Transportation Impact Analysis for the Carolina North Development

SUBMITTED TO
TOWN OF CHAPEL HILL, NORTH CAROLINA

SUBMITTED BY
Vanasse Hangen Brustlin, Inc.

MAY 1, 2009

Carolina North Plan
Early to Mid Stage

Map showing the Carolina North Plan with various roads and landmarks.
# Table of Contents

1 **Introduction** ................................................................................................................. 1-1  
1.1 Project Overview and Study Methodology ................................................................. 1-3  
1.2 Site Location ............................................................................................................. 1-5  
1.3 Description of Site .................................................................................................. 1-5  
1.4 Development Program ......................................................................................... 1-7  
1.5 Existing and Committed Transportation Network ............................................... 1-10  

2 **Existing Conditions** .................................................................................................. 2-1  
2.1 Existing Traffic Conditions ..................................................................................... 2-1  
2.2 Existing Transit Conditions ................................................................................... 2-39  
2.3 Existing Pedestrian Conditions ............................................................................ 2-55  
2.4 Existing Bicycle Conditions ................................................................................ 2-67  
2.5 Transportation Demand Management .................................................................. 2-76  

3 **Future Conditions without Proposed Development** ............................................. 3-1  
3.1 Methodology .......................................................................................................... 3-1  
3.2 Estimation of Background Growth ....................................................................... 3-2  
3.3 Anticipated Roadway and Intersection Improvements ........................................ 3-5  
3.4 No-Build Volumes ................................................................................................. 3-9  
3.5 Intersection Operations Analysis .......................................................................... 3-28  
3.6 Roadway Segment Analysis ................................................................................. 3-42  
3.7 Transit ................................................................................................................... 3-45  

4 **Project Impacts** .......................................................................................................... 4-1  
4.1 Carolina North Development Program (2015 & 2025) ........................................ 4-2  
4.2 Preliminary Evaluation of the Carolina North Site Plan ....................................... 4-5  
4.3 Trip Generation ..................................................................................................... 4-10  
4.4 Trip Distribution .................................................................................................. 4-16  
4.5 Project Trip Assignments and Build Scenario Peak Hour Volumes ................. 4-24  
4.6 Future Build Intersection Operations Analysis .................................................. 4-43  
4.7 Transit Impacts .................................................................................................. 4-53  
4.8 Parking Supply Sensitivity Analysis .................................................................... 4-58  

5 **Mitigation Measures** .................................................................................................. 5-1  
5.1 Traffic Mitigation ................................................................................................. 5-2  
5.2 Potential Traffic Calming .................................................................................... 5-29
5.3 Transit Mitigation .............................................................................................. 5-35
5.4 Pedestrian Facility Mitigation ........................................................................... 5-38
5.5 Bicycle Facility Mitigation ............................................................................... 5-41

6 Greenhouse Gas Emissions ............................................................................. 6-1
6.1 Mesoscale Analysis ......................................................................................... 6-1
6.2 Greenhouse Gas Analysis ................................................................................ 6-9
6.3 Conclusion ....................................................................................................... 6-12
## List of Figures

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1-1: Preliminary Study Area</td>
<td>1-6</td>
</tr>
<tr>
<td>Figure 1-2: 2025 (TIA Phase 2) Carolina North Program</td>
<td>1-9</td>
</tr>
<tr>
<td>Figure 1-3: Anticipated and Committed Transportation Improvements</td>
<td>1-15</td>
</tr>
<tr>
<td>Figure 2-1: Existing (2009), Phase One (2015), and Phase Two (2025) Study Area Intersections</td>
<td>2-7</td>
</tr>
<tr>
<td>Figure 2-2: Lane Usage (Quadrant 1)</td>
<td>2-9</td>
</tr>
<tr>
<td>Figure 2-3: Lane Usage (Quadrant 2)</td>
<td>2-10</td>
</tr>
<tr>
<td>Figure 2-4: Lane Usage (Quadrant 3)</td>
<td>2-11</td>
</tr>
<tr>
<td>Figure 2-5: Existing (2009) AM Peak Hour Traffic Volumes (Quadrant 1)</td>
<td>2-12</td>
</tr>
<tr>
<td>Figure 2-6: Existing (2009) AM Peak Hour Traffic Volumes (Quadrant 2)</td>
<td>2-13</td>
</tr>
<tr>
<td>Figure 2-7: Existing (2009) AM Peak Hour Traffic Volumes (Quadrant 3)</td>
<td>2-14</td>
</tr>
<tr>
<td>Figure 2-8: Existing (2009) Midday Peak Hour Traffic Volumes (Quadrant 1)</td>
<td>2-15</td>
</tr>
<tr>
<td>Figure 2-9: Existing (2009) Midday Peak Hour Traffic Volumes (Quadrant 2)</td>
<td>2-16</td>
</tr>
<tr>
<td>Figure 2-10: Existing (2009) Midday Peak Hour Traffic Volumes (Quadrant 3)</td>
<td>2-17</td>
</tr>
<tr>
<td>Figure 2-11: Existing (2009) PM Peak Hour Traffic Volumes (Quadrant 1)</td>
<td>2-18</td>
</tr>
<tr>
<td>Figure 2-12: Existing (2009) PM Peak Hour Traffic Volumes (Quadrant 2)</td>
<td>2-19</td>
</tr>
<tr>
<td>Figure 2-13: Existing (2009) PM Peak Hour Traffic Volumes (Quadrant 3)</td>
<td>2-20</td>
</tr>
<tr>
<td>Figure 2-14: 2009 Existing Level of Service</td>
<td>2-24</td>
</tr>
<tr>
<td>Figure 2-15: Chapel Hill Transit Annual Ridership FY 1997 to FY 2008</td>
<td>2-39</td>
</tr>
<tr>
<td>Figure 2-16: Typical Weekday Ridership Patterns for Chapel Hill Transit Routes</td>
<td>2-40</td>
</tr>
<tr>
<td>Figure 2-17: Chapel Hill Transit Weekday Routes</td>
<td>2-41</td>
</tr>
<tr>
<td>Figure 2-18: Chapel Hill Transit Saturday Routes</td>
<td>2-42</td>
</tr>
<tr>
<td>Figure 2-19: Chapel Hill Transit Sunday Routes</td>
<td>2-43</td>
</tr>
<tr>
<td>Figure 2-20: ¼ Mile Service Coverage of Chapel Hill Transit Fixed Routes</td>
<td>2-44</td>
</tr>
<tr>
<td>Figure 2-21: Existing Park and Ride Locations</td>
<td>2-46</td>
</tr>
<tr>
<td>Figure 2-22: Triangle Transit Weekday Service</td>
<td>2-48</td>
</tr>
<tr>
<td>Figure 2-23: Chapel Hill Transit Weekday Routes that Serve Carolina North</td>
<td>2-50</td>
</tr>
<tr>
<td>Figure 2-24: Existing Pedestrian Facilities</td>
<td>2-56</td>
</tr>
<tr>
<td>Figure 2-25: Example of a Non-Existing Sidewalk on Martin Luther King, Jr. Blvd</td>
<td>2-57</td>
</tr>
<tr>
<td>Figure 2-26: Example of Discontinuous Sidewalk at Martin Luther King, Jr. Blvd &amp; Critz Dr</td>
<td>2-57</td>
</tr>
<tr>
<td>Figure 2-27: Pedestrian Crossing Warning in Advance of Shadowood Apartments</td>
<td>2-59</td>
</tr>
<tr>
<td>Figure 2-28: Estes Dr Ext West of Martin Luther King, Jr. Blvd</td>
<td>2-60</td>
</tr>
<tr>
<td>Figure 2-29: Paved Walkway Along North Estes Dr. East of Martin Luther King, Jr. Blvd</td>
<td>2-60</td>
</tr>
<tr>
<td>Figure 2-30: Pedestrian Signal at N Estes Dr. and Martin Luther King, Jr. Blvd</td>
<td>2-61</td>
</tr>
<tr>
<td>Figure 2-31: Pedestrian Warning Sign at Old Forest Creek Dr and Piney Mountain Rd</td>
<td>2-62</td>
</tr>
<tr>
<td>Figure 2-32: Illustration of Multiple-Threat Scenario</td>
<td>2-65</td>
</tr>
<tr>
<td>Figure 2-33: Warning Sign Prior to Intersection of Martin Luther King, Jr. Blvd and Estes Dr</td>
<td>2-68</td>
</tr>
<tr>
<td>Figure 2-34: Existing Bicycle Network</td>
<td>2-69</td>
</tr>
<tr>
<td>Figure 2-35: Shared Lane Pavement Markings along Martin Luther King, Jr. Blvd South of Estes</td>
<td>2-70</td>
</tr>
<tr>
<td>Figure 2-36: Pedestrian and Bicycle Crashes 1998-2002</td>
<td>2-74</td>
</tr>
<tr>
<td>Figure 3-1: Site Specific Background Project Locations</td>
<td>3-4</td>
</tr>
<tr>
<td>Figure 3-2: Anticipated and Committed Transportation Improvements</td>
<td>3-8</td>
</tr>
<tr>
<td>Figure 3-3: 2015 (TIA Phase 1) AM Peak Hour No Build Traffic Volumes (Quadrant 1)</td>
<td>3-10</td>
</tr>
<tr>
<td>Figure 3-4: 2015 (TIA Phase 1) AM Peak Hour No Build Traffic Volumes (Quadrant 2)</td>
<td>3-11</td>
</tr>
<tr>
<td>Figure 3-5: 2015 (TIA Phase 1) AM Peak Hour No Build Traffic Volumes (Quadrant 3)</td>
<td>3-12</td>
</tr>
</tbody>
</table>
Table No. | Page
--- | ---
Table 1-1: 2015 (TIA Phase 1) Carolina North Development Program | 1-7
Table 1-2: 2025 (TIA Phase 2) Carolina North Development Program | 1-8
Table 2-1: Study Area Intersections by Scenario | 2-3
Table 2-2: 2009 Existing Intersection Levels of Service (#1 to #6) | 2-25
Table 2-3: 2009 Existing Intersection Levels of Service (#7 to #12) | 2-26
Table 2-4: 2009 Existing Intersection Levels of Service (#13 to #18) | 2-27
Table 2-5: 2009 Existing Intersection Levels of Service (#19 to #24) | 2-28
Table 2-6: 2009 Existing Intersection Levels of Service (#25 to #30) | 2-29
Table 2-7: 2009 Existing Intersection Levels of Service (#31 to #36) | 2-30
Table 2-8: 2009 Existing Intersection Levels of Service (#37 to #41) | 2-31
Table 2-9: 2009 Existing Intersection Levels of Service (#42 to #45) | 2-32
Table 2-10: 2009 Existing Intersection Levels of Service (#46 to #48) | 2-33
Table 2-11: 2009 Existing Intersection Levels of Service (#49 to #52) | 2-34
Table 2-12: Threshold Capacities by Roadway Classification | 2-35
Table 2-13: 2009 Existing Roadway Segment Capacity Analysis | 2-36
Table 2-14: Crash Data Summary from September 2004 to August 2007 | 2-37
Table 2-15: Park-and-Ride Capacity and Utilization | 2-45
Table 2-16: Existing Weekday Transit Service at Carolina North Site | 2-49
Table 2-17: Current Ridership Patterns on CHT Routes Serving Carolina North Site | 2-51
Table 2-18: Current Ridership on CHT Routes Serving Carolina North Site | 2-52
Table 2-19: Existing Peak Direction Available Capacity to Carolina North | 2-53
Table 2-20: Existing Peak Direction Available Capacity from Carolina North Site | 2-54
Table 2-21: Summary of Pedestrian Counts | 2-64
Table 2-22: Summary of Bicycle Counts | 2-72
Table 3-1: 2015 (TIA Phase 1) No Build Intersection Levels of Service (#1 to #12) | 3-31
Table 3-2: 2015 (TIA Phase 1) No Build Intersection Levels of Service (#13 to #37) | 3-32
Table 3-3: 2015 (TIA Phase 1) No Build Intersection Levels of Service (#42 and #43) | 3-33
Table 3-4: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #1-#8) | 3-34
Table 3-5: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #8-#15) | 3-35
Table 3-6: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #15-#23) | 3-36
Table 3-7: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #24-#32) | 3-37
Table 3-8: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #33-#43) | 3-38
Table 3-9: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #44-#48) | 3-39
Table 3-10: 2025 (TIA Phase 2) No Build Intersection Levels of Service (Intersections #49-#52) | 3-40
Table 3-11: 2015 (TIA Phase 1) No-Build Roadway Segments Capacity | 3-43
Table 3-12: 2025 (TIA Phase 2) No-Build Roadway Segments Capacity | 3-44
Table 3-13: 2015 (TIA Phase 1) No Build Peak Direction Available Capacity to Carolina North | 3-48
Table 3-14: 2015 (TIA Phase 1) No Build Peak Direction Available Capacity from Carolina North | 3-49
Table 3-15: 2025 (TIA Phase 1) No Build Peak Direction Available Capacity to Carolina North | 3-50
Table 3-16: 2025 (TIA Phase 1) No Build Peak Direction Available Capacity from Carolina North | 3-51
Table 4-1: 2015 (TIA Phase 1) Carolina North Development Program | 4-2
Table 4-2: 2025 (TIA Phase 2) Carolina North Development Program | 4-3
Table 4-3: Parking Generation Rates | 4-11
Table 4-4: Mode Share | 4-12
Table 4-5: 2015 (TIA Phase 1) Development Program Trip Generation .................................................. 4-13
Table 4-6: 2025 (TIA Phase 2) Development Program Trip Generation ........................................ 4-14
Table 4-7: 2015 (TIA Phase 1) & 2025 (TIA Phase 2) Development Program Trip Generation (Midday) .................................................................................................................................................. 4-15
Table 4-8: Difference between Actual and Model Predicted Travel Times (min) through Gateway 4. 4-17
Table 4-9: Actual Travel Times to/from Carolina North (min) through Gateway 4 ........................ 4-17
Table 4-10 Gateway Distribution ........................................................................................................ 4-18
Table 4-11: Site Generated Trips Originating Inside Study Area versus Outside Study Area ............. 4-18
Table 4-12: 2015 (TIA Phase 1) Build and Build with Mitigation Intersection LOS Comparison........ 4-45
Table 4-13: 2015 (TIA Phase 1) Build without Mitigation Roadway Segment Capacity Analysis .... 4-46
Table 4-14: 2025 (TIA Phase 2) Build and Build with Mitigation Intersection LOS Comparison 4-49
Table 4-15: 2025 (TIA Phase 2) Build and Build with Mitigation Intersection LOS Comparison 4-50
Table 4-16: 2025 (TIA Phase 2) Build Roadway Segment Capacity Analysis ................................... 4-51
Table 4-17: 2015 (TIA Phase 1) Build Peak Direction Available Capacity to Carolina North ............ 4-54
Table 4-18: 2015 (TIA Phase 1) Build Peak Direction Available Capacity from Carolina North ........ 4-54
Table 4-19: 2025 (TIA Phase 1) Build Peak Direction Available Capacity to Carolina North ........... 4-56
Table 4-20: 2025 (TIA Phase 1) Build Peak Direction Available Capacity from Carolina North ........ 4-56
Table 4-21: 2025 (TIA Phase 2) Build Peak Direction Available Capacity to Carolina North .......... 4-56
Table 4-22: Park-and-Ride Space Needs for Carolina North ............................................................ 4-57
Table 4-23: 2015 (TIA Phase 1) Parking Sensitivity Scenarios .......................................................... 4-58
Table 4-24: Change in Transit Passenger Trips for 2015 (TIA Phase 1) Early Phase Parking Scenario 4-60
Table 4-25: Change in Transit Passenger Trips for 2015 (TIA Phase 1) Constrained Parking (-10%) Scenario ............................................................................................................................................. 4-60
Table 4-26: Phase 1 Parking Sensitivity Scenarios ............................................................................. 4-61
Table 4-27: 2025 (TIA Phase 2) Parking Sensitivity Scenarios .......................................................... 4-63
Table 4-28: Change in Transit Passenger Trips for 2025 (TIA Phase 2) Constrained Parking (-10%) Scenario ............................................................................................................................................. 4-64
Table 4-29: Change in Transit Passenger Trips for 2025 (TIA Phase 2) Constrained Parking (-20%) Scenario ............................................................................................................................................. 4-64
Table 4-30: Phase 2 Parking Sensitivity Scenarios ............................................................................. 4-65
Table 5-1: 2015 (TIA Phase 1) Level of Service Summary AM Peak Hour (Intersections #1 to #8) .... 5-7
Table 5-2: 2015 (TIA Phase 1) Level of Service Summary AM Peak Hour (Intersections #9 to #27) .... 5-8
Table 5-3: 2015 (TIA Phase 1) Level of Service Summary AM Peak Hour (Intersections #32 to #43) .... 5-9
Table 5-4: 2015 (TIA Phase 1) Level of Service Summary PM Peak Hour (Intersections #1 to #8) ....... 5-10
Table 5-5: 2015 (TIA Phase 1) Level of Service Summary PM Peak Hour (Intersections #9 to #31) ....... 5-11
Table 5-6: 2015 (TIA Phase 1) Level of Service Summary PM Peak Hour (Intersections #32 to #43) ....... 5-12
Table 5-7: 2025 (TIA Phase 2) Level of Service Summary AM Peak Hour (Intersections #1 to #8) ....... 5-13
Table 5-8: 2025 (TIA Phase 2) Level of Service Summary AM Peak Hour (Intersections #9 to #15) ....... 5-14
Table 5-9: 2025 (TIA Phase 2) Level of Service Summary AM Peak Hour (Intersections #16 to #24) ...... 5-15
Table 5-10: 2025 (TIA Phase 2) Level of Service Summary AM Peak Hour (Intersections #25 to #33) .... 5-16
Table 5-11: 2025 (TIA Phase 2) Level of Service Summary AM Peak Hour (Intersections #35 to #44) .... 5-17
Table 5-12: 2025 (TIA Phase 2) Level of Service Summary AM Peak Hour (Intersections #45 to #50) .... 5-18