

Downtown Circulation and Mobility Study

April 2015



Acknowledgements

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Project Objective

The objective of the Downtown Circulation and Mobility Study is to develop strategies to improve multimodal access and mobility within Downtown Knoxville. This plan builds upon some of the previous work and strategies identified in the Downtown Improvement Strategy prepared by the City of Knoxville's Downtown Advisory Committee.

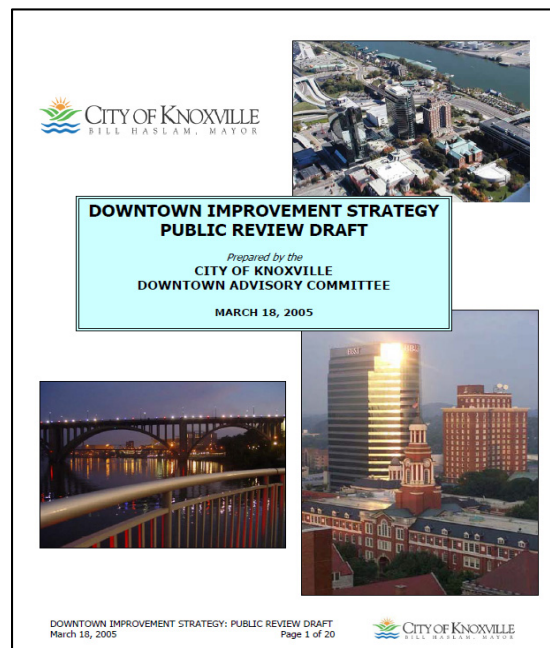


Figure 1: Downtown Improvement Strategy

Recommendations presented in this study are based upon 'tree top-level' transportation planning efforts, and not detailed traffic engineering analysis. Prior to implementing any of the recommendations in this document, a more thorough traffic engineering analysis should be undertaken utilizing current traffic data.

The study area is bounded by Depot Street to the north, Hall of Fame Drive to the east, the Tennessee River to the south, and 11th Street to the west as depicted in Figure 2. Through coordination with the Steering Committee, two primary objectives for the study were identified:

- Determining a feasible layout for one-way and two-way streets within the core of the Central Business District (CBD), and

Defining the most efficient layout for the City's primary north-south destination corridor in the Central Business District (CBD), Gay Street.

Recommendations presented in this study are based upon 'tree top-level' transportation planning efforts, and not detailed traffic engineering analysis. Prior to implementing any of the

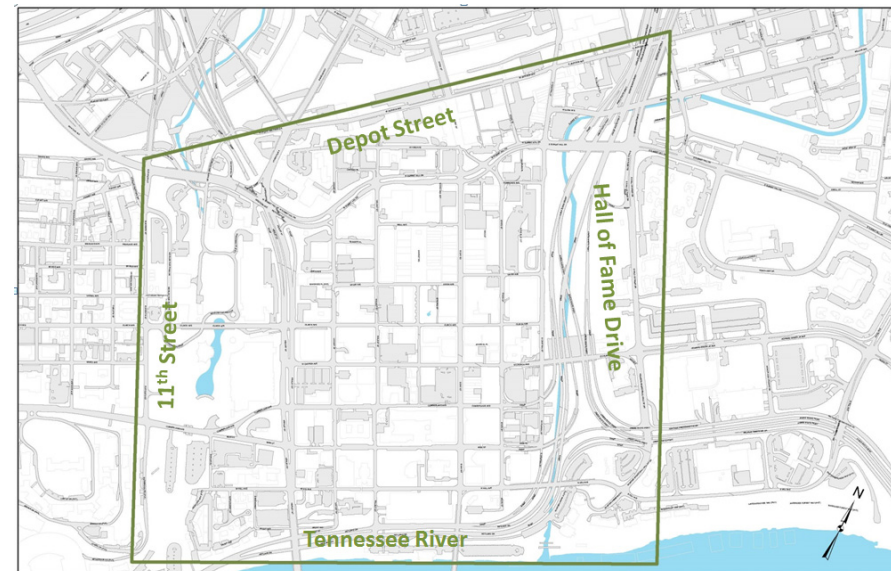


Figure 2: Study Limits

There are numerous one-way streets and one-way pairs within the CBD. Determining whether they should remain one-way, be converted to two-way, or have portions converted to two-way is central to this study. Additionally, shaping a plan to best utilize the existing travel way along Gay Street is also a primary goal of this study. There are essentially four lanes along Gay Street through the heart of downtown Knoxville. This study will determine how best to accommodate five competing interests:

- Through travel lanes
- Exclusive turn lanes (i.e. left-turn and right-turn lanes)
- Bicycle and pedestrian travel
- On-street parking / loading zones
- Curbside transit stops

Data Collection

Existing conditions and pertinent information were obtained to evaluate four elements:

- Motor Vehicle Circulation
- Multimodal Circulation
- Curbside Activity
- Parking

Geographic Information Systems (GIS) data was obtained from the Knoxville, Knox County, and Knoxville Utilities Board Geographic Information System (KGIS).

Field inventory was performed in October 2013 and November 2013. Existing roadway and intersection conditions were verified and documented, such as traffic control, pedestrian infrastructure, bus stop locations, on-street parking areas, locations of surface lots and parking structures, on-street loading zones, and directional traffic flow along the roadways.

Motor Vehicle Circulation

The existing roadway laneage, intersection geometry, and major access locations were documented as part of the field inventory. Additionally, significant traffic generators were identified.

Traffic data collected by count stations were obtained from the Tennessee Department of Transportation (TDOT). The 24-hour traffic volumes, AM and PM peak hour traffic volumes, and corresponding peak hour factors are summarized in these TDOT reports. This data was obtained for 23 locations in Downtown Knoxville, many of which are illustrated in Figure 3.

The team decided not to collect current intersection turning movement counts. With the Henley Street Bridge being under construction for the vast majority of the project schedule, it was determined that current travel patterns within the CBD would be altered and that turning movement count data gathered during that time would not accurately reflect typical commuting patterns. However, historical intersection volume data gathered by others were gathered for 19 intersections, which reflected conditions prior to the Henley Street Bridge construction.

The grid street network in Downtown Knoxville is a combination of one-way and two-way vehicular flows. Within the core Downtown area (bounded by Summit Hill Drive, James White Parkway, Neyland

Drive, and Henley Street), the directional traffic flow was reviewed block-by-block. Figure 4 graphically depicts one-way versus two-way street segments in the CBD, which are also tabulated below.

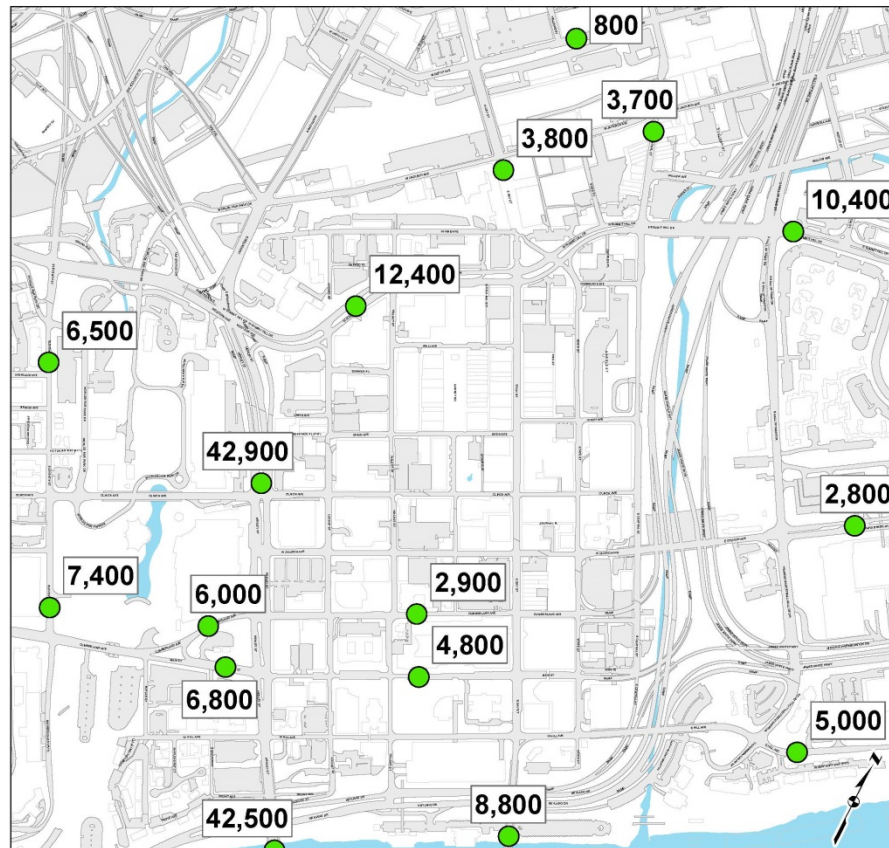


Figure 3: Existing Daily Traffic Volumes within the CBD

The following streets consist of two-way traffic flows in the core Downtown area:

- Gay Street
- Church Avenue
- Hill Avenue
- Commerce Avenue
- Summer Place

The following streets consist of one-way traffic flows in the core Downtown area with directional flow documented:

- Main Street (eastbound)
- Cumberland Avenue (westbound)
- State Street (northbound)
- Central Street (southbound)
- Market Street (northbound)
- Wall Avenue (westbound)

- Union Avenue (one-way eastbound from Walnut Street to State Street)
- Locust Street (one-way southbound from Union Avenue to Neyland Drive)
- Walnut Street (one-way northbound from Neyland Drive to Union Avenue)

As depicted in Figure 4, the core street network within Knoxville's CBD is dominated by one-way streets. The core street network, as defined by roadway segments bounded by Summit Hill Drive to the north, James White Parkway to the east, Neyland Drive to the south, and Henley Street to the west, has a total of approximately 80 roadway segments. Of those approximately 80 segments, about 60 percent of them are one-way streets. This set-up has a direct effect on traffic operations for both private and commercial vehicle traffic. The abundance of one-way streets in the CBD hampers accessibility, and often causes motorists to drive additional roadway segments within the CBD and oftentimes requires them to 'back track' to reach their intended destination.

The Tennessee Department of Transportation (TDOT) assigns a functional classification to the majority of public roadways. The classifications of roads in the Downtown Knoxville area are summarized:

- Henley Street / Broadway – Urban Principal Arterial
- Neyland Drive – Urban Principal Arterial
- James White Parkway – Urban Principal Arterial
- Cumberland Avenue – Urban Principal Arterial
- Western Avenue – Urban Principal Arterial
- Main Street – Urban Principal Arterial
- Gay Street – Urban Minor Arterial
- Central Street – Urban Minor Arterial
- Summit Hill Drive – Urban Collector
- 11th Street – Urban Collector

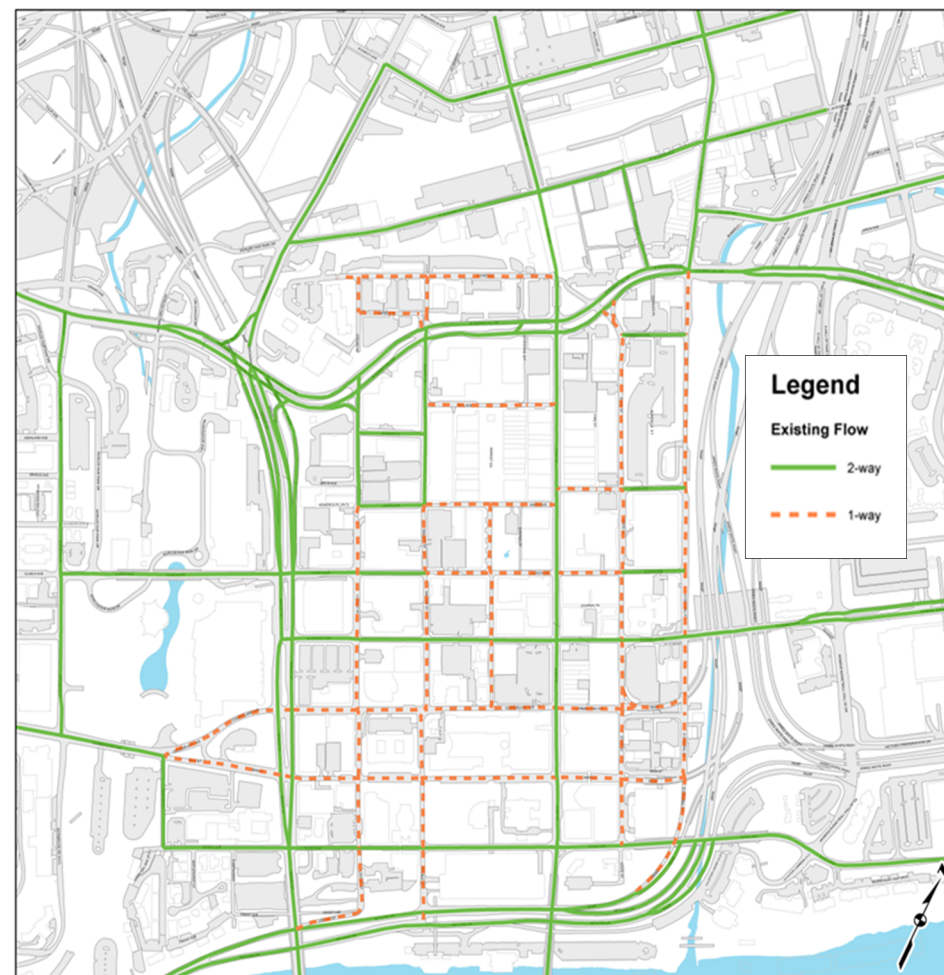


Figure 4: One-Way / Two-Way Operation of CBD Street Network

The following streets consist of both one-way and two-way traffic flows along varying segments in the core Downtown area:

- Clinch Avenue (one-way westbound from State Street to Walnut Street)

Clinch Avenue is classified as an Urban Collector to the west of Henley Street, but is not classified east of Henley Street within the CBD. Hall of Fame Drive is classified as an Urban Minor Arterial to the north of Summit Hill Drive, but not classified south of Summit Hill Drive.



Figure 5: Damaged Sidewalk along South Central Street

Also, the 2011 Knoxville-Knox County Major Road Plan classified a number of the downtown streets within the project limits. According to the Knoxville-Knox County MPC, the classification of downtown roads in Knoxville is summarized below coinciding with a brief summary of how they compare to TDOT's classification system:

- Henley Street / Broadway – Major Arterial (similar to Urban Principal Arterial classification by TDOT)
- Neyland Drive – Minor Arterial (considered an Urban Principal Arterial by TDOT)
- James White Parkway – Expressway (considered an Urban Principal Arterial by TDOT)
- Cumberland Avenue – Major Collector (considered an Urban Principal Arterial by TDOT)

- Western Avenue – Major Arterial (similar to Urban Principal Arterial classification by TDOT)
- Main Street – Major Collector (considered Urban Principal Arterial by TDOT)
- Gay Street – Minor Arterial (consistent with TDOT)
- Church Avenue – Major Collector (not classified by TDOT)
- Central Street – Minor Arterial (consistent with TDOT)
- Clinch Avenue – Minor Collector from 22nd Street to Gay Street, unclassified east of Gay Street (not classified by TDOT within the CBD)
- Locust Street – Minor Collector (not classified by TDOT)
- Walnut Street – Minor Collector (not classified by TDOT)
- Hill Avenue – Minor Collector (not classified by TDOT)
- Summit Hill Drive – Major Arterial (considered an Urban Collector by TDOT)
- 11th Street – Minor Collector (considered an Urban Collector by TDOT)

Multimodal Circulation

Pedestrian accommodations throughout the study area were reviewed. As depicted in Figure 5 along South Central Street there are sidewalk segments with downtown that need replacing. However, the objective of this study was not to document each and every segment of sidewalk for connectivity and ADA compliance. Existing bicycle lanes and designated bicycle routes were identified and documented.

The transit services provided by Knoxville Area Transit (KAT) were evaluated to understand the bus routes and stop locations.

Existing bus routes were obtained from KAT. There are 25 bus routes: 16 routes include stops in Downtown Knoxville, and 14 routes include a stop at the Knoxville Station / Downtown. KAT also provided 3 trolley routes throughout the CBD, with headways every 10 minutes. Figure 6 depicts a trolley operated by KAT.



Figure 6: Trolley Transit Service in the CBD

The Knoxville Bicycle Map, prepared by the Knoxville Regional Transportation Planning Organization (TPO), was reviewed to consider bicycle accommodations. The vast majority of streets in Downtown Knoxville are classified in the category 'roadway has limited or no shoulders, and low to moderate volumes and speeds'.

The Tennessee Department of Transportation (TDOT) Bicycle and Pedestrian Plan and Statewide Bicycle Routes were also reviewed. The 'Nashville to Bristol' bicycle route travels through Downtown Knoxville along Gay Street.

Curbside Activity

On-street parking and commercial loading zones were identified and documented along each corridor within the project limits. The presence of bus stations and taxi standing zones also contribute to curbside activity.

Parking

The locations and relative size of the parking supply, both surface lots and garage structures, were considered. The parking supply in Downtown Knoxville is shown in Figure 7. However, the focus of this study was not intended to provide a parking inventory or assessment for the CBD.

Community and Stakeholder Involvement

Two Steering Committee meetings and one Public Involvement meeting occurred during the preparation of the Downtown Circulation and Mobility Plan. Once completed the final plan was presented to the public as well.

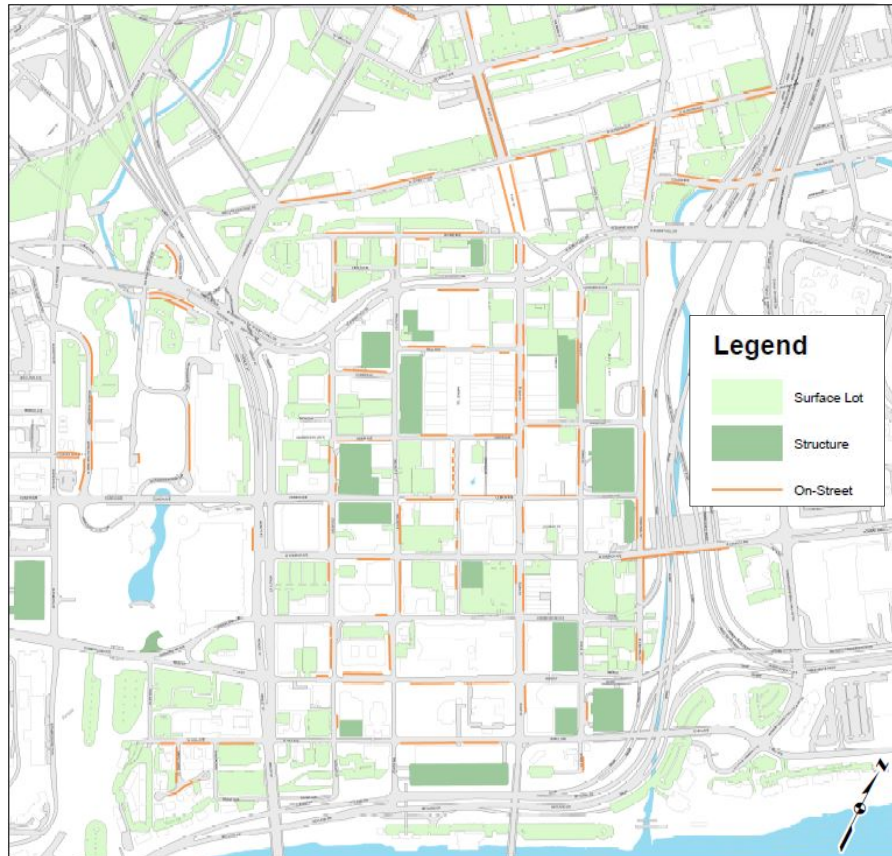


Figure 7: Existing Parking within Downtown Knoxville

The first Steering Committee meeting occurred on March 11, 2014 to discuss the project status. Thirteen people attended to represent the City of Knoxville, Knoxville Regional Transportation Planning Organization (TPO), Knoxville Area Transit (KAT), Tennessee Department of Transportation (TDOT), Mast General Store, and the consultant team.

The second Steering Committee meeting occurred on May 21, 2014 to discuss the project status as well as the preliminary concepts for Gay Street, Locust Street, and Walnut Street. Fourteen people attended to represent the City of Knoxville, Knoxville Regional

Transportation Planning Organization (TPO), Knoxville Area Transit (KAT), the Downtown Knoxville Central Business Improvement District (CBID), and the consultant team.

Public involvement sessions occurred on May 22, 2014 and August 13, 2014 at the Small Assembly Room at the City-County Building and East Tennessee History Center, respectively. Topics of discussion included the project objectives, vehicular circulation, multimodal (pedestrian / bicycle / transit) circulation, curbside activity (loading zones and on-street parking), and parking within surface lots and garage structures.

Following each public meeting, the community was given an opportunity to provide feedback via both a comment card made available at the meeting and an online mechanism provided via the City's website following the meeting.

Parking

Efforts to identify overall supply and demand of on-street and off-street parking were not included in this plan. The City has other programs underway that are aimed at addressing parking needs. Rather, this plan is intended to consider on-street parking needs when assessing one-way and two-way operational changes on corridors within the study limits. Figure 7 is a graphic depicting the locations of on-street and off-street parking with the CBD and was provided by the University of Tennessee College of Architecture. Parking is identified in three categories: surface lot, structure, and on-street. As illustrated in Figure 7, there are a number of parking facilities within downtown. However, as is typically the case in most downtown settings, the proximity to and convenience of parking is often where the general public struggles and/or complains. Additionally, an understanding of where the parking is located in a downtown setting is often not readily known by the general public, especially visitors / tourists. However, the City is currently preparing a downtown wayfinding signage project, and a portion of this project will include signage to direct motorists to parking facilities in the CBD. The design has been completed, and the City anticipates completing this project this year. Some of the directional signing (parking and destination) will need to be adjusted if some of the one-way / two-way changes that are recommended in this report are implemented.

A generalized recommendation is to adopt a standard set of on-street parking / loading zone signs that are MUTCD-compliant throughout the CBD, and to select a consistent way of marking the designated parking / loading stalls. Consideration should also be given to marking the individual stalls on a per car basis for on-street parking. When motorists are left to park their cars in an unmarked section or in a section where the on-street parking is not marked with individual stalls, they tend to leave wider gaps between the cars, and therefore do not fully utilize the entire space available for parking.

Figure 8 depicts a number of on-street parking pavement marking examples which could be adopted as a consistent standard for Downtown Knoxville. Examples A, B, and C are those which are detailed in the MUTCD. Examples D and E are often found in Tennessee. Examples A-E can all be installed with traffic paint or thermoplastic. However, example F incorporates more of a streetscape theme and can be accomplished with colored, textured or stamped pavement or via brick pavers. The only example not recommended is D simply because it does not designate individual parking stalls and therefore does not maximize on-street parking as mentioned earlier. Adopting a consistent template to delineate on-street parking in the CBD utilizing example A, B, C, E, or F is recommended.

Multimodal

Downtown streets function as conduits for all travel modes. Due to the proximity of many destination points as well as the growth of its residential areas, downtown is an ideal place for pedestrians, bicyclists, and transit. As a result, multimodal accommodations were heavily considered in the development of the Downtown Circulation and Mobility Study.

Pedestrian accommodations in downtown Knoxville take the form of sidewalks, widened (as shown in Figure 9) in many locations to accommodate heavy pedestrian traffic as well as sidewalk retail. There is a high level of sidewalk connectivity currently existing. As stated earlier in this document, the intent of this study is not to

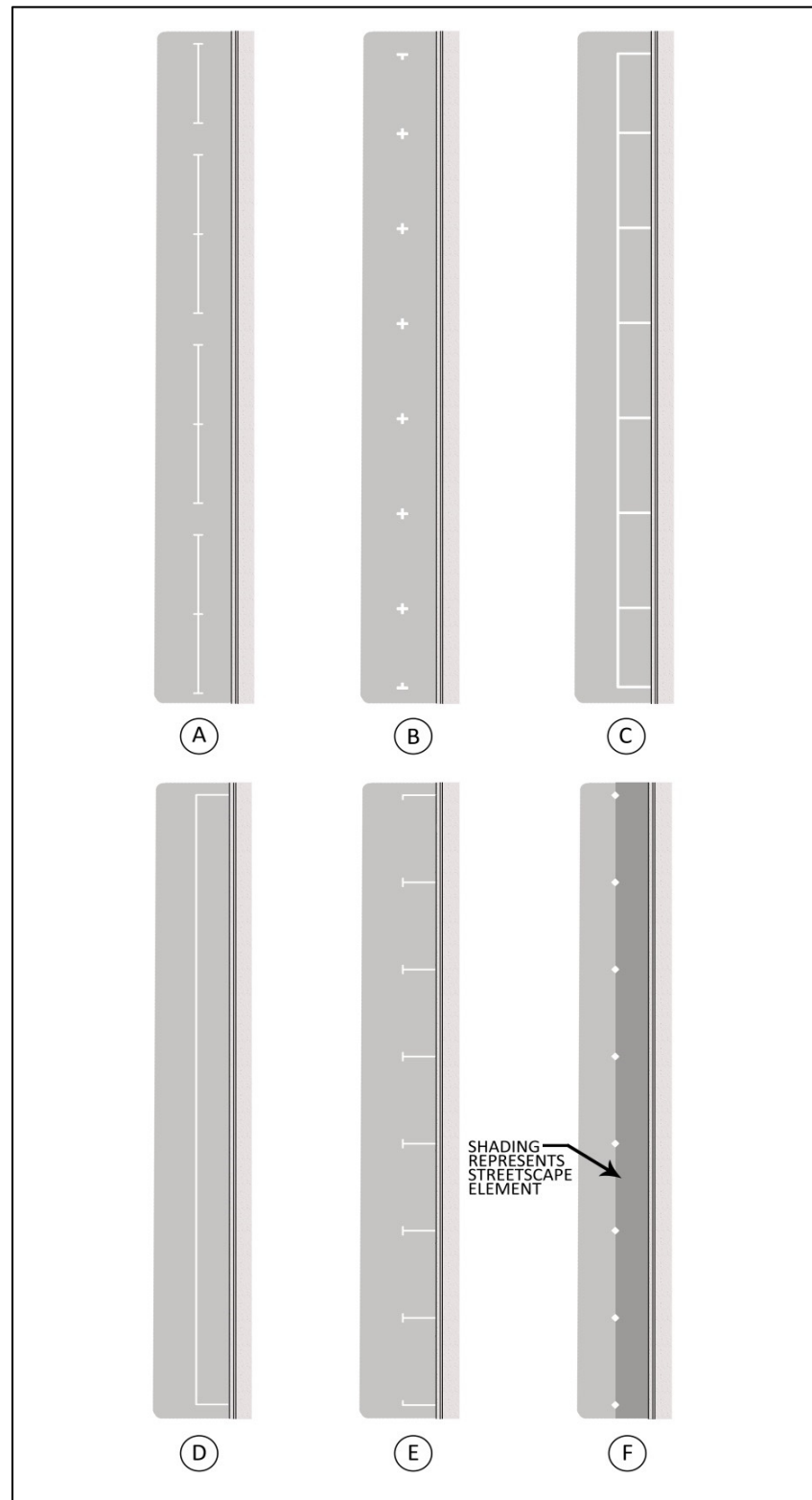


Figure 8: Typical On-Street Parking Delineations

identify or recommend maintenance improvements. The City should continue to identify and replace sidewalk panels that are in need of maintenance. Special attention will need to be given to sidewalk sections near street trees, since these panels will be more likely to shift out of place. Intersection-level treatments should focus on the provision of ADA compliant crossings, both constructing new curb ramps and updating existing curb ramps to comply with current design standards.



Figure 9: Bicycle / Pedestrian Traffic along Church Avenue

Recommendations for bicycle facilities in the downtown area were correlated with the ongoing development of a Bicycle Facilities Plan for the City of Knoxville. This plan has identified a network of facility type improvements across the city. Several recommendations for bicycle improvements exist along the perimeter of the downtown area. Striped bicycle lanes are recommended on Hall of Fame Drive and Hill Avenue. Sharrows are recommended on Jackson Avenue and on a portion of Church Avenue. A short section of greenway construction is recommended on Walnut Street to connect to the pedestrian bridge across Neyland Drive. A portion of Clinch Avenue between Market Street and Walnut Street is proposed to include a contraflow bicycle lane. However, with the recommendation of this study to convert Clinch to two way operations in this section, this treatment will no longer be needed.

From a transit perspective, this study did not attempt to analyze transit routes within the CBD. Rather, the ability to maintain transit service that is easily accessible for the transit riders as well as the buses / trolleys themselves became a focus along the Gay Street corridor. Provisions for appropriate turning radii for the buses / trolleys with the proposed changes along Gay Street were included. Additionally, a few bus stop locations along Gay Street were moved in an effort to accommodate the many competing multimodal needs along this corridor. These changes are detailed in the following sections of this document.

Proposed Circulation

The existing street network, configuration (i.e. one-way, two-way), traffic patterns, and significant trip origins / destinations were evaluated during the data gathering phase of this project. Based on this evaluation, a series of general and corridor-specific recommendations were developed for the CBD.

General Recommendations

Recommendation: Implement a CBD Signal Timing Optimization Program

Plan for, budget, and implement a CBD Signal Timing Optimization Program. Signals along Summit Hill Drive were optimized in 2003 as part of a Congestion Mitigation and Air Quality (CMAQ)-funded project including the Summit Hill Drive / Western Avenue / Henley Street signal depicted in Figure 10. However, it has been several years since a holistic look at signal timing in Downtown Knoxville has been completed. Upgrading local controller settings (vehicle minimum green, passage time, pedestrian WALK and flashing DON'T WALK settings, and vehicle yellow and all-red times) to meet new federal requirements is necessary, and a fresh set of eyes on signal phasing, vehicle progression, and pedestrian phasing is needed. A total of 107 traffic signals in Nashville's CBD were retimed in 2008 resulting in a 28 percent delay reduction, 12 percent fuel consumption savings, and a project benefit-to-cost ratio of 18 : 1. Similar results could be expected in Downtown Knoxville. If done right these retiming programs can benefit vehicular traffic as well as pedestrians / bicyclists in a downtown setting.



Figure 10: Traffic Signal at the Intersection of Henley Street at Summit Hill Drive / Western Avenue

Recommendation: Adopt a Standard CBD Crosswalk Designation

Within the CBD, select a standard crosswalk type in terms of pattern and width. A 10 foot width is recommended in a downtown setting, and the TDOT standard longitudinal cross-walk is predominantly used in the CBD. Carrying this standard throughout the downtown will increase motorist awareness of designated crossings within the CBD, as shown in Figure 11.

Recommendation: Consider CBD Wayfinding Program Adjustments

Adjust the City's new downtown wayfinding guide signing and destination signing to reflect the traffic flow changes recommended in this study. Making sure the wayfinding signage program is consistent with new traffic patterns in the CBD is critical, especially for visitors / tourists.

A rough order of magnitude (ROM) cost projection to implement a CBD Signal Timing Optimization Program is approximately \$220,000

(assuming \$5,500 / signal for roughly 40 downtown traffic signals) and approximately \$1,000 per intersection to install longitudinal crosswalks within the CBD (assuming a typical crossing width of 40 feet).



Figure 11: Longitudinal Crosswalk along Henley Street

State Street

Recommendation: Convert to two-way between Summit Hill Drive and Clinch Avenue.

State Street between Summit Hill Drive and Clinch Avenue is a two-lane facility with parallel on-street parking. State Street operates as a one-way street serving northbound traffic, and is not classified within TDOT's functional classification system. The following statements describe the existing corridor conditions.

State Street, between Clinch Avenue and Union Avenue (see Figure 12):

- The right-of-way varies between approximately 47 feet and 55 feet (based on KGIS).

- The existing on-street parking along the west side is comprised of commercial loading zones, reserved parking for persons with disabilities, and police vehicle parking.
- There is a driveway along the east side that provides vehicular exit from a parking garage structure. The current operations and physical layout of this driveway does not currently provide the opportunity for exiting vehicles to perform a left-turn maneuver and travel southbound along State Street.



Figure 12: State Street Looking North from Clinch Avenue

State Street, between Union Avenue and Commerce Avenue:

- The right-of-way varies between approximately 39 feet and 68 feet (based on KGIS).
- The existing on-street parking along the west side is comprised of metered parking.

State Street, between Commerce Avenue and Summit Hill Drive:

- The right-of-way is approximately 50 feet (based on KGIS).
- The current operations and physical layout of the signalized intersection does not currently provide the opportunity for vehicles traveling along Summit Hill Drive to perform a left-turn maneuver and travel southbound along State Street.

A redevelopment project (Marble Alley) has been proposed on the site bounded by Commerce Avenue, State Street, Union Avenue, and Central Street. As part of this redevelopment, State Street is proposed to be converted from one-way to two-way traffic flow between Summit Hill Drive and Clinch Avenue. On-street parallel parking will be provided along both sides of State Street, along with sidewalks and landscaping. This change will provide greater mobility for motorists in the northeast quadrant of the CBD, provide greater accessibility for residents of the proposed development, and provide additional on-street parking one block off of Gay Street.

To accomplish this conversion, the following infrastructure and/or operational modifications are necessary:

- Construct a westbound left-turn lane in the median at the intersection of Summit Hill Drive / State Street.
- Modify the traffic signal at the intersection of Summit Hill Drive / State Street to provide for a protected-permissive westbound left-turn phase.
- Remove the existing channelizing island on the northbound State Street approach at the Summit Hill Drive / State Street intersection to allow for two-way traffic along State Street.
- Modify the State Street Garage entrance south of Union Avenue to allow southbound State Street traffic to enter the garage. This will require the ADA compliant sidewalk ramp adjacent to the garage entrance to be relocated.
- Modify the State Street Garage exit just north of Clinch Avenue to allow for existing vehicles to turn right (southbound) onto Clinch Avenue.

A ROM cost projection to implement these changes is approximately \$470,000. Each of the ROM cost projects for each corridor consist of the following items: construction budgets (including contractor mobilization at 10 percent of construction, traffic control at 7.5 percent, and a utility allowance of 10 percent), surveying at 5 percent of construction, engineering at 10 percent of construction, and finally a 15 percent construction contingency.

Church Avenue

Recommendation: Convert the second eastbound through lane to on-street parking from Henley Street to Gay Street.

Church Avenue is considered a gateway into the Downtown Knoxville Central Business District (CBD) from Henley Street. It is an 'unbalanced' two-way facility as it consists of two eastbound through lanes and a single westbound through lane between Henley Street and Gay Street. The following statements describe the corridor as it changes throughout the CBD. The following statements describe the corridor as it changes throughout the CBD.

Church Avenue, between Henley Street and Locust Street:

- The right-of-way varies between approximately 50 feet and 55 feet (based on KGIS).
- The roadway cross-section consists of three lanes (two eastbound lanes and one westbound lane) with no on-street parking.
- Trees are present along both the north and south sides of this segment.

Church Avenue, between Locust Street and Walnut Street:

- The right-of-way varies between approximately 53 feet and 55 feet (based on KGIS).
- The roadway cross-section consists of three lanes (two eastbound lanes and one westbound lane) with no on-street parking, with a few exceptions. Parking for persons with disabilities is provided directly in front of the public library along with a transit stop, which essentially removes the second eastbound through lane for half of the block. Additionally there is a taxi turnout on the westbound shoulder just west of the Hilton Hotel.

Church Avenue, from Walnut Street to Gay Street:

- The right-of-way varies between approximately 44 feet and 54 feet (based on KGIS).

- The roadway cross-section consists of three lanes (two eastbound lanes and one westbound lane) with no on-street parking for these two blocks (See Figure 13). The second eastbound left-turn lane terminates as an exclusive left-turn trap lane at Gay Street.



Figure 13: Church Avenue looking west towards Market Street

Church Avenue, from Gay Street to the Church Avenue Bridge crossing over Central Street and Neyland Drive:

- The right-of-way varies between approximately 44 feet and 58 feet (based on KGIS).
- The roadway cross-section consists of two lanes (one in each direction). At both Gay Street and State Street the westbound approach has a second lane (serving as a shared through-right-turn lane with a small segment of on-street parking at Gay Street and serving as an exclusive right-turn lane at State Street).
- As Church Avenue transitions to a bridge, there is on-street parking on portions of both sides of the facility.

Figure 16 on the next page illustrates a concept of this proposed conversion. To accomplish this conversion, the following changes would be necessary:

- At the Henley Street / Church Avenue intersection reduce the southbound dual left-turn movement from a dual movement to a single movement (see Figure 14). This can be accomplished with striping (hatching out the second left-turn lane with pavement markings) or by widening the landscaped median. Prior to making this change, an operational assessment of the signal operations at this intersection should be completed to determine if a single lane left-turn movement can be accomplished without queuing left-turning vehicles past the left-turn storage bay. *If the operational assessment results in queuing in excess of the storage bay, then the current dual left-turn movement should be maintained.*



Figure 14: Henley Street at Church Avenue

- Restripe the block between Henley Street and Locust Street to consist of two-11 foot lanes and on-street parking on both sides. 18 to 20 additional on-street parking stalls can be added with this striping change (see Figure 15 for current conditions). *If the southbound dual left-turn movement at the Henley Street / Church Avenue intersection needs to be maintained, then the second eastbound through lane along*

this block should also be maintained and terminated as a lane-drop at the intersection with Locust Street. With this option, the westbound on-street parking could still remain, resulting in a reduced number of added on-street parking stalls (9-10 additional stalls).

- Construct a bulb-out on the northwest corner at the intersection of Church Avenue / Locust Street.
- Reconfigure the block between Locust Street and Walnut Street to consist of two-9.5 to 10 foot travel lanes, on-street parking on the eastbound shoulder up to the library, and then construction of an enhanced transit stop with bulb-outs on each side to provide multimodal enhancements (additional sidewalk, bicycle racks, etc.). Approximately 5 additional on-street parking stalls can be provided along this block with these improvements.
- Restripe the block between Walnut Street and Market Street to consist of two-10 foot lanes and on-street parking on the eastbound shoulder. Approximately 9 additional on-street parking stalls can be added with this striping change.
- Construct a bulb-out on the southwest corner at the intersection of Church Avenue / Market Street.
- Restripe the block between Market Street and Gay Street to consist of two-11 foot lanes and on-street parking on the westbound shoulder. Approximately 11 additional on-street parking stalls can be added with this striping change. Prior to making this change, an operational assessment of the signal operations at the Gay Street / Church Avenue intersection should be performed to confirm that the exclusive left-turn lane on the eastbound approach is not necessary.
- At the intersection of Gay Street / Church Avenue, restripe the westbound approach to consist of a single shared lane serving left-turn, through, and right-turn movements. Restripe the outside lane to increase the on-street parking for the current single stall to a total of 6 stall (increase of 5 parking stalls). Prior to making this change, an operational assessment of the signal operations at the Gay Street / Church Avenue intersection should be performed to confirm

that the exclusive left-turn lane on the westbound approach is not necessary.

- At the intersection of Church Avenue / State Street, reconfigure the east leg of this intersection in an effort to better define the southeast corner of this intersection by increasing the sidewalk area, reducing pedestrian crossing distances, and removing the angled ingress / egress of the parking lot within the intersection.



Figure 15: Church Avenue between Henley Street and Locust Street

- If each of these modifications is made on a block-by-block basis, approximately 50 new on-street parking stalls can be added to the CBD network along Church Avenue. A ROM cost projection to implement these changes is approximately \$600,000. ROM costs broken out include roughly \$90,000 for signing / striping, around \$210,000 for asphalt milling / overlay, and approximately \$85,000 for bulb-outs / sidewalks / ADA ramps. The remaining budget items cover mobilization, traffic control, design, a utility allowance, and the 15 percent contingency mentioned earlier.

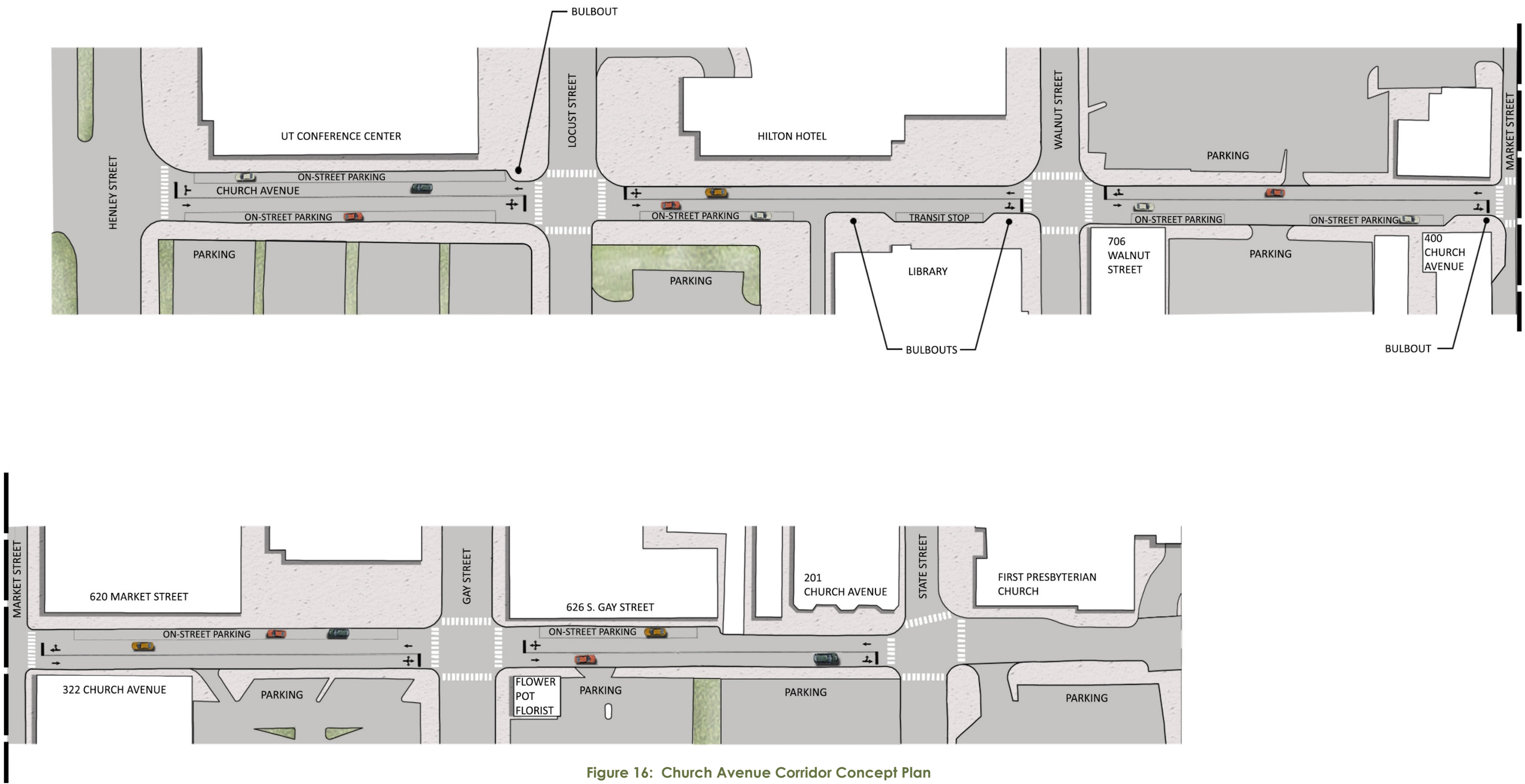


Figure 16: Church Avenue Corridor Concept Plan

Clinch Avenue

Recommendation: Convert to two-way between Walnut Street and State Street.

Clinch Avenue is considered a primary gateway into the Downtown Knoxville Central Business District (CBD) from the Fort Sanders area and yet it does not provide direct connectivity to the City's most prominent north-south destination corridor – Gay Street. Clinch Avenue is a two-way facility, except between Walnut Street and State Street where vehicles travel one-way westbound. If a motorist wants to reach Gay Street or other eastern destinations in the CBD, he or she must turn right or left on the Locust Street / Walnut Street one-way pair. Clinch Avenue essentially operates as two-way for 2 blocks, one-way for 3 blocks, and then two-way for 1 block. The following statements describe the existing corridor conditions

Clinch Avenue, between Walnut Street and Market Street:

- The right-of-way varies between approximately 32 feet and 44 feet (based on KGIS).
- The existing on-street parking along the south side is comprised of commercial loading zones, reserved parking for persons with disabilities, and metered parking.
- Trees are present along both the north and south sides.

Clinch Avenue, between Market Street and Gay Street (see Figure 17):

- The right-of-way varies between approximately 26 feet and 28 feet (based on KGIS).
- The existing on-street parking along the north side is comprised of metered parking.
- Trees are present along both the north and south sides.

Clinch Avenue, between Gay Street and State Street:

- The right-of-way varies between approximately 31 feet and 33 feet (based on KGIS).

- The existing on-street parking along the north side is comprised of commercial loading zones.

Consistency in traffic flow along this street should benefit driver expectation while also providing an opportunity for a consistent “feel” along Clinch Avenue. To accomplish this conversion, the following infrastructure and/or operational modifications are necessary:



Figure 17: Clinch Avenue Looking East towards Gay Street

- Reduce the size of the bulb-out on the southeast corner of the Clinch Avenue / Walnut Street intersection to allow for an eastbound through lane and adequate turning movements for northbound traffic from Walnut Street that desires to turn right onto eastbound Clinch Avenue.
- Remove on-street parking on the south side of Clinch Avenue between Walnut Street and Market Street.
- Consider removing multi-way stop control at the intersection of Clinch Avenue / Market Street to only require northbound Market Street traffic to stop.

- Remove four bulb-outs and street trees on the north side of Clinch Avenue between Strong Street (operating as an alley) and Gay Street along with the removal of the on-street parking (depicted in Figure 17). Portions of this on-street parking will be relocated to the southbound Gay Street curb line just north of Clinch Avenue – See Figure 22).
- If intersection sight distance is an issue for eastbound motorists at the intersection of State Street / Clinch Avenue, consider multi-way stop control.
- Remove on-street parking / loading on the north side of Clinch Avenue between State Street and Gay Street.
- Modify the traffic signal at the intersection of Gay Street / Clinch Avenue to accommodate eastbound motorists (i.e. install vehicle signal indications for eastbound motorists).
- Install MUTCD-compliant pedestrian crosswalk markings at the intersection of Gay Street / Clinch Avenue. The current brick pavers do not meet federal / state requirements found in the MUTCD.

A ROM cost projection to implement these changes is approximately \$170,000.

Walnut Street and Locust Street

Recommendation: Convert each to two-way between Union Avenue and Church Avenue

Walnut Street and Locust Street are both two-way facilities between Summit Hill Drive and Union Avenue. South of Union Avenue, these roads function as a one-way pair (Locust Street – southbound; Walnut Street – northbound) until their respective termini with Neyland Drive. The following statements describe the existing corridor conditions.

Walnut Street, between Church Avenue and Clinch Avenue (see Figure 18):

- The right-of-way varies between approximately 41 feet and 43 feet (based on KGIS).

- The existing on-street parking along the east side is comprised of metered parking.
- The existing on-street parking along the west side is comprised of short-term parking.

Walnut Street, between Clinch Avenue and Union Avenue:

- The right-of-way varies between approximately 37 feet and 40 feet (based on KGIS).
- The existing on-street parking along the west side is comprised of commercial loading zones.

Locust Street, between Church Avenue and Clinch Avenue (See Figure 19):

- The right-of-way varies between approximately 46 feet and 49 feet (based on KGIS).
- The existing on-street parking along the west side is comprised of commercial loading zones, reserved parking for persons with disabilities, and police vehicle parking.
- The current operations of the signalized intersection will require modification to provide appropriate traffic control to northbound vehicles along Locust Street.

Locust Street, between Clinch Avenue and Union Avenue:

- The right-of-way varies between approximately 40 feet and 42 feet (based on KGIS).
- The existing on-street parking along the west side is comprised of general purpose parking.
- There is a driveway along the east side that provides vehicular entrance to a parking garage structure. The current operations and physical layout of this driveway does not currently provide the opportunity for vehicles traveling northbound along Locust Street to perform a right-turn maneuver into the driveway.
- There is a driveway along the east side that provides vehicular exit from a parking garage structure. The current

operations and physical layout of this driveway does not currently provide the opportunity for exiting vehicles to perform a right-turn maneuver and travel northbound along Locust Street.



Figure 18: Walnut Street Looking South towards Church Avenue

From a connectivity standpoint, it makes more sense for Church Avenue to be the boundary between two-way operations and the one-way pair. Converting the portions of Walnut Street and Locust Street between Union Avenue and Church Avenue to two-way operation opens up more opportunities for traffic to maneuver in this section of the CBD. To accomplish these conversions, the following infrastructure and/or operational modifications are necessary along Locust Street:

- Remove or reduce the width of the landscaped area in the southeast corner of the Locust Street / Union Avenue Intersection to accommodate two-way operation.
- Modify the Locust Street Garage exit to allow for motorists to turn northbound onto Locust Street.
- Modify the Locust Street Garage entry to allow for motorists from northbound Locust Street to turn right into the garage.

- Modify the traffic signal at the intersection of Locust Street / Clinch Avenue to provide signal indications and vehicle detection for the northbound approach.



Figure 19: Locust Street Looking South towards Clinch Avenue and the Locust Street Garage Entry

Stakeholder input along Locust Street referenced the crest vertical curve near the intersection of Union Avenue, and the potential concern with intersection sight distance if two-way operation is implemented. Follow-up field visits by the Consultant team indicate that sight distance is adequate for two-way operation along Locust Street near Union Avenue.

And along Walnut Street:

- Remove the loading zone on the west side of Walnut Street just upstream from the Walnut Street / Union Avenue intersection (area is needed for southbound through lane).
- Sign the southbound approach of Walnut Street at its intersection with Clinch Avenue as an all-way stop. However, if via an engineering study conditions warrant two-way stop control (i.e. traffic volumes warrant a reduction to two-way stop control for one of the streets and intersection sight distance is not an issue), this less restrictive stop control should be implemented in lieu of all-way stop control.

- Sign the southbound approach of Walnut Street at its intersection with Church Avenue as an all-way stop. However, if via an engineering study conditions warrant two-way stop control (i.e. traffic volumes warrant a reduction to two-way stop control for one of the streets and intersection sight distance is not an issue), this less restrictive stop control should be implemented in lieu of all-way stop control.

A ROM cost projection to implement these changes is approximately \$480,000.

Union Avenue

Recommendation: *Convert to one-way operation between Locust Street and Walnut Street*

Union Avenue essentially operates as two-way for 1 block (see Figure 20), one-way for 2 blocks, undergoes a 75-foot offset along Gay Street, one-way for 1 block, and then two-way for 1 block. The following statements describe the existing corridor conditions:

Union Avenue, between Locus Street and Walnut Street:

- The right-of-way is approximately 39 feet (based on KGIS).
- The existing on-street parking along the south side is comprised of metered parking, commercial loading zones, and short-term passenger loading zones.
- Trees are present along the south side.

Converting the segment between Gay Street and State Street from one-way to two-way would result in lessened efficiency regarding traffic operations at the signalized intersection of Gay Street and Union Street. However, converting the segment between Locust Street and Walnut Street from two-way to one-way eastbound should benefit driver expectation while also providing an opportunity for a consistent “feel” for the 3 blocks along Union Avenue located west of Gay Street. To accomplish this conversion, the following infrastructure and/or operational modifications could be implemented:

- Option 1: This segment could be restriped to include one eastbound travel lane and an entire block of on-street parking and/or commercial loading zone along the north side of Union Avenue.
- Option 2: The pedestrian realms on both curb lines along Union Avenue could be extended to provide more square footage for pedestrian traffic, outdoor café style restaurant seating, and/or ‘sidewalk sale’ outdoor retail efforts.



Figure 20: Union Avenue Looking East towards Walnut Street

A ROM cost projection to implement these two optional changes is approximately \$13,000 for Option 1 and \$170,000 for Option 2.

Gay Street

Recommendation: *Restripe the entire length of the corridor in an effort to balance the demands for through lanes, turn lanes, transit needs, and on-street parking / loading zones.*

Gay Street is the premier destination corridor in downtown Knoxville; hence, there is demand for every transportation need along this corridor – through lanes, turn lanes, bus stops, on-street parking, loading zones, and bicycle / pedestrian amenities. This is

best illustrated in Figure 21, which depicts the various modes of transportation as well as on-street parking along this corridor. Obviously, with only four lanes of travel, a compressed right-of-way, and buildings fronting the vast majority of the corridor, there is no opportunity for additional space to accommodate each of these competing demands. Therefore, the Consultant Team in coordination with the Steering Committee looked at determining the most efficient way to utilize the approximately 40 feet of travel lanes within this corridor.



Figure 21: Multimodal Activities on Gay Street

The following is a brief overview of the existing conditions along Gay Street.

Gay Street, between Hill Avenue and Main Street:

- The right-of-way varies between approximately 74 feet and 82 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of commercial loading zones.

Gay Street, between Main Street and Cumberland Avenue:

- The right-of-way is approximately 60 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of commercial loading zones.

Gay Street, between Cumberland Avenue and Church Avenue:

- The right-of-way is approximately 61 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of commercial loading zones and two-hour parking.

Gay Street, between Church Avenue and Clinch Avenue:

- The right-of-way varies between approximately 68 feet and 73 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of passenger loading zones.
- The existing on-street parking along the west side is comprised of commercial loading zones, reserved parking for persons with disabilities, and two-hour parking.

Gay Street, between Clinch Avenue and Union Avenue:

- The right-of-way varies between approximately 66 feet and 70 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of commercial loading zones, passenger loading zones, and two-hour parking.
- The existing on-street parking along the west side is comprised of two-hour parking.

Gay Street, between Union Avenue and Wall Avenue:

- The right-of-way varies between approximately 61 feet and 70 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of two-hour parking.

- The existing on-street parking along the west side is comprised of commercial loading zones and two-hour parking.

Gay Street, between Wall Avenue and Summit Hill Drive:

- The right-of-way varies between approximately 64 feet and 70 feet (based on KGIS).
- The existing on-street parking along the east side is comprised of reserved parking for persons with disabilities and two-hour parking.
- The existing on-street parking along the west side is comprised of two-hour parking.

Figure 22 graphically represents the chosen concept developed by the Consultant Team and Steering Committee. Some of the additional details to describe the recommended improvements along the corridor also include the following:

- Optimize the signals along Gay Street to promote northbound / southbound progression and improved pedestrian timings (as a subset of the overall CBD signal timing optimization program recommended earlier in this document).
- Analyze the signal phasing at each intersection along Gay Street and remove possible side street split-phased operation with concurrent permissive phasing.
- Consider a gateway entry median feature and/or a landscaped median on the northbound approach of Gay Street at its intersection with Summit Hill Drive.
- Introduce bulb-outs at a number of intersections along the corridor to provide additional room for pedestrians and bicycle amenities (e.g. bicycle racks) and to also reduce the pedestrian crossing distances at the signalized intersections.
- Remove the on-street parking within the offset intersection of Union Avenue at Gay Street. Replace the on-street parking with additional sidewalk plaza area serving as a bulb-out and install a single crosswalk crossing Gay Street at this

location. Consider an exclusive pedestrian signal phase to accommodate this shortened pedestrian crossing.

- Adjust the southbound bus stop upstream of the Gay Street / Clinch Avenue intersection. Place it further north and introduce a number of on-street parking stalls in the current bus stop location to accommodate some of the removed parking on Clinch Avenue due to Clinch Avenue becoming two-way.
- Consider offsetting the southbound bus stop between Church Avenue and Cumberland Avenue 3-6 ft. into the existing curb line / sidewalk if and/or when redevelopment occurs along this block of Gay Street. This offset would lessen the transitions required for southbound motorists along Gay Street, and redevelopment efforts could provide for additional sidewalk depth to recoup the width lost via the proposed offset bus stop. This offset is not depicted in Figure 22.
- Add crosswalk striping to a number of the existing brick paver crosswalks. Without reflective striping, these crosswalks do not meet Federal standards.
- A ROM cost projection to implement the changes along Gay Street is approximately \$1,300,000. ROM costs broken out include roughly \$140,000 for signing / striping, around \$210,000 for asphalt milling / overlay, \$200,000 for signal improvements, roughly \$120,000 for rebuilding the Gay Street / Union Avenue intersection streetscaping elements, a \$35,000 allowance for landscaping / gateway entry treatments at Summit Hill Drive, and approximately \$140,000 for bulb-outs / sidewalks / ADA ramps / curb and gutter. The remaining budget items cover mobilization, traffic control, design, a utility allowance, and a 15 percent contingency.

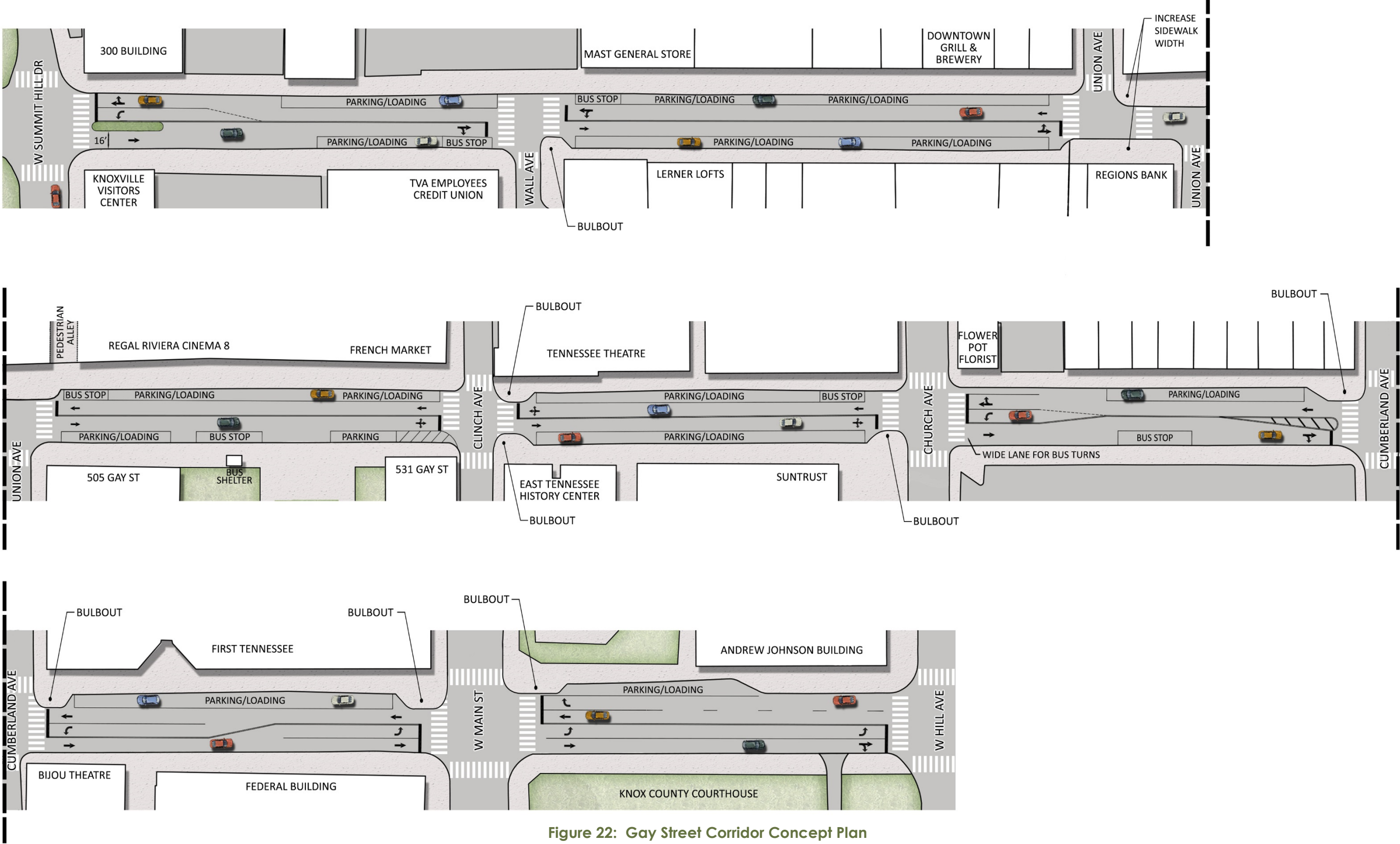


Figure 22: Gay Street Corridor Concept Plan

Conclusions and Next Steps

Downtown Knoxville is vibrant and growing. It is experiencing redevelopment on virtually every corridor within the CBD. Residential and mixed-use redevelopment is either recently completed, underway, or planned in the near future in many locations. As residential density within Downtown grows, the ability to move people and goods will become more challenging. Having a plan in place that reduces the City's dependency on one-way streets will provide the mobility and circulation desired by residents, business owners, workers, visitors, tourists, and each person that desires to live, work, play, or visit Downtown Knoxville.

Many of these changes in circulation will be driven by redevelopment efforts in Downtown, such as the proposed redevelopment in the northeast corner of Downtown along State Street. However, others changes such as the conversion of a segment of Union Avenue or the reallocation of right-of-way along Gay Street will need to be driven by the City.

Prior to finalizing the concepts recommended in this document, more detailed traffic engineering analysis will be needed. For instance, turning templates for transit vehicles should be analyzed prior to the relocation of transit stops and on-street parking / loading zones prior to implementing the conceptual corridor layout along Gay Street. Detailed turning movement counts and intersection sight distances should be determined at certain intersections to confirm the need for all-way stop control versus two-way stop control at certain downtown intersections or the ability to remove exclusive turn lanes along Church Avenue. As the City chooses to implement these circulation changes, detailed engineering analysis and design should be undertaken to confirm and/or adjust the concepts recommended in this study.

