TRAFFIC STUDIES
TRAFFIC IMPACT ANALYSIS

3737 Lander Road, Pepper Pike, OH
(Proposed Willey Creek Overlay District)

Prepared For

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August 2019
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1 EXECUTIVE SUMMARY

As the initial step in understanding the potential traffic impacts associated with the Proposed Willey Creek Overlay District, Axiom Development Group has retained AECOM Technical Services, Inc. to perform this preliminary traffic analysis.

There are three development scenarios taken into consideration for the purposes of this preliminary traffic analysis. Scenario 1 includes a residential-only development and Scenarios 2 and 3 incorporate different proportions of mixed-use development (residential, office, and retail). The scenario with residential-only development would have two access points on Lander Road, south of Lander Circle and on each side of Willey Creek. The mixed-use scenarios would both have two access points, one on Lander Road and one on Chagrin Boulevard, with a roundabout at each end of a connector road bisecting the development.

As determined by this analysis and previously completed studies, Lander Circle has significant existing operational deficiencies that requires a complete reconfiguration to holistically address the problem. Two of the three proposed development scenarios discussed within this analysis offer a way to mitigate existing and potential traffic impacts resulting from the development. Scenarios 2 and 3 include a connector road that would divert the traffic that currently uses Lander Circle by providing a more direct route between Lander Road (south) and Chagrin Boulevard (southeast). All development traffic coming from the south and southeast would also use the Connector Road and never reach the Circle. This bypass scenario was accounted for in the trip distribution and analysis of this study.

In addition to the connector road, The City of Pepper Pike is pursuing improvements at the Circle to eliminate or restrict access at driveways, provide pedestrian facilities, reduce lanes on the Chagrin Boulevard (southeast) approach, delineate travel lanes within the circle itself, and modify the access points to a yield condition rather than a stop, with splitter islands to be constructed on each approach roadway. These improvements will result in an improvement in safety by reducing intermittent access at private driveways. Driver confusion and conflicts within the Circle should be alleviated by marking lanes for circular travel vs. exiting traffic.

At this initial stage of analysis, the modeling associated with the mixed-use development scenarios are inflated since trip generation is currently determined strictly by land use standards and does not account for any reductions that would result from pass-by or internal capture trips. Pass-by trips are those where a motorist makes an intermittent stop between their primary origin and destination. These are new trips for the proposed development, but not new trips on the existing roadway network. Internal capture trips are those generated as a result of a new development but never reach the external roadway network. At this preliminary level of analysis, published information from similar mixed-use developments suggests that internal capture could reduce trips for Scenario 2 by as much as 24% and Scenario 3 by 16%. Pass-by traffic could be expected to reduce the site-generated retail trips in both scenarios by up to 34%.

Additionally, other forms of mitigation that may occur naturally or be enforced through leasing agreements could involve staggered hours of the office and retail portions of the development. Different types of businesses tend to have different hours of operation, which reduces the amount of traffic that
may be generated during the true roadway peak hours. Some restaurants may not be open beyond the lunch hour; a service-oriented business such as a bank may not open until after the morning peak hour is concluded. These variations in hours would reduce site-generated peak traffic and spread the trips out over a longer period than the traditional peak hour. Refining the modeling for this level of detail will be completed once there is a more defined development composition however based on other developments within the region, it is likely that this will reduce the currently projected peak hour traffic.

In reviewing the existing conditions within the study area and taking into consideration a range of three future development scenarios, this preliminary analysis has identified that each scenario will attract new traffic to Lander Circle and the approaching roadways. While Scenario 1 produces the least amount of new traffic, it does not offer the benefit of a mitigating feature as in Scenarios 2 and 3 which include a bisector road that will remove a percentage of both existing and future traffic from entering Lander Circle. As detailed within this analysis, Scenarios 2 and 3 are more complex and several mitigating factors, including staggered hours of business operation, and reductions resulting from internal capture and bypass traffic have yet to be considered. For Scenarios 2 and 3, the above-mentioned mitigating factors are likely to reduce overall trip generation and shift some of the development generated traffic outside of the standard peak hours.
2 INTRODUCTION

AECOM previously performed an evaluation of the existing and potential traffic conditions in the vicinity of the Beech Brook Facility on Lander Road in Pepper Pike, Ohio. The evaluation was part of a due diligence study completed for ADG Willey Creek, LLC (ADG).

As the development of the property is moving forward, ADG retained AECOM to update the traffic analysis to identify the potential for traffic impacts and mitigation for a variety of possible development scenarios. The traffic evaluation is not a comprehensive traffic impact study, but rather an initial step in the evaluation of the potential traffic changes that could result from the redevelopment of the property.

2.1 Study Area and Parameters

The study area for this traffic analysis is limited to the existing intersection of Chagrin Boulevard, Lander Road, and Pinetree Road, which is a large traffic circle with an outside diameter of approximately 340 feet (see Figure 1). Each of the six approach roadways operates with stop sign control entering the circle, which has two unmarked circulating lanes with a total width of approximately 40 feet.

Several private commercial driveways have direct access to the circle between the approach roadways. The large size of the circle, excessive width of the circulating lane, high traffic volumes, and number of access points all contribute to a confusing and congested intersection.

The study area also includes proposed access points to the Proposed Willey Creek Overlay District on both Lander Road and the southeast leg of Chagrin Boulevard. The Ohio Department of Transportation (ODOT) website indicates a growth rate of 3% per year which was used to expand Average Daily Traffic (ADT) volumes from 2016 to 2017 values. The surrounding area is near its development capacity except for the area of the Proposed Willey Creek Overlay District, therefore a growth rate of 1% per year was used to project the existing traffic volumes for the Opening Day. This is more in line with growth rates used for other traffic studies and design projects in the region.
Miovision video traffic data collection units were deployed on each leg of the circular intersection to collect peak hour traffic volumes. Due to the size and configuration of the circle, individual traffic volumes were collected for each approach entering the circle and traffic exiting the circle to the approach roadways, as well as at a single location on the circle itself to establish circulating volumes. Traffic was collected during morning and afternoon peak hours on typical weekdays in May 2018 when school was in session and there were no holidays or adverse weather conditions. The traffic data collected is provided in Appendix A.

The traffic volumes were summarized, and system-wide peak hours were identified for the overall intersection as occurring at 8:00-9:00 a.m. and 4:15-5:15 p.m. The existing volumes were then projected to Opening Day 2023 volumes using the 1% annual growth rate as previously discussed.

3 TRAFFIC VOLUMES AND ANALYSIS

3.1 Low-Build Conditions

There is currently little active use of the Beech Brook property and there is a desire to see a more robust use of the property, whether through redevelopment within the existing zoning or as the Proposed Willey Creek Overlay District. In order to evaluate base conditions with the property in use, a scheme was evaluated that would more fully utilize the available land on both sides of Willey Creek within the existing institutional zoning. Based on the size of the developable land and the available land uses it was determined that an appropriate use could be as a satellite institutional campus. The Institute of Transportation Engineers (ITE) Trip Generation, 10th Edition includes a land use for a satellite institutional campus that most closely aligns with what could be constructed within the current zoning. The ITE manual is considered the industry standard for developing traffic volumes for developments. Evaluation of the property indicates that buildings totaling 215,000 square feet could be constructed within the zoning conditions. The traffic that would be generated by this land use is summarized below in Table 1.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>ITE Code</th>
<th>Size</th>
<th>AM Peak Trips</th>
<th>PM Peak Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Enter</td>
<td>Exit</td>
</tr>
<tr>
<td>Institutional Satellite Campus</td>
<td>540</td>
<td>215,000 sq ft</td>
<td>402</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>402</td>
<td>120</td>
</tr>
</tbody>
</table>

These volumes were distributed over the roadway network based on existing traffic around the Lander Circle, assuming two driveways would be provided to the campus on Lander Road, one on each side of Willey Creek. The generated trips were added to the existing traffic that had been projected to year 2023. The Opening Day (2023) Low-Build AM and PM peak hour traffic volumes are shown on Figure 2 below.
Due to the size and configuration of the traffic circle, the most appropriate way to evaluate traffic operations is to treat each approach leg as an individual stop sign controlled intersection, with a right-turn movement from the approach entering the circle, a thru movement passing on the circle, and a right-turn movement exiting the circle. Although the pavement of the circle is not marked as two lanes, motorists treat it as a two-lane roadway with an inner circulating lane and an outer shared lane for thru and right turn traffic. Observations and review of the video collected for the traffic counts indicates that motorists
are unsure how to utilize the pavement width. A previous study completed for the City in 2008 used a similar lane configuration, although a test of using a single circulating lane and a right-turn lane exiting the circle approach yielded similar capacity results. Highway Capacity Software (HCS) 7 was used for the traffic analysis. The software follows the methodology of the Highway Capacity Manual, a publication of the Transportation Research Board that is the industry standard for traffic capacity.

Analysis was performed for the AM and PM peak hours to determine whether the circle and individual approach roadways can adequately process the Low-Build traffic volumes during the busiest times of day. According to the analysis the right-turn movement entering the circle operates at level of service (LOS) E for the Pinetree Road approach during the AM peak hour and all other approaches operate at LOS F. In the PM peak hour, which generally has higher traffic volumes, all approaches to the circle operate at LOS F. The delays range from approximately two to ten minutes on average. The traffic on the circle, operating in free-flow conditions, operates at LOS A with no delays. Both driveways for the proposed institutional campus operate with adequate LOS B or C in both peak hours, assuming there are separate lanes for left and right turns exiting the campus and the driveways operate with stop sign control. The capacity analysis results of existing conditions are summarized in Figure 3, including both the LOS and the average delay per vehicle in seconds. Copies of the analysis worksheets are provided in Appendix B.
Based on discussions with ADG, this analysis covers three (3) potential development scenarios for the Proposed Willey Creek Overlay District. Scenario 1 would involve only residential development as single-family detached homes on one-acre, with a maximum estimated development of 51 dwelling units. Scenarios 2 and 3 would each be a mixed-use development of single-family detached homes, single-family attached homes (townhomes/condos), multi-family housing, retail, and office space with differing levels of each land use in the two scenarios. Scenario 1 would include two access points on Lander Road.
which would terminate within the property. Scenarios 2 and 3 would include a connector road between the southeast leg of Chagrin Boulevard and the south leg of Lander Road that would bisect the Proposed Willey Creek Overlay District, providing access to the new development and an bypass route for traffic between those two roadways.

Trip generation was performed for each potential development scenario using the ITE Trip Generation to calculate AM peak hour and PM peak hour traffic for the site. Trip generation for each land use was performed using an appropriate independent variable (square footage of retail, office, and restaurants; dwelling units for residential) and was based on the peak hour of traffic on adjacent roadways. The potential land uses, sizes, and trip generation for the AM and PM peak hours of each scenario are shown in Table 1, below.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>ITE Code</th>
<th>Size</th>
<th>AM Peak Trips</th>
<th>PM Peak Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Enter</td>
<td>Exit</td>
</tr>
<tr>
<td>Detached Single Family</td>
<td>210</td>
<td>51 units</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detached Single Family</td>
<td>210</td>
<td>47 units</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Attached single family (Low rise)</td>
<td>220</td>
<td>40 units</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Multi family housing (Mid rise)</td>
<td>221</td>
<td>220 units</td>
<td>21</td>
<td>59</td>
</tr>
<tr>
<td>Retail (Shopping Centre)</td>
<td>820</td>
<td>40,000 sq ft</td>
<td>107</td>
<td>65</td>
</tr>
<tr>
<td>Office</td>
<td>721</td>
<td>75,000 sq ft</td>
<td>83</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>182</td>
<td>254</td>
<td>283</td>
</tr>
<tr>
<td>Scenario 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detached Single Family</td>
<td>210</td>
<td>47 units</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Attached single family (Low rise)</td>
<td>220</td>
<td>60 units</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Multi family housing (Mid rise)</td>
<td>221</td>
<td>245 units</td>
<td>23</td>
<td>66</td>
</tr>
<tr>
<td>Retail (Shopping Centre)</td>
<td>820</td>
<td>90,000 sq ft</td>
<td>122</td>
<td>75</td>
</tr>
<tr>
<td>Office</td>
<td>721</td>
<td>125,000 sq ft</td>
<td>125</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>287</td>
<td>213</td>
<td>386</td>
<td>457</td>
</tr>
</tbody>
</table>

The site-generated trips for each scenario were distributed onto the roadway network based on existing travel patterns and engineering judgment of general origin-destination in the study area. The majority of traffic will traverse the Lander/Chagrin circle, but a portion of site-generated trips will come from the south on Lander Road or the southeast on Chagrin Boulevard and never enter the traffic circle. A summary of the distribution of the site-generated trips is provided in Table 2.
Site-generated trips were overlaid with the projected existing traffic volumes, which were adjusted to reflect traffic diversions that would occur under Scenarios 2 and 3 with the Connector Road in place. The Opening Day trips are depicted in Figures 4-6 for the individual development scenarios.
Figure 4. Opening Day (2023) Build Scenario 1 Traffic
Figure 5. Opening Day (2023) Build Scenario 2 Traffic
3.3 Proposed Conditions

The Opening Day Build Scenario volumes were analyzed with HCS to determine the potential traffic impact of site development on the Lander/Chagrin circle, as well as expected traffic conditions at the terminal intersections of the connector road. The same land use and traffic control was used as for existing conditions. For Scenario 1, the access drives on Lander Road were assumed to be stop controlled with the development roads stopping and Lander Road in free-flow. Due to the low turning volumes, no dedicated turn lanes were evaluated on southbound Lander Road. The termini of the connector road were assumed to be single-lane roundabouts for Scenarios 2 and 3.
Scenario 1 does not introduce large volumes of additional traffic since it is limited to a development comprised solely of single family lots approximately 1-acre in size. The operating conditions for the Build Scenario 1 alternative are shown on Figure 7.

When compared to the Low-Build development scheme, Scenario 1 results in lower delays overall in both the AM and PM peak hours. There are several approaches to Lander Circle that will operate with LOS E or F in the morning and all approaches operate at LOS F in the afternoon. The access drives to the proposed development will operate with acceptable LOS and delays less than 20 seconds. Copies of the HCS analysis reports are included in Appendix C.
Scenario 2 introduces approximately 400 new trips in the AM peak hour and approximately 550 new trips in the PM peak hour (excluding reductions for pass-by and internal capture). Figure 8 presents the capacity analysis results for Build Scenario 2 conditions. Scenario 2 also generally shows less delay than the institutional use, with shorter delays on all approaches to Lander Circle in the morning. In the PM peak the Chagrin Boulevard (southeast) approach shows a potential increase in delay of approximately 30 seconds. The proposed connector road offers the potential for improving the existing condition at Lander Circle by decreasing the delay during the AM peak hour for the northbound Lander Road and northwest bound Chagrin Boulevard approaches. Both roundabouts at the ends of the Connector Road will operate efficiently with LOS A and low delays for all traffic movements. As with Scenario 3, by factoring internal capture and pass-by traffic, the currently modeled delays noted above will be reduced. The HCS analysis reports are included in Appendix C.
Scenario 3 includes more mixed-use development which results in a higher number of site-generated trips, at 500 in the AM and nearly 850 in the PM.

Figure 8. Opening Day (2023) Build Scenario 2 LOS
Without a detailed site plan showing internal road configurations, mitigating factors that would support the reduction of traffic entering Lander Circle (such as pass-by and internal trip traffic) cannot be taken into account and therefore the resulting traffic counts are inflated. Without factoring the impact of pass-by and internal trip traffic into our analysis, the delay for traffic on the Chagrin Boulevard (west) approach may increase by 1.5 minutes in the PM peak, while the Lander Road (north) approach shows an improvement in delay of 3 minutes. The other approaches show minimal increases in delay of 1 minute or less. As noted above, with more detailed modeling it is expected that any projected delays will be significantly reduced. Copies of the analysis reports are included in Appendix C.
4 SUMMARY OF TRAFFIC CONDITIONS

Based on the existing traffic counts and capacity analysis of a development scheme with existing zoning (Low-Build Development), there are significant operational deficiencies on the Lander Road/Chagrin Boulevard/Pinetree Road circle. The intersection is very confusing, with multiple commercial driveways having direct access to the circle in addition to the five individual roadway approaches. The wide pavement of the circle is not marked as separate lanes but is treated as a two-lane circulating roadway. During the AM peak hour, most of the approach roadways operate at LOS F, except the Pinetree Road approach that operates at LOS E. During the PM peak hour, all approach roadways operate at LOS F, with delays ranging from approximately 2 minutes to 10 minutes.

In all scenarios that involve rezoning, the development of the Proposed Willey Creek Overlay District will introduce new traffic to the roadway network, the level of which varies depending on the development scenario. With the variations in site-generated traffic, there are variations in the potential changes in traffic as compared to redeveloping the site within existing zoning limitations. The potential for changes in delays and LOS (excluding decreases associated with pass-by and internal capture) experienced on each approach to Lander Circle are presented on Table 3.

<table>
<thead>
<tr>
<th>Approach Roadway</th>
<th>Low-Build</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chagrin Boulevard (west)</td>
<td>Net Zero</td>
<td>-85.1 ^</td>
<td>-68.1 ^</td>
<td>-44.8</td>
</tr>
<tr>
<td>Lander Road (south)</td>
<td>Net Zero</td>
<td>-150.1 ^</td>
<td>-163.1 ^</td>
<td>-303.6</td>
</tr>
<tr>
<td>Chagrin Boulevard (southeast)</td>
<td>Net Zero</td>
<td>-98.1</td>
<td>-108.9</td>
<td>-31.1</td>
</tr>
<tr>
<td>Pinetree Road</td>
<td>Net Zero</td>
<td>-15.1 ^</td>
<td>-10.6 ^</td>
<td>-8.4 ^</td>
</tr>
<tr>
<td>Lander Road (north)</td>
<td>-221</td>
<td>-124.5</td>
<td>-30.9</td>
<td>103.3</td>
</tr>
</tbody>
</table>

Notes: Negative numbers (-) indicate less delay compared to Low-Build
^ indicates an improvement in LOS compared to Low-Build

Each of the scenarios for the Proposed Willey Creek Overlay District would result in better operations at Lander Circle in the AM peak hour, with shorter delays as compared to an institutional use that is consistent with the existing zoning. Both Scenarios 1 and 2 would also have generally shorter delays in the PM peak hour, with a minor increase in delay on the Chagrin Boulevard (southeast) approach under Scenario 2. Scenario 3 will result in minor delays on most approaches in the PM peak hour, with no increase greater than 1.5 minutes.

Providing a connector road between Lander Road (south) and Chagrin Boulevard (southeast) will divert all traffic heading west on Chagrin Boulevard towards Lander Road (south) and all traffic that is headed north on Lander towards Chagrin Boulevard (southeast), as these vehicles will no longer have to traverse the circle. Although only two roadways would be directly impacted by the connector road, reducing the circulating traffic will improve conditions for the remaining Lander Circle approaches. The proposed roundabouts to be constructed as part of development of Scenarios 2 and 3 will provide adequate operations at the access points to the development, as will simple stop-controlled intersections for Scenario 1. No dedicated turn lanes on either Chagrin Boulevard or Lander Road are needed at the access points under any Scenario.

The greater traffic operations issue is Lander Circle itself. It is understood that the City of Pepper Pike is pursuing improvements at the Circle which will eliminate or restrict access at driveways, provide pedestrian facilities, reduce lanes on the Chagrin Boulevard (southeast) approach, delineate travel lanes...
within the circle itself, and modify the access points to a yield condition rather than stop, with splitter islands to be constructed on each approach roadway. These improvements result in an improvement in safety by reducing intermittent access at private driveways and better delineating lanes in the circle.

While any development scenario will have the potential to increase traffic entering at Lander Circle, there are ways that the impacts can be mitigated. As noted previously, more detailed modeling of scenarios 2 and 3, that factors pass-by and internal capture will significantly reduce the trip generation that is currently being dictated by land-use alone. Pass-by traffic results from a motorist making a secondary stop while en route to a primary destination, such as stopping for dinner on the way home from work. Similarly, some percentage of trip generation will be captured internally. This occurs when a trip begins and ends within the development and has no impact on the external traffic network. If, for example, a resident of the housing worked at one of the offices, their commute would be considered a site-generated trip for both the residential and portion of the development and the office, yet they would never access the existing roads. At this preliminary level of analysis, pass-by and internal traffic were not modelled in detail but based on published information from similar mixed-use developments, internal capture could reduce trips for Scenario 2 by as much as 24% and Scenario 3 by 16%. Pass-by traffic could account for up to 34% of the site-generated retail trips. Incorporating these factors once a clearer picture of the specific development profile has been determined, will substantially reduce the potential for increasing the delays for traffic heading towards Lander Circle.

In addition, the current trip generation model assumes one overall peak hour for the development, whereas the individual offices and retail establishments may have staggered hours. For example, some restaurants that would be part of the retail area may only be open during breakfast and lunch hours and therefore would not contribute to PM peak hour traffic. A doctor’s office may be open from 8:00 a.m. to 3:00 p.m., also not contributing to PM peak traffic, while an attorney may not open until 9:00 a.m., after the morning peak hour is concluded.

A complete reconfiguration of Lander Circle is the ultimate solution to resolve both existing and anticipated operational deficiencies in the study area, however, there are intermediate countermeasures as discussed above to mitigate the increased traffic loads. As the proposed development moves forward with a more concise site plan, a full traffic impact study will be performed, including detailed evaluation of pass-by and internal capture traffic.
Note: The analysis is not a comprehensive traffic impact study and additional detailed analysis is required to more accurately understand the possible changes in traffic. This preliminary analysis is limited to trip generation, a general overview of potential operational impacts, and an overview of mitigation considerations based on any potential changes in traffic. A more refined study is required to fully understand traffic changes that will result from various development scenarios.
APPENDIX A

TRAFFIC DATA
APPENDIX B

LOW-BUILD CAPACITY ANALYSIS