



# South Waterfront Traffic Study

Knoxville, Tennessee

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## Project Background

The Knoxville South Waterfront (hereinafter KSW) study area, (Figure 1) encompassing some 3.9 square miles, lies along the south side of the Tennessee River, opposite downtown Knoxville. The traffic impact area for the KSW (Figure 2) is bounded on the west by the western end of Scottish Pike. To the south, the study area encompasses the Fort Dickerson Park, and the residential neighborhoods on the north side of the ridge. To the east, the traffic impact area incorporates the James White Parkway, and its interchange with Anita Drive and Hillwood Drive.

Almost all of the new development proposed in the KSW plan falls within a narrow zone along the riverfront, with most of the intensity centered on Blount Avenue, Sevier Avenue and the proposed new River Street.

Ten major intersections are identified as being significant in the traffic impact analysis for KSW. Nine of these intersections are existing and one (Cherokee Connector/Blount) is proposed. Three of the ten major intersections will be reconfigured into proposed roundabouts.

The KSW plan (Figure 3) includes a mix of land uses that will combine multi-family residential, office and retail. Upon build-out, the development will serve a wide range of people seeking homes in a similarly wide variety of configurations, price ranges and levels of finish and amenity packages. The South Waterfront is being carefully planned to make the most of its excellent location within the surrounding historic neighborhood and to optimize its location on the Tennessee River.

The project is expected to be under construction by 2007 with development occurring over time depending on market considerations. Although the program is planned for a 20 year period, for purposes of analysis, this report has assumed a buildout year of 2015.

All told, the development will revitalize, heal and reconnect this area and bring to the public a waterfront that has historically been pre-empted or shielded behind industry.

## Development Program and Phases

The land uses and intensities proposed for the project are summarized in *Table 1*.

**Table 1**  
**DEVELOPMENT PROGRAM - SOUTH WATERFRONT**

Category	Phase I	Phase II	Phase III	Total
Residential (dwelling units, DU)	600 DU	600 DU	1,000 DU	<b>2,200 DU</b>
Retail (square feet, SF)	15,000 SF	20,000 SF	30,000 SF	<b>65,000 SF</b>
Restaurant (entertainment)	15,000 SF	15,000 SF		<b>30,000 SF</b>
Hotel (rooms)		150 Rooms		<b>150 Rooms</b>

Office	100,000 SF	150,000 SF	150,000 SF	<b>400,000 SF</b>
Marina (slips)	50 Slips	75 Slips	100 Slips	<b>225 Slips</b>

Source: Knoxville South Waterfront, Creating an Actionable and Inspirational Vision, Hargreaves Associates et al, March 2006.

### Proposed Street Network

Major objectives of the proposed street plan (*Figure 3*), and the associated street improvements, include more east-west network on both sides of Chapman Highway, resulting in a “Figure 8” configuration of arterial or collector streets. At present the sole east-west route to the west of Chapman Highway is Blount Avenue, whose value as an arterial street is diminished by a single lane railroad underpass just to the west of Chapman Highway, a steep approach to Chapman Highway from the west, and numerous driveway cuts within the South Waterfront area. The KSW plan remedies these shortcomings in Blount Avenue by creating a parallel east-west arterial street, comprised of a new segment of Augusta Avenue (“Augusta Avenue Extension”) between Blount Street and the existing segment of Augusta Avenue. This segment of Augusta Avenue extended is combined with a rebuilt segment of Hawthorne Avenue, connecting with Chapman Highway some 400 feet to the south of the existing Chapman/Blount intersection, and forming the

western half of the “Figure 8,” an efficient and attractive east-west alternative to the existing Blount Avenue.

In the proposed plan, Blount Avenue remains an important street for local access, but no longer the primary route for east-west through traffic (i.e., with neither origin nor destination in KSW). The value of the new Augusta/Hawthorne route as an arterial road, and the associated de-emphasis of the existing Blount Avenue route, is further enhanced by a new connection, tunneling under the railroad tracks, between Cherokee Drive and the new Augusta/Hawthorne route. This connection, closing the loop of the western half of the “Figure 8,” permits traffic to/from Cherokee Drive to use the new Augusta/Hawthorne route to Chapman Highway, rather than being compelled to use the existing Blount Avenue as its only alternative.

To the east of Chapman Highway, the eastern loop of the “Figure “ of proposed KSW plan is a new east-west street (River Street) parallel to Sevier Avenue and offering an alternative route, to Sevier Avenue, for local as well as through traffic. The new traffic generated from the entire KSW district to the east of Gay Street would use the new River Street as its primary means of east-west access. In addition to this large component of locally generated traffic, two elements of through traffic would also find the new River Street attractive: (1) through traffic between the Island Home district and Chapman Highway, using River Street as an alternative to Sevier Avenue and (2) traffic between James White Parkway and Gay Street, also able to use River Street as an attractive alternative to Sevier Avenue.

A further important addition in street capacity provided by the proposed plan is the roundabout at the Blount/Sevier/Gay/River

intersection. This roundabout, the elimination of one-way traffic presently at this intersection, and the connectivity gained throughout the new River Street, all combine to make this intersection a more important connection to downtown, as well as having a higher traffic capacity than at present.

A further significant intersection improvement in the proposed plan is the roundabout at Sevier/Anita/Marina Drive. Replacement of the existing intersection by a roundabout improves accessibility into the KSW area from Sevier Avenue, creates attractive parcels for redevelopment along Sevier Avenue, and assures reduction in vehicular speeds for traffic through the proposed commercial district on Sevier Avenue. This proposed roundabout also improves travel to/from Island Home by: (1) providing a traffic control device (roundabout) at the Sevier/Anita intersection, thereby assuring safe and comfortable access to this location and (2) providing an alternate route along River Street, thereby eliminating the need to use Sevier Avenue at all for Island Home residents.

The KSW's tight grid of small streets, once considered obsolete, is now recognized as an asset, well scaled for redevelopment, amenable to a wide variety of fronting reuses, and efficient for traffic. The existing street and block pattern can be easily extended into redevelopment areas. Sevier Avenue, once the business center, has an alignment and cross section well suited to a revival of that role.

Character, not vehicular capacity, is the shortcoming of KSW streets. Local streets, while well spaced and sized, are frayed, often lacking in sidewalks. Continuity of the Sevier/Blount spine is interrupted by a one-way segment and a single-lane railroad viaduct. The north-south arterials, while efficient traffic conduits, all lack character:

Chapman Highway is bordered by strip commercial uses; Gay Street terminates unceremoniously at what should be a focal point; and the James White Parkway is still an unhealed suburban road scar.

### **Need for New Blocks and Streets**

The 15-20 new City blocks created by the KSW plan yield the following transportation advantages:

- **Traffic Circulation** – Adding more blocks and the local streets needed to form them reduces the vehicle miles of travel within the overall street system (due to more direct routing), reduces the need for traffic signals, permits the more efficient operation (i.e., with fewer phases) of those traffic signals that are required, and diffuses traffic volumes to multiple locations rather than concentrating it at existing intersections.
- **Vehicular Parking** – A highly developed system of blocks and local streets maximizes the access to off-street parking lots and decks, maximizes the number of on-street parking spaces (the “gold standard” of commercial parking and loading), and accommodates some commercial loading at on-street spaces rather than interior spaces on private land. A dense pattern of blocks is a critical prerequisite for the “park-once” mode of parking, in which motorists accept spaces throughout a district, rather than seeking a space only on the premises of their final destination. The “park-once” pattern of parking typically reduces the need for off-street parking (a private expense) by some thirty to fifty percent compared to typical suburban pattern of totally-on-premise parking, while simultaneously improving the overall parking experience for the motorist.

- **Pedestrian Circulation** – A highly developed system of compact blocks is a critical prerequisite for a good pedestrian environment. Such a system minimizes the number of multi-lane (i.e., greater than two lane) streets, and provides a wide variety of pedestrian routes. The reduced vehicle speeds, protection of sidewalks by on-street parking, and short traffic signal cycles provide the essential walking environment (attractive, safe) critical for the “park-once” pattern of parking.
- **Public Safety and Public Service** – Public safety providers (fire rescue and private ambulance) strongly prefer a well developed system of blocks and street network, as contrasted to the alternative of superblocks with no street network. The well-developed pattern of blocks provides alternate routes, an important advantage for both evading traffic congestion as well as for routing additional equipment to emergency scenes. Public service providers (utilities, solid waste pickup, school bus operators) prefer systems of well developed blocks, due to the routing possibilities, avoidance of dead-end streets and variety of on-street loading spaces provided.
- **Development Value** – The vehicular and pedestrian circulation patterns that accompany a well developed system of blocks yield large advantages for private development located on these blocks. These advantages include the amount of commercial and residential frontage created, the number of commercial corners produced, the low-speed environment associated with numerous small streets rather than fewer large ones, and the “forgiving” street network that permits visitors to intuitively feel their

way through the street system. The quantity of on-street parking for both automobiles and service vehicles permits a corresponding decrease in the need for private off-street parking. The superior pedestrian atmosphere supports the “park once” pattern of parking, which further reduces the need for private off-street parking. A well developed block system extends the value of attractive natural features (in this case, river and ridge views) by aligning new streets so that a number of street front properties are within sight of such vistas.

The street and block pattern has proved to be the circulation pattern with the most durable value for business. Throughout the United States, street and block patterns retain their value through decades of transition in commercial tenant types. The contrasting form of development – the large superblock without streets – is proving to be a special-use pattern, prone to obsolescence as traffic becomes congested and blighted, and difficult to reconfigure for changing real estate markets.

#### **Site Access**

The permitting agency for all driveway access points for the South Waterfront project will be the City of Knoxville. Access to onsite parking will be gained via a combination of new streets, alleys, existing driveways and new driveways.

#### **Existing Traffic Data**

In order to establish a baseline for the traffic analysis to follow, traffic data collection was conducted for the proposed development.

Weekday turning movement counts were taken during the evening peak period at the following intersections:

- Chapman/Blount/Sevier
- Chapman Hwy./Martin Mill Pk.
- Sevier/Gay/Blount
- Sevier Ave./Davenport Rd.
- Sevier Ave./Island Home Ave.
- Sevier Ave./Lincoln St.
- James White Pkwy. SB Ramps/Anita Dr.
- James White Pkwy. NB Ramps/Anita Dr.

Copies of the peak period and 24-hour bidirectional counts are included in *Appendix A*.

Existing AM and PM peak hour traffic volumes are summarized in *Figures 5 and 6*.

### **Background Traffic Growth**

Because the project build-out is not expected to occur until 2015, it is reasonable to anticipate that some growth in traffic will occur in the intervening years with or without the new development. There are generally two components to be considered in the development of background traffic growth:

- (a) growth close to the site resulting from specific, identified projects already in the “pipeline” (that is, actual nearby projects already approved, or further along in the approval process), sometimes called “background development.” In the case of this study area, no developments of consequence have been identified.

- (b) traffic increment along roadways resulting from the growth of the region, and to other non-specific development further from the site, often referred to as “background growth.”

Rather than a growth trend, traffic volumes in recent years along Chapman Highway have actually declined to some degree (*Figure 7*). In order to assure that this was not an isolated phenomenon, a similar analysis of the Gay Street river crossing was undertaken.

This street likewise, showed relatively flat or even declining traffic volumes (*Figure 8*). Even though regional trips through this area are on a declining trend, it was the desire of the study team to undertake a conservative analysis. Therefore, the analysis assumes a 1% growth rate per year for through traffic volumes along Chapman Highway, Sevier Avenue and Gay Street. The same assumption could be made for James White Parkway, but since it is grade separated, through volumes are not a part of this analysis. Over the nine years between now and buildout, this assumption would result in a 9% increase in background traffic volumes. This rate was applied to develop 2015 background traffic volumes.

Year 2015 a.m. and p.m. peak hour volumes are summarized in *Figures 9 and 10*.

### **Trip Generation**

The development program for the KSW area and its trip generation is summarized in *Table 2*. Trip generation was computed separately for each of six sectors within the KSW area. The development program assigned to each of these sectors, and the resulting trip generation is summarized in *Appendix B*. The total for all six zones within the KSW area, is shown in *Table 2*.

The proposed new development for KSW generates a total of 28,791 daily trips (Table 2). In the single hour of greatest traffic generation, the p.m. peak hour, the project generates a total of 2,850 trips, with the peak hour, peak direction of flow (outbound) of 1,470 trips. The a.m. peak hour trip generation is substantially less than the p.m., with 2,308 total peak hour trips, and only 1,128 peak direction in the a.m. peak hour.

A pass-by traffic ratio of 10% is assumed, in the p.m. peak hour, for traffic generated by two land uses: specialty retail and high turnover restaurant. No pass-by/internal capture is assumed for any of the remaining land uses.

### **Trip Distribution**

The distribution of traffic generated by the KSW plan, as stipulated in the methodology agreement for this study, is summarized in *Figure 11*. Almost half of the external traffic (i.e., into or out of the KSW area) is assigned to Chapman Highway: 27% to/from the north, and 21% to/from the south. Next in importance for traffic assignment is the Gay Street bridge, accounting for 22% of traffic in/out of the KSW area. The James White Parkway, in both directions, accounts for a total of 17% of traffic (11% northbound and 6% southbound) to/from the KSW study area. Blount Avenue to the west accounts for only 8% of project traffic.

### **Year 2015 With-Project Traffic**

The year 2015 with-project traffic (*Figure 12* for the a.m. peak hour and *Figure 13* for the p.m. peak hour) is comprised of the year 2015 background traffic (*Figures 9 and 10*) plus the assignment of project traffic (*Table 2* as detailed in *Appendix B*) in accordance with the directional distribution pattern (*Figure 11*).

**Table 2**  
**Trip Generation Summary**

Land Use	ITE Code	Intensity		Daily Trip Ends	PM Peak-Hour Trip Ends			AM Peak-Hour Trip Ends		
					Total	In	Out	Total	In	Out
Single Family	210	174	DU	1,852	192	121	71	160	40	120
Condo	230	1,520	DU	8,215	744	499	246	625	106	519
Multi-Family	220	507	DU	3,949	385	250	135	271	54	217
Specialty Retail	814	65,000	GLA	2,969	263	116	148	78	37	41
High-Turnover Rest.	932	30,000	GFA	3,815	328	200	128	346	180	166
Office	710	400,000	GFA	5,442	842	143	699	763	671	92
Hotel	310	100	Rms.	892	53	26	27	48	28	20
Marina	140	225	Slips	1,658	43	26	17	18	12	6
<b>Total</b>				<b>28,791</b>	<b>2,850</b>	<b>1,380</b>	<b>1,470</b>	<b>2,308</b>	<b>1,128</b>	<b>1,180</b>

## Year 2015 Intersection Analysis

The intersection delay and level of service expected in year 2015 with the project are summarized in *Table 3*. Important conclusions which can be drawn from this table are:

- At all intersections, other than the Blount/Chapman Highway and Hawthorne/Chapman Highway intersections, for the full development program can be accommodated at Level of Service “C” or better. The intersection of Blount/Gay/Sevier will function as a one lane roundabout according to FHWA analysis methodology. Entering traffic patterns will naturally balance given the extensive surrounding network.

## Importance of the “Figure 8” Configuration of Collectors and Arterial Streets

Forming the “Figure 8” configuration of the collector and arterial system (relocated Blount Avenue, Augusta Avenue Extension, new River Street) not only helps to form new blocks (advantages listed above) but more importantly is essential for carrying the traffic generated by the development projected in the KSW plan, because of:

- **Vehicular Capacity** – Even small increments of development in KSW will require more east-west road capacity. At present the Chapman/Blount intersection is operating near capacity during peak hours, and could therefore accommodate little, if any, additional development in the western half of KSW. The Blount/Sevier/Gay intersection, while currently operating at acceptable levels of service, would reach its capacity with less than one-half of the proposed KSW development in the immediate vicinity

(east of Chapman Highway) in place. The KSW plan addresses this need for additional east-west capacity through the “Figure 8” configuration yielded by three major segments of new or relocated collector or arterial streets: relocation of Blount Avenue, extension of Augusta Avenue, and creation of the new River Street. The “Figure 8” configuration, therefore, adds two continuous lanes of arterial or collector street capacity across the entire KSW.

The only possible alternative to the “Figure 8” configuration, widening of the existing east-west spine comprised of Blount Avenue and Sevier Avenue, is highly problematical. In general, it is always preferable to gain capacity through a new parallel street, rather than adding the same number of lanes to an existing street. This advantage in traffic capacity for multiple smaller streets (compared to a single larger street) stems from the diminishing efficiency of additional lanes, due to lane use patterns, size of intersection and complexity of traffic signal phases required at larger intersections. In the case of the Blount/Sevier east-west spine, three other factors accrue strongly for an additional street rather than widening the existing spine: (1) the expense of widening the railroad overpass on Blount Avenue, (2) the insurmountably steep grade on Blount Avenue near Chapman Highway and (3) the funneling of traffic through the single Blount/Gay/Sevier intersection.

- **Pedestrian Capacity** – Pedestrians are far better served by an arterial and collector street system in the proposed “Figure 8” pattern, rather than by attempting to gain the same vehicular capacity through widening of the Blount/Sevier spine. Advantages of the “Figure 8” configuration for pedestrians are the smaller and therefore safer and more comfortable street size, variety of walking

routes produced and likelihood that the smaller streets will be fronted with development contributing to an appealing walking environment.

- **Separation of Local and Through Traffic** – The “Figure 8” configuration provides direct routes for through traffic (i.e., with neither origin nor destination in KSW) along with routes more suitable for local travel (i.e., with origin or destination or both within KSW). To the west of Chapman Highway, the existing Blount Avenue and Scottish Pike would most likely be the focus of local travel, while the new Augusta Extension/Hawthorne route would be preferred by through motorists. To the east of Chapman Highway, both Sevier Avenue and the new River Street could be expected to serve as attractive routes for both local and through traffic.
- **The Chapman/Blount Intersection** – This problem location is itself a powerful factor in support of the “Figure 8” configuration as proposed in the KSW plan. In the absence of a “Figure 8” configuration, all east-west traffic generated by the west half of the KSW plan would be focused at this intersection, already a capacity problem location and further handicapped by a steep approach from the west. The western half of the “Figure 8” configuration addresses this problem in the most effective manner possible: by providing an entirely new route for east-west traffic to the west of Chapman Highway, and by providing an additional signalized intersection at Hawthorne Avenue for accommodating entry/exit to/from Chapman Highway.
- **Flexibility for Transit** – The proposed “Figure 8” configuration in the KSW plan is an advantage for transit service for two reasons: (1) the additional streets provide

new opportunities for transit service and (2) the new streets and connecting fabric of local streets provide the walking environment needed to join transit stops with origins (homes) and destinations (work places, businesses).

- **Fronting Real Estate Value** – The proposed configuration of two-lane streets forming the “Figure 8” is vastly superior, as a business armature, than the alternative of widening the existing east-west spine. Reasons for this business advantage are the amount of new street frontage created, the village scale of the streets, the visitor-friendly street layout, the appropriateness of much of the street frontage for on-street parking, the improved access into and out of the KSW, and the attractive pedestrian environment.

### **Mitigating Factors**

At the Chapman/Blount intersection, the first approach to mitigation is the redirection of traffic to other available network. Two attractive alternatives for such rerouting will be present, with the KSW “Figure 8” street improvements in place. These include more use of the Gay Street bridge (rather than the Chapman Highway/Henley Street bridge) for traffic between KSW and downtown Knoxville. The James White Parkway and its ramps at Anita Drive will continue to flow freely in the year 2015, thereby offering a viable alternative to the use of the Chapman/Blount intersection for many trips. Although this use of James White Parkway may call for out-of-direction travel, the projected delays at the Chapman/Blount intersection strongly suggest that it would be used as an alternative.

The projected delay, for the year 2015 with the KSW in place, at the Chapman/Blount intersection also informs the discussion about continuation and completion of the James White Parkway. Traffic

loadings of the projected magnitude at the Chapman/Blount intersection argue strongly for the diversion of through traffic (i.e., traffic with neither origin nor destination in or near KSW area).

A variety of further mitigating measures are possible. The proposed pedestrian and multi-purpose trail along the riverfront would permit non-vehicular traffic in the east-west direction to avoid the Chapman/Blount intersection completely. Traffic conditions at this intersection strongly suggest, therefore, that the completion of this segment of multi-purpose trail be a high priority.

Commercial success of the KSW, with its projected mix of uses, will provide a strong mitigation for congestion at the Chapman/Blount intersection. With the mix of uses as projected in KSW, much of the traffic captured internally can avoid the use of this intersection. For new residents in KSW, therefore, the majority of home-based trips (i.e., trips beginning/ending at home) during the day will be able to avoid the Chapman/Blount intersection completely, or at least avoid using it during peak traffic periods.

Finally, a major mitigating effort for Chapman Highway lies not in adding to its vehicular capacity, but in making it into a complete street, serving all the needs of the community, not just a conduit for moving as much through traffic as fast as possible. This project, now underway, could transform Chapman Highway into a community armature, by access management, streetscaping, community-serving traffic signal locations and phasing, pedestrian and bicycle accommodation and form-based codes to transform the sprawl environment currently present into a true town center atmosphere.

**Table 3  
Traffic Capacity Analysis**

**AM Peak**

Intersection	Existing		2015 With Project	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS
1 Blount/Cherokee Connector	N/A	N/A	2	A
2 Augusta/ Hawthorne	N/A	N/A	N/A	A
3 Chapman/Blount	41	D	148	F
4 Chapman /Hawthorne	N/A	N/A	N/A	F
5 Chapman /Martin Mill	13	B	10	A
6 Blount /Gay/Sevier	18	B	Acceptable*	Acceptable*
7 Sevier/Davenport	4	A	7	A
8 Sevier/Island Home/Anita	2	A	N/A	A
9 Anita/James White SB	5	A	5	A
10 Anita/James White NB	9	A	19	A

**PM Peak**

Intersection	Existing		2015 With Project	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS
1 Blount/Cherokee Connector	N/A	N/A	2	A
2 Augusta/ Hawthorne	N/A	N/A	N/A	A
3 Chapman/Blount	86	F	298	F
4 Chapman /Hawthorne	N/A	N/A	N/A	F
5 Chapman /Martin Mill	11	B	12	B
6 Blount /Gay/Sevier	19	B	Acceptable*	Acceptable*
7 Sevier/Davenport	2	A	3	A
8 Sevier/Island Home/Anita	3	A	N/A	A
9 Anita/James White SB	6	A	6	A
10 Anita/James White NB	7	A	19	A

\* Analysis based on **Roundabouts: An Informational Guide**, FHWA-RD-00-67, June 2000

### Conclusions

1. Currently, all intersections except the Chapman/Blount intersection operate at a satisfactory level of service (LOS “D” or better) during peak hours.
2. With the exception of two intersections on the Chapman Highway (Chapman/Blount and Chapman/Hawthorne), all intersections in the study area will operate at a satisfactory level of service in peak hours in the Year 2015, with full development of the KSW development program.
3. The proposed “Figure 8” configuration of collector and arterial streets and the supporting network of new or extended local streets forming new blocks is essential for accommodating the KSW development plan. Without both of these features (“Figure 8” and blocks), very little of the planned development of the KSW plan to the west of Chapman Highway can be reasonably accommodated. To the east of Chapman Highway, less than one-half of the KSW plan can be accommodated in the absence of its proposed street features.
4. Several highly effective mitigation measures are possible to address the existing and anticipated traffic capacity problems on Chapman Highway. These measures include more use of the existing James White Parkway by KSW traffic, extension of the James White Parkway (resulting in major traffic diversion from Chapman Highway), avoidance of the Chapman /Blount intersection through use of the proposed signalized intersection at Chapman/Hawthorne, and internal capture of trips due to the density and mixture of proposed KSW land uses.
5. The ongoing corridor improvement project for Chapman Highway affords further opportunity for mitigating traffic congestion in the Chapman Highway corridor. Possible improvements are signal system equipment and timing upgrades, access management to reduce turning movements, and pedestrian travel improvements.
6. The density, compactness and well connected and attractive street system proposed in the KSW plan are all factors that promote the suitability of future transit service to/from/within the KSW.
7. The already-congested condition of major radial arterial highways such as Chapman Highway argues strongly that regional growth be concentrated in compact, centrally located projects such as KSW, rather than in more distant sprawl locations (e.g., Blount County).

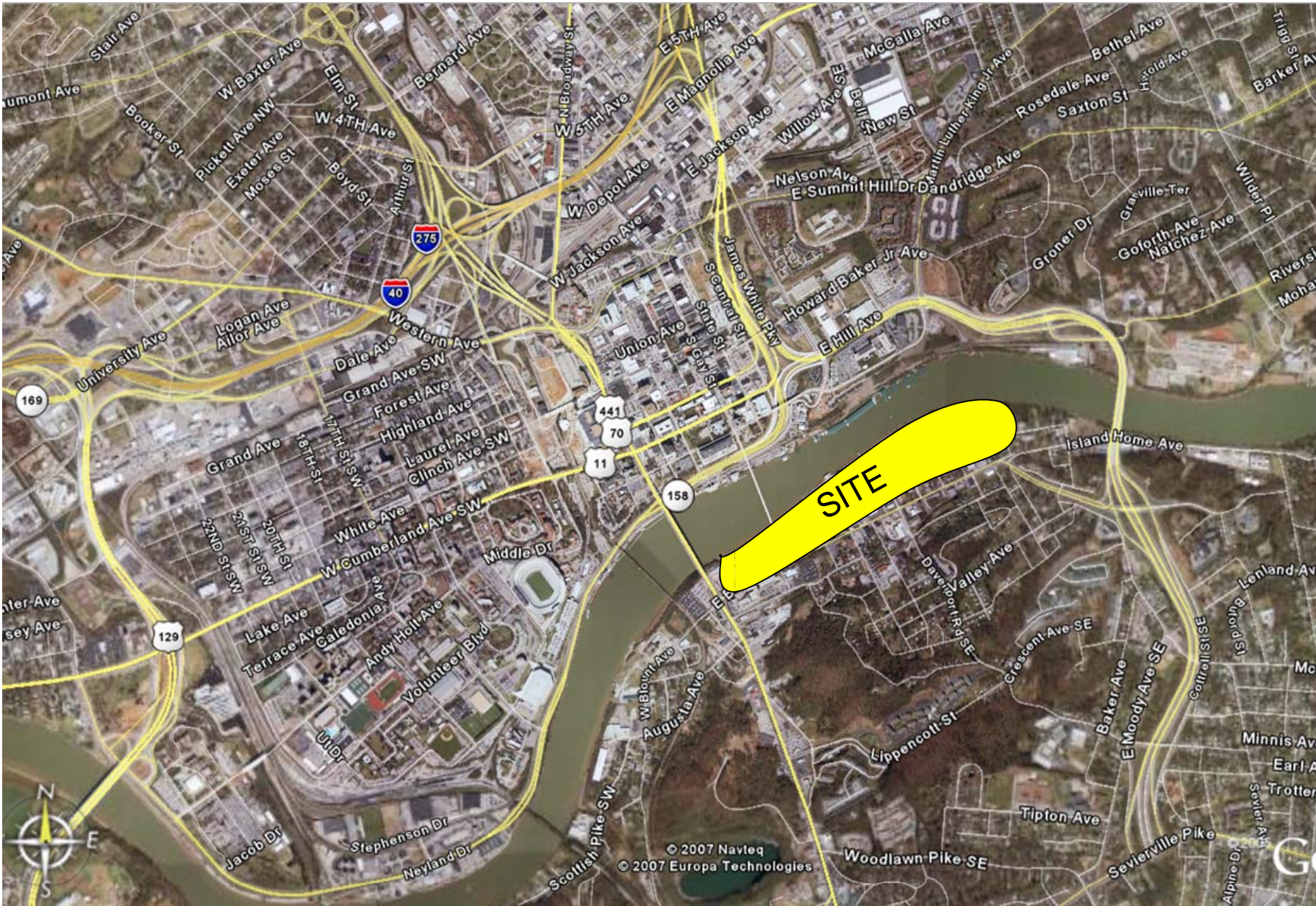


Figure 1  
Knoxville South Waterfront Project Location

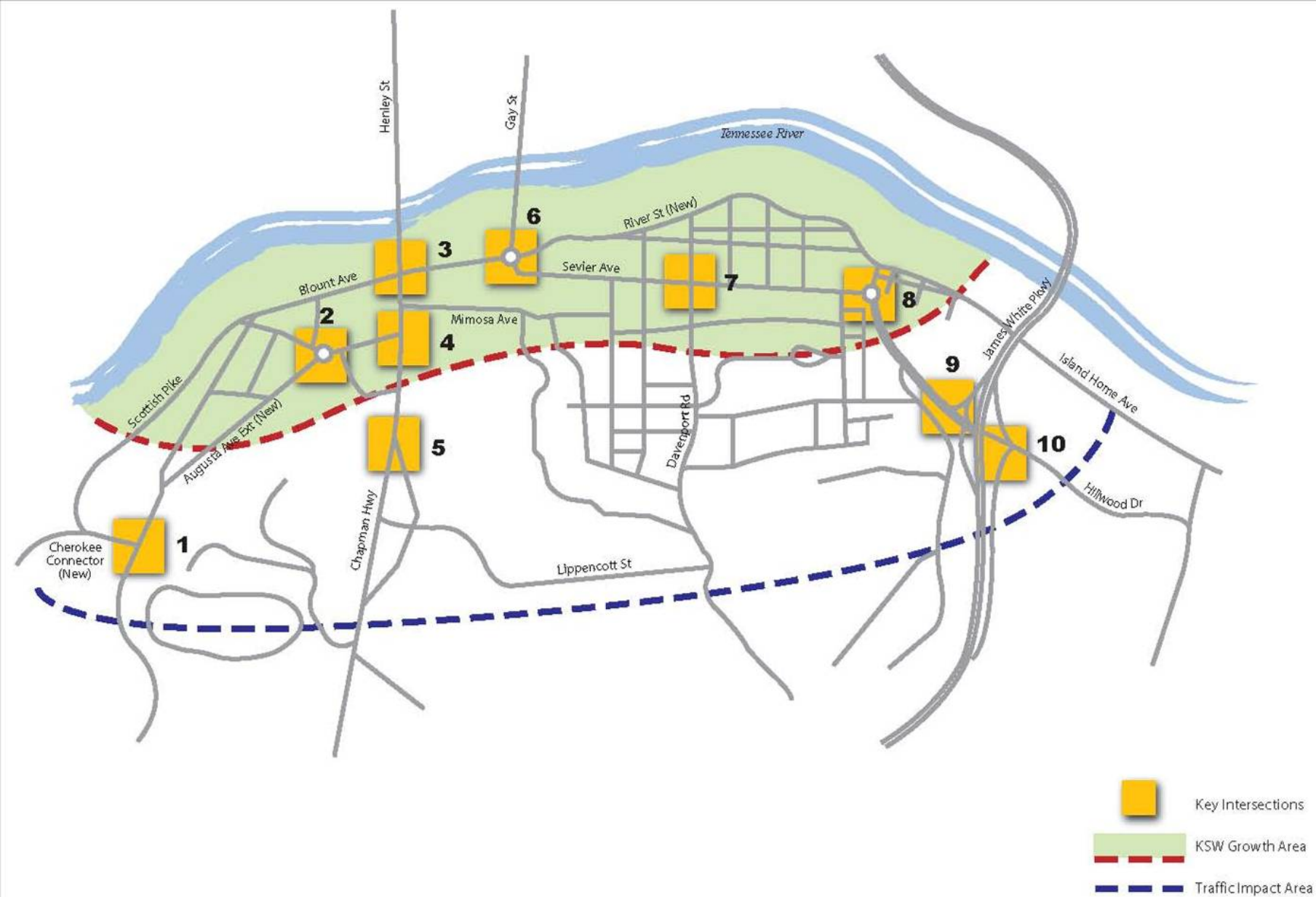


Figure 2  
Knoxville South Waterfront Traffic Impact Study Area



Figure 3  
Knoxville South Waterfront Plan

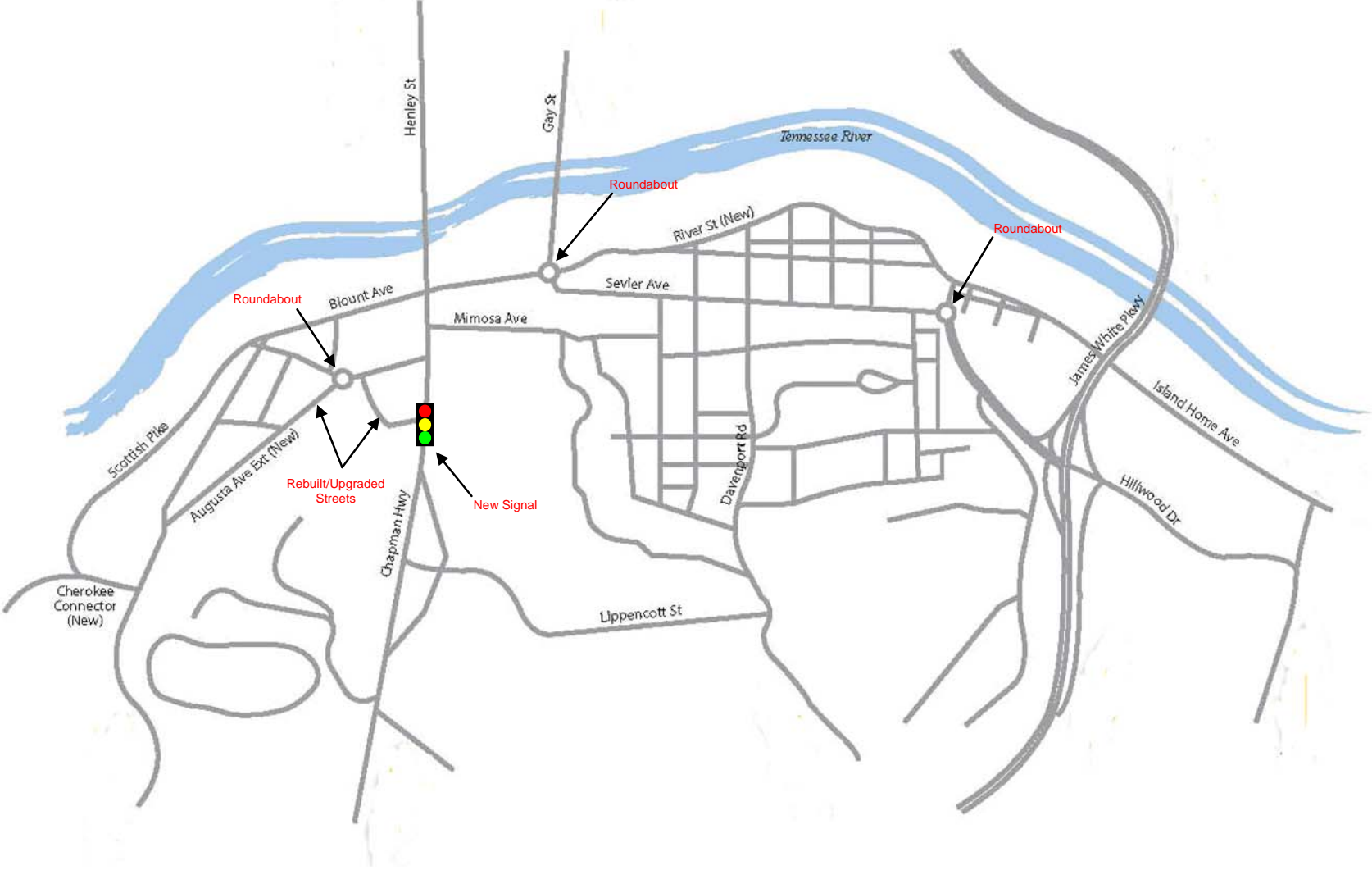


Figure 4  
Proposed Street System

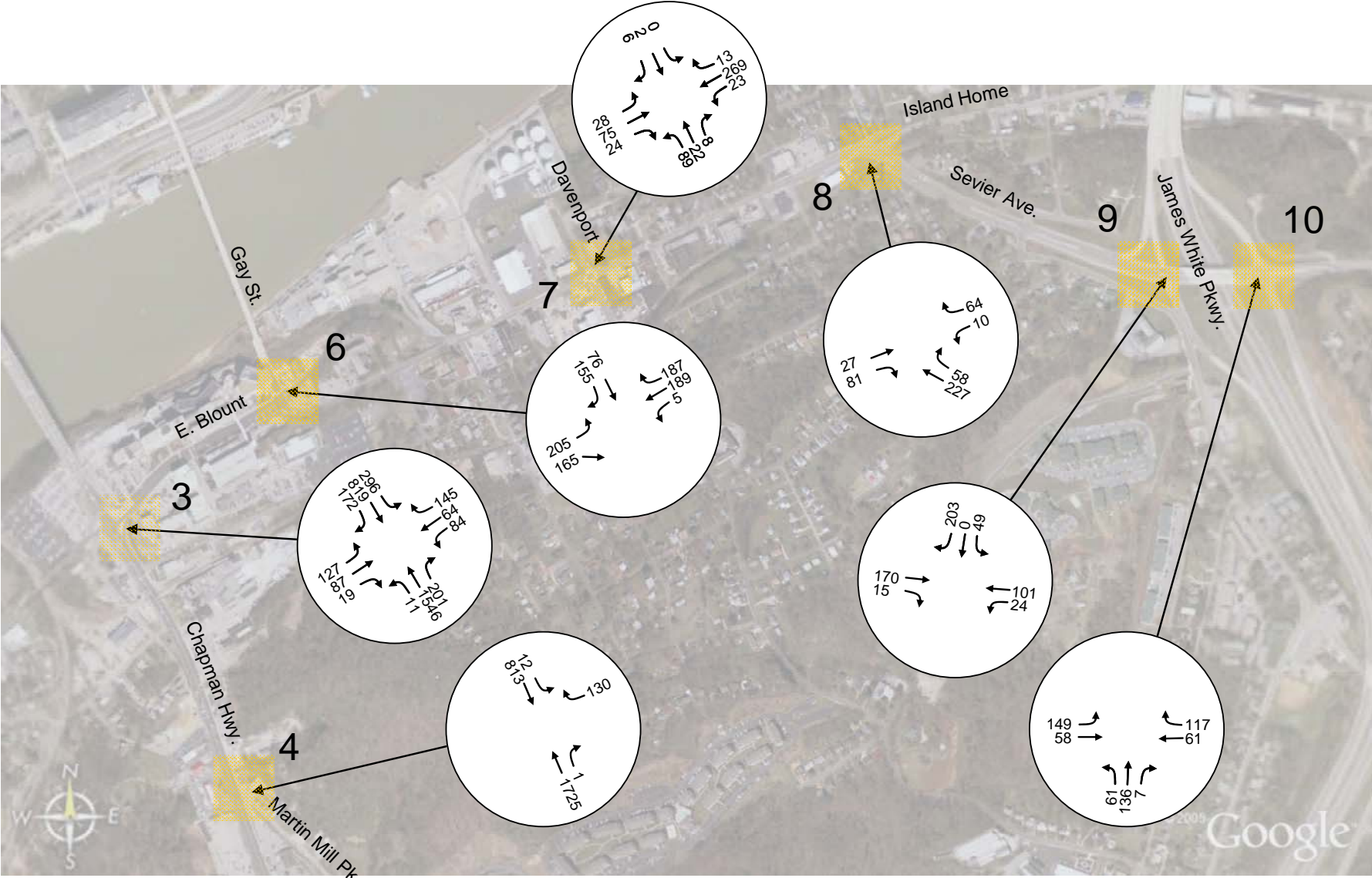


Figure 5  
Existing AM Peak Hour Traffic

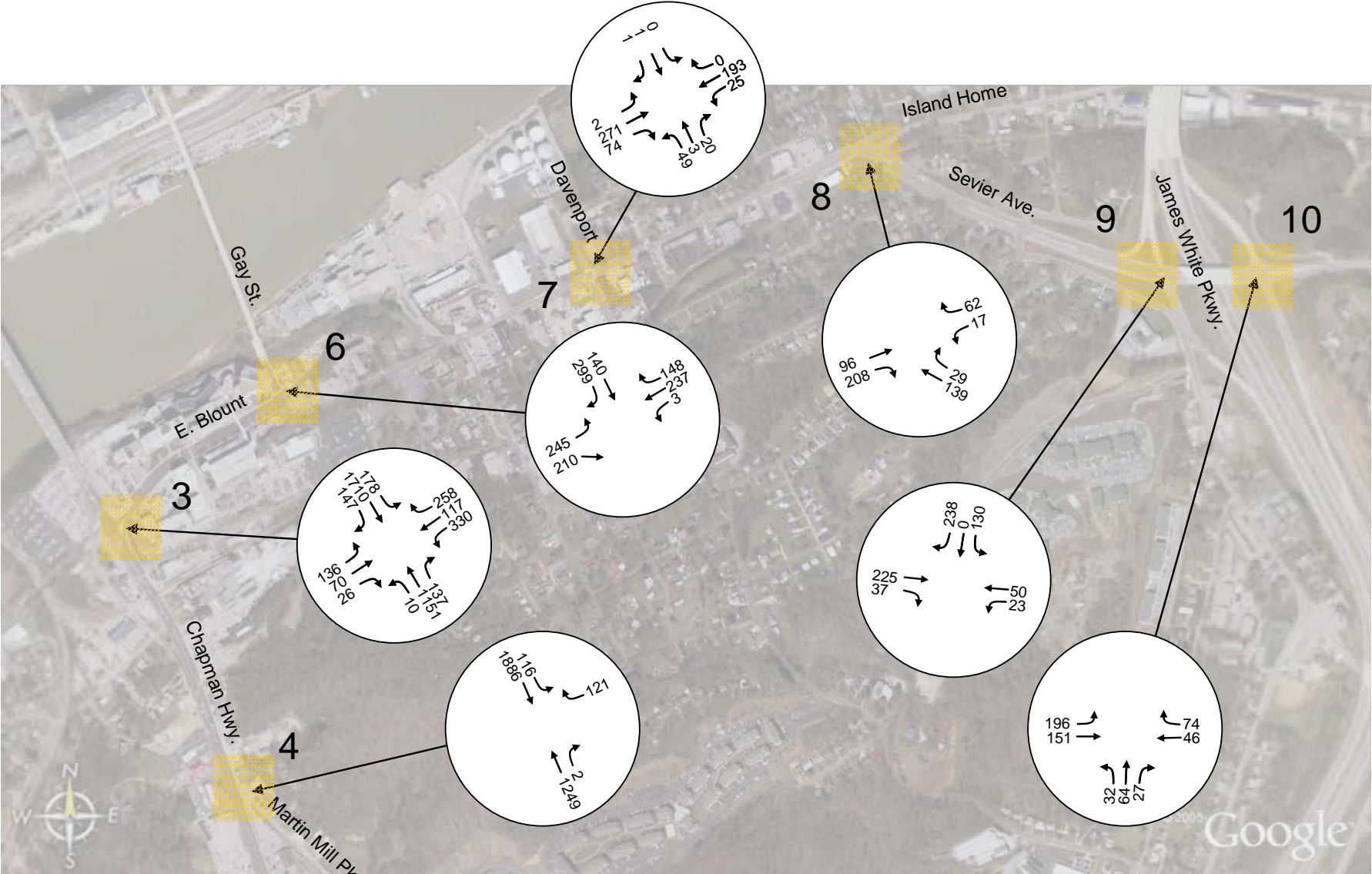


Figure 6  
Existing PM Peak Hour Traffic

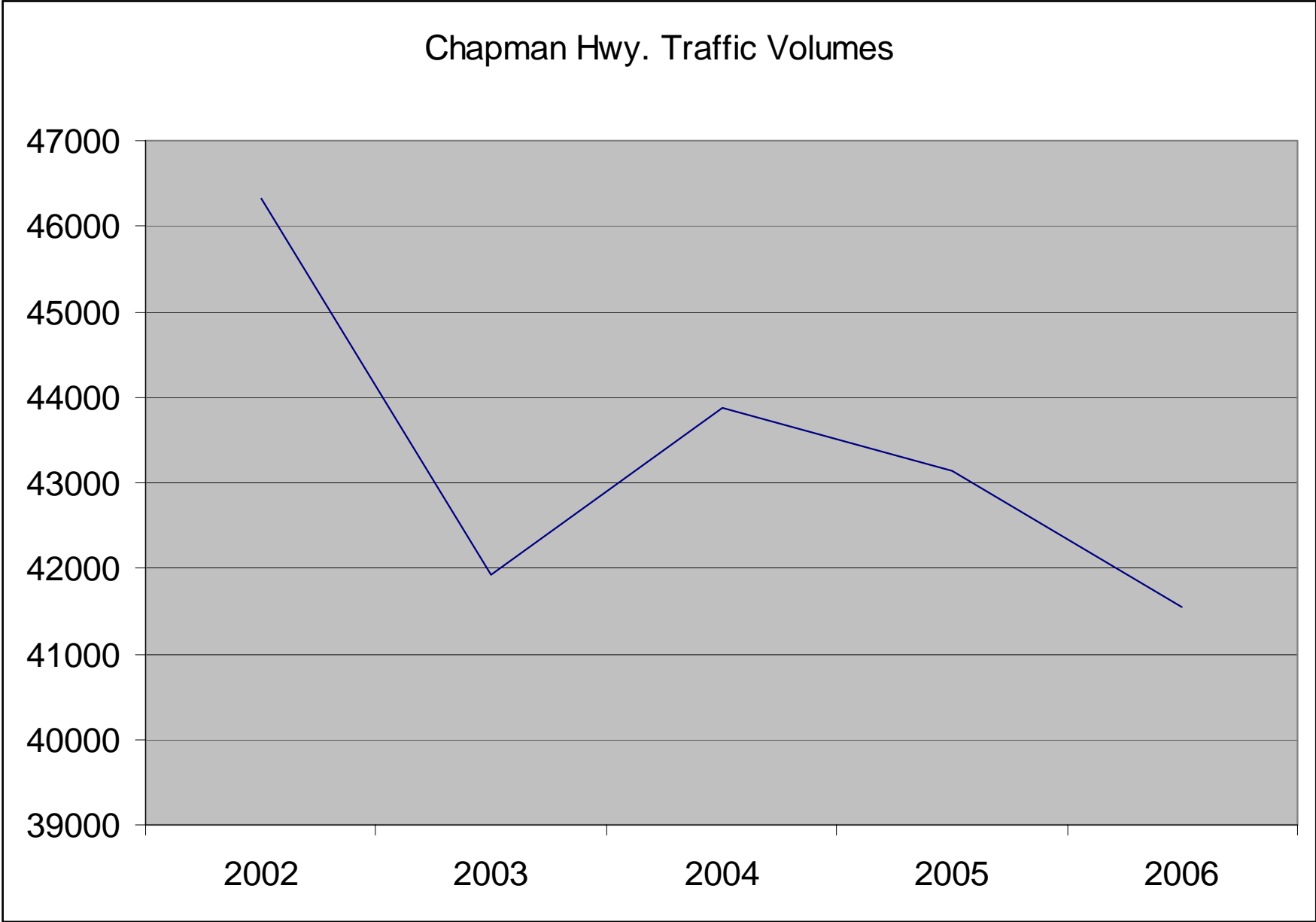


Figure 7  
Traffic Growth Pattern, Chapman Highway

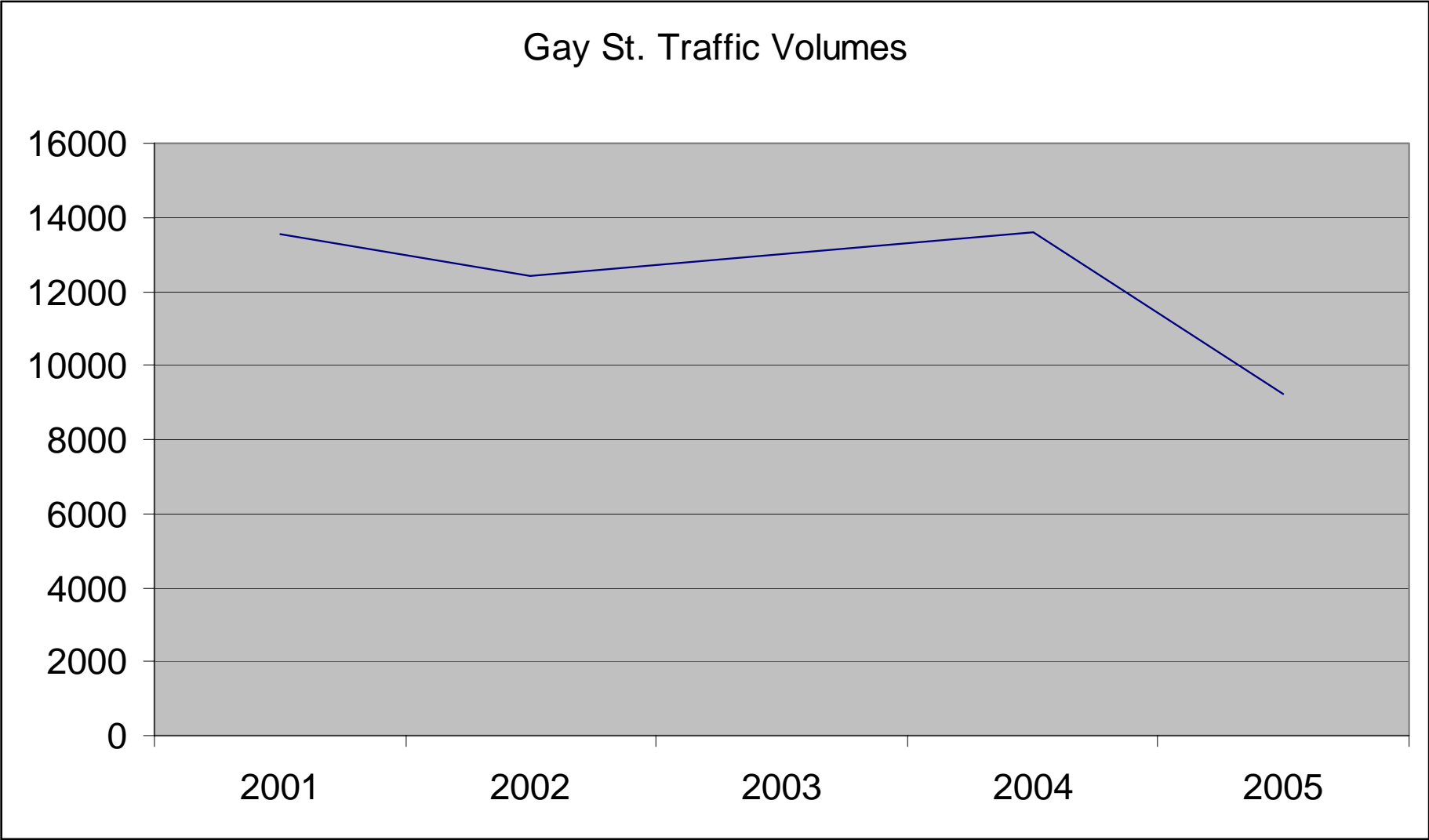


Figure 8  
Traffic Growth Pattern, Gay Street

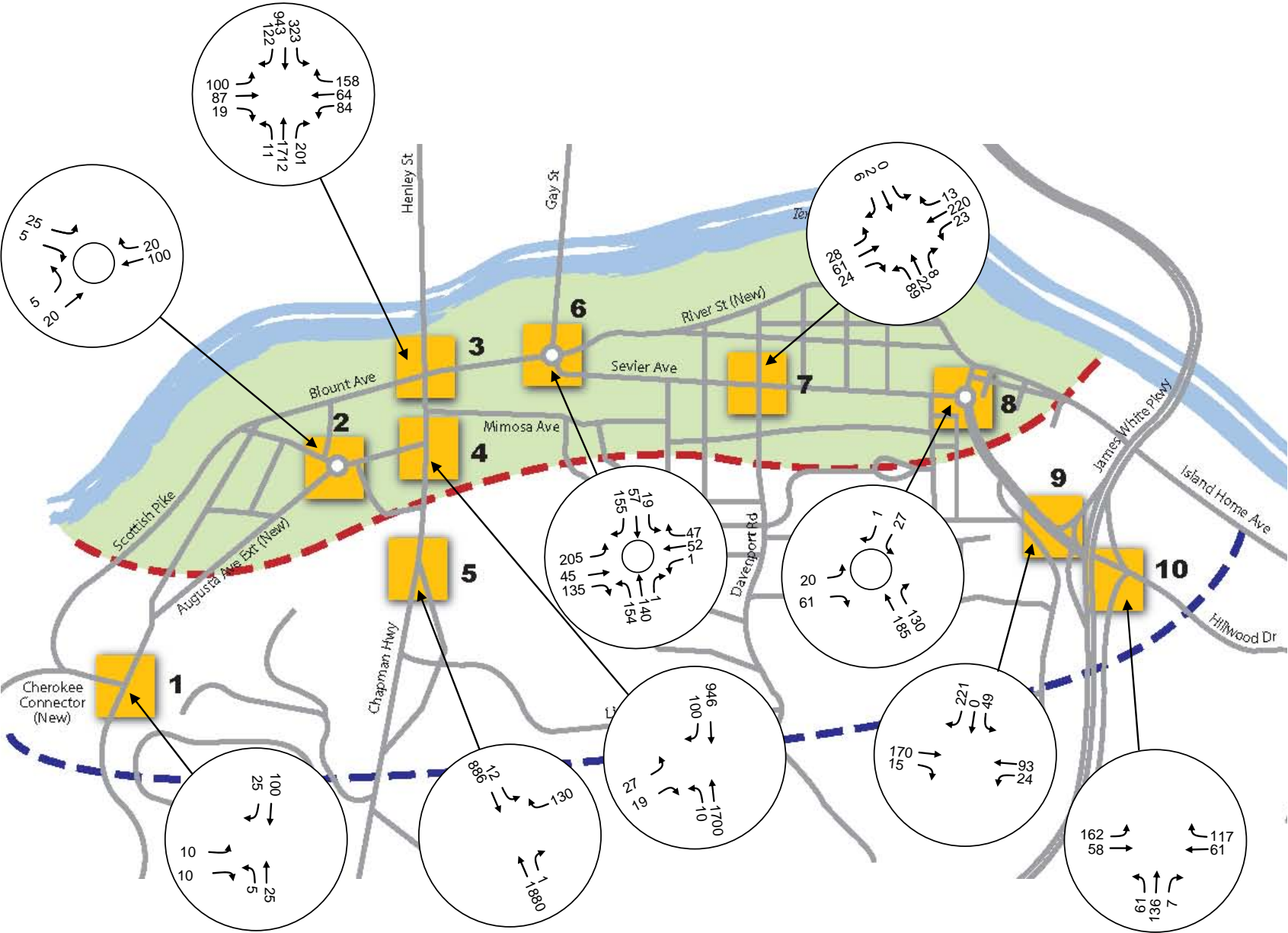


Figure 9  
2015 No-Build AM Peak Hour Traffic

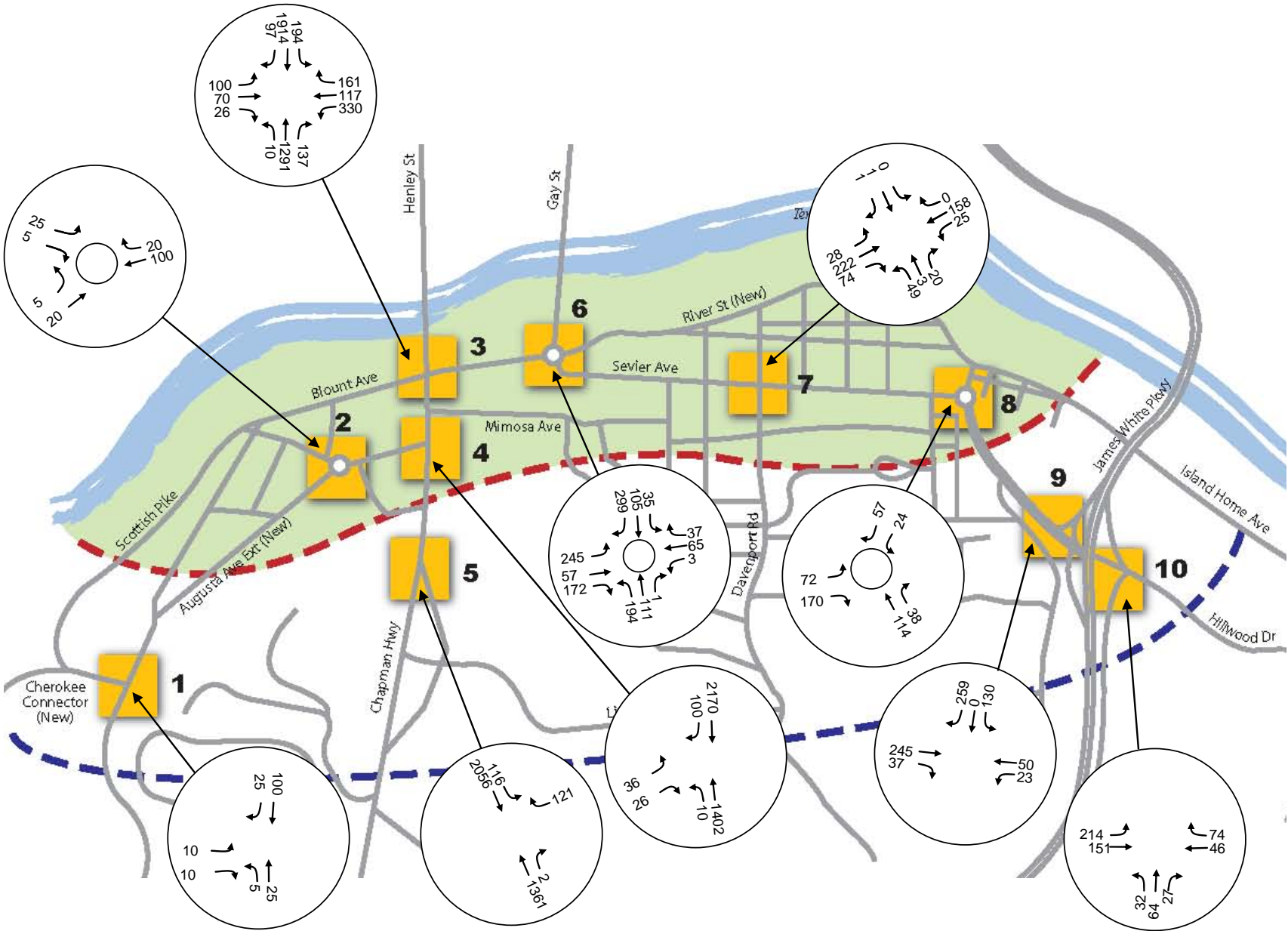


Figure 10  
2015 No-Build PM Peak Hour Traffic

# Traffic Analysis

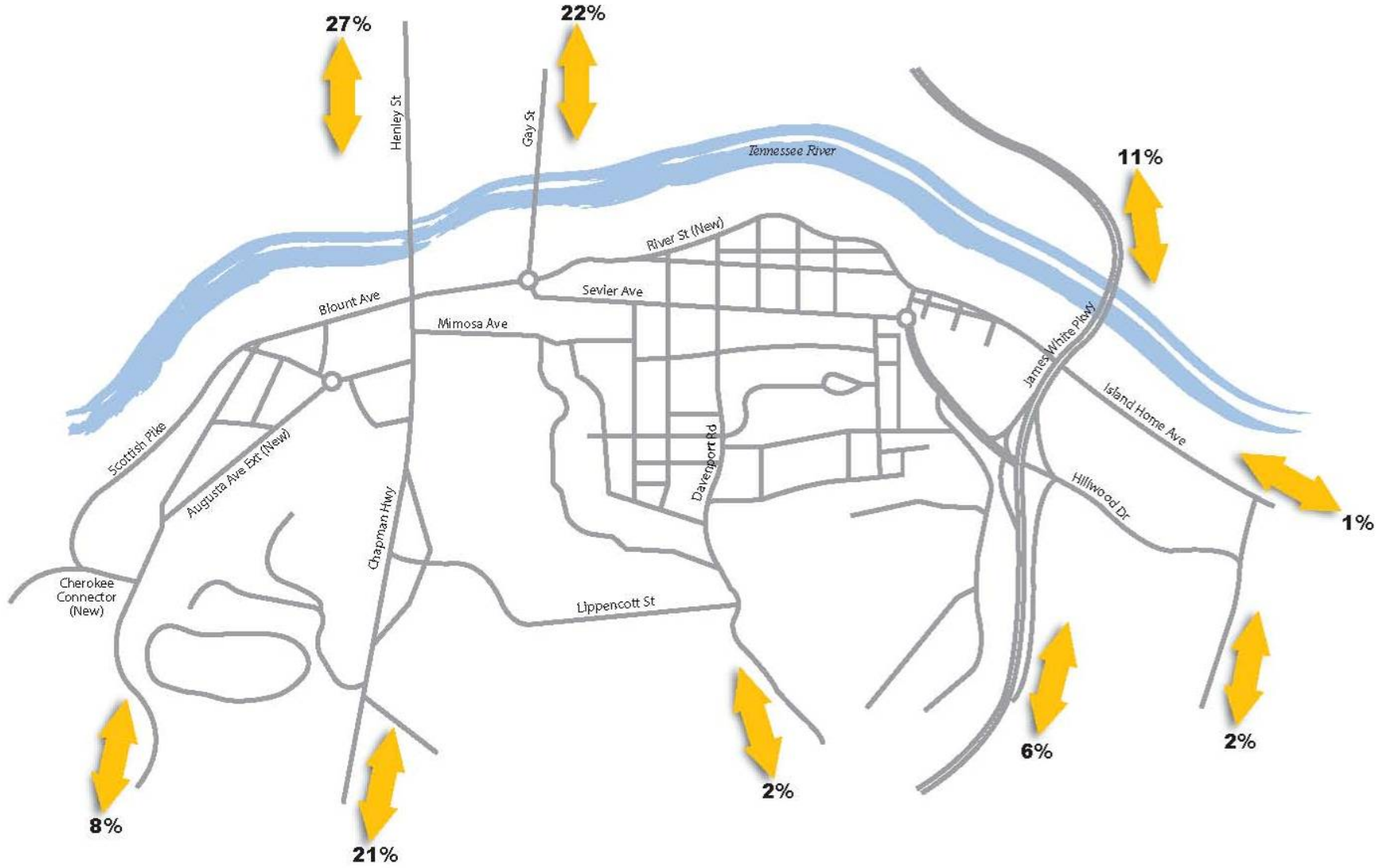


Figure 11  
Directional Distribution

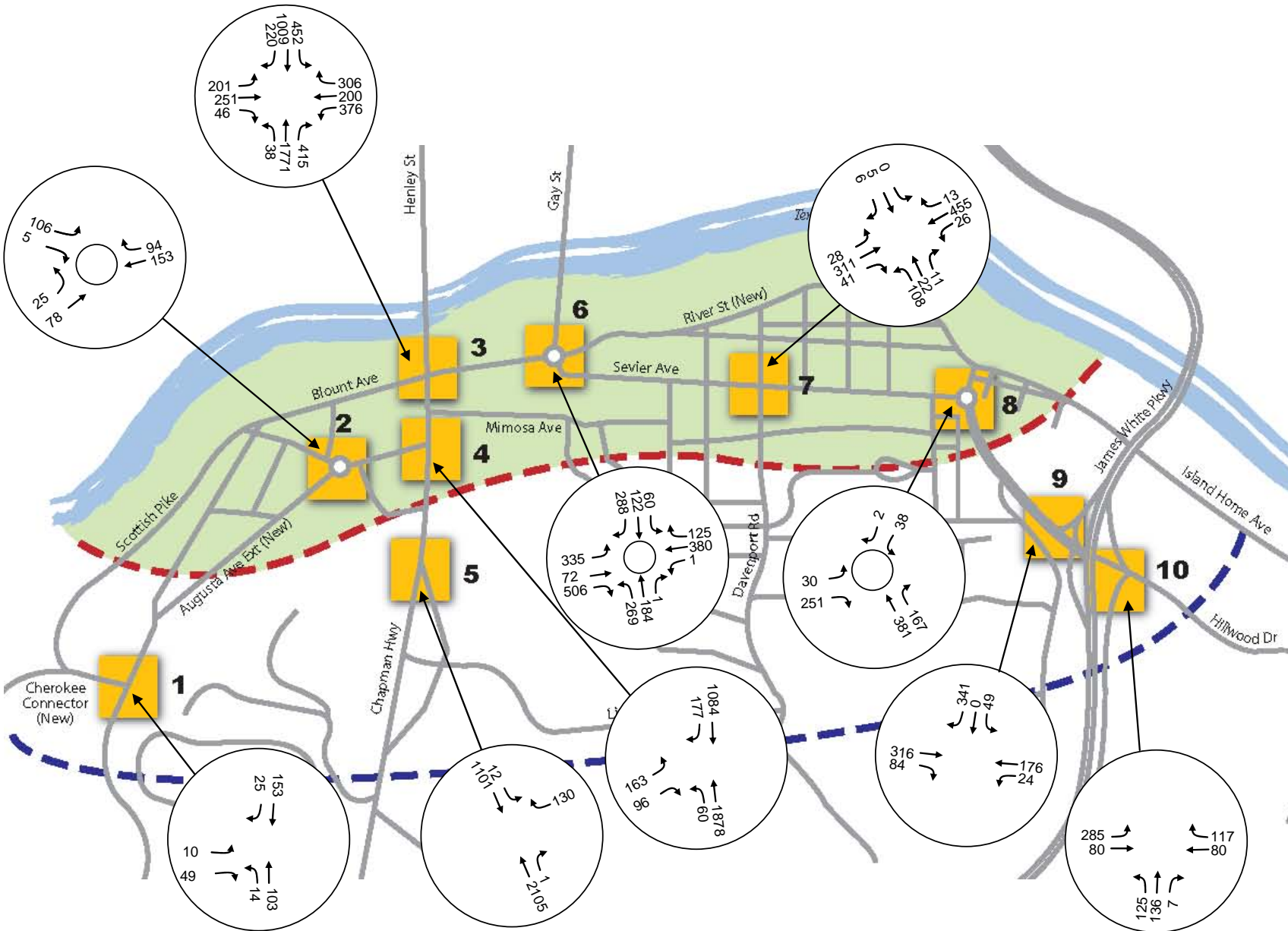


Figure 12  
2015 With-Project AM Peak Hour Traffic

