



## MEMORANDUM

To: Doug Hausladen  
From: Holly Parker and Larry Gould  
Date: April 28, 2016  
Subject: Text for Downtown Crossing Full Build TIGER grant

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Please see below and let us know if you would like any changes made:

## NEW HAVEN GRID RESTORATION

The connection of Temple Street to Congress Avenue, and Orange Street to South Orange Street across the former Route 34 expressway will restore the city's historic grid from the New Haven Green to the West River. Restoration of the grid has a wide range of benefits: traffic flow is more dispersed and resilient, pedestrian and cycling paths are more direct and intuitive, and all fleet operations, especially transit and circulator shuttles, but also deliveries and emergency response, are more efficient and productive. The benefits to pedestrians, cyclists, and transit riders align with the City's Complete Streets policy—which prioritizes first the pedestrian, cyclist, and transit rider.<sup>1</sup>

## TRANSIT BENEFITS: Temple Street-Congress Avenue

Connecting Temple Street from the north, to Congress Street on the south, creates a signature axis because Temple Street is the only street to bisect the New Haven Green—the main corridor serving Yale New Haven Hospital and University of New Haven toward West Haven, Orange and Milford.

A Temple Street-Congress Avenue connection will allow the creation of, at minimum, a streamlined transit corridor and, better, a Transit Emphasis Corridor (TEC). A TEC is a routing pattern that places all buses heading in the same direction through downtown on the same street, making the same stops. It allows three or four routes, combined, to form an ultra-frequent combined service with little or no increase in operating costs. Passengers traveling within the corridor take the first bus that comes, rather than waiting for a specific route.

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<sup>1</sup> <http://www.cityofnewhaven.com/Engineering/pdfs/CS-Manual-FINAL.pdf> (page 11)

In this case, buses operating southbound through New Haven Green on Temple Street, from as far north as the Yale Campus to as far west as University of New Haven (about 2 miles) could run an identical route, then diverge to serve communities to the west. This would create a TEC with waits short enough that no timetable would be required.

If Temple Street were 2-way south of Chapel St., this TEC could also operate northbound on Temple. This segment of Temple Street was not recommended for 2-way conversion in the 2014 City of New Haven Two-Way Conversion report, because it is exceptionally narrow, especially on the block between Chapel and Crown, where there are sidewalk enhancements and traffic calming treatments. This could be reassessed, and 2-way operation may be worthy of analysis, with particular attention to the area in front of the Omni Hotel.

If Temple Street south of Chapel Street cannot operate 2-way, it should be possible to create a companion, eastbound and northbound TEC using Church Street.

## Travel Time/Performance

Transit and transit passengers benefit when turning movements are replaced by tangent (straight) bus movement. Turns are among the most vulnerable operations for potential pedestrian collisions, so buses operate exceptionally slowly and carefully. Turns cause longer signal delays because the turn can only occur in short intervals of the signal cycle, either on a green arrow or when pedestrians clear the crosswalk. Most bus trips from downtown New Haven to and from the west will save 1-2 minutes from the Temple connection, and performance (reliability) will be enhanced by preventing the variability in travel time caused by these turns.

## Cost

As a rule, saving one or two minutes per trip will not allow the current service to be delivered with one fewer bus or one fewer driver. However, transit costs are a step-function, meaning that, the more bus routes that benefit from the turn reduction, the more likely it is that one route will save just enough time to run the same service with one fewer bus. If a TEC is created by strategically aligning routes, and the travel time savings is bidirectional (because an acceptable way is found to make Temple, south of Chapel, 2-way) it is likely that at least one of the routes will save just enough time for a reduction in bus and driver requirements, through productivity, without reducing service.

## Convenience

Clearly, the TEC provides a convenience for passengers traveling from downtown and Yale toward Yale New Haven Hospital (YNHH) and the University of New Haven. Logically, this is a first, very low cost way to start building a Bus Rapid Transit Network. The main benefits are waiting time, which could be reduced by 10 minutes or more per passenger, plus a travel time improvement of one or two minutes.

## **Safety**

As mentioned above, turns in general, and bus turns in particular, are a safety exposure, particularly on the side of bus on the inside of the turn. Transit operators maintain safety through training, slower operation and extreme caution. Reducing turns is a desirable safety outcome for transit.

## **CIRCULATOR/SHUTTLE BENEFITS**

A Temple Street-Congress Avenue connection in conjunction with stop relocation can reduce turns by reducing the unproductive looping needed to serve Yale New Haven Hospital. The connection would allow shuttles and circulators to avoid traffic signals with long cycles, especially on the streets crossing the former CT 34 expressway. This is most applicable to shuttles and circulators connecting YNNH to downtown New Haven and Yale, whether run by the hospital, Yale or other entities. The logical new stop, for these shuttles only, would be on Congress at Cedar. Passengers on board shuttles and circulators are likely to save 1-2 minutes, a considerable amount on trips generally under 10 minutes.

### **Travel Time/Performance**

As with transit, a reduction in turns reduce long signal delays. Most shuttle and circulator trips between YNHH and downtown New Haven or Yale will save 1-2 minutes, and performance (reliability) will be enhanced by preventing the variability in travel time caused by these turns. This improvement would be experienced only from rd Yale and downtown toward YNHH, unless Temple, south of Chapel, is converted to 2-way operation.

### **Cost**

Due to the headway (interval) being set to a multiple of the running time cycle, shuttles and circulators are less likely than a transit route to use the savings to run the same service with one fewer bus. What can be said with confidence is that the shorter travel time cycles will allow the shuttles to run more frequently with the same resources.

### **Convenience**

The travel time savings for shuttle passengers comes when leaving the hospital, which arguably is the more important direction for a hospital employee with an appointment at a downtown business or Yale.

## **Safety**

The more heavily used shuttles in New Haven, especially certain routes operated by Yale University, operate buses with “body on chassis” specifications which are nearly as long as transit buses, although with shorter wheelbases. These buses are equally vulnerable to safety issues on turns, and drivers are similarly trained in extreme caution and turning slowly. Reducing turns facilitates maintenance of safety.

## **TRANSIT BENEFITS: Orange Street**

Orange Street in downtown New Haven is a narrow, historic street that prioritizes pedestrians through constrained geometry and slow design speed. It is not suitable for most transit buses and shuttle routes avoid the blocks between Elm St. and George Street. South of Route 34, Orange is a wide vestige of a street, used for Police car parking.

The primary benefit for transit by connecting Orange Street and South Orange Street is the mitigation of an awkward and time consuming series of turns required by the CTTransit J buses toward downtown and Whitney Avenue. Leaving Union Station, buses turn left from Union Avenue (State Street) at Water Street, using the North Frontage road, right on Orange Street and left on George Street to reach Church Street.

The restoration of Orange Street would allow buses from Union Station to use a fragment of Columbus Avenue to connect directly to Orange Street. This allows the bus to avoid the left turn at the complex Union/Water/State intersection, which has a long signal cycle, and instead substitutes a lightly used stretch of Orange St. behind the Police Headquarters.

The J bus route in the opposite direction, from Whitney and downtown toward Union Station may also use Orange and Columbus between Route 34 and Union Avenue for symmetry, avoiding the Union/Water/State intersection.

The J bus is the only major public transit route to serve Union Station. If Orange Street were connected across Route 34, it is likely that other routes from the west could serve Union Station en route to downtown, without incurring the travel time penalty of the existing J route.

### **Travel Time/Performance**

The J route toward Whitney Avenue would save about 2 minutes, and one minute toward Union Station, and the signal issues would produce a more predictable arrival in downtown New Haven and Union Station.

### **Cost**

The 1-2 minute savings is likely not enough to reduce bus or driver requirements, but could reduce the incremental cost of allowing other routes from the west to serve Union Station enroute to downtown.

### **Convenience**

As a result of using the proposed Orange connection, in addition to travel time savings, the J route becomes somewhat more intuitive and reliable.

### **Safety**

The current right turn on the J route toward downtown, at N. Frontage Road and Orange Street, exposes the bus to merging with traffic coming from I-91 and I-95. While this

traffic should be at city speeds at this point, it is likely that there are speeders and a new route via Orange would further mitigate this exposure.

## **CIRCULATOR/SHUTTLE BENEFITS**

Nearly all shuttles and circulators serving Union Station at the front apron will benefit from the connection of Orange Street across Route 34. Whether destined for Yale, YNHH, Alexion, the New Haven Green (Union Station Shuttle) or any destination west of State Street, the routing via Orange Street (and the fragment of Columbus Avenue) will save 1-2 minutes leaving Union Station, using the route proposed above for Route J. Those shuttles approaching Union Station which alight passengers across Union Avenue from the front apron will also save about 1 minute by approaching from southbound Orange and Columbus to Union Avenue.

### **Travel Time/Performance**

As with Route J, most shuttles and circulators from Union Station's apron would save about 2 minutes, and one minute approaching the stop across from Union Station, and the signal issues would produce a more predictable arrival at both their destination and Union Station.

### **Cost**

As with Temple Street, due to the headway (interval) being set to a multiple of the running time cycle, shuttles and circulators are less likely than a transit route to use the savings to run the same service with one fewer bus. What can be said with confidence is that the shorter travel time cycles will allow the shuttles to run more frequently with the same resources.

### **Convenience**

As with the J route, in addition to travel time savings, the shuttles and circulators become somewhat more intuitive and reliable.

### **Safety**

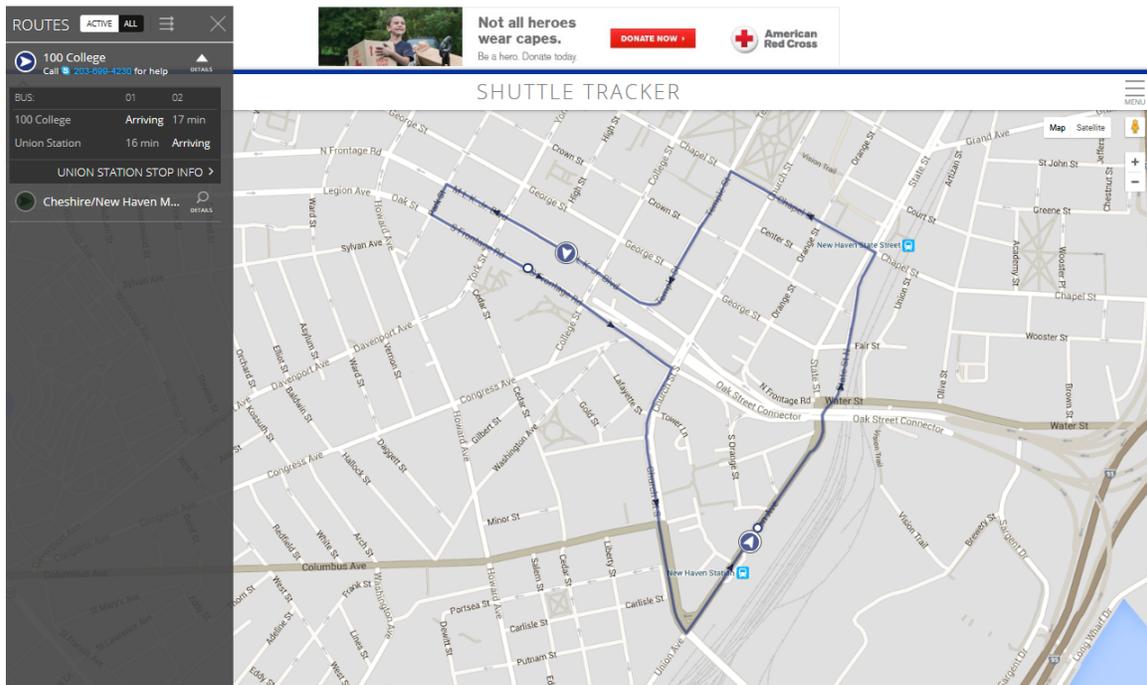
Also as with the J route, reducing exposure to merging with traffic coming from I-91 and I-95 at North Frontage and Temple is a mitigation that enhances safety on any shuttle route using the Orange Street connection.

## **BICYCLIST AND PEDESTRIAN BENEFITS**

Every transit rider is a pedestrian first. A safe and connected network of walking facilities is, therefore, critical in supporting transit trips as well as walking (and cycling) trips. Re-connecting Orange Street and connecting Temple Street to Congress Street facilitates all of these transportation modes. Good street network connectivity provides greater opportunity for all forms of active transportation by creating intuitive and direct paths for pedestrians and bicyclists, not just at the new connection, but with benefits accruing to people with many destination pairs.

During the design and public involvement process for the Downtown Crossing project, the New Haven community was very vocal and clear in its expression of support for safe and convenient pedestrian and bicycle facilities.<sup>2 3</sup>

Alexion Pharmaceuticals—newly established at 100 College Street—is transporting its employees from Union Station at considerable expense. The distance between 100 College Street and Union Station is 0.7 miles, which can be covered on foot in 13-14 minutes, or by bicycle in 6-7 minutes. In addition to the need for improvements to the streetscape along South Orange Street, the physical and psychological barrier of Route 34 creates an environment most pedestrians and cyclists consider inhospitable.



Alexion Pharmaceuticals' Private Shuttle route

Specific to bicycle facilities and connectivity, a frequently cited 2012 study for the Mineta Transportation Institute titled “Low-Stress Bicycling and Network Connectivity” developed a means for rating level of traffic stress tolerable for cyclists of various ages and abilities. The report revealed that:

”For a bicycling network to attract the widest possible segment of the population, its most fundamental attribute should be low- stress connectivity, that is, providing routes between people’s origins and destinations that do not require

<sup>2</sup>[http://downtowncrossingnewhaven.com/pdfs/whats\\_new/phase%20ii%20public%20information%20meeting%20report\\_09\\_29\\_14.pdf](http://downtowncrossingnewhaven.com/pdfs/whats_new/phase%20ii%20public%20information%20meeting%20report_09_29_14.pdf)

<sup>3</sup> <http://www.urbandesignleague.org/43/>

cyclists to use links that exceed their tolerance for traffic stress, and that do not involve an undue level of detour.”<sup>4</sup>

In the study, a level of traffic stress 1 (LTS 1) represents a level that most children can tolerate; LTS 2—which is based on Dutch bikeway design criteria—represents the traffic stress that most adults will tolerate; LTS 3 and 4 represent greater levels of tolerance for traffic stress acceptable to American cyclists who are “enthused and confident” but still prefer having their own dedicated space for riding (LTS 3); and the “strong and fearless” (LTS 4).

For that segment of the population that will tolerate LTS 2, their bicycle network is taken to be the subset of the street and path network whose links have been categorized as a LTS 2 or less. Following this line of reasoning, the stress of a route is determined by its most stressful link, not by an average. Several low-stress links cannot compensate for a high-stress link. The high-stress traffic link is the barrier created by Route 34 at South Orange Street and the abrupt end of Temple Street where it would otherwise cross Route 34 to connect New Haven’s downtown with its Medical area and regional transit hub, Union Station.

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<sup>4</sup> <http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf>