



**SAFETY AND TRAFFIC REVIEW OF  
PROPOSED RODNEY SQUARE TO  
SHIPLEY STREET  
BUS SERVICE CHANGE**

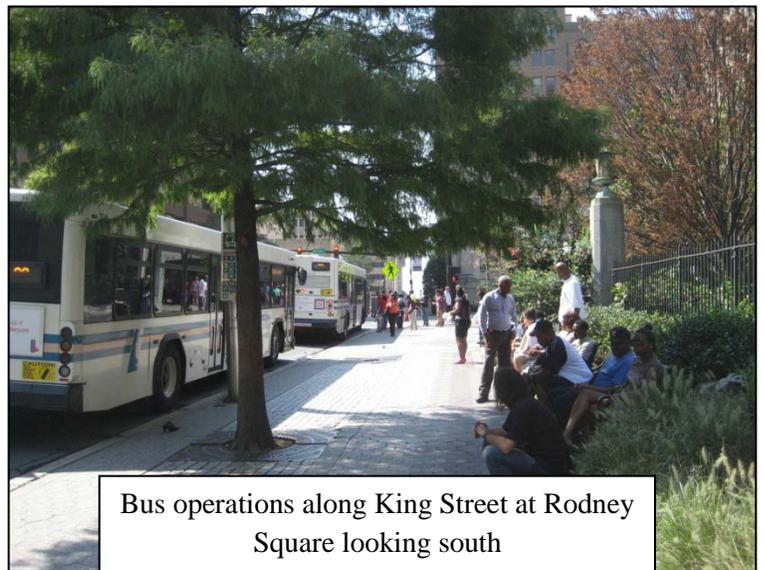
November 2011



## Study Background

We were asked to determine the safety and traffic implications of a proposed shift of approximately one-third of DART First State bus operations associated with Rodney Square to Shipley Street between 8<sup>th</sup> and 9<sup>th</sup> Streets. PB conducted field reviews at the site, stakeholder interviews, and used modeling tools to evaluate proposed improvements. PB was also asked to review relevant sections of the *Wilmington Downtown Circulation Study*, completed by Whitman, Requardt, and Associates (WRA) in April 2011. That report, and the accompanying *Wilmington Downtown Circulation Study Transit Center Evaluation* (TCE) completed in March 2010, both identified the need to reduce the reliance on Rodney Square as the defacto transit hub in downtown Wilmington. Such a plan would also eliminate the current condition in which buses double and triple stack along Rodney Square, creating an unsafe condition for pedestrian and vehicular traffic. While the TCE proposed shifting bus service to Shipley Street from Orange Street via 11<sup>th</sup>, French, and 10<sup>th</sup> Streets, the City of Wilmington has proposed a less circuitous route to Shipley Street from Orange Street via 10<sup>th</sup> Street. Following stakeholder input, this plan was further refined to shift some buses to Shipley Street from Orange Street via 9<sup>th</sup> Street, while others would use the proposed route to Shipley Street via 10<sup>th</sup> Street. This review is focused on the proposed shift of routes to Shipley Street via 9<sup>th</sup> and 10<sup>th</sup> Streets.

A three-phased Transportation Enhancements (TE) project is focused on improving Rodney Square to increase usage as a public space. In conjunction with the TE project, bus operations would be shifted away from Rodney Square. Construction on Phase One of the TE project is anticipated to begin in 2012, during which a significant portion of the area fronted by 10<sup>th</sup> and King Streets would be reconstructed to improve soil conditions, street trees and overall landscaping. Phases Two and Three would continue similar work along 11<sup>th</sup> and Market Streets adjacent to Rodney Square in 2013-2014. This construction is expected to impact bus operations, making a transition necessary to maintain current levels of bus service.



Bus operations along King Street at Rodney Square looking south

Under the proposed plan provided by Delaware Transit Corporation (DTC), 383 buses daily would be rerouted from Rodney Square to the Shipley Street site. This shift would allow for the TE project construction to begin with minimal impacts to passenger needs. This shift would ultimately involve the movement of 207 buses to Shipley Street via 9<sup>th</sup> Street and 176 buses to Shipley Street via 10<sup>th</sup> Street.

The Shipley Street route was selected for several reasons. More specifically the Shipley Street route is already used for DART First State operations when events at Rodney Square force a detour from the current routes. Second, the proximity of Shipley Street to Rodney Square and the generally flat terrain of the landscape between the two locations would provide pedestrians with a fairly straightforward connection. Third, Shipley Street has the available roadway capacity and will be least impacted by the necessary removal of on-street parking, given the number of business along the section of Shipley Street within the study area. Finally, the choice of Shipley Street was extensively studied by WRA as part of the TCE.

Stakeholder interviews were conducted with staff from DART First State, the City of Wilmington, and potentially impacted citizens of the proposed Shipley Street route to identify their ultimate goals and needs from this anticipated shift. These interviews provided substantial historical information regarding the need to shift bus operations from Rodney Square, as well as commonly heard themes obtained from public and stakeholder outreach. The most

significant concern they shared was from workers in the Community Service Building located on the southeastern corner of 10<sup>th</sup> and Orange Streets, noting that the influx of buses onto 10<sup>th</sup> Street from Orange Street will impact pedestrian movements at this intersection. Several concerned citizens that were interviewed by phone noted that even with improvements to signing and striping, they are still apprehensive about the shifting of buses to the new location and stressed the importance of enforcement as a way to further enhance pedestrian safety regardless of the improvements put in place.

Given the need to find both a safe and acceptable solution to the ultimate removal of bus operations at Rodney Square, Parsons Brinckerhoff reviewed the need for safety and traffic improvements based on the increased bus traffic to Shipley Street and associated roadways.

## Existing Conditions

Parsons Brinckerhoff performed a field view of the study area, bounded by 10<sup>th</sup> Street (north), Market Street (east), 8<sup>th</sup> Street (south), and Orange Street (west). The field view concentrated on pedestrian and traffic conditions at the signalized and non-signalized intersections as well as midblock sections of major roadways. The review focused on an inventory of existing conditions and deficiencies, including the identification of any potential traffic and safety issues associated with the proposed shift of some bus operations from Rodney Square to Shipley Street, via 9<sup>th</sup> and 10<sup>th</sup> Streets.

## Safety

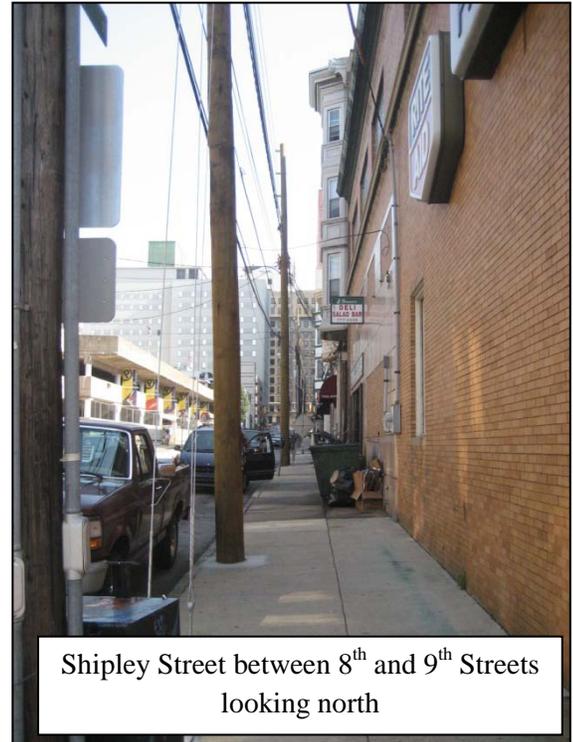
The existing conditions inventory identified no significant negative safety issues associated with the proposed shift of buses to Shipley Street based on existing roadway widths and curbing. This was confirmed using AutoTURN Version 6 to review bus right-turning movements at the four impacted intersections:

- Orange Street to 9<sup>th</sup> Street
- 9<sup>th</sup> Street to Shipley Street
- Orange Street to 10<sup>th</sup> Street
- 10<sup>th</sup> Street to Shipley Street.

Several deficiencies were noted along Shipley Street between 8<sup>th</sup> and 9<sup>th</sup> Streets. This block is currently used primarily as a service roadway for businesses that front Market Street, to the east of Shipley Street. This has created a situation where sections of the sidewalk along the eastern curb of Shipley Street are difficult to traverse due to the placement of garbage receptacles. The sidewalk along the western curb of Shipley Street will serve as a passenger waiting area, but the existing overhang from the former parking garage is in poor condition and may require rehabilitation or removal before installing shelters and/or benches.

Deficient lighting was identified along several blocks within the study area. Orange and Shipley Street were both identified as having insufficient or damaged lighting between 8<sup>th</sup> and 10<sup>th</sup> Streets. 9<sup>th</sup> Street, between Orange Street and Market Street has either limited or no lighting.

At the signalized intersection of 8<sup>th</sup> and Orange Streets, pedestrian accommodations were limited, as no crosswalks are currently striped and pedestrians standing on the northwestern corner of the intersection cannot see any signal faces and therefore cannot determine the current phase of the signal.



## Traffic

A review of traffic operations data made available by the City indicates a level of service (LOS)<sup>1</sup> of A or B along study area routes and intersections. Our analysis indicates that the proposed shift of buses to the Shipley Street route via 9<sup>th</sup> and 10<sup>th</sup> Streets is not expected to significantly degrade operations at these locations, maintaining LOS A or B as in the current condition. The Shipley Street route would involve a shift of 22

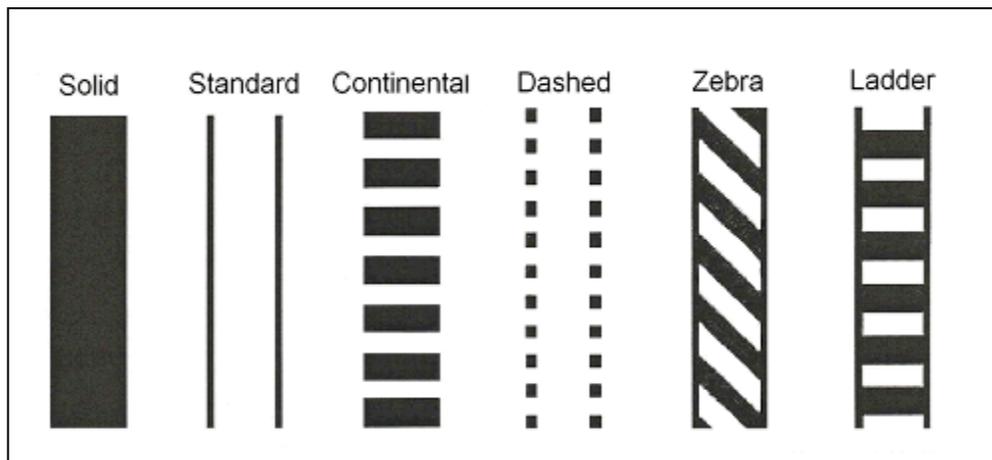
buses from Orange Street to 9<sup>th</sup> Street and 18 buses from Orange Street to 10<sup>th</sup> Street, for a total of 40 buses during the PM peak hour. A summary of the traffic conditions for the existing (no-build) and existing (Shipley Street route) are included in Table 1.

Table 1 – Traffic Conditions Summary

Intersection	Existing No-Build		Proposed Shipley Street Route	
	Delay (sec)	LOS	Delay (sec)	LOS
10th Street/Orange Street	8.5	A	8.7	A
10th Street/Shipley Street	1.3	A	1.4	A
9th Street/Orange Street	10.4	B	10.2	B
9th Street/Shipley Street	12.0	B	15.0	B
8th Street/Shipley Street	11.7	B	15.7	B

The results of the existing conditions inventory, including measurements and observations, are included in Tables 2 and 3 on pages 4 and 5. Site-specific improvements for the intersections at 8<sup>th</sup> and Orange Streets, 9<sup>th</sup> and Orange Streets, 9<sup>th</sup> and Shipley Streets, 10<sup>th</sup> and Orange Streets, and 10<sup>th</sup> and Shipley Streets, as well as mid-block improvements for Shipley Street between 8<sup>th</sup> and 10<sup>th</sup> Streets are discussed following the tables.

As part of the data collection effort detailed in Table 2, several crosswalk types were noted within the study area. The figure below denotes the difference between a “continental” striped crosswalk that is found throughout downtown Wilmington, and a “standard” striped crosswalk that may be used at locations with lower pedestrian and/or vehicular volumes.



Source: *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation*, Publication Number FHWA-HRT-05-106

<sup>1</sup> Level of service (LOS) is defined by the average total vehicle delay of all movements at an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Further, vehicle delay is a complex measure based on several variables, including signal phasing, signal cycle length, traffic volumes, and heavy vehicle percentages, with respect to intersection capacity. The amount of delay corresponds to a resultant LOS on a scale ranging from A (free flow conditions) to F (forced or breakdown flow conditions). (*Highway Capacity Manual*, Transportation Research Board).

Table 2 – Existing Mid-block Conditions

Street Name	Limits	Roadway Width	No. of Lanes	On Street Parking	Speed Limit	Sidewalks	Grades	Lighting	Driveways	Other
Orange	8th to 9th	30-36'	2 plus loading zone on eastern curb	western curb	25	10' both sides	slight grade south to north	Limited - old.	Yes - parking lot	
Orange	9th to 10th	30'	3 - limited parking in right lane	eastern curb	25	10' both sides, some obstructions (ramp to business)	slight grade south to north	Limited	Yes	
Shipley	8th to 9th	30-36'	Defacto 2 - no striping	Eastern and western curbs	25	8' eastern curb - many obstructions - dumpsters, etc./ 10' western curb - 6' overhang from parking garage	slight grade south to north	Fair	No	Pass-through corridor to Market
Shipley	9th to 10th	30'	1	Eastern and western curbs	25	10' both sides	slight grade south to north	Poor/damaged	Yes - loading and parking areas	
Market	9th to 10th	28'	2 - NB/SB two way	Eastern and western curbs	25	14' - good condition	generally flat	Good - pedestrian scale	No	
10th	Orange to Shipley	42'	3 - 1 EB, 2 WB	Southern curb	25	12' southern curb, 14' northern curb	generally flat	Good - pedestrian scale	No	
10th	Shipley to Market	42'	3 - 1 EB, 2 WB	Southern curb	25	12' southern curb, 14' northern curb	generally flat	Good - pedestrian scale	No	
10th	Market to King	42'	3 - 1 EB, 2 WB	Southern curb	25	12' both sides	generally flat	Good - pedestrian scale	No	
9th	Orange to Shipley	30-38'	2	Southern and northern curb	25	13' both sides	Slight grade west to east	Limited	No	
9th	Shipley to Market	26'	2	No	25	9.5' both sides	Slight grade west to east	No	No	
8th	Orange to Shipley	30'	2	Yes	25	11' both sides	Slight grade west to east	Yes	No	
8th	Shipley to Market	24'	2	No	25	11' both sides	Slight grade west to east	Yes	No	

Table 3 – Existing Intersection Conditions

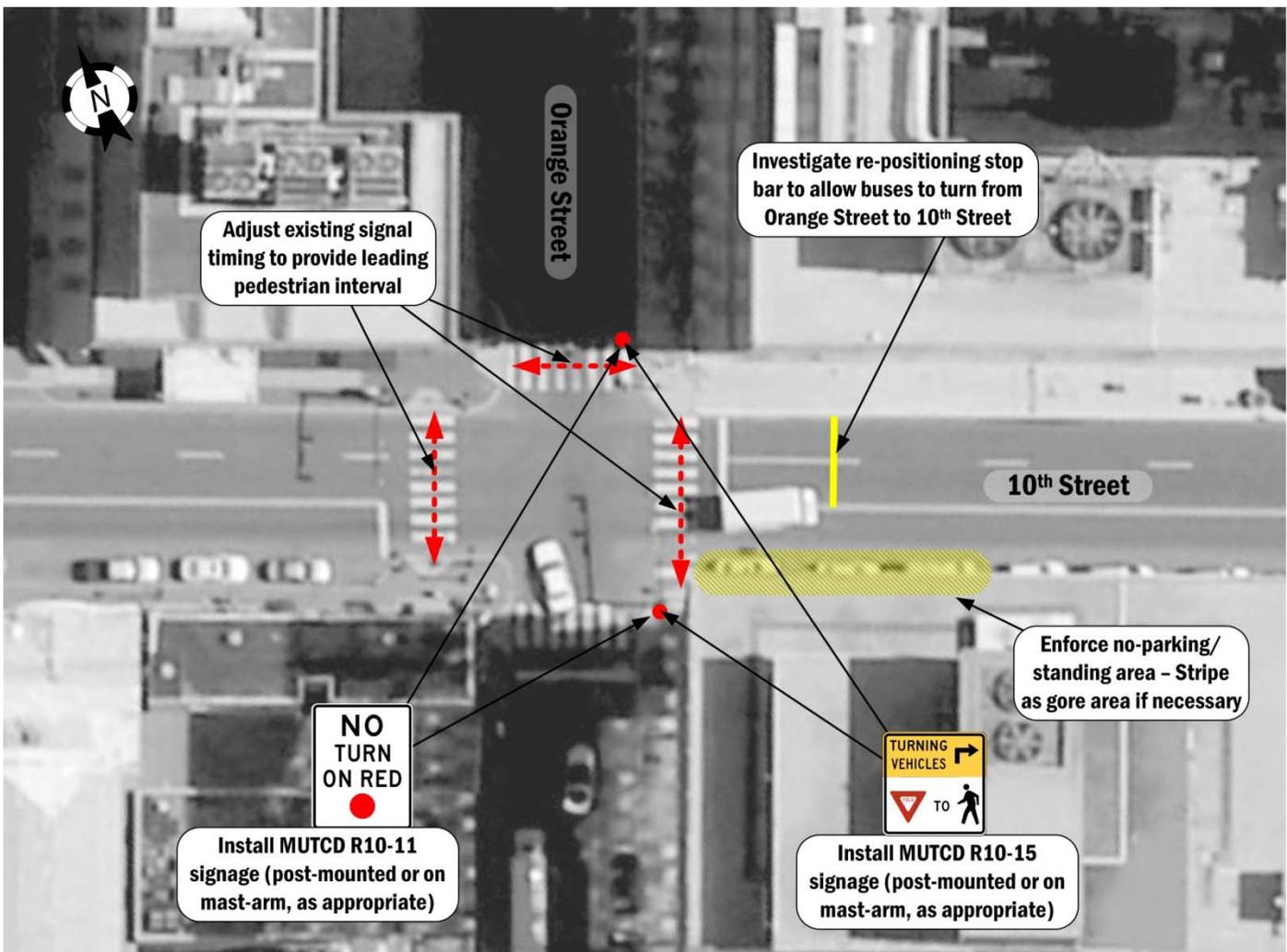
Location	Ped Signals	Push Buttons	ADA Curb Ramps	Lighting	Crosswalks	Points of interest	Bus Stops	Sidewalks	Other
10th and Market	Yes - Countdown	No	Ramps installed, but lack detectable warning surface	Good - pedestrian scale	Textured with standard striping	Rodney Square	Near-side on 10th Street adjacent to Rodney Square	Good	
10th and Shipley	No	No	Ramps installed for Shipley crossing, but lack detectable warning surface	Good - pedestrian scale	Continental	Several mid/high rise buildings	Near-side on 10th Street adjacent to Rodney Square	Good	
10th and Orange	Yes - Countdown	No	Ramps installed, but lack detectable warning surface	Good - pedestrian scale	Continental	Several mid/high rise buildings	No	Good	
9th and Market	No	No	Ramps installed, but lack detectable warning surface	Good - pedestrian scale	Textured	Several mid rise buildings	No	Good	Curb extensions
9th and Shipley	Yes - Countdown	No	Ramps installed, but lack detectable warning surface	Fair	Continental	Former parking garage, low rise buildings	Far-side on 9th	Fair	
9th and Orange	Yes - Countdown	No	Ramps installed, but lack detectable warning surface - ramps poorly situated to corners	Limited	Continental	Former parking garage, low/mid rise buildings	Far side on 9th, Near side on Orange	Fair	Garbage can on SE corner
8th and Shipley	NB approach crossing only - Countdown	No	Ramps installed, but lack detectable warning surface	Limited	None	Low-rise buildings, St. Andrews Church	Far side on 8th	Fair	Pedestrians traveling NB cannot see any signal heads
8th and Orange	No	No	Ramps installed, but lack detectable warning surface	Limited	Standard striping - worn	Low-rise buildings	Far side on 8th	Fair	Pedestrians traveling EB cannot see any signal heads

## Proposed Improvements

In the event of a shift of service, several relatively inexpensive improvements to signals, striping, and signage can be implemented as a next step to improve pedestrian and vehicular safety in the areas of concern. A key element that will play a part in the implementation of any improvement is the necessity of enforcement by local police to encourage appropriate behaviors by vehicular traffic and pedestrians.

### 10<sup>th</sup> Street at Orange Street

A review of pedestrian conditions at the signalized intersection of 10<sup>th</sup> and Orange Streets indicated above average pedestrian accommodations, including pedestrian-scaled lighting and crosswalks with high-visibility continental striping. Given the expected increase in turning movements for northbound buses destined to the proposed Shipley Street route, several improvements are recommended. To reinforce the parking prohibition along 10<sup>th</sup> Street eastbound east of Orange Street, a gore area should be painted to fully allow buses to make this turn without impeding traffic. Along Orange Street northbound approaching 10<sup>th</sup> Street, “Turning Vehicles Yield to Pedestrians” signage (MUTCD R10-15) should be installed.

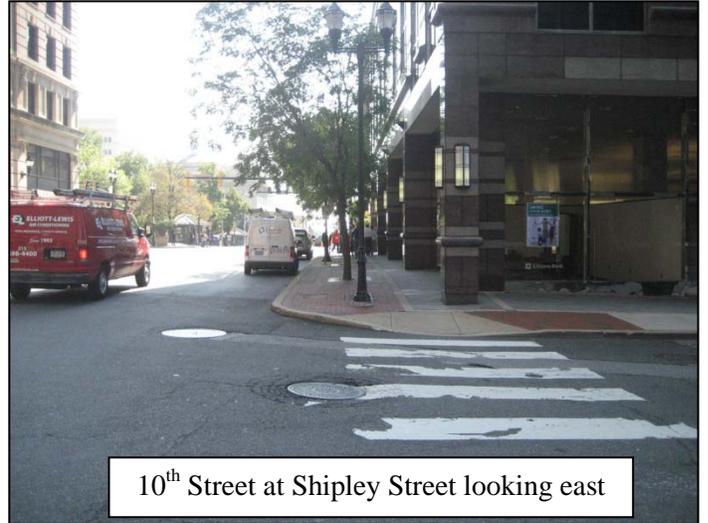


Similarly, “No Turn on Red” signage (MUTCD R10-11) should be installed, preventing vehicles from turning right to 10<sup>th</sup> Street from Orange Street northbound during a red signal phase. Further, a leading pedestrian interval should be investigated at this intersection, given the high number of projected pedestrian and turning vehicle conflicts at this location.

A review of bus operations using AutoTURN at this intersection indicate that some encroachment may be necessary for buses to turn from Orange Street to 10<sup>th</sup> Street. From Orange Street, a turning bus slightly encroaches on the other travel lane and there is some front overhang crossing the yellow line on 10th Street. This was the best path without hitting the curb line. One solution for this is to pull back the stop bar on the westbound 10th Street approach to allow for this movement. The bus clears the parking lane along 10th Street approximately 70 feet from the Orange St curb line.

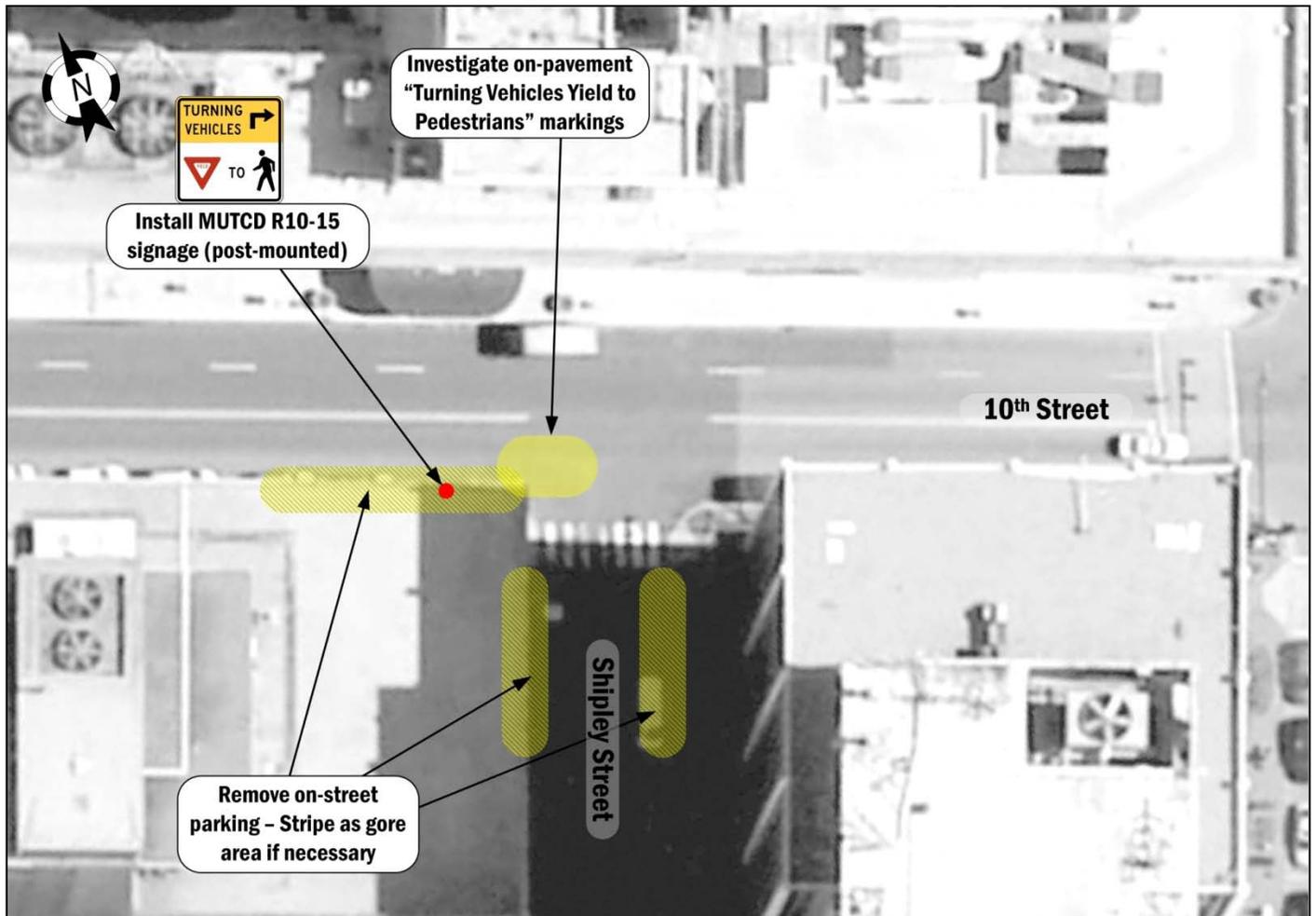
### 10<sup>th</sup> Street at Shipley Street

The non-signalized intersection of 10<sup>th</sup> and Shipley Streets currently provides a continental striped crosswalk along the southern leg of the intersection across Shipley Street. In order to provide increased turning space for buses traveling to the proposed Shipley Street route, two parking spaces located directly west of Shipley Street along 10<sup>th</sup> Street eastbound should be removed. To reinforce the parking prohibition along 10<sup>th</sup> Street, a gore area should be painted to fully allow buses to make this turn without impeding traffic. The removal of parking will also provide increased visibility for pedestrians traveling eastbound across the Shipley Street crosswalk. Along 10<sup>th</sup> Street eastbound approaching Shipley Street, “Turning Vehicles Yield to Pedestrians” signage (MUTCD R10-15) should be installed. On-pavement “Yield to Pedestrians” striping should be investigated as well.



10<sup>th</sup> Street at Shipley Street looking east

A review of bus operations using AutoTURN at this intersection indicate that some encroachment may be necessary for buses to turn from 10<sup>th</sup> Street to Shipley Street. The turn from 10<sup>th</sup> Street eastbound onto Shipley Street forces a bus to slightly encroach onto oncoming traffic to allow for a larger radius to make the turn. The bus will also require the removal of parking along Shipley Street for a minimum of 75 feet from the 10<sup>th</sup> Street curb line.



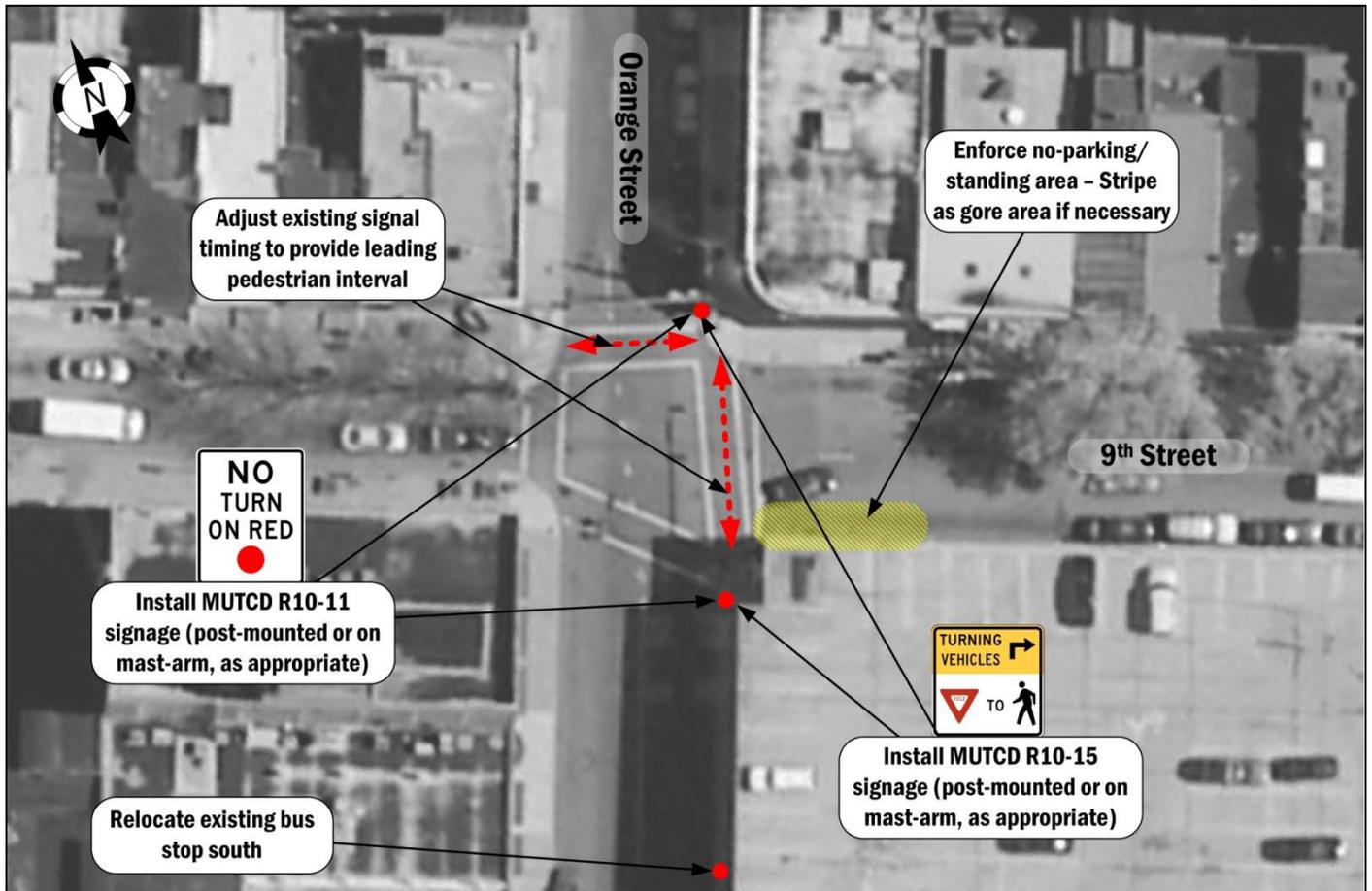
### 9th Street at Orange Street

A review of pedestrian conditions at the signalized intersection of 9<sup>th</sup> and Orange Streets indicated adequate pedestrian accommodations, including crosswalks with standard striping and pedestrian signal heads with countdown timers. Given the expected increase in turning movements for buses destined to the proposed Shipley Street route via 9<sup>th</sup> Street, several improvements are recommended. To reinforce the parking prohibition along 9<sup>th</sup> Street eastbound east of Orange Street, a gore area should be painted to fully allow buses to make this turn without impeding traffic. Along Orange Street northbound approaching 9<sup>th</sup> Street, “Turning Vehicles Yield to Pedestrians” signage (MUTCD R10-15) should be installed. Similarly, “No Turn on Red” signage (MUTCD R10-11) should be installed, preventing vehicles from turning right to 9<sup>th</sup> Street from Orange Street northbound during a red signal phase. A leading pedestrian interval should be investigated at this intersection, given the high number of projected pedestrian and turning vehicle conflicts at this location. Finally, the existing bus stop located on Orange Street just south of 9<sup>th</sup> Street should be relocated further south to allow buses turning onto 9<sup>th</sup> Street additional space to pull out from the curb prior to making the turn.



Orange Street at 9<sup>th</sup> Street looking north

A review of bus operations using AutoTURN at this intersection indicate that some encroachment may be necessary for buses to turn from Orange Street to 9<sup>th</sup> Street. From Orange Street, a turning bus slightly encroaches on the left travel lane of 9<sup>th</sup> Street.



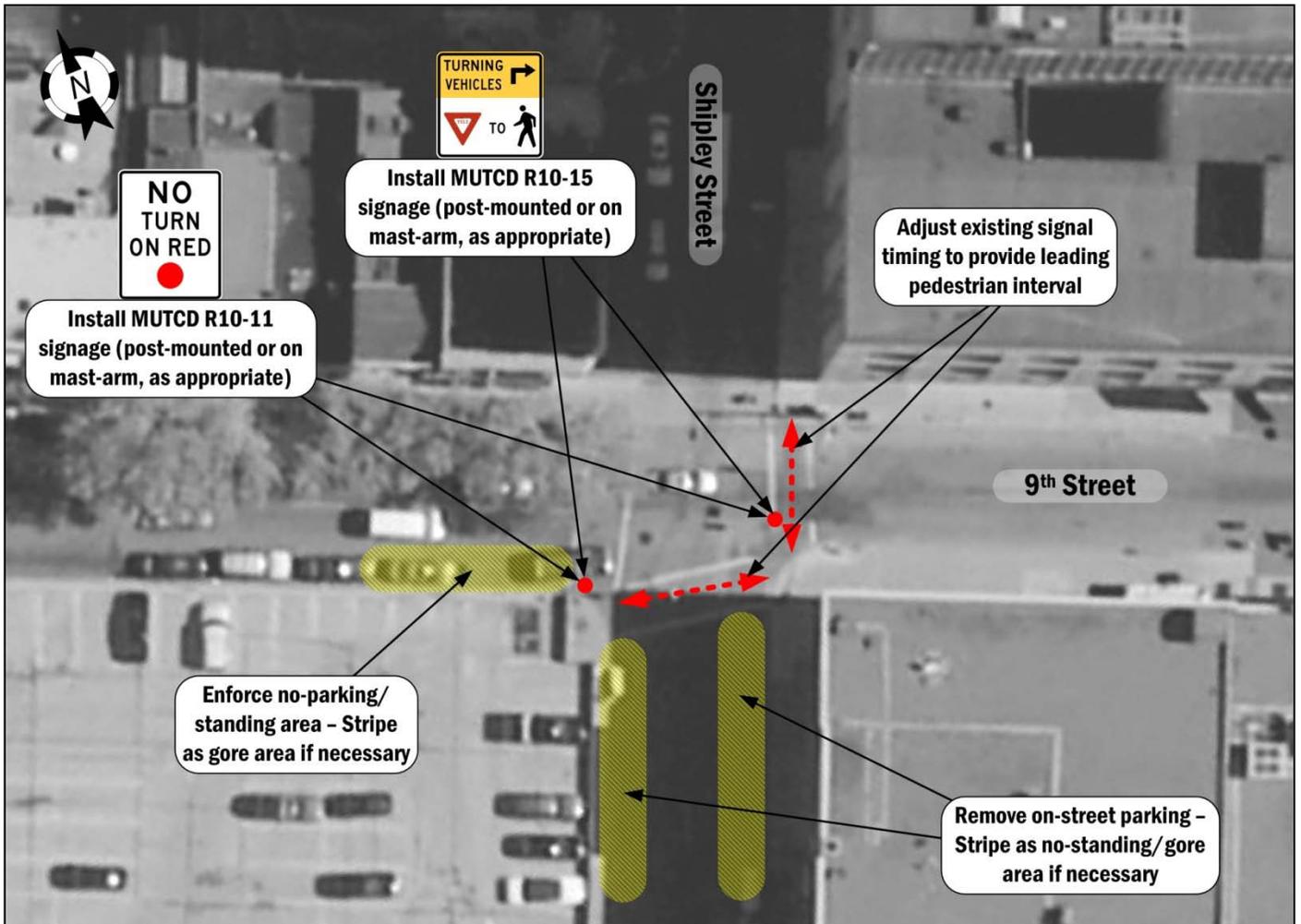
### 9<sup>th</sup> Street at Shipley Street

A review of pedestrian conditions at the signalized intersection of 9<sup>th</sup> and Shipley Streets indicated adequate pedestrian accommodations, including crosswalks with high-visibility continental striping and pedestrian signal heads with countdown timers. Given the expected increase in turning movements for buses along the proposed Shipley Street route, several improvements are recommended. To reinforce the parking prohibition along 9<sup>th</sup> Street eastbound west of Shipley Street, a gore area should be painted to fully allow buses to make this turn without impeding traffic. Similar gore areas should be painted on Shipley Street southbound beyond the existing crosswalk south of 9<sup>th</sup> Street. Along 9<sup>th</sup> Street eastbound approaching Shipley Street, “Turning Vehicles Yield to Pedestrians” signage (MUTCD R10-15) should be installed. Similarly, “No Turn on Red” signage (MUTCD R10-11) should be installed, preventing vehicles from turning right onto Shipley Street from 9<sup>th</sup> Street northbound during a red signal phase. Further, a leading pedestrian interval should be investigated at this intersection, given the high number of projected pedestrian and turning vehicle conflicts at this location.



Shipley Street at 9<sup>th</sup> Street looking south

A review of bus operations using AutoTURN at this intersection indicates that no encroachment will occur into another travel lane for buses to turn from 9<sup>th</sup> Street to Shipley Street. As noted above, this will require the removal and enforcement of proposed no-parking areas along 9<sup>th</sup> Street and Shipley Street.

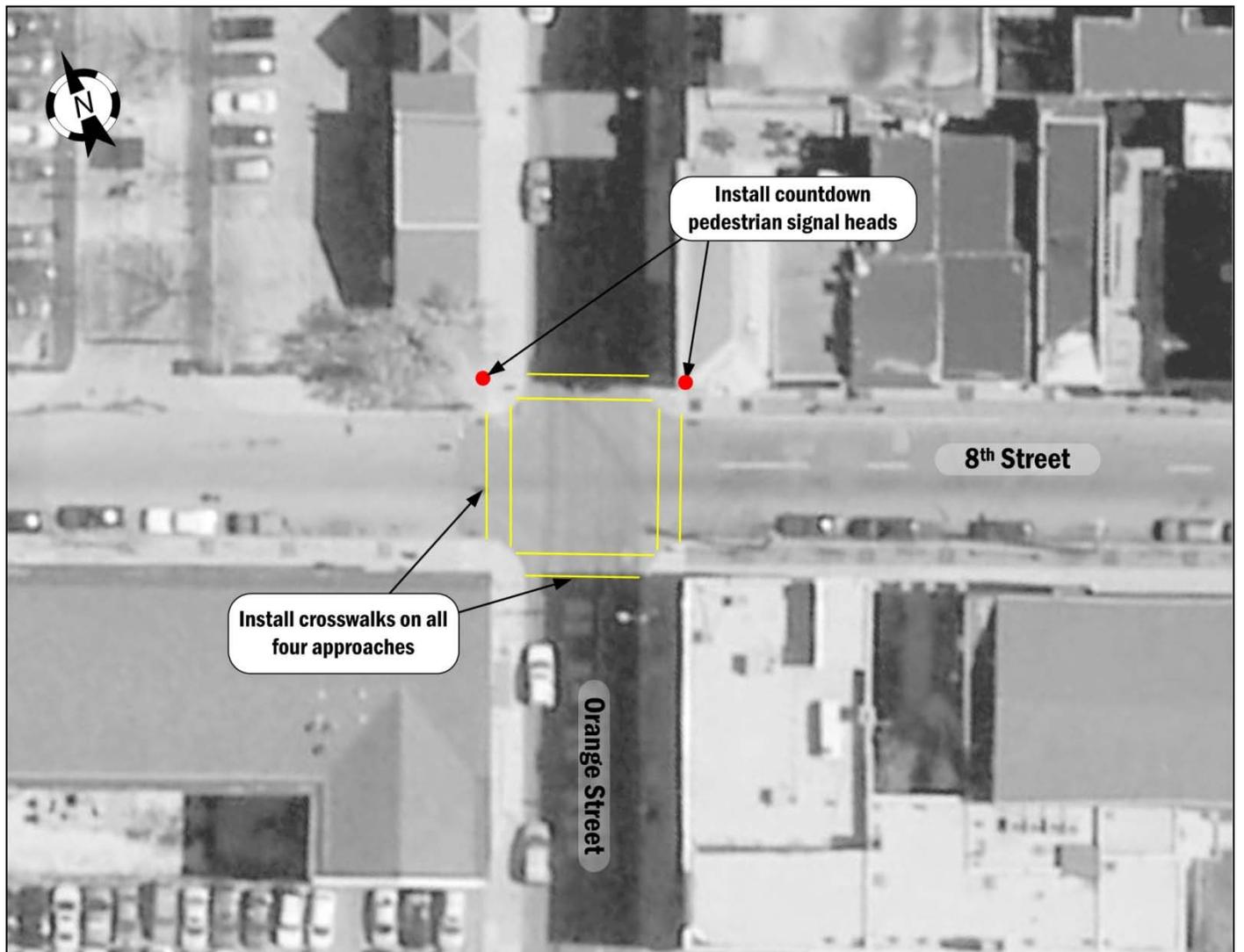


### 8th Street at Orange Street

The signalized intersection of 8<sup>th</sup> and Orange Streets has several pedestrian deficiencies that limit the circulation of non-motorized traffic through this intersection. While observed pedestrian traffic at this intersection was significant, crosswalks are not installed for any of the crossings at this intersection. Further, pedestrians standing on the northwestern corner of the intersection cannot see any signal faces indicating when it is safe for them to cross. In order to improve pedestrian circulation at this intersection for the proposed Shipley Street route, crosswalks should be striped on all four approaches, and pedestrian signal heads should be installed for the northern crossing of Orange Street, at a minimum.

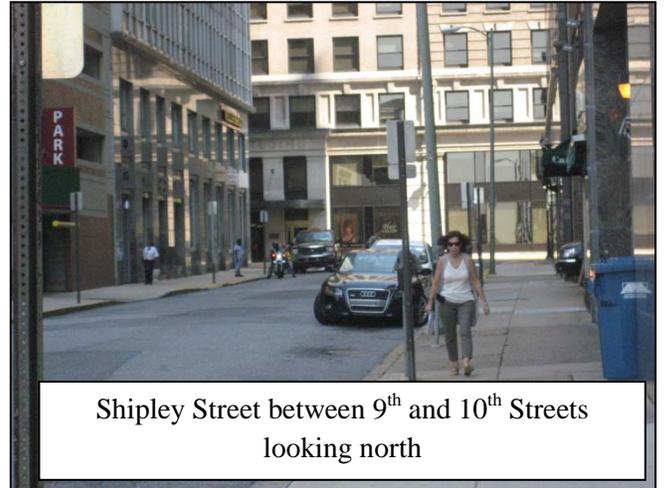


8<sup>th</sup> Street at Orange Street looking west

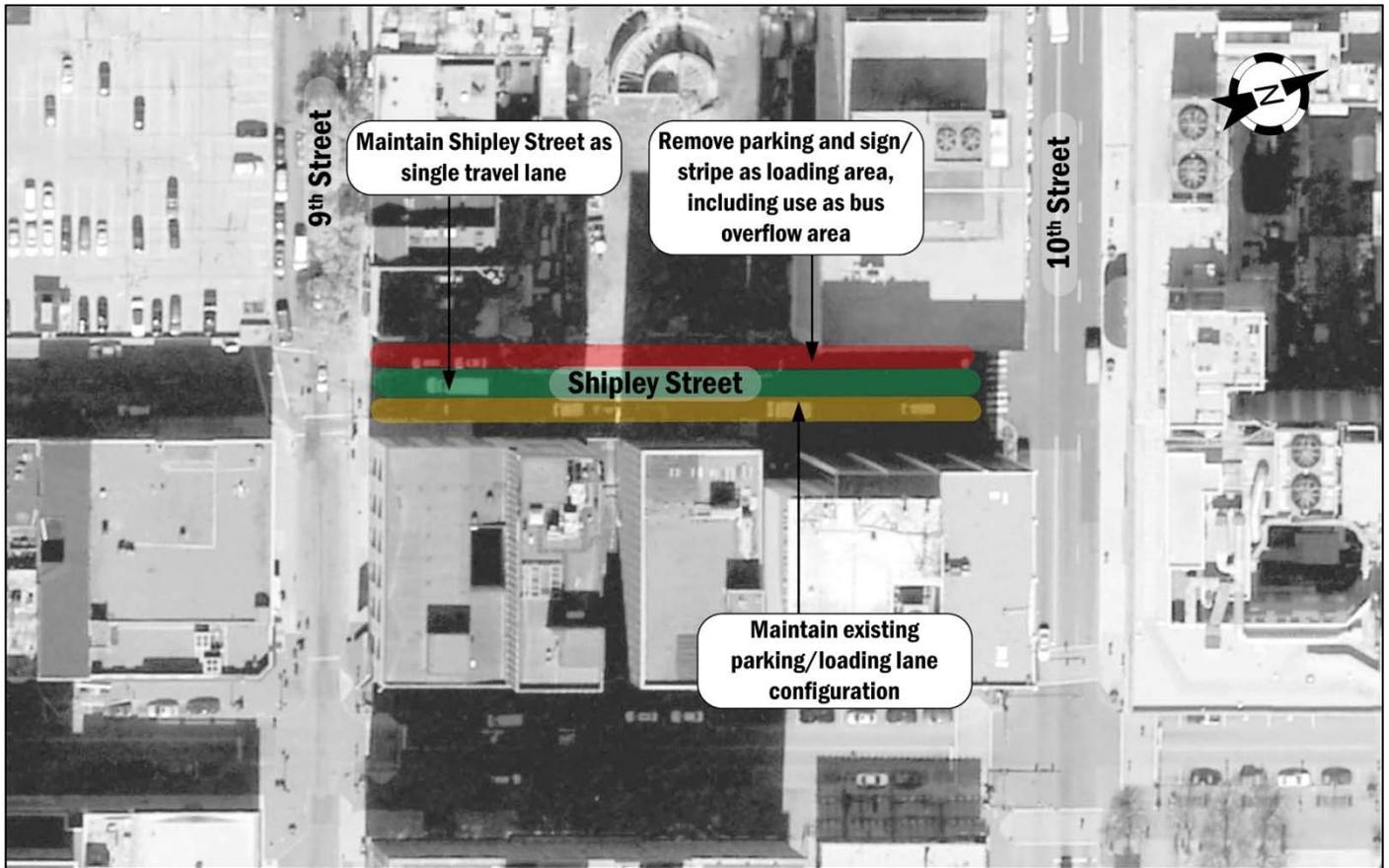


### Shipley Street (10th Street to 9th Street)

In order to provide an overflow area for buses using the proposed Shipley Street location south of 9<sup>th</sup> Street, parking should be removed along the western curb, to be replaced with a 10-foot wide striped shoulder/gore area and signage indicating the location as a no parking area. This area can also serve as a potential overflow/staging area for buses during peak periods. Parking along the eastern curb can be maintained along with a single travel lane as exists in the current condition.



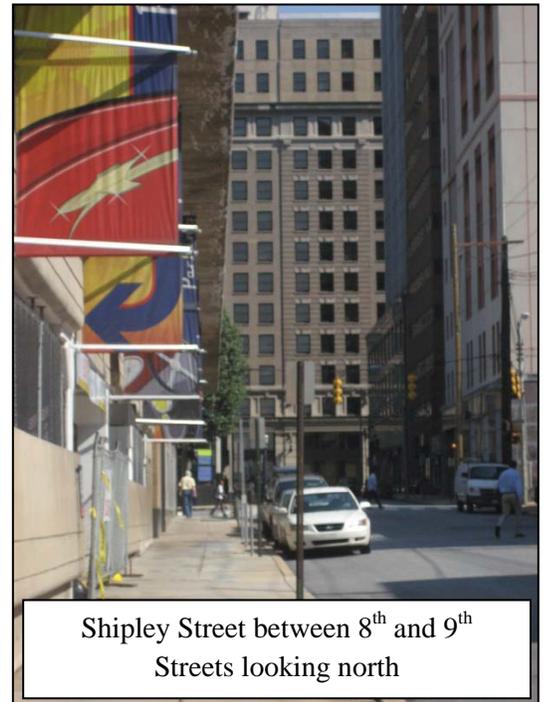
Shipley Street between 9<sup>th</sup> and 10<sup>th</sup> Streets looking north



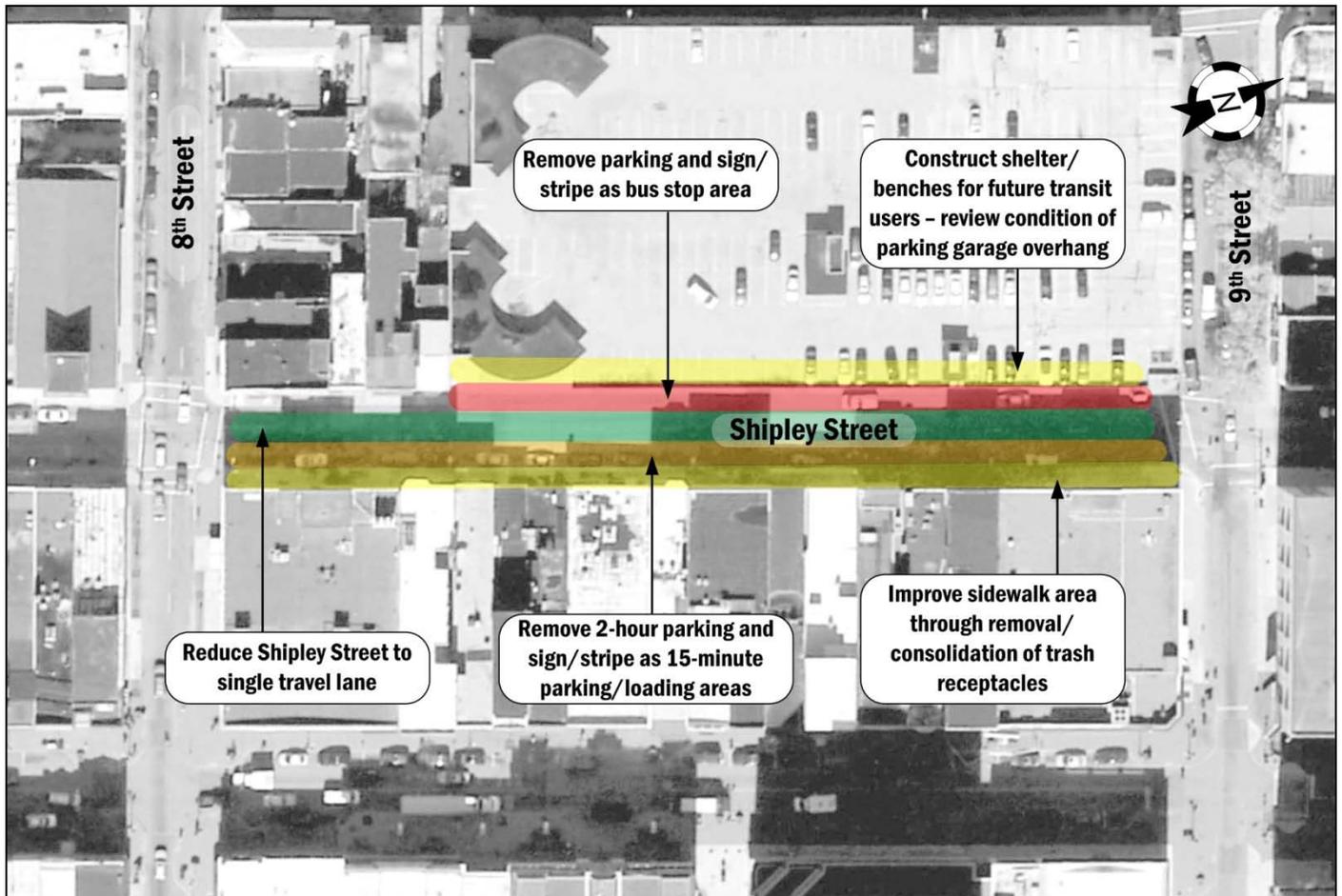
### Shipley Street (9th Street to 8th Street)

To provide an adequate staging area for buses along Shipley Street, parking should be removed along the western curb, to be replaced with a 12-foot wide striped shoulder/gore area and signage indicating the location as a bus stop area. In order to maintain Shipley Street as a service street for Market Street businesses, parking along the eastern curb should be removed, to be replaced with a 12-foot wide striped shoulder/gore area and signage indicating the location as a loading zone/short-term (15-minute) parking area, to be determined based on cooperative input from adjacent business owners. The removal of parking along both curbs would allow for a single 12-foot travel lane along this block of Shipley Street.

To improve conditions for transit users, a shelter and/or benches should be installed along the western sidewalk of Shipley Street beneath the overhang attached to the former parking garage. Any use of the area beneath the overhang will require a review of the structural condition of the overhang area, as a visual review of the structure indicates it is in a state of disrepair. Pedestrian access along the eastern sidewalk of Shipley Street can be improved by removing and/or consolidating trash receptacles throughout this area. This would likely require a significant level of cooperation amongst the City, DTC, DeIDOT, and local business owners.



Shipley Street between 8<sup>th</sup> and 9<sup>th</sup> Streets looking north



## Conclusions

1. There are no significant negative transportation-related safety findings associated with the relocation of some bus routes to the Shipley Street location and no discernable changes to level-of-service anticipated.
2. In the event of a shift of service, several relatively inexpensive improvements to signals, striping, and signage can be implemented as a next step to improve pedestrian and vehicular safety in the areas of concern. The two-hour parking on the east side of Shipley Street between 8<sup>th</sup> and 9<sup>th</sup> Streets should be signed and striped to allow for trucks to access the businesses located on this block.
3. The structural integrity of the parking garage overhang needs to be assessed to determine if any safety precautions need to be in place prior to an increase of pedestrians and transit users in the area.
4. This study has focused solely on the safety and traffic implications of the proposed shift of approximately one-third of DART First State bus operations associated with Rodney Square to Shipley Street. As a result, no opinion is given with regard to any decision involving the permanent location of a bus hub along Shipley Street or any other location.