

# Urban Air Dublin

## Turning Lane Analysis

Prepared For:



Prepared By:



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August 23, 2017

Osborn Project No. J20170111.100

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## EXECUTIVE SUMMARY

This Analysis documents the need for turning lanes on S.R. 161 that may be created by the development of a present vacant parcel on the south side of State Route 161 (Dublin-Plain City Road) just west of Cosgray Road in the City of Dublin, Franklin County, Ohio. The development is expected to consist of two (2)-20,000 square foot buildings that will house indoor skydiving and trampoline park facilities. The buildings and on-site improvements will be constructed in two phases.

This Study evaluates the existing transportation conditions, the trip generation and distribution for the development, and opening and design year conditions.

Construction of the development is expected to begin in fall 2017. Phase 1 of the project is expected to be completed in 2018. The construction date for Phase 2 has not been established as yet, but is expected to begin once Phase 1 is complete and in operation.

The need for dedicated left and right turn lanes on S.R. 161 were analyzed for traffic during the opening year (2018) and the design year (2038) of the project. For all warrants, the project was assumed to be fully developed and occupied.

This Study found that the following improvements may be needed in the Study Area as part of the construction of the development:

- Upon the full occupancy of the development, a left turn lane on westbound S.R. 161 will be warranted.
- Coordination with the City of Dublin should be considered to coordinate their project that will construct a roundabout at the intersection of S.R. 161 and Cosgray Road and the westbound left turn lane warranted with this project.



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## 1.0 INTRODUCTION, AUTHORIZATION, AND SCOPE

### 1.1 INTRODUCTION

Osborn Engineering was hired by the m+a Architects to evaluate the transportation impacts of the construction of a new commercial development that will be constructed on parcels of land in the City of Dublin, Franklin County, Ohio. The proposed development is located on the south side of State Route 161 (Dublin-Plain City Road) west of Cosgray Road in the City of Dublin, Franklin County. This Study will evaluate the existing traffic conditions and the transportation impacts within the Study Area as a result of the new development. The purpose of this Study is to determine the impacts on the surrounding roadway network as a result of the project and identify mitigation measures that are needed to offset these impacts.

This Analysis follows the guidelines outlined in the Ohio Department of Transportation State Highway Access Management Manual (Version 8-15-03) and was prepared with input from the Ohio Department of Transportation (ODOT).

### 1.2 AUTHORIZATION

This Turning Lane Analysis is provided under the Osborn Engineering Professional Services Agreement (ASR No. 1) dated August 10, 2017, and approved by Andreas Larisch of m+a Architects on August 16, 2017.

### 1.3 SCOPE

As per the project Proposal, the following items of work were to be performed:

- Initial contact with City of Dublin and Ohio Department of Transportation (ODOT) officials to discuss the final scope and what ODOT expects for the final study.
- Analysis of the existing traffic conditions on State Route 161 and impact of the development traffic on and recommended improvements to the highway, following the requirements of the ODOT State Highway Management Manual.
- Preparation of report for submittal to the Client, ODOT, and the City of Dublin.



## 2.0 EXISTING AREA CONDITIONS

### 2.1 STUDY AREA AND PEAK PERIOD SCENARIOS

The approach for the Study was discussed with Mr. Andrew Hurst, Access Engineer for District 6 of the Ohio Department of Transportation, and summarized as follows:

**Study Area:** Since the projected trip ends for full build-out of the project was determined to be less than 100, the study was limited to an analysis of whether turn lane(s) would be required on State Route 161 at the intersection of the project access driveway. The Vicinity Map for the Urban Air project is shown in Figure 1.

The existing land use immediately at and to the west of the site is generally rural in nature. The area to the east of the site is commercially and institutionally developed, with a Costco and the Dublin Campus of the Ohio University Heritage College of Osteopathic Medicine located nearby.

**Study Peak Period Scenarios:** Operating conditions during the PM Peak Period were evaluated so that the times that the highest volumes on the local transportation network and greatest potential impacts for the proposed development were analyzed.

### 2.2 PEDESTRIAN, BICYCLE, AND TRANSIT SYSTEMS

There are currently no sidewalks located within the Study Area. There is an eight foot (8') wide asphalt shared-use path on the south side of S.R. 161 that ends at the west property line of the project site. The path currently begins at Houchard Road, approximately 1600 feet west of the west property line. As part of the Urban Air project, this path is expected to be extended across the frontage of the site.

There is no public transit available within the Study Area. The closest COTA bus stop is located about 4 miles east of the project site.

### 2.3 STUDY AREA ROADWAYS

State Route 161 (Dublin-Plain City Road) is an uncurbed two-lane asphalt road that runs in an east-west direction, and is striped with two (2) 11 foot wide travel lanes. There is a 3 foot ( $\pm$ ) wide paved shoulder on each side of the pavement.

The posted speed limit of S.R. 161 within the Study Area is 45 MPH. The design speed of the facility is also 45 MPH, and the functional classification is Urban Principal Arterial. It is considered a Category IV Low Emphasis Access Management Roadway.



At the time of this study, the City of Dublin was in the design stages for the installation of a new roundabout at the intersection of S.R. 161 and Cosgray Road to the east of the project area (Project 16-020-CIP). Using the stationing found on the roundabout project, the new access driveway will intersect S.R. 161 at approximately Station 9+75. According to the drawings received from the City, the widening and pavement replacement of S.R. 161 will begin at Station 11+54.

## 2.4 EXISTING TRAFFIC VOLUMES

The existing traffic count for S.R. 161 at the project site was developed as follows:

**Historical Traffic Count:** In order to provide the existing traffic on S.R. 161 at the project site, the Mid-Ohio Regional Planning Commission (MORPC) Traffic Count Database System was reviewed. This System consist of an accumulation of traffic count data input by agencies within the MORPC.

The review found that a traffic count with turning movements was performed at the intersection of S.R. 161 and Cosgray Road on Friday, April 4, 2014 from 6:00 AM to 7:00 PM in fifteen minute intervals. This count found that the PM Peak Hour for the intersection occurred between 4:45 PM and 5:45 PM. During the PM Peak Hour, traffic on the west approach of SR 161 was as follows:

- 239 eastbound vehicles entered the intersection.
- 555 westbound vehicles exited the intersection.

The Peak Hour Diagrams for this intersection are included in Appendix A.

The ODOT Transportation Data Management System was also reviewed to determine if it contained any more recent data. The closest count in the TDMS data was performed in 2015 at the roundabout at S.R. 161 and Industrial Parkway, located approximately ½ mile east of the project site. However, the count was performed in the roundabout itself, so a determination of what approach traffic was using could not be determined. Therefore, this count could not be used.

**Historical Traffic Growth:** According to the MORPC data, from 2003 to 2013, the AADT on S.R. 161 grew at a compound rate of 1% per year.





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**Opening Day (2018) Traffic:** Using the historic 1% compound annual growth rate and projecting it to the expected Opening Year of 2018, the existing traffic on S.R. 161 during the P.M. Peak Hour is adjusted from the 2014 count as follows:

- Eastbound vehicles =  $239 \times 1.01^4 = 249$  Eastbound vehicles.
- Westbound vehicles =  $555 \times 1.01^4 = 578$  Westbound vehicles.







### 3.0 PROPOSED DEVELOPMENT

#### 3.1 PROPOSED PROJECT

The proposed project is located on the south side of State Route 161 at 7679 Dublin-Plain City Road (Franklin County Auditor Parcel Identification Number 274-001453-00) in the City of Dublin, Ohio. The total project site consists of 4.9 acres and is currently vacant.

The proposed project will consist of the construction of two (2) 20,000 square foot pre-engineered buildings, along with an adjacent parking lot with 160 parking spaces. It is anticipated that the project will be constructed in two phases, with the first phase consisting of construction of the east building and 87 parking spaces, and the second phase consisting of the construction of the west building and the remaining parking spaces. The PRELIMINARY proposed site plan is shown on Figure 2.

Access to the site would be provided by a single driveway off of the south side of State Route 161. The driveway is expected to be located at the approximate center of the parcel, approximately 360 feet east of Fulk Road, and 975 feet west of Cosgray Road. The access driveway is expected to have one lane entering the project site and two lanes (a left turn lane and a right turn lane) leaving the site.

#### 3.2 SIGHT DISTANCE ANALYSIS

The location of the access driveway being installed with the development of this Project was evaluated to determine if there were any sight distance issues for vehicles turning out of the driveway and onto S.R. 161. For this evaluation, a design speed of 45 MPH was used for vehicles on S.R. 161 to determine if the sight distance for the driveway was sufficient.

The available sight distance was measured from the perspective of a vehicle stopping at the end of the access driveway, and then completing the turn onto S.R. 161. According to the Ohio Department of Transportation's Location and Design Manual, Volume One, Figure 201-5E (Intersection Sight Distance), the minimum sight distance required for the street in either direction is as follows:

**SITE ACCESS SIGHT DISTANCES**

|                                | <b>Left Turn<br/>(ISD to the east)</b> | <b>Right Turn<br/>(ISD to the west)</b> |
|--------------------------------|--|---|
| <b>Required sight distance</b> | 500 feet                               | 430 feet                                |





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The existing roadway profile on S.R. 161 was generated and the available sight distance was found using this profile. S.R. 161 in both directions from the access driveway is relatively flat; therefore, the available sight distance in both directions easily exceeds the criteria for a 45 MPH Design Speed.

To ensure that the required sight distances will be met, parking, significant landscaping, and large signs should be restricted adjacent to the street.



## 4.0 PROJECTED TRAFFIC

### 4.1 SITE TRAFFIC

**Trip Generation:** Calculating the future trips requires an estimate of the amount of traffic generated by the proposed development. The industry standard to determine the amount of traffic that a proposed development will generate is to use the rates published in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 9<sup>th</sup> Edition. This publication provides trip generation rates for numerous land use and building types by estimating the number of trips entering and exiting a site at a given time based on measureable items.

The ITE Manual does have a specific land use for trampoline parks or indoor skydiving facilities, nor were any of the land uses that are in the Manual considered to be similar. The ITE *Trip Generation Handbook*, 2<sup>nd</sup> Edition, states that “if a description of a site is **not covered by the land use classifications** presented in *Trip Generation*, the analyst should collect data and establish a local rate.” Since the project land use is not in the ITE Manual, Urban Air was contacted to provide a Trip Impact Analysis to evaluate the trips generated by their facilities. The study by Urban Air that provided the expected traffic generation, and the method that was used to produce this data, is included in Appendix B and summarized as follows:

- The average facility size that the Urban Air Analysis is based on is 42,000 square feet. The proposed development will consist of two (2) buildings at 20,000 square feet each.
- 74 trip ends (32 entering and 42 exiting) will occur during the weekday PM Peak hour.
- 96 trip ends (48 entering and 48 leaving) will occur during the weekend midday Peak hour.

This Analysis was submitted to Mr. Andrew Hurst at Ohio Department District 6 for review. His determination was that the trip ends that were concluded by the Urban Air Analysis were acceptable and could be used in this Study.

The Analysis found that the number of Weekend Peak Hour trip ends exceeded the number of weekday PM Peak Hour trip ends. Also, the Access Manual states that for developments that generate their peak hours predominantly on weekends, a weekend analysis may be required. This was discussed with Mr. Hurst, who confirmed that if the analysis of the PM Peak hour volumes warranted a westbound left turn lane, then a weekend analysis would not be needed.

Due to the location of the project, it is anticipated that all customers and employees will travel to and from the site using private vehicles. Users arriving by bus, bicycle, or walking are not anticipated.



**Pass-by Trips:** Pass-by trips are defined as vehicles that are included in the amount of traffic being generated by the site that would already be traveling on the adjacent highway without the development of the project. For example, a vehicle on S.R. 161 that is currently driving in front of the vacant parcel, but that will enter and exit the development upon completion, is a “pass-by.” Since these vehicles are being double counted (once as an existing condition vehicle, and once as a generated vehicle), pass-by trips are generally accounted for in determining the traffic volumes. The number of pass-by trips varies based on several factors, including type and size of development and the nature of the roadway network.

For this Project, it is likely that the number of vehicles currently on the adjacent roadway network that will access the new development when it is completed are minimal. Therefore, although some amount of pass-by traffic may occur, in order to provide a conservative estimate, this Study will assume that the project will consist of 0% Pass-by trips.

**Trip Distribution:** Trip distribution provides an estimate of where the additional trips are coming from and going to. For this project, the trip distribution for the additional traffic was estimated based on the direction of where residents living in the development are going to and coming from during the Weekday Peak Hour period.

It is expected that the majority of people that will be using this facility will be coming from the larger urban areas of Columbus and Dublin to the east. US Route 33 and Interstate 270, both of which are major highways that serve the urban and suburban areas of Franklin County, are also located to the east of this project. The area to the west of the project is basically rural in nature, with the nearest municipality being the Village of Plain City, which is located about 4 miles west of the project site. Using this rationale, it was estimated that 80% of the traffic generated by the development would be from the east, and the remaining 20% would be from the west.

The traffic entering and exiting the development from both directions during the PM Weekday Peak Hour is summarized as follows:

**PM PEAK HOUR TRIP ENDS DISTRIBUTION**

| Direction   | Percent | PM Trips |      |
|---|---------|----------|------|
|   |         | Enter    | Exit |
| West State Route 161<br>(towards Plain City)      | 20%     | 6        | 8    |
| East State Route 161<br>(towards Columbus/Dublin) | 80%     | 26       | 34   |
| TOTALS  |         | 32       | 42   |





## 4.2 FUTURE TRAFFIC GROWTH

In order to determine the design year traffic on S.R. 161 at the project site, an annual traffic growth rate for the following 20 years is required. The Title Sheet of the S.R. 161/Cosgray Roundabout project contains average daily traffic on S.R. 161 for both the current year (2017), as well as the design year for that project in 2037. Using these figures, the future compound annual traffic growth rate for S.R. 161 was determined to be **1.9 percent per year**. Therefore, for the purposes of this report, the future traffic volume for S.R 161 will use this rate.

Using this growth rate and projecting it to the project Design Year of 2038, the future traffic volumes on S.R. 161 during the P.M. Peak Hour, without the facility being constructed, is as follows:

- Eastbound vehicles = 249 (Opening Year)  $\times 1.019^{20}$  = 363 Eastbound vehicles (Design Year).
- Westbound vehicles = 578 (Opening Year)  $\times 1.019^{20}$  = 842 Westbound vehicles (Design Year).

The traffic on S.R. 161 for both the Opening Year and Design Year, as well as the traffic expected to be generated at full build-out of this project, as shown in Figure 3.

## 4.3 ACCESS DRIVEWAY STANDARDS

According to the State Highway Access Manual, the access driveway is classified as a Low Volume Driveway (more than 5 but less than 100 trip ends in the peak hour). On an Access Category IV roadway, Section 4.4.4 of the Access Manual permits one direct private access with full traffic movements per parcel under common ownership. For a 45 mph posted speed limit, the minimum distance from the driveway to the next driveway or intersection is 360 feet.



## 5.0 AUXILIARY TURN LANE ANALYSIS

### 5.1 INTRODUCTION

The State Highway Access Management Manual states that the need for auxiliary turn lanes will be determined for the proposed development at full 20-year build out and occupancy, using the Auxiliary Lane Graphs contained in the Access Manual. The following paragraphs summarize the methods used to determine the need for these auxiliary turn lanes on S.R. 161.

### 5.2 WESTBOUND S.R. 161 LEFT TURN LANE

**Left Turn Lane Warrant:** Section 401.6.1 of the ODOT Location and Design Manual states that left turn lanes may be needed if they meet the warrants provided in the Manual. Figure 401-5bE of the Manual is used to warrant left turn lanes on high speed (>40 mph posted speed) facilities, based on total traffic in both directions and the percentage of left turns during the Peak Hour. The need for a left turn lane in the westbound direction of S.R. 161 at the new access driveway was checked during the PM Peak Hour using the Opening Year (2018) in the build condition. The results of this warrant found that once both phases of the development is complete, a dedicated left turn lane in the westbound direction of S.R. 161 **will be warranted**. The Warrant Analysis for the westbound S.R. 161 left turn lane is shown in Figure 4.

**Left Turn Lane Storage and Pavement Taper Lengths:** The required storage length for the westbound left turn lane was determined using the Location and Design Manual. According to Figure 401-9E, for a 45 MPH Design Speed, an unsignalized through road with a low left turn demand volume (<10% or less of approach volume traffic), the required length of the left turn lane is 175 feet, including the 50 foot diverging taper.

Using a 12-foot wide left turn lane and the 45 MPH Design Speed, the approach and departure tapers for the left turn lane is 205 feet if S.R. 161 is widened symmetrically, or 405 feet if S.R. 161 is widened only on one side.

**Other Considerations:** The City of Dublin project is widening S.R.161 to two westbound lanes as it leaves the roundabout at Cosgray Road. The two westbound lane section ends at Station 15+90, at which point the pavement tapers from two lanes to one lane in 436 feet, ending at Station 11+54. During design of the left turn lane, the City of Dublin could be contacted to discuss the possibility including the design and construction of the project left turn lane, at the cost of the project developer, with the roundabout project.





### 5.3 EASTBOUND S.R. 161 RIGHT TURN LANE

Section 401.6.3 of the ODOT Location and Design Manual states that right turn lanes may be needed if they meet the warrants provided in the Manual. Figure 401-6bE of the Manual is used to warrant right turn lanes on high speed (>40 mph posted speed) facilities, based on the total advancing traffic volume and the volume of traffic turning right during the Peak Hour. The need for a right turn lane in the eastbound direction of S.R. 161 at the new access driveway was checked during the PM Peak Hour using both the Opening Year (2018) and Design Year (2038) volumes in the Build Condition. The results of these warrants found that once the development is complete, a dedicated right turn lane in the eastbound direction of S.R. 161 **will not be warranted**. The Warrant Analysis for the right turn lane is shown in Figure 5.





## 6.0 RECOMMENDATIONS AND CONCLUSIONS

Recommendations and conclusions of this Analysis are summarized as follows;

- Upon the full occupancy of the development, a left turn lane in the westbound direction of S.R. 161 will be warranted.
- A right turn lane in the eastbound direction of S.R. 161 will not be warranted in either the Opening Year (2018) or the Design Year (2036).
- Coordination with the City of Dublin should be considered to coordinate their project that will construct a roundabout at the intersection of S.R. 161 and Cosgray Road and the westbound left turn lane warranted with this project.



# Figures



DUBLIN URBAN AIR  
S.R. 161 TURN LANE ANALYSIS

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VICINITY MAP  
Figure 1



# DUBLIN URBAN AIR

LOCATION | 7679 DUBLIN PLAIN CITY RD., DUBLIN, OH 43016

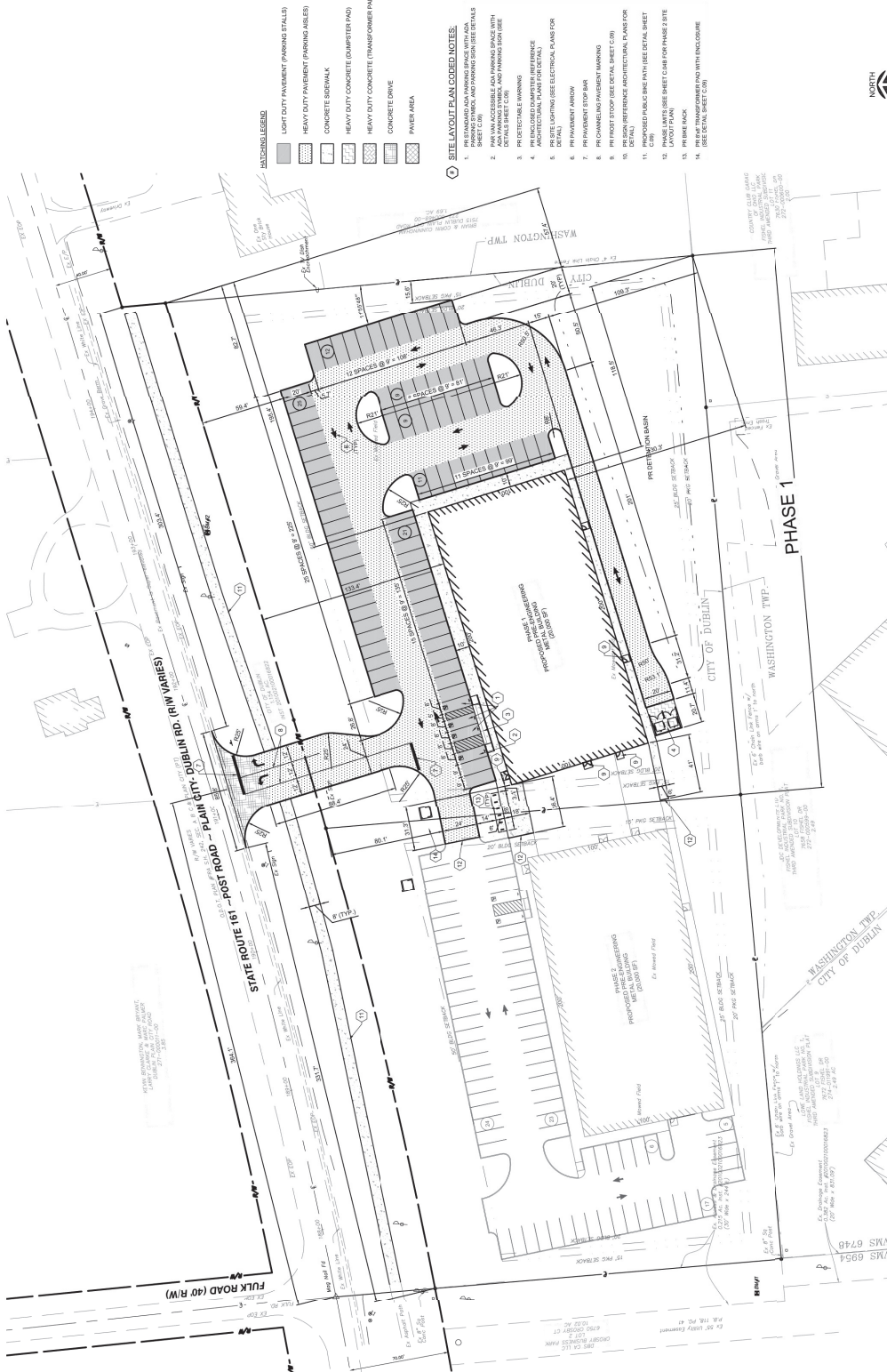
ma architects

PROJECT USE: XXXXX  
SQUARE FT: 25000 SF  
DATE: 03.16.17  
SHEET NUMBER: C.04A



GRAPHIC SCALE  
0 15 30  
(IN FEET)  
1 inch = 30 ft

## PHASE 1 SITE LAYOUT PLAN



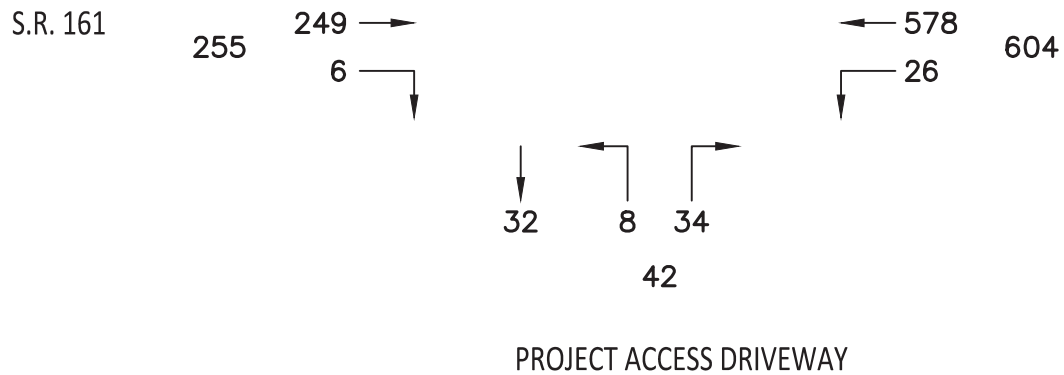
SITE STATISTICS  
CURRENT ZONING: D-2 RESEARCH FLEX DISTRICT  
TOTAL SITE AREA: 4.88 AC  
PARKING SPACES: 132 TOTAL INCLUDING 4 STANDARD ADA SPACES AND 2 VAN ACCESSIBLE ADA SPACES



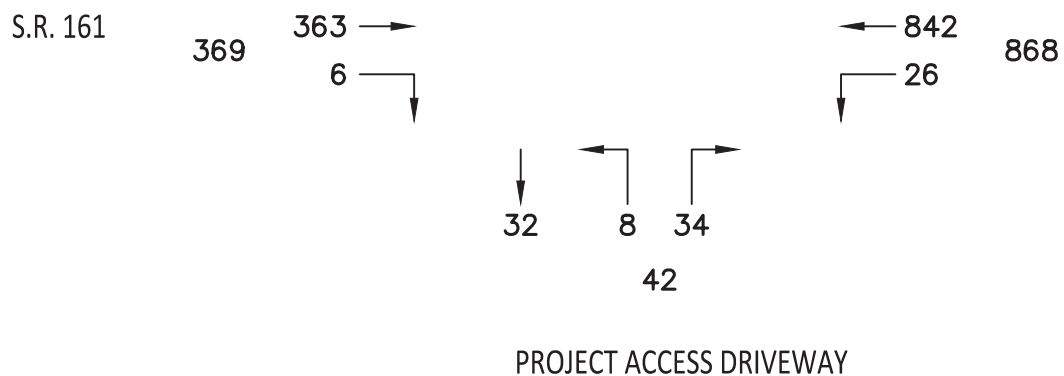
## DUBLIN URBAN AIR S.R. 161 TURN LANE ANALYSIS

## PRELIMINARY PROPOSED SITE PLAN Figure 2

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### OPENING YEAR (2018) BUILD CONDITION



### DESIGN YEAR (2038) BUILD CONDITION

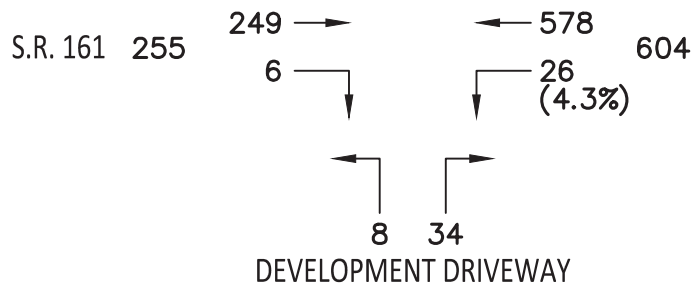


DUBLIN URBAN AIR  
S.R. 161 TURN LANE ANALYSIS

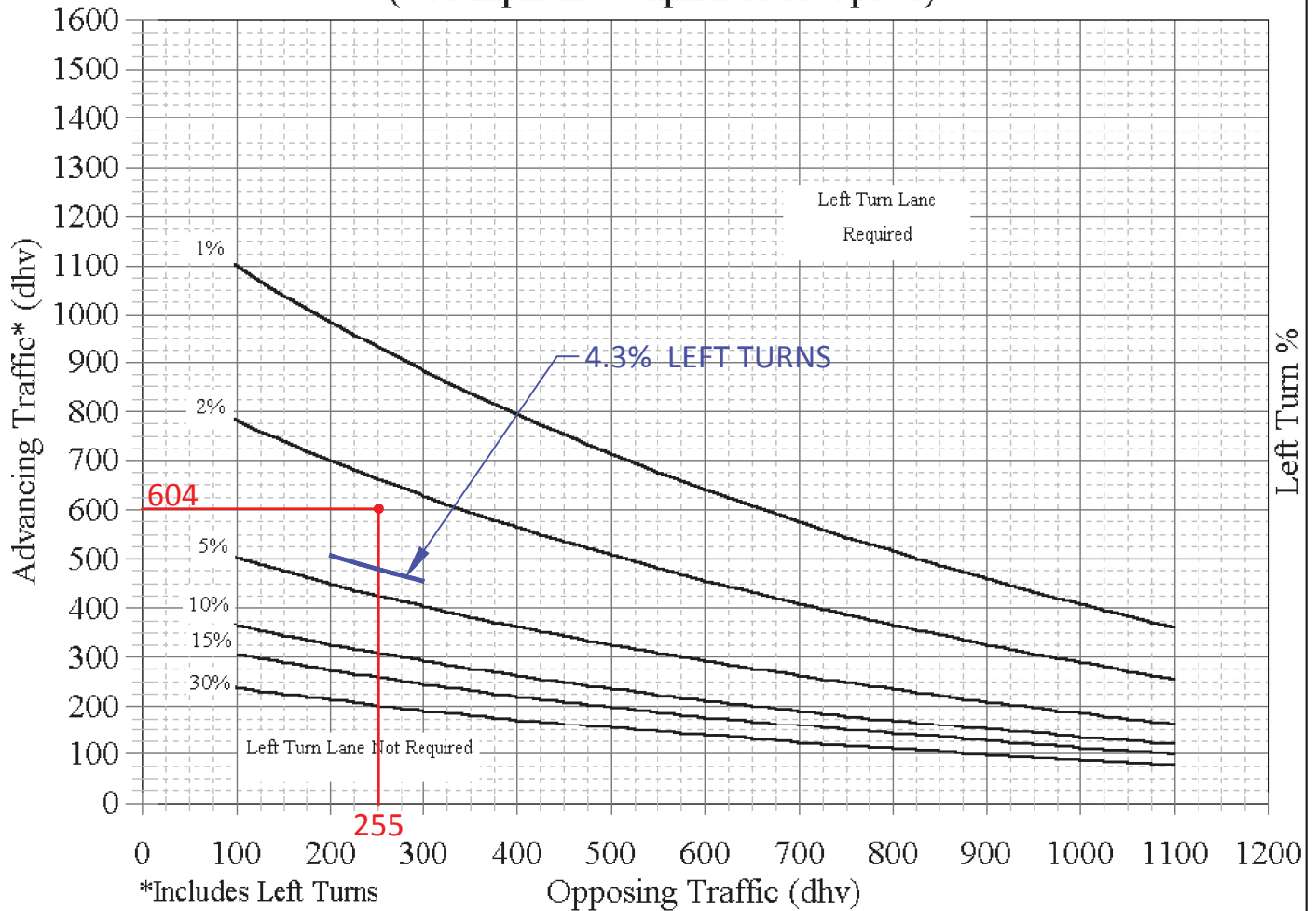
OPENING YEAR (2018)  
& DESIGN YEAR (2038)  
PEAK HOUR VOLUMES  
BUILD CONDITION

Figure 3

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## 2-Lane Highway Left Turn Lane Warrant (>40 mph or 70 kph Posted Speed)



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State Highway Access Management Manual

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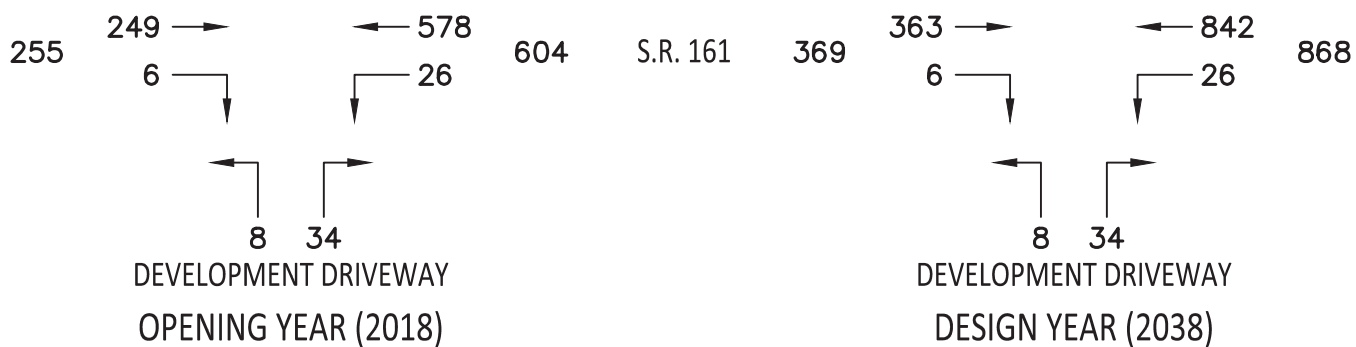


DUBLIN URBAN AIR  
S.R. 161 TURN LANE ANALYSIS



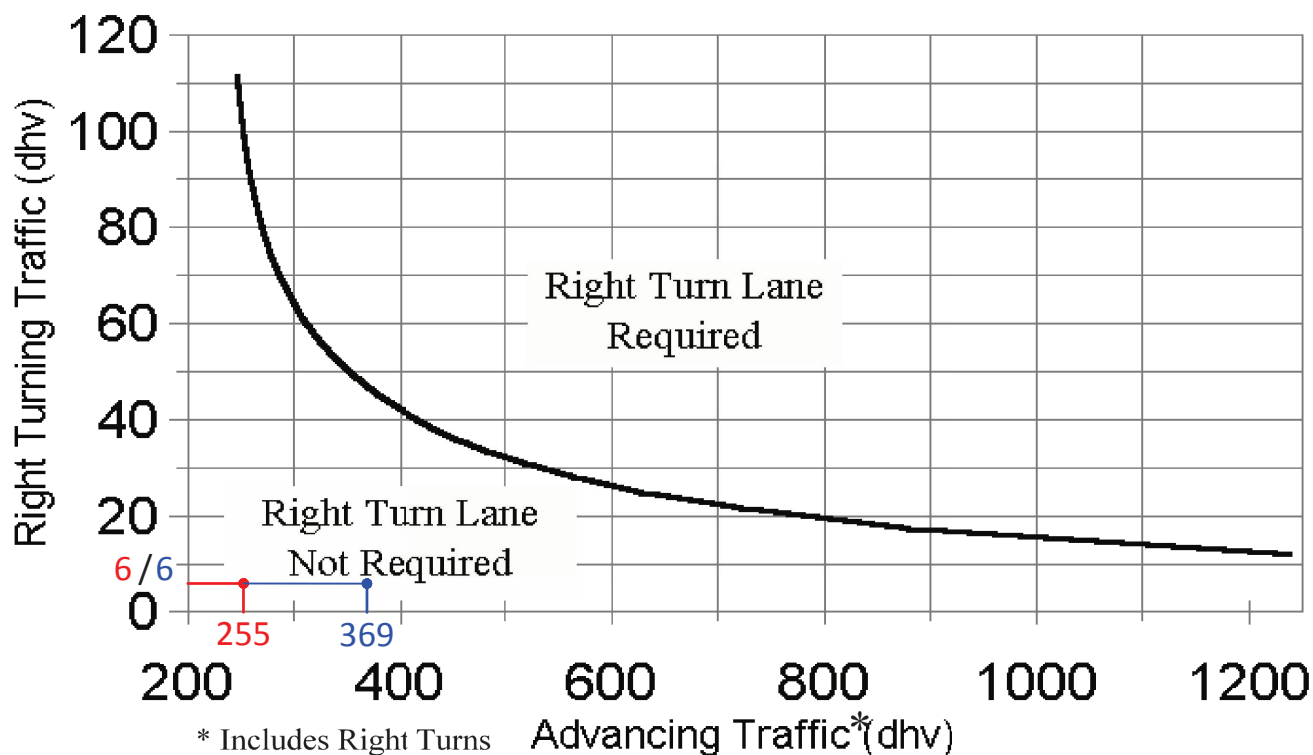
OPENING YEAR (2018)  
LEFT TURN LANE  
WARRANT ANALYSIS  
Figure 4

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## 2-Lane Highway Right Turn Lane Warrant

> 40 mph or 70 kph Posted Speed



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— OPENING YEAR (2018) VOLUMES  
— DESIGN YEAR (2038) VOLUMES



DUBLIN URBAN AIR  
S.R. 161 TURN LANE ANALYSIS

OPENING YEAR (2018)  
& DESIGN YEAR (2038)  
RIGHT TURN LANE  
WARRANT ANALYSIS

Figure 5

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# **Appendix A**



# Peak Hour Data for Intersection

Int ID: 4012  
 Community: -  
 Road 1: COSGRAY RD  
 Road 2: SR 161

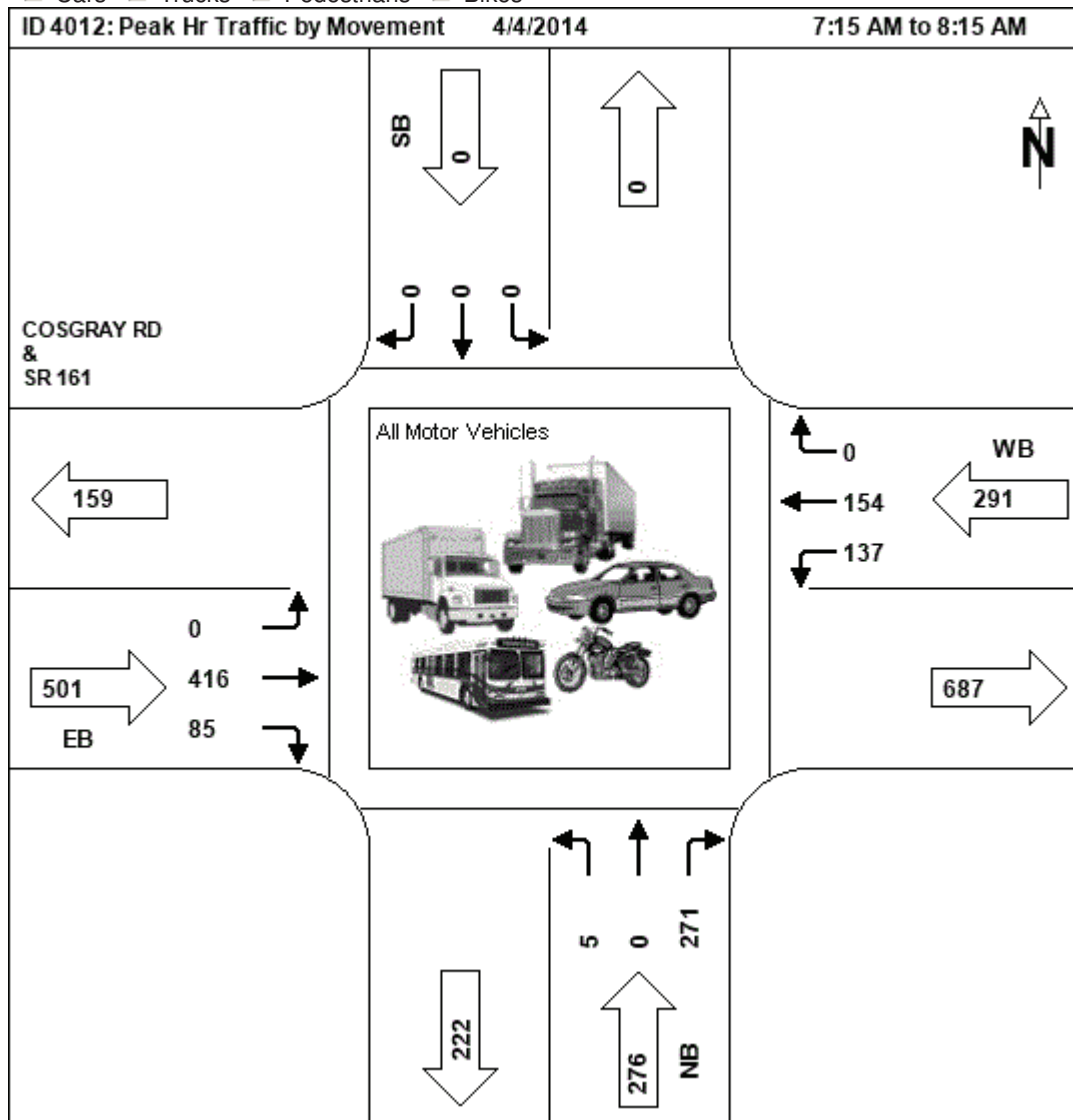
Corridor: NA  
 Road 3:  
 Road 4:

|<<|<|>|>>| 1-2 of 2

## AM Peak Hour 04/04/2014

| NB         |      |      |       |     | EB        |      |      |       |     | WB        |      |      |       |     | Int       |       |
|------------|------|------|-------|-----|-----------|------|------|-------|-----|-----------|------|------|-------|-----|-----------|-------|
| Start Time | Left | Thru | Right | Ped | App Total | Left | Thru | Right | Ped | App Total | Left | Thru | Right | Ped | App Total | Total |
| 7:15 AM    | 1    | 0    | 62    | 0   | 63        | 0    | 117  | 24    | 1   | 141       | 40   | 33   | 0     | 0   | 73        | 277   |
| 7:30 AM    | 2    | 0    | 53    | 0   | 55        | 0    | 107  | 26    | 0   | 133       | 32   | 29   | 0     | 0   | 61        | 249   |
| 7:45 AM    | 2    | 0    | 92    | 1   | 94        | 0    | 92   | 17    | 0   | 109       | 36   | 50   | 0     | 0   | 86        | 289   |
| 8:00 AM    | 0    | 0    | 64    | 1   | 64        | 0    | 100  | 18    | 0   | 118       | 29   | 42   | 0     | 0   | 71        | 253   |
| Total      | 5    | 0    | 271   | 2   | 276       | 0    | 416  | 85    | 1   | 501       | 137  | 154  | 0     | 0   | 291       | 1068  |
| PHF        | 0.63 |      | 0.74  |     | 0.73      |      | 0.89 | 0.82  |     | 0.89      | 0.86 | 0.77 |       |     | 0.85      |       |
| HV %       | 0    |      | 0     |     |           | 0    | 0    |       |     |           | 0    | 0    |       |     |           |       |

☒ Cars ☒ Trucks ☐ Pedestrians ☐ Bikes



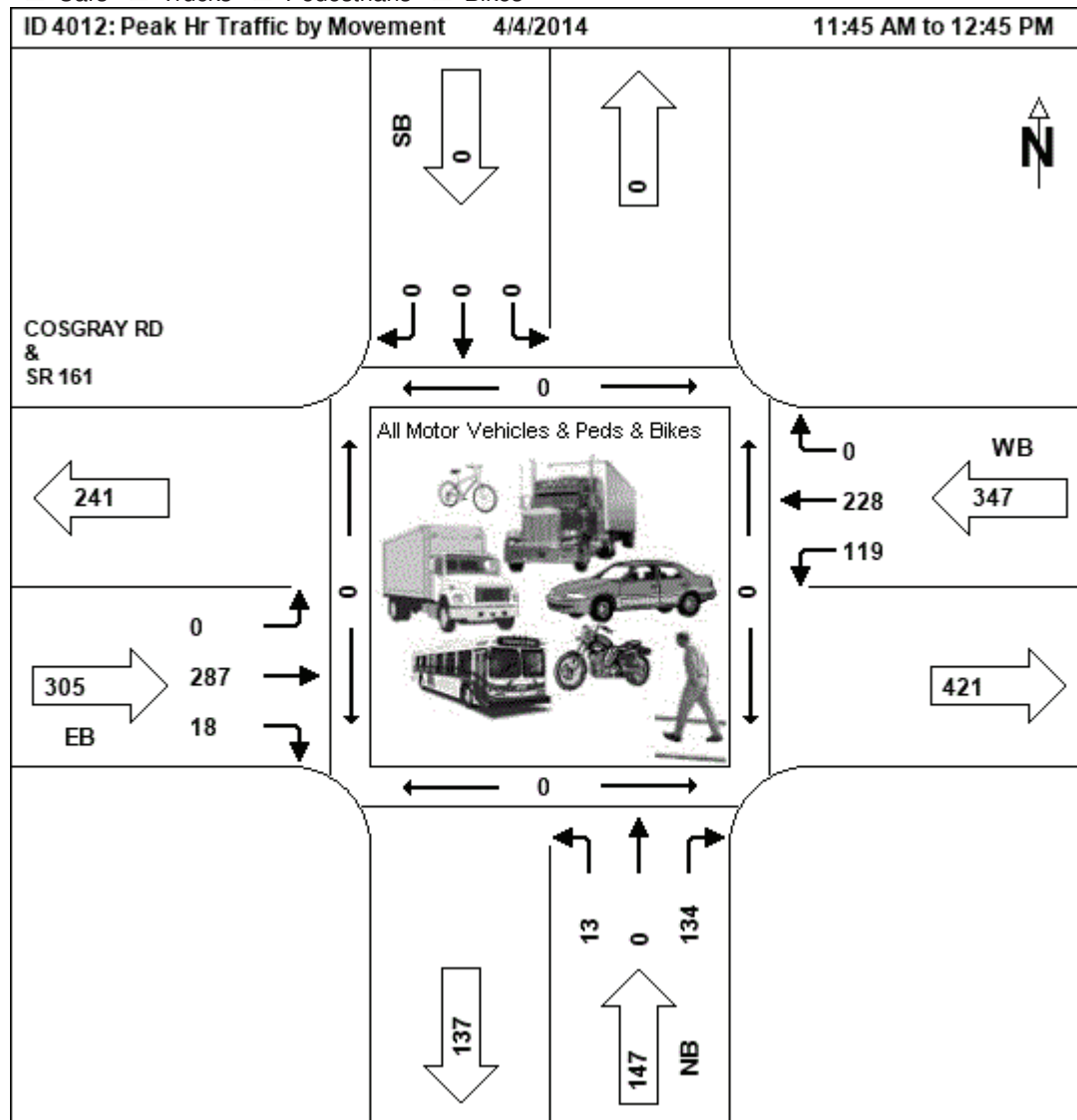


# Midday Peak Hour

04/04/2014

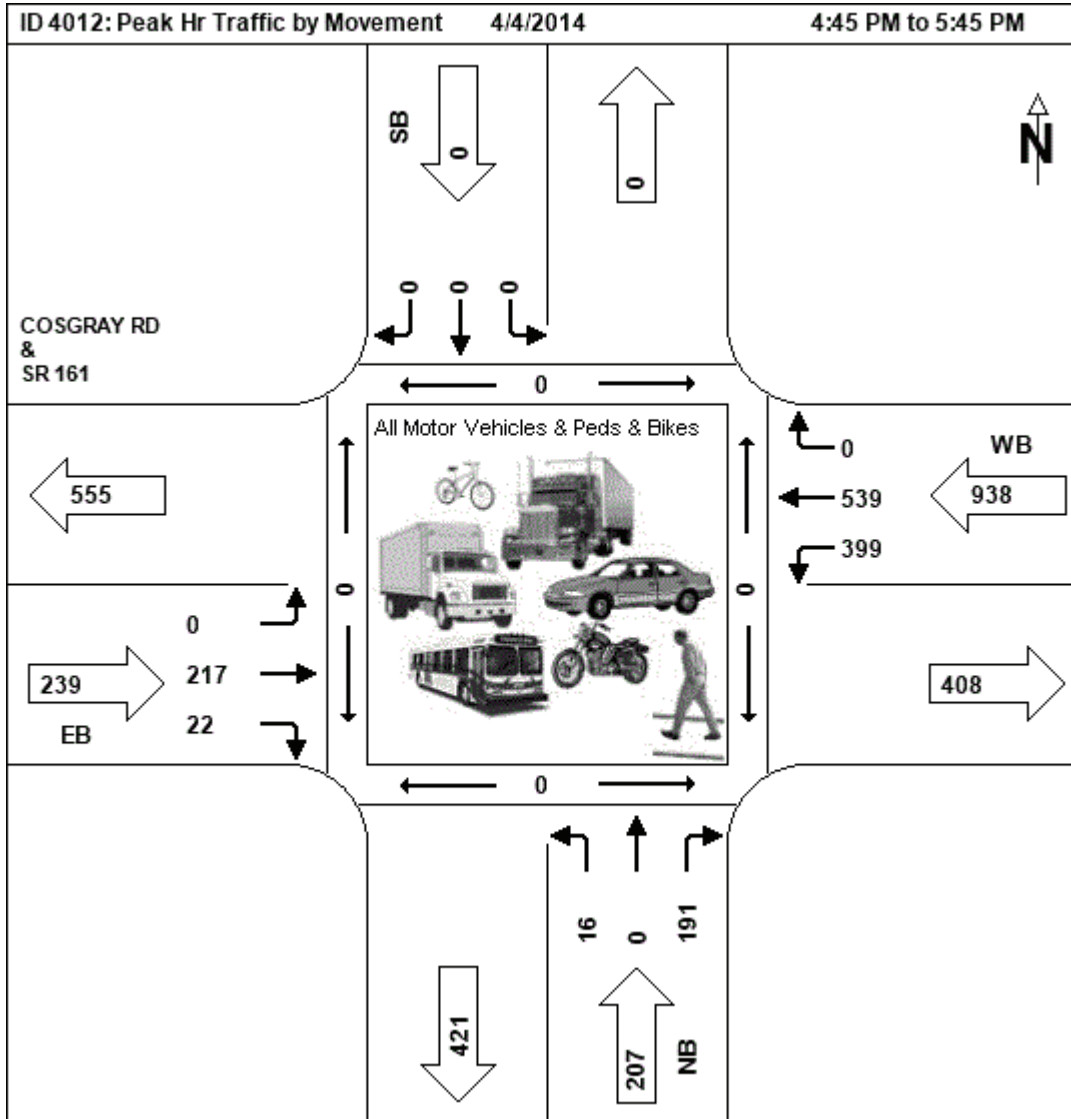
| NB       |      |      |       |     | EB    |      |      |       |     | WB    |      |      |       |     |       |       |
|----------|------|------|-------|-----|-------|------|------|-------|-----|-------|------|------|-------|-----|-------|-------|
| Start    | App  |      |       |     | Start | App  |      |       |     | Start | App  |      |       |     | Int   |       |
| Time     | Left | Thru | Right | Ped | Total | Left | Thru | Right | Ped | Total | Left | Thru | Right | Ped | Total | Total |
| 11:45 AM | 2    | 0    | 44    | 0   | 46    | 0    | 62   | 3     | 0   | 65    | 33   | 54   | 0     | 0   | 87    | 198   |
| 12:00 PM | 4    | 0    | 34    | 0   | 38    | 0    | 71   | 5     | 0   | 76    | 34   | 49   | 0     | 0   | 83    | 197   |
| 12:15 PM | 5    | 0    | 30    | 0   | 35    | 0    | 67   | 4     | 0   | 71    | 26   | 66   | 0     | 0   | 92    | 198   |
| 12:30 PM | 2    | 0    | 26    | 0   | 28    | 0    | 87   | 6     | 0   | 93    | 26   | 59   | 0     | 0   | 85    | 206   |
| Total    | 13   | 0    | 134   | 0   | 147   | 0    | 287  | 18    | 0   | 305   | 119  | 228  | 0     | 0   | 347   | 799   |
| PHF      | 0.65 |      | 0.76  |     | 0.80  | 0.82 | 0.75 |       |     | 0.82  | 0.88 | 0.86 |       |     | 0.94  |       |
| HV%      | 0    |      | 0     |     |       | 0    | 0    |       |     | 0     | 0    |      |       |     |       |       |

☒ Cars ☒ Trucks ☒ Pedestrians ☒ Bikes



**PM Peak Hour**  
**04/04/2014**

| NB                                       |      |      |       |     | EB   |      |      |       |     | WB  |      |      |       |     |
|--|------|------|-------|-----|--|------|------|-------|-----|---|------|------|-------|-----|
| Start                                    | App  |      |       |     | Start                                      | App  |      |       |     | Start   | App  |      |       |     |
| Time                                     | Left | Thru | Right | Ped | Time                                       | Left | Thru | Right | Ped | Time  | Left | Thru | Right | Ped |
| 4:45 PM                                  | 3    | 0    | 40    | 0   | 4:45 PM                                    | 0    | 52   | 3     | 0   | 4:45 PM   | 82   | 143  | 0     | 0   |
| 5:00 PM                                  | 5    | 0    | 57    | 0   | 5:00 PM                                    | 0    | 46   | 7     | 0   | 5:00 PM   | 118  | 119  | 0     | 0   |
| 5:15 PM                                  | 1    | 0    | 44    | 0   | 5:15 PM                                    | 0    | 58   | 6     | 0   | 5:15 PM   | 113  | 149  | 0     | 0   |
| 5:30 PM                                  | 7    | 0    | 50    | 0   | 5:30 PM                                    | 0    | 61   | 6     | 0   | 5:30 PM   | 86   | 128  | 0     | 0   |
| Total                                    | 16   | 0    | 191   | 0   | Total                                      | 0    | 217  | 22    | 0   | Total   | 399  | 539  | 0     | 0   |
| PHF                                      | 0.57 | 0.84 | 0.83  |     | PHF  | 0.89 | 0.79 |       |     | PHF   | 0.89 | 0.85 | 0.90  |     |
| HV%                                      | 0    | 0    |       |     | HV%  | 0    | 0    |       |     | HV%   | 0    | 0    |       |     |
| <input checked="" type="checkbox"/> Cars |      |      |       |     | <input checked="" type="checkbox"/> Trucks |      |      |       |     | <input checked="" type="checkbox"/> Pedestrians |      |      |       |     |
|  |      |      |       |     | <input checked="" type="checkbox"/> Bikes  |      |      |       |     |   |      |      |       |     |



# **Appendix B**



## Traffic Impact Analysis

**Urban Air** has conducted this Traffic Impact Study to evaluate the traffic impacts of Urban Air recreational facilities across the United States. Urban Air is a trampoline park family recreational destination providing clean, supervised activities for customers of all ages.

Activities include trampoline jumping, fitness classes, dodge ball and volleyball leagues, pre-school and toddler classes, middle school and teen nights, as well as birthday parties and special events. The average facility size is 42,000 square feet.

Urban Air's typical operating hours will be Mondays, Tuesdays, and Thursdays from 3:00 PM to 8:00 PM, Wednesdays and Sundays from 10:00 AM to 8:00 PM, and Fridays and Saturdays from 10:00 AM to 11:00 PM. The site location in relation to the surrounding roadways is shown on Figure 1.

This study provides an estimate of the expected traffic generation and distribution characteristics of the project. As documented in this report, the trip-generation estimates made in this report are conservatively high as they are based on the highest-observed customer transaction data across its portfolio of locations.

Urban Air will generate only slightly more traffic on weekdays and in fact, will generate no traffic during the weekday AM peak hour. The biggest difference in site traffic generation will occur on Saturdays, when Urban Air generates most of its traffic.

Urban Air is expected to draw traffic from a regional area. The majority of traffic is expected during peak hour traffic-volume which is expected between 44 and 58 vehicles, representing on average less than one additional vehicle per minute. On lower traffic days, volume of 19 to 24 vehicles are expected during the peak hours, representing approximately one additional vehicle every 3 minutes.

### **Trip Generation**

Typically, the ITE *Trip Generation Manual* is used to estimate traffic generation for a proposed land use. However, the ITE manual does not have any data for trampoline parks. The closest Land Use Code (LUC) in the ITE manual is LUC 495 - Recreational Community Center. The ITE defines this land use as "*stand-alone public facilities similar to and including YMCAs. These facilities often include classes and clubs for adults and children; a day care or nursery school; meeting rooms; swimming pools and whirlpools; saunas; tennis, racquetball, handball,*

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*basketball and volleyball courts; outdoor athletic fields/courts; exercise classes; weightlifting and gymnastics equipment; locker rooms; and a restaurant or snack bar.”*

Based on the ITE trip generation rates for this land use, a recreational community center generates substantially more traffic on weekdays than on Saturdays, which is not the case with the proposed Urban Air facility, which generates most of its traffic on Saturdays, as described further below.

Accordingly, the anticipated traffic generation of an Urban Air facility was estimated using customer transaction data obtained from Urban Air at their existing facilities. The facilities were chosen from stores of approximately the same size and has similar demographics. In addition, the following information was obtained from Urban Air:

- Saturdays experience the most number of customers of any day of the week.
- Fridays experience the most number of customers of any weekday.
- There is not significant variation in the number of customers by month of the year
- Over 70 percent of their customers are minors under the age of 13 and therefore do not drive a car.

Urban Air records the times that each customer checks into their facilities. These records were obtained for each facility for every Friday and Saturday in 2016. As the majority of customers do not drive a car, it was assumed that groups of customers that checked in at the same time (within the same minute) represent one car. A summary of the customer transaction data is provided in the Appendix.

Based on these data, the average number of customer vehicles to Urban Air facility on Fridays was 213 with an average peak hour generation of 14 vehicles (the peak hour is assumed to be weekday PM peak hour between 5:00 and 6:00 PM). The maximum number of cars on any one Friday was 250 and the maximum peak hour generation on any one Friday was 25 vehicles. On Saturdays, the average number of customer vehicles to Urban Air was 380 with an average peak hour generation of 37 vehicles (the peak hour is assumed to be Saturday midday peak hour between 11:45 AM and 12:45 PM). The maximum number of cars on any one Saturday was 408 and the maximum peak hour generation on any one Saturday was 48 vehicles. To present a conservative (high) estimate of traffic generation, the maximum numbers cited above were assumed. In addition, although the remaining weekdays (Monday through Thursday) will have significantly fewer customers, the Friday numbers were assumed to occur every weekday to present a worst-case scenario.

In addition, Urban Air will have a total of 31 employees working in three shifts with 7 employees working from 10:00 AM to 2:00 PM, 17 employees working from 2:00 PM to 5:00

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PM, and 7 employees working from 5:00 PM to closing. Accordingly, the total expected daily and peak hour traffic generation for an Urban Air facility is summarized in Table 5.

**Table 5**  
**Trip Generation Comparison**

| Time Period               | Proposed Urban Air Project |                        |           |
|---------------------------|----------------------------|------------------------|-----------|
|                           | Employees <sup>b</sup>     | Customers <sup>c</sup> | Total     |
| <b>Weekday Daily</b>      | 62                         | 500                    | 562       |
| <b>Weekday AM</b>         |                            |                        |           |
| <b>Peak</b>               | 0                          | 0                      | 0         |
| Enter                     | <u>0</u>                   | <u>0</u>               | <u>0</u>  |
| Exit                      | 0                          | 0                      | 0         |
| Total                     |                            |                        |           |
| <b>Weekday PM</b>         |                            |                        |           |
| <b>Peak</b>               | 7                          | 25                     | 32        |
| Enter                     | <u>17</u>                  | <u>25</u>              | <u>42</u> |
| Exit                      | 24                         | 50                     | 74        |
| Total                     |                            |                        |           |
| <b>Saturday Daily</b>     | 62                         | 816                    | 878       |
| <b>Saturday Peak Hour</b> |                            |                        |           |
| <b>Peak</b>               | 0                          | 48                     | 48        |
| Enter                     | <u>0</u>                   | <u>48</u>              | <u>48</u> |
| Exit                      | 0                          | 96                     | 96        |
| Total                     |                            |                        |           |

<sup>b</sup> Assumes a total of 31 employees in three shifts. Based on the shift times, no employees would arrive or depart the site during the weekday AM and Saturday peak hours. During the weekday PM peak hour (5:00 to 6:00 PM), 17 employees are assumed to leave after ending their 2:00 to 5:00 PM shift and 7 employees are assumed to enter to start their 5:00 PM to closing shift.

<sup>c</sup> Based on customer transaction data attached to this letter. Facility not open until 10:00 AM.

<sup>d</sup> TMC Services is closed on Saturdays, except during emergencies.

As shown, an Urban Air facility is expected to generate up to 562 vehicle trips on a Friday (less traffic during all other weekdays), of which 74 trips (32 entering and 42 exiting) will occur during the weekday PM peak hour. On Saturdays, an Urban Air facility will generate up to 878

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trips of which 96 vehicle trips (48 entering and 48 exiting) will occur during the midday peak hour.

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