIS

A. Phasing Analysis Introduction

TPD analyzed the impact of constructing the interchange improvements in two phases. The future year that was studied for the Phase 1 of the interchange improvements is 2020. The purpose of the phasing analysis is to identify portions of the interchange improvements and/or interim improvements which will improve traffic operations and safety prior to the completion of the entire interchange project. The Phase 1 improvements can be constructed earlier than the entire interchange project since Mount Joy Township will be utilizing impact fee funds for these improvements.

B. 2020 No-Build Conditions

2020 No-Build Condition Traffic Volumes

Future traffic volumes were developed by applying a background growth factor of 1.15 (0.5% per year for 15 years) and the projected developments included in the 2030 No-Build Conditions. Since the LUAR projected developments would occur over a 10-year time frame (through 2013), all of these developments are expected to be constructed by 2020. However, Mount Joy Township is in the process of rezoning the parcels in the immediate vicinity of the Route 283/Cloverleaf Road interchange. The parcels north of Route 283 are currently zoned for light industrial development, and the parcel in the southeast quadrant of the Route 283/Cloverleaf Road interchange is currently zoned for commercial development. The updates to the zoning ordinance will provide an "interchange overlay district" and is expected to be completed by Spring 2006. The overlay district would provide for a wide variety of residential, light industrial, office, and commercial uses for these parcels. The Township is also considering designating these parcels as "agricultural reserve areas." This zoning designation would permit residential, light industrial, office, and commercial uses, but only if certain infrastructure was in place prior to the development of these parcels (such as the Route 283/Cloverleaf Road interchange improvements identified in this report). These parcels would remain agricultural until all 2030 build improvements are under construction or completed. Therefore, traffic from these developments was not included in the Phase 1 analysis.

Since the Ridge Run Road Extension will be constructed in conjunction with the development of Parcel C-1, and Parcel C-1 will not be developed under Phase 1 since it is being placed in agricultural reserve, the Ridge Run Road Extension was not included in the Phase 1 analysis.

2020 No-Build Condition Levels of Service

Capacity analyses were conducted for the weekday A.M. and P.M. peak hours at the study area intersections for 2020 No-Build conditions. The results of these analyses are contained in Appendix K.

The results of the capacity analyses indicate failing conditions will occur at the majority of the study area intersections.

C. 2020 Phase 1 Build Conditions

2020 Phase 1 Build Condition Traffic Volumes

Future traffic volumes were developed by redistributing traffic movements from 2020 No-Build Conditions as described in the alternatives development sections. The redistributions account for the relocation of various ramps within the interchange and the construction of the Merts Drive extension to relieve traffic on Cloverleaf Road.

2020 Phase 1 Build Levels of Service

Capacity analyses were conducted for the weekday A.M. and P.M. peak hours at the study area intersections for 2020 Phase 1 Build conditions for Alternatives 2, 3, and 4. The capacity analysis worksheets are contained in Appendix L.

D. Build Alternative 1 – Phase 1

Since Alternative 1 maintains all of the existing ramps, and requires significant widening along Cloverleaf Road within the vicinity of the Route 283 interchange, it is not feasible to construct the improvements associated with this alternative in phases. Therefore, Alternative 1 was not evaluated as part of the phasing analysis.

E. Build Alternative 2 – Phase 1

Description of Build Alternative 2 – Phase 1

The Alternative 2 – Phase 1 conceptual design is shown in Exhibit 5. Alternative 2 consists of the relocation of Ramp D and interim improvements north of Route 283.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive;
- Cloverleaf Road & Ramps A/B;
- Cloverleaf Road & Merts Drive;
- Merts Drive Extension & Ramp D.

Additionally, turning lanes would be constructed at each of these intersections, as shown in Exhibit 5.

This alternative requires a three-lane cross section on Cloverleaf Road underneath the Route 283 overpass and a four-lane cross section between Ramp C and Merts Drive. Cloverleaf Road would also require widening for approximately 700 feet south of Merts Drive for an additional northbound through lane, and the tapers for turning lanes.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The existing Ramp A will remain at its current location, but the left turn movement from northbound Cloverleaf Road onto Ramp A will be eliminated as an interim improvement. These left turns will be accommodated via a jughandle onto Steel Way Drive, then turning left onto Cloverleaf Road and entering Ramp A via a right turn movement.

Ramp B (Route 283 West off-ramp)

The existing Ramp B will remain at its current location. An additional left turn lane will be constructed on Ramp B as an interim improvement. In order to accommodate the dual left turn lanes, Cloverleaf Road must be widened for two lanes southbound. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp C (Route 283 East on-ramp)

No improvements are required for Ramp C other than modifying the Cloverleaf Road terminal due to the widening on Cloverleaf Road. The existing acceleration lane onto Route 283 meets current design criteria.

Ramp D (Route 283 East off-ramp)

Ramp D will be relocated approximately 3,000 feet to the west and will terminate at Merts Drive Extension at its intersection with Collector Road A to form the fourth leg of the intersection. A 350-foot left turn lane will be constructed on Ramp D approaching this intersection. The relocated Ramp D will have a design speed of 70 mph for the first curve, and 30 mph for the second curve. The deceleration lane from Route 283 eastbound was designed for 70 mph. An alternative design for the Ramp D intersection with Merts Drive has been proposed where both Ramp D and Collector Road A would intersect Merts Drive at signalized T-intersections. A roundabout could also be considered at this location during the final design phase of the project.

The improvements identified for Alternative 2 – Phase 1 will enable all intersections and turning movements in the interchange area to operate at LOS D or better, and there will be no queuing problems between intersections along Cloverleaf Road.

Design Exception for Alternative 2 – Phase 1

The interim improvements on the northern side of Route 283 will require the following design exception:

- In order to accommodate 3 lanes under the existing Route 283 overpass on Cloverleaf Road, an 11-foot wide center lane is proposed and 14-foot wide outer lanes with a single-face barrier to protect the bridge piers. The DM-2 design criteria specify 8-foot wide shoulders.

F. Build Alternative 3 – Phase 1

Description of Alternative 3 – Phase 1

The Alternative 3 – Phase 1 conceptual design is shown in Exhibit 6. Alternative 3 – Phase 1 consists of the relocation of Ramp D and interim improvements north of Route 283.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive;
- Cloverleaf Road & Ramps A/B;
- Cloverleaf Road & Merts Drive;
- Merts Drive Extension & Ramp D.

Additionally, turning lanes would be constructed at each of these intersections, as shown in Exhibit 6.

This alternative requires a three-lane cross section on Cloverleaf Road underneath the Route 283 overpass and a four-lane cross section between Ramp C and Merts Drive. Cloverleaf Road would also require widening for approximately 450 feet south of Merts Drive for an additional northbound through lane and the tapers for turning lanes.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The existing Ramp A will remain at its current location, but the left turn movement from northbound Cloverleaf Road onto Ramp A will be eliminated as an interim improvement. These left turns will be accommodated via a jughandle onto Steel Way Drive, then turning left onto Cloverleaf Road and entering Ramp A via a right-turn movement.

Ramp B (Route 283 West off-ramp)

The existing Ramp B will remain at its current location. An additional left turn lane will be constructed on Ramp B as an interim improvement. In order to accommodate the dual left turn lanes, Cloverleaf Road must be widened for two lanes southbound. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp C (Route 283 East on-ramp)

No improvements are required for Ramp C other than modifying the Cloverleaf Road terminal due to the widening on Cloverleaf Road. The existing acceleration lane onto Route 283 meets current design criteria.

Ramp D (Route 283 East off-ramp)

The configuration of Ramp D under Alternative 3 will be the same as under Alternative 2. Ramp D will be relocated approximately 3,000 feet to the west and will terminate at Merts Drive Extension at its intersection with Collector Road A to form the fourth leg of the

intersection. A 350-foot left turn lane will be constructed on Ramp D approaching this intersection. The relocated Ramp D will have a design speed of 70 mph for the first curve, and 30 mph for the second curve. The deceleration lane from Route 283 eastbound was designed for 70 mph. An alternative design for the Ramp D intersection with Merts Drive has been proposed where both Ramp D and Collector Road A would intersect Merts Drive at signalized T-intersections. A roundabout could also be considered at this location during the final design phase of the project.

The improvements identified for Alternative 3 will enable all intersections and turning movements in the interchange area to operate at LOS D or better, and there will be no queuing problems between intersections along Cloverleaf Road.

Design Exception for Alternative 3 – Phase 1

The interim improvements on the northern side of Route 283 will require the following design exception:

- In order to accommodate 3 lanes under the existing Route 283 overpass on Cloverleaf Road, an 11-foot wide center lane is proposed and 14-foot wide outer lanes with a single-face barrier to protect the bridge piers. The DM-2 design criteria specify 8-foot wide shoulders.

G. Build Alternative 4 – Phase 1

Description of Alternative 4 – Phase 1

The Alternative 4 – Phase 1 conceptual design is shown in Exhibit 7. Alternative 4 – Phase 1 consists of relocation of Ramp D, and interim improvements north of Route 283.

Traffic signals would be installed at the following intersections:

- Cloverleaf Road & Steel Way Drive;
- Cloverleaf Road & Ramps A/B;
- Cloverleaf Road & Merts Drive/Ramp C;
- Merts Drive Extension & Ramp D.

Additionally, turning lanes would be constructed at each these intersections, as shown in Exhibit 7.

This alternative requires a three-lane cross section on Cloverleaf Road underneath the Route 283 overpass and between the Route 283 overpass and Merts Drive/Ramp C. Cloverleaf Road would also require widening for approximately 1,400 feet south of Merts Drive/Ramp C for an additional southbound through lane, a northbound right turn lane, and the tapers for turning lanes.

The interchange will function as follows:

Ramp A (Route 283 West on-ramp)

The existing Ramp A will remain at its current location, but the left turn movement from northbound Cloverleaf Road onto Ramp A will be eliminated as an interim improvement.

These left turns will be accommodated via a jughandle onto Steel Way Drive, then turning left onto Cloverleaf Road and entering Ramp A via a right-turn movement.

Ramp B (Route 283 West off-ramp)

The existing Ramp B will remain at its current location. An additional left turn lane will be constructed on Ramp B as an interim improvement. In order to accommodate the dual left turn lanes, Cloverleaf Road must be widened for two lanes southbound. Additionally, the deceleration lane will be lengthened along Route 283 to meet current design criteria.

Ramp C (Route 283 East on-ramp)

No improvements are required for Ramp C other than modifying the Cloverleaf Road terminal due to the widening on Cloverleaf Road. The existing acceleration lane onto Route 283 meets current design criteria. Merts Drive will be realigned to the north to intersect Cloverleaf Road opposite Ramp C.

Ramp D (Route 283 East off-ramp)

The configuration of Ramp D under Alternative 4 will be the same as under Alternative 2. Ramp D will be relocated approximately 3,000 feet to the west and will terminate at Merts Drive Extension at its intersection with Collector Road A to form the fourth leg of the intersection. A 350-foot left turn lane will be constructed on Ramp D approaching this intersection. The relocated Ramp D will have a design speed of 70 mph for the first curve, and 30 mph for the second curve. The deceleration lane from Route 283 eastbound was designed for 70 mph. An alternative design for the Ramp D intersection with Merts Drive has been proposed where both Ramp D and Collector Road A would intersect Merts Drive at signalized T-intersections. A roundabout could also be considered at this location during the final design phase of the project.

The improvements identified for Alternative 4 will enable all intersections and turning movements in the interchange area to operate at LOS D or better, and there will be no queuing problems between intersections along Cloverleaf Road.

Design Exception for Alternative 4 – Phase 1

The interim improvements on the northern side of Route 283 will require the following design exception:

- In order to accommodate 3 lanes under the existing Route 283 overpass on Cloverleaf Road, an 11-foot wide center lane is proposed and 14-foot wide outer lanes with a single-face barrier to protect the bridge piers. The DM-2 design criteria specify 8-foot wide shoulders.

H. Phase 1 Cost Estimates

Preliminary Cost Estimates were completed for Phase 1 of Alternatives 2-4. The preliminary cost estimates include excavation, pavement, barrier, major structures, signalization, E&S control, MPT,

mobilization, construction inspection, construction management, and cost escalation. The details of these cost estimates are included in Appendix M. The cost estimates are summarized in Table 11.

TABLE 11
PRELIMINARY COST ESTIMATES – PHASE 1

Alternative	Roadway Cost	Right-of-Way Cost	Total Cost
2	$5,133,000	$289,800	$5,422,800
3	$5,222,000	$289,800	$5,511,800
4	$4,851,000	$289,800	$5,140,800

The cost estimates do not include preliminary engineering or final design.

I. Phase 2

Phase 2 of the interchange improvements will include all of the additional improvements required to bring the interchange to the full build-out condition, as described in Section IV of this report and shown in Exhibits 1-4.

VI. CONCLUSIONS

The results of the Route 283/Cloverleaf Road interchange point of access study are summarized as follows:

- Volumes exceed existing intersection capacity for the majority of the study area intersections. Queues due to this lack of capacity contribute to safety concerns.
- Significant future development is anticipated in the vicinity of the interchange, and will worsen the existing operational problems.
- Four alternatives were developed for interchange area improvements. The conceptual plans for these alternatives are shown in the following Exhibits:
    - Alternative 1: Exhibit 1;
    - Alternative 2: Exhibit 2;
    - Alternative 3: Exhibit 3;
    - Alternative 4: Exhibit 4.
- Each of these alternatives achieves the desired level of service D or better for all movements in the interchange area. The range in costs is between $17,559,700 and $27,285,500.
- Phasing of the improvements was analyzed for Alternatives 2-4. The conceptual plans for these alternatives are shown in the following Exhibits:
    - Alternative 2-Phase 1: Exhibit 5;
    - Alternative 3-Phase 1: Exhibit 6;
    - Alternative 4-Phase 1: Exhibit 7.
- Phase 1 of Alternatives 2-4 achieves the desired level of service D or better for all movements in the interchange area. The range in costs is between $5,140,800 and $5,511,800.
- Phase 2 of the interchange improvements will include all of the additional improvements required to bring the interchange to the full build-out condition, as shown in Exhibits 1-4.
- Based on the results of the Point of Access Study and the Public Involvement process (Appendix G), Mount Joy Township has expressed a preference for Alternative 4.
- As the project moves forward, environmental clearance will need to be obtained for Phase 1 improvements as well as Phase 2 improvements, for Alternative 4.
- It is anticipated that with construction of Alternatives 2, 3, or 4, Merts Drive will become a PennDOT-owned roadway from the proposed relocation of Ramp D to Cloverleaf Road. In order for PennDOT to assume responsibility for this roadway, Mount Joy Township will need to take back an equal amount of state roadway.

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
8-0	LANCASTER	0283		1 of 4
MOUNT JOY TOWNSHIP				

REVISION NUMBER	REVISIONS	DATE	BY

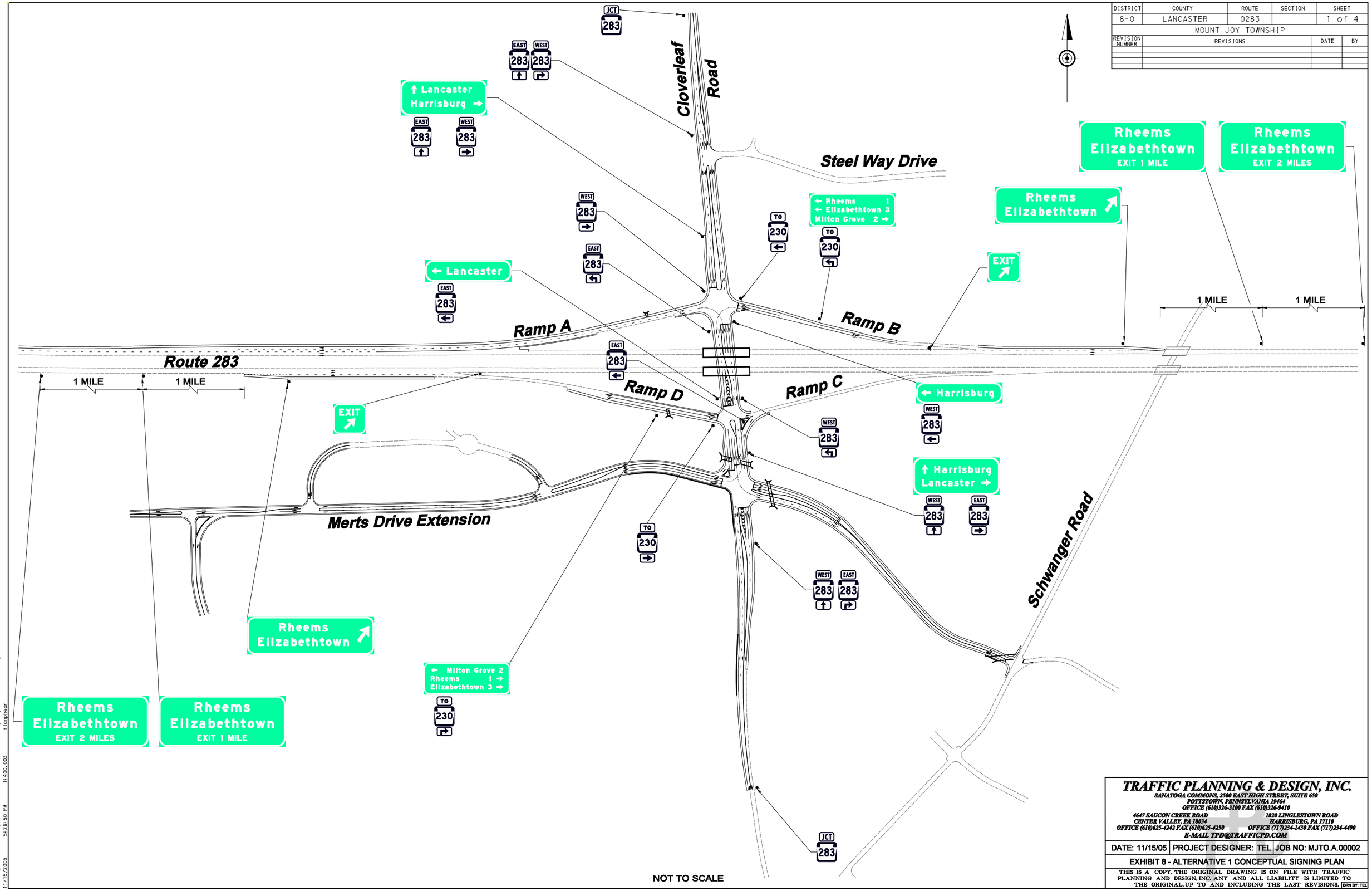

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EXHIBIT 8 - ALTERNATIVE 1 CONCEPTUAL SIGNING PLAN

DRN BY: TEL

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DISTRICT	COUNTY	ROUTE	SECTION	SHEET
8-0	LANCASTER	0283		2 of 4
MOUNT JOY TOWNSHIP				

REVISION NUMBER	REVISIONS	DATE	BY

Cloverleaf Road

Steel Way Drive

Ramp A

Route 283

Ramp B

Ramp C

Ramp D

Merts Drive Extension

Schwanger Road

MATCH BELOW

MATCH ABOVE

JCT 283

EAST 283 / WEST 283

↑ Lancaster
Harrisburg →

TO 230

← Harrisburg

WEST 283

Rheems 1
Elizabethtown 3

EAST 283

Milton Grove 2

EXIT

Rheems Elizabethtown
EXIT 1 MILE

Rheems Elizabethtown
EXIT 2 MILES

Rheems Elizabethtown

Milton Grove

1 MILE

1/2 MILE

Milton Grove
NEXT RIGHT

Rheems Elizabethtown
SECOND RIGHT

← Lancaster

EAST 283

← Milton Grove 2
Rheems 1 ↑
Elizabethtown 3 ↑

TO 230 / TO 283

TO 283 / TO 230

← Milton Grove 2
Rheems 1 →
Elizabethtown 3 →

↑ Harrisburg
Lancaster →

WEST 283 / EAST 283

JCT 283

Route 283

1 MILE

1 MILE

Ramp D

EXIT

Rheems Elizabethtown

Rheems Elizabethtown
EXIT 2 MILES

Rheems Elizabethtown
EXIT 1 MILE

NOT TO SCALE

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EXHIBIT 9 - ALTERNATIVE 2 CONCEPTUAL SIGNING PLAN

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DISTRICT	COUNTY	ROUTE	SECTION	SHEET
8-0	LANCASTER	0283		3 of 4
MOUNT JOY TOWNSHIP				

REVISION NUMBER	REVISIONS	DATE	BY

Cloverleaf Road

Steel Way Drive

Ramp A

Route 283

Ramp B

Ramp C

Ramp D

Merts Drive Extension

Schwanger Road

MATCH BELOW

MATCH ABOVE

JCT 283

EAST 283 / WEST 283

↑ Lancaster
Harrisburg →

TO 230

← Harrisburg

WEST 283

Rheems 1
Elizabethtown 3

EAST 283

Milton Grove 2

EXIT

Rheems Elizabethtown
EXIT 1 MILE

Rheems Elizabethtown
EXIT 2 MILES

Rheems Elizabethtown

Milton Grove

1 MILE

1/2 MILE

Milton Grove
NEXT RIGHT

Rheems Elizabethtown
SECOND RIGHT

← Lancaster

EAST 283

← Milton Grove 2
Rheems 1
Elizabethtown 3

TO 230 / TO 283

TO 283 / TO 230

TO 283 / TO 230

EAST 283

↑ Harrisburg
Lancaster →

WEST 283 / EAST 283

WEST 283 / EAST 283

JCT 283

Route 283

1 MILE

1 MILE

Ramp D

EXIT

Rheems Elizabethtown

Rheems Elizabethtown
EXIT 2 MILES

Rheems Elizabethtown
EXIT 1 MILE

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EXHIBIT 10 - ALTERNATIVE 3 CONCEPTUAL SIGNING PLAN

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MOUNT JOY TOWNSHIP				

REVISION NUMBER	REVISIONS	DATE	BY

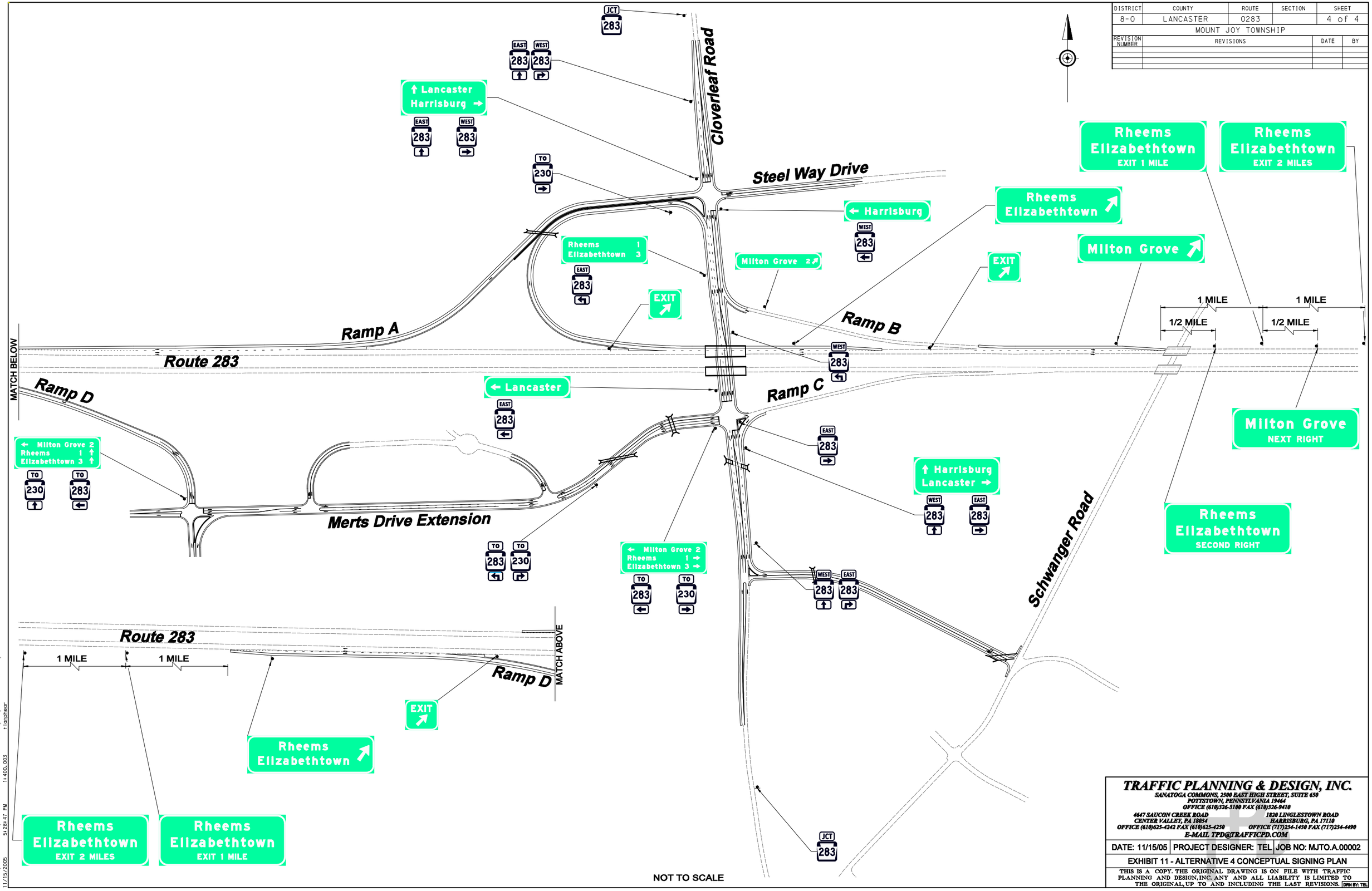

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EXHIBIT 11 - ALTERNATIVE 4 CONCEPTUAL SIGNING PLAN

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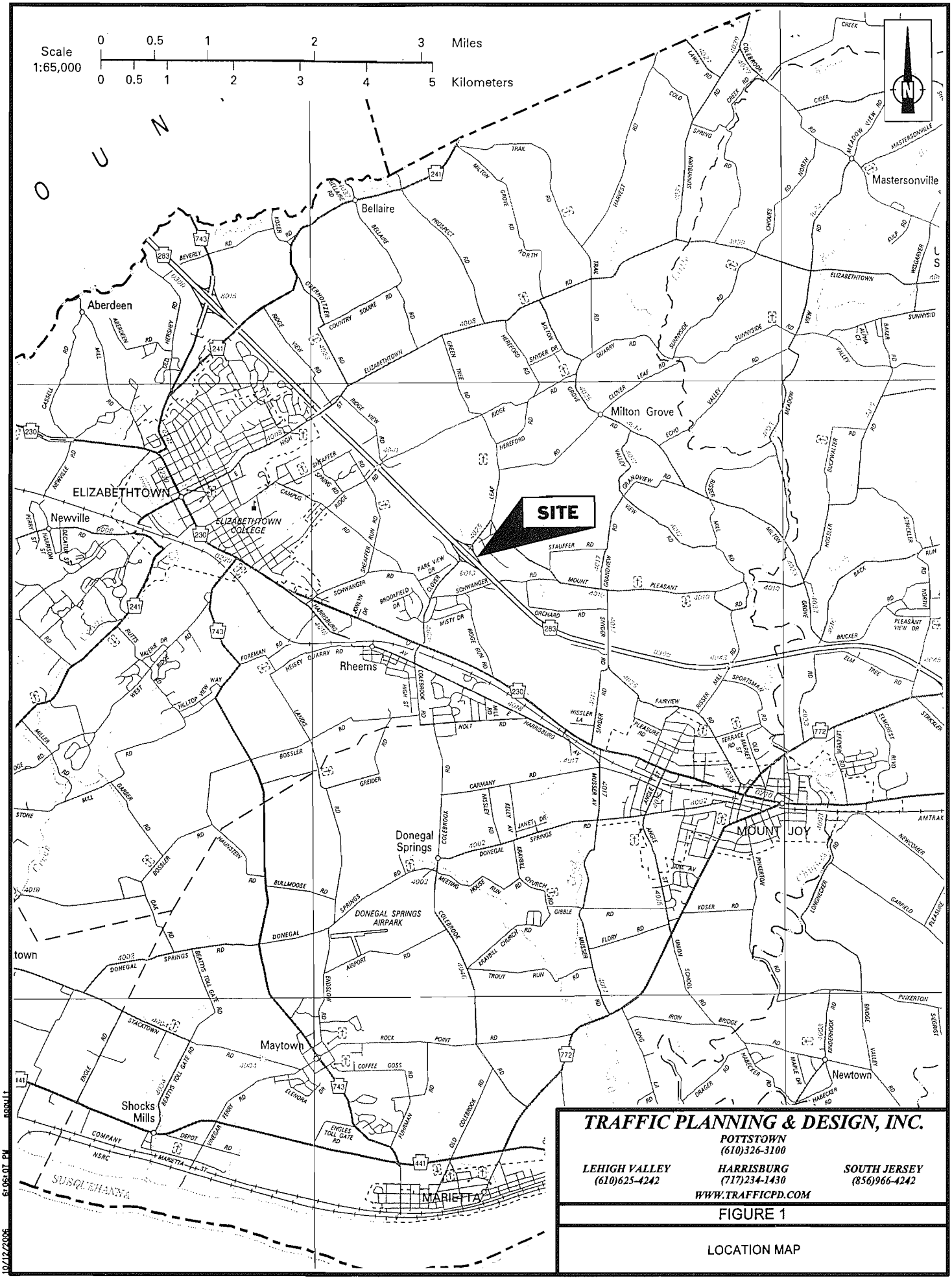

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FIGURE 1

LOCATION MAP

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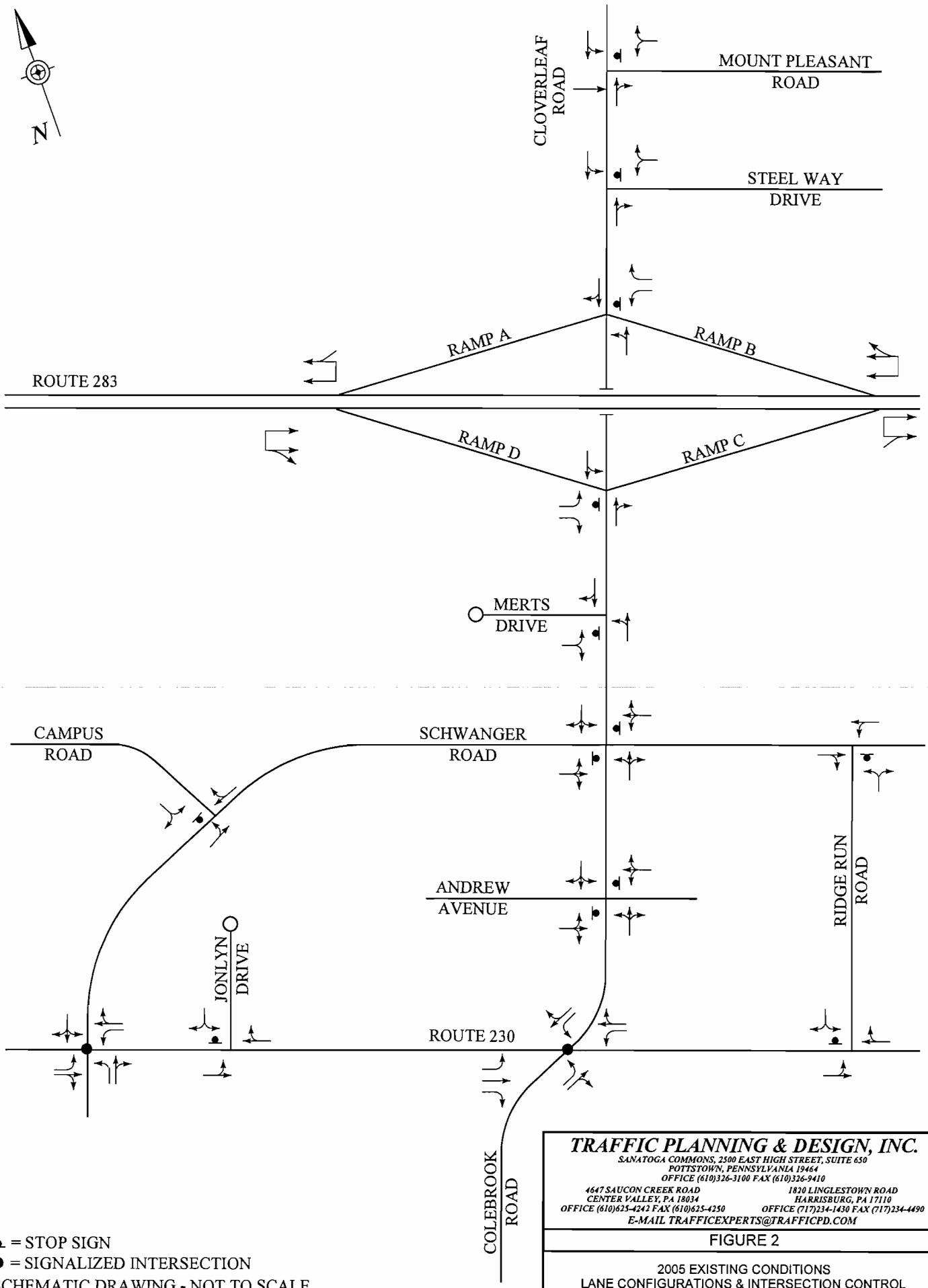

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● = SIGNALIZED INTERSECTION
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FIGURE 2

2005 EXISTING CONDITIONS
LANE CONFIGURATIONS & INTERSECTION CONTROL

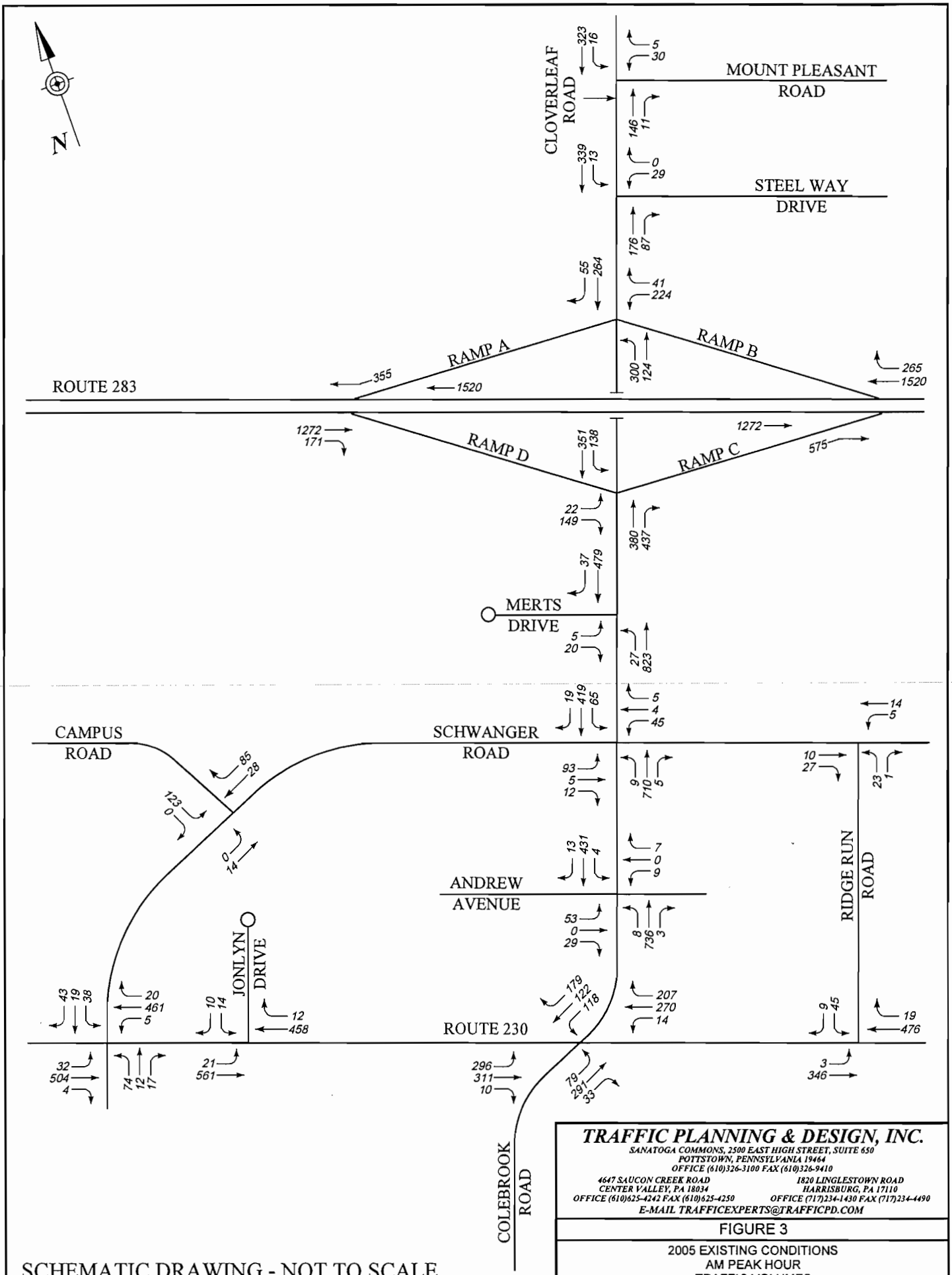

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FIGURE 3

2005 EXISTING CONDITIONS
AM PEAK HOUR
TRAFFIC VOLUMES

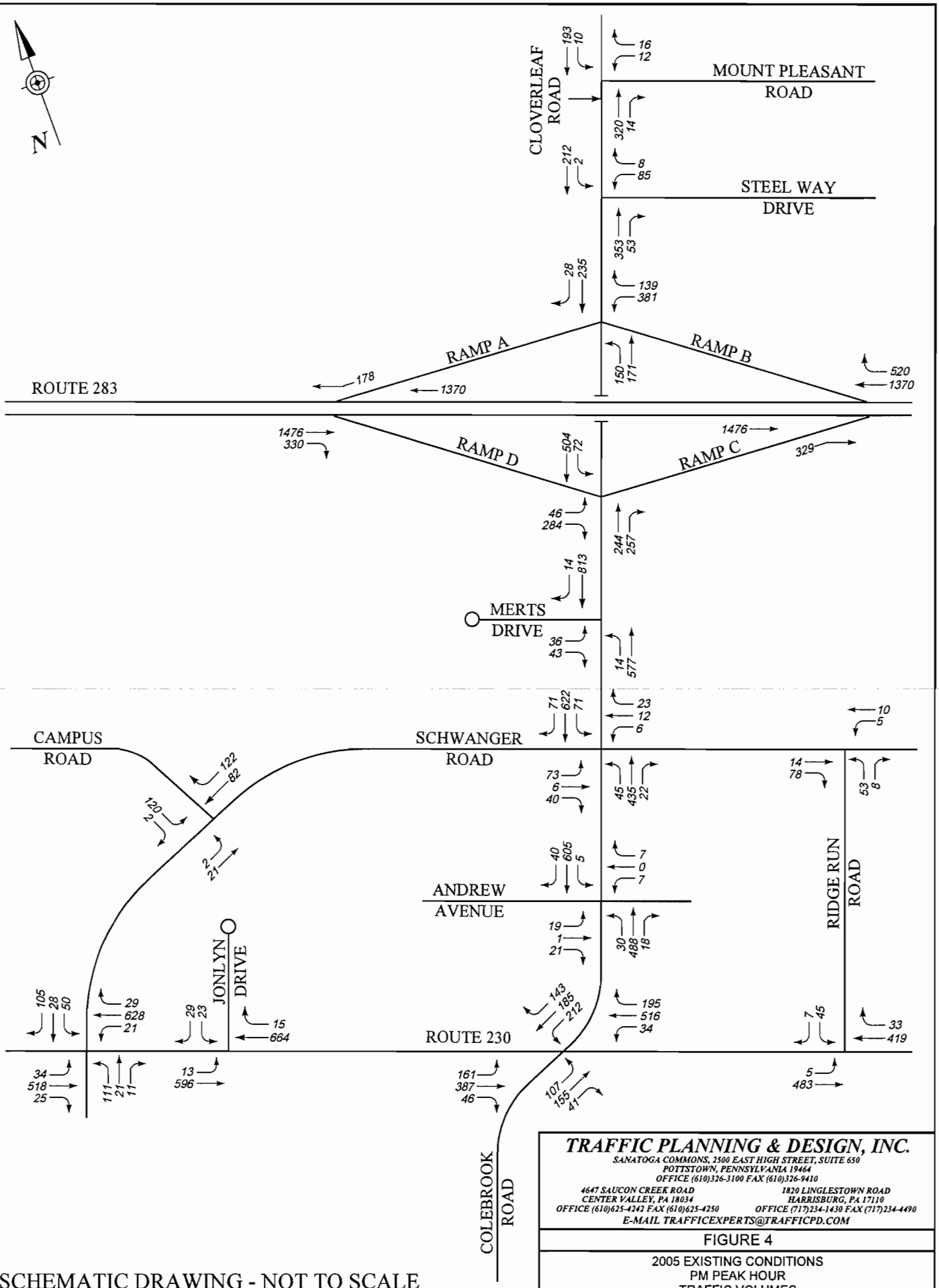

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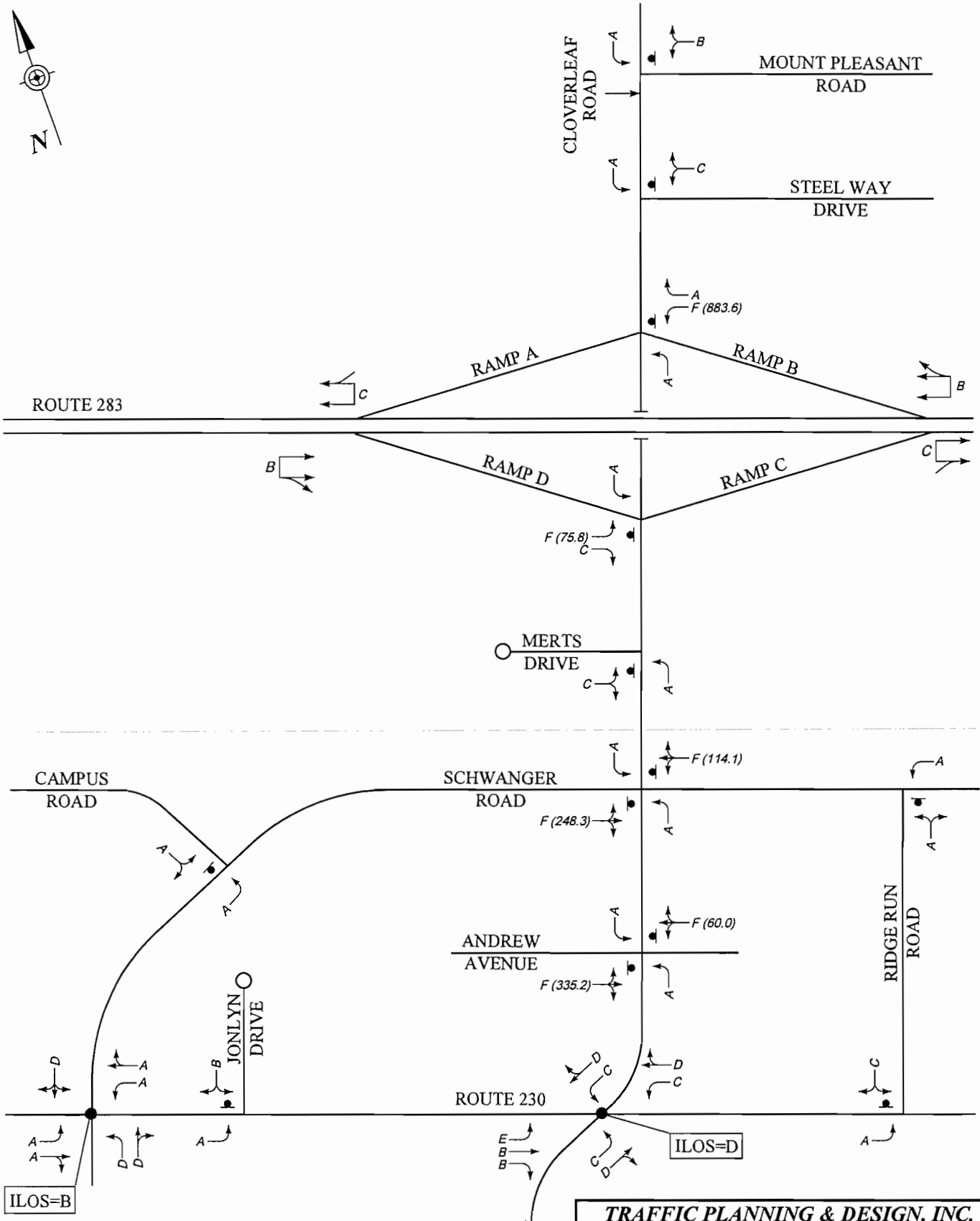
FIGURE 4

2005 EXISTING CONDITIONS
PM PEAK HOUR
TRAFFIC VOLUMES



KEY: LOS (DELAY)
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
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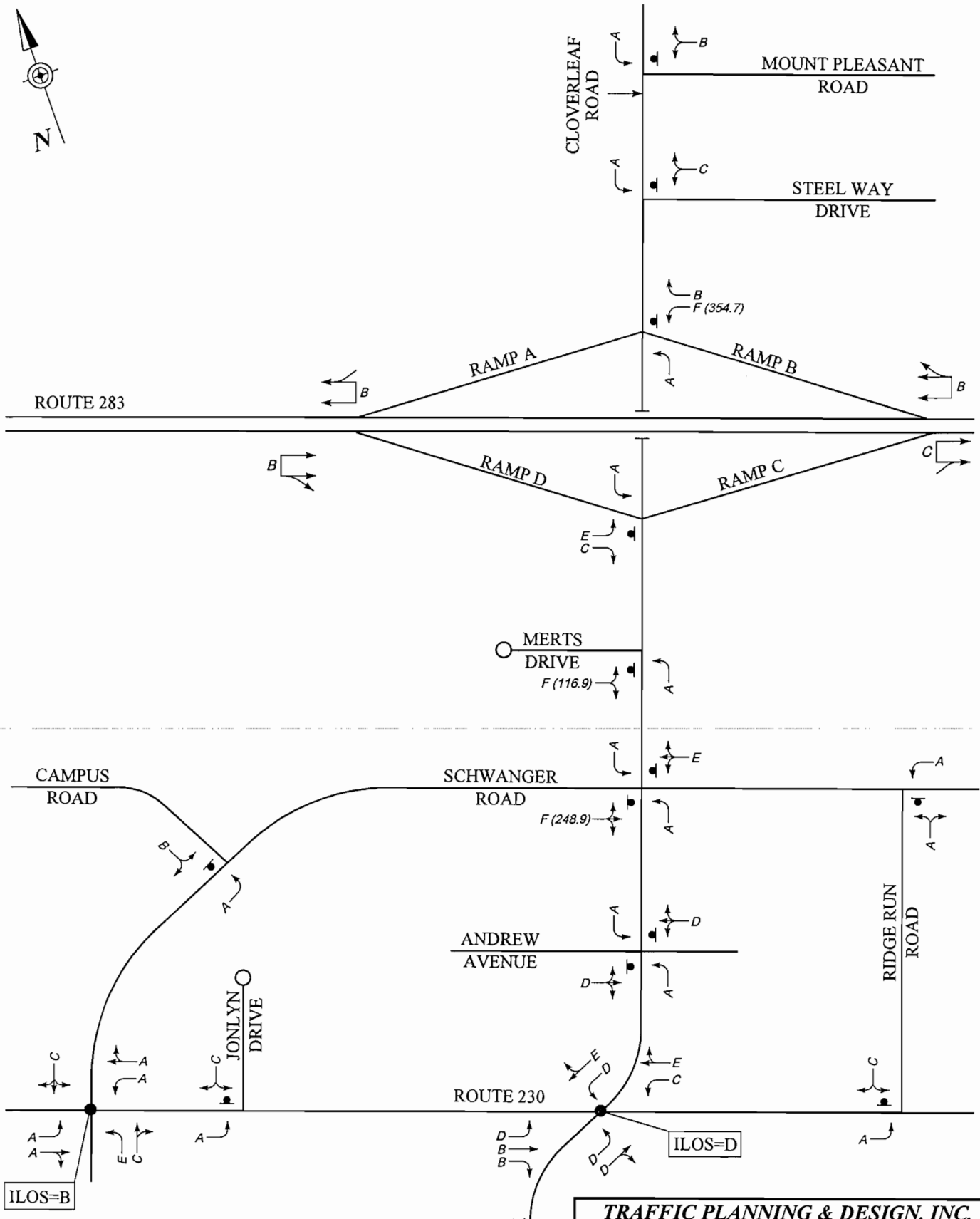
FIGURE 5

2005 EXISTING CONDITIONS
AM PEAK HOUR
LEVELS OF SERVICE



KEY: LOS (DELAY)
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
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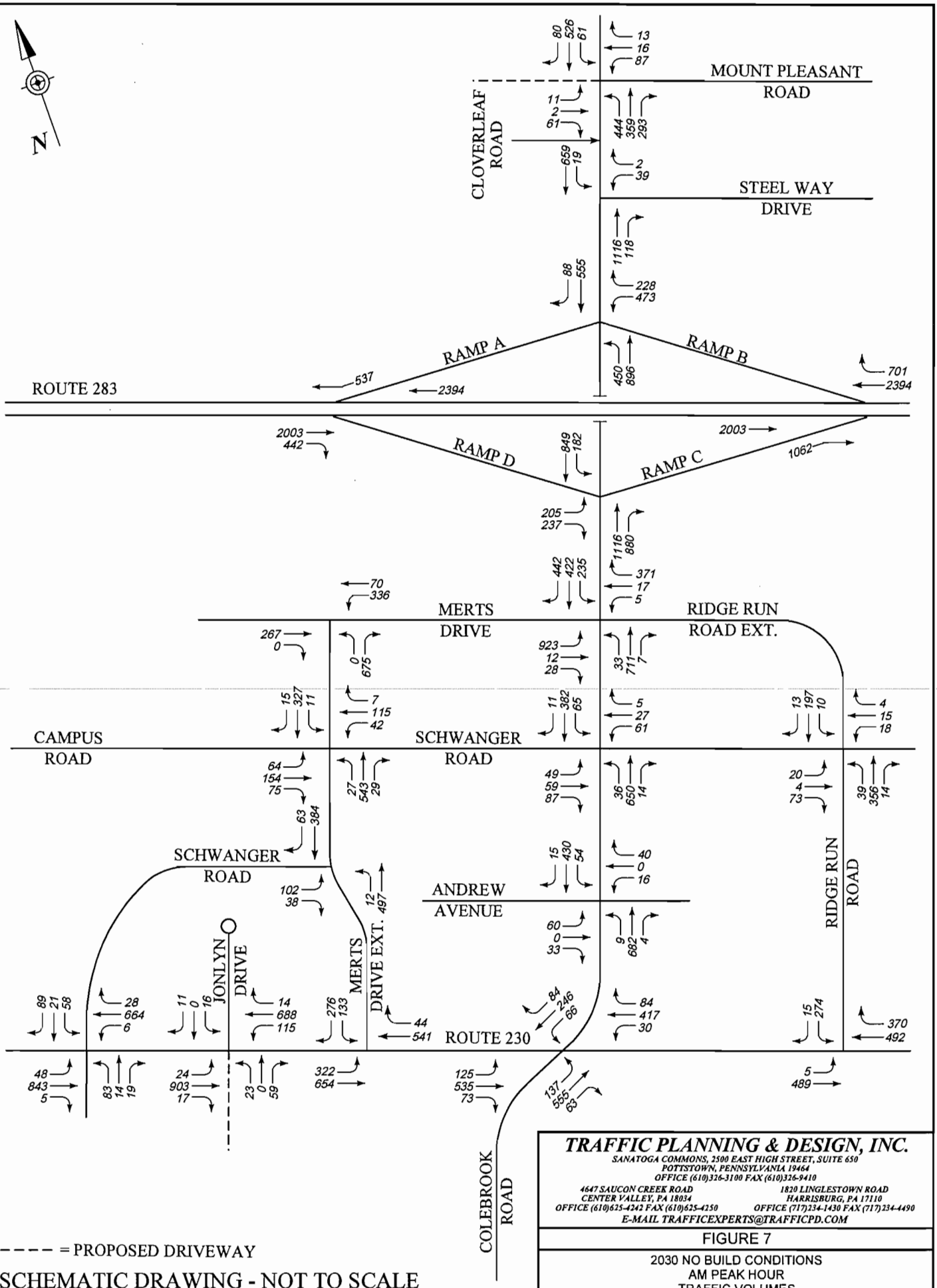
FIGURE 6

2005 EXISTING CONDITIONS
PM PEAK HOUR
LEVELS OF SERVICE



---- = PROPOSED DRIVEWAY

SCHEMATIC DRAWING - NOT TO SCALE

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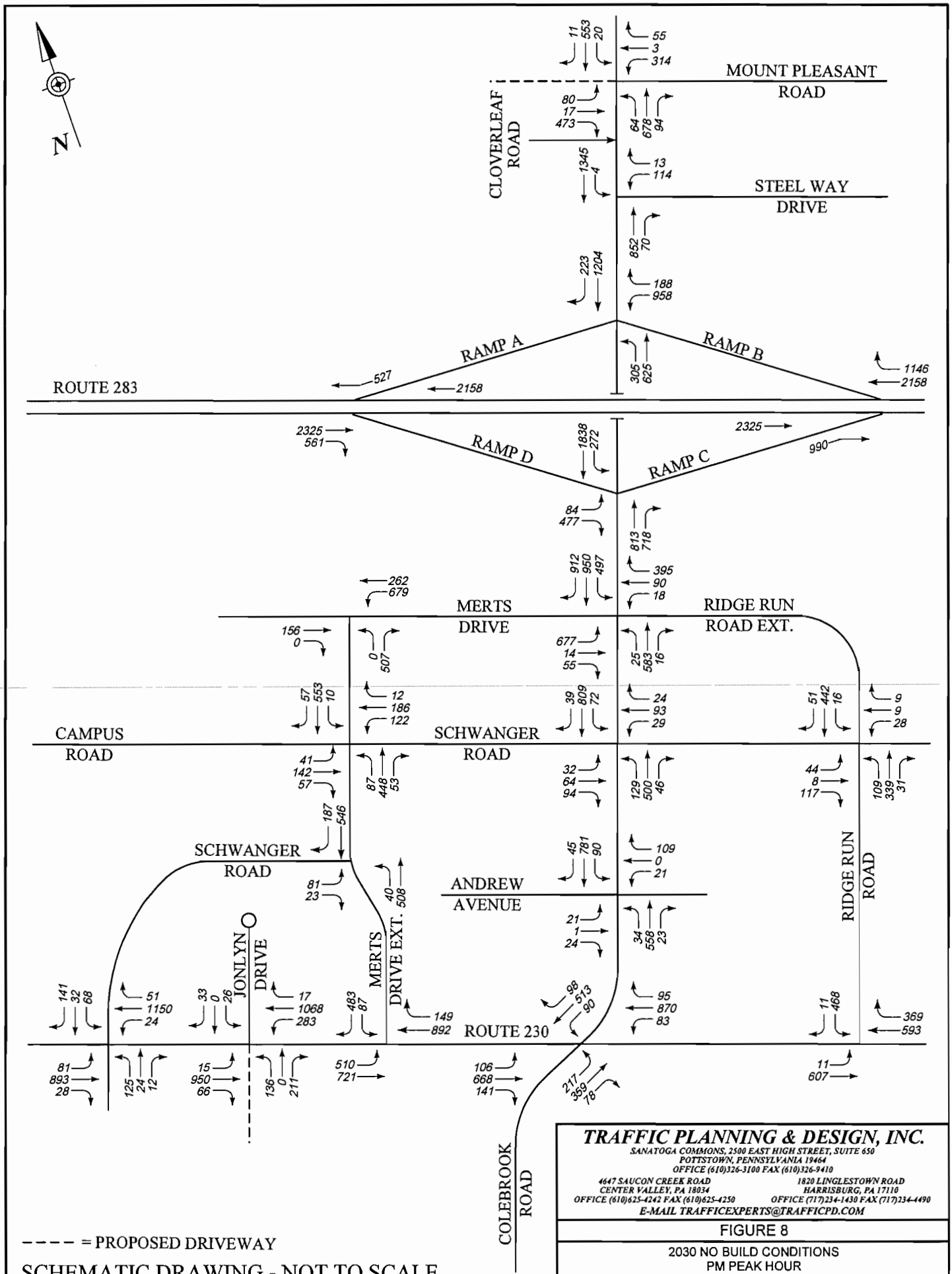
FIGURE 7

2030 NO BUILD CONDITIONS
AM PEAK HOUR
TRAFFIC VOLUMES



---- = PROPOSED DRIVEWAY

SCHEMATIC DRAWING - NOT TO SCALE

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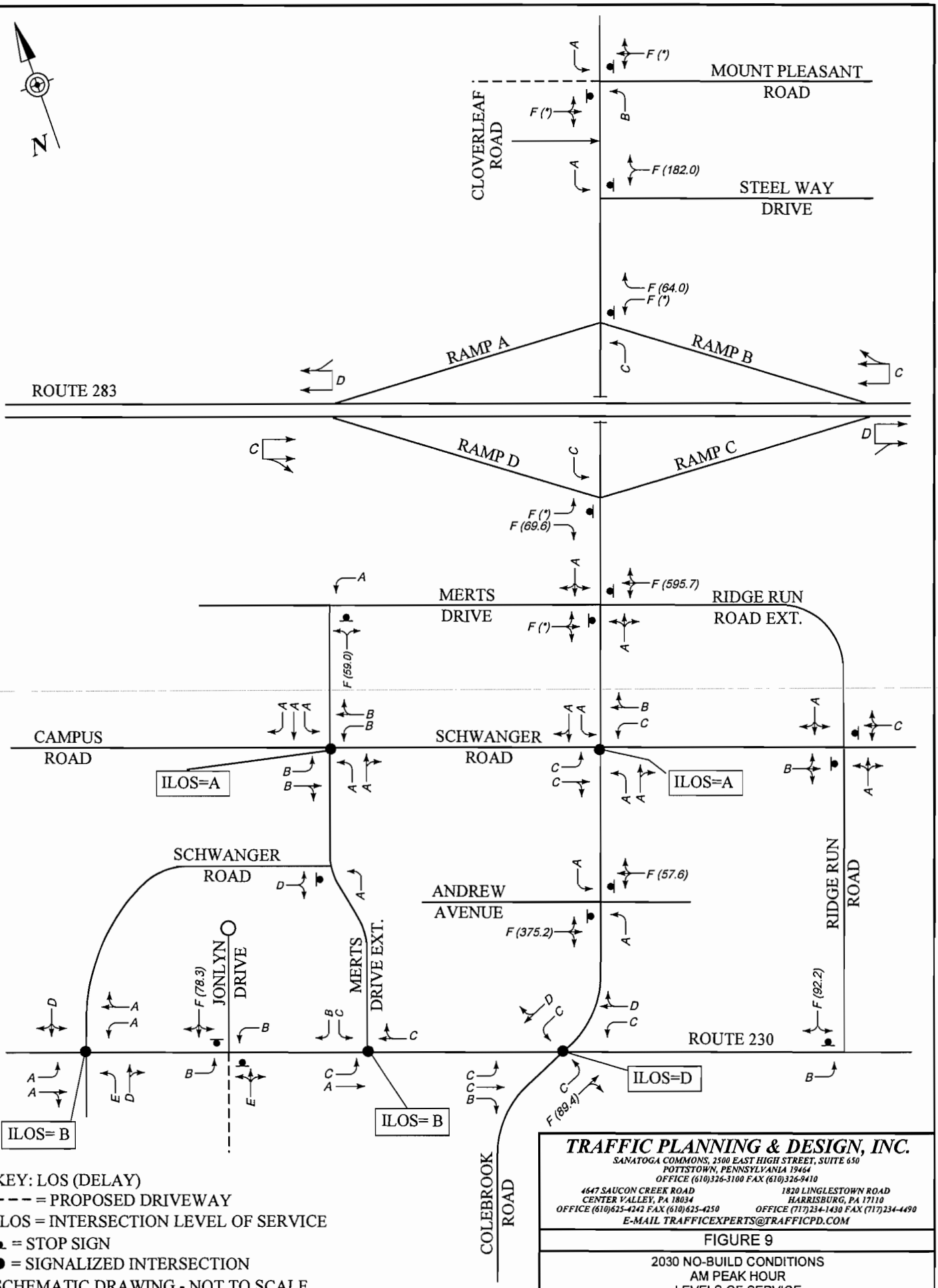
FIGURE 8

2030 NO BUILD CONDITIONS
PM PEAK HOUR
TRAFFIC VOLUMES



KEY: LOS (DELAY)
- - - = PROPOSED DRIVEWAY
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
SCHEMATIC DRAWING - NOT TO SCALE

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FIGURE 9

2030 NO-BUILD CONDITIONS
AM PEAK HOUR
LEVELS OF SERVICE

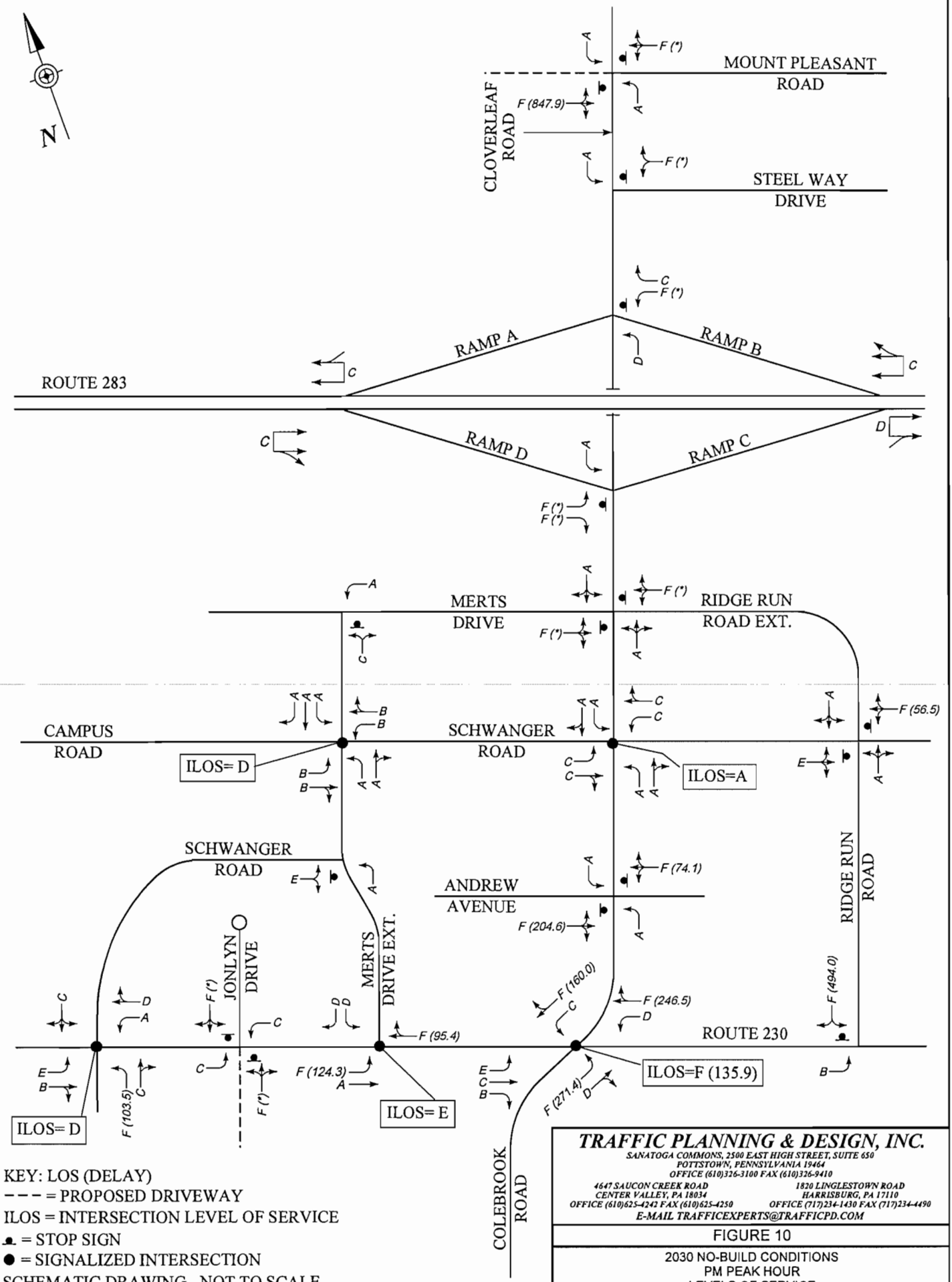

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FIGURE 10

2030 NO-BUILD CONDITIONS
PM PEAK HOUR
LEVELS OF SERVICE

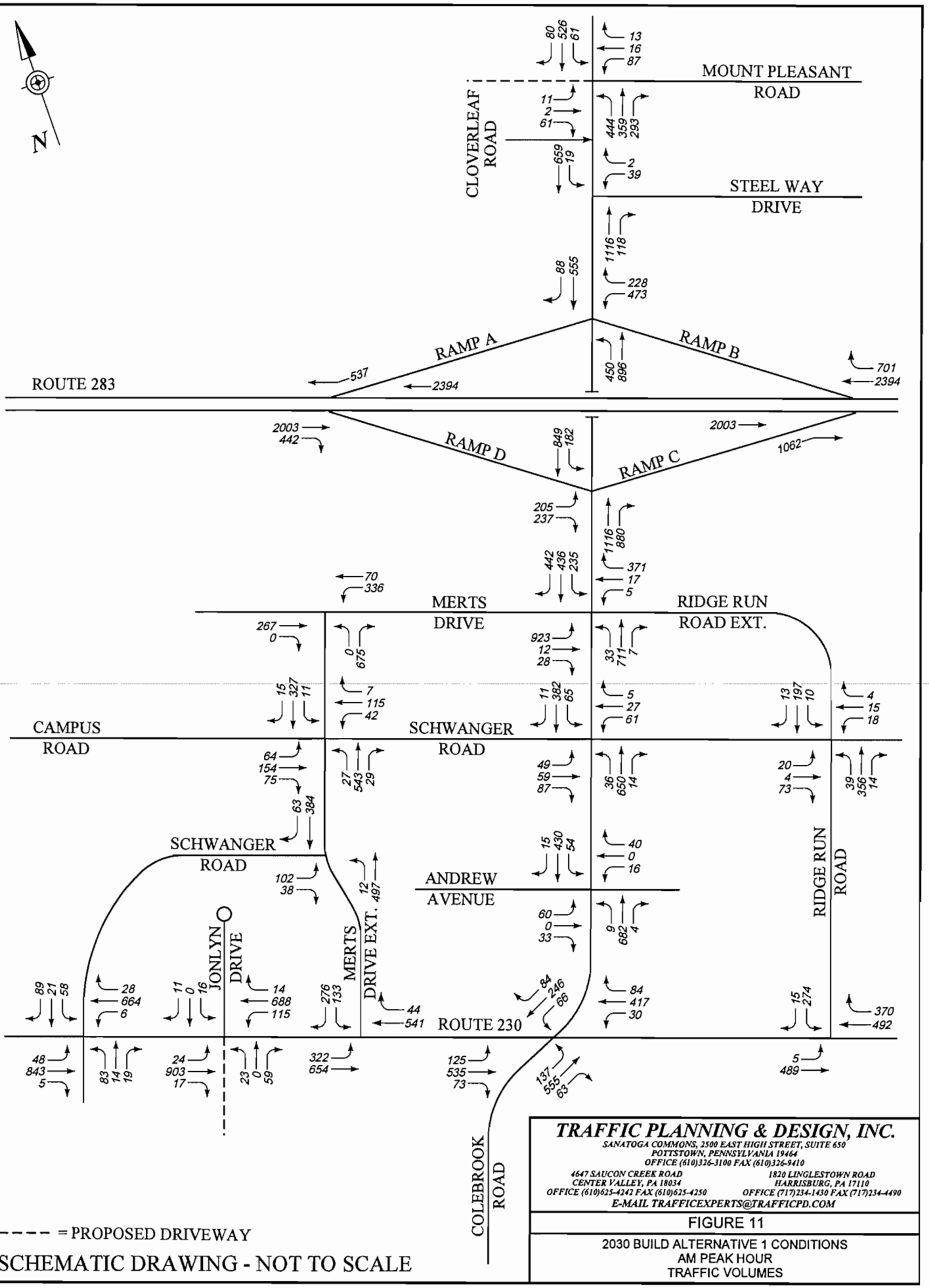

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FIGURE 11

2030 BUILD ALTERNATIVE 1 CONDITIONS
AM PEAK HOUR
TRAFFIC VOLUMES

---- = PROPOSED DRIVEWAY

SCHEMATIC DRAWING - NOT TO SCALE

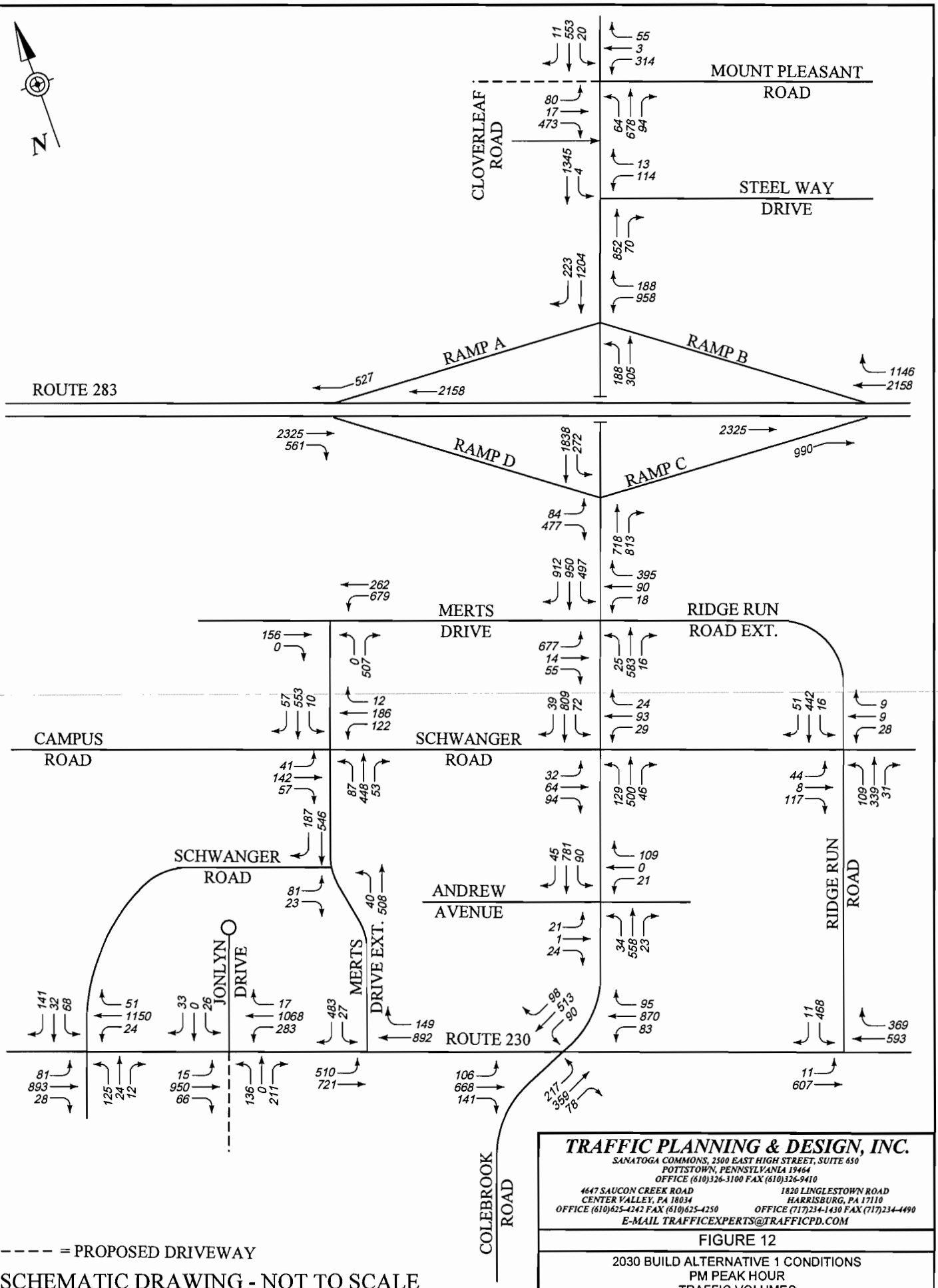

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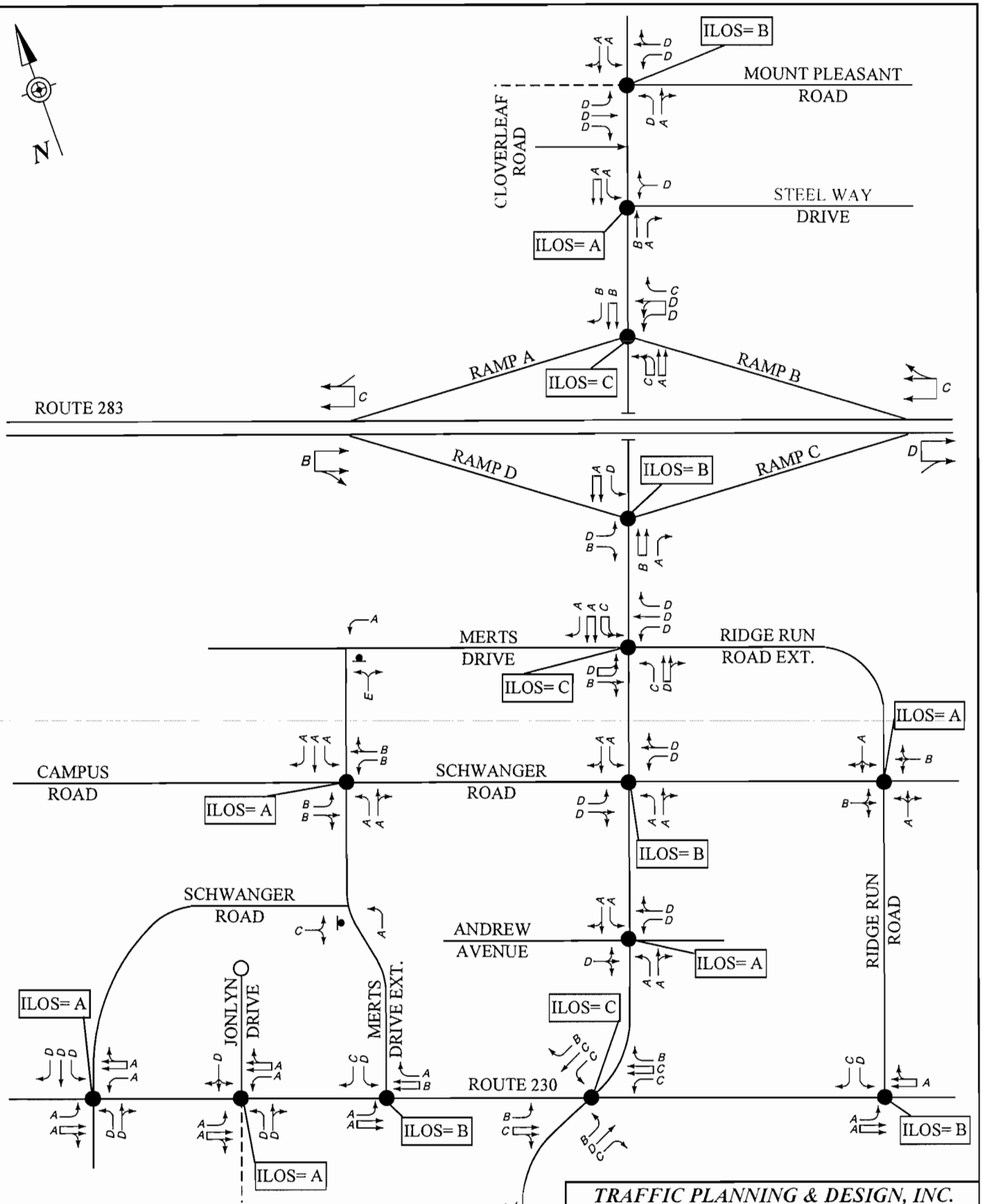
FIGURE 12

2030 BUILD ALTERNATIVE 1 CONDITIONS
PM PEAK HOUR
TRAFFIC VOLUMES



KEY: LOS (DELAY)
- - - = PROPOSED DRIVEWAY
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
SCHEMATIC DRAWING - NOT TO SCALE

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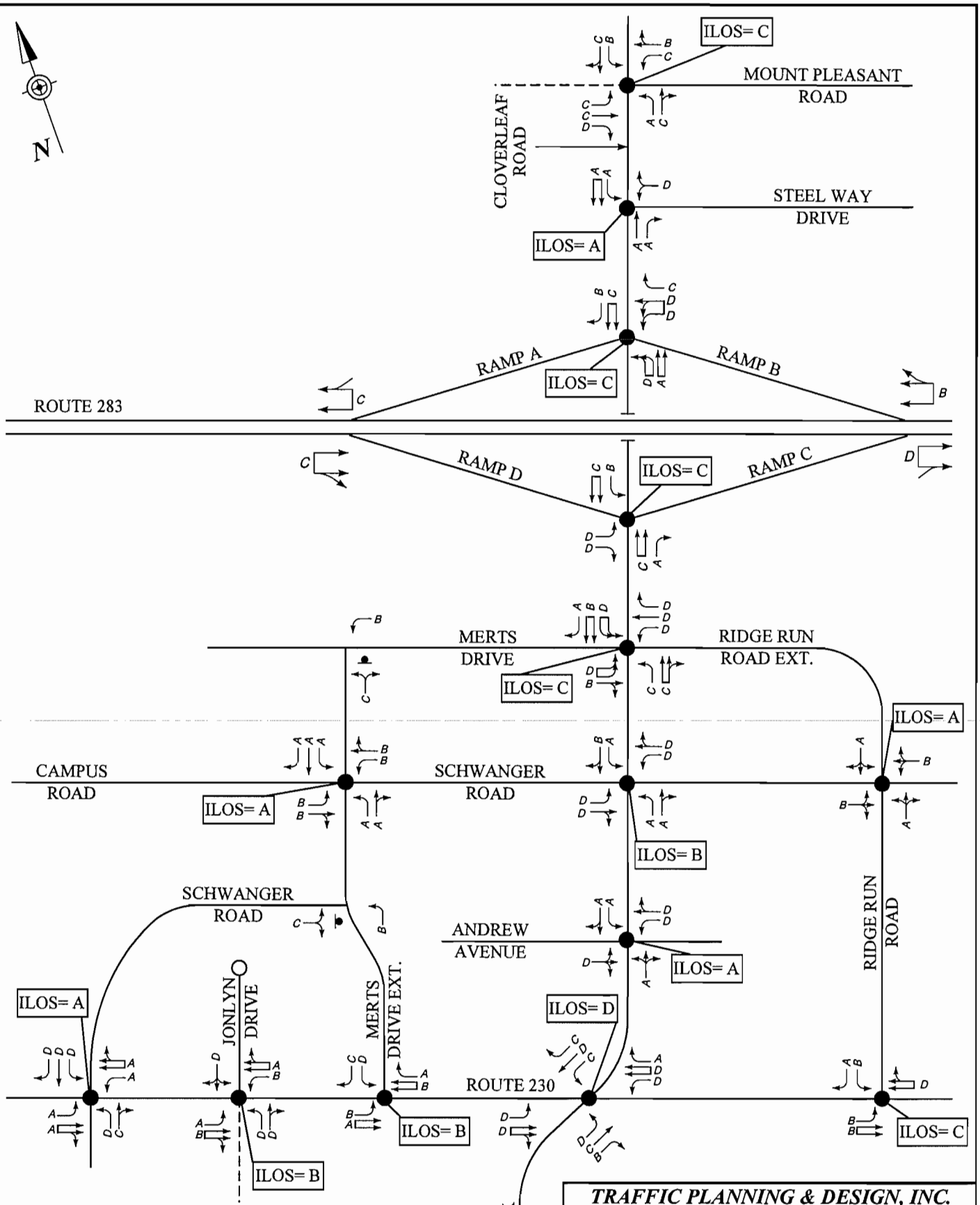
FIGURE 13

2030 BUILD ALTERNATIVE 1 CONDITIONS
AM PEAK HOUR
LEVELS OF SERVICE



KEY: LOS (DELAY)
- - - = PROPOSED DRIVEWAY
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
SCHEMATIC DRAWING - NOT TO SCALE

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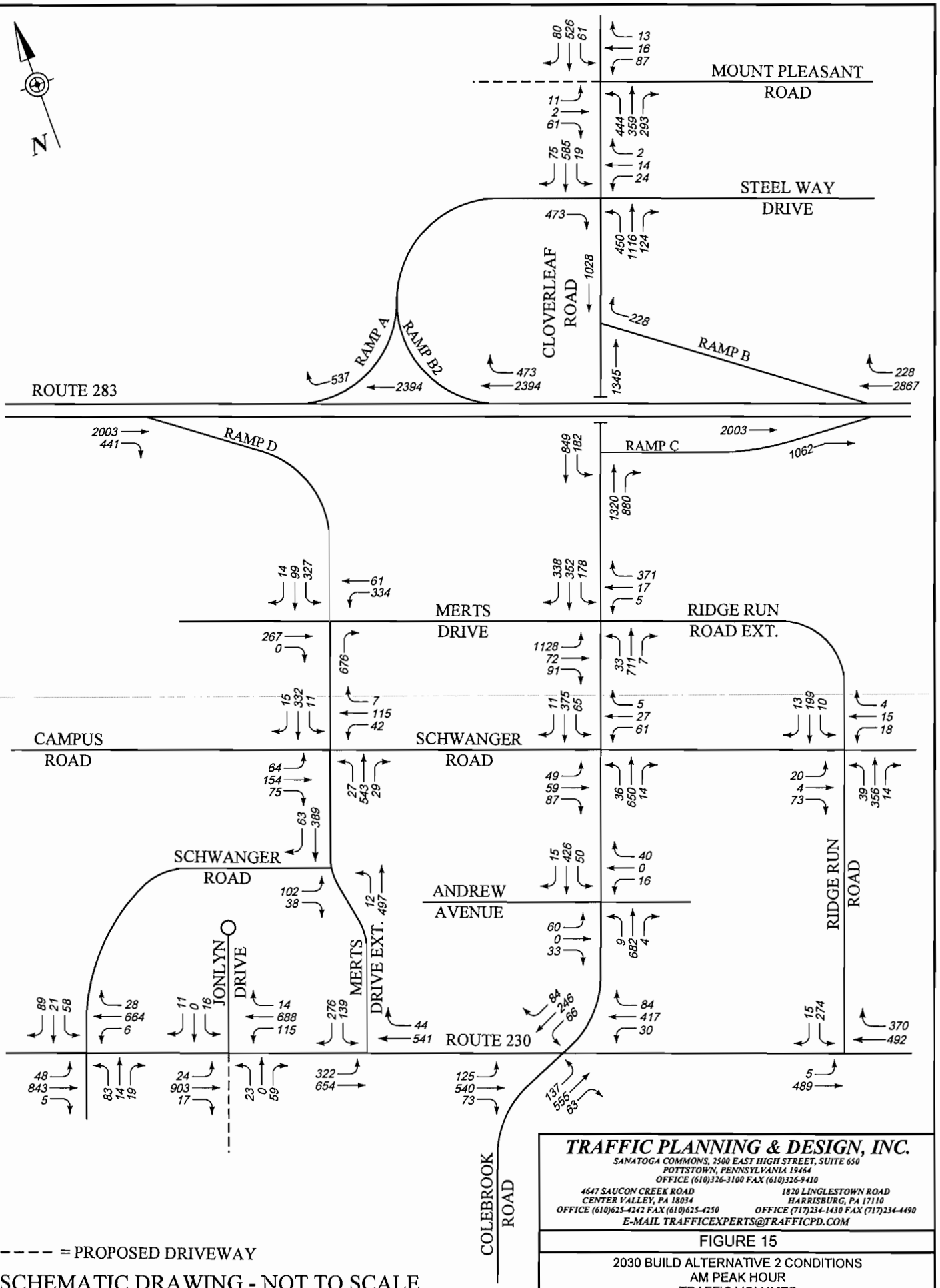
FIGURE 14

2030 BUILD ALTERNATIVE 1 CONDITIONS
PM PEAK HOUR
LEVELS OF SERVICE



---- = PROPOSED DRIVEWAY

SCHEMATIC DRAWING - NOT TO SCALE

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FIGURE 15

2030 BUILD ALTERNATIVE 2 CONDITIONS
AM PEAK HOUR
TRAFFIC VOLUMES

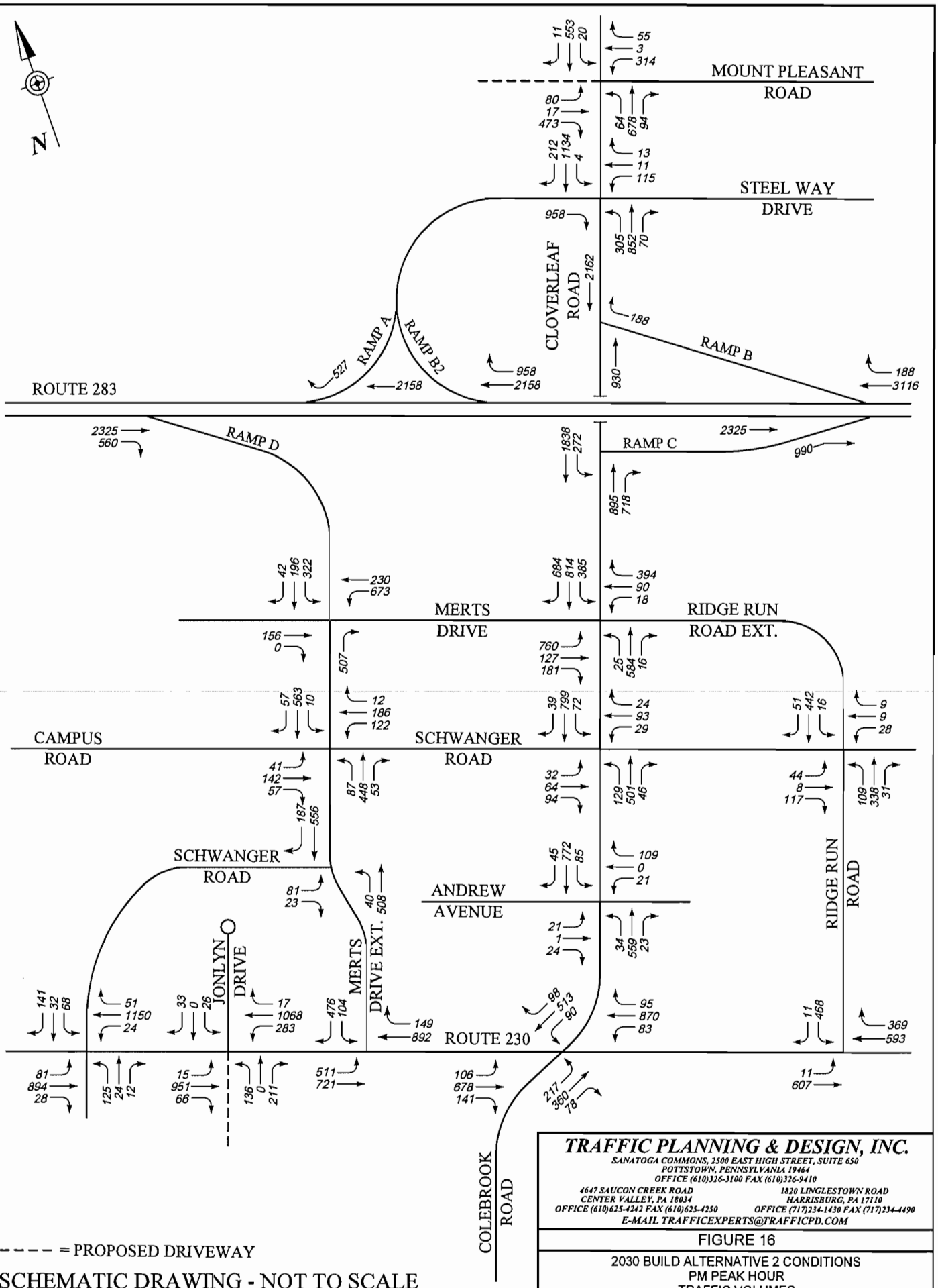

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FIGURE 16

2030 BUILD ALTERNATIVE 2 CONDITIONS
PM PEAK HOUR
TRAFFIC VOLUMES

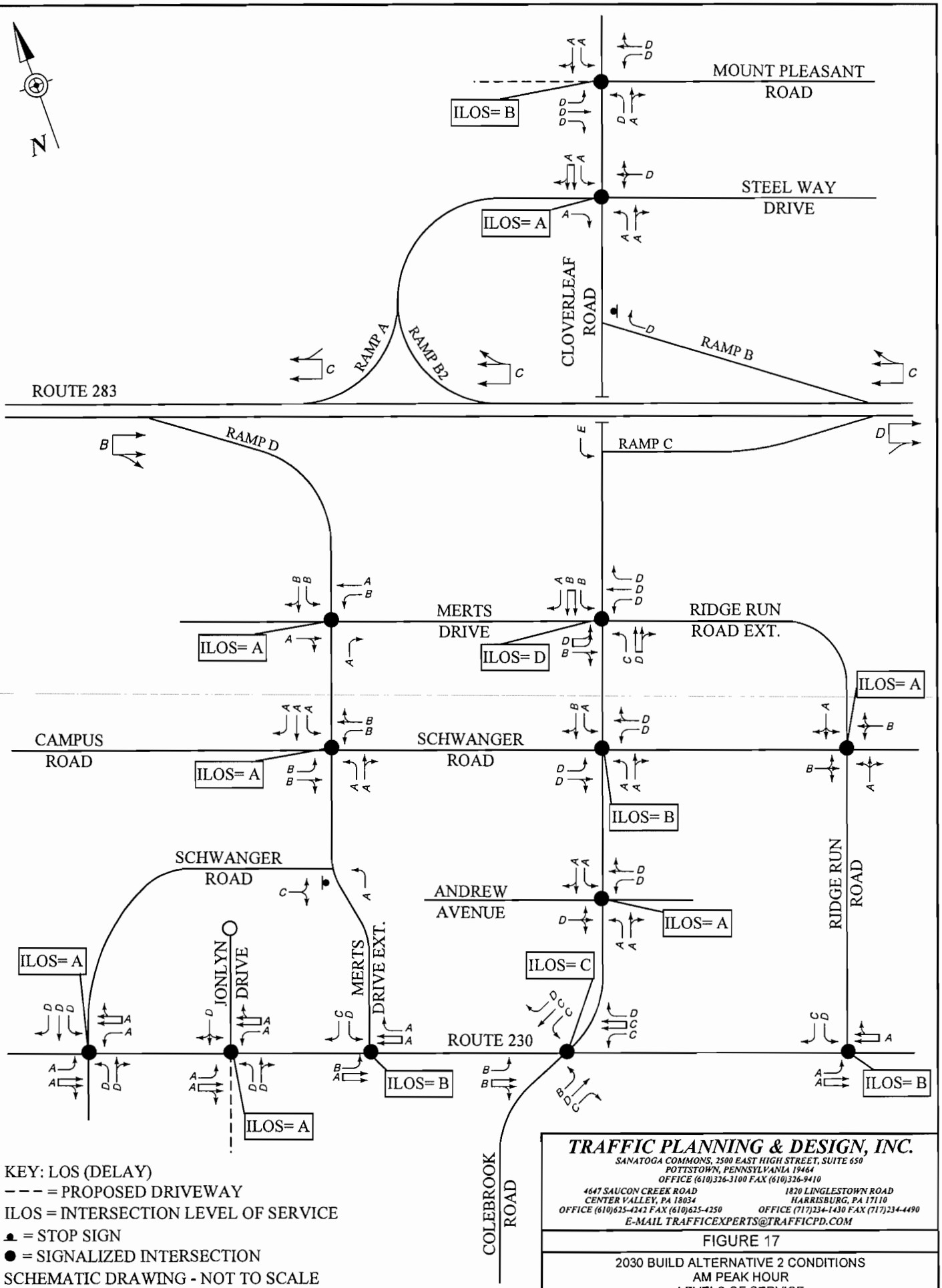

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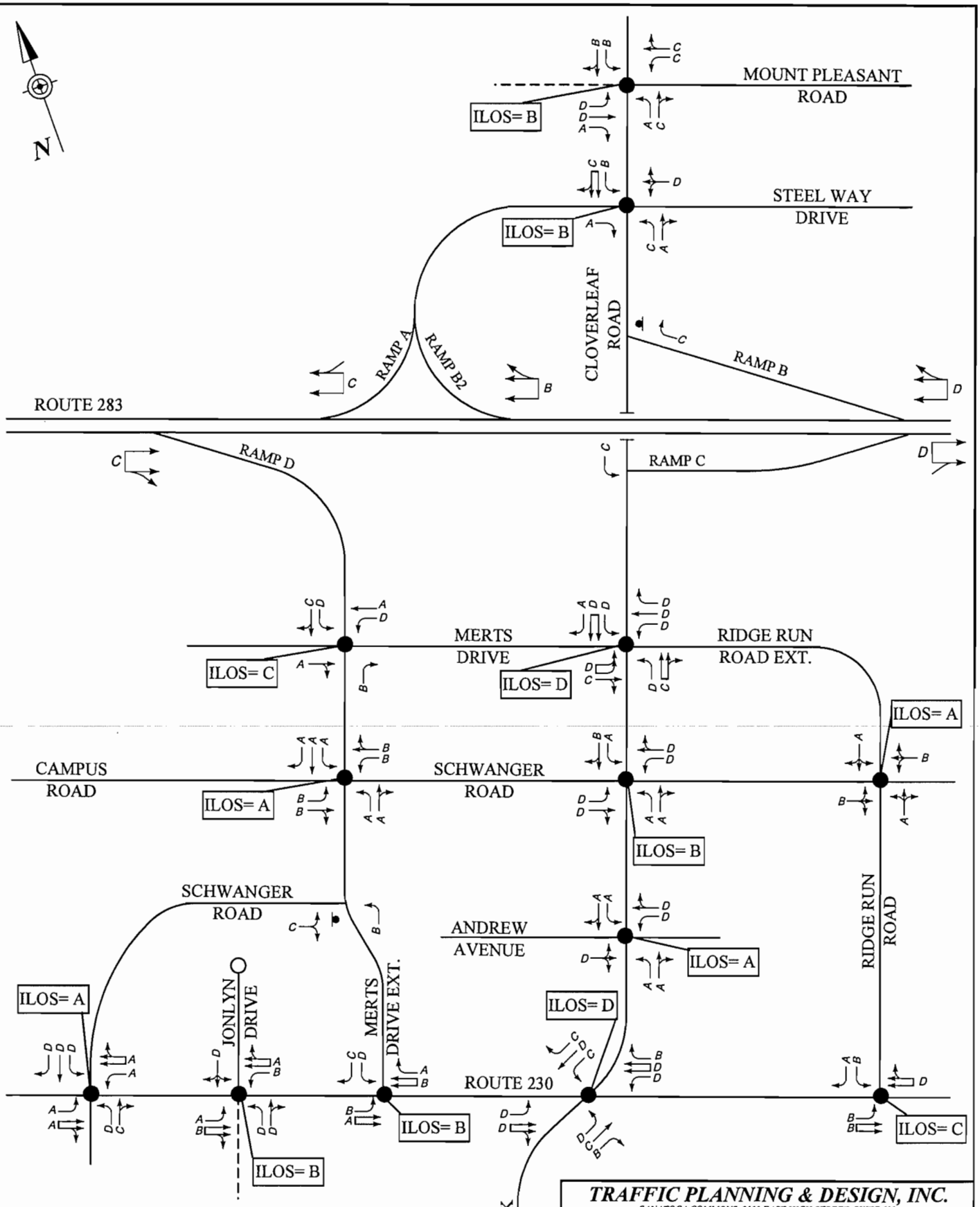
FIGURE 17

2030 BUILD ALTERNATIVE 2 CONDITIONS
AM PEAK HOUR
LEVELS OF SERVICE



KEY: LOS (DELAY)
- - - = PROPOSED DRIVEWAY
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
SCHEMATIC DRAWING - NOT TO SCALE

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FIGURE 18

2030 BUILD ALTERNATIVE 2 CONDITIONS
PM PEAK HOUR
LEVELS OF SERVICE

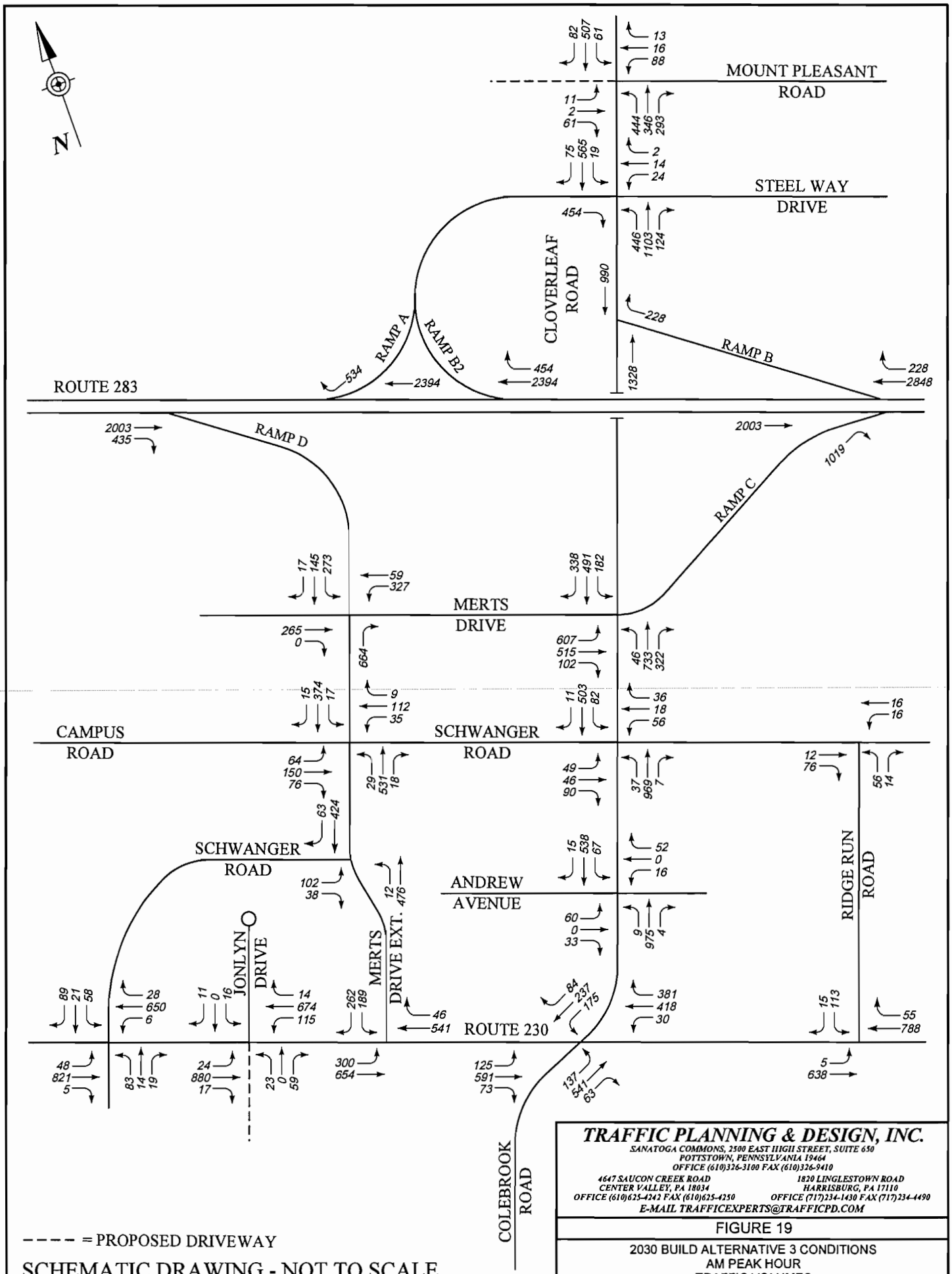

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FIGURE 19

2030 BUILD ALTERNATIVE 3 CONDITIONS
AM PEAK HOUR
TRAFFIC VOLUMES

---- = PROPOSED DRIVEWAY

SCHEMATIC DRAWING - NOT TO SCALE

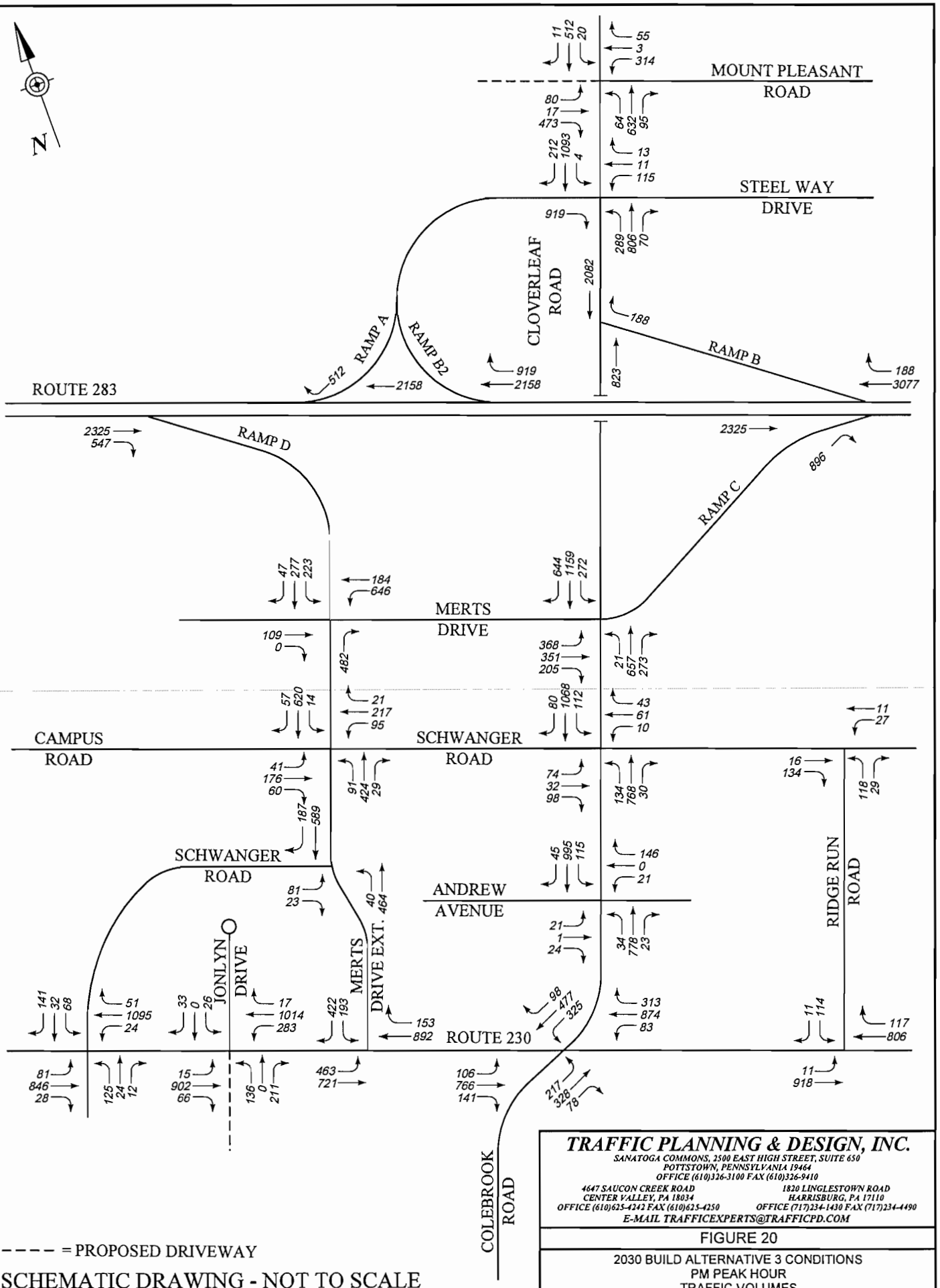

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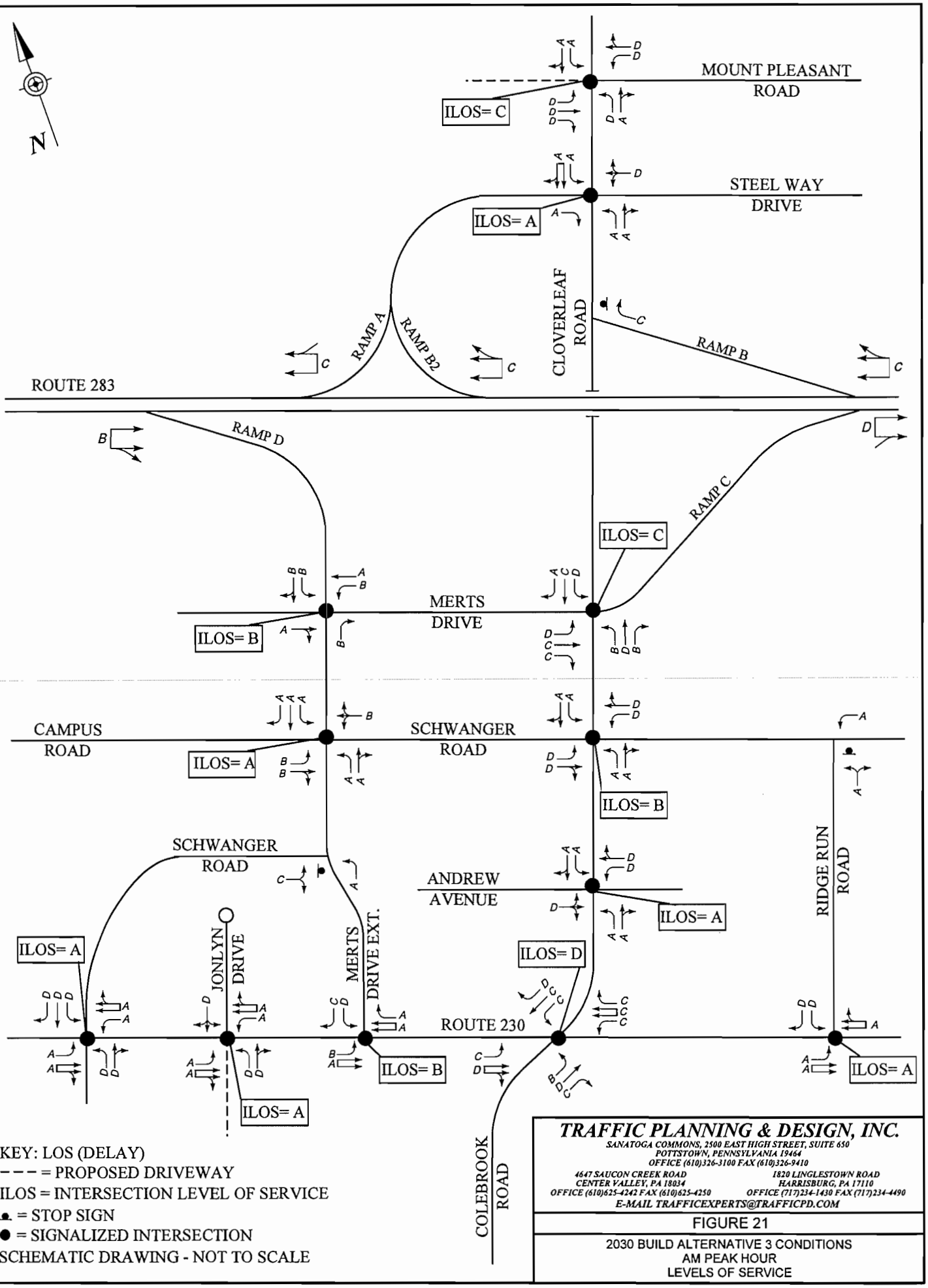
FIGURE 20

2030 BUILD ALTERNATIVE 3 CONDITIONS
PM PEAK HOUR
TRAFFIC VOLUMES



KEY: LOS (DELAY)
- - - = PROPOSED DRIVEWAY
ILOS = INTERSECTION LEVEL OF SERVICE
= STOP SIGN
● = SIGNALIZED INTERSECTION
SCHEMATIC DRAWING - NOT TO SCALE

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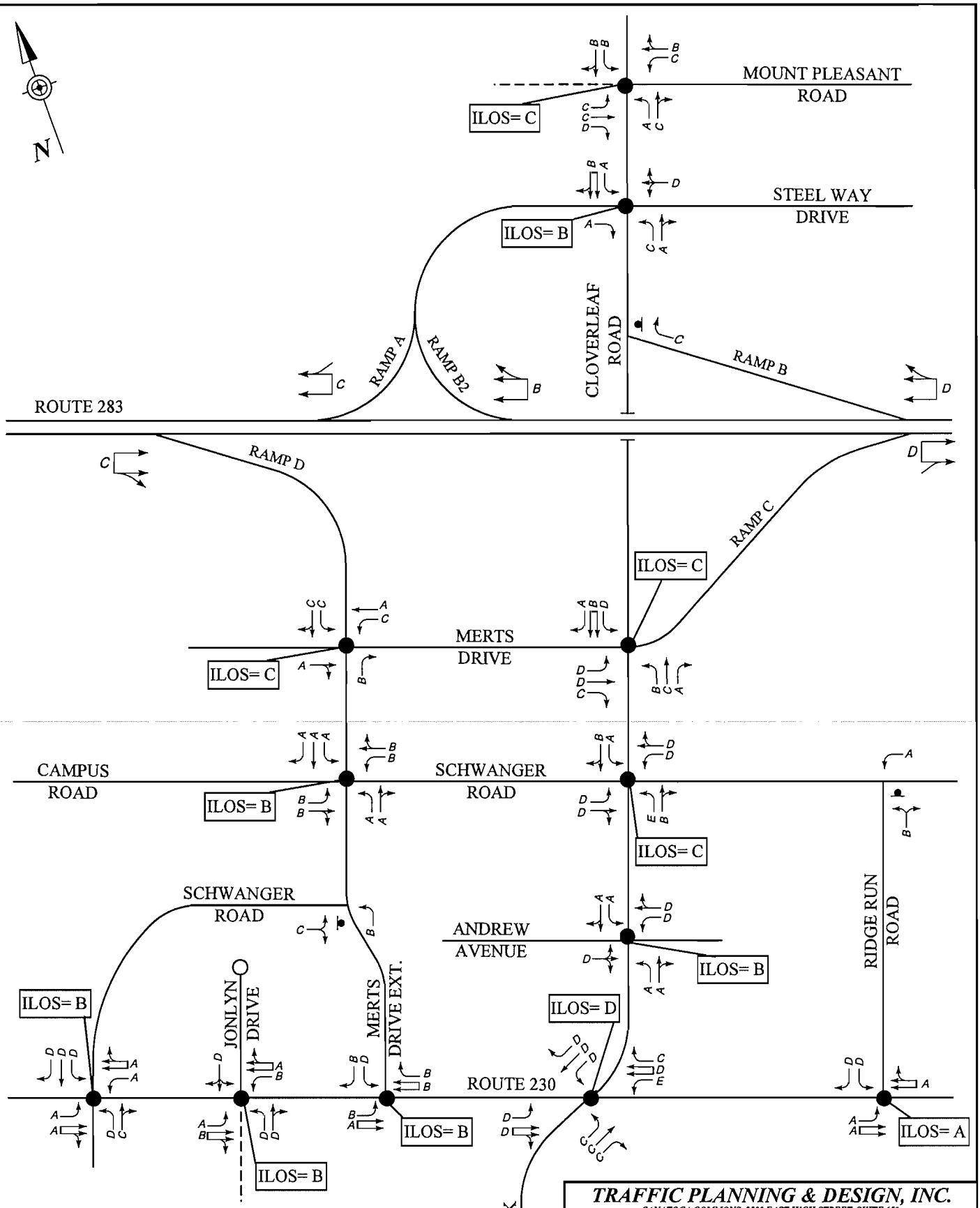
FIGURE 21

2030 BUILD ALTERNATIVE 3 CONDITIONS
AM PEAK HOUR
LEVELS OF SERVICE



KEY: LOS (DELAY)
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ILOS = INTERSECTION LEVEL OF SERVICE
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SCHEMATIC DRAWING - NOT TO SCALE

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FIGURE 22

2030 BUILD ALTERNATIVE 3 CONDITIONS
PM PEAK HOUR
LEVELS OF SERVICE

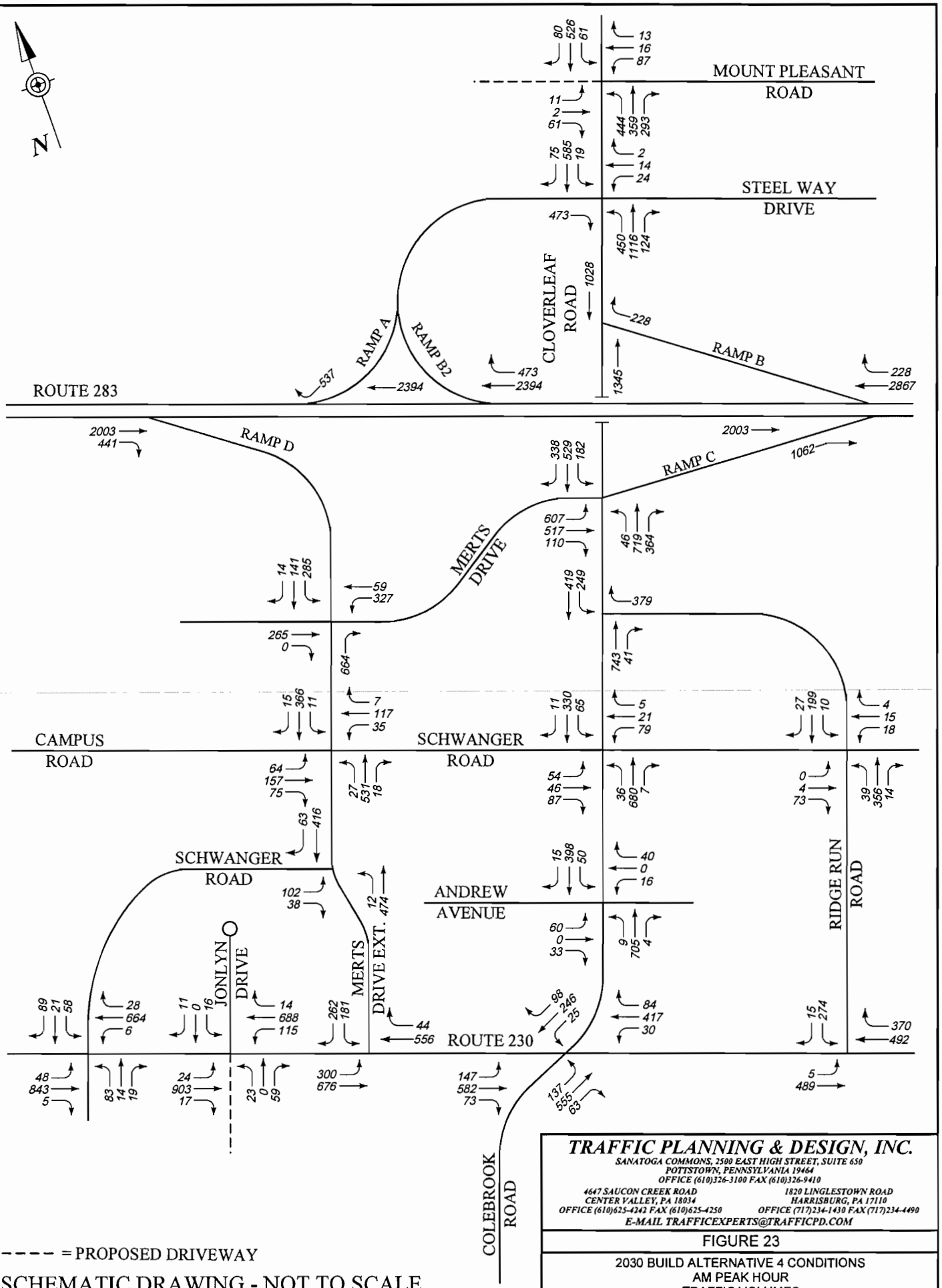
N
MOUNT PLEASANT ROAD
STEEL WAY DRIVE
CLOVERLEAF ROAD
RAMP A
RAMP B2
RAMP B
RAMP C
RAMP D
ROUTE 283
MERTS DRIVE
CAMPUS ROAD
SCHWANGER ROAD
ANDREW AVENUE
JONLYN DRIVE
MERTS DRIVE EXT.
RIDGE RUN ROAD
ROUTE 230
COLEBROOK ROAD
80 526 61
13 16 87
11 2 61
444 359 293
75 585 19
2 14 24
473
450 1116 124
1028
228
1345
537
2394
473 2394
228 2867
2003 441
338 529 182
2003
1062
607 517 110
46 719 364
14 141 285
59 327
419 249
379
265 0
664
743 41
15 366 11
7 117 35
11 330 65
5 21 79
27 199 10
4 15 18
64 157 75
27 531 18
54 46 87
36 680 7
0 4 73
39 356 14
63 416
15 398 50
40 0 16
102 38
12 474
60 0 33
9 705 4
89 21 58
28 664 6
11 0 16
14 688 115
262 181
44 556
98 246 25
84 417 30
15 274
370 492
48 843 5
83 14 19
24 903 17
23 0 59
300 676
147 582 73
137 555 63
5 489
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FIGURE 23
2030 BUILD ALTERNATIVE 4 CONDITIONS
AM PEAK HOUR
TRAFFIC VOLUMES
= PROPOSED DRIVEWAY
SCHEMATIC DRAWING - NOT TO SCALE

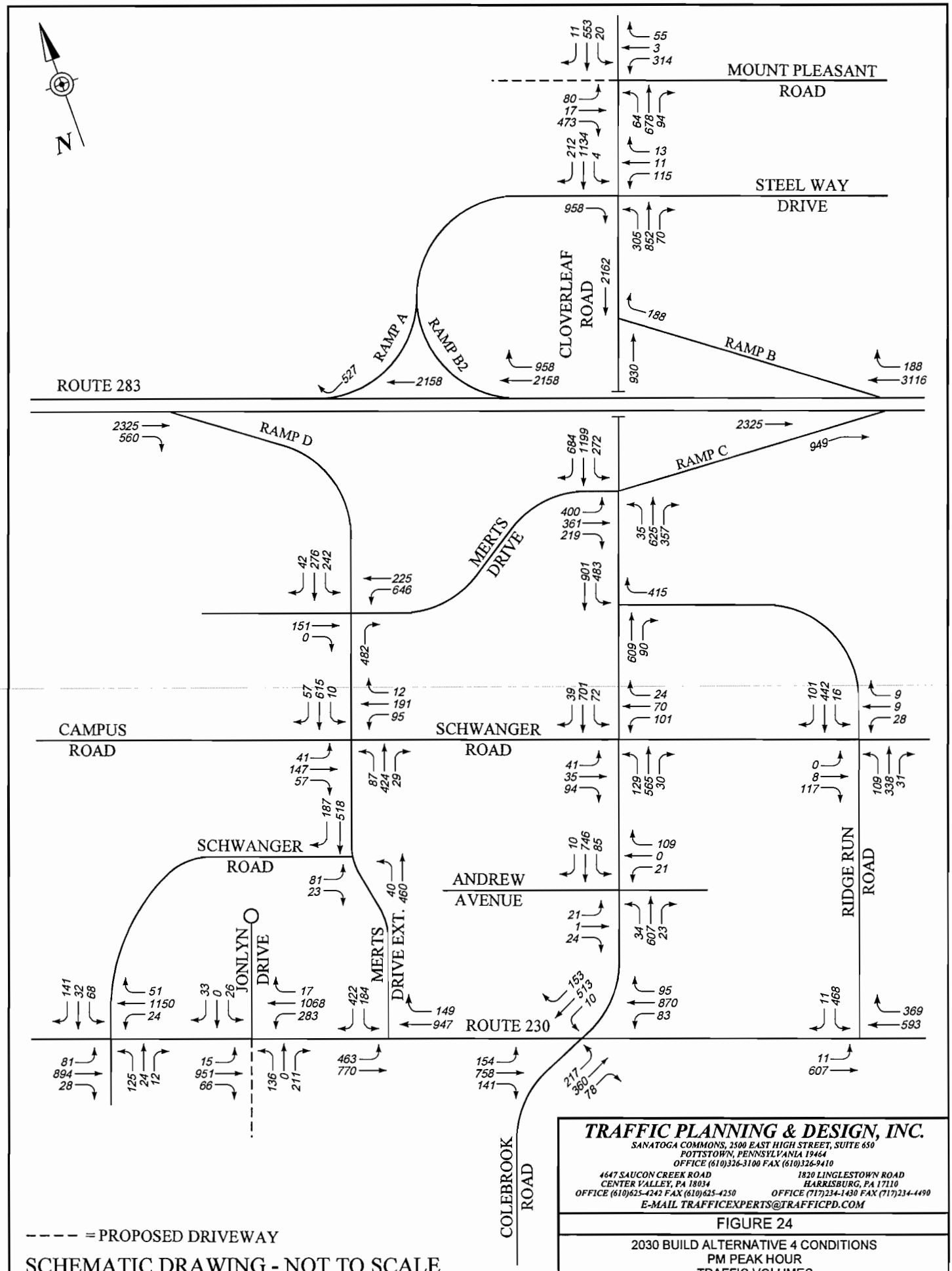

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FIGURE 24

2030 BUILD ALTERNATIVE 4 CONDITIONS
PM PEAK HOUR
TRAFFIC VOLUMES

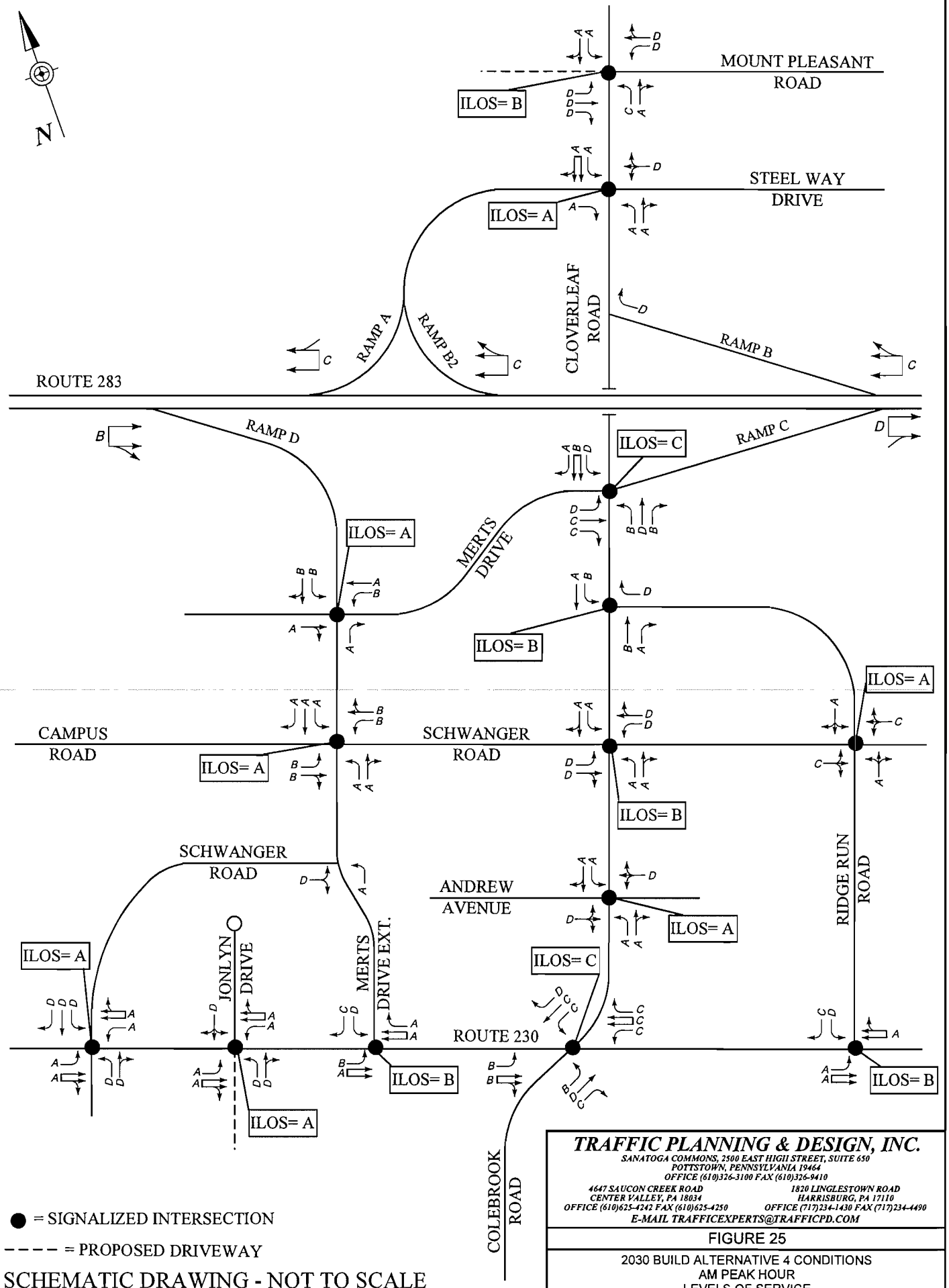

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FIGURE 25

2030 BUILD ALTERNATIVE 4 CONDITIONS
AM PEAK HOUR
LEVELS OF SERVICE

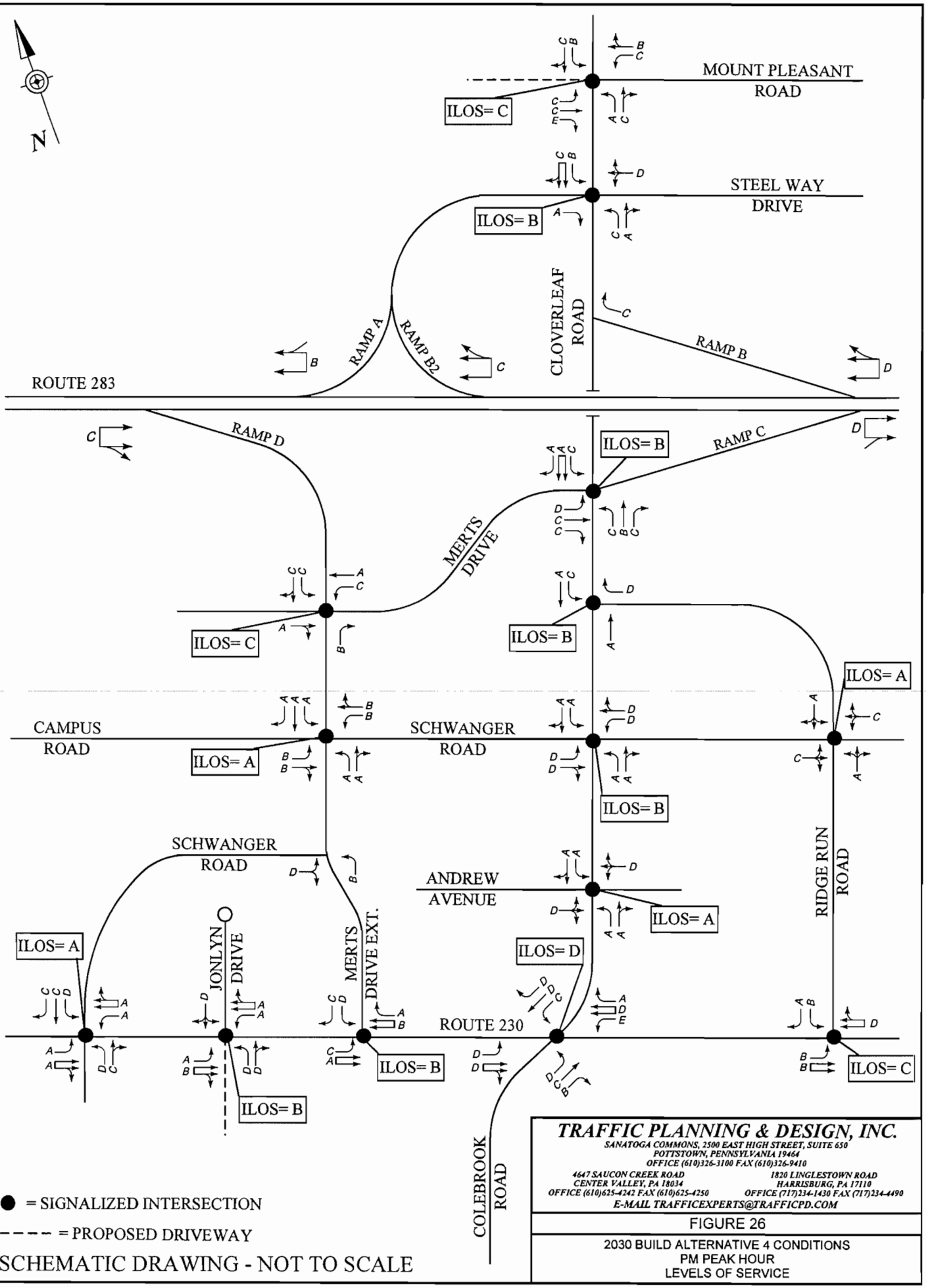

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FIGURE 26

2030 BUILD ALTERNATIVE 4 CONDITIONS
PM PEAK HOUR
LEVELS OF SERVICE