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Date: 9/13/19

To: Transportation Energy and Utilities Committee
From: Norman J. Baldwin, P.E.
City Engineer/Ass't Director of Public Works

C.C. Miro Weinberger, Mayor
Chapin Spencer, Director of Public Works
Olivia Lavecchia, Mayoral Communications Coordinator
Laura Wheelock, Senior Public Works Engineer

Subject: Proposed Geometric Design Revisions to intersection of Maple and St.Paul Street

GREAT STREETS OVERVIEW

The Great Streets Initiative (GSI) launched in the summer of 2016 to create design and construction standards to guide the development of downtown streets. At the forefront of this approach was pedestrian safety, livability, commercial vitality and rebalancing the ecology of the streetscape. GSI built on many years of planning and project development to advance three individual but connected projects:

- Conceptual Design of 6 blocks of Main Street
- Redevelopment of St.Paul Street from Main to Maple
- Redevelopment of City Hall Park

The vigorous public process lasted 18 months and engaged key stakeholders including and not limited to: Public Works Commission, Parks Commission, Burlington Electric Commission, Transportation, Energy and Utilities Committee and the Neighborhood Planning Assemblies. Burlington City Council formally adopted the standards on Monday, April 16, 2018. In addition to this process, outreach has also been conducted on specific Great Streets projects, including numerous business and neighborhood meetings.

In August 2018, the City began the construction of Burlington's first Great Streets project on St. Paul Street. The renovation of a streetscape happens, at most, once in a generation. We were aggressive in implementing the standards – as you can see by a newly reinvigorated streetscape, getting closer to completion each day. Included in this approach was narrowing the streetscape at two intersections to make crossings shorter for pedestrians and discouraging truck

traffic through residential streets. We believe the project has been and will be a success for our community, including on these key elements of public safety. At the same time, we have listened closely to our community and after a thorough analysis are proposing modest, but impactful geometric changes to Maple & St. Paul; and a more modest change to the King & St. Paul intersection. We lay out our rationale and recommendations in the following memo.

GREAT STREETS DESIGN STANDARDS

"Burlington recognizes its street system not merely as roadways for vehicles, but as the backbone of its collective public spaces, which reflects values, identity and character of Burlington." Great Streets BTV, Page 5

" A great street system for downtown Burlington will also restore a balance among all of the users and uses within the public realm. Throughout most of urban history, walking has been the primary form of movement on city streets. But over the past 100 years, the growing demands of the automobile for ever more space to move and to park have tended to overwhelm all other users, not least the pedestrian. **Burlington intends for these standards to correct that imbalance by once again placing the needs and experience of pedestrians first, while ensuring that all other users and uses are accommodated in a delicate balance.**" Great Streets BTV, Page 5

"These Standards DO:

- Identify a common palette of materials and furnishings that will provide for unity and visual integrity as downtown's streets are developed over time
- ….
- Take precedence over the existing City policies/documents regarding the design and construction of elements within the public right of way that existed prior to the most recent date of adoption by Council(unless otherwise noted)

These Standards DO NOT:

- Mandate immediate reconstruction of all streets or replacement of individual elements within the row; instead the standards should be applied to streets as they are redeveloped in a significant way, and guide the replacement of furnishing when they reach the end of useful life
- **Provide specific designs for each street in downtown Burlington; some streets will require corridor-specific master plans to identify future design/transportation system goals**
- Inventory all conditions that may exist within the City's public right of way, particularly unknown conditions such as locations of abandoned utilities, contaminated soils, etc." Great Streets BTV, Page.13

GREAT STREET & OTHER APPLICABLE STANDARDS-ST.PAUL STREET AND MAPLE STREET

The Civil Engineering Design Consultant for Great Streets St.Paul is Dubois and King. Dubois and King has been working in collaboration with the City of Burlington preparing Design Drawings for the Great Streets-St.Paul Street Project. Development of the design of St.Paul Street made use of the Great Streets Design Standards, Utilities Design Standards, Planning Documents, Truck, Bike and Transit Routes among many of design references. Below is specific sections relevant to the geometric design of the St.Paul and Maple as well as King Street and Maple Street.

- Maple Street within the Great Streets Design Manual Maple Street was designated as a Downtown Residential Street. See Fig. 1 Below
- St.Paul Street was designated as a Commercial Slow Street with Transit. See Fig. 2 Below
- Bumpout and Radii Design Discussion and Dimensions See Fig. 3 & 4 Below
- St.Paul Street was designated as a truck route Fig. 5

J Maple Street is not designated as a truck route See Fig. 5 Below

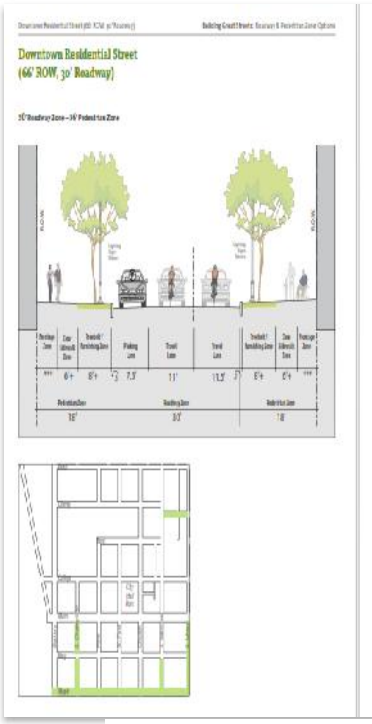


Fig.1. Maple Street Conceptual Cross Section, Pg.78 & 79

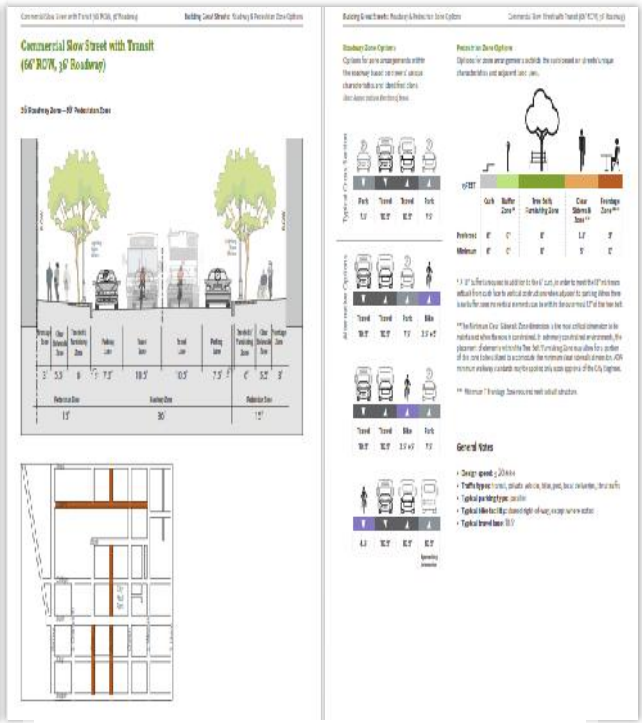


Fig. 2 Saint Paul Street Conceptual Cross Section, pg. 70 & 71

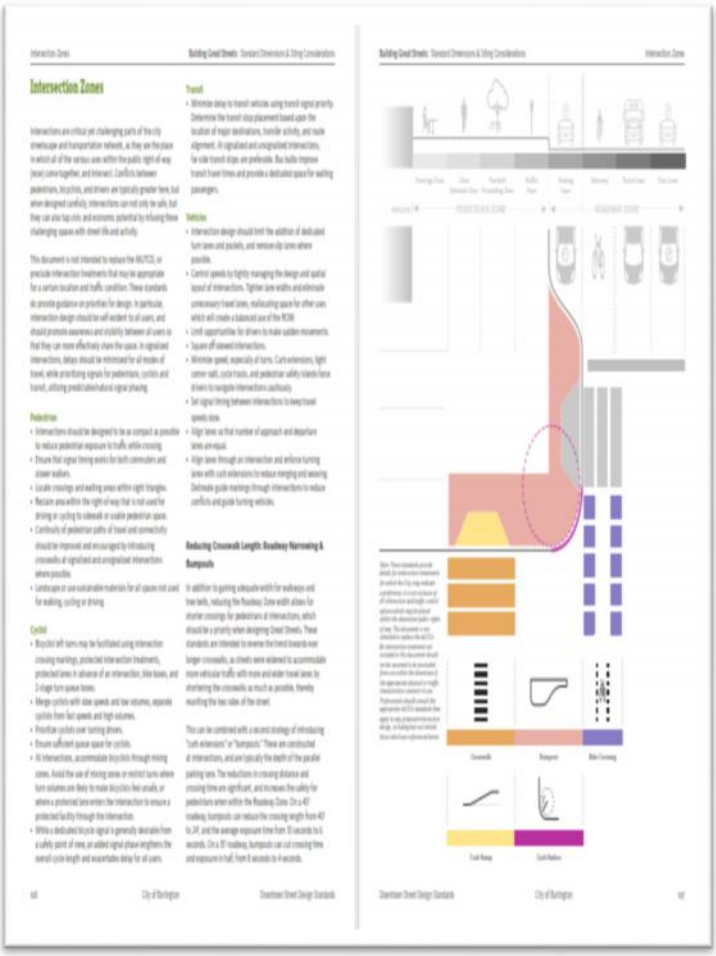


Fig. 3 Intersection Zones, Pg.106 & 107

Fig. 4 Bumpouts and Curb Radii, Pg.108 & 109

FIGURE 12: DESIGNATED TRUCK ROUTES

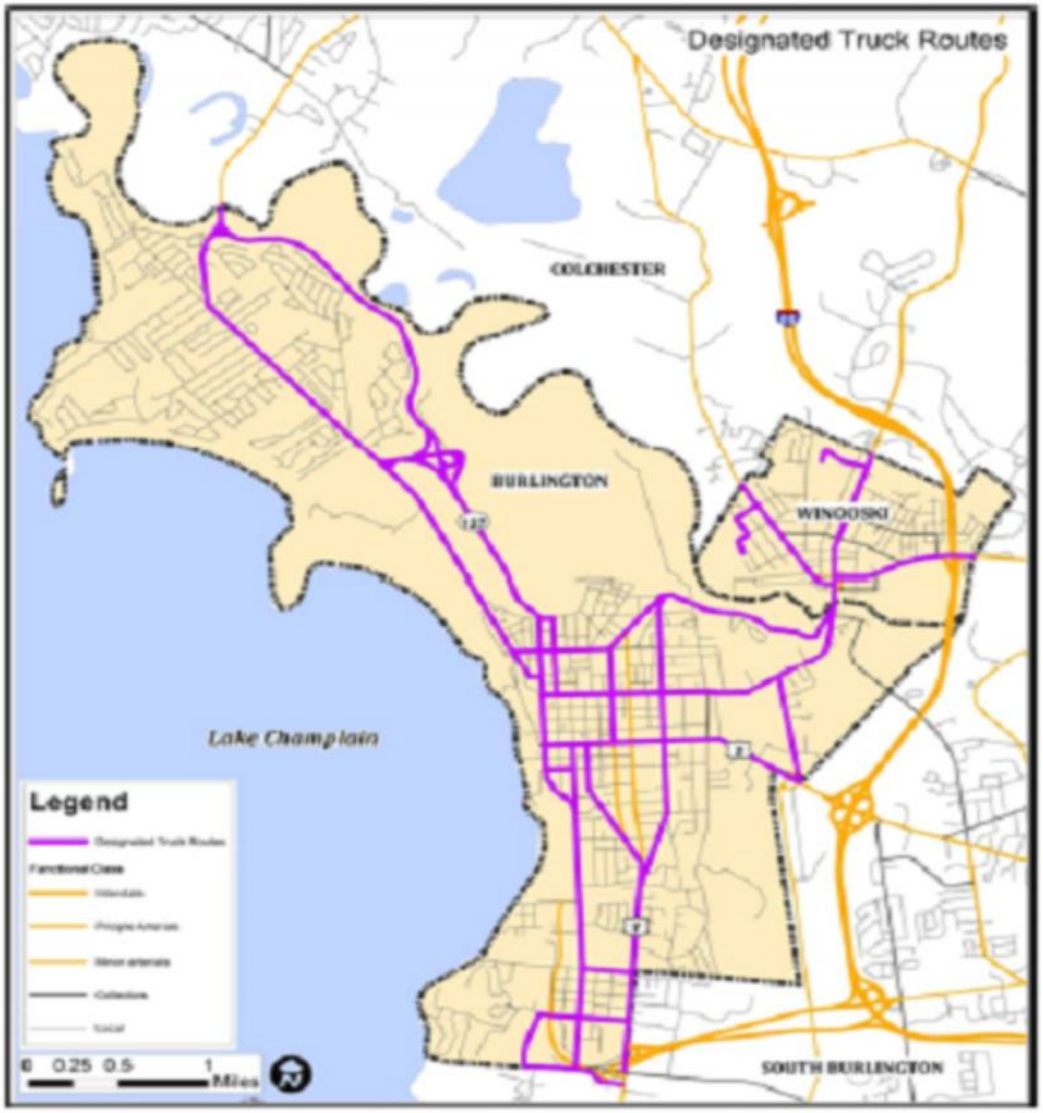


Fig. 5 Burlington-Truck Routes

The intersection of Maple and St.Paul Street prior to construction had corner radius and effective radius of:

- Curb Radius 11.97', Effective Radius S.B. Right Turn 22.5'-Southwest Corner
- Curb Radius 14.83', Effective Radius E.B. Right Turn 22.5'-Southeast Corner
- Curb Radius 13.95', Effective Radius S.B. Right Turn 40.0'-Northwest Corner
- Curb Radius 21.39', Effective Radius W.B. Right Turn 40.0'-Northeast Corner

See Fig. 6 Below, please note Eastbound Right Turn and Northbound Right Turns overlap and the Single Unit Truck SU-30 cannot make the same movement at the same time under pre construction condition.

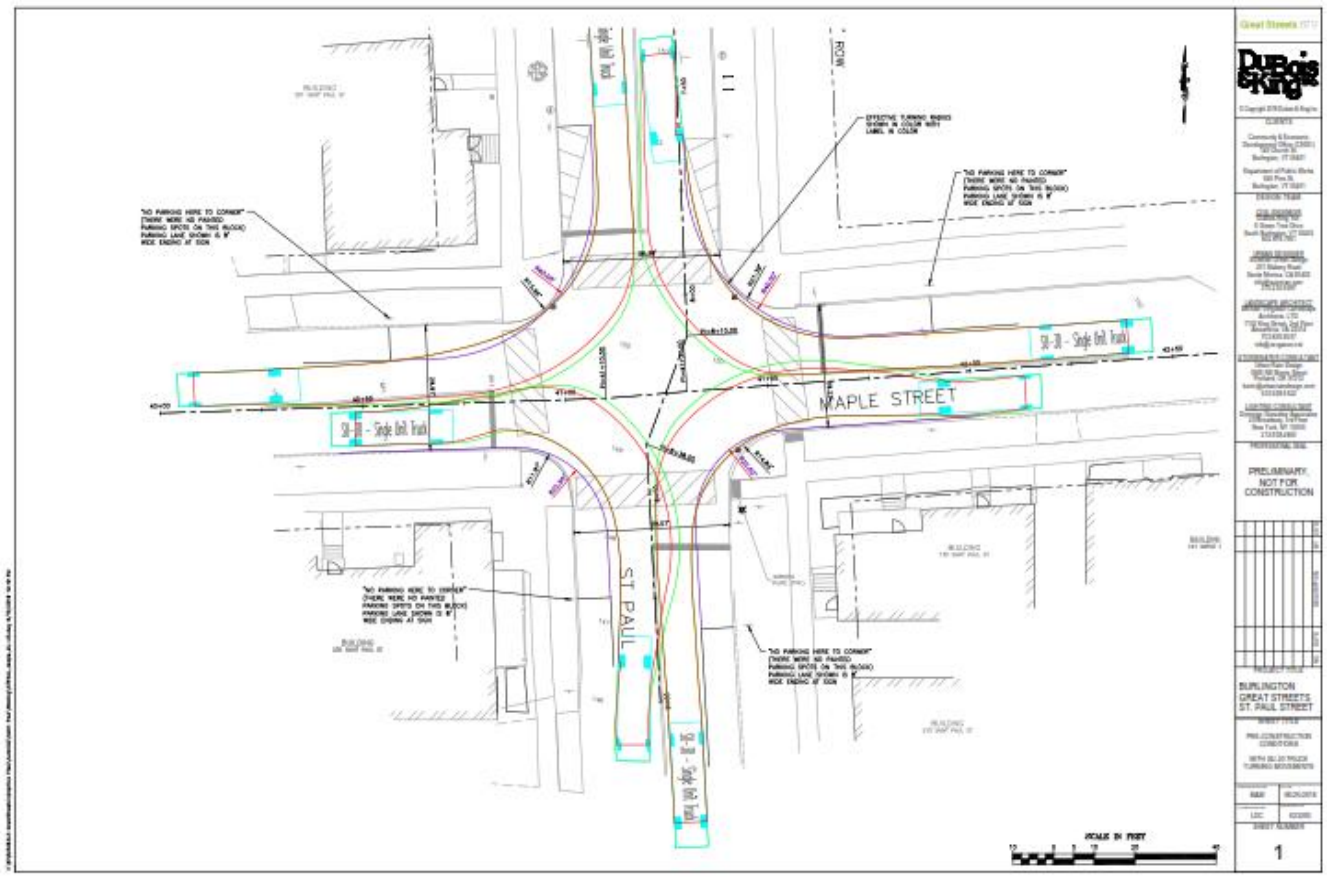


Fig. 6 Pre Construction Condition Single Unit Truck SU-30 Turning

Throughout the various stages, Conceptual Design-30%, Preliminary Design-60%, Semi Final Design-90%, Final Design-100%. Various stakeholders were consulted, including the Fire Department and Public Works Right of Way Team.

Of particular interest to the designers was the need to appropriately accommodate Fire Apparatus while improving pedestrian safety. Design of the Intersection of Maple and St.Paul according to the approved plan set was designed to accommodate the WB-40 turning associated with dimension and turning movement of the City's Tower Truck, with the understanding that the apparatus would be required to make use of the entire intersection and cross over into the receiving approaches.

Given the Great Streets Design intent was to achieve the following key performance objectives of

- Pedestrians are to be served as a first priority, crossing distance would be as short as possible
- The design would be required to accommodate the intended class of vehicle making specific turning
    - movements the assumption more specifically that all passenger vehicles at all turning movements would be accommodated staying within their departure and receiving lane and

- WB-40 Fire Apparatus would be accommodated however it would require use of the entire intersection and some of the receive lane opposing approach.
- Limit turning movement speed

The current design

- shortened crossing distances prior to construction Crossing St.Paul 38.3 feet, Maple Street 29.3 feet to 22 feet for both St.Paul and Maple
- Curb Radius 14.0', Bumpout-St.Paul 8.0', None-Maple-Southwest Corner
- Curb Radius 14.0', Bumpout-St.Paul 8.0'-None-Maple-Southeast Corner
- Curb Radius 14.0', Bump out St.Paul 7.5'-Maple 7.5'-Northwest Corner
- Curb Radius 14.0', Bump out St.Paul 7.5'-Maple 7.5'-Northeast Corner

We anticipated there would be some difficulties for people with larger classes of vehicles attempting to make maneuvers that were never intended to be accommodated by the current design with the intent to protect the adjacent neighborhood streets from commercial truck traffic. During the period of on-going construction, the north-south route for commercial truck traffic has been closed, leaving commercial truck traffic to detour around the lower St.Paul construction closure. This proved to exacerbate made the public's acceptance of the design given the volume of commercial vehicles making right hand turns at the same time passenger vehicles attempting to maneuver. There are numerous accounts of people entering the intersection and hitting the curb and doing damage to their tires to avoid commercial truck traffic.

Seeing the geometries for Maple and St.Paul have been determined to be more challenging than anyone could accept DPW had begun working on examining the existing built condition in the middle of August.

DPW's Evaluation took into account:

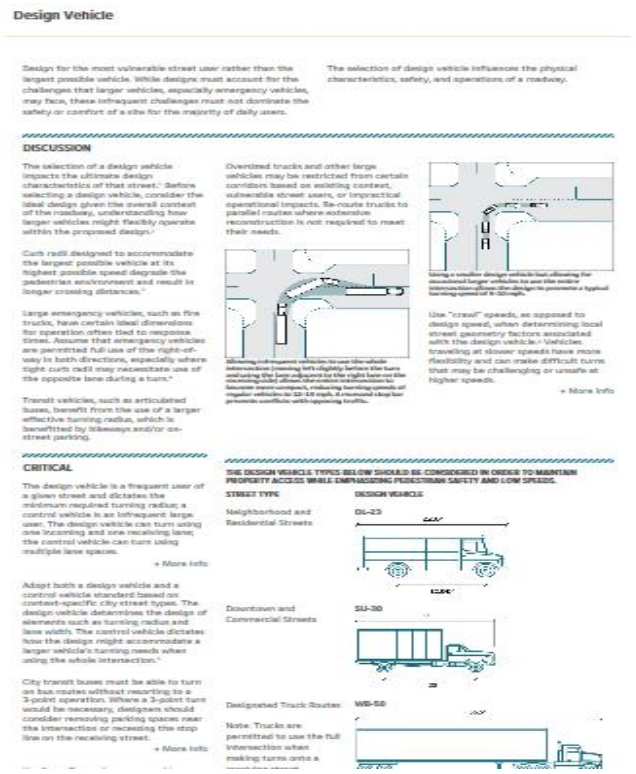
- Cost to dismantle what had already been built,
- Time necessary to procure and install material(granite vs. concrete)
- Developing a range of geometric permutations that included
  - narrowing of the proposed bumpout,
  - widening the approach widths,
  - broadening the curb return radius to arrive at a more favorable effective travel radius for larger vehicles
- Determining what larger class of vehicle would be appropriate to be accommodated,
- Which movements would be accommodated?

Below is the various permutations we considered, and the class of vehicles we used to determine our next steps to reconstruct the two southernmost corners of Maple and St.Paul Street.Fig 10-Fig.12

The National Association of City Transportation Officials(NACTO) recommends to adopting design vehicles for various street types.

- Neighborhood and Residential Streets-Delivery Truck DL-23
- Downtown and Commercial Streets-Single Unit Truck SU-30
- Designated Truck Routes-WB-50
- Designated Bus Routes-BU40

Maple Street would be considered a Neighborhood and Residential Street-Delivery Truck DL-23
St.Paul Street would be considered a Downtown and Commercial Street as well, as a Truck Route for through movements, not side street movements.



Design Vehicle

Design for the most vulnerable street user rather than the largest possible vehicle. While designs must account for the challenges that larger vehicles, especially emergency vehicles, may face, these infrequent challenges must not dominate the safety or comfort of a site for the majority of daily users.

The selection of design vehicle influences the physical characteristics, safety, and operations of a roadway.

DISCUSSION

The selection of a design vehicle impacts the ultimate design characteristics of that street.[1] Before selecting a design vehicle, consider the ideal design given the overall context of the roadway, understanding how larger vehicles might flexibly operate within the proposed design.[2]

Curb radii designed to accommodate the largest possible vehicle at its highest possible speed degrade the pedestrian environment and result in longer crossing distances.[3]

Large emergency vehicles, such as fire trucks, have certain ideal dimensions for operation often tied to response times. Assume that emergency vehicles are permitted full use of the right-of-way in both directions, especially where tight curb radii may necessitate use of the opposite lane during a turn.[4]

Transit vehicles, such as articulated buses, benefit from the use of a larger effective turning radius, which is benefitted by bikeways and/or on-street parking.

Oversized trucks and other large vehicles may be restricted from certain corridors based on existing context, vulnerable street users, or impractical operational impacts. Re-route trucks to parallel routes where extensive reconstruction is not required to meet their needs.

Use "crawl" speeds, as opposed to design speed, when determining local street geometry factors associated with the design vehicle.[5] Vehicles traveling at slower speeds have more flexibility and can make difficult turns that may be challenging or unsafe at higher speeds.

+ More Info

CRITICAL

The design vehicle is a frequent user of a given street and dictates the minimum required turning radius; a control vehicle is an infrequent large user. The design vehicle can turn using one incoming and one receiving lane; the control vehicle can turn using multiple lane spaces.

+ More Info

Adopt both a design vehicle and a control vehicle standard based on context-specific city street types. The design vehicle determines the design of elements such as turning radius and lane width. The control vehicle dictates how the design might accommodate a larger vehicle's turning needs when using the whole intersection.[1]

City transit buses must be able to turn on bus routes without resorting to a 3-point operation. Where a 3-point turn would be necessary, designers should consider removing parking spaces near the intersection or recessing the stop line on the receiving street.

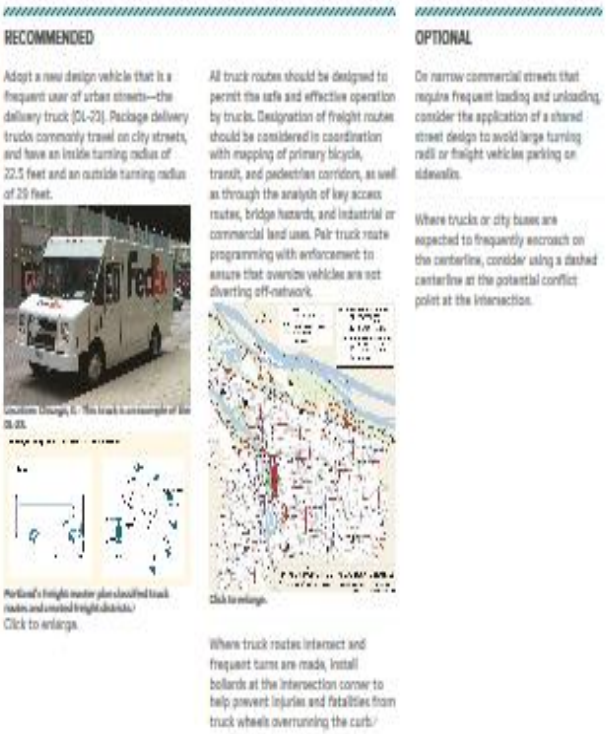
+ More Info

THE DESIGN VEHICLE TYPES BELOW SHOULD BE CONSIDERED IN ORDER TO MAINTAIN PROPERTY ACCESS WHILE EMPHASIZING PEDESTRIAN SAFETY AND LOW SPEEDS.

STREET TYPE	DESIGN VEHICLE
Neighborhood and Residential Streets	DL-23
Downtown and Commercial Streets	SU-30
Designated Truck Routes	WB-50

Note: Trucks are permitted to use the full intersection when making turns onto a

Fig.8-NACTO Reference to Design Vehicles



RECOMMENDED

Adopt a new design vehicle that is a frequent user of urban streets—the delivery truck (DL-23). Package delivery trucks commonly travel on city streets, and have an inside turning radius of 22.5 feet and an outside turning radius of 29 feet.

Click to enlarge

All truck routes should be designed to permit the safe and effective operation by trucks. Designation of freight routes should be considered in coordination with mapping of primary bicycle, transit, and pedestrian corridors, as well as through the analysis of key access routes, bridge hazards, and industrial or commercial land uses. Pair truck route programming with enforcement to ensure that oversize vehicles are not diverting off-network.

Where truck routes intersect and frequent turns are made, install bollards at the intersection corner to help prevent injuries and fatalities from truck wheels overrunning the curb.[1]

OPTIONAL

On narrow commercial streets that require frequent loading and unloading, consider the application of a shared street design to avoid large turning radii or freight vehicles parking on sidewalks.

Where trucks or city buses are expected to frequently encroach on the centerline, consider using a dashed centerline at the potential conflict point at the intersection.

Fig.9-NACTO Delivery Vehicle DL-23

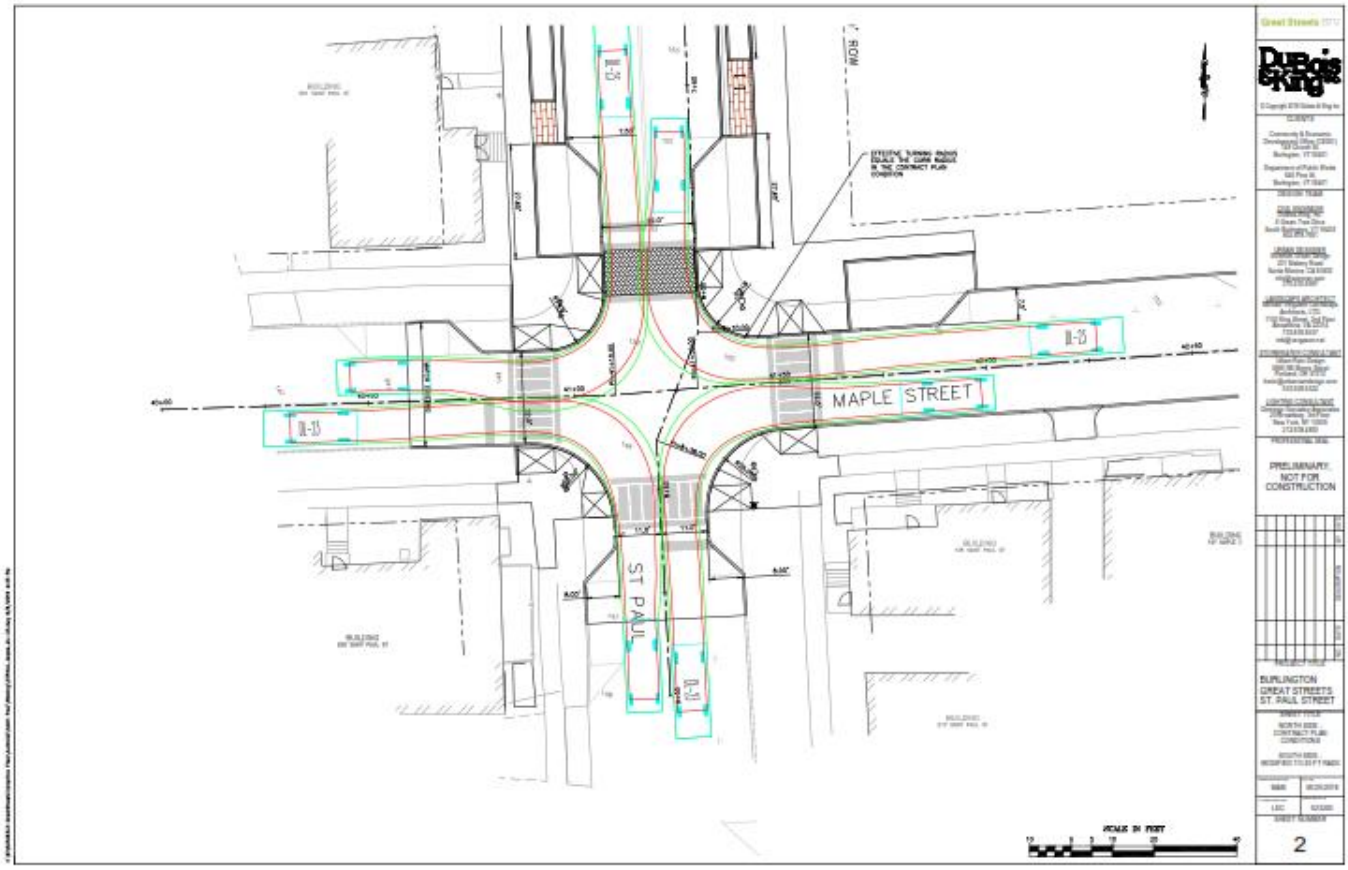


Fig.10-Maple & St.Paul 20' Curb Radius

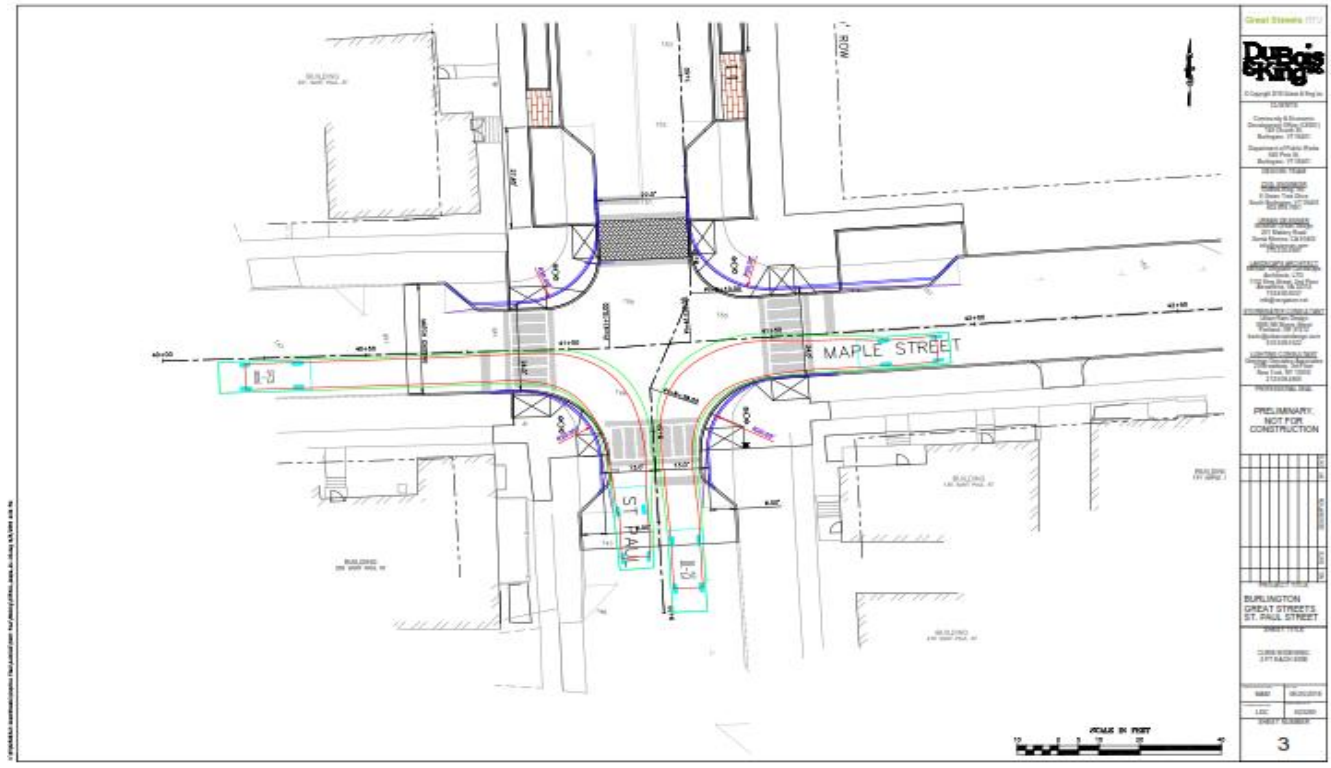


Fig.11-Maple St & St.Paul St.-20'Curb Radius-4' widening of Northbound Approach

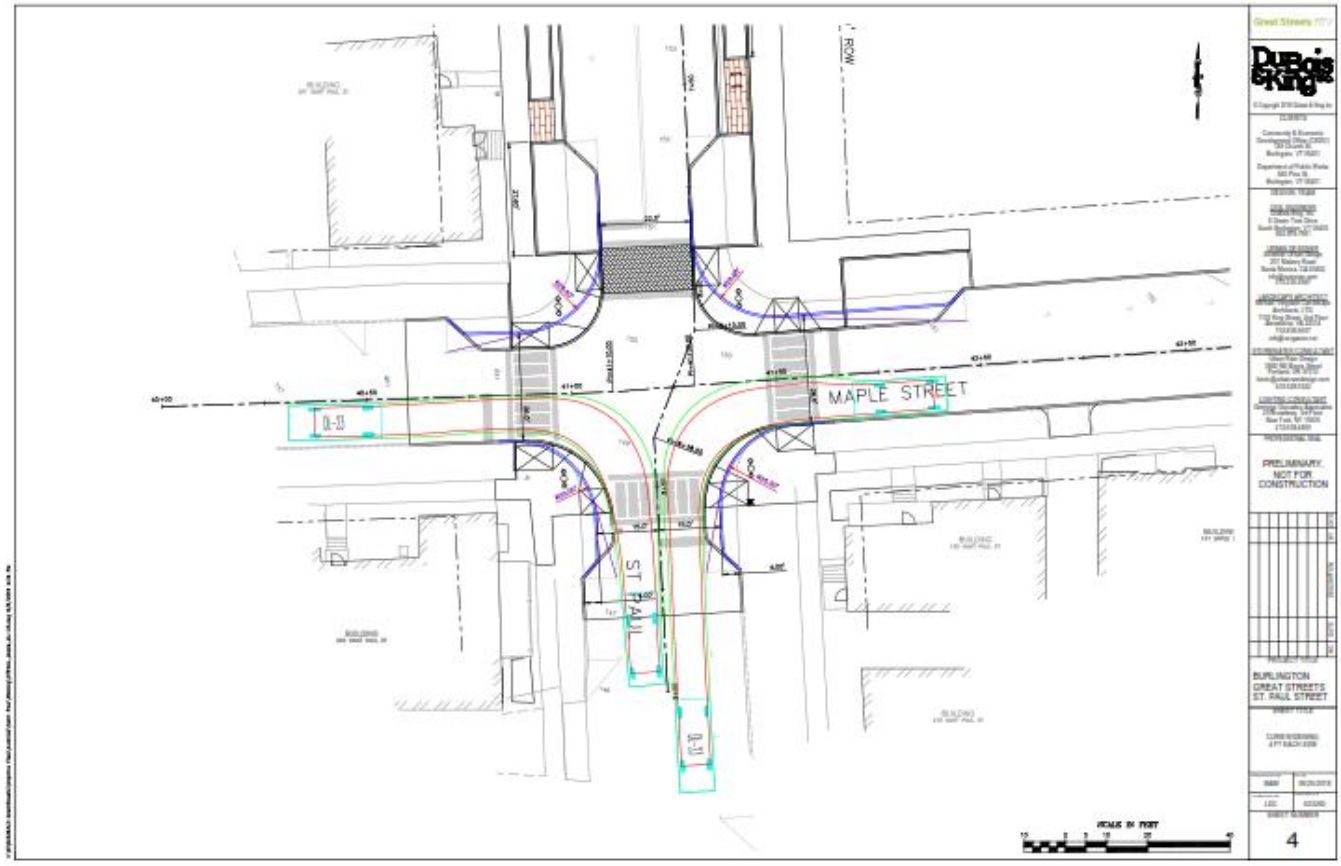


Fig.12-Maple Street and St.Paul Street-20 Curb Radius, 8' widening of northbound approach

CONCLUSIONS AND RECOMMENDATIONS:

DPW has concluded that the intersection of Maple and St.Paul Street as built, requires modifications. In attempting to create the a new balance in how the public will make use of the right of way, we recognize our first attempt at finding the right balance of accommodating pedestrians and vehicular movement did not arrive at a favorable result for the public.

We believe having a design that will accommodate a Delivery Vehicle-DL23 the design vehicle for Eastbound Right Turns and Northbound Right Turns at Maple and St.Paul is appropriate, given Maple Street is intended to be a Downtown Residential Street.

The Design shown in Fig.12 calling for a 20' Curb Radius and an additional 8' of approach widening for the northbound approach is suitable for Delivery vehicle DL-23's and to a lesser degree Single Unit Trucks-SU-30.

Therefore the design modifications identified in Fig. 12, calling for a 20' radius for the two southern most corners and an 8' widening of the northbound approach at Maple and St.Paul is the design modifications DPW would recommend in this case.

Staff has gotten pricing from S.D.Ireland for the proposed curb and chamfering work to be approximately $20,000. The work could be completed prior to the opening of two way traffic on the lower block of St.Paul currently closed, however the work needs to be released immediately to avoid further extending the roadway closure.

In addition DPW would recommend that the granite curbs for the intersection of King and St.Paul be modified to have a 3 inch chamfer cut on the inside edge of the curb to reduce the potential of damaging tires or rims in the event that people maneuver too close to the limits of the roadway.

DPW plans on monitoring the performance of the street and intersections once the project is completed and in full operation.

Thank you for taking the time to read and understand the circumstance surrounding this complex issue and being a partner in getting this issue resolved as soon as possible. I will be at the meeting present this solution and available to answer any questions you may have.