TRANSPORTATION TECHNICAL MEMORANDUM

Date: April 11, 2012

To: Mr. Rick Grochoske, P.E.
Engineering Services Section Manager
Charlotte Department of Transportation

From: Randy E. Goddard, P.E.
Managing Principal
Design Resource Group, PA (C-2165)

Subject: Woodfield South Park (RP 2012-045) (217-016)

EXECUTIVE SUMMARY

- As currently approved/zoned (129,485 SF office), the site is expected to generate 231 trips in the AM peak hour (approximately 4 vehicles added to the roadway network per minute during the 1 hour AM peak) and 224 trips in the PM peak hour (approximately 4 vehicles added to the roadway network per minute during the 1 hour PM peak).

- Using the 300 dwelling unit general apartments land use (versus the mid-rise apartment land use [which generates fewer trips]), the site is expected to generate 153 trips in the AM peak hour (less than 3 vehicles added to the roadway network per minute during the 1 hour AM peak) and 186 trips in the PM peak hour (approximately 3 vehicles added to the roadway network per minute during the 1 hour PM peak). This equates to 78 fewer trips in the AM peak hour and 38 fewer trips in the PM peak hour when compared to the office land use. Therefore, 300 residential units will generate less trips (and less of an impact on the adjacent road network) during the critical AM and PM peak hours when compared to the approved 129,485 SF of office space.

- For informational purposes, using the 300 dwelling unit mid-rise land use classification, the site is expected to generate 90 trips in the AM peak hour (approximately 1.5 vehicles added to the roadway network per minute during the 1 hour AM peak) and 117 trips in the PM peak hour (approximately 2 vehicles added to the roadway network per minute during the 1 hour PM peak).
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Trip Generation Comparison

<table>
<thead>
<tr>
<th>Land Use [ITE Code]</th>
<th>Daily</th>
<th>AM Peak Hour</th>
<th>PM Peak Hour</th>
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<tr>
<td></td>
<td></td>
<td>Enter</td>
<td>Exit</td>
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<tr>
<td>Existing Zoning (O-2 (CD))</td>
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<td>Office [710]</td>
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<td>Proposed Zoning (MUDP-(O)) – 300 Apartments</td>
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<tr>
<td>General Apts. [220]</td>
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<td>Trip Generation Difference Between General Apartments and Office Land Uses</td>
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<td></td>
<td>367</td>
<td>-173</td>
<td>95</td>
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<tr>
<td>300 Mid-Rise Apts. (Between 3–10 Floors) – FOR INFORMATIONAL PURPOSES ONLY</td>
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<td></td>
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<tr>
<td>Mid-Rise Apts. [223]</td>
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<td>27</td>
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</table>

- Based on current traffic counts and input/direction from the Charlotte Department of Transportation (CDOT), approximately 70% of the site traffic is expected to arrive/depart via the south side of the development (i.e. Carnegie Boulevard, Morrison Boulevard, and Barclay Downs Drive [via Fairview Road]), while only 30% is expected to arrive/depart via Barclay Downs Drive and Scofield Road from the north (48 AM peak trips [less than 1 vehicle per minute during the 1 hour AM peak] and 57 PM peak trips [approximately 1 vehicle per minute during the 1 hour PM peak]). This amount is much lower than what is expected under the existing entitled office use. In addition, the increase would be lower using the mid-rise apartment classification.

- The anticipated overall increase in the ADT volume on Barclay Downs Drive between Morrison Boulevard/Carnegie Boulevard and Sayre Road/Scofield Road using the general apartment daily volume is less than 6% (from 10,175 vpd to 10,800 vpd), which is minimal.

The development intends to utilize three driveways:

1. A full movement access on Barclay Downs Drive, approximately 500 feet north of the signalized intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard with one entering lane and one exit lane. The Petitioner has committed that service vehicles will not use this access location to service the site.

2. A right-in/right-out only access on Morrison Boulevard, approximately 385 feet east of the signalized intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard with one entering lane and one exit lane.

3. A right-in/right-out only access on Morrison Boulevard, approximately 135 feet east of the signalized intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard with one entering lane and one exit lane. This driveway is assumed to be used primarily for exiting trucks (due to the tight
parking lot conditions it will not be feasible for a full size truck to perform a 180-degree maneuver and exit the driveway described above).

We offer the following recommendations and conclusion (see Figure 11 at the end of this document for a summary of the recommended improvements):

- CDOT is in the process of implementing a laneage modification on the southbound leg of Barclay Downs Drive at Morrison Boulevard/Carnegie Boulevard (as was suggested by area residents during a community meeting). Currently the southbound laneage includes a combined through–left turn lane and a combined through–right turn lane; CDOT will re-mark the through–left turn lane pavement to an exclusive left turn lane with 225 feet of storage and a 160–foot bay taper. We are in favor of this laneage reconfiguration as a means of improving the functionality of the intersection benefitting in particular motorists from southbound Barclay Downs Drive.

- We recommend the three access locations as described previously: a full movement access on Barclay Downs Drive and two right–in/right–out only driveways on Morrison Boulevard.

- We recommend re–marking Barclay Downs Drive at the Proposed Access driveway with a southbound left turn lane with 75 feet of storage, a 100–foot bay taper, and a 200–foot through lane taper (this improvement should not require any roadway widening). This will ensure the movement of motorists without concern for those seeking to make a left turn into this driveway access.

- It should be noted that with a full movement access driveway on Barclay Downs Drive, interconnectivity within the site will potentially reduce the number of westbound u–turns on Morrison Boulevard at Barclay Downs Drive (i.e. a left exiting movement from the site onto Barclay Downs Drive and a southbound left onto eastbound Morrison Boulevard).

- In addition to intersection improvements for vehicular traffic, we also recommend installing a crosswalk on the east leg of the intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard. Pedestrian signal heads and pushbuttons currently exist on all four legs of the intersection and crosswalks are present on the three remaining legs of the intersection.

We concur with CDOT's position that the proposed Woodfield South Park project will not negatively impact the adjacent roadways, based on the minimal increase in traffic expected to be generated from this multi–family development. In addition, the scheduled lane conversion improvement by CDOT, along with our left–turn lane improvement and pedestrian enhancements, will improve Barclay Downs Drive and mitigate the minor increase in traffic.
DISCUSSION

Background/Location:

Woodfield Acquisitions, LLC is proposing to rezone (RP 2012-045) approximately 3.2 acres (tax parcel 177-021-76) on the northeast quadrant of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard, in the South Park area of Charlotte, North Carolina (see Figure 1 – Area of Influence Map). The existing zoning is O-2 (CD) [a maximum of 129,485 SF of office] and the proposed zoning is MUDD-O [300 apartments].

Per the Charlotte Department of Transportation’s (CDOT) request, Design Resource Group, PA (DRC) provides the following information pertaining to the location of the development, roadway/access locations, proposed trip generation, field information regarding existing roadway queue lengths, traffic volumes for three access scenarios, traffic analysis at two existing intersections (which includes a revised southbound lane configuration by CDOT on Barclay Downs Drive at Morrison Boulevard/Carnegie Boulevard to a dedicated left turn lane and a combined through-right turn lane), and our recommendations:

Roadways/Sight Distance:

As indicated on the most current Existing and Proposed Major Collector Roads Map, Barclay Downs Drive is a major collector (located on the west side of the proposed development) with a posted speed limit of 25 mph. The roadway is a two-way, four-lane median-divided facility with appropriate left and right turn lanes south of Morrison Boulevard/Carnegie Boulevard; north of Morrison Boulevard/Carnegie Boulevard the road is one lane in each direction (with occasional speed humps and multi-way stop intersections, and is residential in nature). Curb and gutter, planting strips (with varying widths), and sidewalk are located on both sides of the street south of Morrison Boulevard/Carnegie Boulevard; north of Morrison Boulevard/Carnegie Boulevard the road has curb and gutter and sidewalk on both sides of the street (no planting strip is present). A CATS bus stop (routes #18 and 30) is located on the east side of Barclay Downs Drive adjacent to the proposed site; a CATS bus
stop (routes #57 and 60) is located on the west side of Barclay Downs Drive south of Carnegie Boulevard. Sight distances in both directions along Barclay Downs Drive in the vicinity of the proposed development are adequate, meeting or exceeding normal CDOT requirements for a 25 mph posted roadway (30 mph design speed) = 335 feet of sight distance.

Morrison Boulevard is a major collector (located on the south side of the proposed development) with no posted speed limit (therefore assumed 35 mph). The roadway is a two-way, four-lane undivided facility with occasional left and right turn lanes. The roadway has curb and gutter and sidewalks on both sides of the street; occasional planting strips (with varying widths) are also present on both sides of the street. A CATS bus stop (routes #18, 30, 57, and 60) is located on the north side of Morrison Boulevard, east of Coca-Cola Plaza. Sight distances in both directions along Morrison Boulevard in the vicinity of the proposed development are adequate, meeting or exceeding normal CDOT requirements for a 35 mph posted roadway (40 mph design speed) = 445 feet of sight distance.

**Accident Data:**

According to the latest data collected by CDOT, the two study intersections within the area of influence are not listed as high accident locations (HAL) nor high congestion locations (HCL).

CDOT provided accident data between 2007 and 2011 (5 years) for the signalized intersection of Barclay Downs Drive & Morrison Boulevard/Carnegie Boulevard and the unsignalized intersection of Barclay Downs Drive & Sayre Road/Scofield Road. The results are as follows (a copy of the crash listings are located at the end of this document):

- **Barclay Downs Drive & Morrison Boulevard/Carnegie Boulevard** – 12 crashes (an average of approximately 2.4 crashes per year), with approximately 33% being a left turn different roadway collision type, and the remaining 67% a mixture of rear end collision, angle, turning, and sideswipe collisions (no predominant collision pattern). Currently, all four left turn movements use permitted signal phasing and the only "Right Turn on Red" movement allowed is the northbound right turn movement from Barclay Downs Drive onto eastbound Morrison Boulevard. Based on this information, our recommendation is to leave the intersection as is, with no modifications to the traffic signal configuration.

- **Barclay Downs Drive & Sayre Road/Scofield Road** – 4 crashes (an average of approximately 0.8 crashes per year), with a mixture of rear end collision and angle collisions (no predominant collision pattern).
Proposed Access:

According to the schematic site plan dated February 27, 2012, the development intends to utilize three driveways:

1. A full movement access on Barclay Downs Drive, approximately 500 feet north of the signalized intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard with one entering lane and one exit lane. The Petitioner has committed that service vehicles will not use this access location to service the site.

2. A right-in/right-out only access on Morrison Boulevard, approximately 385 feet east of the signalized intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard with one entering lane and one exit lane.

3. A right-in/right-out only access on Morrison Boulevard, approximately 135 feet east of the signalized intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard with one entering lane and one exit lane. This driveway is assumed to be used primarily for exiting trucks (due to the tight parking lot conditions it will not be feasible for a full size truck to perform a 180-degree maneuver and exit the driveway described above).

Existing Maximum Vehicle Queues:

Field observations were performed during the busiest 30 minutes of the morning and afternoon peak hour (documenting approximately every five minutes during the traffic signal cycling at the signalized intersection and when appropriate at the unsignalized intersections) in order to determine the maximum vehicle queue lengths for pertinent traffic movements for the proposed multi-family site. These movements included:

- All southbound movements on Barclay Downs Drive at Morrison Boulevard/Carnegie Boulevard
- All westbound movements on Morrison Boulevard at Barclay Downs Drive
- Eastbound left/u-turn movements on Morrison Boulevard at Coca-Cola Place (located east of the proposed site)
- All movements on all four legs of the Barclay Downs Drive & Sayre Road/Scofield Road unsignalized intersection

The maximum (and average) queues are as follows:
- Morning Peak 8:00 AM – 8:30 AM

- Southbound movements on Barclay Downs Drive at Morrison Boulevard/Carnegie Boulevard
  - For the two southbound through/turn lanes the maximum queue witnessed during the morning peak time was 9 vehicles per lane (225 feet per lane, or 450 feet total), and occurred on a couple occasions. The average queue for this 30-minute peak time was approximately 5 vehicles per lane (125 feet per lane, or 250 feet total), with some of the time having no queued vehicles at the traffic signal.

- Westbound movements on Morrison Boulevard at Barclay Downs Drive
  - For the westbound left turn lane the maximum queue witnessed during the morning peak hour was 8 vehicles (200 feet total), and occurred on a couple occasions. The average left turn lane queue for this 30-minute peak time was approximately 5 vehicles (150 feet total). During each traffic signal cycle, all of the vehicles queued in the turn lane cleared the intersection within that signal cycle.
  - For the two westbound through/right turn lanes the maximum queue witnessed during the morning peak time was 6 vehicles per lane (150 feet per lane, or 300 feet total), and occurred on one occasion. The average queue for this 30-minute peak time was approximately 4 vehicles per lane (100 feet per lane, or 200 feet total).

- Eastbound left/u-turn movements on Morrison Boulevard at Coca-Cola Plaza
  - For the eastbound left turn lane at this unsignalized intersection the maximum queue witnessed during the morning peak time was 7 vehicles (175 feet total), and occurred one time. The average left turn lane queue for this 30-minute peak time was approximately 3 vehicles (75 feet total), with the
majority of the time having no queued vehicles (which is dependent on the traffic signals to the east and west along Morrison Boulevard).

- Northbound movements on Barclay Downs Drive at Sayre Road/Scofield Road
  - For the combined northbound left/through/right lane the maximum queue witnessed during the morning peak time was 4 vehicles (100 feet total), and occurred one time. The average queue for this 30-minute peak time was approximately 2 vehicles (50 feet total).

- Southbound movements on Barclay Downs Drive at Sayre Road/Scofield Road
  - For the combined southbound left/through/right lane the maximum queue witnessed during the morning peak time was 6 vehicles (150 feet total), and occurred one time. The average queue for this 30-minute peak time was approximately 4 vehicles (100 feet total).

- Eastbound movements on Scofield Road at Barclay Downs Drive
  - For the combined eastbound left/through/right lane the maximum queue witnessed during the morning peak time was 5 vehicles (125 feet total), and occurred one time. The average queue for this 30-minute peak time was approximately 3 vehicles (75 feet total).

- Westbound movements on Sayre Road at Barclay Downs Drive
  - For the combined westbound left/through/right lane the maximum queue witnessed during the morning peak time was 1 vehicle (25 feet total), and occurred one time. The average queue for this 30-minute peak time was less than 1 vehicle (25 feet total).

- **Afternoon Peak 5:00 PM – 5:30 PM**
- Southbound movements on Barclay Downs Drive at Morrison Boulevard/Carnegie Boulevard
  - For the two southbound through/turn lanes the maximum queue witnessed during the afternoon peak time was 5 vehicles per lane (125 feet per lane, or 250 feet total), and occurred on a few occasions. The average queue for this 30-minute peak time was approximately 4 vehicles per lane (100 feet per lane, or 200 feet total), with a couple occasions having no queued vehicles at the traffic signal.

- Westbound movements on Morrison Boulevard at Barclay Downs Drive
  - For the westbound left turn lane the maximum queue witnessed during the afternoon peak hour was 13 vehicles (325 feet total) [which queued into the inner through lane], and occurred on a couple occasions. The average left turn lane queue for this 30-minute peak time was approximately 8 vehicles (175 feet total). During each traffic signal cycle, all of the vehicles queued in the turn lane cleared the intersection within that signal cycle.
  - For the two westbound through/right turn lanes the maximum queue witnessed during the afternoon peak time was 17 vehicles per lane (425 feet per lane, or 900 feet total), and occurred on one occasion. The average queue for this 30-minute peak time was approximately 5 vehicles per lane (125 feet per lane, or 250 feet total).

- Eastbound left/u-turn movements on Morrison Boulevard at Coca-Cola Plaza
  - For the eastbound left turn lane at this unsignalized intersection there was no queueing of vehicles (office land use, which typically has a minimal amount of entering traffic during the afternoon peak).

- Northbound movements on Barclay Downs Drive at Sayre Road/Scofield Road
  - For the combined northbound left/through/right lane the maximum queue witnessed during the afternoon peak time was 40 vehicles (1,000 feet total – to Morrison Boulevard), and occurred on one occasion (due to the extensive amount of office development south of the intersection). The average queue for this 30-minute peak time was approximately 11 vehicles (275 feet total), and by 5:30 PM the queue was less than 6 vehicles (150 feet total).
Southbound movements on Barclay Downs Drive at Sayre Road/Scofield Road
  - For the combined southbound left/through/right lane the maximum queue witnessed during the afternoon peak time was 5 vehicles (125 feet total), and occurred one time. The average queue for this 30-minute peak time was approximately 3 vehicles (75 feet total).

Eastbound movements on Scofield Road at Barclay Downs Drive
  - For the combined eastbound left/through/right lane the maximum queue witnessed during the afternoon peak time was 1 vehicle (25 feet total), and occurred on a few occasions. The average queue for this 30-minute peak time was less than 1 vehicle (25 feet total).

Westbound movements on Sayre Road at Barclay Downs Drive
  - For the combined westbound left/through/right lane the maximum queue witnessed during the morning peak time was 2 vehicles (50 feet total), and occurred one time. The average queue for this 30-minute peak time was approximately 1 vehicle (25 feet total).

Figure 2 illustrates the maximum vehicle queues for these pertinent traffic movements during both the morning and afternoon peaks.

Traffic Counts:

Morning (6:30–9:00 AM) and afternoon (2:00–6:30 PM) peak period turning movement counts were conducted at the two existing intersections on Wednesday, March 14, 2012. In addition, a 24-hour mid-block count (ADT) was collected on Barclay Downs Drive between the two intersections on the same date. Figure 3 shows the 2012 existing traffic volumes for the morning and afternoon peak hours as well as the daily traffic volume (10,175 vehicles per day [vpd]).

Trip Generation:

The daily and peak-hour-trip-generation data for the site is presented in Table 1. The values for the trips generated by the land uses are obtained from the Institute of Transportation Engineers, Trip Generation Manual, 8th Edition, 2008.
Table 1: Trip Generation

<table>
<thead>
<tr>
<th>Land Use [ITE Code]</th>
<th>Daily</th>
<th>AM Peak Hour</th>
<th>PM Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Enter</td>
<td>Exit</td>
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<tr>
<td><strong>Existing Zoning (O-2 (CD))</strong></td>
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<td></td>
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<tr>
<td>Office [210]</td>
<td>129,485</td>
<td>SF</td>
<td>1,628</td>
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<td><strong>Proposed Zoning (MUDD-(O)) - 300 Apartments</strong></td>
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<tr>
<td>General Apts. [220]</td>
<td>300</td>
<td>DU</td>
<td>1,995</td>
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<td>Trip Generation Difference Between General Apartments and Office Land Uses</td>
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<td>-173</td>
<td>95</td>
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<td><strong>Proposed Zoning (MUDD-(O)) - 300 Mid-Rise Apartments (Between 3-10 Floors)</strong></td>
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<td>35</td>
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</table>


* Daily Has No Calculated Value. 1,218 Trips Calculated Using Ratio of AM/PM Peak & Daily Total of 300 General Apartments

The existing zoning (office) trip generation results indicate that the development would generate a total of 231 morning and 224 afternoon peak hour trips. The proposed development using the general apartment land use is expected to generate a total of 153 morning and 186 afternoon hour trips (78 fewer morning peak hour trips and 38 fewer afternoon peak hour trips when compared to the existing zoning). The proposed development using the mid-rise apartment land use is expected to generate a total of 90 morning and 117 afternoon hour trips (141 fewer morning peak hour trips and 107 fewer afternoon peak hour trips when compared to the existing zoning). Also (per CDOT), no nearby approved (offsite) developments were included in the analyses.

The directional trip distributions of the site traffic for the access scenarios is provided in Figures 4a and 4b, and was approved by CDOT. The trip assignments for the 2012 morning and afternoon peak hour traffic volumes using the 300 mid-rise apartment land use are presented in Figures 5 through 7 (depending on access scenario). The trip assignments for the 2012 morning and afternoon peak hour traffic volumes using the 300 apartment land use are presented in Figures 8 through 10 (depending on access scenario). The background traffic is indicated to the far left of the movement arrows followed by the site traffic in parentheses. The two volumes are added to obtain the projected total traffic for that movement: Background + (Site) = Total.

Traffic Analysis:

The two intersections identified within the area of influence were analyzed to identify the traffic impact that the site development has under the proposed zoning scenario using the 300 apartments land use (to
represent a “worst case scenario”). The traffic analysis is based on the LOS analysis at the identified intersections in 2012.

LOS is a qualitative measurement of traffic operations. It is a measure of delay time. The Transportation Research Board’s Highway Capacity Manual\textsuperscript{1} (HCM) defines six levels of service for intersections with LOS “A” representing the best operating condition and LOS “F” the worst. Table 16-2 of the HCM gives the criteria for signalized intersections.

<table>
<thead>
<tr>
<th>HCM Table 16-2 for Signalized Intersections</th>
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<tr>
<td><strong>Signalized Level of Service</strong></td>
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<tr>
<td>A</td>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
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<td>D</td>
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<tr>
<td>E</td>
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<tr>
<td>F</td>
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</table>

SYNCHRO Pro 7.0 was the software tool used in determining the delay, capacity and corresponding level of service at the study intersection. This software optimizes the intersection splits for the approach volumes for the signalized intersection. The intersection worksheet reports are provided in the Appendix.

For the analysis of unsignalized intersections, the vehicular movements that must stop at the intersection experience delay. For descriptive purposes:

- LOS results between “A” and “C” are assumed to represent short vehicle delays
- LOS results between “D” and “E” are assumed to represent moderate delays
- LOS results of “F” is assumed to represent long delays.

Table 17-2 gives the criteria for unsignalized intersections.

<table>
<thead>
<tr>
<th>HCM Table 17-2 for Unsignalized Intersections</th>
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<tr>
<td><strong>Unsignalized Level of Service</strong></td>
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<td>A</td>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
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<tr>
<td>D</td>
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<tr>
<td>E</td>
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<tr>
<td>F</td>
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</table>

This study evaluates the following scenarios (using the 300 apartments land use):

- 2012 AM & PM Peak Existing Traffic Conditions
- 2012 AM & PM Peak Build Access Scenario 1 (full movement access on Barclay Downs Drive & a right-in/right-out only access on Morrison Boulevard)

- 2012 AM & PM Peak Build Access Scenario 3 (a right-in/right-out only access on Morrison Boulevard)

Access Scenario 2 includes a right-in/right-out only access on Barclay Downs Drive & a right-in/right-out only access on Morrison Boulevard – these traffic volumes fall between Access Scenario 1 and 3, and are therefore not relevant as a separate analysis scenario.

Currently, the signalized intersection operates under capacity and at a LOS "B" during both peak hours. The unsignalized intersection operates at a short or moderate vehicle delay during the peak hours; when analyzed with a traffic signal the LOS is “A” during both peak hours. Typically, an intersection is said to be operating at capacity at a volume-to-capacity (v/c) ratio of 1.00 and acceptable at a LOS “D” or better. The LOS results of the various scenarios are presented in Table 2.

<table>
<thead>
<tr>
<th>Table 2: Levels of Service</th>
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<tr>
<td>Intersection</td>
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<tr>
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<tr>
<td>2012 Existing Conditions</td>
</tr>
<tr>
<td>1. Barclay Downs Dr &amp; Morrison Blvd/Carnegie Blvd</td>
</tr>
<tr>
<td>2. Barclay Downs Dr &amp; Sayre Rd/Scofield Rd (unsignalized)</td>
</tr>
<tr>
<td>2. Barclay Downs Dr &amp; Sayre Rd/Scofield Rd (signalized)</td>
</tr>
<tr>
<td>2012 Proposed Zoning Scenario 1</td>
</tr>
<tr>
<td>1. Barclay Downs Dr &amp; Morrison Blvd/Carnegie Blvd</td>
</tr>
<tr>
<td>2. Barclay Downs Dr &amp; Sayre Rd/Scofield Rd (signalized)</td>
</tr>
<tr>
<td>2012 Proposed Zoning Scenario 3</td>
</tr>
<tr>
<td>1. Barclay Downs Dr &amp; Morrison Blvd/Carnegie Blvd</td>
</tr>
</tbody>
</table>

* The LOS results are the same for all scenarios (no change in directional distribution or traffic volume)

1 Southbound laneage on Barclay Downs is a left turn lane and combined thru-right turn lane

2 Access scenario includes full movement on Barclay Downs Dr. & a RI/RO on Morrison Blvd.

3 Access scenario includes a RI/RO on Morrison Blvd.

The impacts of the proposed zoning are based on the v/c ratio calculated for each intersection. Significant congestion is highly correlated with the v/c ratios at the intersection, generally occurring when the volume exceeds capacity. Comparing the v/c ratios of the intersection provides the best indication as to the need for geometric improvements to the intersection to alleviate or prevent congestion.
CDOT considers mitigation necessary at intersections where the proposed development would increase v/c ratios above the existing conditions in the amounts shown in the table to the right. Table 3 shows the comparisons between the v/c results of the existing conditions and proposed zoning for 2012.

Table 3: 2012 Capacity Analysis Results for Impact Determination

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Existing Conditions (v/c)</th>
<th>Proposed Zoning (v/c)</th>
<th>Rezoning Impact (v/c increase)</th>
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<tr>
<td></td>
<td><strong>2012 Proposed Zoning Scenario 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Barclay Downs Dr &amp; Morrison Blvd/Carnegie Blvd</td>
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<td>PM 0.69</td>
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<tr>
<td></td>
<td><strong>2012 Proposed Zoning Scenario 2</strong></td>
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</tr>
<tr>
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<td>AM 0.54</td>
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<tr>
<td></td>
<td>PM 0.66</td>
<td>0.68</td>
<td>0.02</td>
</tr>
</tbody>
</table>

* The LOS results are the same for all scenarios (no change in dir, distribution or traffic volume)
1 Access scenario includes full movement on Barclay Downs Dr. & a RI/RO on Morrison Blvd.
2 Access scenario includes a RI/RO on Morrison Blvd.

2012 CDOT Mitigation Analysis Results – Scenario 1:

**Barclay Downs Drive & Carnegie Boulevard/Morrison Boulevard**
When comparing the impact of the proposed zoning to the existing conditions, the v/c ratio falls 0.06 below the allowable threshold in the morning peak hour and falls 0.08 below the allowable threshold in the afternoon peak hour. Therefore, mitigation is not required at this intersection by the developer.

**Barclay Downs Drive & Sayre Road/Scofield Road**
When comparing the impact of the proposed zoning to the existing conditions, the v/c ratio in the morning peak hour falls 0.04 below the allowable threshold in the morning peak hour and falls 0.04 below the allowable threshold in the afternoon peak hour. Therefore, mitigation is not required at this intersection by the developer.

2012 CDOT Mitigation Analysis Results – Scenario 3:

**Barclay Downs Drive & Carnegie Boulevard/Morrison Boulevard**
When comparing the impact of the proposed zoning to the existing conditions, the v/c ratio falls 0.04 below the allowable threshold in the morning peak hour and falls 0.04 below the allowable threshold in the afternoon peak hour. Therefore, mitigation is not required at this intersection by the developer.
Recommendations:

We provide the following recommendations (see Figure 11):

- CDOT is in the process of implementing a laneage modification on the southbound leg of Barclay Downs Drive at Morrison Boulevard/Carnegie Boulevard (as was suggested by area residents during a community meeting). Currently the southbound laneage includes a combined through–left turn lane and a combined through–right turn lane; CDOT will re-mark the through–left turn lane pavement to an exclusive left turn lane with 225 feet of storage and a 160-foot bay taper. We are in favor of this laneage reconfiguration as a means of improving the functionality of the intersection benefitting in particular motorists from southbound Barclay Downs Drive.

- Based on the anticipated mid-rise apartment or general apartment site traffic volumes, we recommend three access locations as shown on the RZ 2.0 schematic site plan (a full movement access on Barclay Downs Drive and two right-in/right-out only driveways on Morrison Boulevard) as described in the Proposed Access section of this memorandum.

- We recommend re-marking Barclay Downs Drive at the Proposed Access driveway with a southbound left turn lane with 75 feet of storage, a 100-foot bay taper, and a 200-foot through lane taper (this improvement should not require any roadway widening). This will ensure the movement of motorists without concern for those seeking to make a left turn into this driveway access.

- If a full movement access driveway is not allowed on Barclay Downs Drive, intersection u-turn improvements will be required on Morrison Boulevard. In general, u-turn movements add to intersection congestion and compromise safety for drivers and pedestrians:
  
  o The northwest corner of the intersection of Morrison Boulevard at Coca-Cola Plaza will need to be widened six feet and tapered for a length of 100 feet in order to safely perform eastbound u-turn movements for vehicles to enter the site via the access on Morrison Boulevard.

  o In order to perform westbound u-turn movements for exiting site vehicles on Morrison Boulevard at Barclay Downs Drive, the southeast corner of the intersection will need to be widened six feet and tapered for a length of 100 feet. Due to the existing mast arm traffic signal pole's location on this corner of the intersection, this roadway widening is not feasible.
It should be noted that with a full movement access driveway on Barclay Downs Drive, interconnectivity within the site will potentially reduce the number of westbound u-turns on Morrison Boulevard at Barclay Downs Drive (i.e. a left exiting movement from the site onto Barclay Downs Drive and a southbound left onto eastbound Morrison Boulevard).

- In addition to intersection improvements for vehicular traffic, we also recommend installing a crosswalk on the east leg of the intersection of Barclay Downs Drive and Morrison Boulevard/Carnegie Boulevard. Pedestrian signal heads and pushbuttons currently exist on all four legs of the intersection and crosswalks are present on the three remaining legs of the intersection.

**Conclusion:**

We concur with CDOT’s position that the proposed Woodfield South Park project will not negatively impact the adjacent roadways, based on the minimal increase in traffic expected to be generated from this multi-family development. The anticipated overall increase in the ADT volume on Barclay Downs Drive between Morrison Boulevard/Carnegie Boulevard and Sayre Road/Scofield Road using the general apartment daily volume is less than 6% (from 10,175 vpd to 10,800 vpd), which is minimal. In addition, the scheduled lane conversion improvement by CDOT, along with our left-turn lane improvement and pedestrian enhancements, will improve Barclay Downs Drive and mitigate the minor increase in traffic.

Please contact us should you need any additional information.

**Attachments:**
- Figure 1: Area of Influence Map
- RZ-2.0: Schematic Site Plan
- Figure 2: AM/PM Peak Vehicle Queue Lengths
- Figure 3: 2012 Existing Peak Hour/24-Hour ADT Volumes & Existing Laneage
- Figures 4a–4b: Directional Distribution
- Figures 5–7: 2012 Peak Mid-Rise Apts. Traffic Volumes Scenarios 1 thru 3
- Figures 8–10: 2012 Peak Apartments Traffic Volumes Scenarios 1 thru 3
- Figure 11: Recommended Improvements
- Crash Listings for the Two Study Intersections
- Existing Traffic Counts
- Synchro

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