Heart of the Triad
The Land Use and Transportation Plan
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**INTRODUCTION**

This volume combines the activities of the charrette, the plan refinement process, the Interactive Value Assessment (IVA) and the preferred alternative. Implementation recommendations are found in Volume 3. This volume is the core of the entire project - which direction will the region go.

The Heart of the Triad is truly at a crossroads. Regionalism is in its infancy, and the Piedmont Authority for Regional Transportation (PART) is one of a few regional entities. While there can be concerns that regional efforts may diminish local prerogatives, the Triad must also recognize it is in competition with other regions within the state, as well as beyond state boundaries. The Triad is in a fierce competitive challenge from the Triangle and the greater Charlotte region. An overly sensitive view of “local” regionalism can place the Triad, and the Heart of the Triad, in a secondary competitive position.

HOT’s greatest challenge is not whether every land use is right, or that there is exact agreement on potential employment levels – and these are important issues – but the real issue is: Will HOT choose to act in a unified, concerted effort to find ways to share in a vision and opportunities that go beyond what a single jurisdiction can do? Can you make the “Sum of the whole GREATER than the parts?”

The “Business as Usual Future” is not compelling – it is a future with no purpose or unique sense of place. Without joint action, a future of low density residential urban sprawl and large areas of lower wage warehousing is inevitable. Communities will aimlessly blend into one another with no particular rhyme or reason.

So, what is the purpose of the HOT planning process, and what are its prospects of achieving success? HOT planning is about:

- Taking a hard look at the future if no action is taken
- Protecting local economic development initiatives
- Challenging local governments to look beyond their singular interests
- Exploring means of joint action that can be beneficial to each community
- Proposing new ways to develop HOT – new ways to live, work, shop, and play
- Pushing the region out of its “comfort zone” to consider different implementation tools
- Underscoring the economic benefits of regional action when compared to “no action”

You are identified as “The Triad” – this is a Region. It represents at least a kernel of an idea that can take root and grow. HOT does represent a challenge, but it is not a threat.

The plan’s ideal is quite simple… **Something for EACH, Something for ALL.** The plan can be a success, if the elected officials and decision-makers will

- Seize this truth
- Come together to endorse a common plan
- Adopt enabling planning and implementation tools
- Jointly pursue unique, specialized economic development initiatives
- Embark on a coordinated implementation program

Then the future will look very different – a **future that is intentional, not accidental.** Now is the time for the Triad to act its size and take the actions necessary to propel it into the next phase of development.

**THE DESIGN CHARRETTE**

**INTRODUCTION**

Between April 3 and April 7, 2006, the Steering Committee, the Technical Committee, and the HOT community joined the design team for a dynamic charrette. The purpose of the charrette is to concentrate and activate the key players to help define a vision and alternative plans for fulfilling the vision. The week combined technical sessions with a variety of public and specific
group sessions. Every possible group was invited to attend and participate. A key event was a “hands-on” planning session held mid-week. During this session, citizens developed their own ideas for how HOT should develop. Many of the ideas were incorporated by the design team into the planning concepts. The charrette schedule is as follows.

Figure 1 - Design Charrette Schedule

There were seven principal results from the charrette:

- Specific Group Summary
- The Vision, Goals, and Objectives
- Economic Development Strategies
- Concept Plan Principles
- Concept Plan Land Use Elements
- Four Alternative Concepts
- Concept Plan Refinements

SPECIFIC GROUP SUMMARY

One of the aims of the charrette was to understand the issues from the perspective of a broad range of constituencies. To that end, there were multiple specific group sessions during the first two days. Specific groups met in interactive workshop settings to discuss issue, concerns, and opportunities. In all, there were 10 groups that were processed:

- Elected Officials and Managers
- Economic Development Advisory Committee and Chambers of Commerce
- Education – Public, Private, Local School Boards, Higher Education, Vocational Education
- Planning Boards
- State ad Local DOT Directors
- Utility and Infrastructure Providers
- Environmental Groups
- Piedmont Triad Aviation Authority
- Property Owners
- Developers

Because of the diversity of the groups, and the wide ranging interest levels, there was no attempt to rationalize or merge issues across the various categories of interest. Rather, the summary recognizes the essential summaries from each of the groups. The following represents that summary.

- There Was Uniform Agreement the Time Was Right
- Growth is Imminent and Happening
- Every Group Understood the Need for Cooperation and Coordination
- Joint Service Delivery was essential
- The Idea Had to Be BIGGER Than What One Jurisdiction Could Do Alone
- Elected Officials Are Interested in the Details – What do you gain? What do you lose?
VISION, GOALS AND OBJECTIVES

Plan making depends on the direction the Steering Committee desires to take HOT. A Vision – the “big idea” or desired result for HOT is critical. Then, a set of defining goals and target objectives begin giving content and detail to the Vision.

THE VISION

Building on the themes of natural assets, regional pride, new development approaches, exciting economic development initiatives, public and private cooperation, and a sustainable future, the Committee’s vision statement is:

Working Together to Envision and Create HOT as One Great Memorable Place...

- Defined by its Natural Assets
- Dedicated to Celebrate its Regional traditions
- Designed for Active Ways to Live, Learn, Work, Play and Move
- Driven by Continuous Knowledge-based Innovation
- Delivered by Political Commitment and Private Investment
- Destined for Sustainable Economic and Community Development

Due to the complexity of dealing with two counties and four cities, yet with a desire and intent to create One Great Memorable Place that benefits for all involved, the “New HOT Math” emerged - 2 + 4 = 1. Additionally, instead of trying to identify a single unifying economic development strategy, the expanded size of HOT drove the emphasis to The Power of Place. In essence, if the Place became the emphasis, it can accommodate many different approaches and strategies within the land use and transportation framework.

GOALS AND OBJECTIVES

The intent of the Goals and Objectives is to actualize the Vision. Goals translate the essential Vision elements into directional actions, supported by specific actions. Following are the seven Goals and the implementing Actions.

GOAL I

Enhance and incorporate environmental features into place-making

Actions
- Protect HOT’s natural resources as an essential element of the plan
- Manage stormwater runoff for property protection and enhanced water quality
- Provide habitat and greenway corridors as form-giving plan features
- Promote active and passive recreation areas
- Maintain and conserve HOT’s viable and desired agricultural resources
- Encourage Eco/Agri-tourism

GOAL II

Bring Regional Attractions and Institutions as Focal Features

Actions
- Consider HOT as location for future public assembly and specialty facilities that transcend any single community
- Evaluate such facilities and events as
  - A Heritage Museum – Furniture, Textiles, Tobacco and Railroad
  - The relocated Wyndham Championship Golf Tournament
  - A “HOT Monument” at the 40s Triangle

GOAL III

Conceptualize, plan and develop HOT as a place that offers a full range of development opportunities

Actions
- Develop new land use typologies that offer different mixes of use, scale and character
Land Use/Transportation Plan

- Promote diversity in housing and employment opportunities
- Use civic and cultural facilities, such as performing arts centers, amphitheaters, and central sports district as focal points
- Emphasize life long learning opportunities by providing a higher education center
- Provide area for employment districts and centers to accommodate a variety of economic development initiatives

Develop a True Multi-modal Transportation System that Distinguishes HOT

**Actions**
- Develop a roadway hierarchy that reinforces and supports the natural and built environments
- Actively pursue the completion of the PART commuter rail program as an integral transportation investment
- Add a new commuter rail station between the NC 68 and Kernersville stations
- Harness transit’s place making power around the new commuter rail station
- Consider the use of the streetcar in well-defined urban districts
- Incorporate bus and shuttle technologies for internal circulation
- Include a pedestrian and bicycle system as an integral mobility feature

Target and Recruit Internet Technology, Research & Development, Health Care, Knowledge-based Industries, and Specialized Manufacturing Facilities

**Actions**
- Develop focused, coordinated recruitment and attraction strategies that target both domestic and international users
- Stimulate international partnerships with China and India for an

Intellectual Asset Center

- Focus on high salary, high employment per square foot users
- Identify specialized manufacturing facilities that support local research and development efforts
- Constantly monitor technology advances and changes
- “HOT Wire and HOT Link” the area as a competitive incentive and advantage
- Incorporate retirement as an economic development component, focusing on high discretionary income retirees

Develop cooperative organizational approaches to maintain and advocate the vision

**Actions**
- Have all jurisdictions adopt the HOT recommendations, including Comprehensive Plan proposals
- Designate a “Vision Steward” to maintain HOT’s momentum
- Appoint a HOT Advisory Council to ensure intergovernmental collaboration
- Establish a coordinated HOT marketing program that is economic development oriented and private sector driven
- Develop public/private partnerships as a means to achieve success
- Evaluate creative revenue sharing and incentive programs
- Develop a set of legislative initiatives for General Assembly action

Develop Sustainability Approaches and Standards

**Actions**
- Focus on a broad-based, healthy economic development strategy for all income levels
- Develop high salary primary jobs that spin-off quality secondary jobs
- Incubate growth industries
ECONOMIC DEVELOPMENT IDEAS

With the recent dramatic losses in manufacturing jobs – tobacco, textiles and furniture – a concerted, multi-directional economic development strategy is necessary for HOT to be a success. As discussed earlier, and reflected in the Goals and Objectives, HOT should not depend or attempt to identify a single economic development type. The global and technological advances are so rapid that today’s “winner” is tomorrow’s “loser”. At that end, HOT’s long term success is based on the Place, not a single technology niche. Rather, a creative set of land use typologies can accommodate a variety of related, yet distinct, economic development initiatives. This approach gives priority to the power of place to accept multiple initiatives. That said, given the area’s transportation assets – highways, railroads and airport – warehousing and distribution is HOT’s natural economic development attraction. However, these industry types do not deliver the job level the community desires. Therefore, HOT must consider short- and long-term economic development ideas. Working through a consensus process, the Steering Committee selected six possible directions. Again, more than strategy one can and should be actively pursued.

Strategy I - The Recreational Capital of the Carolinas

The intent of this initiative is to take advantage of HOT’s abundant natural resource base and the country’s growing interest in health and wellness. This strategy combines with health care and retirement strategies, as an example of how strategies can integrate. Elements of this strategy are:

- Network of outdoor recreational opportunities
- Hunting and fishing
- Tournaments
- Sports medicine, holistic health and communicative arts
- Specialty recreational retail – Bass Pro Shop
- Bicycle highways and regional greenways

Strategy II - Professional/Amateur Athletics

This strategy advances the recreational ideas from the previous, but with a more specific approach to organized sports, both amateur and professional level. To pursue a vision for amateur athletic venues, there are opportunities to collaborate with local school boards, private institutions, and colleges and universities. The athletic facilities could attract facilities for east coast high school and related competitions. The Greensboro PGA golf event (Wyndham Championship) is tied to its ability to be a regional draw, leveraging the entire Triad market. Therefore, an opportunity may exist to build a world-class golf venue in HOT that could host that PGA event. The professional sports focus is Major League Soccer, and a new stadium can anchor a sports and entertainment complex, as part of a town center. The stadium is of the size to attract NCAA championships. With a special tax district, Amendment 1 financing, and perhaps a special hotel occupancy tax, dedicated sources could generate sufficient funds to build the soccer stadium.

Strategy III - Collaborative International ‘Intellectual Asset’ Center

A third scenario is a national or international center that could anchor the development of a specialized intellectual asset in the Triad. This could involve a federal earmark or a state investment (for example, the NC Biotechnology Center, MCNC, the National Institute of Statistical Sciences, the National Humanities Center, or EPA laboratory. An international partnership with India or China would be an opportunity to explore. For example, the Indian Institute of Technology (IIT) campuses are among the world’s leading technology centers. One idea is to develop a campus for IIT in HOT to allow their engineers/technologists to study/work in the Triad. Research and Development collaboration is possible with Wake Forest, UNCG, NC A&T, Winston-Salem State, High Point University, and other Triad universities. The Research Triangle Park just opened the North Carolina China Center near RDU, and HOT could develop a world-class institutional partnership with IT and India in the Triad.

Similarly, some form of collaborative effort among the various local universities and medical facilities can be the nucleus for a high-end employment center. The first benefit for the Triad is that the universities and/or medical institutions
work together on a joint project. Then, this center can serve as the nucleus for a mixed-use activity center with enough open space to have the feel of a campus setting that gives the area a sense of “place. Under any scenario, combined state and federal facilities, a technology center, a conference center and related facilities can provide a powerful economic development focus.

**Strategy IV- Retirement Lifestyle Community**

Retirement is a viable economic development strategy, because today’s retirees desire an active lifestyle. Retiring “Baby Boomers” bring high disposable incomes, a longer life span, an interest in continuing education, as well as community involvement. This strategy is an excellent match with the recreation, education and sports strategies. New opportunities such as expanded equestrian activities, including polo cannot be discounted. At least one championship golf course accompanies this strategy.

Because this age group also is interested in travel, a “Resort” Town Center can be an attraction. In this special town center can be conference areas, lodges, retail, food and entertainment services. An unique addition is multi-family housing set up as timeshare units. These can be owned by local residents and “traded” for timeshare units in other locations.

Fully developed, walkable residential communities can focus on the town center, and they will include an interesting array of neighborhood and community type shops.

**Strategy V - Agri-Business and Tourism**

Agriculture is a significant part of the area’s history. While tobacco growing is all but finished, there are prime agricultural lands that can still be utilized for farming purposes. Fields lying fallow could convert to other types of agricultural and tourism purposes. Ideas such as heritage farming, organic farming, and urban farming can meet emerging interest in “healthy foods”.

Tourism can pair with related agricultural endeavors. Eco-tourism and agri-tourism can represent other economic development opportunities. A heritage farm/museum and lodging can be combined. Potential may exist for more vineyards and wineries, adding further tourism interest.

The area must address the future of agriculture in the Triad, because a growing number of properties are coming under development pressure. Current land use and land development regulations do not protect the agricultural areas. The only available tool is a Voluntary Agricultural District, available under North Carolina’s state law.

**Strategy VI - Specialized Industry and Manufacturing**

This strategy corresponds to the region’s industrial history but with a contemporary expression. While the Triad and HOT will see growth in warehousing and distribution facilities, this strategy aims at more specialized manufacturing and industry. These endeavors support the area’s current R&D initiatives.

The industry clusters include large-scale biotech manufacturing, nano-manufacturing, medical diagnostic testing, customized furniture design and manufacturing, back-office financial services, printing and packaging, and the processing and packaging of local organic farm products.
**CONCEPT PRINCIPLES**

Prior to developing the plan concepts that reflect the Vision, Goals and Objectives — and that can accommodate the potential economic development strategies — an understanding of the planning principles is important. These are fundamental tenets.

- **Change is Happening Now** — There is apparent local concern that this plan will create “future problems”. That is not the case. Change is not in some distant future. If anything, the area may be late. Vacant lands and fallow lands are converting daily to subdivisions, industrial areas and other commercial enterprises. Action is required now before the future is lost.

- **Maintain Natural Systems** — The area’s abundant natural features are enhanced and are integral to the sustainable design process. These features are part of the final design, because they provide air quality benefits, protect habitat, and offer “natural” amenities. They can help define HOT’s basic community structure, providing demarcation between natural and built areas.

- **New Development Forms Take Pressure Off Systems and Roads** — By avoiding sprawling development in favor of clustered patterns, efficient service delivery systems are possible. Concentrated development can mean fewer auto trips, and transit, pedestrian and bicycles are equal partners in the mobility equation. The “trip not taken” is a fundamental principle — that is, the intent is to have development forms and patterns that do not require an auto trip. Some other form of travel occurs instead.

- **Agriculture is a Legacy Land Use** — Traditional residential categories permit agricultural uses as long as the landowner uses the lands for productive farming and agricultural purposes.

- **Residential Can Support “Conservation”** — The large residential areas will retain natural features as part of the planning and development process. Land development regulation provisions will be included for site clearance and tree protection, erosion control, stream buffers, development clustering and related provisions.

**THE PLAN CONCEPTS**

The Plan Concepts are the culmination of the Charrette. Four separate land use and transportation concepts resulted from the various public and planning team processes. The environmental systems set the basic structure for the planning effort. Based on the Goals and Objectives, market findings, and economic development strategies, a set of mixed-use typologies emerged.

**LAND USE TYPOLOGIES**

The typologies ranged from the un-built to the most intensely developed. There are ten typologies, beginning with open space and parks, and culminating with sports and entertainment venues.
Land Use/Transportation Plan

Critical Open Space

**Elements**
- Serve to foster as the unique sense of place that makes up the community’s character
- These include:
  - Waterways
  - Wetlands
  - Environmentally sensitive habitats
  - Agricultural lands
- Link system components and facilitate cycling, hiking and horseback riding

Regional Park

**Elements**
- Minimum 100 acres
- Regionally orientated open space serves two or more municipalities.
- Extremely specialized
- Half or full-day excursions
- Active and passive recreation
- Easy access to population density
- Hike, bike, and pedestrian linkages

Town Center

**Elements**
- 150 acres
- Mixed-use environment
- “Hub” of community
- Critical mass
- Integrating office, retail, lodging and civic spaces
- Proper scale and pace of buildings, street widths and grids
- Leisure time component
- Authentic public spaces
- Multi-family 40 Du/Acre, Single family 8 Du/Acre

Village Center

**Elements**
- 40 acres
- Mixed-use environment – less intense then town center
- Mix of residential, office, retail, lodging and civic spaces
- “Hub” of neighborhoods
- Pedestrian scale and pace, of buildings, street widths and grids
- Central feature
- Authentic public spaces
- Multi-family 40 Du/Acre, Single family 8 Du/Acre
### Traditional Neighborhood
- **Elements**
  - Follows the traditional prototype of suburban development
  - Primarily single family residential
  - Small scale supporting uses - office, retail and public
  - Average density 5 units per acre

### Urban Neighborhood
- **Elements**
  - Mixed-use environment
  - Based on traditional town planning principles
  - Integrates residential, office, retail, limited lodging and public spaces
  - Average density 8 units per acre

### Employment District
- **Elements**
  - Generally low intensity employment district
  - 500 acres
  - Mixture of: - Warehousing - Light industrial - R&D
  - Mixed vertically and/or horizontally
- **Supporting uses:**
  - Office
  - Retail
  - Service
  - Restaurants

### Employment Center
- **Elements**
  - 100 acres
  - High intensity employment center
  - Significant user may include:
    - Research/Development
    - Light manufacturing/assembly
    - Office
  - Character of a business park but more integrated uses
- **Mixed vertically and/or horizontally**
- **Supporting Uses**
  - Retail
  - Services
  - Multi-Family Housing
  - Lodging
  - Restaurants
Retail/Entertainment Destination

**Elements**
- 200 acres
- Mixed use destination with integrated design
- Emphasize indoor/outdoor relationships
- Sale of merchandise, goods, and commodities
- Destinations may include:
  - Regional mall
  - Lifestyle Center
  - Power Center
  - Hotels
  - Restaurants
  - Entertainment Venues
  - Multi-family Residential

Sports Venues/Destination

**Elements**
- 25 acres
- Located in a town center setting in conjunction with mixed use development and other activities
- Civic presence and scale
- Shares infrastructure and services with surrounding uses
- Preferably at high capacity roadways or transit lines.
LAND USE CONCEPTS

Four land use and transportation plan concepts emerged from the five-day Charrette process. While all four plans employed the ten typologies, each took a different direction or emphasis.

Concept A – The features of Concept A are:
- Natural systems are maintained, and the center of the area is in open space, agriculture or residential. The northeast corner remains lower density residential and open space.
- There are three primary development areas:
  - The northeast corner, just east of the I-40 and Business 40 split, has a major concentration of uses, including an employment district, and anchored by a town center and major sports venue. This concentration is on the proposed commuter rail line, and a new station would be located here.
  - The second concentration lies along NC 66, and the general orientation is toward village and town centers, with employment centers.
  - The third concentration clusters around the Dell facility, including an employment district.
- Regional parks are associated with each concentration
- The largest areas of traditional residential development are in the center of the area.
- The road system is a “bent” grid and addresses the concentrations of uses and attempts to avoid large natural areas. The road network does not have true direct north/south movement.
Concept B – The features of Concept B are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows as a watershed/conservation area. The current Colfax community adds a village center.
- There are four principal development areas:
  - The I-40/Business 40 triangle shows as a major employment district.
  - The second concentration lies along NC 66, corresponding to the Kernersville Metro Activity Center.
  - The third concentration is around the Dell facility, but it greatly expands with the addition of a town center and retail/entertainment destination at I-40, and a regional park.
  - The fourth is a linear concentration along Sandy Ridge Road/Squire Davis Road. A series of three village centers follows these roads, punctuated by urban residential neighborhoods and employment centers.
- Regional parks are associated with each concentration.
- The largest areas of traditional residential development are in the center of the area.
- The road system is a modified grid network, with good north/south and east/west movement.

Figure 3 - Concept B
Concept C – The features of Concept C are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows as open space, reflecting watershed/conservation.
- This concept has the most dispersed development pattern. The principal development areas area are:
  - Except for natural systems, the entire area north of Business 40 is an employment district.
  - The I-40/Business 40 triangle shows as a mix of retail/entertainment, employment center and urban neighborhoods.
  - An east/west concentration is more in the center of the area, and it acts a major activity center – town center, sports venue, employment centers, and urban residential - along NC 66 and to the east.
  - A concentration is around the Dell facility is similar to Concept B. The area greatly expands with the addition of a town center and retail/entertainment destination at I-40, and a regional park.
  - There is a linear concentration along Sandy Ridge Road/Squire Davis Road. A series of two village centers follows these roads, punctuated by employment centers.
- Regional parks are associated with each concentration.
- The largest areas of traditional residential development are north and south of the central activity center.
- The road system is curvilinear in nature, principally serving the central concentration of uses. The north/south roads tend to be more local serving than regional serving.

Figure 4 - Concept C
Concept D – The Steering Committee asked for this Concept, and its features are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows as traditional residential and open space.
- This concept has six discrete development concentrations. The principal development areas area are:
  - The northeast corner, just east of the I-40 and Business 40 split, has a major concentration of uses, including an employment district, and anchored by a town center and major sports venue. This concentration is on the proposed commuter rail line, and a new station would be located here.
  - The I-40/Business 40 triangle shows as employment district, with the town center at NC 66 and I-40.
  - An employment district expands around the Dell facility, with an associated town center and urban residential areas.
  - Two separate clusters, one on Sandy Ridge Road and the other on Squire Davis Road, show more concentration. The two village centers have employment centers and the higher density urban residential neighborhoods.
- Regional parks are associated with each concentration
- The largest areas of open space, agriculture and traditional residential development follow the new road that connects US 311 to I-40.
- The road system is curvilinear in nature, principally serving the central concentration of uses. The north/south roads tend to be more local serving than regional serving.
CONCEPT PLAN REFINEMENT

After the Charrette, the Planning Team reviewed the overall population and employment potential for the eight county MSA to develop a baseline for comparing the concepts. Additionally, the four concepts were consolidated into three, consistent with the Steering Committee’s direction. Using GIS, each of the three concepts was analyzed to determine its:

- Land use tabulations
- Population estimates
- Employment estimates
- Transportation effects
- Comparative summaries

BASELINE FOR COMPARISON

With the tabulations and calculations completed, a baseline of comparison was necessary. Based on the 25-year regional growth, HOT’s natural share of the regional total of the future population is amounts to an additional 85,000 residents and 40,000 employees over 2002. For residential, the natural growth equates to more than 18,000 residential acres and more than 3,000 non-residential acres. This natural growth, in essence, could fill the entire study with just the residential demand. Worse yet, the residential density to accomplish this “filling-in” of HOT is based on 2.5 units per acre; current development densities in HOT are likely even less than 2.5. The non-residential uses are warehousing and distribution uses, and they do not yield many employees per acre. Simply stated, without taking action, HOT will be conventional suburban sprawl with large areas of warehouses.

These factors – 85,000 residents, 40,000 employees, 18,000 acres residential and 3,000 acres non-residential – form the baseline for comparing the three alternative concepts.

CONSOLIDATION OF CONCEPTS

At the direction of the Steering Committee, the Planning Team reduced the four concepts into three. This was accomplished by combining Concepts A and B into the new Concept “I”.

THE FINAL CONCEPTS

For clarity and simplicity, the final concepts were renamed Concepts I, II, and III. Concept I is the consolidation of the original Concepts A and B; Concept II is original concept C; and Concept III is original concept D. The features are repeated, accompanied by the final conceptual land use maps.
Concept I – The features of Concept I are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows traditional residential and open space.

- There are five principal development areas:
  - The northeast corner, just east of the I-40 and Business 40 split, has a major concentration of uses, including an employment district, and anchored by a town center and major sports venue. This concentration is on the proposed commuter rail line, and a new station would be located here. This is the same as the original Concept A.
  - The I-40/Business 40 triangle shows an employment district, with the traditional residential neighborhoods, a regional park and a retail/entertainment district.
  - NC 66 and a proposed north/south major road create a natural development “corridor” toward the center of the area. The larger scaled pattern give a strong sense of place to the center of HOT. A town center, regional park, employment centers, retail/entertainment destination and urban neighborhoods provide a clear focus.
  - The fourth concentration is around the Dell facility, but it is greatly expands with the addition of a town center and retail/entertainment destination at I-40. This is similar to original Concept B.
  - There are two development areas along Sandy Ridge Road/Squire Davis road. Each has a village center facing the road, accented by urban residential neighborhoods and employment centers. This is similar to the pattern in original Concept B.

- Regional parks are associated with each concentration.
- The largest areas of agriculture, open space, and traditional residential development are east and west of the new HOT “center”.
- The road system is a modified grid network, with good north/south and east/west movement. The road network is similar to original Concept B.

The land use distribution (in acres) for concept is:

<table>
<thead>
<tr>
<th>Land Uses</th>
<th>Concept I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town Center</td>
<td>634</td>
</tr>
<tr>
<td>Village Center</td>
<td>162</td>
</tr>
<tr>
<td>Traditional Neighborhood</td>
<td>5,959</td>
</tr>
<tr>
<td>Urban Neighborhood</td>
<td>2,469</td>
</tr>
<tr>
<td>Employment District</td>
<td>961</td>
</tr>
<tr>
<td>Employment Center</td>
<td>1,108</td>
</tr>
<tr>
<td>Retail/Entertainment</td>
<td>726</td>
</tr>
<tr>
<td>Sports Venue</td>
<td>64</td>
</tr>
<tr>
<td>Open Space</td>
<td>6,082</td>
</tr>
<tr>
<td>Total</td>
<td>18,164</td>
</tr>
</tbody>
</table>

Land Use Mix

Figure 6 - Concept I

Figure 7 - Concept I
Land Use/Transportation Plan

Concept II – The features of Concept II are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows as open space, reflecting watershed/conservation.
- This concept has the most dispersed development pattern. The principal development areas are:
  - Except for natural systems, the entire area north of Business 40 is an employment district.
  - The I-40/Business 40 triangle shows as a mix of retail/entertainment, employment center and urban neighborhoods.
  - An east/west concentration is more in the center of the area, and it acts a major activity center – town center, sports venue, employment centers, and urban residential - along NC 66 and to the east.
  - A concentration is around the Dell facility is similar to Concept B. The area greatly expands with the addition of a town center and retail/entertainment destination at I-40, and a regional park.
  - But urban residential and a town center characterize this concept.
  - There is a linear concentration along Sandy Ridge Road/Squire Davis Road. A series of two village centers follows these roads, punctuated by employment centers.
- Regional parks are associated with each concentration.
- The largest areas of traditional residential development are north and south of the central activity center.
- The road system is curvilinear in nature, principally serving the central concentration of uses. The north/south roads tend to be more local serving than regional serving.

The land use distribution (in acres) for concept II is:

<table>
<thead>
<tr>
<th>Land Uses</th>
<th>Concept II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town Center</td>
<td>306</td>
</tr>
<tr>
<td>Village Center</td>
<td>293</td>
</tr>
<tr>
<td>Traditional Neighborhood</td>
<td>5,009</td>
</tr>
<tr>
<td>Urban Neighborhood</td>
<td>2,462</td>
</tr>
<tr>
<td>Employment District</td>
<td>2,010</td>
</tr>
<tr>
<td>Employment Center</td>
<td>769</td>
</tr>
<tr>
<td>Retail/Entertainment</td>
<td>251</td>
</tr>
<tr>
<td>Sports Venue</td>
<td>48</td>
</tr>
<tr>
<td>Open Space</td>
<td>7,017</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18,164</strong></td>
</tr>
</tbody>
</table>

Figure 8- Concept II Land Use Mix

![Figure 9 - Concept II](image_url)
Concept III – The features of Concept III are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows as traditional residential and open space.
- This concept has six discrete development concentrations. The principal development areas are:
  - The northeast corner, just east of the I-40 and Business 40 split, has a major concentration of uses, including an employment district, and anchored by a town center and major sports venue. This concentration is on the proposed commuter rail line, and a new station would be located here.
  - The I-40/Business 40 triangle shows as employment district, with the town center at NC 66 and I-40.
  - An employment district expands around the Dell facility, with an associated town center and urban residential areas.
  - Two separate clusters, one on Sandy Ridge Road and the other on Squire Davis Road, show more concentration. The two village centers have employment centers and the higher density urban residential neighborhoods.
- Regional parks are associated with each concentration
- The largest areas of open space, agriculture and traditional residential development follow the new road that connects US 311 to I-40.
- The road system is curvilinear in nature, principally serving the central concentration of uses. The north/south roads tend to be more local serving than regional serving.

The land use distribution (in acres) for concept III is:

<table>
<thead>
<tr>
<th>Land Uses</th>
<th>Concept III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town Center</td>
<td>423</td>
</tr>
<tr>
<td>Village Center</td>
<td>321</td>
</tr>
<tr>
<td>Traditional Neighborhood</td>
<td>5,497</td>
</tr>
<tr>
<td>Urban Neighborhood</td>
<td>2,233</td>
</tr>
<tr>
<td>Employment District</td>
<td>1,729</td>
</tr>
<tr>
<td>Employment Center</td>
<td>1,034</td>
</tr>
<tr>
<td>Retail/Entertainment</td>
<td>304</td>
</tr>
<tr>
<td>Sports Venue</td>
<td>38</td>
</tr>
<tr>
<td>Open Space</td>
<td>6,585</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18,164</strong></td>
</tr>
</tbody>
</table>

Figure 10- Concept III Land Use Mix

Figure 11- Concept III
CONCEPT COMPARISONS

The reason for Concept comparisons is to see how each performs against the baseline and against the others. Additionally, information from the Concepts became part of the enhanced transportation analysis via PART's new travel demand model. Following are calculations and estimates for each of the concepts – land use tabulations, population estimates, employment estimates, and transportation effects.

<table>
<thead>
<tr>
<th></th>
<th>Concept I</th>
<th>Concept II</th>
<th>Concept III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>123,000</td>
<td>110,000</td>
<td>139,000</td>
</tr>
<tr>
<td><strong>Housing Units</strong></td>
<td>47,000</td>
<td>42,000</td>
<td>54,000</td>
</tr>
<tr>
<td>Single-Family</td>
<td>15,000</td>
<td>13,000</td>
<td>18,000</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>32,000</td>
<td>29,000</td>
<td>36,000</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td>135,000</td>
<td>126,000</td>
<td>143,000</td>
</tr>
<tr>
<td>Office</td>
<td>45,000</td>
<td>46,000</td>
<td>52,000</td>
</tr>
<tr>
<td>Retail</td>
<td>45,000</td>
<td>31,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Hwy Retail</td>
<td>15,000</td>
<td>10,000</td>
<td>13,000</td>
</tr>
<tr>
<td>Service</td>
<td>15,000</td>
<td>10,000</td>
<td>13,000</td>
</tr>
<tr>
<td>Industrial</td>
<td>14,000</td>
<td>29,000</td>
<td>26,000</td>
</tr>
<tr>
<td><strong>Traffic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Trips</td>
<td>697,000</td>
<td>593,000</td>
<td>740,000</td>
</tr>
<tr>
<td>Internal Capture Rate</td>
<td>50.0%</td>
<td>47.4%</td>
<td>47.0%</td>
</tr>
<tr>
<td>Employment/Population</td>
<td>1.10</td>
<td>1.15</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Concept I, II, III

Comparison of Concepts - Following is a comparison of the concepts, citing the highest and lowest for each of the principal categories.

- **Population**
  - Concept II lowest at 110,000
  - Concept III highest at 139,000

- **Total employment**
  - Concept II lowest at 126,000
  - Concept III highest at 143,000

- **Office employment**
  - Concept I lowest at 45,000 employees
  - Concept III highest at 52,000 employees

- **Industrial/warehouse employment**
  - Concept I lowest at 14,000
  - Concept II highest at 29,000

- **Single Family Residential**
  - Concept II lowest at 13,000 units
  - Concept III highest at 18,000 units

- **Multi-family Residential**
  - Concept II lowest at 29,000 units
  - Concept III highest at 36,000 units

- **Open Space**
  - Concept I lowest at 34%
  - Concept II highest at 39%

Traffic Implications – Likewise, there are results from a preliminary traffic analysis performed after the Charrette. One of the primary goals was to consider total trips (magnitude of effects), internal capture (less impacts on the external network), and the population/employment ratios (the relationships between where people live and work). From the highest and lowest, the implications are:

- **Total traffic levels**
  - Concept II lowest at 750,000 trips
  - Concept III highest at 900,000 trips
• **Internal capture rates**
  - Concept III lowest at 47%
  - Concept I highest at 50%

• **Employment/Population ratio**
  - Concept III lowest at 1.03
  - Concept II highest at 1.15

**SUMMARY OF CONCEPTS**

A summary of the final concepts shows the relative differences between the three.

**Concept I**
- Highest population, highest office employment, lowest industrial employment
- Shortest trips
- Lowest total open space

**Concept II**
- Lowest population, lowest total employment, lowest office employment, greatest imbalance between population & employment
- Lowest traffic
- Highest total open space

**Concept III**
- Highest total employment, highest industrial employment, and least imbalance between population & jobs
- Highest traffic and longest trips

**TRANSPORTATION ANALYSIS**

**INTRODUCTION**

The purpose of the Transportation Analysis was to determine the relative strengths and weaknesses of the three Land Use Plan concepts regarding the levels of congestion that might result from the development scenarios. For the first level of analysis, the road regional travel demand model network was only modified to reflect roadway proposals developed during the charrette for the three concepts. That meant that the supporting road network, especially the local roads, were not changed, and in most cases these were two lane roads in the model. Even with a large internal capture rate and enhanced transit and non-traditional travel modes, there was every expectation that some levels of congestion would occur, given the tremendous difference in land use, population, and employment found in the new concepts versus the lower rates in the model itself.

For those reasons, the Transportation Analysis features two separate morel runs – the original model network and an enhanced model network that added more four lane local roads, a more diverse transit system, and an enhanced bicycle/pedestrian network. As found later in the chapter, a new set of roadway types (consistent with NCDOT criteria), oriented to the Land Use Plan concepts, provides a well-integrated approach to vehicular circulation and land use.

**THE ANALYSIS APPROACH**

Each development concept required a corresponding transportation plan. These transportation networks were then subjected to analysis through the regional travel demand model.

The travel demand model originally assumed a limited level of development would occur between now and 2035. Only 30,705 people were projected to live in the study area, and only 15,724 jobs were projected to be located in the study area. The majority of the roads remained as two-lane rural highways. The exception to this is the addition of the planned Airport Connector Freeway transversing the northern portion of the study area. This new highway is planned to have two connections to I-40 – one a northerly extension of Sandy Ridge Road, and the second a new limited-access roadway diagonally north from the I-40 / Business 40 split.

This planned roadway system was modified to closely replicate the diagrammatic roadways from the development concepts. The roadway locations were not precise owing to the constraints of the model, but fairly replicated the conceptual plans.

The travel demand model as it existed in August 2006 provided the best analysis tool for estimating the effects of the development on the area’s transportation system. While this model has not been officially endorsed by the region’s Metropolitan Planning Organizations, it does represent the best assumptions of the region’s officials.
The model, in common with all travel demand models, does have some limitations. It does not model all roadways in an area, only the major ones; the underlying analysis zones are large; it reflects travel habits in place at the time of its calibration; and it has difficulty estimating short trips, especially walk and bicycle trips. As a result, congestion levels will be overstated since the model assumes most people for most trips travel by car on the major roadways. Transit ridership does not reflect any changes in the mindset that makes transit more acceptable to residents, nor are more walk/bike trips made reflecting the more attractive walk environment and shorter trip distances.

**INITIAL SYSTEM DESCRIPTION**

For all development concepts, no roadway widenings were included in the initial plan over any planned widenings in the baseline. This approach was taken in order to determine the effect of the development concept on the area’s roads.

The planned transit network in the baseline conditions was limited in the study area due to the low density of development. While some routes traveled non-stop through the area, the only routes directly serving the study area were three shuttle routes – only along Union Cross to Dell, one along NC 66 north of I-40, and one along the northern portions of Sandy Ridge. For the development concepts, four additional routes were added to these planned shuttles. The bus routes varied based upon the underlying roadway network, but were similar in design. All development concepts included the addition of a Colfax Rail Station on the planned regional rail service now going through the New Starts process. The bus routes operated on the same frequency as the rail service – 20 minutes during peak times and 30 minutes during the off-peak.

**Concept I Transportation Network**

The graphics below illustrate the changes in the roadway and transit networks that were analyzed in the travel demand model. Five roadway modifications were made primarily to add additional north/south roadway capacity. The limited-access connector roads to the Airport Connector Freeway were deleted from the model in keeping with the development concept that preserved this area as open space and farmland.

Four additional transit routes were modeled – one from the Kernelsville station to the Dell plant, one from the Kernelsville station south along NC 66, one from the new Colfax station to the Dell plan, one from the new Colfax station south along North Carolina 66, and the fourth from the Airport station south along Sandy Ridge.

Additional information on the transportation modeling changes can be found in the separate Technical Analysis of Future Scenarios document.
Concept II Transportation Network

The Concept II transportation network is shown in the next set of graphics. One of the requests that came out of the development process was to analyze the effect of a highway within the study area. A county-line highway from I-85 south to the Airport Connector has been proposed by area organizations. This facility is tested in Concept II. Besides the highway facility, the roadway network proposed for Concept II and III are similar, and testing the effect of a highway provides some relative comparison of its effect on traffic levels. Concept II includes the limited-access roadway from the I-40 split to the Airport Connector as part of the new highway, but deletes the limited-access roadway from Sandy Ridge north, in keeping with the development concept.

The transit network modeled in this concept is the same as Concept I, with the exception that the route from the Colfax station operates limited stop along the new highway. The other three routes remain the same.
Concept III Transportation Network

The Concept III transportation network is shown in the next set of graphics. New roadways in Concept III include additional north/south and east/west roadways. As with Concept I, the limited-access roadways between I-40 and the Airport Connector have been deleted. The transit network is the same as the other two concepts, with the exception that the Colfax station route operates on the new local street network to Dell.

Figure 17- Highway Baseline/Concept III

Figure 18- Transit Baseline/Concept III
RESULTS

The following table summarizes the key findings of the travel demand analysis. Total trip making in the study area increases 350% to 480%, depending upon the concept. This is an enormous increase in trip making, reflecting the three- to four-fold increases in population and employment called for by the development concepts.

However, because of how the development was allocated, the effects on congestion are dramatically lower. The percentage of trips occurring in congested conditions only increases by 21% to 75%, depending upon the concept and how congestion is measured. The majority of the increased trip making was accommodated by the plans without occurring in congested conditions.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline</th>
<th>Concept I</th>
<th>Concept II</th>
<th>Concept III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total daily trips</td>
<td>127,000</td>
<td>697,000</td>
<td>593,000</td>
<td>740,000</td>
</tr>
<tr>
<td>% of congested miles traveled</td>
<td>5.7%</td>
<td>7.7%</td>
<td>6.9%</td>
<td>7.8%</td>
</tr>
<tr>
<td>% of congested hours traveled</td>
<td>8.3%</td>
<td>13.1%</td>
<td>11.0%</td>
<td>14.5%</td>
</tr>
<tr>
<td>Amount &amp; % non-motorized trips</td>
<td>4,000 (3.1%)</td>
<td>24,000 (3.5%)</td>
<td>18,000 (3.1%)</td>
<td>25,000 (3.3%)</td>
</tr>
<tr>
<td>Transit boardings &amp; percent</td>
<td>1,000 (0.05%)</td>
<td>2,400 (0.10%)</td>
<td>2,000 (0.11%)</td>
<td>2,100 (0.08%)</td>
</tr>
</tbody>
</table>

As expected, non-auto trips are very low in all concepts, reflecting the limitations of the model. Actual use of these modes would be higher, leading to lower congested levels. Despite this limitation, the comparison among the concepts fairly shows the relative results. Concept I showed the highest percent of non-motorized trips, while Concept II showed the highest percentage of transit trips, although Concept I had the highest absolute number of transit trips. Concept II had the lowest levels of congestion, but also the lowest percentage of non-motorized trips. Concept III had the highest levels of congestion and the lowest percentage of transit trips.

The maps following graphically illustrate the level of congestion. Shown are the volume-to-capacity ratios for each roadway segment during the evening travel hours (4-7 PM). While the amount of segments in red in the development concepts is significant, most segments have less than a 2.00 ratio. Since most roadways are two-lane rural highways, doubling the roadway width to four lanes would eliminate most congested conditions.

Baseline

Figure 20- PM Volume to Capacity Ratio
As illustrated, Concept II has the least number of roadway segments that operate at congested levels. This result is due partially from the lower level of development in Concept I, and from the addition of a freeway.

Several conclusions were drawn from these results:
- The addition of a freeway lowered congestion levels
- Widening most roadways to four lanes would eliminate most congestion
- Transit usage was low, reflecting the modest levels of transit service
- Concept III did the poorest job at diverting travelers out of their cars
- Concept I did the best job overall of diverting travelers from their cars

MODIFIED SYSTEM DESCRIPTION

Based upon the above conclusions, a modified transportation network was modeled. This modified network combined elements of the transportation system from Concept II with the development levels of Concept I to try and capture the best elements of each. Given its overall poorer performance, Concept III was not considered further. The modified network was developed in consultation between the Consultant and PART and was modeled by PART staff.
For the modified concept, the development levels remained the same as in Concept I, both for the overall population and employment, and how it was allocated throughout the study area. The limited-access roadway from Concept II was added, with modifications to its alignment to bring it more in line with the MPOs’ proposed north/south freeway. Instead of a freeway, however, a “parkway” was modeled. The parkway is a limited access facility, but has a lower speed limit. Access is also permitted in the denser portions of the study area. All two-lane roadway segments that were congested in Concept I were widened to four-lane roadways. The map below shows the new roadway segments that were added to the network.

More transit service was added to the modified concept to increase the attractiveness of this alternate mode. One additional bus route was added to the model (for a total of five routes in the study area) and the frequency of service was increased. Routes were relocated to travel more through the middle of the Traffic Analysis Zones (TAZ) to minimize the walk distance, and the routes were more focused on the more dense areas. The map below shows the revised routes in comparison with the TAZs and their density of development.

Figure 24- Modified Highway Network

Figure 25- Modified Transit Network
**Results**

The resulting traffic congestion levels are shown in the map below. The number of congested segments significantly declined, with more areas showing free-flow conditions.

With these modifications, the percentage of travel in congested conditions declined. The total percentage of vehicle miles traveled in congested conditions declined to 6.8%, while the percentage of vehicle hours traveled in congested conditions declined to 9.9%. Similarly, the percentage of total transit boardings increased to 0.33%, still quite low reflecting the limitations of the model, but more than triple the previous percentages. [Refer to Figure 19 for the comparable percentages for the other concepts.]

**Figure 26- Modified Volume to Capacity Ratio**

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**The IVA Cost/Benefit Process**

**INTRODUCTION**

One of the most exciting and groundbreaking aspects of the HOT project was the application of the Interactive Value Assessment (IVA) as a means of testing the cost/benefit results of comparing each of the Concepts against a baseline. The IVA gives the Steering Committee a clear look into the future – it depicts THE ECONOMIC COST OF ACTION VERSUS NO ACTION.

If HOT elects to choose “hope”, not action, as its strategy, things will NOT change from “business as usual”.

The IVA can help identify a preferred land use and transportation plan. The IVA process is a unique analysis tool for evaluating the economic value of the plans. IVA’s role is to help the Steering Committee to make informed decisions regarding the preferred plan. Working closely with the Committees, IVA sessions were held to select the preferred alternative by evaluating the anticipated land uses. IVA combines the rigor of evidence-based Cost-Benefit Analyses with state-of-the-art tools of risk analysis, and visually interactive stakeholder facilitation.

IVA process compared the alternative plans in “real-time”, using a disciplined approach and risk analytic framework for making decisions under uncertainty and risk. The process involved using the Technical Committee as the “experts”, since they have worked on HOT for over two years. The intent of the IVA process is to provide risk analysis for the alternative plans. Risk analysis helps avoid the lack of perspective in “high” and “low” cases by measuring the probability that an outcome will materialize. This is accomplished by attaching ranges (probability distributions) to the forecasts of each input variable. For HOT, 160 variables were included in the IVA. The approach allowed all inputs to be varied simultaneously within their distributions. The approach recognizes the interrelationships between variables and their associated probability distributions.

This interaction with the Technical Committee brought out the best insights and demonstrated the need for shared ownership and commitment to the result. Prior to the IVA session, a meeting was held with the Technical Committee to develop the logic framework. After receiving input on the plan characteristics and transportation results, the cost/benefit analysis was prepared. Meeting with the Technical Committee, the initial results of the HOT analysis was presented, and the Committee assessed and manipulated the data in “real-time”. This process enabled the Committee to:

- Develop a clear problem definition and an evaluate the alternatives
- Identify all sources of benefits and costs
- Recognize key uncertainties and their inter-relationships to each other
and to the potential outcomes

- Analyze the value and risk associated with key decisions
- Optimize shareholders’ values
- Identify the “preferred” alternative to recommend to the Steering Committee.

COST BENEFIT FRAMEWORK

Charette concepts was conducted to determine the economic value of the concepts relative to each other and a base case scenario – the existing land use and employment projections utilized in the regions existing transportation demand modeling. To develop the economic modeling framework, HDR employed the four-step Risk Analysis Process (RAP), a facilitative consensus building framework approach to develop the appropriate approach and valuation. The RAP process involves four steps:

- Step 1: Define the structure and logic of the forecasting problem;
- Step 2: Assign estimates and ranges to each variable and forecasting coefficient in the forecasting structure and logic;
- Step 3: Engage experts and stakeholders in assessment of model and assumptions (the “RAP Session”); and,
- Step 4: Issue forecast risk analysis.

Through the RAP process, HDR has been engaged with the Triad Technical Committee to develop, refine and populate the economic modeling framework in two RAP Sessions. In June, the HDR Team presented a preliminary cost-benefit analysis structure and logic (e.g., framework) to the Technical Committee for feedback (e.g., Step 1 & 2). Based on the feedback from that session, HDR finalized the economic modeling framework to include five key benefit-cost areas and the key variables underpinning each category. The benefit-cost areas are provided in Figure 1.

Figure 27: Cost-Benefit Analysis Framework

Post the June RAP session, the HDR team worked to collect data independently and in conjunction with the Technical Committee to populate the economic model and to program the model into a user-friendly modeling tool. On November 29, the HDR and the Committee met again to again review the model logic and the key data assumptions (e.g., Step 1, 2 & 3). Based on the feedback during that session, the economic modeling framework was fine-tuned and data inputs provided for some of the key variables that are most influential in determining the economic outcomes. These key modeled variables are provided in Tables 1 through 5 and relate primarily to local government operating costs and market valuations for land and structures.
Figure 28: Government Operating and Capital Costs (Base Case and Concepts)

<table>
<thead>
<tr>
<th>Service</th>
<th>Median</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire (per HH)</td>
<td>$192</td>
<td>$153</td>
<td>$230</td>
</tr>
<tr>
<td>Police (per HH)</td>
<td>$226</td>
<td>$181</td>
<td>$271</td>
</tr>
<tr>
<td>Street Mtce/Traffic control (per HH)</td>
<td>$114</td>
<td>$92</td>
<td>$137</td>
</tr>
<tr>
<td>Human Services (per HH)</td>
<td>$406</td>
<td>$325</td>
<td>$487</td>
</tr>
<tr>
<td>Refuse/Yard/Brush/Leaf/Bulk Collection and Recycling (per HH)</td>
<td>$229</td>
<td>$183</td>
<td>$275</td>
</tr>
<tr>
<td>School Operations (per student)</td>
<td>$1,765</td>
<td>$1,412</td>
<td>$2,118</td>
</tr>
<tr>
<td>School Capital (student) – E</td>
<td>$29,522</td>
<td>$23,617</td>
<td>$35,426</td>
</tr>
<tr>
<td>School Capital (student) – M</td>
<td>$35,580</td>
<td>$28,464</td>
<td>$42,695</td>
</tr>
<tr>
<td>School Capital (student) – H</td>
<td>$32,501</td>
<td>$26,001</td>
<td>$39,001</td>
</tr>
<tr>
<td>Water Plant per Household (Residential)</td>
<td>$1,853</td>
<td>$1,483</td>
<td>$2,224</td>
</tr>
<tr>
<td>Water Plant per 1000 SF (Non-residential)</td>
<td>$800</td>
<td>$640</td>
<td>$960</td>
</tr>
<tr>
<td>Sewer Plant per Household (Residential)</td>
<td>$2,709</td>
<td>$2,167</td>
<td>$3,251</td>
</tr>
<tr>
<td>Sewer Plant per 1000 SF (Non-residential)</td>
<td>$1,313</td>
<td>$1,050</td>
<td>$1,575</td>
</tr>
<tr>
<td>$ Per Lane Mile (local government only)</td>
<td>$3.0 M</td>
<td>$2.4 M</td>
<td>$3.6 M</td>
</tr>
</tbody>
</table>

Figure 29: Land Valuations (developed) Per Acre by Typology (Base Case)

<table>
<thead>
<tr>
<th>Typology</th>
<th>Median</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$120,000</td>
<td>$108,000</td>
<td>$132,000</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>$200,000</td>
<td>$180,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Office</td>
<td>$200,000</td>
<td>$180,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Retail</td>
<td>$300,000</td>
<td>$270,000</td>
<td>$330,000</td>
</tr>
<tr>
<td>Hotel</td>
<td>$450,000</td>
<td>$405,000</td>
<td>$495,000</td>
</tr>
<tr>
<td>Infrastructure/Civic</td>
<td>$200,000</td>
<td>$180,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>$120,000</td>
<td>$108,000</td>
<td>$132,000</td>
</tr>
<tr>
<td>Warehouse</td>
<td>$120,000</td>
<td>$108,000</td>
<td>$132,000</td>
</tr>
</tbody>
</table>

Figure 30: Land Valuations Including Structures Per Acre by Typology (Base Case)

<table>
<thead>
<tr>
<th>Typology</th>
<th>Median</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$375,000</td>
<td>$300,000</td>
<td>$450,000</td>
</tr>
<tr>
<td>Multi-family</td>
<td>$1,000,000</td>
<td>$800,000</td>
<td>$1,200,000</td>
</tr>
<tr>
<td>Office</td>
<td>$1,125,000</td>
<td>$900,000</td>
<td>$1,350,000</td>
</tr>
<tr>
<td>Retail</td>
<td>$850,000</td>
<td>$680,000</td>
<td>$1,020,000</td>
</tr>
<tr>
<td>Hotel</td>
<td>$1,250,000</td>
<td>$1,000,000</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>Infrastructure/civic</td>
<td>$200,000</td>
<td>$160,000</td>
<td>$240,000</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>$800,000</td>
<td>$640,000</td>
<td>$960,000</td>
</tr>
<tr>
<td>Warehouse</td>
<td>$800,000</td>
<td>$640,000</td>
<td>$960,000</td>
</tr>
</tbody>
</table>
Figure 31: Land Valuations (developed) Per Acre by Typology (Concepts)

<table>
<thead>
<tr>
<th>Typology</th>
<th>Median</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$150,000</td>
<td>$135,000</td>
<td>$165,000</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>$300,000</td>
<td>$270,000</td>
<td>$330,000</td>
</tr>
<tr>
<td>Office</td>
<td>$250,000</td>
<td>$225,000</td>
<td>$275,000</td>
</tr>
<tr>
<td>Retail</td>
<td>$375,000</td>
<td>$337,500</td>
<td>$412,500</td>
</tr>
<tr>
<td>Hotel</td>
<td>$562,500</td>
<td>$506,250</td>
<td>$618,750</td>
</tr>
<tr>
<td>Infrastructure/Civic</td>
<td>$200,000</td>
<td>$180,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>$150,000</td>
<td>$135,000</td>
<td>$165,000</td>
</tr>
<tr>
<td>Warehouse</td>
<td>$150,000</td>
<td>$135,000</td>
<td>$165,000</td>
</tr>
</tbody>
</table>

Figure 32: Land Valuations Including Structures Per Acre by Typology (Concepts)

<table>
<thead>
<tr>
<th>Typology</th>
<th>Median</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$750,000</td>
<td>$600,000</td>
<td>$900,000</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>$2,000,000</td>
<td>$1,600,000</td>
<td>$2,400,000</td>
</tr>
<tr>
<td>Office</td>
<td>$2,250,000</td>
<td>$1,800,000</td>
<td>$2,700,000</td>
</tr>
<tr>
<td>Retail</td>
<td>$1,020,000</td>
<td>$816,000</td>
<td>$1,224,000</td>
</tr>
<tr>
<td>Hotel</td>
<td>$2,500,000</td>
<td>$2,000,000</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Infrastructure/Civic</td>
<td>$200,000</td>
<td>$160,000</td>
<td>$240,000</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>$830,000</td>
<td>$664,000</td>
<td>$996,000</td>
</tr>
<tr>
<td>Warehouse</td>
<td>$830,000</td>
<td>$664,000</td>
<td>$996,000</td>
</tr>
</tbody>
</table>

The economic model was adjusted in real time and the forecasts of the economic value of the Concepts were simulated (Step 4). These results represent the annual economic value that each planning option will deliver at full build out or “steady state”. These results are summarized in Tables 33 and 34.

KEY FINDINGS

The key findings of the cost/benefit analysis are:

- Each of the Concepts provide the potential for approximately an incremental $300 million in economic value annually to the study area, with the majority of the value arising from employment;
- The highest ranking concept in terms of economic value is Concept III at approximately $325 million a year. However, the differences in value between each of the Concepts is not of statistical significance;
- Fiscally, the Concepts add additional value to governments relative to the base case of approximately $20 million per year; and,
- There are significant infrastructure requirements (e.g., schools, water and sewer) associated with the Concepts at approximately $1 Billion in total.

Figure 33: Summary of the Annual Impact of the Concepts and Base Case (at Steady State)

The economic model was adjusted in real time and the forecasts of the economic value of the Concepts were simulated (Step 4). These results represent the annual economic value that each planning option will deliver at full build out or “steady state”. These results are summarized in Tables 33 and 34.
### Preferred Land Use/Transportation Plan

#### INTRODUCTION

The Technical Committee recommended revised Concept I as the Preferred Concept to the Steering Committee. The recommendation was based on a combination of factors that the Technical Committee debated and reviewed over several meetings. The preferred concept:

- Demonstrates a net positive fiscal impact of more than $313 million annually over the base case
- Promotes a future land use pattern that allows the greatest amount of additional development opportunities for each community - beyond HOT, the focus area
- Accommodates a population of 117,000 and some 140,000 employees, well within the market and economic estimates
- Features a compact, mixed use pattern that promotes transit, walkability; minimizes the loss of natural features; and offers efficient use of available land resources
- Retains 34% of the open space and environmental features
- Incorporates a new system of roadways (north/south and east/west), and a new hierarchy of road types – thoroughfares, boulevards, and parkways – that are coordinated with the abutting land uses and natural systems
- Yields a HOT area of 6300 acres that:
  - Accommodates 40% of the potential population and 55% of the estimated employment for the entire study area
  - Accepts the preferred economic development strategies – Logistics and Transportation cluster, the Technology cluster, the Retirement Lifestyle/Recreation Community, and the International "Intellectual Asset” Center” - in unified and connected fashion
  - Illustrates connectivity between the proposed land uses and employment areas
  - Can be the focus of a coordinated development strategy for revenue sharing

#### THE PREFERRED CONCEPT AND “HOT AREA”

The accompanying drawing depicts the revised Concept I, including land use and transportation revisions. The HOT area, shown within the red dotted line, will be refined during the next phase of the HOT planning process.
Land Use/Transportation Plan

Features of the Concept
As a revision of Concept I, it retains the major qualities and features of the original. These are:

- Natural systems are maintained, and large areas of the center are left in open space, agriculture or residential use. The northeast corner shows traditional residential and open space.
- There are five principal development areas:
  - The northeast corner, just east of the I-40 and Business 40 split, has a major concentration of uses, including an employment district, and anchored by a town center and major sports venue. This concentration is on the proposed commuter rail line, and a new station would be located here. This is the same as the original Concept A.
  - The I-40/Business 40 triangle shows as employment district, with the traditional residential neighborhoods, a regional park and a retail/entertainment district.
  - NC 66 and a proposed north/south major road create a natural development “corridor” toward the center of the area. The larger scaled pattern give a strong sense of place to the center of HOT. A town center, regional park, employment centers, retail/entertainment destination and urban neighborhoods provide a clear focus.
  - The fourth concentration is around the Dell facility, but it is greatly expands with the addition of a town center and retail/entertainment destination at I-40. This is similar to original Concept B.
  - There are two development areas along Sandy Ridge Road/Squire Davis road. Each has a village center facing the road, accented by urban residential neighborhoods and employment centers. This is similar to the pattern in original Concept B.
- Regional parks are associated with each concentration.
- The largest areas of agriculture, open space, and traditional residential development are east and west of the new HOT “center”.
- The road system is a modified grid network, featuring good north/south and east/west movement. The principal roadway addition is the north/south Heart of the Triad Parkway. The Parkway provides through traffic capability on a facility that is responsive to the environment and the new land use pattern.

THE PREFERRED LAND USE PLAN

The accompanying drawing depicts the revised Concept I, including land use and transportation revisions. The HOT are, shown within the red dotted line, will be refined during the next phase of the HOT process. The land use mix for the revised Concept I is:

Figure 35 - Study Area Mix

<table>
<thead>
<tr>
<th>Concept I Plan Use Mix</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town Center</td>
<td>698</td>
</tr>
<tr>
<td>Village Center</td>
<td>162</td>
</tr>
<tr>
<td>Traditional Neighborhood</td>
<td>5959</td>
</tr>
<tr>
<td>Urban Neighborhood</td>
<td>2469</td>
</tr>
<tr>
<td>Employment District</td>
<td>961</td>
</tr>
<tr>
<td>Employment Center</td>
<td>1108</td>
</tr>
<tr>
<td>Retail/Entertainment</td>
<td>726</td>
</tr>
<tr>
<td>Open Space</td>
<td>6082</td>
</tr>
<tr>
<td>Total</td>
<td>18165</td>
</tr>
</tbody>
</table>

Figure 36 - HOT Area Mix

<table>
<thead>
<tr>
<th>HOT Area Use Mix</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town Center</td>
<td>476</td>
</tr>
<tr>
<td>Village Center</td>
<td>42</td>
</tr>
<tr>
<td>Traditional Neighborhood</td>
<td>2193</td>
</tr>
<tr>
<td>Urban Neighborhood</td>
<td>612</td>
</tr>
<tr>
<td>Employment District</td>
<td>639</td>
</tr>
<tr>
<td>Employment Center</td>
<td>554</td>
</tr>
<tr>
<td>Retail/Entertainment</td>
<td>148</td>
</tr>
<tr>
<td>Open Space</td>
<td>1668</td>
</tr>
<tr>
<td>Total</td>
<td>6332</td>
</tr>
</tbody>
</table>

The land use categories are defined on pages 8-10.
THE PREFERRED TRANSPORTATION PLAN

The transportation plan for the Heart of the Triad is designed to complement the land use plan and sense of placemaking. This element balances the need for the efficient movement of people and goods while not dominating the landscape and the built environment.

A multimodal plan has been developed to address the four major modes of travel - roadways, transit, bicycle, and pedestrian. These modes are balanced to provide a multiple alternatives for the traveler depending upon trip length.

ROADWAY NETWORK

The core of the transportation plan is the roadway network. Even with a denser development pattern and greater choices of travel modes, the automobile will continue to be the dominant mode of travel. The “density” of the road network parallels the density of development, with a finer grain of roadways in the village and town centers, the urban neighborhoods, and to a certain extent in the traditional neighborhoods, but fewer roadways in the rural/open space areas.

The roadway network maintains as much of the existing roadway network as feasible, including the addition of planned roadways. The recommended plan, however, does make some modifications to the planned network to balance the planned land uses.

The design standards are based on NCDOT’s “Traditional Neighborhood Development Street Design Guidelines”. As a general rule, roadways are no larger than a four-lane divided roadway, with the only exceptions being existing roadways that exceed that width. Larger roadways are not in keeping with the intent to create a special place that encourages local travel by many modes rather than facilitating the movement of through traffic. The design cross sections in the following sections are taken from NCDOT’s guidelines.
Freeways

Several freeways skirt the boundaries of the study area. I-40, Business 40, and US 311 will continue to be in place and are assumed to be widened/improved as called for in the long-range transportation plans. The new “Airport Connector” roadway on the extreme northern boundary of the study area is assumed to be built as planned. One of the controlled-access roadways, roughly parallel to N. Bunker Hill, between I-40 and the Airport Connector remains in place in a modified form, but the northern extension of Sandy Ridge is dropped from the plan. This extension is not compatible with the intent of the plan to preserve as much farmland/open space as possible on the northern side of Market Street.

The principal change the preferred transportation plan makes is the replacement of a north-south freeway with a “parkway” in the NCDOT hierarchy. This parkway is discussed in more detail in the next section, but its purpose is to fulfill the intent of the north-south freeway with a more context-sensitive design.

Heart of the Triad Parkway

As noted above, the preferred transportation plan has as its central roadway feature a new parkway that transverses the length from US 311 to the Airport Connector. This “Heart of the Triad Parkway” is envisioned as a grand roadway that provides a scenic route that reinforces the special nature of the area. It is envisioned as a classical parkway in the olmsted tradition.

The Heart of the Triad Parkway is a modification of the proposed north-south freeway from I-85 west of High Point to the Airport Connector and reflects the findings of the “modified” plan. The parkway will be a higher-speed roadway, with posted speeds of 55 mph. Access to the parkway will be only at grade-separated interchanges with the major east-west roadways. Unlike a freeway, the parkway is slower speed and can have tighter turns and more noticeable changes in elevation.

The parkway design should meet the requirements of the NCDOT guidelines and fit as much as possible in with the natural environment of the study area. Such context-sensitive design will allow the parkway to be an asset for all users and to not be viewed as a barrier between the eastern and western portions of the study area. Landscaping should be abundantly provided to create a pleasant driving experience and to not be just another highway for quickly moving vehicles through an area.

The exact location of the Heart of the Triad Parkway has not been determined, but the conceptual location is shown in the preferred concept plans. The southern end is shown as a parallel roadway to west of Squire Davis. A new interchange in the vicinity of Pine Meadow will be provided. From this point the parkway continues south and rejoins the proposed freeway alignment.

The northern end of the parkway is assumed to be roughly along the alignment of N. Bunker Hill. This alignment preserves more of the farmland north of Market Street. An interchange will be located with the Airport Connector, which requires the relocation of the proposed interchange at Beeson Road. These streets are too close for both to have an interchange.

Within the denser area north of I-40, the parkway transitions to a boulevard cross section in the NCDOT hierarchy. This transition allows for at-grade intersections with the local streets, and could provide on-street parking for adjacent developments. The boulevard cross section also reinforces that the parkway not just for through travel.
Boulevards
The majority of the major roadways within the study area should be considered as “boulevards”. Under NCDOT guidelines, boulevards have four lanes of travel, with each direction separated by a landscaped median. This cross section is appropriate for all major roadways in both the developed and undeveloped portions of HOT. In the developed areas, parking can be provided alongside the travel lanes where adjacent development warrants. In the more rural areas, parking can be left out of the design.

When traffic volumes warrant only a two-lane roadway, the smaller roadway width is preferred over the boulevard cross section.

Local Streets
In the densest areas of development, the appropriate NCDOT cross section is the Main Street section. This design provides for slower speeds and wider sidewalks along with parallel parking. In the concept plan, these streets are illustrated in the northeast corner of the study area and toward the center, between Bodenhammer and the parkway. These streets provide a dense network of streets to disperse traffic and to provide multiple paths for pedestrians. Similar street grids can be provided in the other developed locations.

STREET GRID AND CONNECTIVITY

To disperse the traffic volumes and to increase the accessibility of transit and non-motorized travel, the roadway network should provide a high level of connectivity. Connectivity can be measured by the ratio of the number of links (street segments) to the number of nodes (intersections). A typical suburban development with multiple cul-de-sacs has a connectivity ratio of 1.3 or less. In contrast, a grid network with many connections has a connectivity ratio in excess of 1.55. The overall range is from about 1.2 to 1.7.

Winston-Salem has a connectivity requirement of 1.2 for new subdivisions. While this requirement eliminates the most egregious street patterns, it does little to promote an interconnected neighborhood. For the study area, a street connectivity index of 1.3 to 1.5 is recommended.

This connectivity can be accomplished by adding a finer network of collector and local streets. These additional streets will disperse the travel volumes and should eliminate the need to widen any of the major roadways beyond a four-lane cross section.
TRANSIT NETWORK

Transit service is viewed as an essential part of the transportation network. New routes are implemented that provide a high level of coverage in the study area.

The most visible addition to the transit network is the addition of a Colfax Station on the planned regional rail route. This station will be the central point of the development around Market Street and will be easily accessible from the new Heart of the Triad Parkway. From this station, travelers can go directly to either Winston-Salem or Greensboro. Parking is provided at the station, but is designed so that it is integrated with the adjacent development.

Additional bus routes are provided to serve the study area. These additional routes reflect the new routes described under the "modified" plan above.

These routes are conceptual in nature and should deviate off the major roadways to serve significant developments. Service frequencies will match those provided on the rail service: every 20 minutes during peak time and every 30 minutes during the off-peak.

BICYCLE AND PEDESTRIAN NETWORK

The Existing Conditions Report described the four existing designated bicycle routes in the study area. These routes should be improved as their designated roadways are widened. Wider outside lanes or striped bicycle lanes should be provided in consultation with the local bicycling community. To further enhance the bikability of the area, provisions for bicycles should be made along all major thoroughfares, either by widening the outside lanes, striping a bicycle lane, or providing a parallel multi-use pathway. The SSignature Parkway, because of its speed, should not include provision for bicycles in the travel lanes. Under NCDOT guidelines, a multiuse path separated from the traffic lanes is appropriate.

Three greenways are proposed for the study area: the Piedmont Greenway, the Longview Greenway, and the Deep River Greenway. An additional greenway should be considered along Abbots Creek. Connections from these greenways should be provided to the major destinations in the study area. Additionally, the roadway designs should accommodate the greenways from the outset, by providing wider bridges at the stream crossings, and making other provisions for the greenways to cross roadways in a safe manner.

Sidewalks should be provided along all major and minor thoroughfares on both sides of the street. Pedestrian refuge islands should be installed at all major crosswalks. Collector streets should have a sidewalk on both sides of the street, and local streets should have a sidewalk along at least one side of the street. These sidewalks should be a minimum of five-feet wide, and must meet the ADA requirements.

AIR QUALITY RESULTS

One of the principal objectives of the HOT Land Use study is the evaluation of the impacts of the changes in development on the air quality of the region. Estimating air quality impacts is challenging under ordinary analysis, but it is made more difficult for the HOT analysis because of the purpose of the HOT study. By its very nature, the HOT concepts call for dramatically increasing the population and employment within the study area and reducing the number of jobs and population in other areas of the region and surrounding counties. The study area, however, is only a small portion of the overall air shed for the Triad region. Simply estimating the air quality changes in the HOT area would not provide a complete picture of the changes to the region’s overall air quality; therefore the air quality analyses studied the overall impacts in the model area.

The assumptions of the growth concepts in the HOT area were that a portion of the population and employment growth within the HOT study area will be the result of redistributing some of the overall re-
region’s growth. The remainder of the growth represents an increase in the population and employment of not only of the HOT area, but of the entire Triad region. By implementing the focused development strategies as discussed in the Implementation Program, the overall growth of the Triad is accelerated beyond that level that would ordinarily occur. Residents and jobs are attracted to the Triad in general, and HOT in particular, from throughout the United States.

From an air quality perspective, reallocating a portion of the presumed “natural” growth of the Triad to the HOT area has little impact on the region’s air quality. Those residents and jobs were already included in the air quality analysis. The change to air quality from this relocation is anticipated to be a small positive effect — the number of trips made will not be reduced, but some trips will be redirected to non-auto modes as a result of the land-use guidelines, and the remaining auto trips are projected to be shorter, reducing the amount of pollution that is generated. The shorter trips are confirmed by the travel demand analysis, which shows an internal capture rate of 50 percent — half the trips stay close to home.

The additional residents and jobs attracted to the Triad region due to the “accelerated” growth, however, will decrease air quality since these trips would not have previously occurred within the Triad air shed. While these additional trips will generate air pollution, the impact will be less than if the new trips had occurred without making the HOT land use changes. As with the reallocated trips, the new trips are projected to be shorter due to the land use mix and clustering, and more trips are projected to occur on non-auto modes.

Working closely with PART staff, the Consulting Team developed an estimate of the total number of vehicle trips that were “new” trips from the focused development strategy. This estimate relied heavily on the economic analysis of the Triad region and the estimates of the additional growth that could occur with a targeted marketing effort. The estimate also incorporated the PART travel demand modeler’s knowledge of the trip making characteristics of the region and the amount of trips currently being attracted into the travel demand model area from the fringe counties located in the air shed.

As a result of this discussion and evaluation, the air quality analysis includes the following assumptions for the economic growth:

Of the 100% of the HOT area trips:

- 45% were trips that otherwise were occurring in the Triad travel demand area;
- 15% were trips that otherwise occurred in the air shed area, but were in fringe counties outside of the travel demand area; and
- 40% were new trips from elsewhere in the state or nation.

Based upon these assumptions, PART staff used the travel demand model to estimate the vehicle miles of travel and the speed of the travel. Air quality impacts are directly correlated to the speed of travel, with emission rates declining as speed increases up to about 30 mph, and increasing from that point as speeds increase. Emissions were estimated for the three main air pollutants – Carbon Monoxide (CO), Hydrocarbons (HC), and Oxides of Nitrogen (NOx). Figure 38 shows the results.

**Figure 38: Tons of Air Pollution**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Modified Baseline</th>
<th>Recommended Concept</th>
<th>Difference</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>1,447</td>
<td>1,502</td>
<td>55</td>
<td>3.8%</td>
</tr>
<tr>
<td>Hydrocarbon</td>
<td>115</td>
<td>118</td>
<td>2</td>
<td>1.8%</td>
</tr>
<tr>
<td>Oxides of Nitrogen</td>
<td>209</td>
<td>214</td>
<td>5</td>
<td>2.4%</td>
</tr>
<tr>
<td>Overall</td>
<td>1,771</td>
<td>1,833</td>
<td>62</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

The results of the analysis indicate a modest worsening of air quality, with overall levels of air pollution increasing by 3.5 percent in the
Triad air shed. By comparison, the population for the recommended development concept is about 3.6 percent higher and employment is about 6.8 percent higher for the region as a whole. If the air quality study area were expanded to include the surrounding counties, we would expect to see a decrease in air quality impacts since some employment and population numbers were transferred in the HOT study area from these counties; however, neither the travel demand forecasting model nor the air quality analysis model encompasses the larger territory.

In conclusion, pollution levels increase at a lesser rate than the overall economic growth due to the more efficient distribution of housing and jobs as called for by the recommended concept. This efficiency results from:

- Shorter trips due to mix of development
- Shorter trips due to denser development clusters
- More transit trips due to clustering and additional service
- More non-motorized trips due to clustering and land-use layout.