January 7, 2022

TRANSPORTATION IMPACT STUDY FOR THE PROPOSED GRAND VIEW SENIOR RESIDENCES

Caruthers Lane at
Laurel Avenue

Borough of Irwin and
North Huntingdon Township
Westmoreland County, Pennsylvania

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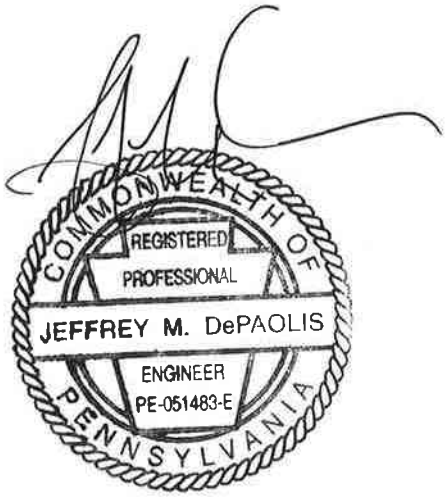

Civil & Environmental Consultants, Inc.

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EXECUTIVE SUMMARY

General Overview of the Development

- Grand View Senior Residences development to be constructed on the northwest corner of the intersection of Caruthers Lane with Laurel Avenue in the Borough of Irwin and North Huntingdon Township, Westmoreland County, Pennsylvania.
- Proposed Grand View Senior Residences development to be constructed in two (2) Phases:
  - Phase 1 of development will include the construction of a four (4) story, 50 unit senior apartment building;
  - Phase 2 of development will include the construction of nine (9) duplex patio homes (18 total residential units) and 18 single level houses.
- Access to the development is proposed via the construction of a new site driveway to Laurel Avenue, the centerline of which will be located approximately 400 feet west of the centerline of Caruthers Lane.

List of Study Intersections

- Caruthers Lane with Laurel Avenue (existing un signalized); and
- Laurel Avenue with the site driveway (proposed).

Trip Generation and Distribution

- Trip generation of the proposed Grand View Senior Residences development was determined using rates and equations contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation*, Eleventh Edition, 2021:
  - Land Use Code 252, *Senior Adult Housing-Multifamily*, was used to determine the trip generation of the proposed four (4) story, 50 unit apartment building; and
  - Land Use Code 251, *Senior Adult Housing-Single-Family*, was used to determine the trip generation of the proposed nine (9) duplex patio homes (18 total residential units) and 18 single level houses.
- Estimated Trip Generation of proposed Grand View Senior Residences development:

  Phase 1

  A.M. Peak Hour: Three (3) Entering/Seven (7) Exiting/10 Total

  P.M. Peak Hour: Seven (7) Entering/Six (6) Exiting/13 Total

Full-Build

A.M. Peak Hour: Nine (9) Entering/19 Exiting/28 Total

P.M. Peak Hour: 19 Entering/14 Exiting/33 Total

- Forecasted trips to be generated by the proposed Grand View Senior Resources development were distributed into and out from the site driveway to Laurel Avenue based on an average of the existing peak hour traffic volumes along Laurel Avenue within the environs of the proposed site driveway.
    - Trips then distributed through the intersection of Caruthers Lane with Laurel Avenue based on an average of the existing peak hour traffic volumes at the intersection of Caruthers Lane with Laurel Avenue.

Mitigation Measures to be Constructed Concurrent with Development

- Construct the proposed site driveway to Laurel Avenue to provide one (1) lane for ingress traffic and one (1) lane for egress traffic. The intersection should be controlled by a Stop sign on the southbound site driveway approach to Laurel Avenue.

TRANSPORTATION IMPACT STUDY
FOR THE PROPOSED
GRAND VIEW SENIOR RESIDENCES
Borough of Irwin and North Huntingdon Township, Westmoreland County, Pennsylvania

Civil & Environmental Consultants (CEC) has completed this Transportation Impact Study for the construction of the proposed Grand View Senior Residences, to be located on the northwest corner of the intersection of Caruthers Lane with Laurel Avenue in the Borough of Irwin and North Huntingdon Township, Westmoreland County, Pennsylvania.

The following sections of this report contain a project description, data collection, site traffic generation and distribution, projected traffic volumes, analysis, and conclusions and recommendations.

PROJECT DESCRIPTION/DATA COLLECTION/EXISTING CONDITIONS

Project Description

As shown in Figure 1, the proposed Grand View Senior Residences are to be located on the northwest corner of the intersection of Caruthers Lane with Laurel Avenue in the Borough of Irwin and North Huntingdon Township, Westmoreland County, Pennsylvania.

The proposed Grand View Senior Residences development is to be constructed in two (2) Phases. Phase 1 of the proposed development is to include the construction a four (4) story, 50 unit senior apartment building. Phase 2 of the proposed development is to include the construction of nine (9) duplex patio homes (18 total residential units) and 18 single level houses.

Access to the development is proposed via the construction of one (1) new site driveway to Laurel Avenue, the centerline of which will be located approximately 400 feet west of the centerline of Caruthers Lane.

A copy of the proposed Grand View Senior Resources site plan has been included with this report as Figure 2.

In accordance with a scope of study developed by CEC and reviewed with a representative of North Huntingdon Township, the following intersections were selected for study:

- Caruthers Lane with Laurel Avenue (existing unsignalized); and
- Laurel Avenue with the site driveway (proposed).

A total of one (1) existing intersection and one (1) proposed intersection were included in the scope of study. The study intersections, with respect to the site, are illustrated in Figure 3.

Data Collection

Manual turning movement counts were performed at the intersection of Caruthers Lane with Laurel Avenue on Tuesday, December 14, 2021 from 7:00 A.M. to 9:00 A.M. and from 4:00 P.M.

to 6:00 P.M. These time periods typically to include the weekday A.M. and weekday P.M. peak hours of adjacent street traffic, respectively.

Based on the results of these manual turning movement counts, the peak hours of adjacent street traffic were identified to be as follows:

- Weekday A.M. Peak Hour – 7:00 A.M. to 8:00 A.M.
- Weekday P.M. Peak Hour – 4:15 P.M. to 5:15 P.M.

The existing 2021 peak hour traffic volume data has been summarized in Figure 4. Summaries of the data collected at each of the study intersections during the turning movement counts have been included in Appendix A to this report.

Crash data for the study area was obtained from the Pennsylvania Department of Transportation (PennDOT) Bureau of Highway Safety and Traffic Engineering (BHSTE) Pennsylvania Crash Information Tool (PCIT). The reports analyzed included the five (5) most recent years of available crashes reported, specifically data from the years 2016 through 2020.

Existing Conditions

A field reconnaissance of the study area was conducted by CEC to obtain information on roadway widths, roadway grades, and posted speed limits within the environs of the study intersections. A description of the study roadways is as follows:

Caruthers Lane – At its intersection with Laurel Avenue, Caruthers Lane is a Township-owned roadway providing a two (2) lane, 20-foot wide cartway with asphalt wedge curbs. Caruthers Lane provides a one (1) lane approach to Laurel Avenue for northbound traffic and a one (1) lane approach to Laurel Avenue for southbound traffic. The posted speed limit of Caruthers Lane is 25 miles per hour within the study area.

Laurel Avenue – At its intersection with Caruthers Lane, Laurel Avenue is a Township-owned roadway providing a two (2) lane, 28-foot wide cartway with asphalt wedge curbs. Laurel Avenue provides a one (1) lane approach to Caruthers Lane for eastbound traffic. The posted speed limit of Laurel Avenue is 25 miles per hour within the study area.

Photographs and sketches of each of the study intersections have been included in Appendix B to this report.

EXISTING 2021 CONDITION CAPACITY ANALYSIS

Capacity calculations were performed for the existing study intersection of Caruthers Lane with Laurel Avenue using existing 2021 peak hour traffic volumes and conditions and the methodologies published by the Transportation Research Board in their *Highway Capacity Manual*, Sixth Edition, 2017. This methodology determines how well an intersection, approach to an intersection, or movement at an intersection operates, and assigns to it a Level of Service (LOS) A through F. LOS A represents the best operating conditions and LOS F, the worst. Detailed definitions of LOS have been included in Appendix C to this report.

The results of the capacity calculations performed using existing 2021 traffic volumes and conditions are presented in Figure 5 for the weekday A.M. and weekday P.M. peak hours. Both LOS and delay for each approach are summarized in Table 1 and Table 2 for the weekday A.M. and weekday P.M. peak hours, respectively.

The results of the capacity calculations performed using existing 2021 peak hour traffic volumes and conditions revealed that the existing study intersection of Caruthers Lane with Laurel Avenue currently operates at an overall intersection Level of Service A during each of the peak periods analyzed.

Copies of the capacity calculations performed using existing 2021 traffic volumes and conditions have been included in Appendix D to this report.

FORECASTED OPENING YEAR 2024 NO-BUILD (BASE) TRAFFIC VOLUMES

Phase 1 of the proposed Grand View Senior Residences development is anticipated to be completed and fully occupied in 2024. Therefore, traffic volumes were projected for the existing study intersection of Caruthers Lane with Laurel Avenue for opening year 2024 conditions.

Forecasted 2024 no-build (base) traffic volumes were determined by applying a background traffic growth rate of 0.53% per year, linear, to the existing 2021 peak hour traffic volumes (Figure 4). This background traffic growth rate was obtained from the Southwestern Pennsylvania Commission (SPC). The resultant opening year 2024 no-build (base) condition traffic volumes are presented in Figure 6.

FORECASTED OPENING YEAR 2024 NO-BUILD (BASE) CONDITION CAPACITY CALCULATIONS

Capacity calculations were performed for the existing study intersection of Caruthers Lane with Laurel Avenue using forecasted opening year 2024 no-build (base) condition traffic volumes during the weekday A.M. and weekday P.M. peak hours.

The results of the capacity calculations performed using forecasted opening year 2024 no-build (base) condition traffic volumes are presented in Figure 7 for the weekday A.M. and P.M. peak hours. Both LOS and delay for each approach are summarized in Table 1 and Table 2 for the weekday A.M. and weekday P.M. peak hours, respectively.

The results of the capacity calculations performed using forecasted opening year 2024 no-build (base) condition traffic volumes revealed that the existing study intersection of Caruthers Lane with Laurel Avenue can be anticipated to operate at an overall intersection Level of Service A during each of the peak periods analyzed.

Copies of the capacity calculations performed using forecasted opening year 2024 no-build (base) condition traffic volumes have been included in Appendix E to this report.

FORECASTED HORIZON YEAR 2029 NO-BUILD (BASE) TRAFFIC VOLUMES

As previously detailed, phase 1 of the proposed Grand View Senior Residences development is anticipated to be completed and fully occupied in 2024. Therefore, traffic volumes were also projected for the study intersections for design horizon year 2029 conditions, five (5) years beyond the anticipated completion and occupancy of Phase 1, as required by PennDOT in their *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits*, 2014. It was assumed that Phase 2 of the Grand View Senior Residences development would be completed by 2029.

Forecasted 2029 base traffic volumes were determined by applying the aforementioned background traffic growth rate of 0.53% per year, linear, to the 2021 background traffic volumes (Figure 4). The resultant horizon year 2029 no-build (base) condition traffic volumes are presented in Figure 8.

FORECASTED HORIZON YEAR 2029 NO-BUILD (BASE) CONDITION CAPACITY CALCULATIONS

Capacity calculations were performed for the existing study intersection of Caruthers Lane with Laurel Avenue using forecasted horizon year 2029 no-build (base) condition traffic volumes during the weekday A.M. and weekday P.M. peak hours.

The results of the capacity calculations performed using forecasted horizon year 2029 no-build (base) condition traffic volumes are presented in Figure 7 for the weekday A.M. and P.M. peak hours. Both LOS and delay for each approach are summarized in Table 1 and Table 2 for the weekday A.M. and weekday P.M. peak hours, respectively.

The results of the capacity calculations performed using forecasted horizon year 2029 no-build (base) condition traffic volumes revealed that the existing study intersection of Caruthers Lane with Laurel Avenue can be anticipated to operate at an overall intersection Level of Service A during each of the peak periods analyzed.

Copies of the capacity calculations performed using forecasted horizon year 2029 no-build (base) condition traffic volumes have been included in Appendix F to this report.

SITE TRAFFIC GENERATION AND DISTRIBUTION

Vehicular Trip Generation

Vehicular trip generation for the proposed Grand View Senior Residences development was projected based upon data published by the Institute of Transportation Engineers (ITE) in their *Trip Generation*, Eleventh Edition, 2021.

Land Use Code 252, *Senior Adult Housing-Multifamily*, was used to determine the trip generation of the proposed four (4) story, 50 unit apartment building to be constructed as Phase 1 of the proposed Grand View Senior Residences development and Land Use Code 251, *Senior Adult Housing-Single-Family*, was used to determine the trip generation of the proposed nine (9) duplex

patio homes (18 total residential units) 18 single level houses to be constructed as Phase 2 of the proposed Grand View Senior Residences development.

Using this methodology, Phase 1 of the proposed Grand View Senior Residences development, which was assumed to include the construction of the proposed four (4) story, 50 unit apartment building only, can be anticipated to generate a total of 169 trips on a typical midweek day, with approximately ten (10) of these trips (three (3) trips entering/seven (7) trips exiting) occurring during the weekday A.M. peak hour and approximately 13 of these trips (seven (7) trips entering/six (6) trips exiting) occurring during the weekday P.M. peak hour.

Similarly, the full build-out of the proposed Grand View Senior Residences development, which was assumed to include the construction of the proposed can it was determined that the proposed 50 unit apartment building and Land Use Code 251, *Senior Adult Housing-Single-Family*, was used to determine the trip generation of the proposed 18 single level houses and nine (9) duplex patio homes (18 total residential units) can be anticipated to generate a total of 419 trips on a typical midweek day, with approximately 28 of these trips (nine (9) trips entering/19 trips exiting) occurring during the weekday A.M. peak hour and approximately 33 of these trips (19 trips entering/14 trips exiting) occurring during the weekday P.M. peak hour.

The total site-generated trips for the proposed Grand View Senior Residences development are summarized in Table 3. Copies of the calculations performed in order to estimate the trip generation of the proposed Grand View Senior Residences development have been included in Appendix G to this report.

Site Traffic Distribution

The forecasted trips to be generated by the proposed Grand View Senior Resources development were distributed into and out from the site driveway to Laurel Avenue based on an average of the existing peak hour traffic volumes along Laurel Avenue within the environs of the proposed site driveway. These trips were then distributed through the intersection of Caruthers Lane with Laurel Avenue based on an average of the existing peak hour traffic volumes at the intersection of Caruthers Lane with Laurel Avenue.

The anticipated arrival/departure distribution of the trips to be generated by the proposed Grand View Senior Residences development are presented in Figure 10.

The forecasted trips to be added to each of the study intersections by Phase 1 of the proposed Grand View Senior Resources development are presented in Figure 11.

The forecasted trips to be added to each of the study intersections by the full build-out of the proposed Grand View Senior Resources development are presented in Figure 12.

FORECASTED OPENING YEAR 2024 BUILD (WITH PHASE 1 DEVELOPMENT) TRAFFIC VOLUMES

The forecasted opening year 2024 build (with Phase 1 of the proposed Grand View Senior Residences development) traffic volumes at the study intersections during the weekday A.M. and

weekday P.M. peak hours were determined by adding the forecasted trips to be added to each of the study intersections by Phase 1 of the proposed Grand View Senior Residences development (Figure 11) to the forecasted opening year 2024 no-build (base) traffic volumes (Figure 6). The resultant forecasted opening year 2024 build (with Phase 1 of the proposed Grand View Senior Residences development) traffic volumes are presented in Figure 13.

FORECASTED OPENING YEAR 2024 BUILD (WITH PHASE 1 DEVELOPMENT) CONDITION CAPACITY CALCULATIONS

Capacity calculations were performed for each of the study intersections using forecasted opening year 2024 build (with Phase 1 of the proposed Grand View Senior Residences development) traffic volumes and conditions at the study intersections during the weekday A.M. and weekday P.M. peak hours.

The results of the capacity calculations performed using forecasted opening year 2024 build (with Phase 1 of the proposed Grand View Senior Residences development) condition traffic volumes are presented in Figure 14 for the weekday A.M. and weekday P.M. peak hours. Both LOS and delay for each approach are summarized in Table 1 and Table 2 for the weekday A.M. and weekday P.M. peak hours, respectively.

The results of the capacity calculations performed using forecasted build opening year 2024 build (with Phase 1 of the proposed Grand View Senior Residences development) condition traffic volumes revealed that the intersection of Caruthers Lane with Laurel Avenue can be anticipated to continue to operate at an overall intersection Level of Service A during each of the peak periods analyzed following the construction of Phase 1 of the proposed Grand View Senior Residences development. Furthermore, no decreases in Level of Service are anticipated for any of the individual movements at the intersection of Caruthers Lane with Laurel Avenue.

In addition, the proposed intersection of Laurel Avenue with the site driveway can be anticipated to operate at an overall intersection Level of Service A during each of the peak periods analyzed following Phase 1 of the proposed Grand View Senior Residences development.

Copies of the capacity calculations performed using forecasted opening year 2024 build (with Phase 1 of the proposed Grand View Senior Residences development) condition traffic volumes have been included in Appendix H to this report.

FORECASTED HORIZON YEAR 2029 BUILD (WITH FULL BUILD DEVELOPMENT) TRAFFIC VOLUMES

The forecasted horizon year 2029 build (with full build-out of the proposed Grand View Senior Residences development) traffic volumes at the study intersections during the weekday A.M. and weekday P.M. peak hours were determined by adding the forecasted trips to be added to each of the study intersections by the full build-out of the proposed Grand View Senior Residences development (Figure 12) to the forecasted horizon year 2029 no-build (base) traffic volumes (Figure 8). The resultant forecasted horizon year 2029 build (with full build-out of the proposed Grand View Senior Residences development) traffic volumes are presented in Figure 15.

FORECASTED HORIZON YEAR 2029 BUILD (WITH FULL BUILD DEVELOPMENT) CONDITION CAPACITY CALCULATIONS

Capacity calculations were performed for each of the study intersections using forecasted horizon year 2029 build (with full build-out of the proposed Grand View Senior Residences development) traffic volumes and conditions at the study intersections during the weekday A.M. and weekday P.M. peak hours.

The results of the capacity calculations performed using forecasted horizon year 2029 build (with full build-out of the proposed Grand View Senior Residences development) condition traffic volumes are presented in Figure 16 for the weekday A.M. and weekday P.M. peak hours. Both LOS and delay for each approach are summarized in Table 1 and Table 2 for the weekday A.M. and weekday P.M. peak hours, respectively.

The results of the capacity calculations performed using forecasted build horizon year 2029 build (with full build-out of the proposed Grand View Senior Residences development) condition traffic volumes revealed that the intersection of Caruthers Lane with Laurel Avenue can be anticipated to continue to operate at an overall intersection Level of Service A during each of the peak periods analyzed following the full build-out of the proposed Grand View Senior Residences development. Furthermore, no decreases in Level of Service are anticipated for any of the individual movements at the intersection of Caruthers Lane with Laurel Avenue.

In addition, the proposed intersection of Laurel Avenue with the site driveway can be anticipated to operate at an overall intersection Level of Service A during each of the peak periods analyzed following full build-out of the proposed Grand View Senior Residences development.

Copies of the capacity calculations performed using forecasted opening year 2024 build (with full build-out of the proposed Grand View Senior Residences development) condition traffic volumes have been included in Appendix I to this report.

ADDITIONAL ANALYSES

Additional analyses performed included a traffic signal warrant evaluation, an auxiliary turn lane warrant evaluation, a crash history evaluation and a sight distance evaluation.

Traffic Signal Warrants Evaluation

Traffic volumes at the intersection of Caruthers Lane with Laurel Avenue were compared with warrants for the installation of traffic signal control. These warrants for the installation of traffic signal control are found in PennDOT Publication 212, *Official Traffic Control Devices*, 2006.

Warrants for the installation of traffic signal control are not currently satisfied at the intersection of Caruthers Lane with Laurel Avenue, and are not forecasted to be satisfied under either forecasted 2024 or 2029 no-build (base) or build (with development) conditions.

Copies of the charts and graphs used to verify warrants for the installation of traffic signal control are included in Appendix J to this report.

Auxiliary Turn Lane Warrants Evaluation

Traffic volumes at the intersection of Caruthers Lane with Laurel Avenue and at the intersection of Laurel Avenue with the proposed site driveway were compared with guidelines for the consideration of the installation of auxiliary left and right turn lanes. These guidelines are found in PennDOT Publication 46, *Traffic Engineering Manual*, 2014.

Guidelines for the consideration of the installation of a northbound auxiliary left turn lane and southbound auxiliary right turn lane are not currently satisfied at the intersection of Caruthers Lane with Laurel Avenue and are not forecasted to be satisfied under forecasted 2024 or forecasted 2029 conditions, both without or following the proposed Grand View Senior Residences development.

Furthermore, guidelines for the consideration of the installation of an eastbound auxiliary left turn lane and westbound auxiliary right turn lane on are not forecasted to be satisfied at the intersection of Laurel Avenue with the proposed site driveway under forecasted 2024 or forecasted 2029 conditions following the proposed Grand View Senior Residences development.

Copies of the worksheets used to evaluate the guidelines for the consideration of the installation auxiliary turn lanes at the study intersections have been included in Appendix K to this report.

Crash History Evaluation

The crash data obtained from the PennDOT PCIT was reviewed in order to determine whether a crash problem exists at the existing study intersection of Caruthers Lane with Laurel Avenue.

Based on the data obtained, there have been a total of four (4) reportable crashes at the intersection of Caruthers Lane with Laurel Avenue over the previous five (5) calendar years. Of the four (4) reportable crashes that have occurred, two (2) of the crashes were single vehicle collisions with fixed objects, one (1) of the crashes was a rear-end crash and one (1) of the crashes was an angle crash.

Of these four (4) reportable crashes, one (1) occurred in the calendar year 2017, one (1) occurred in the calendar year 2018 and two (2) occurred in the calendar year 2020.

PennDOT Publication 212, *Official Traffic Control Devices*, 2006, defines a crash problem as the occurrence of five (5) or more reportable crashes with similar causation factors during a continuous 12-month period. Therefore, a crash problem was not identified to exist at the intersection of Caruthers Lane with Laurel Avenue.

Table 4 includes a summary of the reportable crashes at the intersection of Caruthers Lane with Laurel Avenue.

Sight Distance Evaluation

Measurements were performed in order to verify the available sight distance at the proposed site driveway intersection with Laurel Avenue. The sight distance measurements were performed using the methodologies found in PennDOT Publication 212, *Official Traffic Control Devices*, 2006.

Available sight distance exceeds the required sight distance at the proposed site driveway intersection with Laurel Avenue.

A summary of the available and the required sight distance at the proposed site driveway intersection with Laurel Avenue are presented in Table 5. The worksheets used to summarize the sight distance measurements, along with photographs of the available sight distance, have been included in Appendix L to this report.

CONCLUSIONS/RECOMMENDATIONS

This study has concluded that the construction of the proposed Grand View Senior Residences development will have no significant impact on the operation of the intersection of Caruthers Lane with Laurel Avenue.

The results of the capacity calculations performed using forecasted 2024 and 2029 build (with development) condition traffic volumes revealed that no decreases in overall intersection Level of Service can be anticipated to occur at the intersection of Caruthers Lane with Laurel Avenue following the construction of the proposed Grand View Senior Residences. Furthermore, no decreases in Level of Service are projected for any of the individual movements at the intersection.

The proposed intersection of Laurel Avenue with the site driveway can be anticipated to operate at an overall intersection Level of Service A during each of the peak periods analyzed.

Warrants for the installation of traffic signal control are not currently satisfied at the intersection of Caruthers Lane with Laurel Avenue, and are not forecasted to be satisfied under either forecasted 2024 or 2029 no-build (base) or build (with development) conditions.

Guidelines for the consideration of the installation of auxiliary turn lanes are not currently satisfied at the intersection of Caruthers Lane with Laurel Avenue and are not forecasted to be satisfied under forecasted 2024 or forecasted 2029 conditions, both without or following the proposed Grand View Senior Residences development. Furthermore, guidelines for the consideration of the installation auxiliary turn lanes are not forecasted to be satisfied at the intersection of Laurel Avenue with the proposed site driveway under forecasted 2024 or forecasted 2029 conditions following the proposed Grand View Senior Residences development.

A crash problem was not identified to exist at the intersection of Caruthers Lane with Laurel Avenue.

Available sight distance exceeds the required sight distance at the proposed site driveway intersection with Laurel Avenue.

Therefore, based on the results of these analyses, CEC recommends the following:

- Construct the proposed site driveway to Laurel Avenue to provide one (1) lane for ingress traffic and one (1) lane for egress traffic. The intersection should be controlled by a Stop sign on the southbound site driveway approach to Laurel Avenue.

This concludes CEC's Transportation Impact Study for the proposed Grand View Senior Residences, to be located on the northwest corner of the intersection of Caruthers Lane with Laurel Avenue in the Borough of Irwin and North Huntingdon Township, Westmoreland County, Pennsylvania.

Included with this report is a Technical Appendix containing all counts, analyses and calculations.

TABLES

TABLE 1
LEVEL OF SERVICE – WEEKDAY A.M. PEAK HOUR[1][2]
Transportation Impact Study for the proposed Grand View Senior Residences
Borough of Irwin and North Huntington Township, Westmoreland County, Pennsylvania

Direction	Approach/ Movement	Level of Service (Delay)						
		Existing 2021	Forecasted 2024 – Without Development	Forecasted 2024 – With Development	Forecasted 2024 – With Development and Mitigation	Forecasted 2029 – Without Development	Forecasted 2029 – With Development	Forecasted 2029 – With Development and Mitigation
INTERSECTION	**CARUTHERS LANE AND LAUREL AVENUE**							
CARUTHERS LANE								
Northbound	**Approach**	A (4.3)	A (4.2)	A (4.3)	N/A	A (4.3)	A (4.4)	N/A
LAUREL AVENUE								
Eastbound	**Approach**	A (9.9)	A (9.9)	B (10.0)	N/A	B (10.0)	B (10.1)	N/A
	OVERALL	A (4.9)	A (4.9)	A (5.0)	N/A	A (5.0)	A (5.2)	N/A
INTERSECTION	**LAUREL AVENUE AND GRAND VIEW SENIOR RESOURCES DRIVEWAY**							
GRAND VIEW DRIVEWAY								
Southbound	**Approach**	N/A	N/A	A (9.2)	N/A	N/A	A (9.4)	N/A
LAUREL AVENUE								
Eastbound	**Approach**	N/A	N/A	A (0.1)	N/A	N/A	A (0.3)	N/A
	OVERALL	N/A	N/A	A (0.4)	N/A	N/A	A (1.0)	N/A

(1) Level of Service and vehicular delay calculated using methodologies published by the Transportation Research Board in their *Highway Capacity Manual*, Sixth Edition, 2017.
(2) 7:00 A.M. to 8:00 A.M.

Source: Analysis by CEC

TABLE 2
LEVEL OF SERVICE – WEEKDAY P.M. PEAK HOUR[1][2]
Transportation Impact Study for the proposed Grand View Senior Residences
Borough of Irwin and North Huntington Township, Westmoreland County, Pennsylvania

Direction	Approach/ Movement	Level of Service (Delay)						
		Existing 2021	Forecasted 2024 – Without Development	Forecasted 2024 – With Development	Forecasted 2024 – With Development and Mitigation	Forecasted 2029 – Without Development	Forecasted 2029 – With Development	Forecasted 2029 – With Development and Mitigation
INTERSECTION	**CARUTHERS LANE AND LAUREL AVENUE**							
CARUTHERS LANE								
Northbound	**Approach**	A (4.2)	A (4.2)	A (4.2)	N/A	A (4.2)	A (4.4)	N/A
LAUREL AVENUE								
Eastbound	**Approach**	B (11.9)	B (12.0)	B (12.1)	N/A	B (12.1)	B (12.6)	N/A
	OVERALL	A (4.0)	A (4.0)	A (4.3)		A (4.1)	A (4.3)	
INTERSECTION	**LAUREL AVENUE AND GRAND VIEW SENIOR RESOURCES DRIVEWAY**							
GRAND VIEW DRIVEWAY								
Southbound	**Approach**	N/A	N/A	A (9.7)	N/A	N/A	A (9.8)	N/A
LAUREL AVENUE								
Eastbound	**Approach**	N/A	N/A	A (0.2)	N/A	N/A	A (0.6)	N/A
	OVERALL	N/A	N/A	A (0.3)	N/A	N/A	A (0.7)	N/A

(1) Level of Service and vehicular delay calculated using methodologies published by the Transportation Research Board in their *Highway Capacity Manual*, Sixth Edition, 2017.
(2) 4:15 P.M. to 5:15 P.M.

Source: Analysis by CEC

TABLE 3
TRIP GENERATION SUMMARY
Transportation Impact Study for the proposed Grand View Senior Residences
Borough of Irwin and North Huntington Township, Westmoreland County, Pennsylvania

Land Use Code	Description	Size	Trip Generation[1]						
			Weekday 24-Hour	Weekday A.M. Peak Hour			Weekday P.M. Peak Hour		
				In	Out	Total	In	Out	Total
252	Senior Adult Housing-Multifamily (Phase 1)	50 units	169	3	7	10	7	6	13
251	Senior Adult Housing-Single-Family	36 units	249	6	12	18	12	8	20
TOTAL			419	9	19	28	19	14	33

(1) Anticipated trip generation calculated using the rates and formulae contained within the Institute of Transportation (ITE) publication *Trip Generation*, Eleventh Edition, 2021.

Source: Analysis by CEC

TABLE 4
REPORTABLE CRASH EVALUAION[1]
Transportation Impact Study for the proposed Grand View Senior Residences
Borough of Irwin and North Huntington Township, Westmoreland County, Pennsylvania

Date	Crash Type	Direction of Travel – Primary	Direction of Travel – Secondary	Direction of Travel – Tertiary	Comments
CARUTHERS LANE with LAUREL AVENUE					
January 4, 2017	Hit Fixed Object	SB	N/A	N/A	Primary vehicle driver traveling on southbound on Caruthers Lane hit a fixed object in the roadway.
December 18, 2018	Angle	NB	SB	N/A	Primary vehicle driver traveling on northbound Caruthers Lane was involved in an angle collision due to a left turn performed without proper clearance. The left turning, northbound vehicle on Caruthers Lane was struck by a southbound vehicle proceeding straight on Caruthers Lane.
May 6, 2020	Hit Fixed Object	NB	N/A	N/A	Primary vehicle driver traveling on northbound Caruthers Lane performed a left turn onto Laurel Avenue at a speed too fast for conditions. The vehicle struck the guide rail.
August 4, 2020	Rear-End	NB	NB	N/A	Primary vehicle driver traveling northbound on Caruthers Lane failed to negotiate a curve and struck the secondary vehicle which was slowing or stopping in the travel lane.

(1) Reportable crash history summarized from the PennDOT's Crash Information Tool (PCIT).

Source: Analysis by CEC

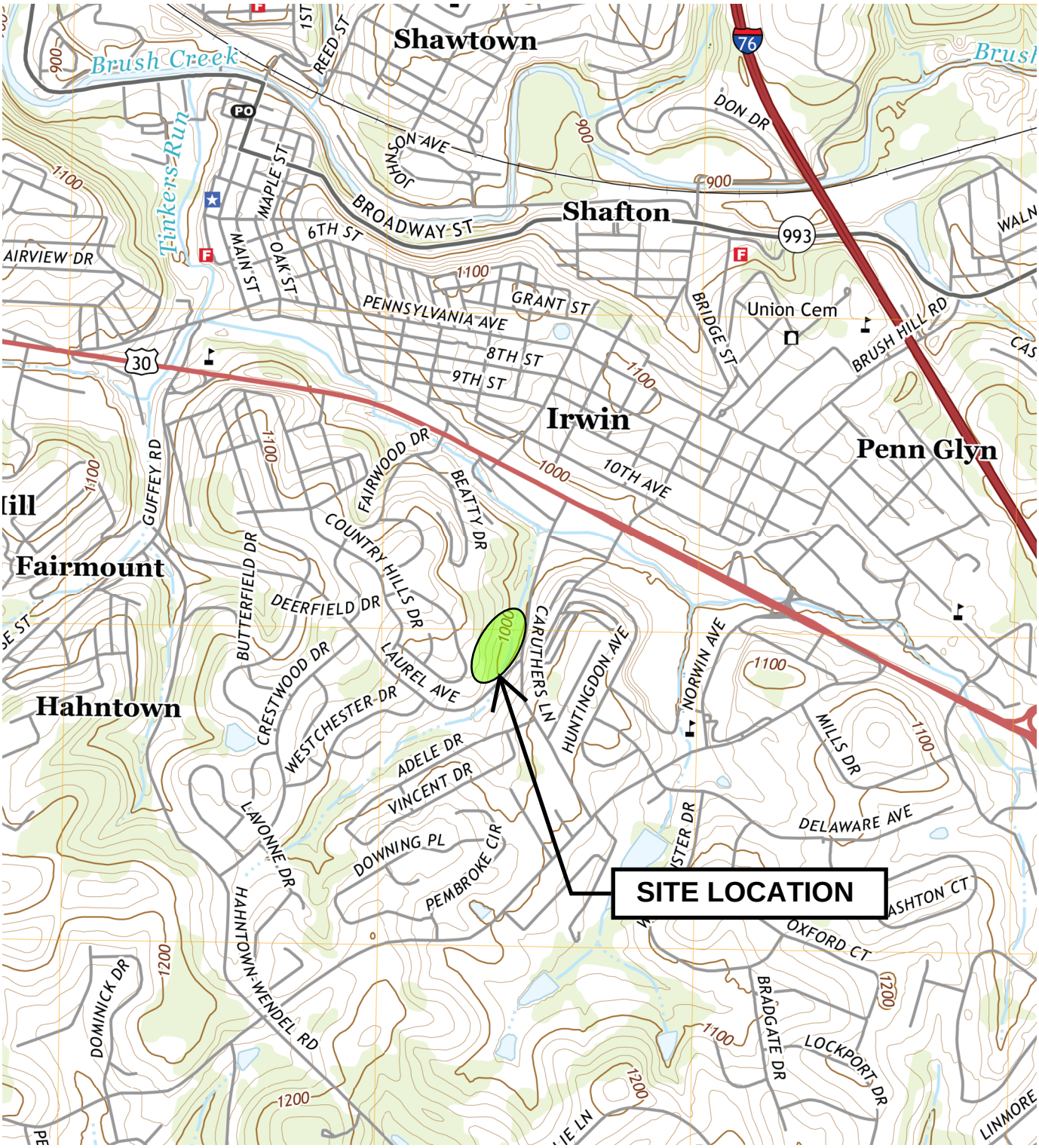
TABLE 5
SIGHT DISTANCE SUMMARY [1]
Transportation Impact Study for the proposed Grand View Senior Residences
Borough of Irwin and North Huntington Township, Westmoreland County, Pennsylvania

Location	Measured Sight Distance (feet)	Posted Speed Limit (mph)	Required Sight Distance (feet)	Sight Distance Acceptable (Yes/No)
LAUREL AVE. AND SITE DRIVEWAY-25 MPH				
Looking Left from Driveway	395’	25 MPH	N/A	YES
Looking Right from Driveway	315’	25 MPH	153’	YES
Approaching Left Turning Vehicle from Rear	290’	25 MPH	156’	YES
Left Turning Vehicle Looking Ahead	415’	25 MPH	159’	YES

(1) Measured and required distance determined in accordance with PennDOT Publication 212, *Official Traffic Control Devices*, 2006.

Source: Analysis by CEC

FIGURES



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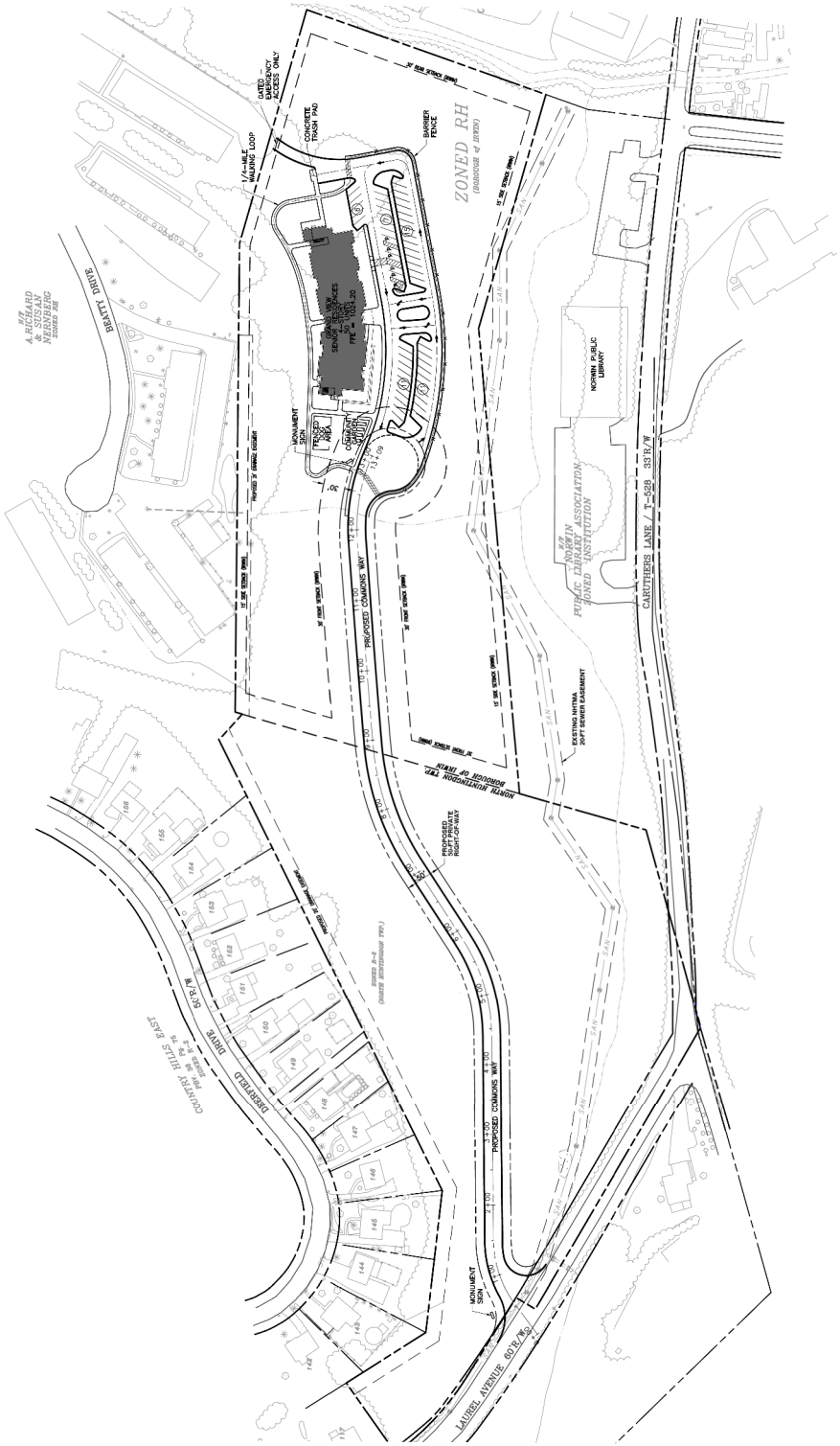
SITE LOCATION

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	1
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		

NORTH



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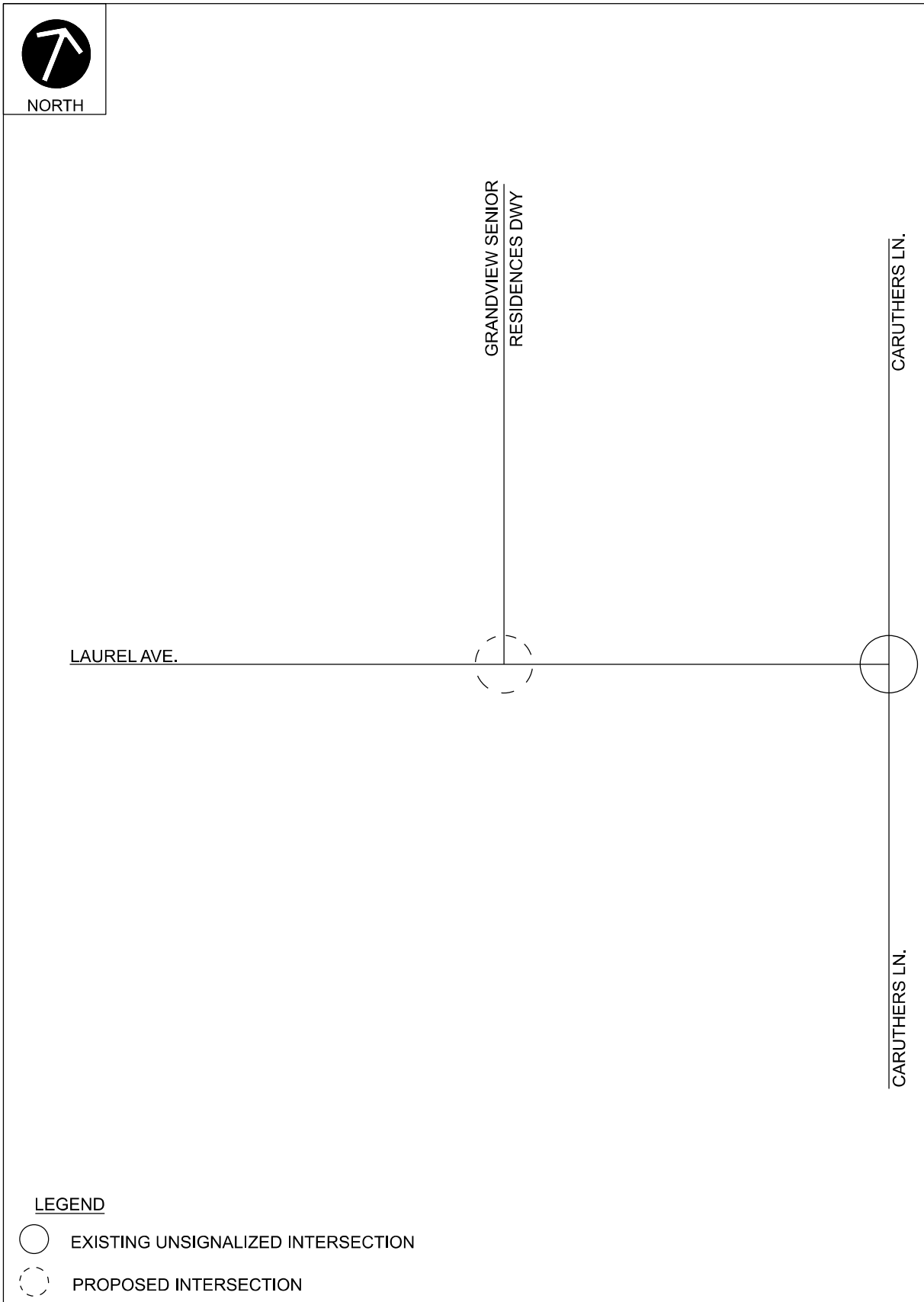
SITE PLAN

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	2
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

EXISTING UNSIGNALIZED INTERSECTION

PROPOSED INTERSECTION

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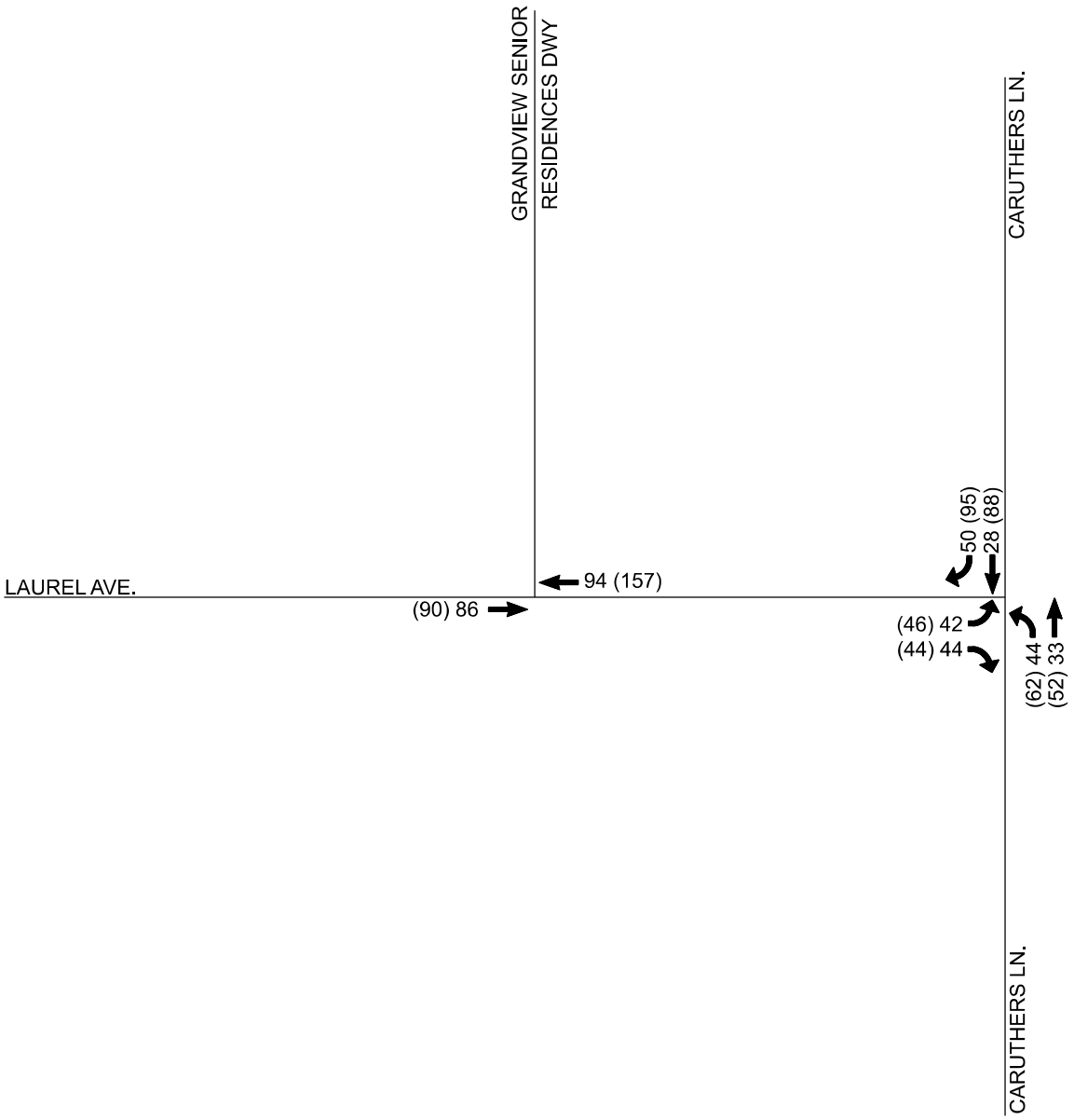
STUDY INTERSECTIONS

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	3
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

(123) PM PEAK HOUR TRAFFIC VOLUMES

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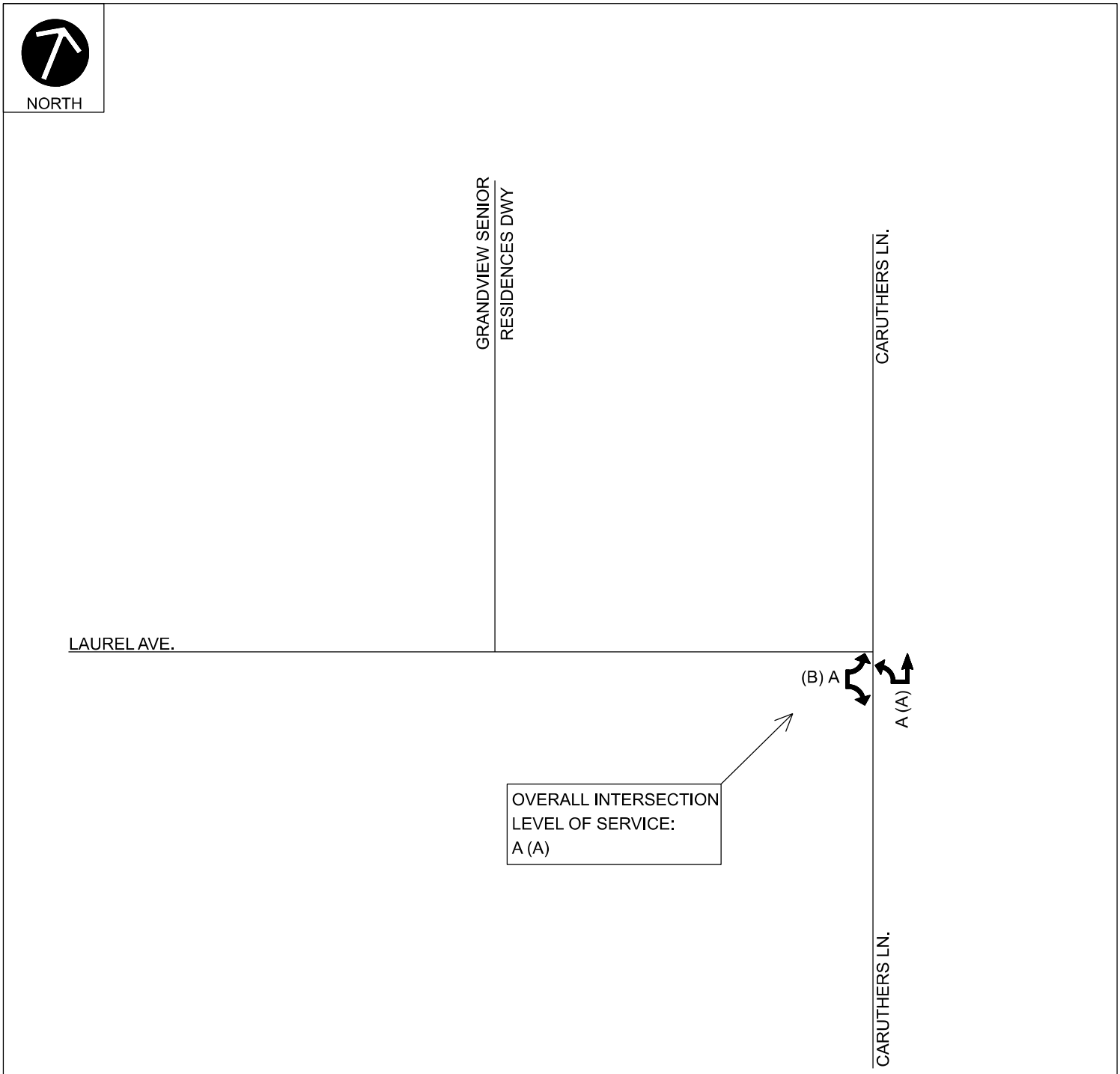
EXISTING 2021 PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	4
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

A AM PEAK HOUR LEVELS OF SERVICE

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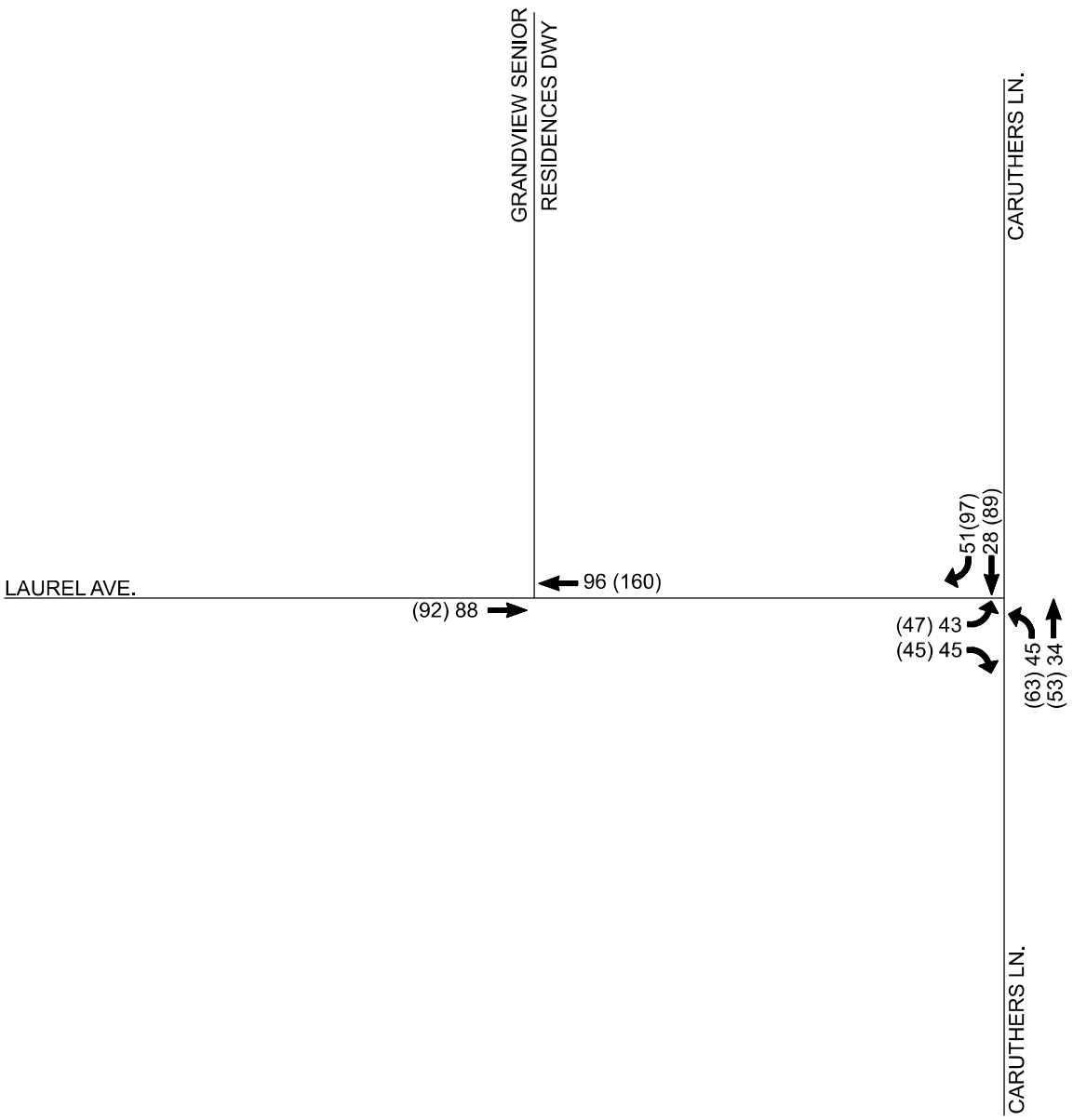
EXISTING 2021 PEAK HOUR LEVELS OF SERVICE

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	5
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

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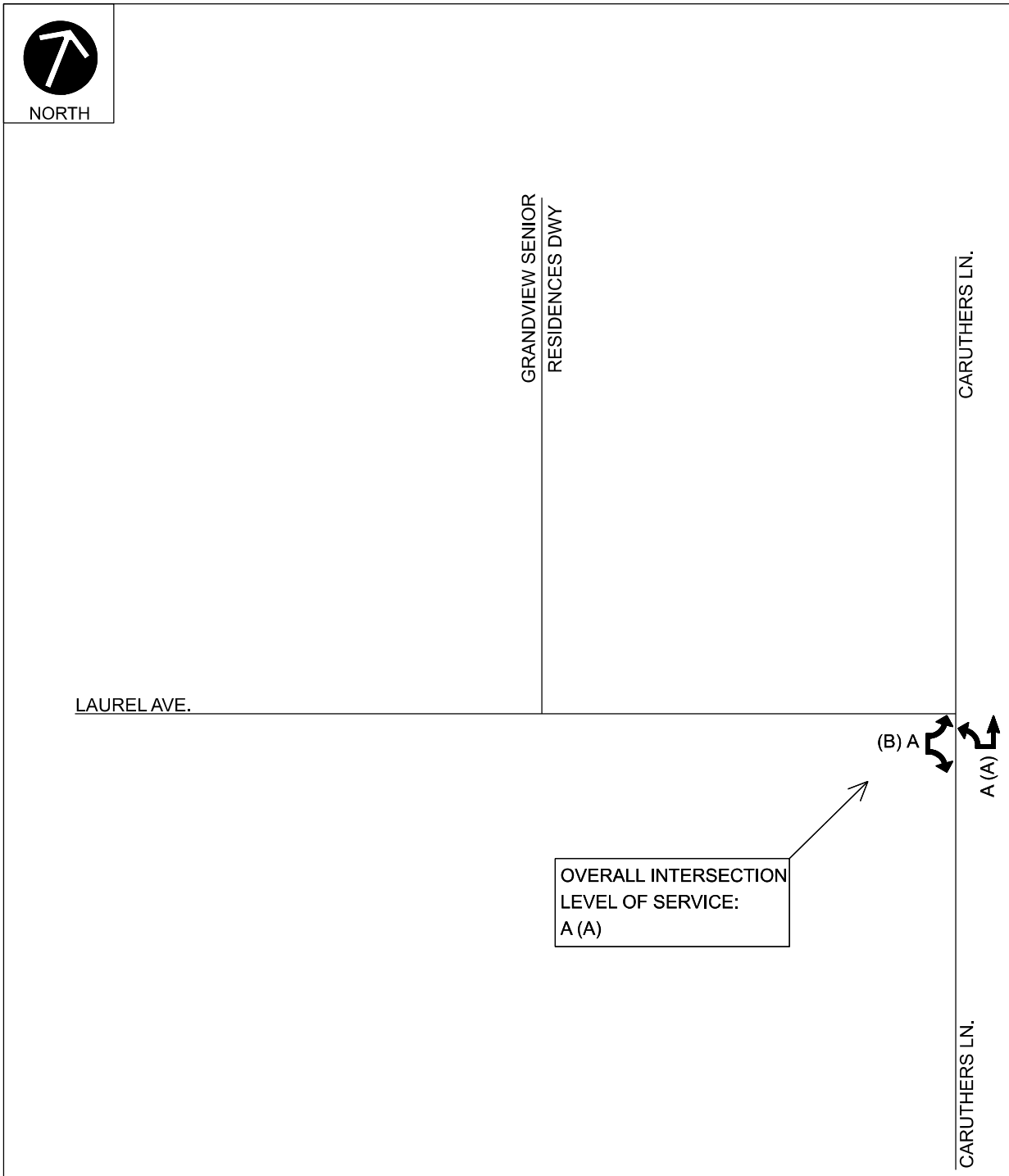
FORECASTED OPENING YEAR 2024 NO-BUILD (BASE)
PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	6
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

A AM PEAK HOUR LEVELS OF SERVICE

(A) PM PEAK HOUR LEVELS OF SERVICE

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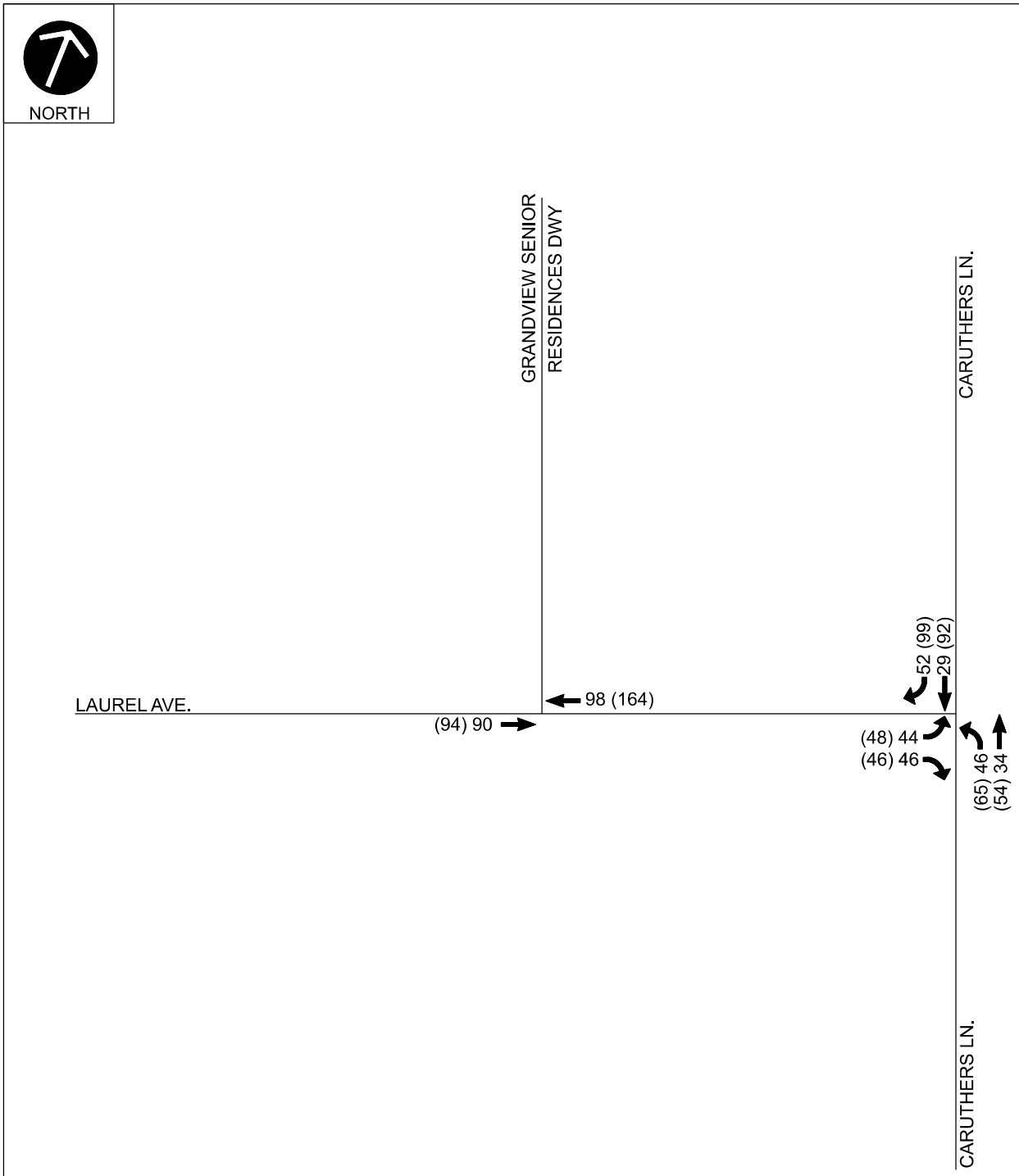
FORECASTED 2024 OPENING YEAR NO-BUILD (BASE)
PEAK HOUR LEVELS OF SERVICE

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	7
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

(123) PM PEAK HOUR TRAFFIC VOLUMES

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FORECASTED HORIZON YEAR 2029 NO-BUILD (BASE)
PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	8
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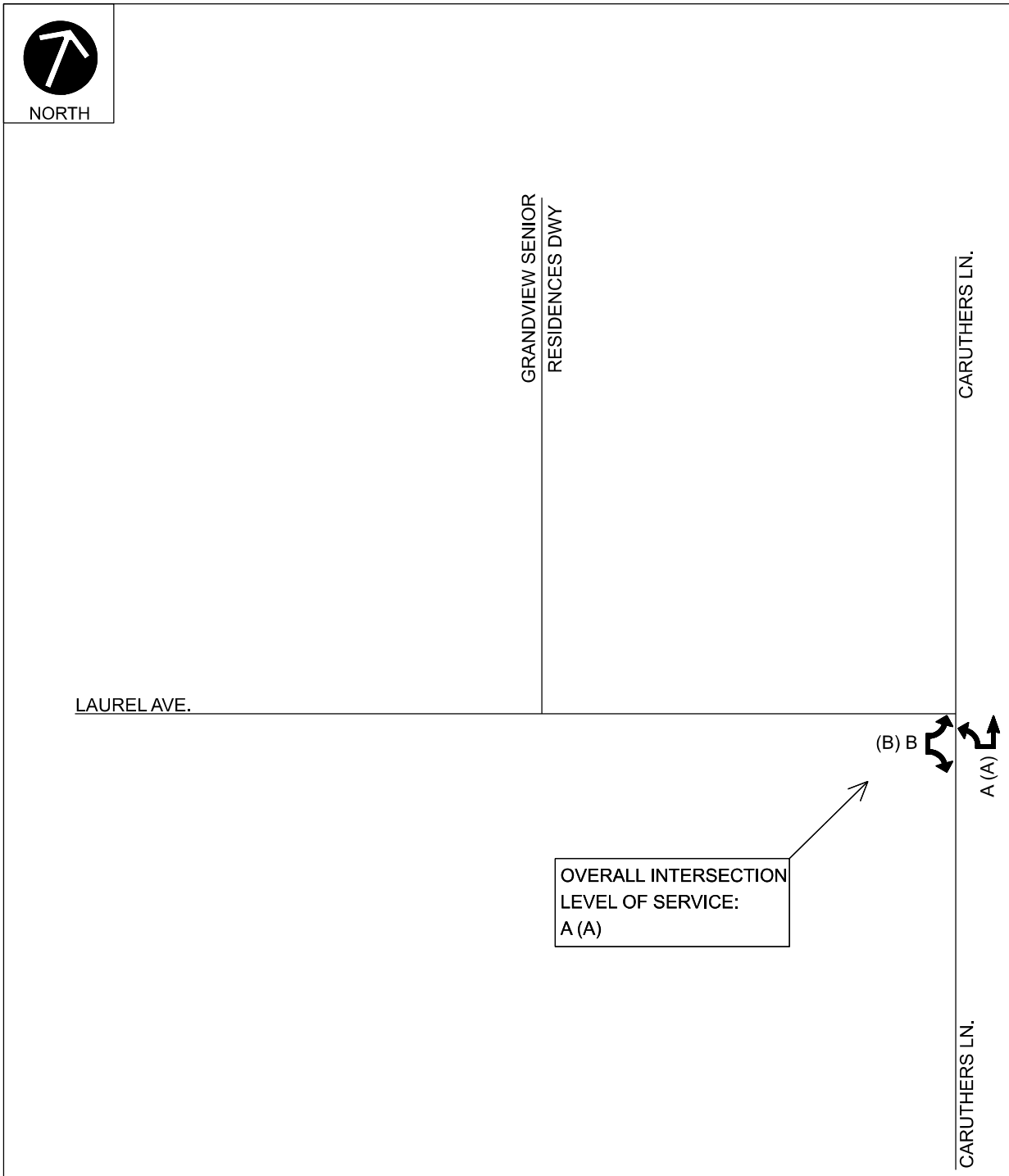

LEGEND

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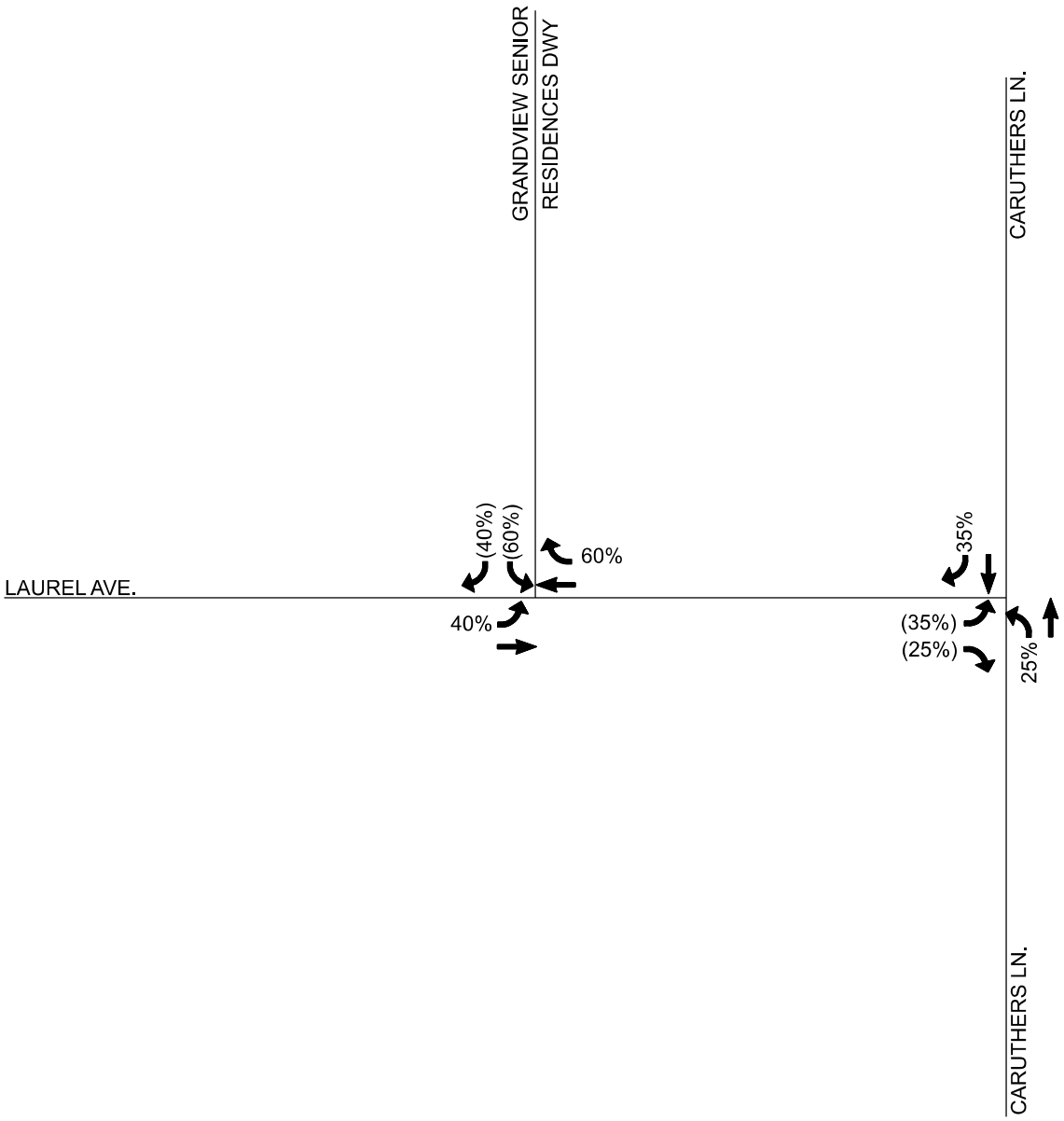
FORECASTED 2029 HORIZON YEAR NO-BUILD (BASE)
PEAK HOUR LEVELS OF SERVICE

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	9
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

12% ARRIVAL TRIP DISTRIBUTION PERCENTAGE

(12%) DEPARTURE TRIP DISTRIBUTION PERCENTAGE

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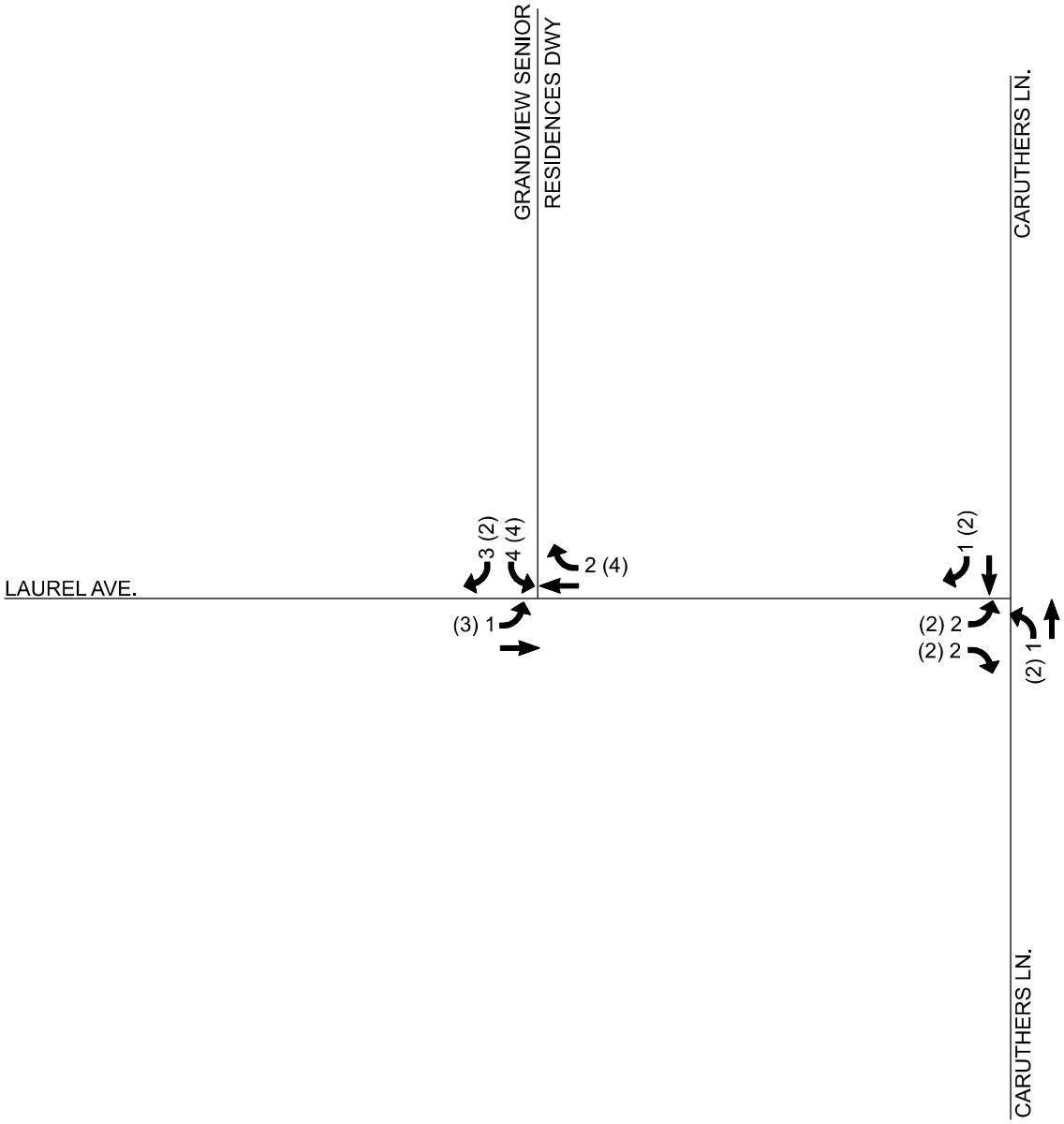
FORECASTED TRIP DISTRIBUTION

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	10
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

123 AM PEAK HOUR TRIP ADDITIONS

(123) PM PEAK HOUR TRIP ADDITIONS

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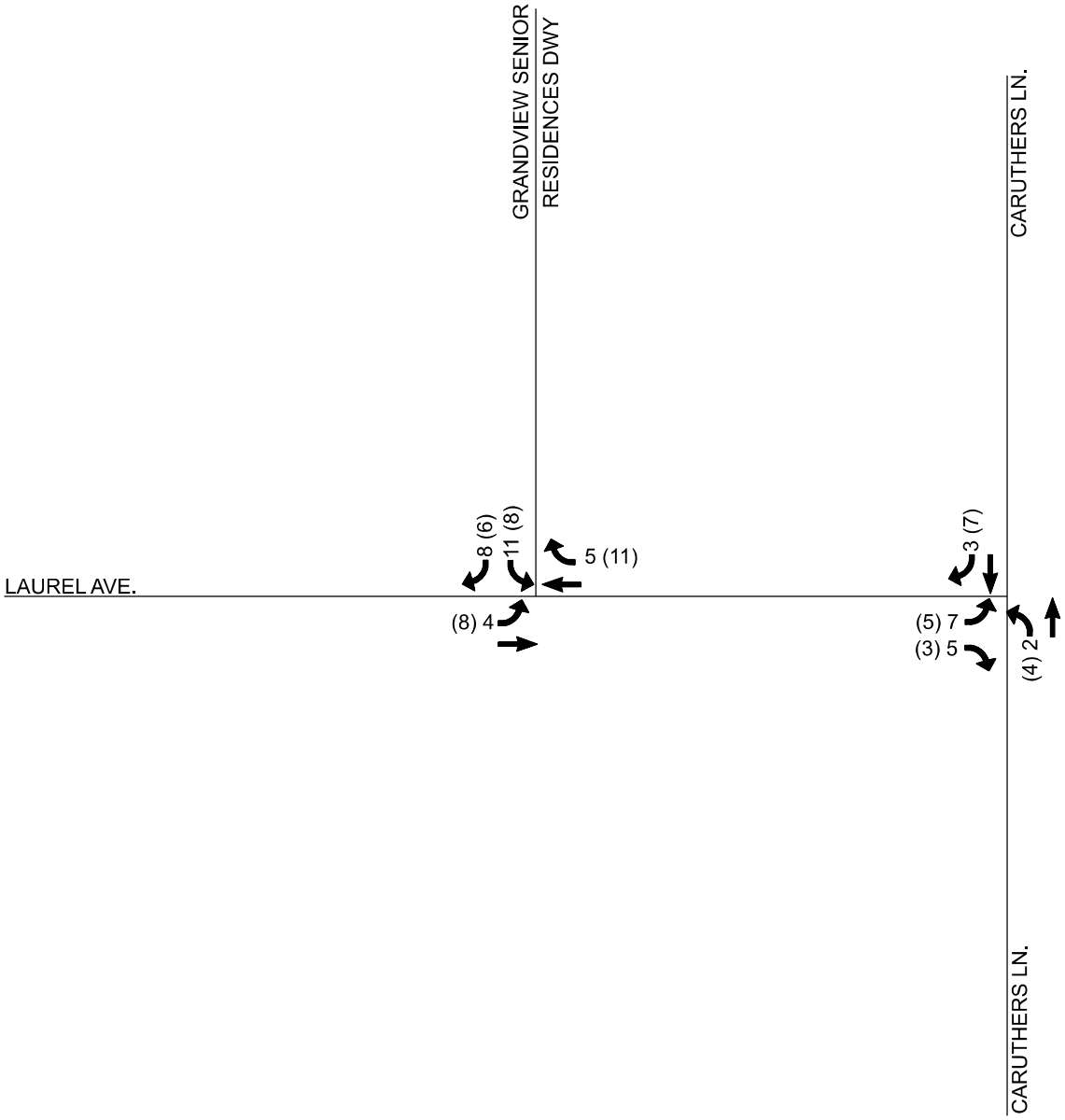
FORECASTED PHASE 1 TRIP ADDITIONS

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	11
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

123 AM PEAK HOUR TRIP ADDITIONS

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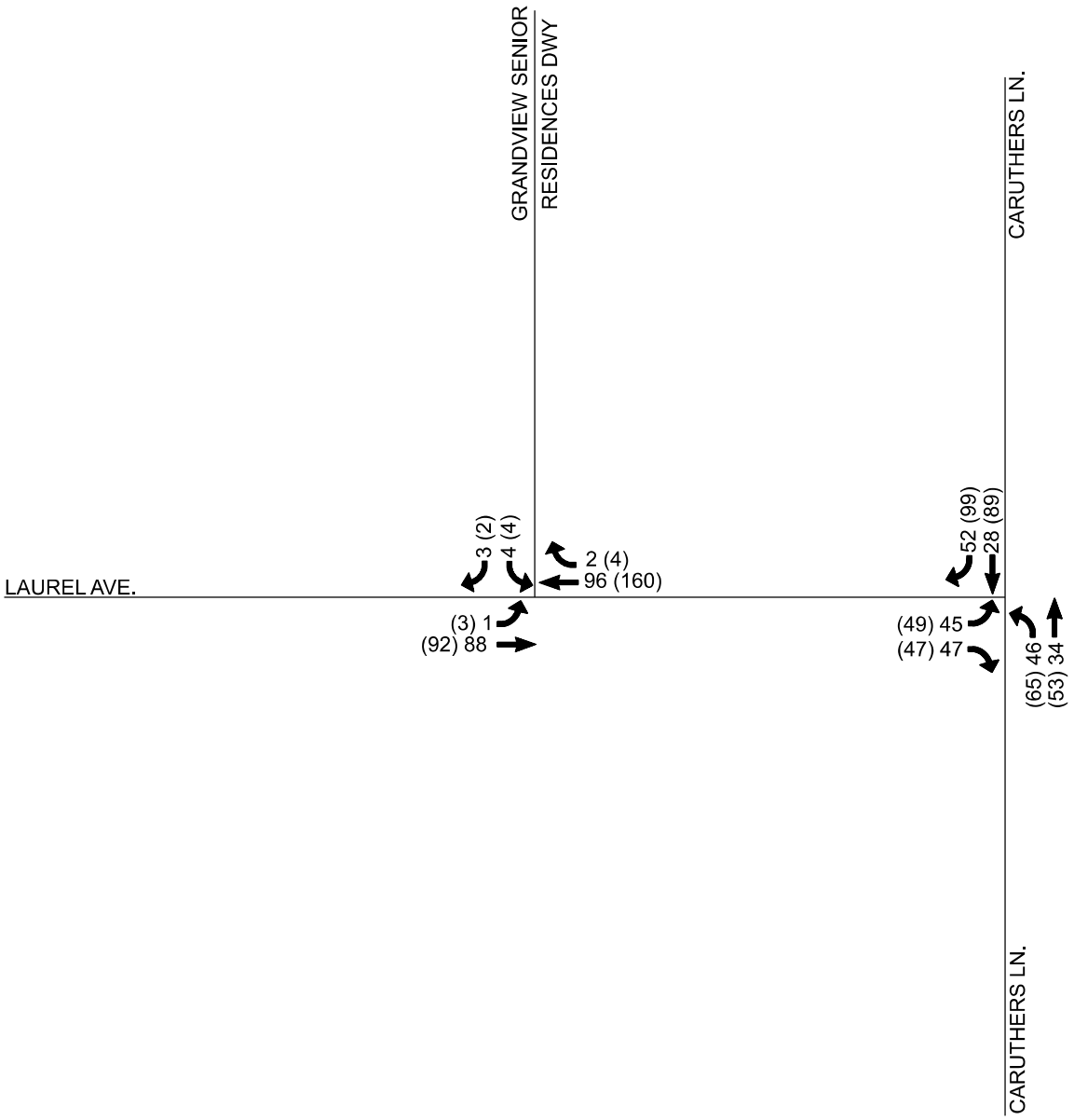
FORECASTED FULL BUILD TRIP ADDITIONS

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	12
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

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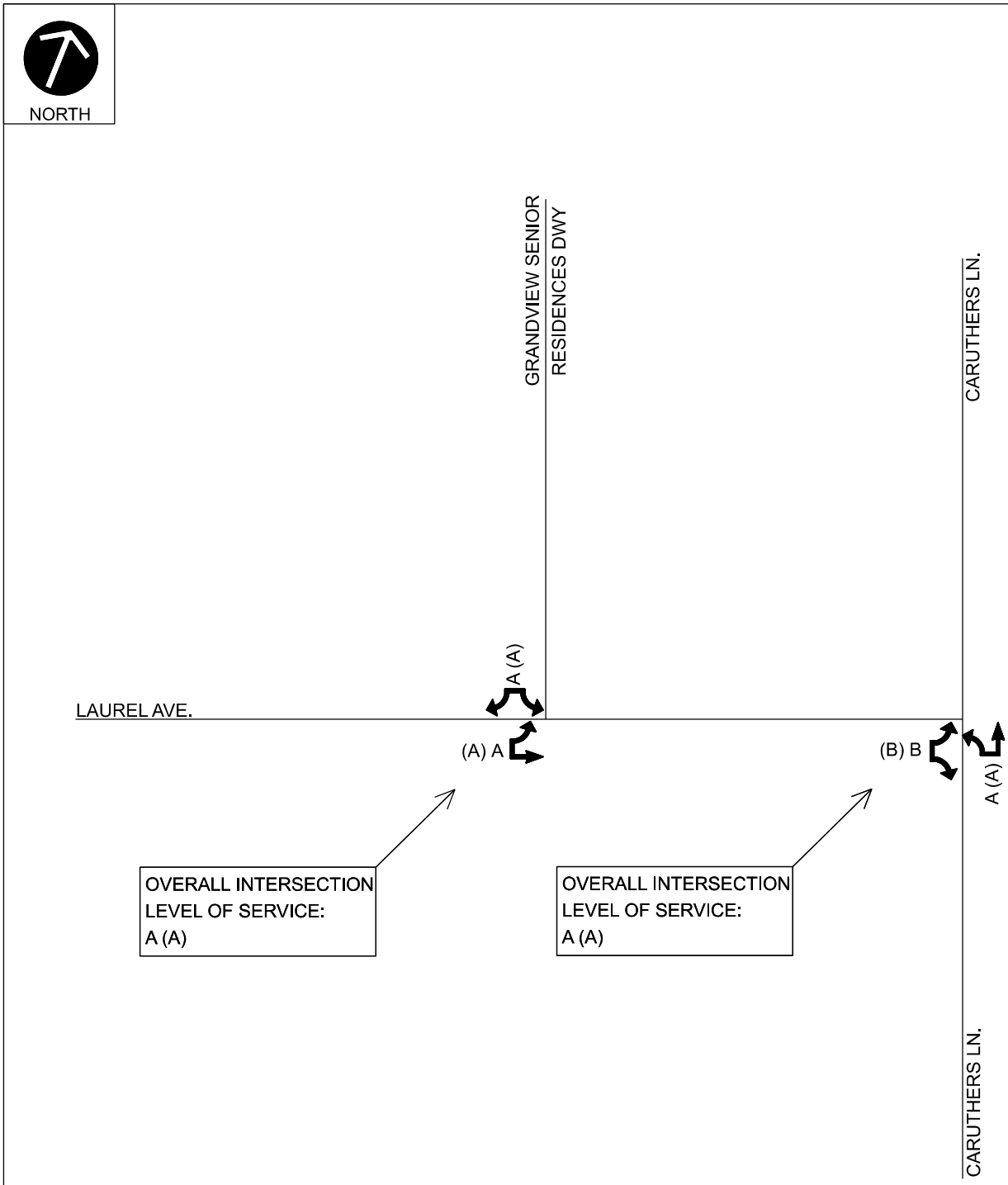
FORECASTED OPENING YEAR 2024 BUILD (WITH DEVELOPMENT)

PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	13
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

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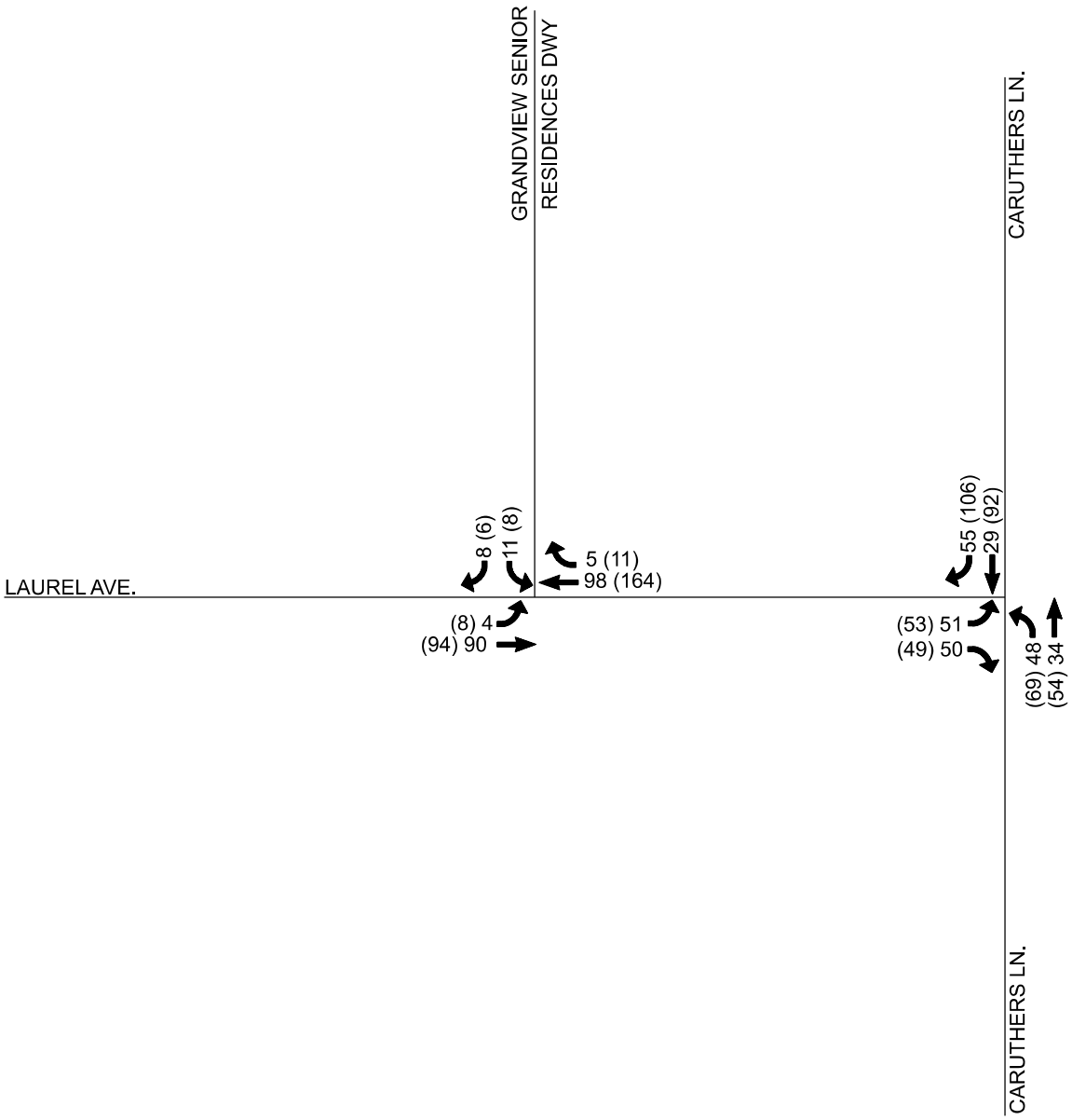
FORECASTED 2024 OPENING YEAR BUILD (WITH DEVELOPMENT)

PEAK HOUR LEVELS OF SERVICE

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	14
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

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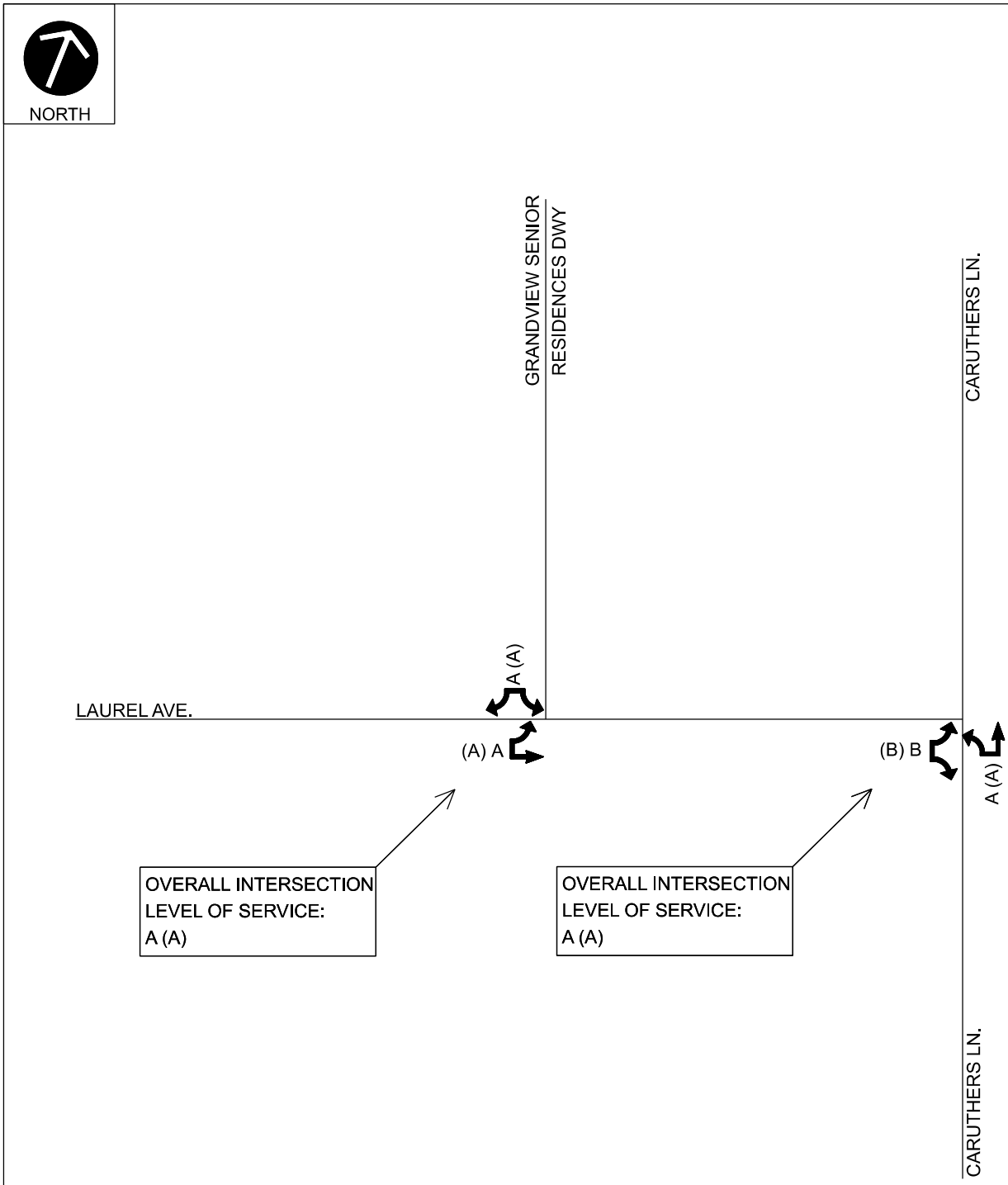
FORECASTED HORIZON YEAR 2029 BUILD (WITH DEVELOPMENT)

PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	15
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		



LEGEND

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FORECASTED 2029 OPENING YEAR BUILD (WITH DEVELOPMENT)

PEAK HOUR LEVELS OF SERVICE

DRAWN BY:	ANL	CHECKED BY:	JMD	APPROVED BY:	JMD	FIGURE NO.:	16
DATE:	DECEMBER 2021	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	305-634		

APPENDIX A

TURNING MOVEMENT COUNT SUMMARIES

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File Name : 305-634 - AM TMC
Site Code : 305-634
Start Date : 12/14/2021
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Laurel Avenue Eastbound			Caruthers Lane Southtbound			Caruthers Lane Northbound			
Start Time	Right	Left	App. Total	Right	Thru	App. Total	Thru	Left	App. Total	Int. Total
07:00 AM	10	11	21	8	10	18	6	17	23	62
07:15 AM	12	14	26	13	6	19	8	7	15	60
07:30 AM	7	6	13	11	9	20	12	12	24	57
07:45 AM	15	11	26	18	3	21	7	8	15	62
Total	44	42	86	50	28	78	33	44	77	241
08:00 AM	3	8	11	7	13	20	8	5	13	44
08:15 AM	4	15	19	16	5	21	6	5	11	51
08:30 AM	9	14	23	13	10	23	10	14	24	70
08:45 AM	15	8	23	17	8	25	9	5	14	62
Total	31	45	76	53	36	89	33	29	62	227
Grand Total	75	87	162	103	64	167	66	73	139	468
Apprch %	46.3	53.7		61.7	38.3		47.5	52.5		
Total %	16	18.6	34.6	22	13.7	35.7	14.1	15.6	29.7	
Passenger Vehicles	72	87	159	96	62	158	66	71	137	454
% Passenger Vehicles	96	100	98.1	93.2	96.9	94.6	100	97.3	98.6	97
Heavy Vehicles	3	0	3	7	2	9	0	2	2	14
% Heavy Vehicles	4	0	1.9	6.8	3.1	5.4	0	2.7	1.4	3

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412-429-2324

File Name : 305-634 - AM TMC
Site Code : 305-634
Start Date : 12/14/2021
Page No : 2

	Laurel Avenue Eastbound			Caruthers Lane Southtbound			Caruthers Lane Northbound			
Start Time	Right	Left	App. Total	Right	Thru	App. Total	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	10	11	21	8	**10**	18	6	**17**	23	**62**
07:15 AM	12	**14**	**26**	13	6	19	8	7	15	60
07:30 AM	7	6	13	11	9	20	**12**	12	**24**	57
07:45 AM	**15**	11	26	**18**	3	**21**	7	8	15	62
Total Volume	44	42	86	50	28	78	33	44	77	241
% App. Total	51.2	48.8		64.1	35.9		42.9	57.1		
PHF	.733	.750	.827	.694	.700	.929	.688	.647	.802	.972
Passenger Vehicles	44	42	86	49	26	75	33	43	76	237
% Passenger Vehicles	100	100	100	98.0	92.9	96.2	100	97.7	98.7	98.3
Heavy Vehicles	0	0	0	1	2	3	0	1	1	4
% Heavy Vehicles	0	0	0	2.0	7.1	3.8	0	2.3	1.3	1.7

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File Name : 305-634 - PM TMC
Site Code : 305-634
Start Date : 12/14/2021
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Laurel Avenue Eastbound			Caruthers Lane Southtbound			Caruthers Lane Northbound			
Start Time	Right	Left	App. Total	Right	Thru	App. Total	Thru	Left	App. Total	Int. Total
04:00 PM	11	11	22	31	20	51	9	12	21	94
04:15 PM	8	15	23	21	20	41	13	21	34	98
04:30 PM	10	17	27	31	22	53	14	13	27	107
04:45 PM	9	7	16	24	19	43	10	16	26	85
Total	38	50	88	107	81	188	46	62	108	384
05:00 PM	17	7	24	19	27	46	15	12	27	97
05:15 PM	11	11	22	20	20	40	15	15	30	92
05:30 PM	10	9	19	32	21	53	8	15	23	95
05:45 PM	4	13	17	23	19	42	13	7	20	79
Total	42	40	82	94	87	181	51	49	100	363
Grand Total	80	90	170	201	168	369	97	111	208	747
Apprch %	47.1	52.9		54.5	45.5		46.6	53.4		
Total %	10.7	12	22.8	26.9	22.5	49.4	13	14.9	27.8	
Passenger Vehicles	79	90	169	200	167	367	97	110	207	743
% Passenger Vehicles	98.8	100	99.4	99.5	99.4	99.5	100	99.1	99.5	99.5
Heavy Vehicles	1	0	1	1	1	2	0	1	1	4
% Heavy Vehicles	1.2	0	0.6	0.5	0.6	0.5	0	0.9	0.5	0.5

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File Name : 305-634 - PM TMC
Site Code : 305-634
Start Date : 12/14/2021

	Laurel Avenue Eastbound			Caruthers Lane Southtbound			Caruthers Lane Northbound			
Start Time	Right	Left	App. Total	Right	Thru	App. Total	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	8	15	23	21	20	41	13	**21**	**34**	98
04:30 PM	10	**17**	**27**	**31**	22	**53**	14	13	27	**107**
04:45 PM	9	7	16	24	19	43	10	16	26	85
05:00 PM	**17**	7	24	19	**27**	46	**15**	12	27	97
Total Volume	44	46	90	95	88	183	52	62	114	387
% App. Total	48.9	51.1		51.9	48.1		45.6	54.4		
PHF	.647	.676	.833	.766	.815	.863	.867	.738	.838	.904
Passenger Vehicles	44	46	90	95	88	183	52	62	114	387
% Passenger Vehicles	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0

APPENDIX B

INTERSECTION SKETCHES/PHOTOGRAPHS

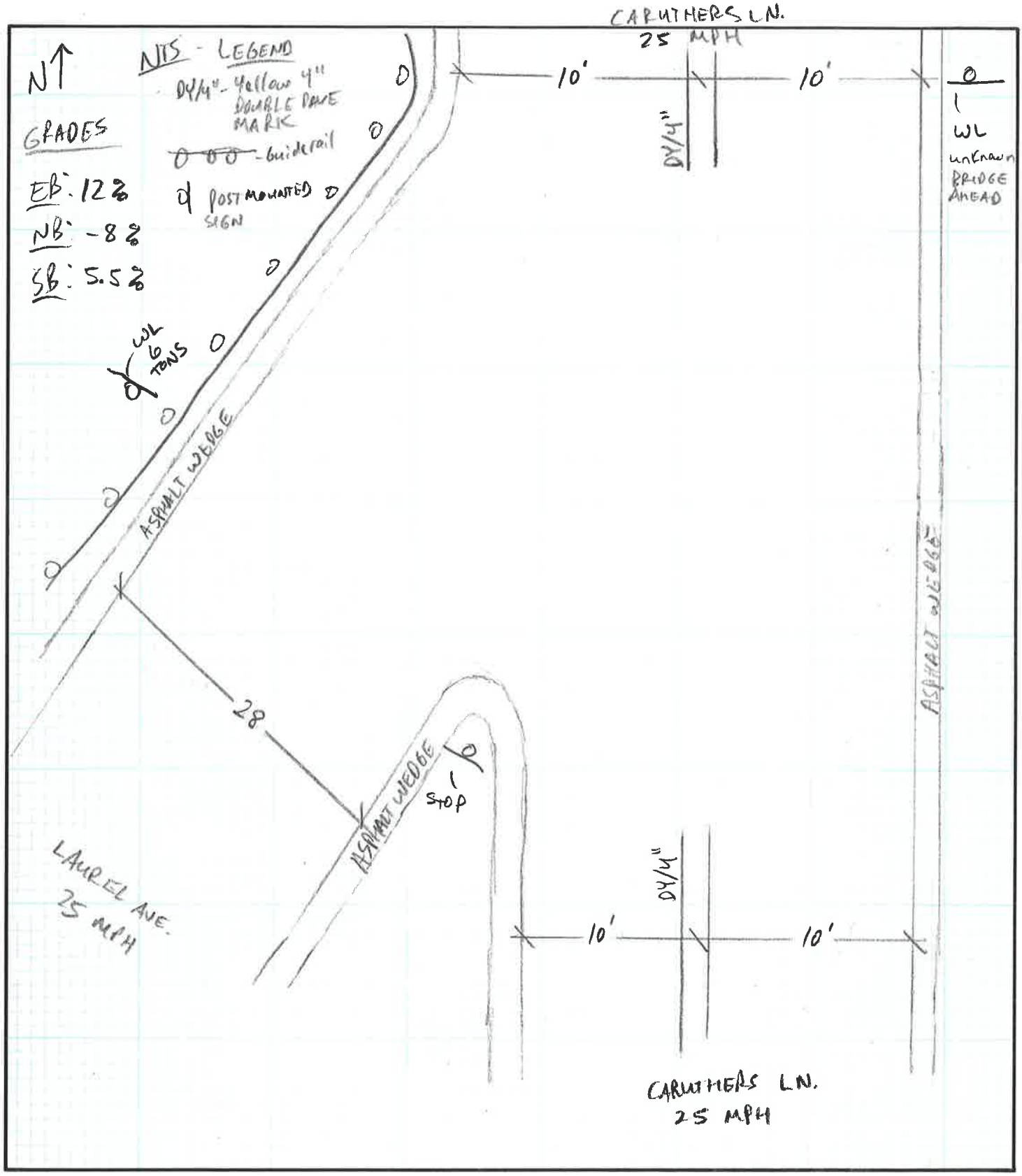
Civil & Environmental Consultants, Inc.

PROJECT 305-634 - Grandview Senior Living Dev. PROJECT NO. 305-634

Intersection Sketch - Caruthers Ln. & Laurel Ave. PAGE 1 OF 2

Transportation Impact Study

PREPARED BY ANL DATE 12/14/21 CHECKED BY JMO DATE 12/14/21



Caruthers Lane Northbound – South of Laurel Avenue

Caruthers Lane Northbound – South of Laurel Avenue

Caruthers Lane Southbound – North of Laurel Avenue

Caruthers Lane Southbound – North of Laurel Avenue

Laurel Avenue Eastbound – West of Caruthers Lane

Laurel Avenue Eastbound – West of Caruthers Lane

APPENDIX C

LEVEL OF SERVICE DEFINITIONS

LEVELS OF SERVICE

Intersection levels of service (LOS) were determined through implementation of the methodology presented in the *Highway Capacity Manual*, Sixth Edition, published by the Transportation Research Board.

i. Signalized Intersections

An explanation of level of service at signalized intersections is as follows:

"The criteria for the automobile mode are different from those for the nonautomobile modes. Specifically, the automobile-mode criteria are based on performance measures that are field measurable and perceivable by travelers. The criteria for the nonautomobile modes are based on scores reported by travelers indicating their perception of service quality.

LOS can be characterized for the entire intersection, each intersection approach, and each lane group. Control delay alone is used to characterize LOS for the entire intersection of an approach. Control delay and volume-to-capacity ratio are used to characterize LOS for a lane group. Delay quantifies the increase in travel time due to traffic signal control. It is also a surrogate measure of driver discomfort and fuel consumption. The volume-to-capacity ratio quantifies the degree to which a phase's capacity is utilized by a lane group. The following paragraphs describe each LOS.

LOS A describes operations with a control delay of 10 s/veh or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If it is due to favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

LOS B describes operations with control delay between 10 and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

LOS C describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle* length is moderate. Individual *cycle failures* (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

LOS D describes operations with control delay between 35 and 55 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

LOS E describes operations with control delay between 55 and 80 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

LOS F describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

A lane group can incur a delay less than 80 s/veh when the volume-to-capacity ratio exceeds 1.0. This condition typically occurs when the cycle length is short, the signal progression is favorable, or both. As a result, both the delay and volume-to-capacity ratio are considered when lane group LOS is established. A ratio of 1.0 or more indicates that cycle capacity is fully utilized and represents failure from a capacity perspective (just as delay in excess of 80 s/veh represents failure from a delay perspective).

Exhibit 18-4 lists the LOS thresholds established for the automobile mode at a signalized intersection."[1]

EXHIBIT 18-4
LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE BY VOLUME-TO-CAPACITY RATIO		CONTROL DELAY PER VEHICLE (SEC)
≤1.0	>1.0	
A	F	≤10
B	F	>10 and ≤20
C	F	>20 and ≤35
D	F	>35 and ≤55
E	F	>55 and ≤80
F	F	>80

1. Highway Capacity Manual, Sixth Edition, Transportation Research Board, 2016, Ch. 18, pp. 5 & 6.

ii. Unsignalized Intersections

"Level of service (LOS) for TWSC intersection is determined by the computed or measured control delay. For motor vehicles, LOS is determined for each minor-street movement (or shared movement) as well as major-street left turns by using a criteria given in Exhibit 19-1. LOS is not defined for the intersection as a whole or for major-street approaches for three primary reasons: *(a)* major-street through vehicles are assumed to experience zero delay; *(b)* the disproportionate number or major-street through vehicles at a typical TWSC intersection skews the weighted average of all movements, resulting in a very low overall average delay for all vehicles; and *(c)* the resulting low delay can mask important LOS deficiencies for minor movements. As Exhibit 19-1 notes, LOS F is assigned to the movement if the volume-to-capacity ratio for the movement exceed 1.0, regardless of the control delay.

The LOS criteria for TWSC intersections are somewhat different from the criteria used in Chapter 18 for signalized intersections, primarily because user perceptions differ among transportation facility types. The expectation is that a signalized intersection is designed to carry higher traffic volumes and will present greater delay than an unsignalized intersection. Unsignalized intersections are also associated with more uncertainty for users, as delays are less predictable than they are at signals, which can reduce users' delay tolerance."[1]

EXHIBIT 19-1
LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

LEVEL OF SERVICE BY VOLUME-TO-CAPACITY RATIO		CONTROL DELAY PER VEHICLE (SEC)
≤1.0	>1.0	
A	F	≤10
B	F	>10 and ≤15
C	F	>15 and ≤25
D	F	>25 and ≤35
E	F	>35 and ≤50
F	F	>50

1. Highway Capacity Manual, Sixth Edition, Transportation Research Board, 2016, Ch. 19, pp. 1 & 2.

"The level-of-service (LOS) criteria for AWSC intersections are given in Exhibit 20-2. As the exhibit notes, LOS F is assigned if the volume-to-capacity *(v/c)* ratio of a lane exceed 1.0, regardless of the control delay. For assessment of LOS at the approach and intersections levels, LOS is based solely on control delay."

EXHIBIT 20-2
LOS CRITERIA

LEVEL OF SERVICE BY VOLUME-TO-CAPACITY RATIO		CONTROL DELAY PER VEHICLE (SEC)
≤1.0	>1.0	
A	F	0-10
B	F	>10 and ≤15
C	F	>15 and ≤25
D	F	>25 and ≤35
E	F	>35 and ≤50
F	F	>50

1. Highway Capacity Manual, Sixth Edition, Transportation Research Board, 2016, Ch. 20, pp. 2 & 3.

APPENDIX D

EXISTING 2021 CAPACITY CALCULATIONS

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	42	44	44	33	28	50
Future Vol, veh/h	42	44	44	33	28	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	0	0	3	0	8	2
Mvmt Flow	43	45	45	34	29	52

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	179	55	81	0	-	0
Stage 1	55	-	-	-	-	-
Stage 2	124	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.13	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.227	-	-	-
Pot Cap-1 Maneuver	724	999	1510	-	-	-
Stage 1	938	-	-	-	-	-
Stage 2	835	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	702	999	1510	-	-	-
Mov Cap-2 Maneuver	702	-	-	-	-	-
Stage 1	910	-	-	-	-	-
Stage 2	835	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	4.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1510	-	828	-	-
HCM Lane V/C Ratio	0.03	-	0.107	-	-
HCM Control Delay (s)	7.5	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	46	44	62	52	88	95
Future Vol, veh/h	46	44	62	52	88	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	51	49	69	58	98	106

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	347	151	204	0	-	0
Stage 1	151	-	-	-	-	-
Stage 2	196	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	519	856	1380	-	-	-
Stage 1	797	-	-	-	-	-
Stage 2	739	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	492	856	1380	-	-	-
Mov Cap-2 Maneuver	492	-	-	-	-	-
Stage 1	756	-	-	-	-	-
Stage 2	739	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.9	4.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1380	-	621	-	-
HCM Lane V/C Ratio	0.05	-	0.161	-	-
HCM Control Delay (s)	7.7	0	11.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

APPENDIX E

FORECASTED OPENING YEAR 2024 NO-BUILD (BASE) CAPACITY CALCULATIONS

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	43	45	45	34	28	51
Future Vol, veh/h	43	45	45	34	28	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	0	0	3	0	8	2
Mvmt Flow	44	46	46	35	29	53

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	183	56	82	0	-	0
Stage 1	56	-	-	-	-	-
Stage 2	127	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.13	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.227	-	-	-
Pot Cap-1 Maneuver	718	997	1509	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	830	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	696	997	1509	-	-	-
Mov Cap-2 Maneuver	696	-	-	-	-	-
Stage 1	907	-	-	-	-	-
Stage 2	830	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	4.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1509	-	823	-	-
HCM Lane V/C Ratio	0.031	-	0.11	-	-
HCM Control Delay (s)	7.5	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	47	45	63	53	89	97
Future Vol, veh/h	47	45	63	53	89	97
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	52	50	70	59	99	108

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	352	153	207	0	-	0
Stage 1	153	-	-	-	-	-
Stage 2	199	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	514	854	1376	-	-	-
Stage 1	795	-	-	-	-	-
Stage 2	735	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	487	854	1376	-	-	-
Mov Cap-2 Maneuver	487	-	-	-	-	-
Stage 1	753	-	-	-	-	-
Stage 2	735	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12	4.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1376	-	617	-	-
HCM Lane V/C Ratio	0.051	-	0.166	-	-
HCM Control Delay (s)	7.8	0	12	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

APPENDIX F

FORECASTED HORIZON YEAR 2029 NO-BUILD (BASE) CAPACITY CALCULATIONS

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	46	46	34	29	52
Future Vol, veh/h	44	46	46	34	29	52
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	0	0	3	0	8	2
Mvmt Flow	45	47	47	35	30	54

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	186	57	84	0	-	0
Stage 1	57	-	-	-	-	-
Stage 2	129	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.13	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.227	-	-	-
Pot Cap-1 Maneuver	714	996	1506	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	828	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	691	996	1506	-	-	-
Mov Cap-2 Maneuver	691	-	-	-	-	-
Stage 1	904	-	-	-	-	-
Stage 2	828	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10	4.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1506	-	819	-	-
HCM Lane V/C Ratio	0.031	-	0.113	-	-
HCM Control Delay (s)	7.5	0	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	48	46	65	54	92	99
Future Vol, veh/h	48	46	65	54	92	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	53	51	72	60	102	110

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	361	157	212	0	-	0
Stage 1	157	-	-	-	-	-
Stage 2	204	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	505	848	1370	-	-	-
Stage 1	789	-	-	-	-	-
Stage 2	729	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	478	848	1370	-	-	-
Mov Cap-2 Maneuver	478	-	-	-	-	-
Stage 1	746	-	-	-	-	-
Stage 2	729	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.1	4.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1370	-	608	-	-
HCM Lane V/C Ratio	0.053	-	0.172	-	-
HCM Control Delay (s)	7.8	0	12.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

APPENDIX G

TRIP GENERATION CALCULATIONS

Trip Generation Calculations
Grand View Senior Residences Development
Borough of Irwin and North Huntingdon Twp., Westmoreland County, Pennsylvania

December 14, 2021

50	Number of Dwelling Units	ITE Land Use Code		252			Senior Adult Housing-Multifamily					
	Weekday 24-Hour	=======>	T=	2.89	(	X	) + 24.82	(	50	% Entering/	50	% Exiting)
			T=	2.89	(	50	) + 24.82					
			T=			169.32						
			T=			169		(	85	Entering/	84	Exiting)
	A.M. Peak Hour	=======>	T=	0.19	(	X	) + 0.90	(	34	% Entering/	66	% Exiting)
			T=	0.19	(	50	) + 0.90					
			T=			10.4						
			T=			10		(	3	Entering/	7	Exiting)
	P.M. Peak Hour	=======>	T=	0.25	(	X	) + 0.07	(	56	% Entering/	44	% Exiting)
			T=	0.25	(	50	) + 0.07					
			T=			12.57						
			T=			13		(	7	Entering/	6	Exiting)

Trip Generation Calculations
Grand View Senior Residences Development
Borough of Irwin and North Huntingdon Twp., Westmoreland County, Pennsylvania

December 14, 2021

36 Number of Dwelling Units ITE Land Use Code 251 Senior Adult Housing-Single-Family

Weekday 24-Hour	=======>	Ln(T) =	0.85	*Ln(X) +	2.47	(	50	% Entering/	50	% Exiting)
		Ln(T) =	0.85	*Ln(36) +	2.47					
		Ln(T) =		5.515991098						
		T =		248.636278		(	125	Entering/	124	Exiting)
		T=		249						
A.M. Peak Hour	=======>	Ln(T) =	0.76	*Ln(X) +	.16	(	33	% Entering/	67	% Exiting)
		Ln(T) =	0.76	*Ln(36) +	.16					
		Ln(T) =		2.883474393						
		T =		17.87627462		(	6	Entering/	12	Exiting)
		T=		18						
P.M. Peak Hour	=======>	Ln(T) =	0.78	*Ln(X) +	.2	(	61	% Entering/	39	% Exiting)
		Ln(T) =	0.78	*Ln(36) +	.2					
		Ln(T) =		2.995144772						
		T =		19.98825342		(	12	Entering/	8	Exiting)
		T=		20						

APPENDIX H

FORECASTED OPENING YEAR 2024 BUILD (WITH DEVELOPMENT) CAPACITY CALCULATIONS

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	45	47	46	34	28	52
Future Vol, veh/h	45	47	46	34	28	52
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	0	0	3	0	8	2
Mvmt Flow	46	48	47	35	29	54

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	185	56	83	0	-	0
Stage 1	56	-	-	-	-	-
Stage 2	129	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.13	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.227	-	-	-
Pot Cap-1 Maneuver	715	997	1508	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	828	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	692	997	1508	-	-	-
Mov Cap-2 Maneuver	692	-	-	-	-	-
Stage 1	906	-	-	-	-	-
Stage 2	828	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10	4.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1508	-	820	-	-
HCM Lane V/C Ratio	0.031	-	0.116	-	-
HCM Control Delay (s)	7.5	0	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	88	96	2	4	3
Future Vol, veh/h	1	88	96	2	4	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-4	-2	-	-2	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	2	2	2	2
Mvmt Flow	1	98	107	2	4	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	109	0	-	0	208	108
Stage 1	-	-	-	-	108	-
Stage 2	-	-	-	-	100	-
Critical Hdwy	4.1	-	-	-	6.02	6.02
Critical Hdwy Stg 1	-	-	-	-	5.02	-
Critical Hdwy Stg 2	-	-	-	-	5.02	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1494	-	-	-	799	952
Stage 1	-	-	-	-	928	-
Stage 2	-	-	-	-	934	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1494	-	-	-	798	952
Mov Cap-2 Maneuver	-	-	-	-	798	-
Stage 1	-	-	-	-	927	-
Stage 2	-	-	-	-	934	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1494	-	-	-	857
HCM Lane V/C Ratio	0.001	-	-	-	0.009
HCM Control Delay (s)	7.4	0	-	-	9.2
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	49	47	65	53	89	99
Future Vol, veh/h	49	47	65	53	89	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	0	0	0	0
Mvmt Flow	54	52	72	59	99	110

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	357	154	209	0	-	0
Stage 1	154	-	-	-	-	-
Stage 2	203	-	-	-	-	-
Critical Hdwy	8.81	7.41	4.1	-	-	-
Critical Hdwy Stg 1	7.81	-	-	-	-	-
Critical Hdwy Stg 2	7.81	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.2	-	-	-
Pot Cap-1 Maneuver	507	850	1374	-	-	-
Stage 1	791	-	-	-	-	-
Stage 2	728	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	480	850	1374	-	-	-
Mov Cap-2 Maneuver	480	-	-	-	-	-
Stage 1	748	-	-	-	-	-
Stage 2	728	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.1	4.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1374	-	610	-	-
HCM Lane V/C Ratio	0.053	-	0.175	-	-
HCM Control Delay (s)	7.8	0	12.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	92	160	4	4	2
Future Vol, veh/h	3	92	160	4	4	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-4	-2	-	-2	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	3	102	178	4	4	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	182	0	-	0	288	180
Stage 1	-	-	-	-	180	-
Stage 2	-	-	-	-	108	-
Critical Hdwy	4.1	-	-	-	6.02	6.02
Critical Hdwy Stg 1	-	-	-	-	5.02	-
Critical Hdwy Stg 2	-	-	-	-	5.02	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1405	-	-	-	725	871
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	928	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1405	-	-	-	724	871
Mov Cap-2 Maneuver	-	-	-	-	724	-
Stage 1	-	-	-	-	866	-
Stage 2	-	-	-	-	928	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1405	-	-	-	767
HCM Lane V/C Ratio	0.002	-	-	-	0.009
HCM Control Delay (s)	7.6	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

APPENDIX I

FORECASTED HORIZON YEAR 2029 BUILD (WITH DEVELOPMENT) CAPACITY CALCULATIONS

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	51	50	48	34	29	55
Future Vol, veh/h	51	50	48	34	29	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	0	0	3	0	8	2
Mvmt Flow	53	52	49	35	30	57

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	192	59	87	0	-	0
Stage 1	59	-	-	-	-	-
Stage 2	133	-	-	-	-	-
Critical Hdwy	8.8	7.4	4.13	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.227	-	-	-
Pot Cap-1 Maneuver	705	993	1503	-	-	-
Stage 1	931	-	-	-	-	-
Stage 2	822	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	682	993	1503	-	-	-
Mov Cap-2 Maneuver	682	-	-	-	-	-
Stage 1	900	-	-	-	-	-
Stage 2	822	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	4.4	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1503	-	807	-	-
HCM Lane V/C Ratio	0.033	-	0.129	-	-
HCM Control Delay (s)	7.5	0	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	90	98	5	11	8
Future Vol, veh/h	4	90	98	5	11	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-4	-2	-	-2	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	2	2	2	2
Mvmt Flow	4	100	109	6	12	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	115	0	-	0	220	112
Stage 1	-	-	-	-	112	-
Stage 2	-	-	-	-	108	-
Critical Hdwy	4.1	-	-	-	6.02	6.02
Critical Hdwy Stg 1	-	-	-	-	5.02	-
Critical Hdwy Stg 2	-	-	-	-	5.02	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1487	-	-	-	787	947
Stage 1	-	-	-	-	924	-
Stage 2	-	-	-	-	928	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1487	-	-	-	785	947
Mov Cap-2 Maneuver	-	-	-	-	785	-
Stage 1	-	-	-	-	921	-
Stage 2	-	-	-	-	928	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1487	-	-	-	846
HCM Lane V/C Ratio	0.003	-	-	-	0.025
HCM Control Delay (s)	7.4	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	53	49	69	54	92	106
Future Vol, veh/h	53	49	69	54	92	106
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	12	-	-	-8	6	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	0	0	0	0
Mvmt Flow	59	54	77	60	102	118

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	375	161	220	0	-	0
Stage 1	161	-	-	-	-	-
Stage 2	214	-	-	-	-	-
Critical Hdwy	8.81	7.41	4.1	-	-	-
Critical Hdwy Stg 1	7.81	-	-	-	-	-
Critical Hdwy Stg 2	7.81	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.2	-	-	-
Pot Cap-1 Maneuver	489	840	1361	-	-	-
Stage 1	782	-	-	-	-	-
Stage 2	714	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	460	840	1361	-	-	-
Mov Cap-2 Maneuver	460	-	-	-	-	-
Stage 1	736	-	-	-	-	-
Stage 2	714	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.6	4.4	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1361	-	588	-	-
HCM Lane V/C Ratio	0.056	-	0.193	-	-
HCM Control Delay (s)	7.8	0	12.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.7	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	94	164	11	8	6
Future Vol, veh/h	8	94	164	11	8	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-4	-2	-	-2	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	9	104	182	12	9	7

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	194	0	-	0	310	188
Stage 1	-	-	-	-	188	-
Stage 2	-	-	-	-	122	-
Critical Hdwy	4.1	-	-	-	6.02	6.02
Critical Hdwy Stg 1	-	-	-	-	5.02	-
Critical Hdwy Stg 2	-	-	-	-	5.02	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1391	-	-	-	706	863
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	916	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1391	-	-	-	701	863
Mov Cap-2 Maneuver	-	-	-	-	701	-
Stage 1	-	-	-	-	856	-
Stage 2	-	-	-	-	916	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1391	-	-	-	762
HCM Lane V/C Ratio	0.006	-	-	-	0.02
HCM Control Delay (s)	7.6	0	-	-	9.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

APPENDIX J

TRAFFIC SIGNAL WARRANTS EVALUATION

Project:		Grand View Senior Residences: North Huntingdon, PA	**Calculations:**	ANL
Major Street	**Name:**	Caruthers Lane	**Date:**	12/22/2021
	Speed Limit (mph):	25	**Checked by:**	JMD
	Approach Lanes:	1	**Date:**	1/7/2022
Minor Street	**Name:**	Laurel Avenue		
	Speed Limit (mph):	25		
	Approach Lanes:	1		
Population < 10000?		No		

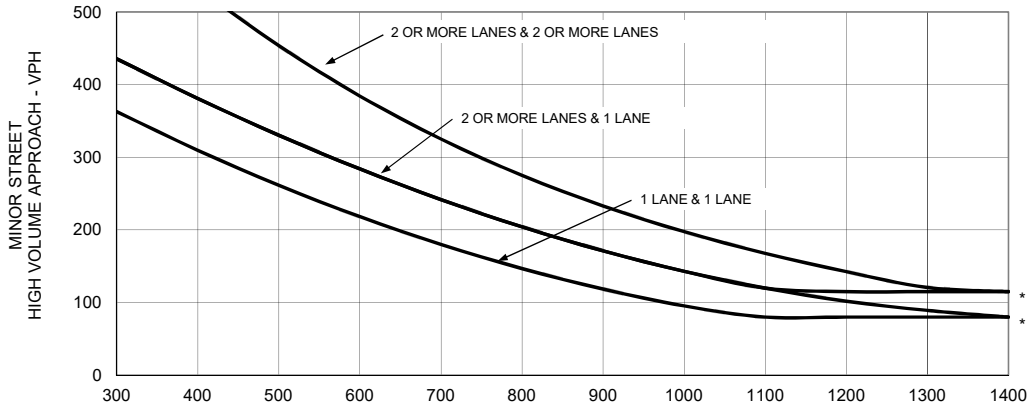
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2024 Build Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies at the lower threshold volume for a minor-street approach with one lane.

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			552	NO
1:00			552	NO
2:00			552	NO
3:00			552	NO
4:00			552	NO
5:00			552	NO
6:00			552	NO
7:00	159	91	446	NO
8:00	155	81	449	NO
9:00			552	NO
10:00			552	NO
11:00			552	NO
12:00			552	NO
13:00			552	NO
14:00			552	NO
15:00			552	NO
16:00	284	93	372	NO
17:00	289	87	369	NO
18:00			552	NO
19:00			552	NO
20:00			552	NO
21:00			552	NO
22:00			552	NO
23:00			552	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

Project:		Grand View Senior Residences: North Huntingdon, PA	**Calculations:**	ANL
Major Street	**Name:**	Caruthers Lane	**Date:**	12/22/2021
	Speed Limit (mph):	25	**Checked by:**	JMD
	Approach Lanes:	1	**Date:**	1/7/2022
Minor Street	**Name:**	Laurel Avenue		
	Speed Limit (mph):	25		
	Approach Lanes:	1		
Population < 10000?		No		

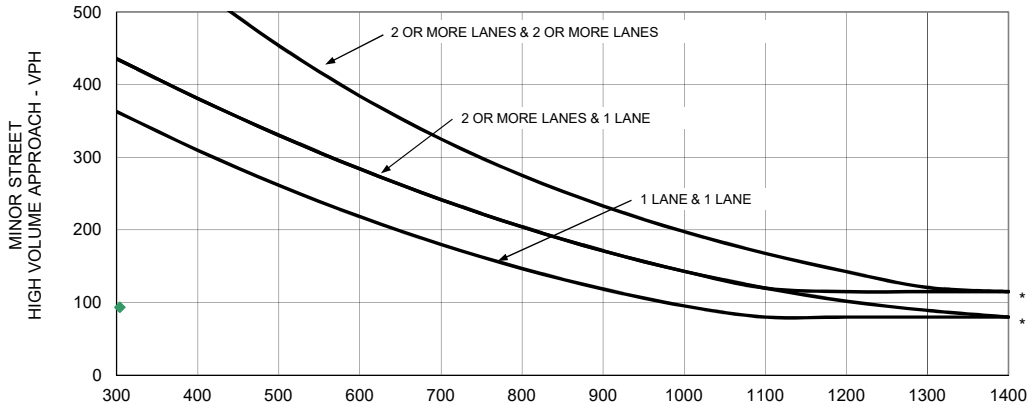
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2029 Build Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies at the lower threshold volume for a minor-street approach with one lane.

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			552	NO
1:00			552	NO
2:00			552	NO
3:00			552	NO
4:00			552	NO
5:00			552	NO
6:00			552	NO
7:00	167	101	442	NO
8:00	162	90	444	NO
9:00			552	NO
10:00			552	NO
11:00			552	NO
12:00			552	NO
13:00			552	NO
14:00			552	NO
15:00			552	NO
16:00	299	100	364	NO
17:00	304	93	361	NO
18:00			552	NO
19:00			552	NO
20:00			552	NO
21:00			552	NO
22:00			552	NO
23:00			552	NO
Signal warrant satisfied?				**NO**

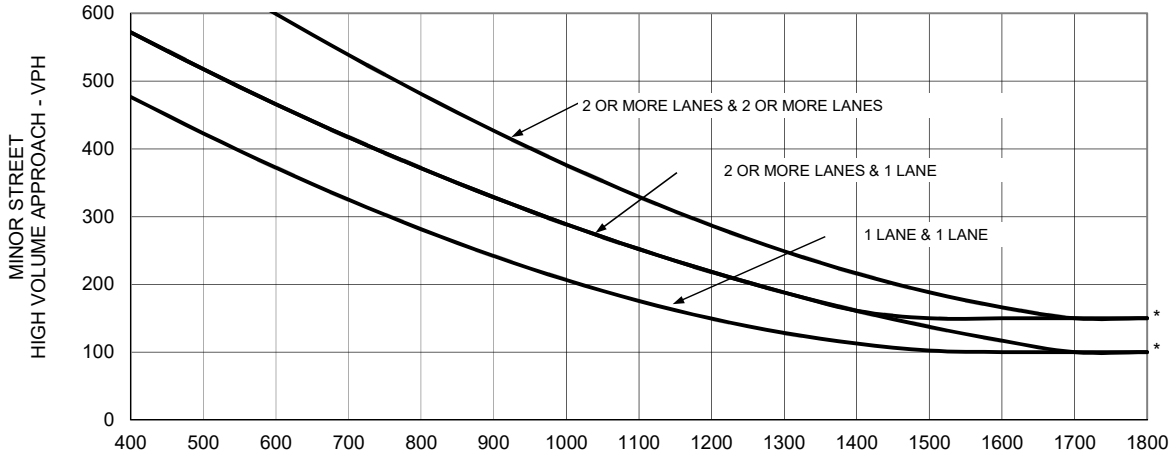
Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

Project:		Grand View Senior Residences: North Huntingdon, PA	**Calculations:**	ANL
Major Street	**Name:**	Caruthers Lane	**Date:**	12/22/2021
	Speed Limit (mph):	25	**Checked by:**	JMD
	Approach Lanes:	1	**Date:**	1/7/2022
Minor Street	**Name:**	Laurel Avenue	Civil & Environmental Consultants, Inc.	
	Speed Limit (mph):	25		
	Approach Lanes:	1		
Population < 10000?		No		

Warrant 1 - Peak Hour

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 3, Peak Hour



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies at the lower threshold volume for a minor-street approach with one lane.

Scenario	Major Street (vph)	Minor Street (vph)	Warrant Volume Minor Street	Warrant Satisfied?
Existing 2021 AM Peak	155	86	620	NO
Existing 2021 PM Peak	260	90	557	NO
2024 No-Build AM Peak	158	88	618	NO
2024 No-Build PM Peak	302	92	532	NO
2029 No-Build AM Peak	161	90	617	NO
2029 No-Build PM Peak	310	94	528	NO
2024 Build, AM Peak	160	92	617	NO
2024 Build PM Peak	306	96	530	NO
2029 Build AM Peak	166	101	613	NO
2029 Build PM Peak	321	102	521	NO

Signal warrant satisfied if hourly threshold satisfied for any 1 hour of an average day.

APPENDIX K

AUXILIARY TURN LANE WARRANTS EVALUATION

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	North Huntingdon Township	**Analysis Date:**	12/21/2021
County:	Westmoreland County	**Conducted By:**	ANL
PennDOT Engineering District:	12	**Checked By:**	
		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Caruthers Lane and Laurel Avenue - Northbound Left Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	A.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	48	3.0%	51
	Through	-	34	0.0%	34
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-	29	8.0%	33
	Right	Yes	55	2.0%	57

Advancing Volume:	85
Opposing Volume:	90
Left Turn Volume:	51
% Left Turns in Advancing Volume:	60.00%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	-	0	0.0%	N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	51
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

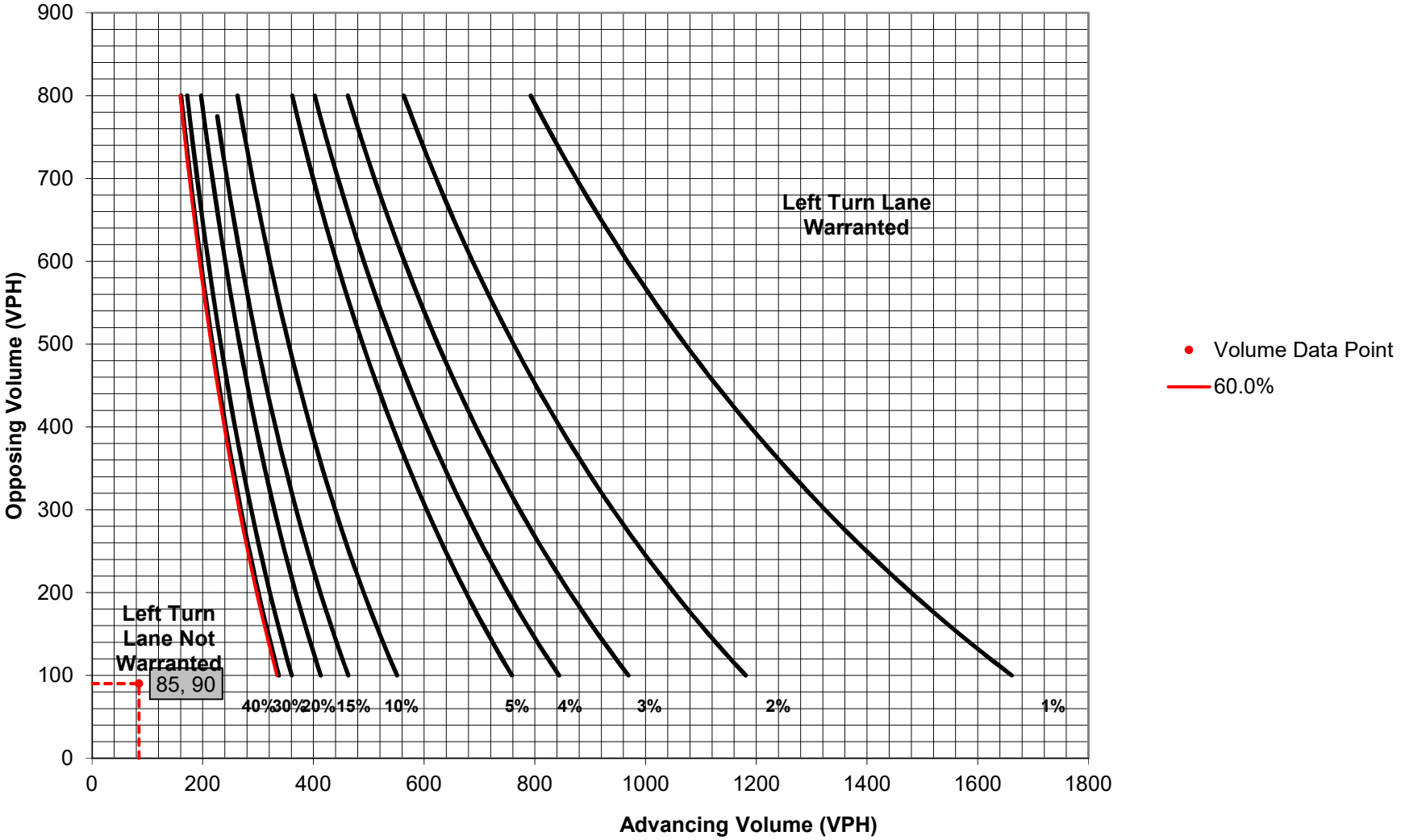
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	North Huntingdon Township	**Analysis Date:**	12/21/2021
County:	Westmoreland County	**Conducted By:**	ANL
PennDOT Engineering District:	12	**Checked By:**	
		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Caruthers Lane and Laurel Avenue - Northbound Left Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	P.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	69	0.0%	69
	Through	-	54	0.0%	54
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-	92	0.0%	92
	Right	Yes	106	0.0%	106

Advancing Volume:	123
Opposing Volume:	198
Left Turn Volume:	69
% Left Turns in Advancing Volume:	56.10%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	-	0	0.0%	N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	69
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

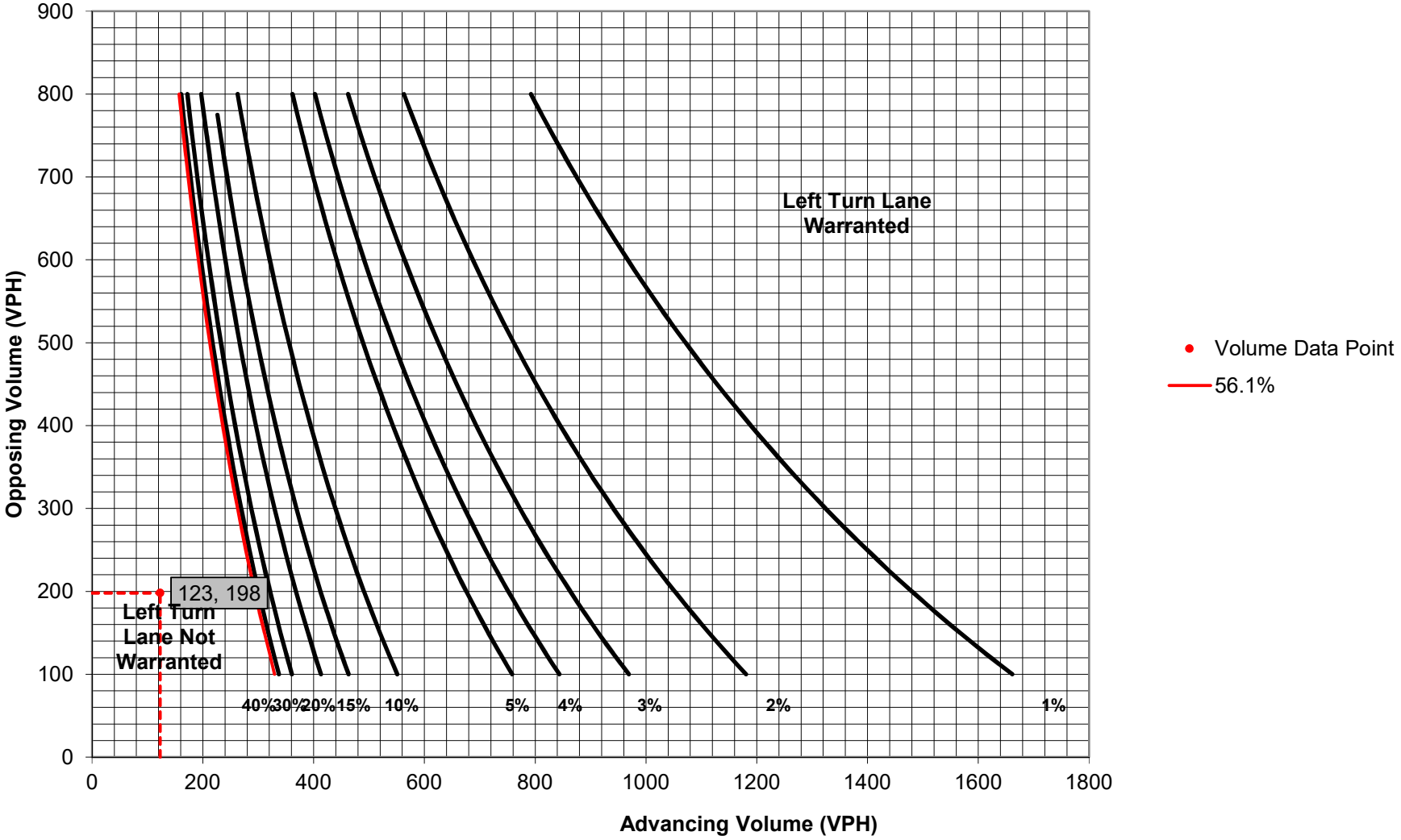
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



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County:	Westmoreland County	**Conducted By:**	ANL
PennDOT Engineering District:	12	**Checked By:**	
		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Caruthers Lane and Laurel Avenue -Southbound Right Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	A.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes			N/A
	Through	-			N/A
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-			N/A
	Right	Yes			N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	0
	Through	-	29	8.0%	33
	Right	-	55	2.0%	57

Advancing Volume:	90
Right Turn Volume:	57

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	57
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

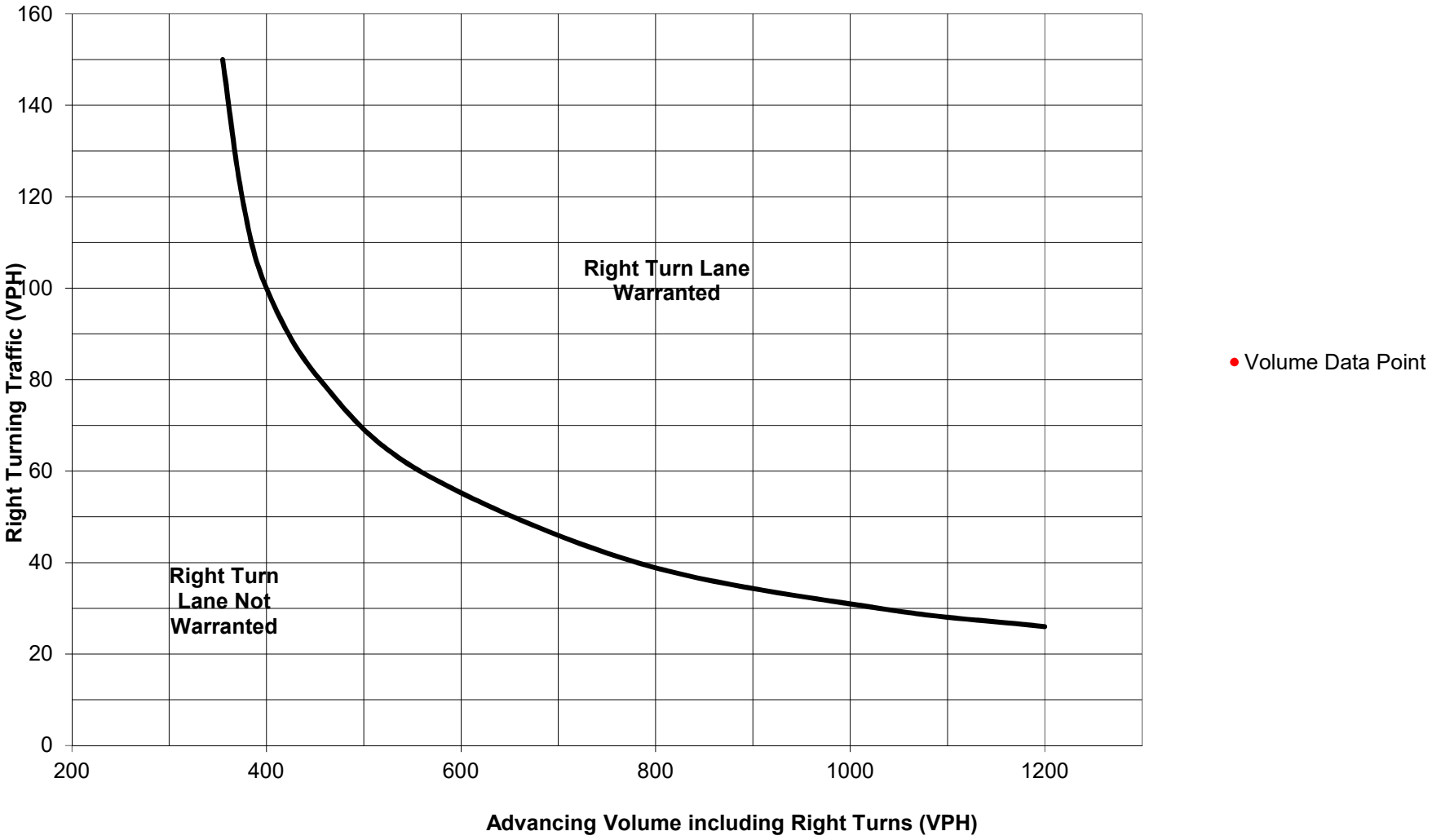
Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



Turn Lane Warrant and Length Analysis Workbook

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County:	Westmoreland County	**Conducted By:**	ANL
PennDOT Engineering District:	12	**Checked By:**	
		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Caruthers Lane and Laurel Avenue -Southbound Right Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	P.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes			N/A
	Through	-			N/A
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-			N/A
	Right	Yes			N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	0
	Through	-	92	0.0%	92
	Right	-	106	0.0%	106

Advancing Volume:	198
Right Turn Volume:	106

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	106
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

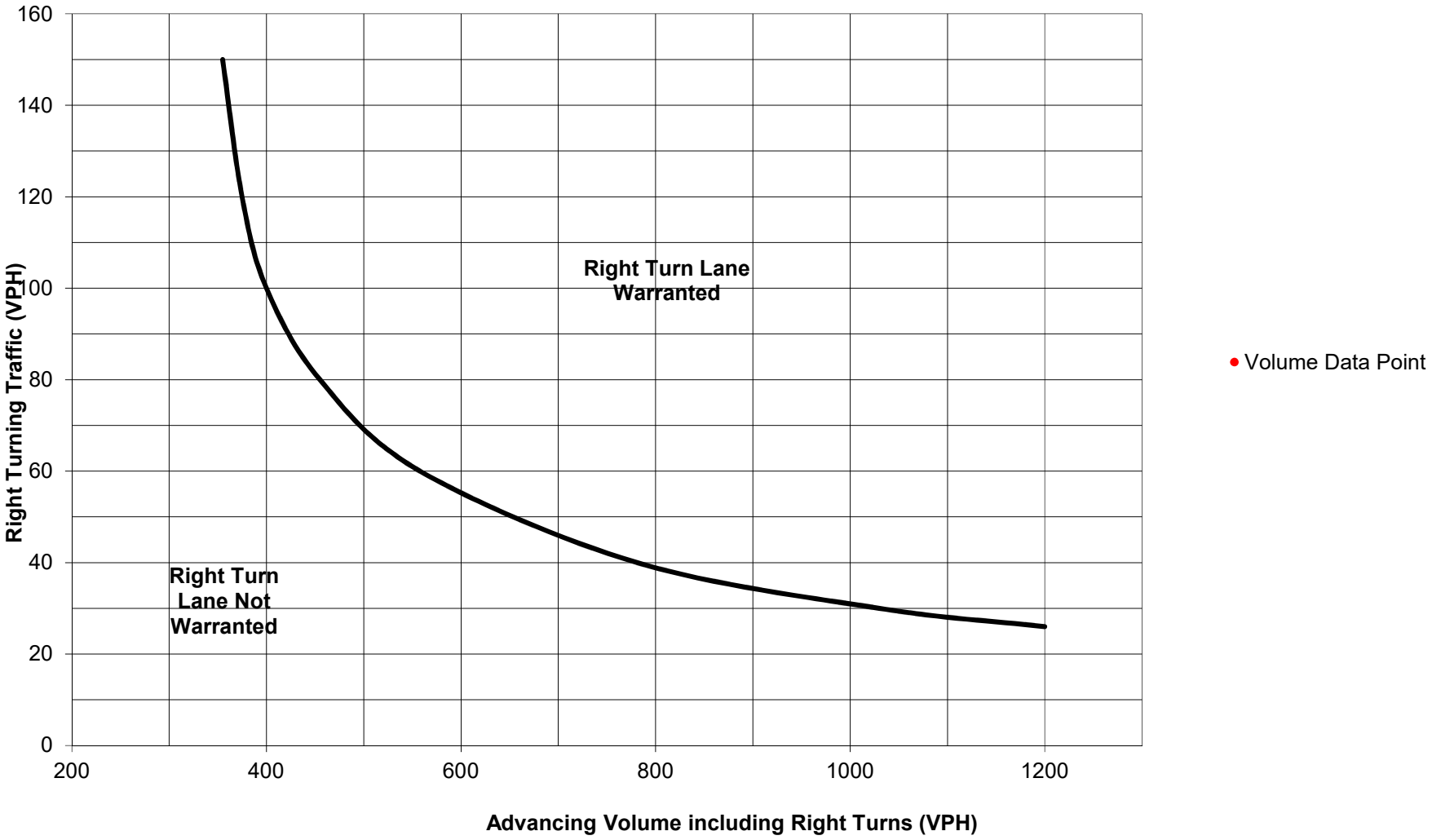
Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



Turn Lane Warrant and Length Analysis Workbook

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PennDOT Engineering District:	12	**Checked By:**	
		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Laurel Avenue and Site Driveway - Eastbound Left Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	A.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25	**Type of Analysis**	
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	4	0.0%	4
	Through	-	90	0.0%	90
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-	98	3.0%	103
	Right	Yes	5	2.0%	6

Advancing Volume:	94
Opposing Volume:	109
Left Turn Volume:	4
% Left Turns in Advancing Volume:	4.26%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	-	0	0.0%	N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	4
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

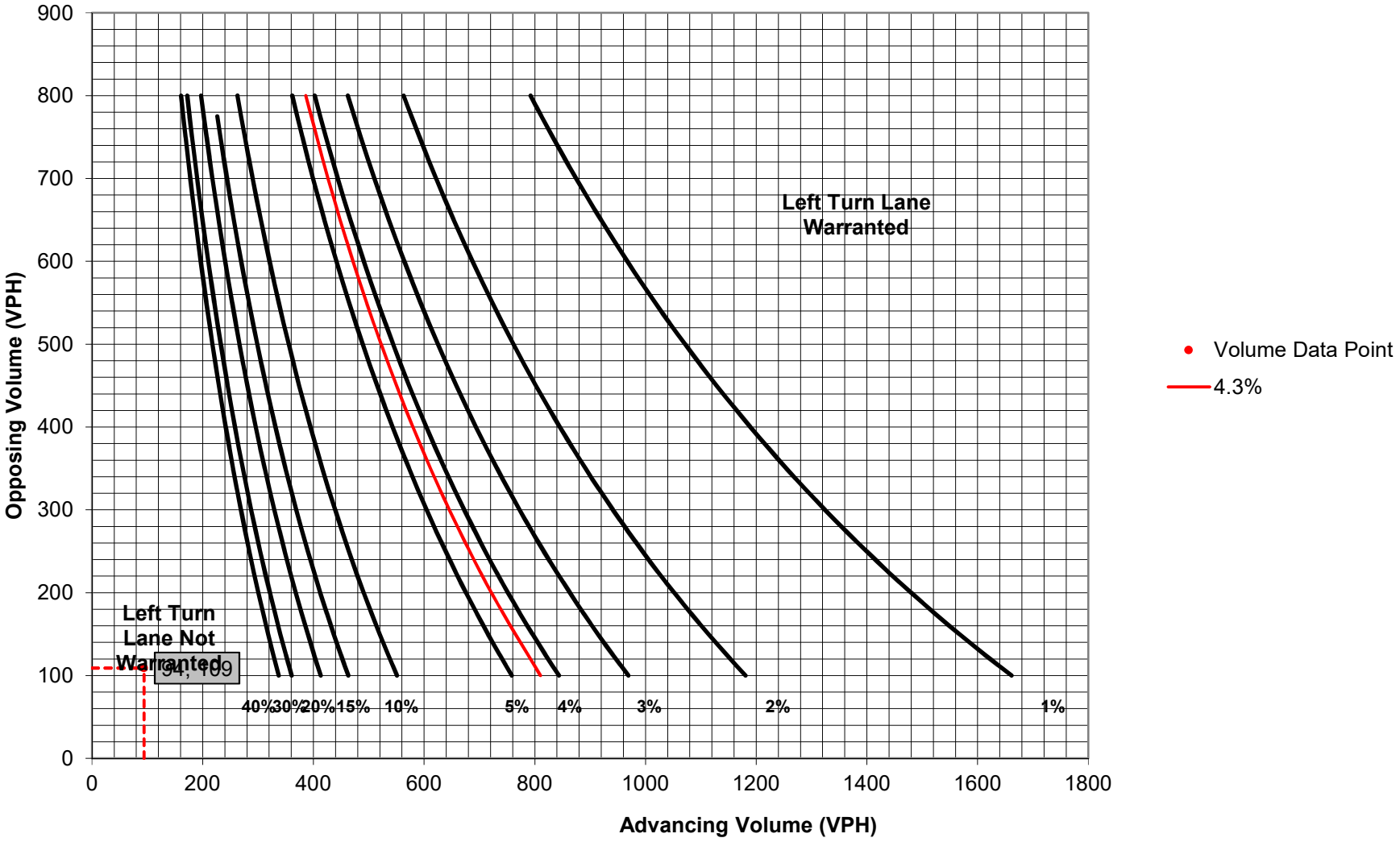
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

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PennDOT Engineering District:	12	**Checked By:**	
		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Laurel Avenue and Site Driveway - Eastbound Left Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	P.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25	**Type of Analysis**	
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	8	0.0%	8
	Through	-	94	0.0%	94
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-	164	0.0%	164
	Right	Yes	11	0.0%	11

Advancing Volume:	102
Opposing Volume:	175
Left Turn Volume:	8
% Left Turns in Advancing Volume:	7.84%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	-	0	0.0%	N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	8
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

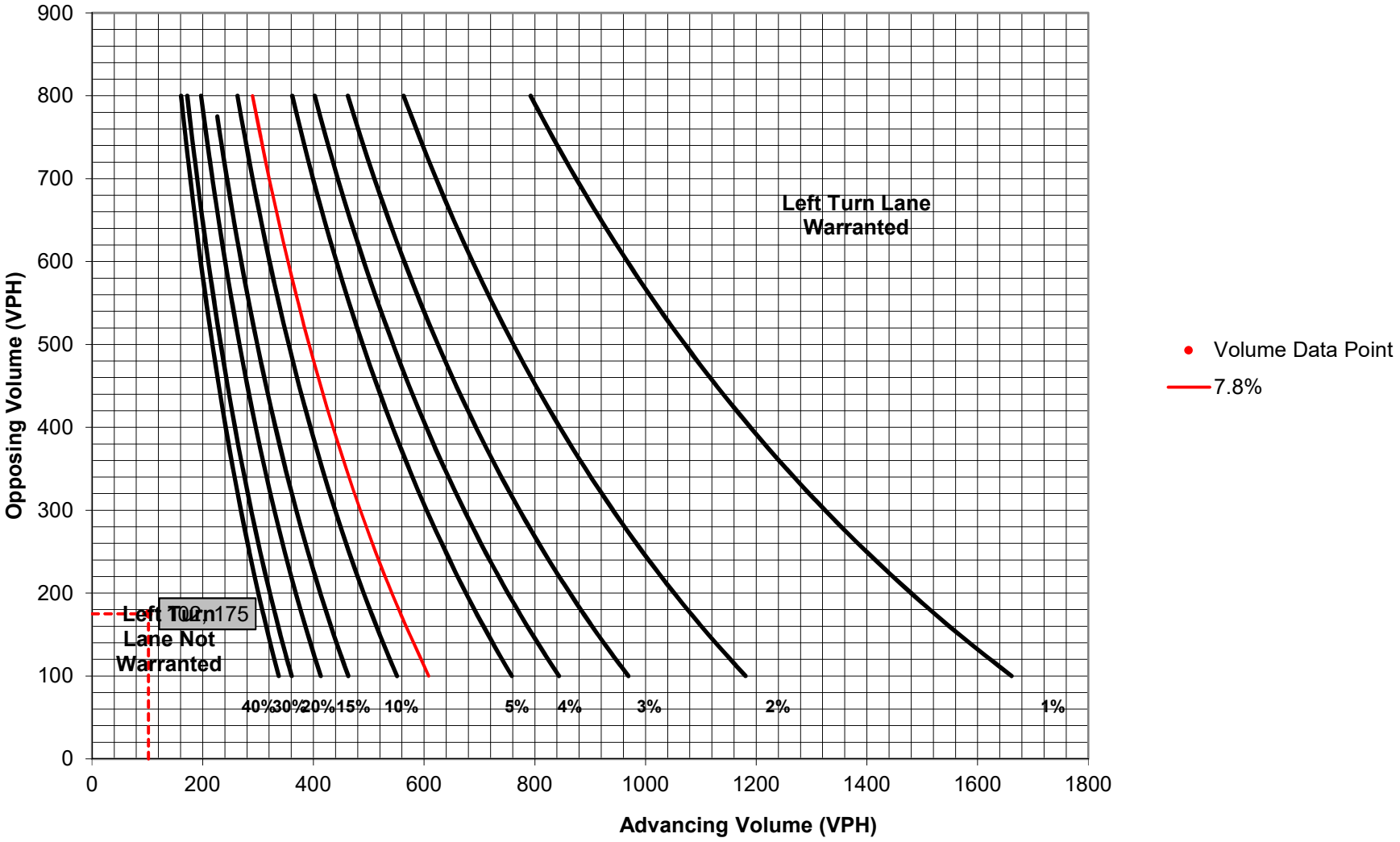
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



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		Agency/Company Name:	Civil & Environmental Consultants

Intersection & Approach Description: Laurel Avenue and Site Driveway -Westbound Right Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	A.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes			N/A
	Through	-			N/A
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-			N/A
	Right	Yes			N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	0
	Through	-	98	3.0%	103
	Right	-	5	2.0%	6

Advancing Volume:	109
Right Turn Volume:	6

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	6
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

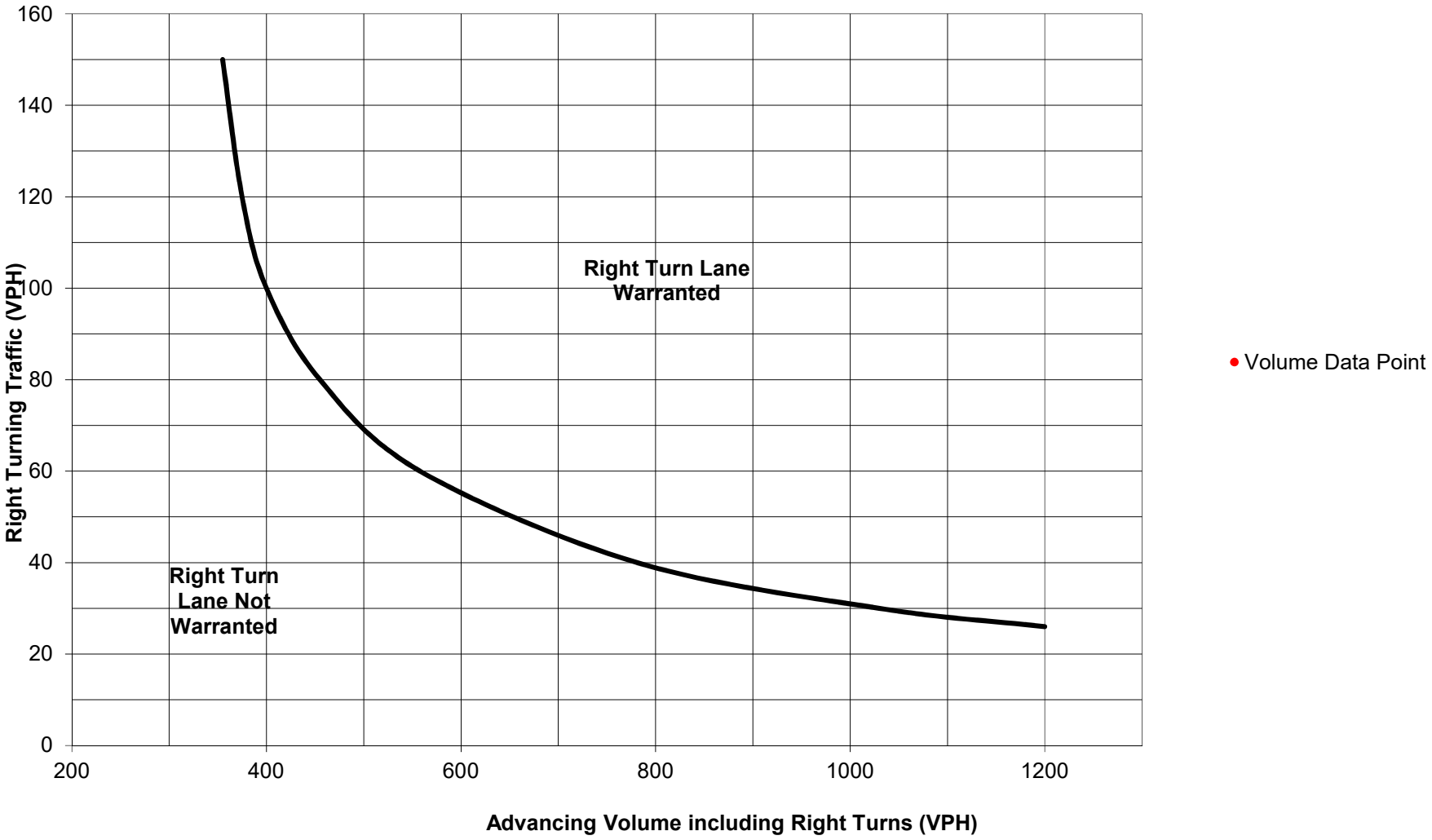
Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



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Intersection & Approach Description: Laurel Avenue and Site Driveway -Westbound Right Turn Lane

Analysis Period:	Forecasted 2029 Build	**Number of Approach Lanes:**	1
Design Hour:	P.M. Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes			N/A
	Through	-			N/A
	Right	No			N/A
Opposing	Left	No			N/A
	Through	-			N/A
	Right	Yes			N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	No	0	0.0%	N/A
	Through	-	164	0.0%	164
	Right	-	11	0.0%	11

Advancing Volume:	175
Right Turn Volume:	11

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	11
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	60

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

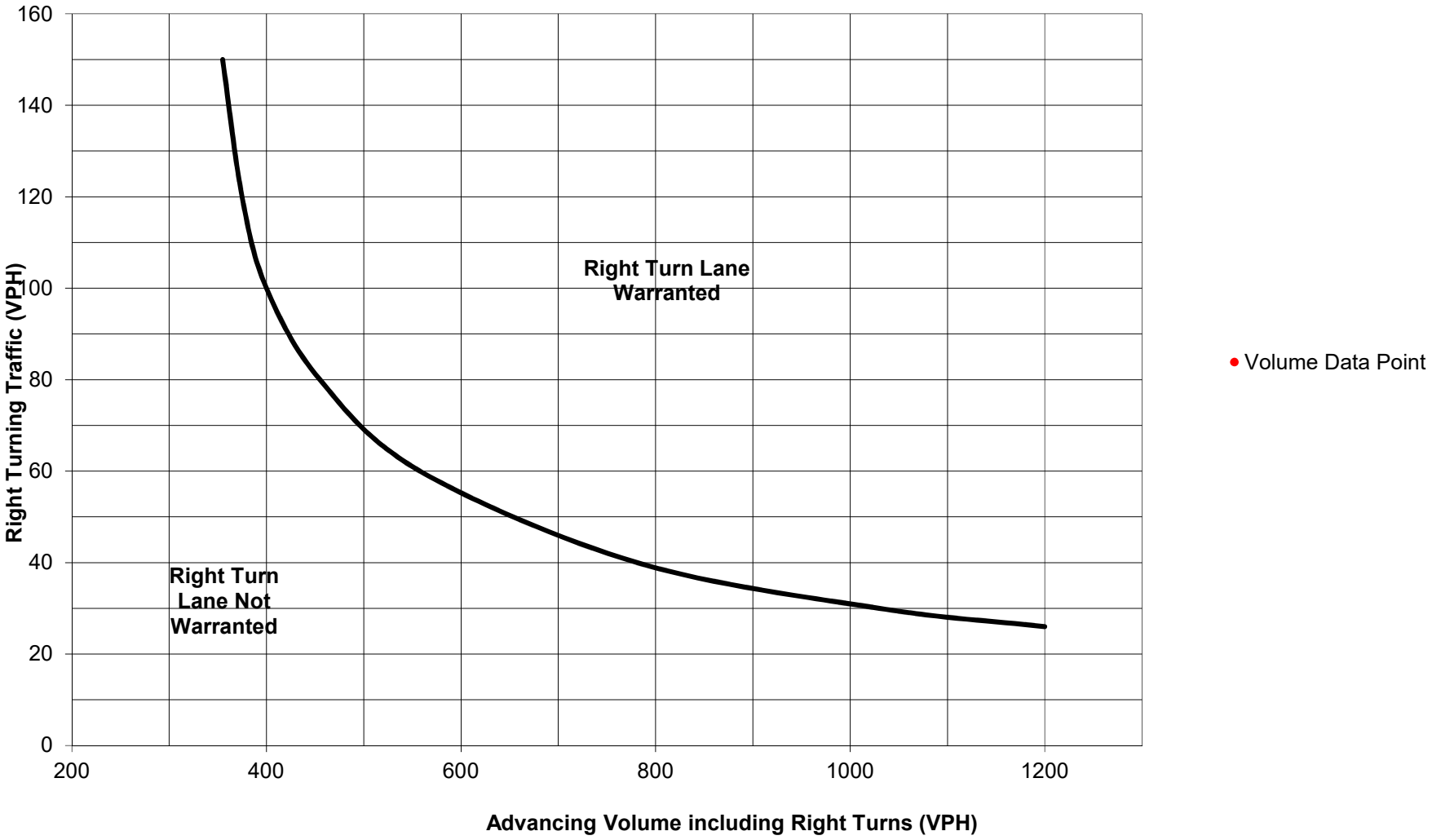
Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings: N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



APPENDIX L

SIGHT DISTANCE CALCULATIONS

M-950S
(03-04)
PENNDOT

DRIVEWAY SIGHT DISTANCE MEASUREMENTS
(FOR LOCAL ROADS, USE PENNDOT PUB 70)

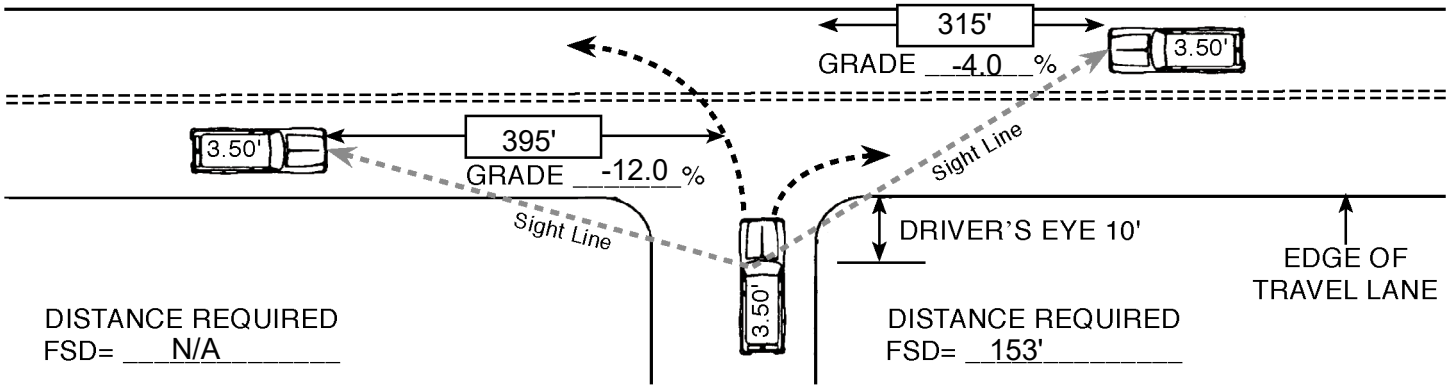
APPLICANT Grandview Senior Living Development APPLICATION NO. _____

T.R. Laurel Ave. SEG. _____ OFFSET _____ LEGAL SPEED LIMIT 25 MPH

MEASURED BY ANL DATE 12/15/2021

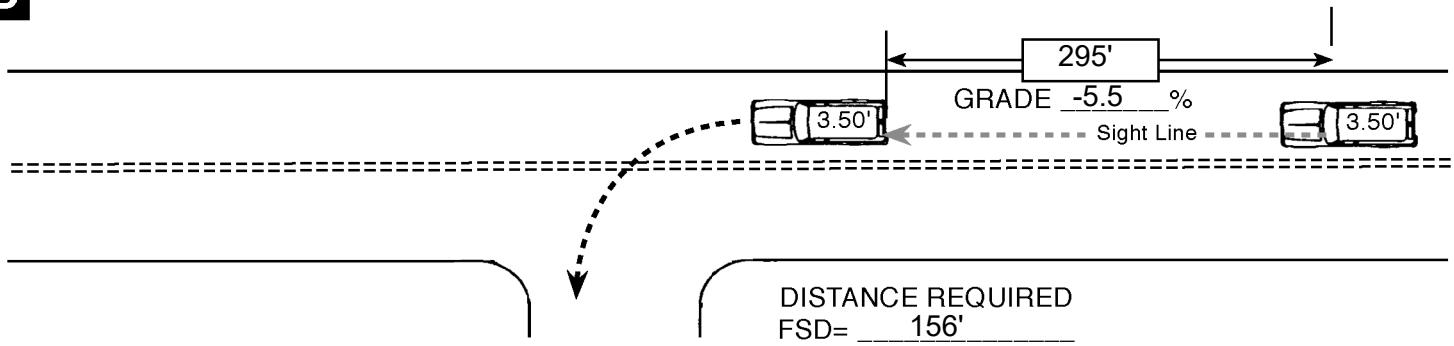
FOR DEPARTMENT USE ONLY: Safe-Running Speed _____ 85th Percentile Speed _____

A



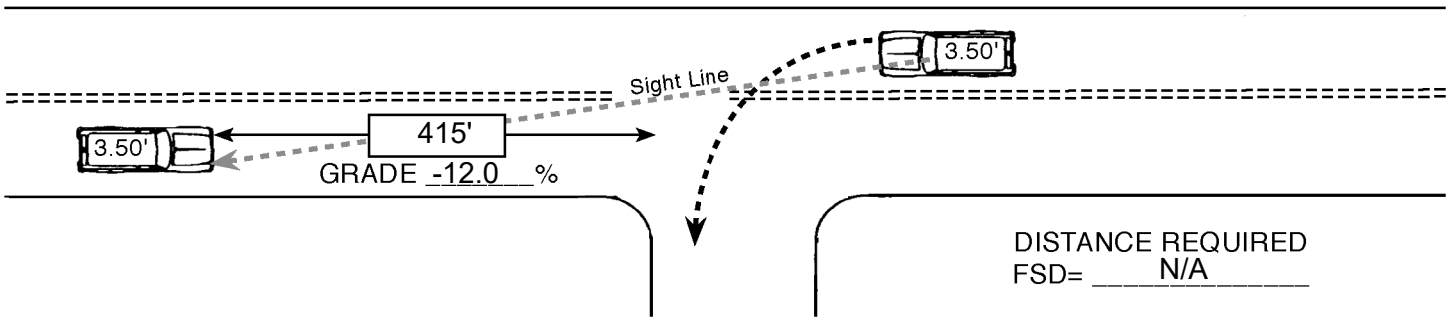
THE MAXIMUM LENGTH OF ROADWAY ALONG WHICH A DRIVER AT A DRIVEWAY LOCATION CAN CONTINUOUSLY SEE ANOTHER VEHICLE APPROACHING ON THE ROADWAY.

B



THE MAXIMUM LENGTH OF ROADWAY ALONG WHICH A DRIVER ON THE ROADWAY CAN CONTINUOUSLY SEE THE REAR OF A VEHICLE WHICH IS LOCATED IN THE DRIVER'S TRAVEL LANE AND WHICH IS POSITIONED TO MAKE A LEFT TURN INTO A DRIVEWAY.

C



THE MAXIMUM LENGTH OF ROADWAY ALONG WHICH A DRIVER OF A VEHICLE INTENDING TO MAKE A LEFT TURN INTO A DRIVEWAY CAN CONTINUOUSLY SEE A VEHICLE APPROACHING FROM THE OPPOSITE DIRECTION.

Minimum Stopping Sight Distance

Source: AASHTO, *A Policy on Geometric Design of Highways and Street* , 2011. 6th Edition

Location: **Laurel Ave. and Proposed Site Driveway**

305-634 N. Huntingdon Twp., Westmoreland Co., PA

Sight Line:	Looking Left from Driveway
SSD = 1.47VT + (V^2/(30 (a/32.2 +- g))	
T (sec.) =	2.5
V (mph) =	25
g =	-12
SSD (ft) =	183
Available Sight Distance (ft) =	395
Meets Min. Requirement ?	YES
Sight Line:	Looking right from driveway
SSD = 1.47VT + (V^2/(30 (a/32.2 +- g))	
T (sec.) =	2.5
V (mph) =	25
g =	-4
SSD (ft) =	160
Available Sight Distance (ft) =	315
Meets Min. Requirement ?	YES
Sight Line:	Vehicle approaching a left turning vehicle from rear
SSD = 1.47VT + (V^2/(30 (a/32.2 +- g))	
T (sec.) =	2.5
V (mph) =	25
g =	-5.5
SSD (ft) =	163
Available Sight Distance (ft) =	295
Meets Min. Requirement ?	YES
Sight Line:	Left turning vehicle looking at approaching vehicle
SSD = 1.47VT + (V^2/(30 (a/32.2 +- g))	
T (sec.) =	2.5
V (mph) =	25
g =	-12
SSD (ft) =	183
Available Sight Distance (ft) =	415
Meets Min. Requirement ?	YES

Available Sight Distance Looking Left from Driveway

Available Sight Distance Looking Right from Driveway