City of Durham
Department of Transportation

February 15, 2010

Memorandum

To: Durham City-County Planning Department

From: Bill Judge, P.E., Transportation Engineer IV

Subject: Arringdon Mixed Use Development (Z0900015) Traffic Impact Analysis

The City-County Unified Development Ordinance requires that a Traffic Impact Analysis (TIA) be prepared for proposed developments estimated to generate 150 or more vehicle trips during the peak hour. The proposed Arringdon mixed-use development is located on the east side of Page Road north of Interstate 40 and south of Chin Page Road. The proposed development consists of the following proposed land uses:

- 355 additional multi-family units (320 existing, 675 total)
- A continuing care retirement community with 325 units
- 520,000 square feet of general office space
- 125,000 square feet of medical office space
- A 15,000 square foot pharmacy with drive-through lanes
- A bank with drive-through lanes
- Two high-turnover sit-down restaurants (7,500 square feet each)
- A 4,000 square foot fast-food restaurant with drive-through lanes
- A gasoline/service station with a c-store and twelve fueling positions

Kimley-Horn and Associates prepared a TIA report for the proposed development in August 2009 with an Addendum in January 2010. The TIA analyzed both the AM peak hour and the PM peak hour traffic volumes. The proposed development will generate 20,294 trips per day of which 1,781 trips will occur during the AM peak hour and 1,997 trips during the PM peak hour. The build-out year of the proposed development is expected to be 2014.

Study Area

The TIA analyzed nine (9) intersections in the vicinity of the proposed site. These intersections are:

<u>Signalized</u>

- Page Road and Slater Road
- Page Road and I-40 Eastbound Ramps / Emperor Boulevard
- Page Road and I-40 Westbound Ramps

Unsignalized

- Page Road and Full-Movement Driveway (Westleigh Drive) / Medical-Office Park Driveway
- Page Road and Arringdon Park Drive / Medical-Office Park Driveway
- Page Road and Right-in /Right-Out Site Driveway
- Page Road and Comstock Road
- Page Road and Chin Page Road
- Page Road and Pleasant Grove Church Road

Trip Generation

Site generated traffic for the proposed development was computed based on ITE's *Trip Generation Manual, 8th Edition, 2008.* The proposed uses will generate a total of 20,294 trips per day of which 1,781 trips will occur during the AM peak hour and 1,997 trips during the PM peak hour. Due to the mixed use nature of the project, some of these trips will be captured internally. Based on ITE guidelines related to internal capture for mixed use developments, the site trips were reduced by 9.0% for daily trips. In addition, the AM and PM peak hour trips were adjusted utilizing published ITE rates to account for pass-by trips.

The final adjusted external trips for the proposed site resulted in 18,468 daily trips, with 1,449 occurring during the AM peak hour and 1,517 occurring during the PM peak hour.

Trip Distribution

The assignment of site traffic on the study area roadway network was based on the following trip distributions:

- To/From the East via I-40: 30% of site trips
- To/From the West via I-40: 30% of site trips
- To/From the North via Page Road: 14% of site trips
- To/From the West via Chin Page Road: 7% of site trips
- To/From the South via Page Road: 3% of site trips
- To/From the West via Slater Road: 3% of site trips
- To/From existing developments on Page Road south of I-40: 3% of site trips
- To/From the South via Pleasant Grove Church Road: 2% of site trips
- To/From the East via Slater Road: 1% of site trips
- To/From adjacent approved developments along Page Road: 7% of site trips

Approved Developments

Approved developments are defined as approved or pending, but not yet constructed, projects within the vicinity of the subject project. There are six (6) approved developments adjacent to the site.

- Hamilton Merritt Development (Business Park located in the southwest quadrant of the Page Road-Chin Page Road intersection; consists of 89,250 square feet of office space, 19,000 square feet of high turn-over sit down restaurants, a 4,000 square feet of fast-food restaurant with drive-thru, a drive-in bank with 4 lanes, a gasoline station with 16 fueling positions and a convenience store.)
- Chin Page Road Development (Mixed use project located on the south side of Chin Page Road, west of Page Road; consists of 200,000 square feet of light industrial space, 107,500 square feet of office space, 70,000 square feet of specialty retail, a 5,000 square feet of high turnover restaurant, 5,000 square feet of day care, 205 single-family units, 288 apartments and 214 townhouses.)
- Chin Page – Page Road Assemblage (ALMO) (Mixed use project located in the northwest quadrant of Page Road and Chin Page Road; consists of 1,300 residential units, 500,000 square feet of office space and 150,000 square feet of shopping center.)
- Chin Page Office Park (Harris/Stroud Property) Development (Office development located on the north side of Chin Page Road, just west of Page Road; consists of 550,000 square feet of general office space).
- Page Road Office Park Development (Office Park located on the west side of Page Road directly opposite the proposed Arringdon Development; consists of 365,000 square feet of general office space and 280,000 square feet of medical office space.)
- Imperial Tower Hotel (proposed 207 room hotel located in the southeast quadrant of Page Road – Emperor Boulevard intersection.)

The TIA distributed the site traffic of these approved developments to the street network based on existing traffic volumes. No additional growth of background traffic was considered in the TIA. The TIA applied traffic reduction factors of 6.0% in the AM peak hour and 9.0% in the PM peak hour to only the approved and pending development traffic volumes to account for 'linked trips' between the closely spaced approved development projects.

TIP Roadway Improvements

The Wake-Durham Collector Street Plan has an unfunded project to realign the Pleasant Grove Church Road to intersect Page Road at Chin Page Road. This new alignment of Pleasant Grove Church Road was not assumed in the TIA analysis.

Traffic Impact Analysis

Capacity analyses were performed using Synchro 7.0 for the AM and PM peak hours for the following scenarios:

- Existing (2009) conditions
- No-Build (2015) conditions (2009 Existing + Approved Development Traffic + Committed Improvements)
- Build (2015) conditions (2015 No-Build + Site Traffic)
- Build with Additional Improvements (2015) conditions (2015 Build + additional proposed roadway improvements)

Page Road and Slater Road (Signalized)

The following table summarizes the LOS at this signalized intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (2009)	**B**	**C**
Future No-Build (2015)	**B**	**C**
Future Build (2015)	**B**	**C**

The intersection will operate at an acceptable LOS C or better with the proposed site traffic for Future Build (2015) Condition. No additional improvements are needed for this intersection.

Page Road and I-40 Eastbound Ramps / Emperor Boulevard (Signalized)

The following table summarizes the LOS at this signalized intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (2009)	**D**	**D**
Future No-Build (2015)	**D**	**F**
Future Build (2015)	**D**	**F**

The intersection currently operates at a LOS D in both peak hours. The TIA analysis assumed no committed or other improvements for this intersection. With the growth in traffic from approved developments, the intersection operation would decrease to a LOS F during the PM peak hour for the Future No-Build condition. With the proposed site traffic, the intersection would continue to operate at a LOS F during the PM peak hour for the Future Build condition.

To improve the LOS in the PM peak hour to a LOS D or better, the construction of an additional northbound left-turn lane on Page Road and/or westbound through lane on Emperor Boulevard is needed. However, the construction of these improvements are not feasible due to existing physical constraints related to interchange spacing along I-40 and current width of the I-40 bridge over Page Road, therefore the TIA did not recommend any improvements at this intersection.

Page Road and I-40 Westbound Ramps (Signalized)

The following table summarizes the LOS at this signalized intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (2009)	**C**	**A**
Future No-Build (2015)	**C**	**C**
Future Build (2015)	**C**	**C**

The intersection currently operates at a LOS C in the AM peak hour. Under the Future No-Build condition, the TIA assumed the completion of the following improvements committed by approved developments:

- Construction of a second eastbound left-turn lane with a minimum of 350 feet of storage on the off-ramp with a second northbound receiving (through) lane on Page Road. The second northbound through lane on Page Road shall be extended as a continuous lane from the I-40 Westbound Ramp to Comstock Road.
- Construction of a second northbound left-turn lane on Page Road to form dual left-turn lanes each with 150 feet of storage with adequate receiving lanes on the I-40 Westbound ramp.
- Construction of a second southbound right-turn lane on Page Road to form dual-right turn lanes each with 250 feet of storage with adequate receiving lanes on the I-40 Westbound ramp.

With these improvements, the intersection is expected to operate at an acceptable LOS C or better in both peak hours for the Future No-Build (2015) and Future Build (2015) conditions.

Page Road and Full-Movement Driveway (Westleigh Drive)/Medical-Office Park Driveway

The following table summarizes the LOS at this intersection for the Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Future No-Build (2015)	**A**	**B**
Future Build w/ Improvements (2015)	**C**	**D**

As a three-leg intersection, this location will operate at an acceptable LOS B or better under the Future No-Build condition with the completion of the following improvements committed by approved developments:

- Construction of a northbound left-turn lane on Page Road with a minimum of 350 feet of storage.
- Construction of a second northbound through lane on Page Road.
- Construction of a southbound right-turn lane on Page Road with a minimum of 100 feet of storage.
- Construction of a second southbound through lane on Page Road.
- Construction of the Medical-Office Park Site Driveway with one ingress and two egress lanes.
- Installation of a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).

To accommodate the additional site traffic the TIA recommended the following roadway improvements:

- Construction of a northbound right-turn lane on Page Road with a minimum of 200 feet of storage.
- Construction of a southbound left-turn lane on Page Road with a minimum of 150 feet of storage.
- Construction of an additional eastbound lane on the Medical-Office Park Driveway to provide three egress lanes. The three egress lanes must provide an exclusive left-turn lane with a

minimum of 300 feet of storage, an exclusive right-turn lane with a minimum of 200 feet of storage, and a shared through/right-turn lane.

- Construction of the Full-Movement Site Driveway (Westleigh Drive) to provide one ingress lanes and three egress lanes. The three westbound egress lanes must include two exclusive left-turn lanes (each with a minimum of 250 feet of storage) and a shared through/right-turn lane.

As a four-leg intersection with the additional site traffic and the improvements listed above, this location will operate at an acceptable LOS D or better for the Future Build condition.

Page Road and Arringdon Park Drive / Medical-Office Park Site Driveway

The following table summarizes the LOS at this intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (2009)	**C***	**B***
Future No-Build (2015)	**C**	**C**
Future Build (2015)	**C**	**D**

* Unsignalized operation, with LOS reported for the worst northbound approach on Arringdon Park Drive

This intersection was analyzed as an unsignalized three-leg intersection under the Existing condition. The Arringdon Park Drive approach of this intersection currently operates at a LOS C or better. Under the Future No-Build condition, the intersection is expected to operate at an acceptable LOS C or better with the following improvements committed by approved developments:

- Construction of a second southbound through lane on Page Road.
- Construction of dual northbound left-turn lanes on Page Road each with a minimum of 300 feet of storage.
- Construction of the Medical-Office Site Driveway with two ingress and two egress lanes. The egress lanes must provide an exclusive left-turn lane with a minimum of 300 feet of storage and a shared through/right-turn lane.
- Installation of a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).

To accommodate the additional site traffic the TIA recommended the following roadway improvements:

- Extend the existing southbound left-turn lane on Page Road to provide a minimum of 300 feet of storage.
- Construction of a northbound right-turn lane on Page Road with a minimum of 200 feet of storage.
- Restripe the westbound approach to Arringdon Park Drive to provide three egress lanes. The egress lanes must provide two exclusive left-turn lanes (each with a minimum of 250 feet of storage) and a shared through/right-turn lane.

With the additional site traffic and the improvements listed above, this location will operate at an acceptable LOS D or better for the Future Build condition.

Page Road and Right-in/Right-out Site Driveway

The following table summarizes the LOS at this intersection for the Future Build conditions.

Scenario	AM LOS	PM LOS
Future Build (2015)	**B***	**B***

* Unsignalized operation, with LOS reported for the worst westbound approach on the site driveway

The intersection was analyzed as an unsignalized intersection with a right-in/right-out only driveway configuration with the following improvement committed by approved developments:

- Construction of a second southbound through lane on Page Road.

To accommodate the additional site traffic the TIA recommended the following additional improvements at this intersection:

- Construction of a second northbound through lane on Page Road. This improvement will require the existing right-turn lane to be converted to a through lane with the construction of an additional northbound through lane between the right-in/right-out driveway and Comstock Road.
- Construction of a northbound right-turn lane on Page Road with a minimum of 100 feet of storage.
- Construction of the site driveway as a right-in/right-out access with one ingress and one egress lane.

With the additional site traffic and the improvements listed above, this location will operate at an acceptable LOS B or better for the Future Build condition.

Page Road and Comstock Road

The following table summarizes the LOS at this intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (2009)	**B***	**B***
Future No-Build (2015)	**F***	**F***
Future Build (2015)	**F***	**F***

* Unsignalized operation, with LOS reported for the worst westbound approach on Comstock Road

The westbound approach of Comstock Road currently operates at a LOS B during both the AM and PM peak hour. The intersection is expected to operate at a LOS F, with significant delays for westbound Comstock for the Future No-Build condition with the following improvement committed by approved developments:

- Construction of a second southbound through lane on Page Road.

To accommodate the additional site traffic the TIA recommended the following roadway improvements:

- Construction of a second northbound lane on Page Road. This additional lane would provide a continuous second northbound lane from the I-40 Westbound Ramp intersection and would terminate at the Comstock Road intersection as a right-turn lane.
- Construction of a southbound left-turn lane on Page Road with a minimum of 250 feet of storage.

With the additional site traffic and the improvements listed above, this location will operate at a LOS F for the Future Build (2015) condition. Although a LOS F is undesirable at signalized intersections, a LOS F is typical at many unsignalized intersections and driveways during the peak hours as nearly all of the anticipated delay is confined to the side street approach.

The long term plans for this area call for Comstock Road to be realigned to the north with development on the parcel located on the northeast corner of this intersection. The realigned Comstock Road would intersect Page Road approximately 420 feet to the north to align with Crown Parkway to form a continuous Collector Street in this area as identified on the Wake-Durham Collector Street Plan. Given the long-term goal of a realigned Comstock Road in this area, a traffic signal for this existing intersection is not appropriate. No additional roadway improvements were proposed or required at this intersection.

Page Road and Chin Page Road

The following table summarizes the LOS at this intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (20079)	**B***	**C***
Future No-Build (2015)	**C**	**C**
Future Build (2015)	**C**	**C**

* Unsignalized operation, with LOS reported for the worst eastbound approach on Chin Page Road

The intersection currently operates at a LOS C or better as an unsignalized intersection. Under the Future No-Build condition, the intersection is expected to operate at an acceptable LOS C or better with the following improvements committed by approved developments:

- Construction of a second northbound through lane on Page Road.
- Construction of a second southbound through lane on Page Road.
- Construction of a southbound right-turn lane on Page Road with a minimum of 150 feet of storage.
- Construction of dual eastbound left-turn lanes on Chin Page Road each with a minimum of 250 feet of storage.
- Extension of the existing eastbound right-turn lane on Chin Page Road to provide a minimum of 400 feet of storage.
- Extension of the existing northbound left-turn lane on Page Road to provide a minimum of 450 feet of storage.
- Installation of a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).

With these improvements and the additional traffic generated by the proposed site and the other approved developments, the intersection will remain at an acceptable LOS C for both peak hours. No additional improvements are required.

Page Road and Pleasant Grove Church Road (Unsignalized)

The following table summarizes the LOS at this intersection for the Existing, Future No-Build and Future Build conditions.

Scenario	AM LOS	PM LOS
Existing (20079)	**B* (EB)**	**F* (EB)**
Future No-Build (2015)	**F* (WB)**	**F* (WB)**
Future Build (2015)	**F* (WB)**	**F* (WB)**

* Unsignalized operation, with LOS reported for the worst approach

The intersection currently operates at a LOS F during the PM peak as an unsignalized intersection. With the current intersection configuration the north/south movement between Page Road and Pleasant Grove Church Road has the right-of-way, with the eastbound approach of Page Road under stop-control. Under the Future No-Build condition, the intersection is expected to operate at a LOS F with the following improvements committed by approved developments:

- Realignment of the intersection to make Page Road the continuous movement. With this new configuration the existing northbound approach of Pleasant Grove Road will become the westbound approach under stop control.
- Construction of a second lane on the westbound approach of Pleasant Grove Church Road to provide exclusive left-turn and right-turn lanes with a minimum of 250 feet of storage.
- Construction of a second northbound lane on Page Road. This additional lane would provide a continuous second northbound lane from the Chin Page Road intersection and would terminate at the realigned Pleasant Grove Church intersection as a right-turn lane.
- Construction of a southbound left-turn lane on Page Road with a minimum of 150 feet of storage.

With the additional site traffic and the improvements listed above, this location will operate at a LOS F for the Future Build (2015) condition. Although a LOS F is undesirable at signalized intersections, a LOS F is typical at many unsignalized intersections and driveways during the peak hours until such time as a traffic signal is warranted as nearly all of the anticipated delay is confined to the side street approach.

To address potential safety and operation concerns at this intersection the following additional improvement which is currently committed to by other developments must also be required with this development:

- Installation of a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).

Summary of TIA Required Improvements

Page Road

1. Widen Page Road between Comstock Road and the I-40 Westbound ramp to provide a four-lane divided cross-section.

Page Road and I-40 Westbound Ramps

1. Extend the existing southbound right-turn lane on Page Road to provide adequate storage and appropriate taper.
2. Construct a second southbound right turn lane on Page Road with adequate storage and taper.
3. Construction a second westbound left-turn lane on the I-40 Westbound off-ramp.
4. Extend the second northbound departure lane on Page Road to Comstock Road to receive dual left-turn lanes.
5. Extend the second southbound through lane on Page Road to Comstock Road.

Page Road and Full Movement Driveway (Westleigh Drive) / Medical-Office Park Driveway

1. Construct a southbound left-turn lane on Page Road with adequate storage and appropriate tapers.
2. Construct a second southbound through lane on Page Road.
3. Construct a second northbound through lane on Page Road.
4. Construct a northbound right-turn lane on Page Road with adequate storage and taper.
5. Installation of a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).
6. Construct an additional eastbound lane on the Medical-Office Park Driveway to provide three egress lanes. The three egress lanes must provide an exclusive left-turn lane with adequate storage, an exclusive right-turn lane with adequate storage, and a shared through/right-turn lane.
7. Construct the Full-Movement Site Driveway (Westleigh Drive) to provide one ingress lanes and three egress lanes with adequate storage and tapers. The three westbound egress lanes must include two exclusive left-turn lanes and a shared through/right-turn lane. Provide adequate internal channelization.

Page Road and Arringdon Park Drive / Medical-Office Park Driveway

1. Construct a second southbound through lane on Page Road.
2. Install a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).
3. Extend the existing southbound left-turn lane on Page Road to provide adequate storage with appropriate tapers.
4. Construct a northbound right-turn lane on Page Road with adequate storage and tapers.
5. Restripe the westbound approach on Arringdon Park Drive to provide three egress lanes with adequate storage and tapers. The egress lanes must provide two exclusive left-turn lanes and a shared through/right-turn lane. Provide adequate internal channelization.

Page Road and Right-in/Right-out Site Driveway

1. Construct a second southbound through lane on Page Road.
2. Construct a second northbound through lane on Page Road. This improvement will require the existing right-turn lane to be converted to a through lane with the construction of an additional northbound through lane between the right-in/right-out driveway and Comstock Road.
3. Construct a northbound right-turn lane on Page Road with adequate storage and tapers.
4. Construct the site driveway as a right-in/right-out access with one ingress and one egress lane. Provide adequate internal channelization.

Page Road and Comstock Road

1. Construct a second southbound through lane on Page Road.
2. Construct a second northbound lane on Page Road. This additional lane will provide a continuous second northbound lane from the I-40 Westbound Ramp intersection terminating at Comstock Road as a right-turn lane.
3. Construct a southbound left-turn lane on Page Road with adequate storage and appropriate tapers.

Summary of improvements required of other developments that may be required of this development

Page Road and I-40 Westbound Ramps

1. Construct a second northbound left-turn lane on Page Road with adequate storage and taper.
2. Construct a second westbound receiving lane with adequate storage and taper for the I-40 Westbound on-ramp.

Page Road and Chin Page Road

1. Construct a second northbound through lane on Page Road. This lane must provide a continuous second northbound lane to the intersection of Pleasant Grove Church Road where it will terminate as a northbound right-turn lane.
2. Construction of a second southbound through lane on Page Road.
3. Construct a southbound right-turn lane on Page Road with adequate storage and taper.
4. Construct dual eastbound left-turn lanes on Chin Page Road each with adequate storage and appropriate tapers.
5. Extend the existing eastbound right-turn lane on Chin Page Road with adequate storage with appropriate taper.
6. Extend the existing northbound left-turn lane on Page Road with adequate storage with appropriate tapers.
7. Install a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).

Page Road and Pleasant Grove Church Road

1. Realign the intersection to make Page Road the continuous movement.
2. Construct a second lane on the westbound approach of Pleasant Grove Church Road to provide exclusive left-turn and right-turn lanes with adequate storage and appropriate tapers.
3. Construct a second northbound lane on Page Road. This additional lane will provide a continuous second northbound lane from the Chin Page Road intersection terminating at the realigned Pleasant Grove Church intersection as a right-turn lane.
4. Construct a southbound left-turn lane on Page Road with adequate storage and appropriate tapers.
5. Install a traffic signal with steel poles and mast arms (subject to MUTCD warrants and approval by NCDOT).