



Appendix G

Design Criteria

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MEMO

TO: Eleni Churchill, CCRPC, Transportation Program Manager

FROM: R. Chamberlin, PE/PTOE; M. Smith, PE

DATE: July 29, 2015

SUBJECT: Railyard Enterprise Project - Design Criteria and Intersection Controls for Phase 2 Alternatives

This memorandum describes the engineering criteria used in the development of the Phase 2 alternatives for the Railyard Enterprise Project (REP). It also proposes intersection controls of each Phase 2 alternative.

These criteria are consistent with VT Act 34 (An act relating to a transportation policy that considers all users), and subsequent City policy on complete streets. Act 34 states:

“Transportation projects and project phases managed by a municipality –including planning, development, construction, or maintenance –must consider “complete streets” principles, which are principles of safety and accommodation of all transportation system users, regardless of age, ability, or modal preference; except projects or project components involving unpaved highways.”

STREET CROSS-SECTION

As recommended in the Burlington City Complete Streets Guidance (v2.2.1)¹, we have developed geometric parameters for all new streets in the REP area, shown in Tables 1 through 3. Where necessary, some criteria may be modified in order to avoid existing structures, private property, and/or known sensitive resources.

Table 1 shows the basic criteria for all new streets. The major street connection between Battery and Pine Street will be designed as a *Complete Street* (Table 2), and all other new minor streets will be designed using the *Slow Street* criteria (see Table 3).

TABLE 1. BASIC DESIGN CRITERIA FOR ALL NEW STREETS

Speed limit	25 mph
Design speed	25 mph
Curbing	yes
Curb radii	15'
Stopping sight distance	150'
Corner sight distance	275'
Horizontal centerline radius	200' min., 300' preferred

¹

[http://www.burlingtonvt.gov/uploadedFiles/BurlingtonVTgov/Departments/DPW/Transportation/Policy and Plan ning/Complete-Streets-Reporting-v2.2.1-workingdraft.pdf](http://www.burlingtonvt.gov/uploadedFiles/BurlingtonVTgov/Departments/DPW/Transportation/Policy_and_Plan ning/Complete-Streets-Reporting-v2.2.1-workingdraft.pdf)

TABLE 2. DESIGN CRITERIA FOR REP COMPLETE STREET ALTERNATIVES

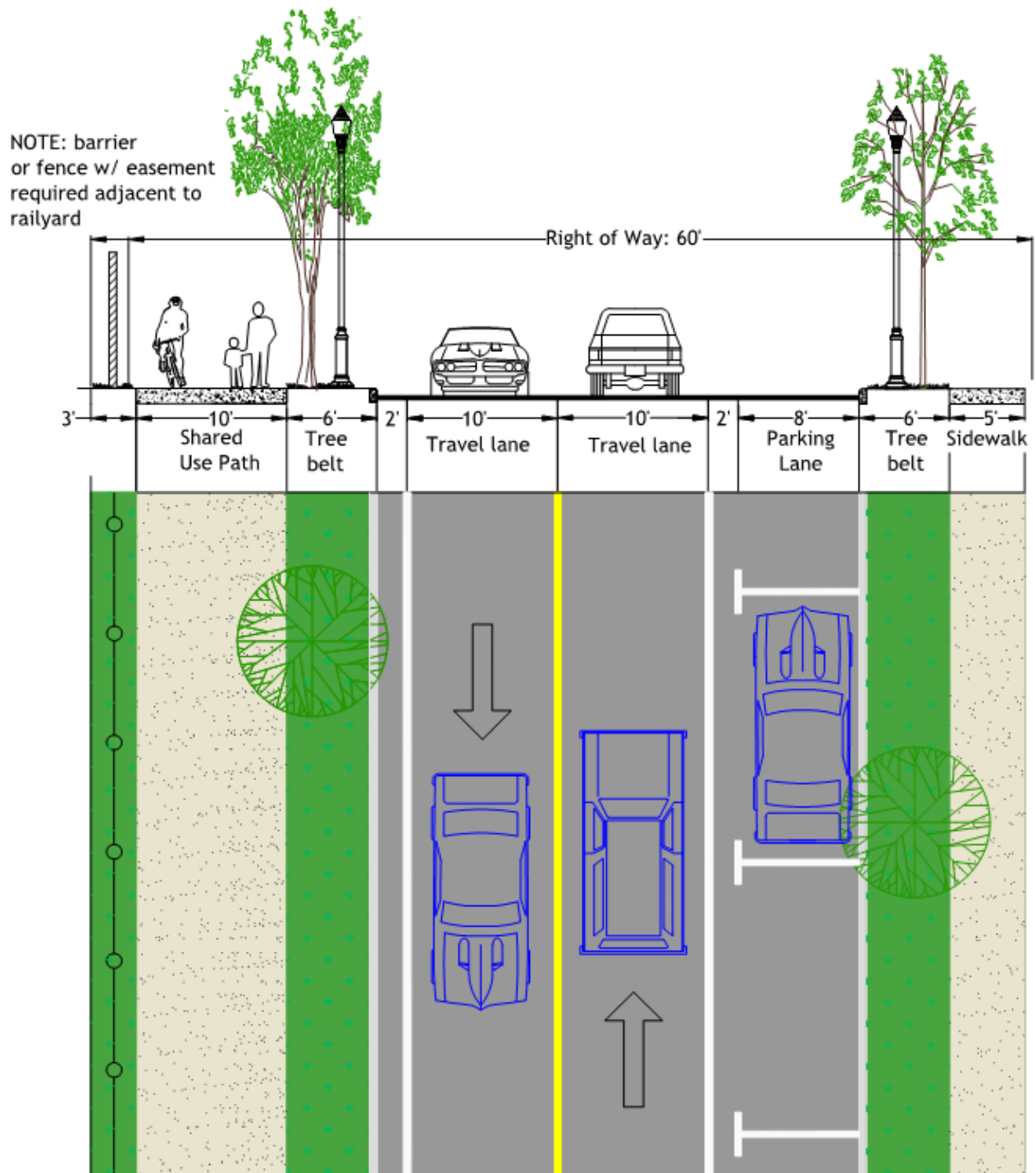
Vehicle lane	10 feet
Shoulder	2 feet
Parking lane	where feasible, parallel, 8', one side
Bike lanes	no, shared on street use
Sidewalks	5' min, one side (where feasible)
Shared use path	yes, 10 feet min. *
Tree belt	6 feet **
Street lighting	at gateways, intersections and other hi-ped areas
<p><i>* if the proposed shared use path along Pine Street (Champlain Parkway project) is determined in the future to not be feasible, it may change the City's desired cross section</i></p>	
<p><i>** may be reduced in specific areas to avoid resource impacts</i></p>	

Note: The complete streets design criteria might be revised in subsequent phases of the REP as more information on constraints and resource impacts become available

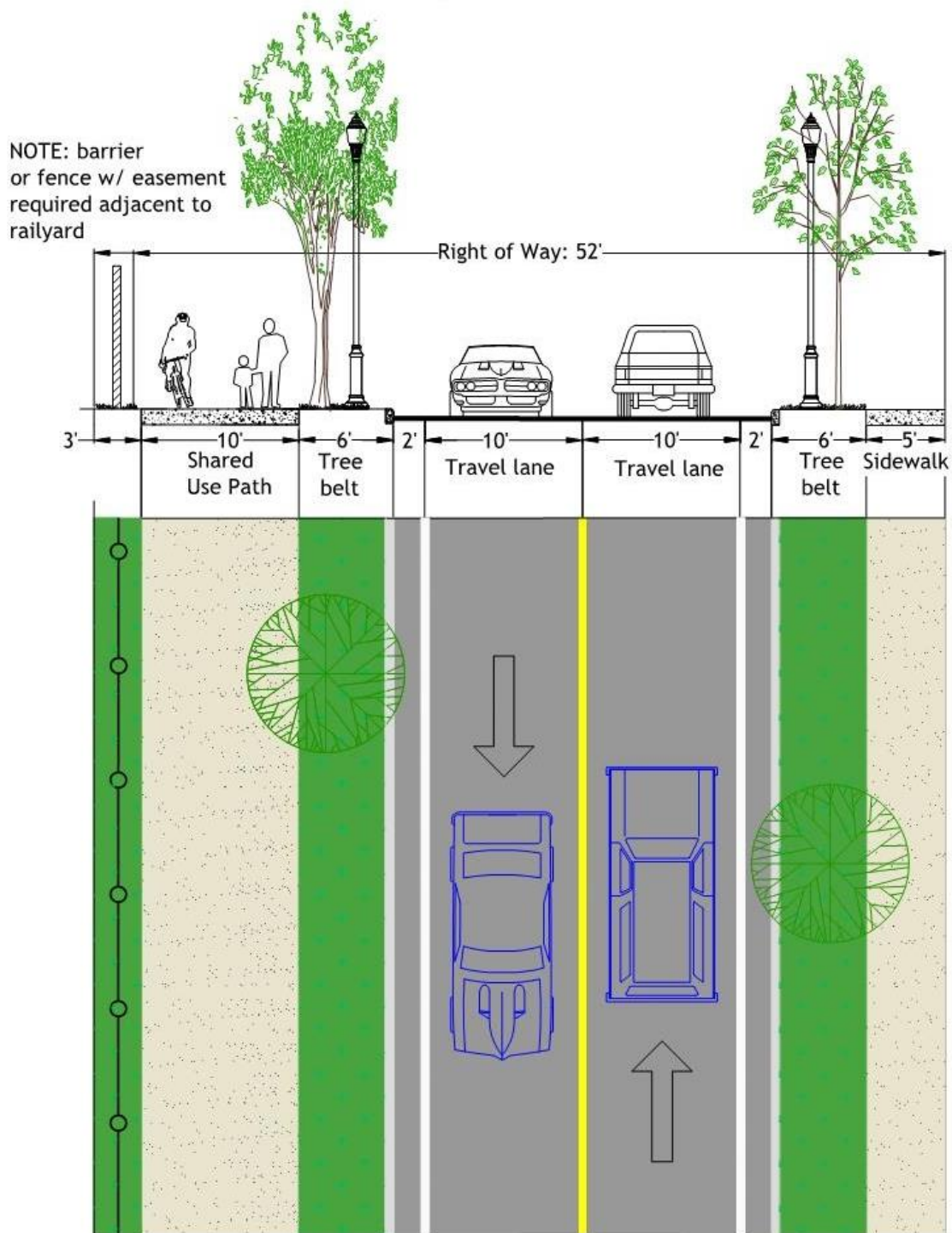
Figure 1 shows three conceptual right-of-way cross-sections for Complete Streets segments. Please note that these cross-sections might change as the Railyard Enterprise Project advances into an EIS and more information becomes available on constraints and opportunities. The Complete Street # 1 section will be used for Alternatives 2 through 5b while the Complete Street 2 (no parking lane) will be used for Alts 1a and 1b. Complete Street # 3 section is intended for use through the railyard, where tight constraints call for a narrower cross section. An optional barrier is shown for implementation when street is adjacent to the railyard.

FIGURE 1: ILLUSTRATIVE COMPLETE STREET CROSS-SECTIONS

Complete Street #1

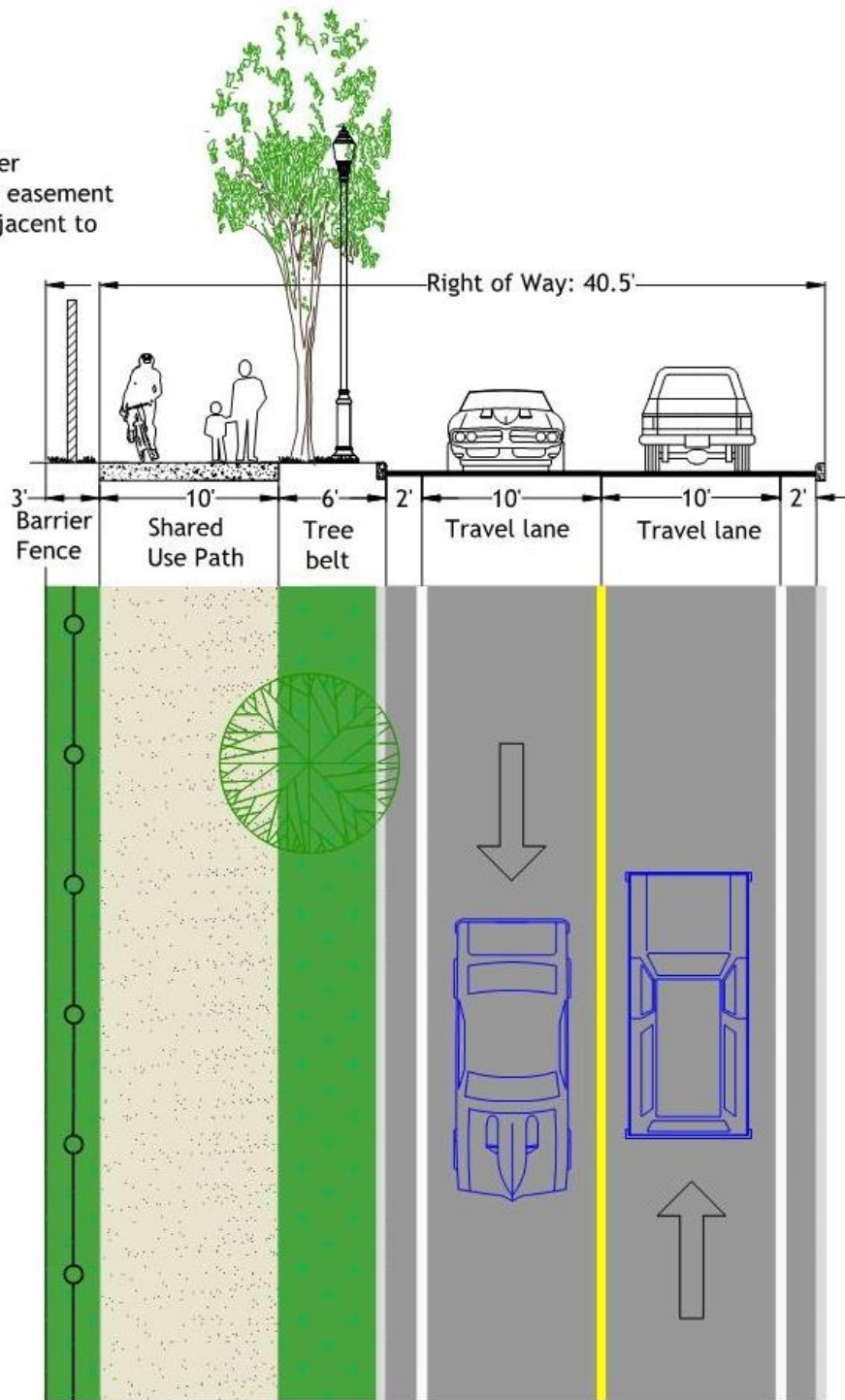


Complete Street #2



Complete Street #3

NOTE: barrier or fence w/ easement required adjacent to railyard



Note: This section is only intended for use through the railyard, where tight constraints call for a narrower cross-section.

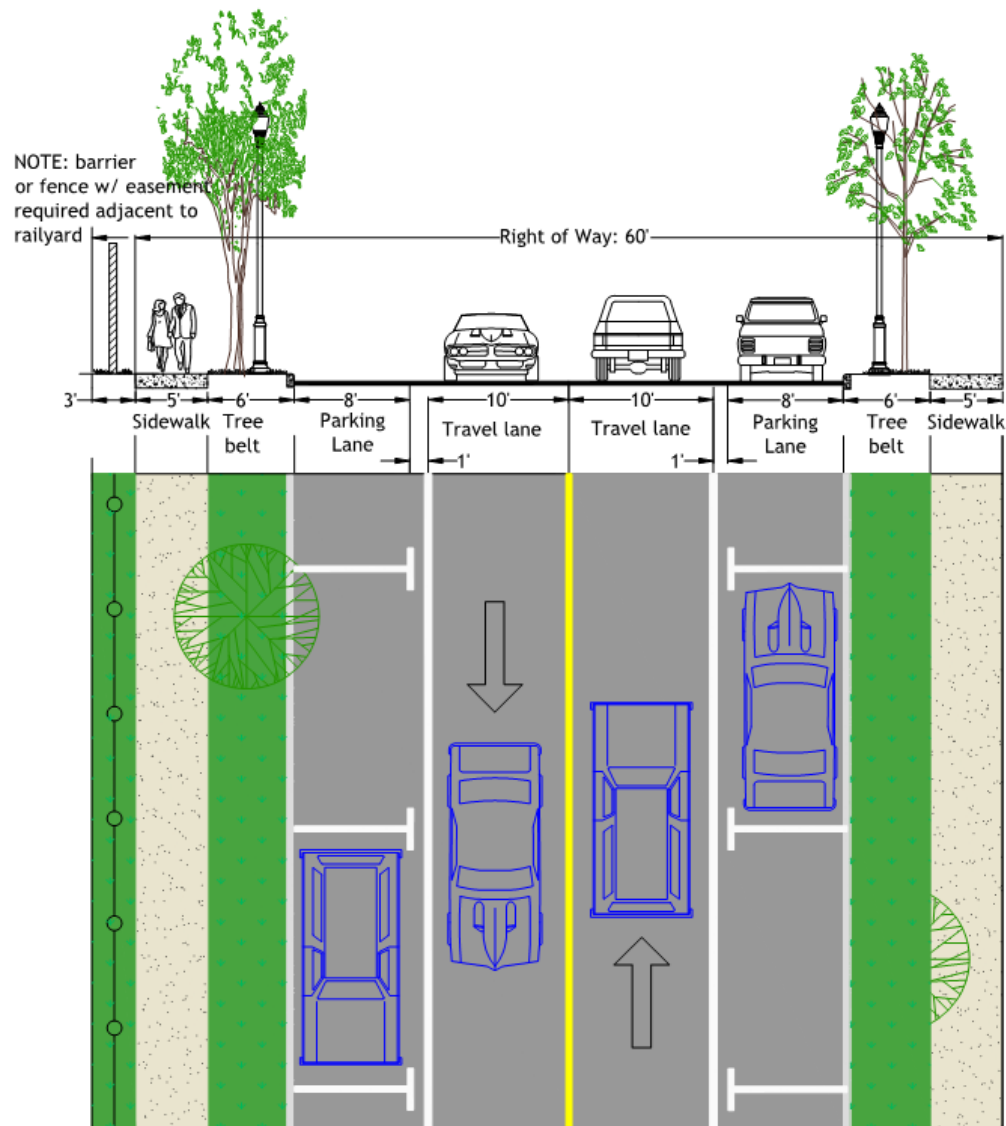
TABLE 3. DESIGN CRITERIA FOR REP SLOW STREET ALTERNATIVES

Vehicle lane	10 feet
Shoulder	1 foot
Parking lane	8' at least one side, where feasible
Bike lanes	no, shared on street use
Sidewalks*	5 feet
Tree belts	6 feet
Street lighting	yes

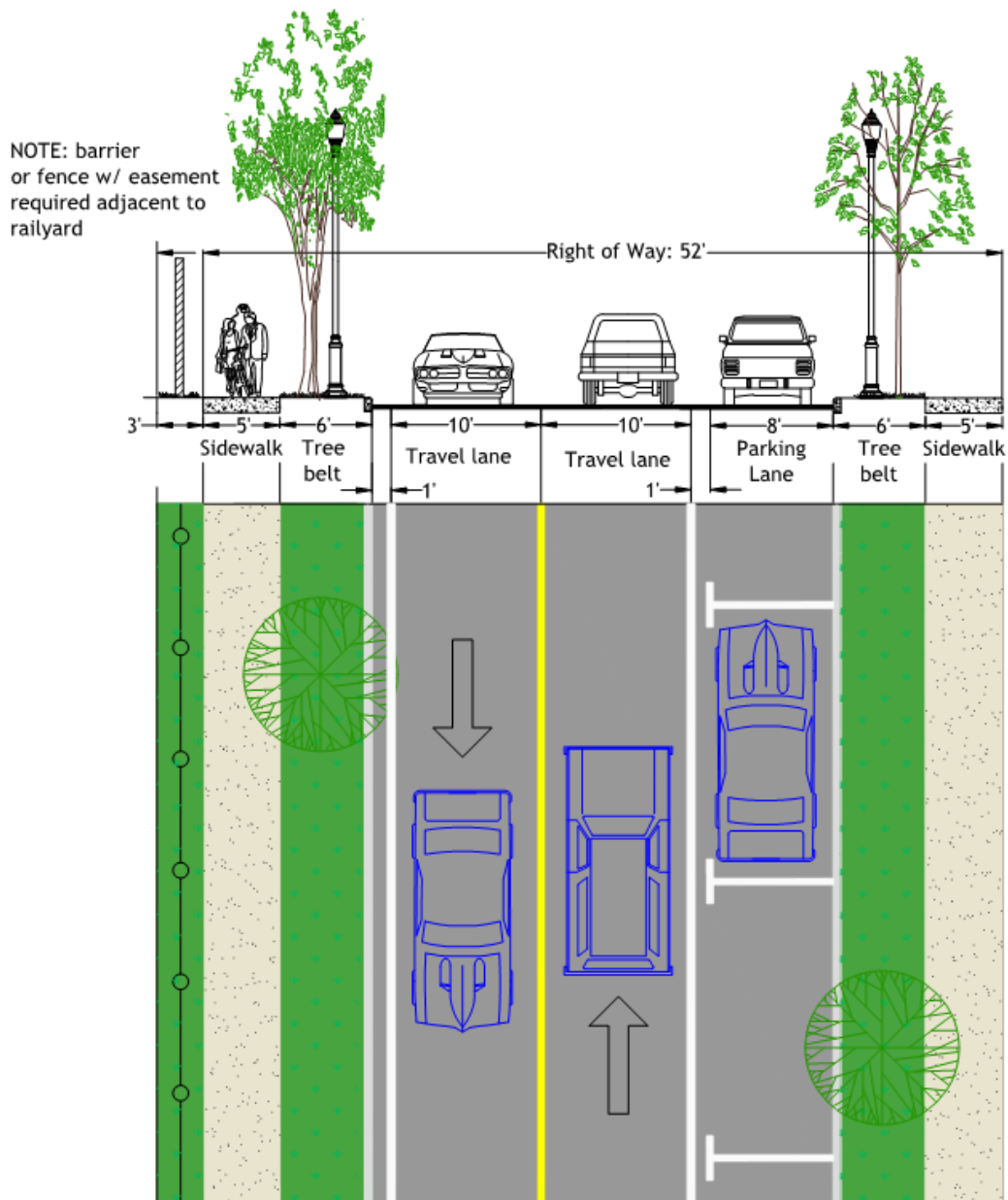
Figure 2 shows two illustrative right-of-way cross-sections for Slow Streets. An optional barrier is shown for implementation when street is adjacent to the railyard.

FIGURE 2: ILLUSTRATIVE SLOW STREET CROSS-SECTION

Slow Street #1



Slow Street #2



The Phase 2 Alternative schematics at the end of this memo show the proposed cross-sections for each new street in the REP area according to a color-coded legend.

INTERSECTION CONFIGURATION AND TRAFFIC CONTROL

In addition to the proposed cross sections, the Phase 2 Alternative schematics indicate the type of intersection control proposed for each alternative. Note that these treatments are a starting point for the traffic analyses that will be conducted after we receive Stakeholder comments on this memo. Some modifications may be necessary in order to obtain adequate capacity and maximum safety at each location.

The proposed intersection controls are based on the following:

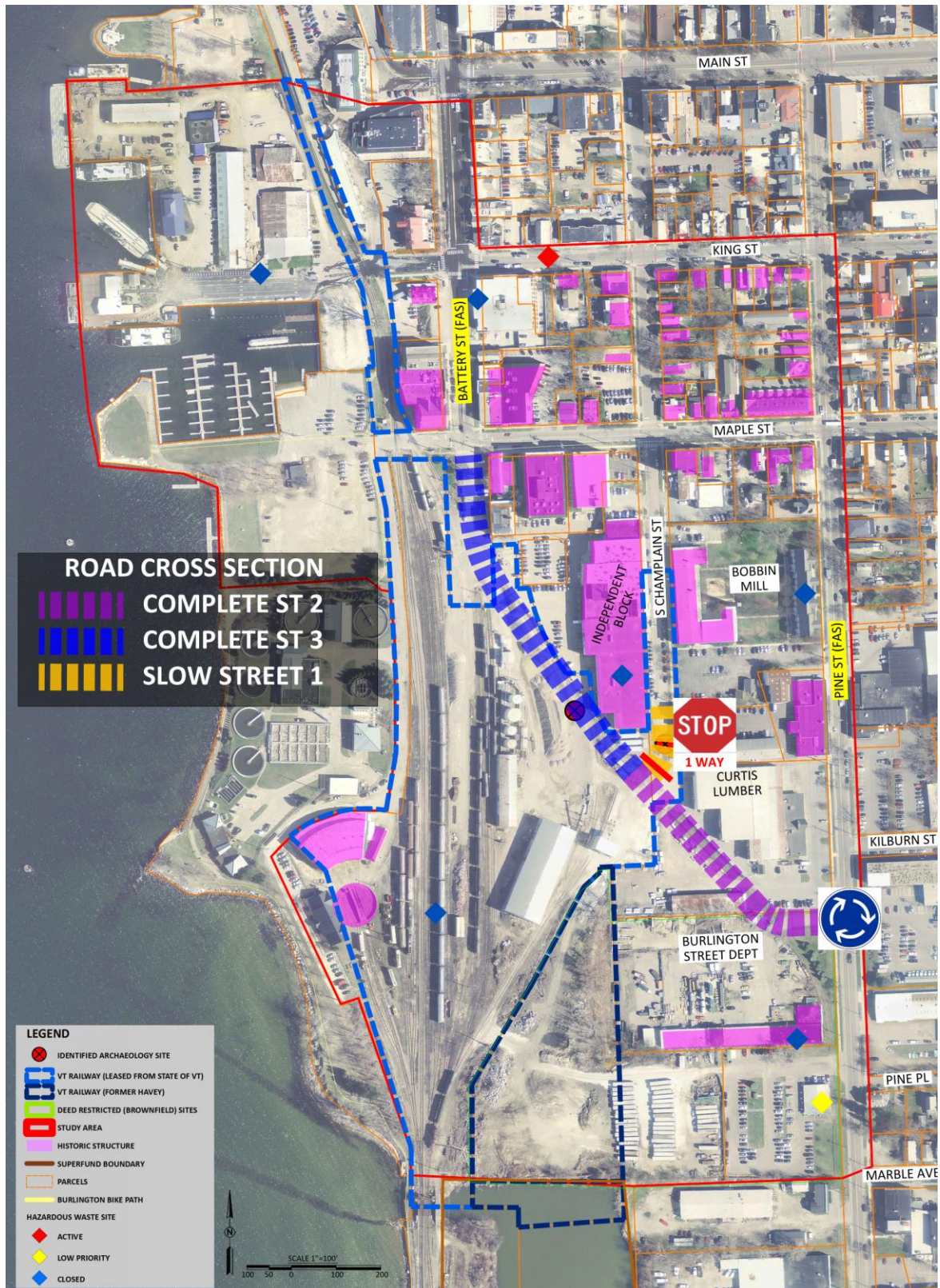
- The complete streets cross-section connecting the two arterials (Battery & Pine), is the segment that will likely see significantly higher traffic volumes than the slow streets, thus where stop signs are employed, the complete street is given priority (if possible).
- Specifically in Alternative 5a the higher volume/complete street segment follows a 90 degree turn in which case an all-way stop is employed, since allowing an unstopped (free) left is unusual and can confuse drivers.
- Offset intersections require inefficient signal phasing (the side streets must be given separate green intervals), thus a roundabout, is suggested in these instances which is more flexible in this regard. Examples of this include:
 - o Alternative 4 at Kilburn St. & Pine St.
 - o Alternative 4, 5a and 5b at Marble St. & Pine St.
- At the intersection of S. Champlain and the new complete street, a roundabout is likely to consume more area than a stop or signalized intersection. Since land is particularly constrained in this area (by Curtis lumber and the railyard) a roundabout is not preferred.

END OF MEMO

Attachment 1-7: Phase 2 Alternative Schematics



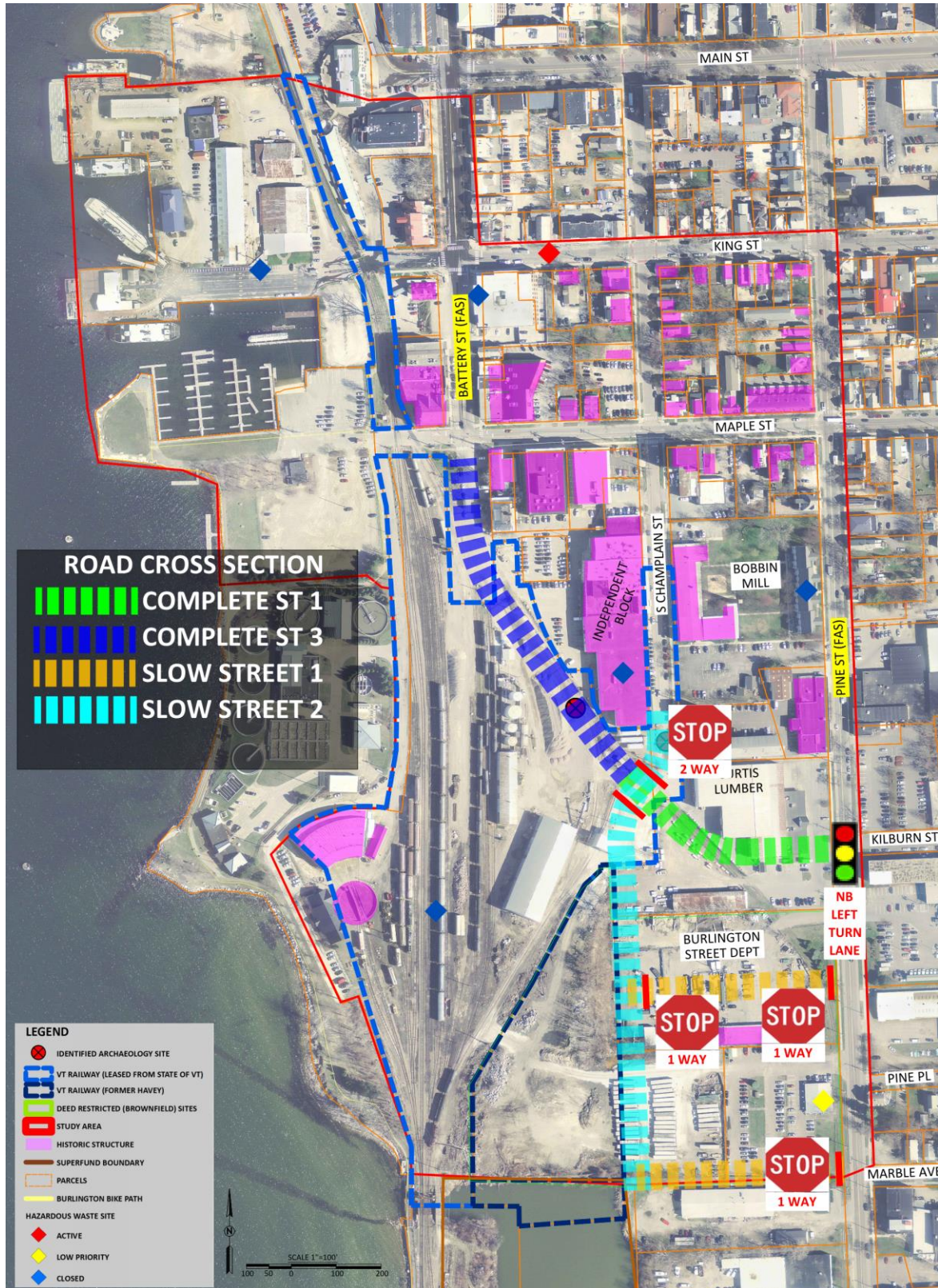
ATTACHMENT 1. REP Phase 2 Alternative 1A



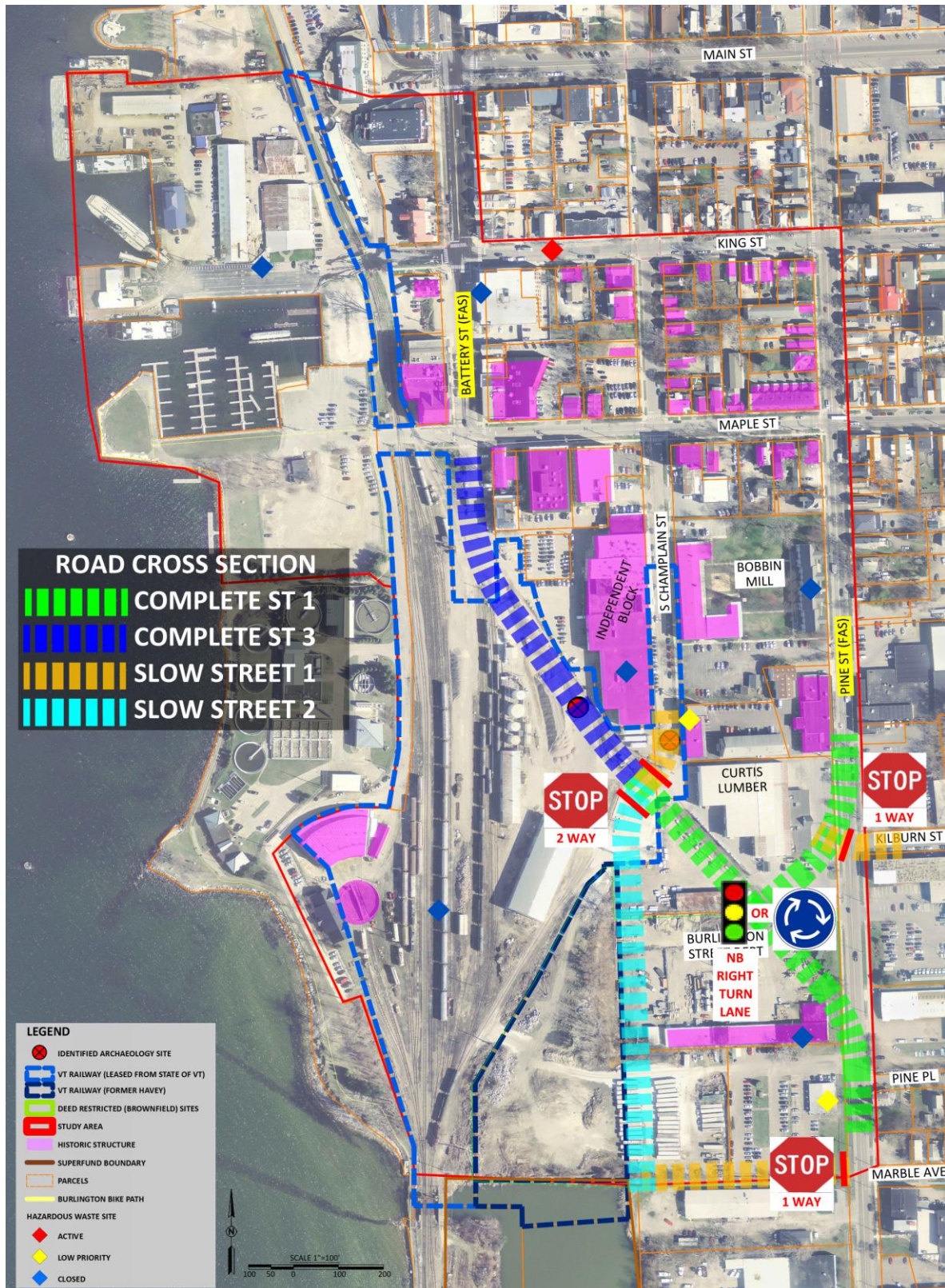
ATTACHMENT 2. REP Phase 2 Alternative 1B



ATTACHMENT 3. REP Phase 2 Alternative 2



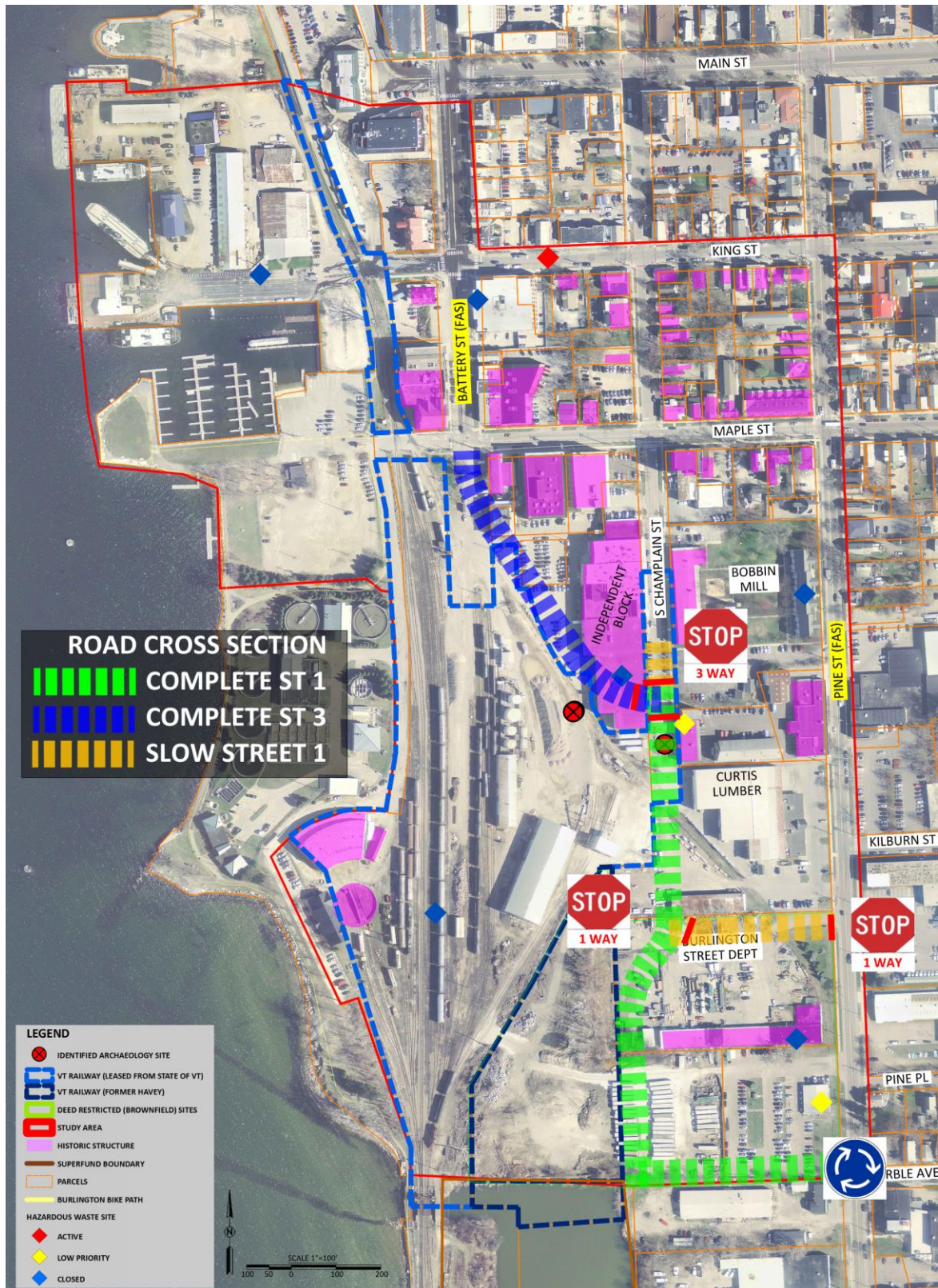
ATTACHMENT 4. REP Phase 2 Alternative 3



ATTACHMENT 5. REP Phase 2 Alternative 4



ATTACHMENT 6. REP Phase 2 Alternative 5A



ATTACHMENT 7. REP Phase 2 Alternative 5B



Comments on Railyard Enterprise Project Design Memo

Prepared by Local Motion

October 2015

This memo outlines several suggestions for changes to the Railyard Enterprise Project phase two design criteria memo. Local Motion prepared these comments in our role as the member of the REP steering committee charged with reviewing plans from the perspective of walking and biking.

STREET CROSS SECTIONS

The primary focus of the street cross section design standards should be to ensure that this major expansion to Burlington's street grid reflects the actual measurements of comparable streets within the city's historic streets. It would be a mistake to impose standards on urban Burlington that are in fact more appropriate to a suburban context, with its higher vehicle speeds and lower volumes of walk-bike traffic (and attendant lack of vibrancy).

To that end, Local Motion staff went out and measured a few comparable streets. Findings are as follows:

- **Willard Street (US Rte 7), just north of the Shelburne Street rotary.** This street is comparable in road classification, traffic volume, and mix of vehicle types to the "Complete Street" in the REP. It is 31 feet from face of curb to face of curb: 8' parking, 10' travel lane, 10' travel lane, and 3' shoulder (northbound for bikes climbing the hill).
- **Champlain Street, just south of Maple Street.** This street is comparable in road classification, traffic volume, and mix of vehicle types to the "Slow Street" in the REP. It is 34 feet from face of curb to face of curb: 8' parking, 18' two-way travel space (no centerline), 8' parking.

What we conclude from this comparison is that the proposed design criteria for both the Complete Street and Slow Street types will result in streets that are overbuilt relative to comparable existing streets in Burlington. Specifically:

1. In the "Complete Streets" cross section, a 2' buffer between parking and a 10' travel lane is not needed, even on a major street with substantial large truck traffic.
2. Also in the "Complete Streets" cross section, a 2' shoulder is not needed if bikes are being accommodated in a separated path.
3. In the "Slow Streets" cross section, 22' of open asphalt (travel lanes plus shoulders/buffers) from curb to parked cars is excessive on a street that is intended to carry low volumes of traffic at slow speeds.

Our concern is that the proposed standards will encourage speeding, which will decrease safety for people walking and biking and (as a consequence) run counter to the City's stated desire to make

this district a lively, pedestrian-oriented place. Most drivers exceed the 25 mph speed limit on Willard Street, even with its narrower lanes. How fast will they go if they have even more elbow room?

Proposal:

- For the "complete streets" cross-sections, reduce the shoulder for lanes that are up against the curb to 1' and eliminate the buffer for travel lanes that are up against on-street parking.
- For the "slow streets" cross-sections, eliminate the center yellow line and provide a total of 18' between parking and parking or between parking and the opposite curb.

Given that these dimensions work quite well on comparable existing streets in Burlington, we can see no reason why they would not work for the REP. If the team feels that, for some reason, these dimensions are problematic, we would appreciate an explanation of what about these new streets makes them different from our existing streets, such that more width is required.

ROUTING OF BIKE PATH

We understand that the team faces extreme constraints in routing both the road and the path through the "pinch point" where the historic roundhouse is buried. Our hope is that the above dimensions will make this needle easier to thread. With the goal of preserving flexibility of design while ensuring that safe and direct connections for bicycle transportation are integrated into the design, we would like to propose that the following language or something like it be added to the memo:

Depending on the alternative chosen, the bicycle path may not run parallel to the "Complete Street" segment. The design team will explore a variety of options for bicycle-specific infrastructure connecting the northern end of the path that parallels Pine Street in the Champlain Parkway design to the waterfront at or near the western terminus of Maple Street. The team will endeavor to design the path such that it: has a minimum of conflict points with vehicles; provides a direct and speedy connection to the waterfront; and separates bicycle traffic from walking traffic wherever possible.

MEMO

TO: Jason Van Driesche, Local Motion

FROM: R. Chamberlin, PE/PTOE

cc: Eleni Churchill, CCRPC; Chapin Spencer, Burlington DPW; Emily Boedecker, Local Motion; Katelin Brewer-Cole, Local Motion

DATE: September 4, 2015

SUBJECT: Railyard Enterprise Project – Phase 2 Design Criteria Supplement

This memorandum responds to issues you have raised regarding the proposed design criteria for the Railyard Enterprise project (emails dated August 4, August 12, and August 23, 2015). The design criteria are described in an RSG memorandum dated July 29, 2015, which was sent to the REP Steering Committee via email on July 31, 2015.

Background

The REP design criteria express the City's desire that the streets constructed within the project area support multiple modes of travel, consistent with the City's Street Design Guidelines. From the outset, the intention has been to develop streets that are consistent with those Guidelines and with the State's Act 34.

For example, the first presentation to the REP Steering Committee (January 29, 2013) addressed street cross-sectional alternatives, and suggested specific dimensions for street elements such as travel lanes, bike lanes, sidewalks, on-street parking, tree belts, etc. At the second Steering Committee meeting (May 7, 2013) the preliminary Purpose and Need Statement was presented including specific reference to "incorporating the principles of Complete Streets". Every Steering Committee meeting has included some mention of street design criteria, reinforcing the intention that accommodating all modes was a central focus of the work (see table below).

Steering Committee Meeting	Date	Content
#1	January 29, 2013	Presentation of 5 Street Cross-Sectional Alternatives; Description of Scope of Work, Including Establishing Multimodal Design Criteria
#2	May 7, 2013	Review of Past Land Use/Transportation Studies in the REP Study Area, Including Street Cross-Sectional Alternatives
#3	June 12, 2013	Description of City's Complete Streets Guidance,

		Preliminary Street Layout Recommendations; Intention to Incorporate Multi-Modal Concerns
#4	July 9, 2013	Reiteration of Design Themes from Meeting #3
#5	December 11, 2013	Presentation of 7 Alternatives with References to Complete and Slow Street Cross-Sections
#6,#7	September 4, 2014, March 4, 2015	Presentation of Revised Purpose and Need Statement with Explicit Reference to Complete Streets Principles

Throughout the project Steering Committee members, members of the general public, and representatives of organizations with a specific modal focus have provided input on the REP street design elements. Included in these other groups are Local Motion, CCTA, and Vermont Rail. Over the course of many months, several stakeholders have critiqued the design criteria, including the Federal Highway Administration, VTTrans, City of Burlington Department of Public Works, and the CCRPC. Ultimately, these stakeholders have approved the REP design criteria as appropriate for the purposes of this scoping/Planning-Environmental Linkages study.

Design Standards

The project team has consulted several design references for the REP design criteria:

1. **Burlington Street Design Guideline** - Appendix 2 of the Burlington Transportation Plan, https://www.burlingtonvt.gov/sites/default/files/DPW/TransportationPlan/BTP_Appendix_2_StreetDesign.pdf
2. **NACTO Urban Street Design Guide** - <http://nacto.org/publication/urban-street-design-guide/> and the **NACTO Urban Bikeway Design Guide** - <http://nacto.org/publication/urban-bikeway-design-guide/>
3. **Vermont Pedestrian and Bicycle Facility Planning and Design Manual** - http://vtransengineering.vermont.gov/sites/aot_program_development/files/documents/ltf/PedestrianandBicycleFacilityDesignManual.pdf
4. **Vermont State Design Standards** - http://vtransengineering.vermont.gov/sites/aot_program_development/files/documents/publications/VermontStateDesignStandards.pdf
5. **American Association of State Highway Transportation Officials (AASHTO)**, including “A Policy on Geometric Design of Highways and Streets (“the Green Book”), the “Guide for the Planning, Design, and Operation of Pedestrian Facilities”, and the “Guide for the Development of Bicycle Facilities”.

The table below provides dimensions for different street elements, as recommended by the design sources cited above:

	Complete Street Elements						
	Vehicle Travel Lanes	Shoulder/Buffer	Lane + Shoulder	Sidewalk	Parallel Parking	Tree Belt	Shared Use Path
Railyard Enterprise Project	10'	2'	12'	5'	8'	6'	10'
Burlington Street Design Guidelines	10' - 12'	not addressed	10' - 12'	5' (min)	8'	5' - 12'	not addressed
NACTO Urban Street Design Guidelines, Urban Bikeway Design Guide	10' - 11'	not addressed	10' - 11'	5' - 12'	7' - 9'	multiple treatments recommended of varying widths	not addressed; 2-way Cycle Track width 12'
Vermont Pedestrian and Bicycle Facility Design Manual	10' - 12' (Wide Curb Lane, 4.4.2)	2' - 3' (Wide Curb Lane, 4.4.2)	12' - 15' (Figure 9-1)	5' - 10'	8' (Table 9-1, Figure 9-1)	6' - 7' (Figure 9-1)	8' - 14' (Table 5-1, Figure 5-6)
Vermont State Design Standards	10' - 13' (Section 4.5, Table 4.9)	2' - 3' (Table 4.8)	13' (Table 4.9)	5'	8' (Section 5.5)	not addressed	Comply with ADAAG (4.14.4)
AASHTO Sources	10' - 12'	1' - 2'	11' - 14'	4' - 8'	7' - 10'	5' - 6'	10' - 12'

The recommended REP design criteria are largely consistent with the guidance and, in some case, are at the lower limits of the guidance. For example, for urban streets with insufficient width for bike lanes, the Vermont Pedestrian and Bicycle Facility Design Manual recommends 13-foot wide curb lanes without on-street parking and 14-foot curb lanes with on-street parking (Section 4.4).

Neither the Burlington Street Design Guidelines nor the NACTO Guidelines address the 2' shoulder/buffer. The striped buffer serves multiple purposes:

1. To define a narrow travel way for slowing traffic.
2. To provide an offset to the vertical curb.
3. To provide some latitude for larger vehicles such as CCTA buses, which are 10.5 feet mirror-to-mirror.
4. To provide space for stormwater drainage.
5. To provide an offset to the occasional car door opening (Complete Street #1).
6. To provide a temporary storage space for plowed snow.

You have raised other interesting points in your emails, some of which are addressed below:

- *Willard Street (US7 north of the Shelburne Street rotary) is comparable in road classification, traffic volume, and mix of vehicle types. It is 31 feet curb-to-curb (August 23).* We do not necessarily agree that the function of Willard Street is the same as the Complete Street being envisioned in the REP, and we do not yet have an estimate of traffic to compare to. However, at 32 feet curb-to-curb, Complete Street #1 is only one foot wider than Willard Street. Complete Streets #2 and #3 are considerably narrower at 24' curb-to-curb.
- *...significant reservations about the use of shared-use paths as the only form of bicycle infrastructure in this area. The emerging consensus that I hear from colleagues around the country is that shared-use paths are seriously sub-optimal if you are in fact trying to encourage bicycling as a means of transportation. (August 4).* Each Complete Street cross-section includes a shared use path. Serious cyclists will be able to use that facility, but if it is inadequate to their needs, they can ride on the street.
- *What I would suggest as an alternative is that you investigate options for skirting along the outside -- i.e., the southwest margin -- of the REP area with a bikes-only path connection. This will avoid conflicts with motor vehicles and provide a direct link to the waterfront path at Maple. (August 4).* This is an interesting suggestion. The work that has been accomplished to date does not preclude this idea being considered in subsequent phases of the REP. Associated with Table 2 in the July 29 RSG memo are the following notes:
 - If the proposed shared use path along Pine Street (Champlain Parkway project) is determined in the future to not be feasible, it may change the City's designed cross-section.

- The complete streets design criteria might be revised in subsequent phases of the REP as more information on constraints and resource impacts become available.

The REP design criteria establish a starting point for future design. We acknowledge the potential for dimensions to change after the project advances to an EIS, during which considerably more will be known about the opportunities and constraints of the project area.

END OF MEMO





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Agency of Transportation

*Rec'd
8/20/15*

August 14, 2015

Ms. Eleni Churchill
Transportation Program Manager
Chittenden County Regional Planning Commission
110 W Canal St #202, Winooski, VT 05404

Mr. Chapin Spencer, Director
Department of Public Works
645 Pine Street, Burlington, VT 05401

RE: Railyard Enterprise Project - Cross-Sections and Intersection Controls for Phase 2 Alternatives

Dear Eleni and Chapin:

I'm writing to reaffirm VTrans' support and prioritization of the Railyard Enterprise Project and to reinforce and support some of the comments that were forwarded to the City by Sue Scribner via email on June 12, 2015 on behalf of VTrans. As you both are well aware, this is a challenging area of the City in which to develop federal aid transportation projects due in part to the resource issues presented by former industrial activities in this area and the historic nature of the district. Yet despite these challenges, VTrans supports the City's goal of creating additional options for mobility in this area for all users and the potential for additional economic development opportunities.

While supporting the project, VTrans continues to have two main areas of concern:

- impacts to the Railyard must be minimized to ensure its functionality is maintained; and
- overall project costs need to be minimized to deliver the project in a timely fashion.

Early discussions among the City and VTrans and FHWA indicated that with some of the alternative designs there are segments of the design that are not eligible for federal funding participation. Generally, design alternatives that have transportation infrastructure that connects Pine Street with Battery Street would be participatory by FHWA and other local roads and infrastructure would not be participatory.

In addition, different design concepts for achieving complete streets objectives to comply with Burlington complete street guidelines have different impacts to the Railyard and total project costs. I want to reiterate that impacts to the Railyard and total project costs are of real concern to VTrans as this project advances. Accordingly, we request that any further presentations to the Stakeholder group, Steering Committee, Resource Agencies, the general public, TEUC and City Council are made with the disclaimer that the various complete streets cross sections shown may not be representative of the final configuration as these design details will be worked out during the EIS and later stages of the design process. The City should anticipate that they will shoulder a greater share of the project costs if many of these elements are still desired.



Ms. Eleni Churchill
Mr. Chapin Spencer
August 14, 2015
Page 2

We look forward to completion of the scoping process so that the project design may be advanced into the EIS stage of the process.

Sincerely,

A handwritten signature in dark ink, appearing to read "Chris Cole". The signature is fluid and cursive, with the first name "Chris" and last name "Cole" clearly distinguishable.

Chris Cole
Deputy Secretary of Transportation

cc: Michele Boomhower, Director of Policy, Planning & Intermodal Development
Sue Scribner, Director of Municipal Assistance Bureau