FUSS & O'NEILL

M E M O R A N D U M

TO: Town of Auburn

FROM: Victoria Houle, PE

DATE: December 29, 2020

RE: Auburn MVP Action Grant - "Green" Bridge Design Evaluation

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Task 2 of the Town of Auburn's FY20 MVP Action Grant was based on the Town's critical need to replace the existing culverted crossing on Sword Street over Kettle Brook given its current condition, importance in the Town's transportation network, and vulnerability to increases in precipitation as a result of climate change. The Town was also interested potentially incorporating "green" infrastructure and nature-based solutions into the future design. As such, the task included the completion of preliminary field investigations as well as development of conceptual "green" bridge designs for the future culvert replacement. Preliminary field investigations included wetlands resource delineation, topographical survey, and geotechnical investigations.

Once the field investigations were completed, the project team, including staff from the Town's Department of Public Works and Planning Department, as well as staff from Fuss & O'Neill and Resilient Civil Engineering, discussed potential "green" infrastructure ideas and sustainable infrastructure strategies to consider in future design phases of the project. Frameworks from both the Greenroads® and Envision™ programs was used as a basis for evaluating sustainable infrastructure design components for consideration.

At the start of discussions, a summary of potential ideas for consideration was developed along with links to example projects or products was circulated amongst the team. Ideas included aspects which would improve ecological connectivity and habitat conservation, better manage vegetation and improve environmental conditions in the project area, improve access & livability features in the community, incorporate recycled materials, and evaluate sourcing of local materials. A copy of the memorandum circulated to the project team in May 2020 is included as Attachment A.

Once team members had a chance to review the initial ideas and sample project information, the team met to discuss the ideas and identify which "green" infrastructure and sustainable design elements Town staff believes could best be incorporated into the project. A summary of these meeting notes is included as Attachment B. It was also noted that some concepts could be included regardless of the bridge design, such as sourcing of local materials, and the project team decided to develop three (3) different concept designs which included differing roadway and sidewalk and themed strategies as it related to incorporation of "green" infrastructure and sustainable design. The themes identified included 1) Art and Education, 2) Focus on Sustainable Materials w/separate pedestrian bridge, and 3) Renewable Power. A follow-up questionnaire was then circulated amongst team members to identify specific strategies to include in each design. A

copy of this questionnaire is included in Attachment C.

After meeting again to discuss the teams idea for each concept design, three (3) conceptual design plans were prepared to reflect each of the three (3) themes identified. Concept plans developed are included as Attachment D. While all three (3) concept design are structurally feasible, more extensive structural design would be needed to develop cost estimates related to each of the designs.

While additional design monies have been granted to the Town through MVP's FY21 Action Grant program, construction monies have not been identified or secured by the Town at this time. As such, the Town is still interested in potentially replacing the existing crossing with multiple culverts as opposed to a single span bridge. That being said, the Town has identified some "green" infrastructure and sustainable project components they would like to consider in the final design regardless of structure type. As such, a fourth (4) concept design was developed at the completion of the project to depict the desired roadway geometry and "green" and sustainable infrastructure products and strategies for incorporation into future designs, provided funding is available. The fourth concept plan is included in Attachment D with the other three (3) concept designs. A memorandum prepared by the Town Department of Public Works regarding the preferred design was also prepared in November 2020 and is included in Attachment E.

Attachments
Attachment A – "Green" Bridge Concept Options Memorandum
Attachment B – "Green" Bridge Concept Options – Meeting Notes
Attachment C – "Green" Bridge Concept Options – Themed Option Questionnaire
Attachment D – Concept Designs
Attachment E – Town Memorandum – Preferred "Green" Bridge Design

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Attachment A

"Green" Bridge Concept Options Memorandum

FUSS & O'NEILL

M E M O R A N D U M

TO: Town of Auburn

FROM: Victoria Houle, PE

DATE: May 27, 2020

RE: Auburn MVP Action Grant - Green Bridge Concept Options - Sword Street

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Below please find a list of options which can be implemented into the bridge design:

1) Accessibility & Livability – Incorporate local or student art into the site.
   https://www.greenroads.org/files/12192.pdf
   https://www.greenroads.org/141/111/sellwood-bridge-replacement-se-tacoma-street.html
2) Accessibility & Livability – Design pedestrian amenities into the site such as:
   a. Look out points with planters and benches
      https://www.greenroads.org/141/109/sellwood-bridge-replacement-sellwood-bridge.html
   b. Informational and educational signage
      https://www.greenroads.org/141/112/sellwood-bridge-replacement-sw-macadam-bay-drive-and-trail.html
3) Materials & Design – Utilize materials that are destine for a landfill such as:
   a. Recycling toilets to use as aggregate for concrete walks
      https://www.greenroads.org/141/37/meador-kansas-ellis-trail.html
   b. Recycled rubber for asphalt pavement binder
      https://www.greenroads.org/141/55/bristol-street-widening-phase-ii.html
4) Materials & Design – Construct bridge using structural members made from recycled plastic bottles. https://axionsi.com/wp-content/uploads/2018/08/Axion_Project-Portfolio_Onion-Ditch-Bridge_V03.pdf
5) Environmental & Water – Replace the pipe culverts with open bottom culvert to restore natural environment and connectivity of the habitat along Kettle Brook. Waterway restoration should include low flow channel and benching for high flows.
   https://www.greenroads.org/141/110/sellwood-bridge-replacement-or-43-interchange.html
   https://www.greenroads.org/141/84/james-street-bridge-replacement-and-road-improvements.html
6) Materials & Design – Specify material percentage that shall be regionally sourced.
   https://www.greenroads.org/141/56/sr-522-bothell-crossroads.html
7) Utilities & Controls – Include energy efficient and light pollution friendly LED lighting.
   https://www.greenroads.org/141/84/james-street-bridge-replacement-and-road-improvements.html
8) Environmental & Water – Design with native drought tolerant plantings.
   https://www.greenroads.org/141/102/todd-lane-improvements.html

9) Accessibility & Livability – Incorporate either shared use paths or sidewalks and bike lanes. https://www.greenroads.org/files/12192.pdf
10) Accessibility & Livability – Improve safety and accessibility with intersection enhancements such as sidewalks, sidewalk ramps, crosswalks, bike signals and dedicated bus pull offs. https://www.greenroads.org/141/110/sellwood-bridge-replacement-or-43-interchange.html
11) Environmental & Water – Develop design to provide stormwater treatment and run off management. https://www.greenroads.org/141/84/james-street-bridge-replacement-and-road-improvements.html
12) Other considerations:
    a. Is a trail system planned for nearby that can be tied into our project
    b. Intersection upgrades to include intelligent transportation systems.
    c. Solar 'roof' over shared use path on bridge
    d. Solar pavement for sidewalk or multi use path https://www.pv-magazine.com/2020/04/23/solar-pavement-for-outdoor-applications/
    e. Utilize concrete pavement instead of asphalt to decrease heat island effect.
    f. Heated pavement to decrease need for salt usage.
    g. Pavement reclamation
    h. Permeable pavers or pavement

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Attachment B

"Green" Bridge Concept Options – Meeting Notes

FUSS & O'NEILL

Project: Auburn MVP Action Grant
Site Location: Sword St, Auburn, MA
Project Phase: Green Bridge Concepts Options - Team Notes
Project Number: 20170390.K50

Category	Idea	Notes
Accessibility & Livability	Incorporate local or student art into the site.	• Open to the idea, perhaps gear art towards environmental habitat in area or education • Could incorporate into town-wide contest
Accessibility & Livability	Incorporate either shared use paths or sidewalks and bike lanes.	• Would definitely like to include provisions for pedestrian traffic. Would like to further evaluate the need to incorporate provisions for formal bike lanes given connectivity to other areas and presence of adjacent railroad.
Accessibility & Livability	Improve safety and accessibility with intersection enhancements such as sidewalks, sidewalk ramps, crosswalks, bike signals and dedicated bus pull offs.	• Town staff have noticed trucks speeds in this area accelerating from traffic coming off of Southbridge Street, would like to incorporate safety measures which could possibly address these speeds.
Accessibility & Livability	Design pedestrian amenities - Look out points with planters and benches	• Open to benches and like the idea of having for area businesses and people eating lunch. Planters present maintenance challenge in terms of watering and also removal of planters during winter months • Benches could be made of recycled materials • What about plastic planters are made of recycled materials?
Accessibility & Livability	Design pedestrian amenities - Informational and educational signage	• Open to educational signage and incorporating information about ecological habitat. • Highlight the history of the crossing itself and possibly historical photos of the area.
Environmental & Water	Design with native drought tolerant plantings.	• Would like to use native plantings
Environmental & Water	Replace the pipe culverts with open bottom culvert to restore natural environment and connectivity of the habitat along Kettle Brook. Waterway restoration should include low flow channel and benching for high flows.	• The intent of the design at this point is to span the entire bankfull width at this time, if costs become an issue then use of several small culverts could be evaluated
Environmental & Water	Develop design to provide stormwater treatment and run off management.	• Would definitely like to evaluation some form of green infrastructure on the bridge o Possibly look at bioswale near foundations o Phosphorus treatments o E.Coli treatment
Materials & Design	Utilize materials that are destine for a landfill such as Recycling toilets to use as aggregate for concrete walks or recycled rubber for asphalt pavement binder	• Open to idea of using recycled materials in sidewalk and pavement materials, would like to look further into types of recycled materials which could be successfully used in this application to better evaluate costs and long-term maintenance challenges
Materials & Design	Construct bridge using structural members made from recycled plastic bottles	• Do not feel there is enough data on long-term success regarding use of materials in bridge/roadway applications. Would consider the idea of using for a separate pedestrian bridge in the same area.
Materials & Design	Utilize concrete pavement instead of asphalt to decrease heat island effect.	• In favor of idea • Are open singing bridges no longer favorable?
Materials & Design	Specify material percentage that shall be regionally sourced.	• Open to including provisions for use of locally sourced materials, however more information on potential vendors within the region would need to be evaluated before determining a percentage number to utilize.
Utilities & Controls	Include energy efficient and light pollution friendly LED lighting.	• Town has recently changed over light-type to LED and they would like to use the same LED light types.
Utilities & Controls	Renewable Power	• Would like to look at potential incorporation of low head hydropower adjacent to brook.

Attachment C

"Green" Bridge Concept Options – Themed Option Questionnaire

FUSS & O'NEILL

Team Member Completing Form:

Project: Auburn MVP Action Grant
Site Location: Sword St, Auburn, MA
Project Phase: Green Bridge Concepts Options
Project Number: 20170390.K50

Category	Idea	Team Comments from 6/10/20	Priority Rating (1 to 5, 5 being most important)	I feel this should be included in all concept Designs (Y/N)	Theme #1 - Art and Education	Theme #2 - Focus on Sustainable Materials w/separate pedestrian bridge	Theme #3 - Renewable Power (Y/N)
Accessibility & Livability	Incorporate local or student art into the site.	• Open to the idea, perhaps gear art towards environmental habitat in area or education • Could incorporate into town-wide contest					
Accessibility & Livability	Design pedestrian amenities - Look out points with planters and benches	• Open to benches and like the idea of having for area businesses and people eating lunch. Planters present maintenance challenge in terms of watering and also removal of planters during winter months • Benches could be made of recycled materials • What about plastic planters are made of recycled materials?					
Accessibility & Livability	Design pedestrian amenities - Informational and educational signage	• Open to educational signage and incorporating information about ecological habitat. • Highlight the history of the crossing itself and possibly historical photos of the area.					
Materials & Design	Utilize materials that are destine for a landfill such as Recycling toilets to use as aggregate for concrete walks or recycled rubber for asphalt pavement binder	• Open to idea of using recycled materials in sidewalk and pavement materials, would like to look further into types of recycled materials which could be successfully used in this application to better evaluate costs and long-term maintenance challenges					
Materials & Design	Construct bridge using structural members made from recycled plastic bottles	• Do not feel there is enough data on long-term success regarding use of materials in bridge/roadway applications. Would consider the idea of using for a separate pedestrian bridge in the same area.					
Environmental & Water	Replace the pipe culverts with open bottom culvert to restore natural environment and connectivity of the habitat along Kettle Brook. Waterway restoration should include low flow channel and benching for high flows.	• The intent of the design at this point is to span the entire bankfull width at this time, if costs become an issue then use of several small culverts could be evaluated					
Materials & Design	Specify material percentage that shall be regionally sourced.	• Open to including provisions for use of locally sourced materials, however more information on potential vendors within the region would need to be evaluated before determining a percentage number to utilize.					
Utilities & Controls	Include energy efficient and light pollution friendly LED lighting.	• Town has recently changed over light-type to LED and they would like to use the same LED light types.					
Environmental & Water	Design with native drought tolerant plantings.	• Would like to use native plantings					
Accessibility & Livability	Incorporate either shared use paths or sidewalks and bike lanes.	• Would definitely like to include provisions for pedestrian traffic. Would like to further evaluate the need to incorporate provisions for formal bike lanes given connectivity to other areas and presence of adjacent railroad.					
Accessibility & Livability	Improve safety and accessibility with intersection enhancements such as sidewalks, sidewalk ramps, crosswalks, bike signals and dedicated bus pull offs.	• Town staff have noticed trucks speeds in this area accelerating from traffic coming off of Southbridge Street, would like to incorporate safety measures which could possibly address these speeds.					

Environmental & Water	Develop design to provide stormwater treatment and run off management.	• Would definitely like to evaluation some form of green infrastructure on the bridge o Possibly look at bioswale near foundations o Phosphorus treatments o E.Coli treatment					
Environmental & Water	Renewable Power	• Would like to look at potential incorporation of low head hydropower in area					
Materials & Design	Utilize concrete pavement instead of asphalt to decrease heat island effect.	• In favor of idea					

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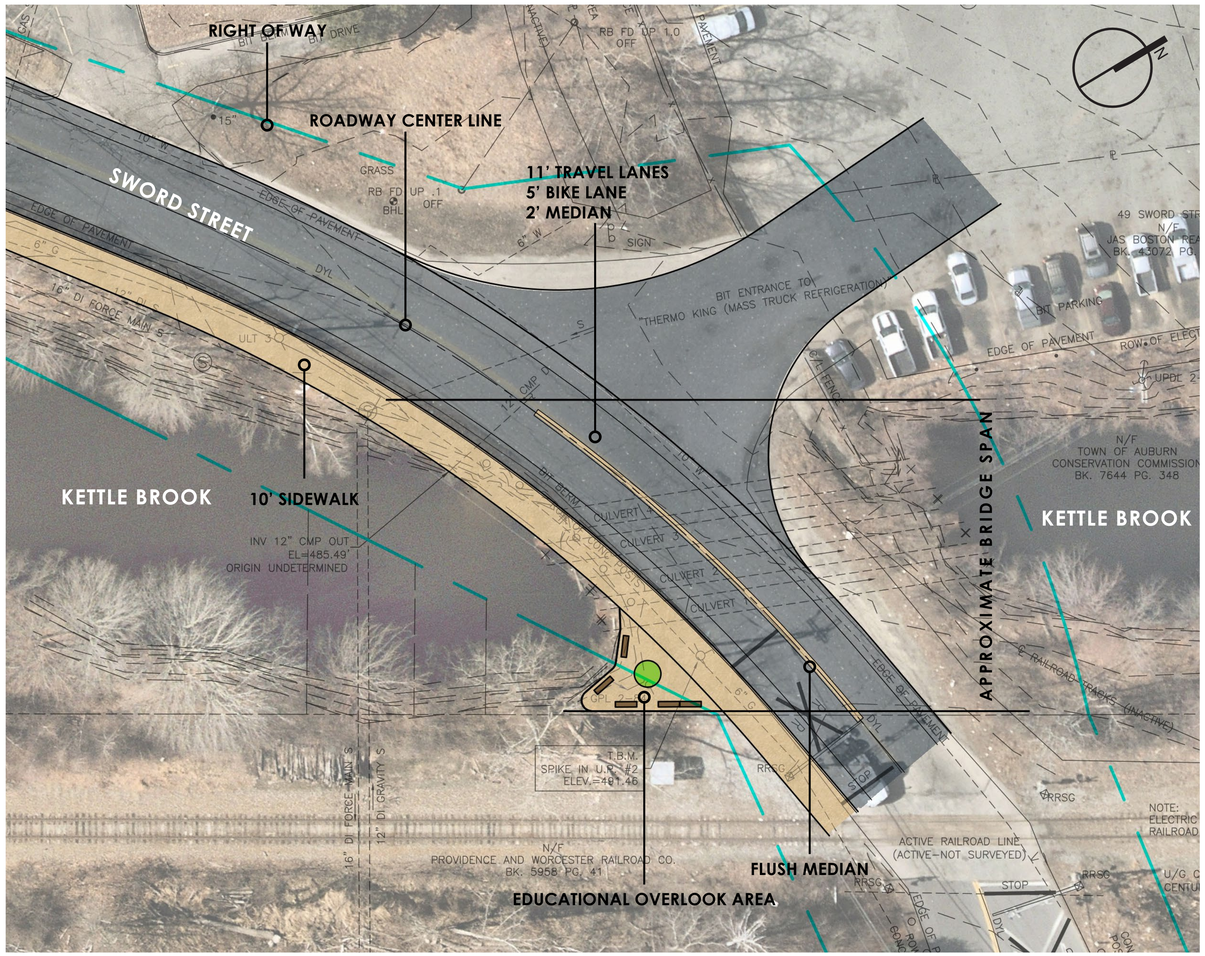
Attachment D

Concept Designs



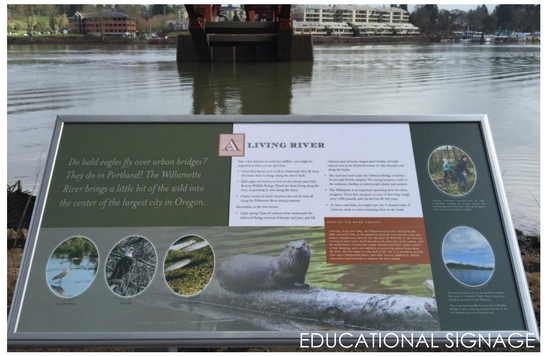
PLAN VIEW - 20SC

DESIGN CONSIDERATIONS

1. SAFETY CONCERNS RELATED TO RAILROAD
2. REVIEW SIGHT LINE DISTANCES
3. WETLAND IMPACTS
4. POTENTIAL LAND ACQUISITIONS
5. UTILITY RELOCATIONS

INSPIRATIONAL EXAMPLES

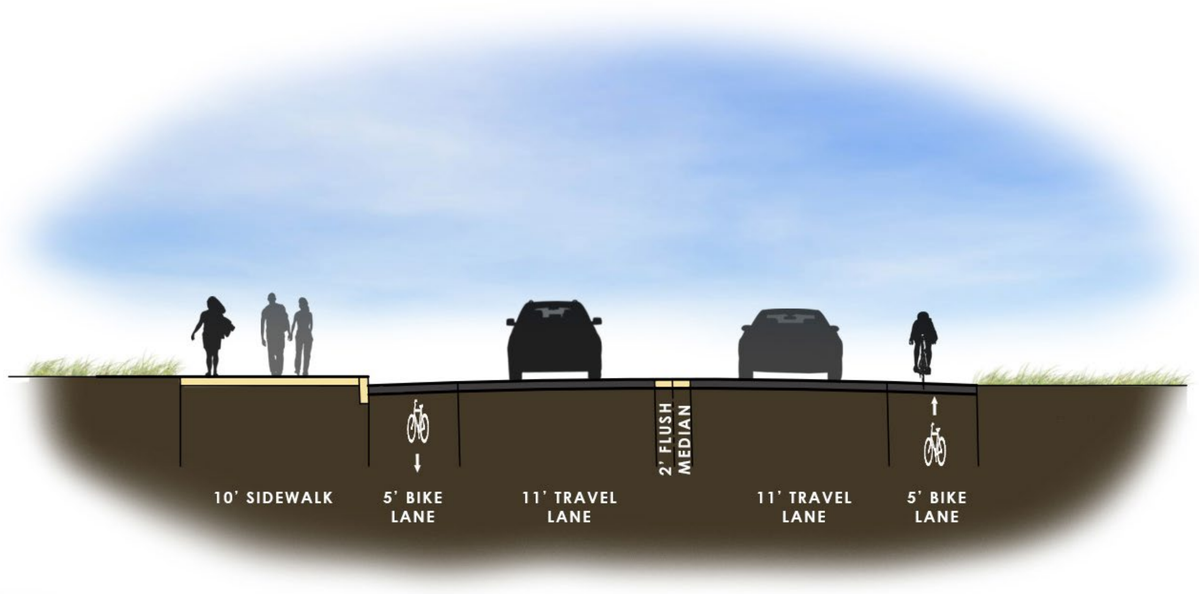
EDUCATIONAL OVERLOOK AND SEATING AREA



EDUCATIONAL SIGNAGE

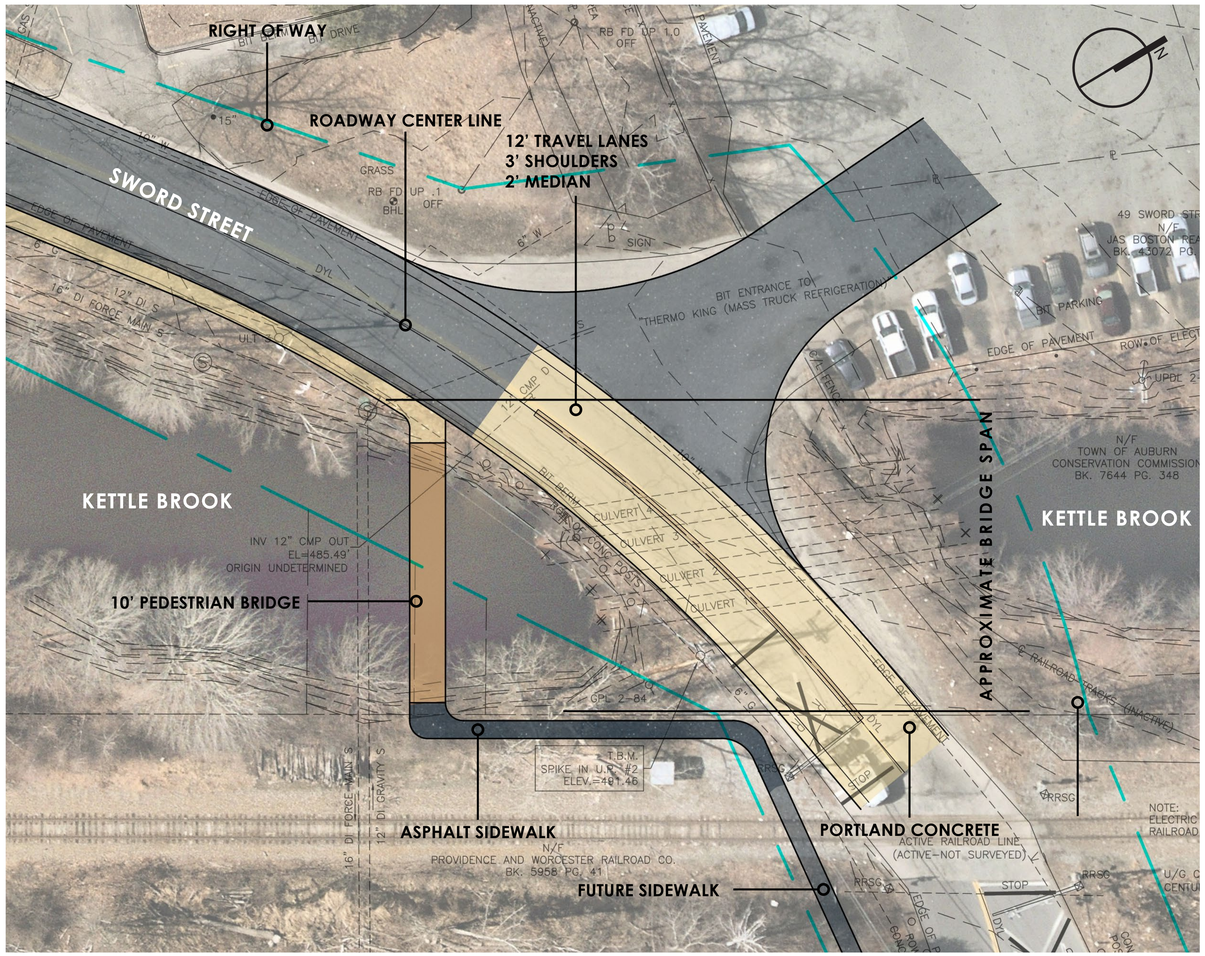
RECYCLED PLASTIC BENCH

WIDE PEDESTRIAN PATH & RAIL CROSSING



TYPICAL STREET SECTION

PRELIMINARY CONCEPT 1



PLAN VIEW - 20SC

SCALE 1"=20' 0' 10' 20' 30' 40'

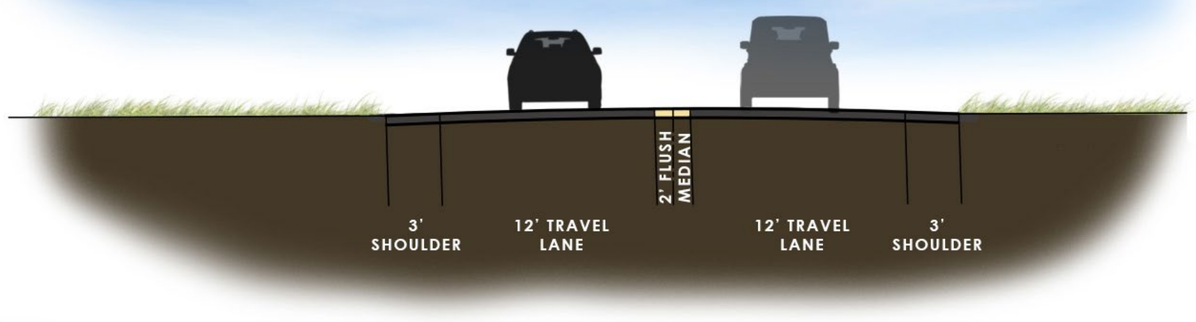
DESIGN CONSIDERATIONS

1. SAFETY CONCERNS RELATED TO RAILROAD
2. REVIEW SIGHT LINE DISTANCES
3. WETLAND IMPACTS
4. POTENTIAL LAND ACQUISITIONS
5. UTILITY RELOCATIONS

INSPIRATIONAL EXAMPLES

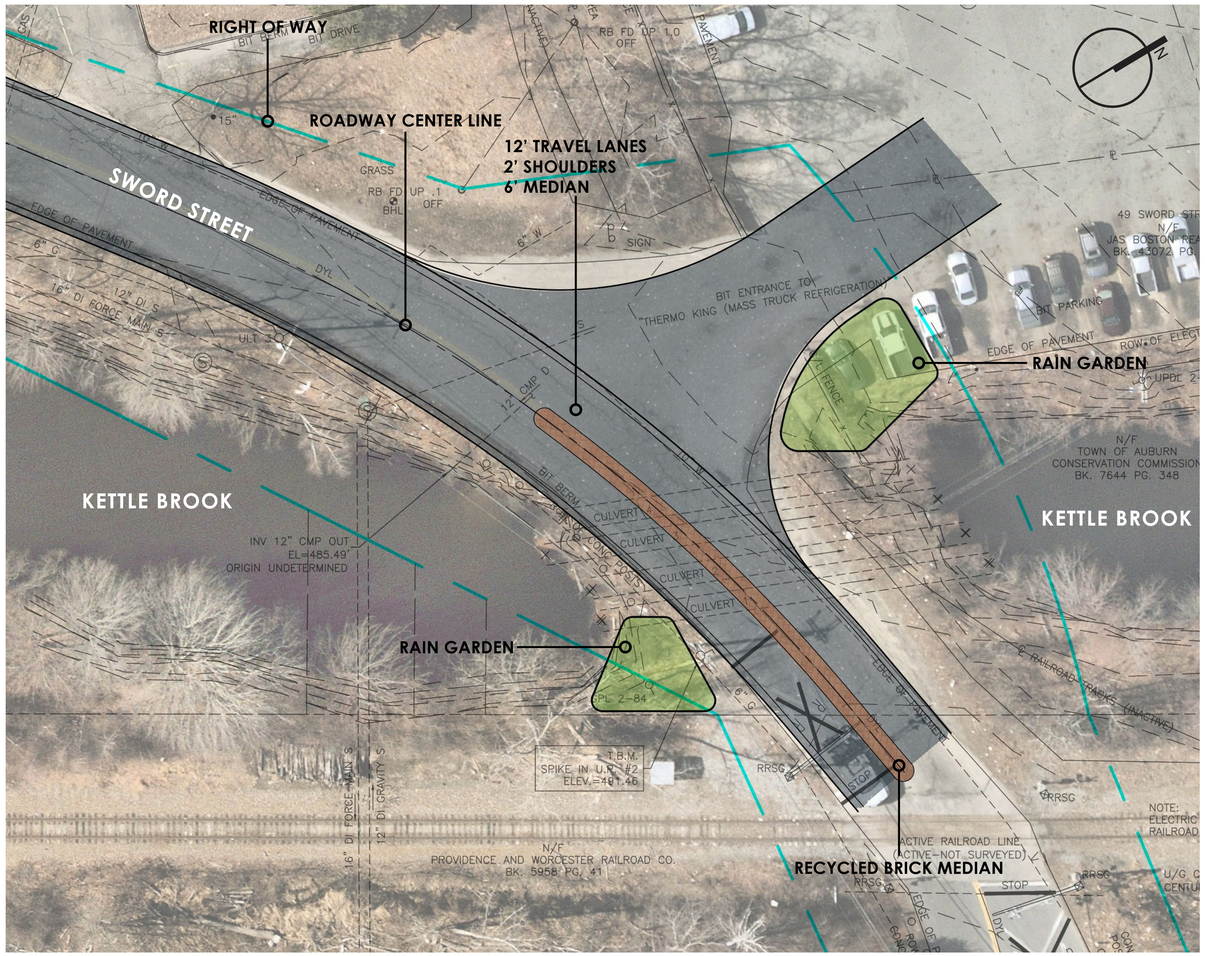
WIDE PEDESTRIAN PATH & RAIL CROSSING

BRIDGE MADE FROM RECYCLED PLASTICS



TYPICAL STREET SECTION

PRELIMINARY CONCEPT 2



PLAN VIEW - 20SC

SCALE 1"=20' 0' 10' 20' 30' 40'

DESIGN CONSIDERATIONS

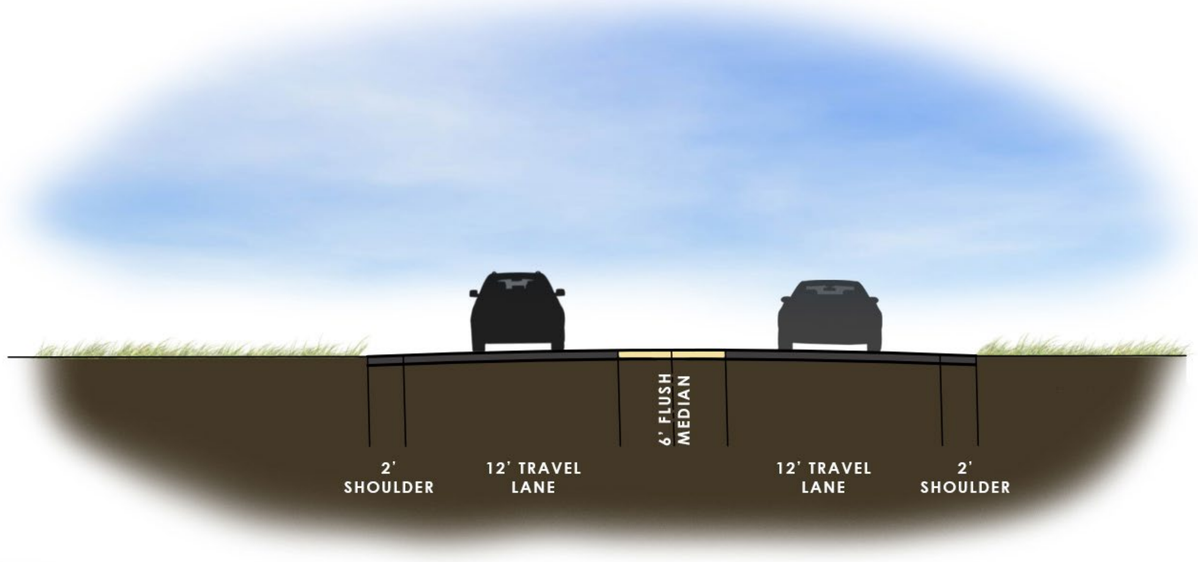
1. SAFETY CONCERNS RELATED TO RAILROAD
2. REVIEW SIGHT LINE DISTANCES
3. WETLAND IMPACTS
4. POTENTIAL LAND ACQUISITIONS
5. UTILITY RELOCATIONS

INSPIRATIONAL EXAMPLES


RAIN GARDEN

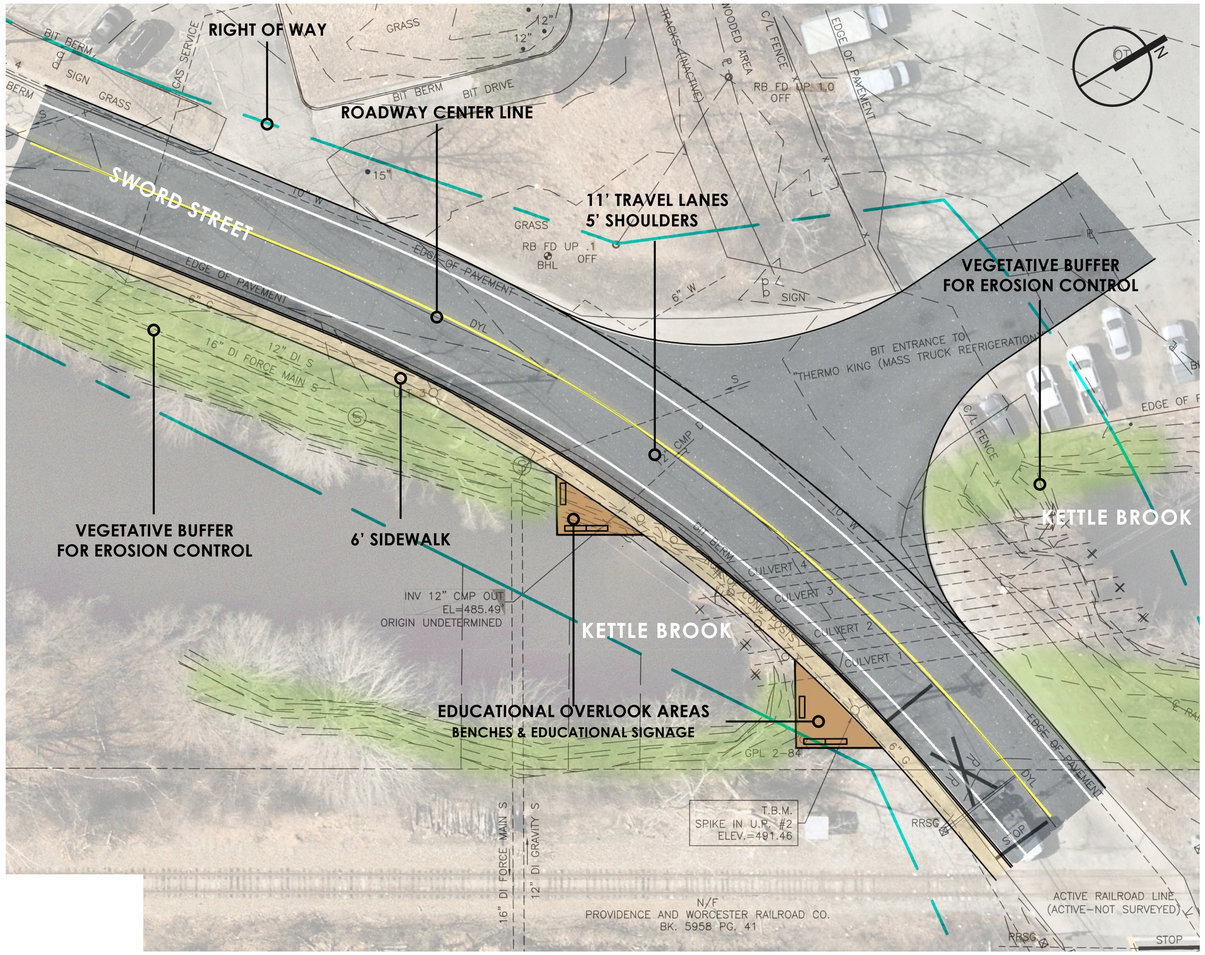

SOLAR LIGHTS


RECYCLED BRICK PAVERS



TYPICAL STREET SECTION

PRELIMINARY CONCEPT 3



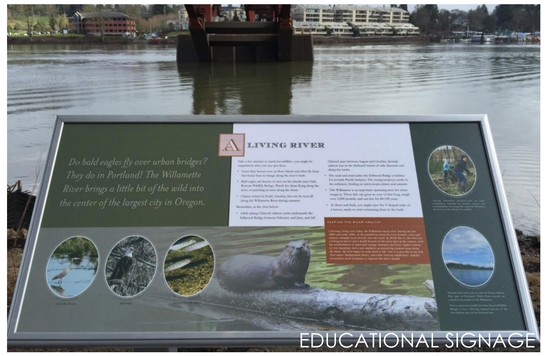
PLAN VIEW - 20SC

DESIGN CONSIDERATIONS

1. SAFETY CONCERNS RELATED TO RAILROAD
2. REVIEW SIGHT LINE DISTANCES
3. WETLAND IMPACTS
4. POTENTIAL LAND ACQUISITIONS
5. UTILITY RELOCATIONS

INSPIRATIONAL EXAMPLES

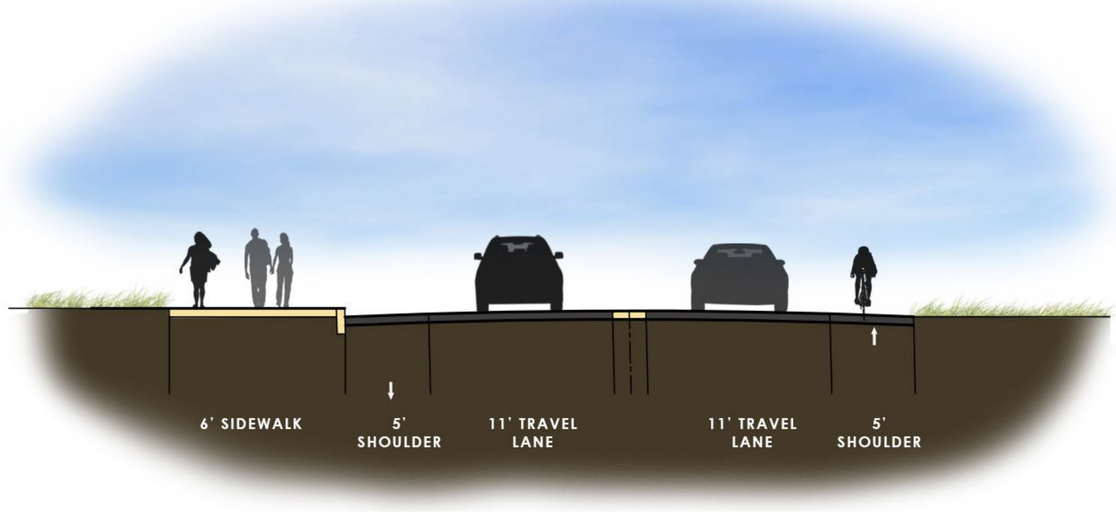
EDUCATIONAL OVERLOOK AND SEATING AREA



EDUCATIONAL SIGNAGE

RECYCLED PLASTIC BENCH

WIDE PEDESTRIAN PATH & RAIL CROSSING



TYPICAL STREET SECTION

PRELIMINARY CONCEPT 4

FUSS & O'NEILL

Attachment E

Town Memorandum – Preferred "Green" Bridge Design

Julie A. Jacobson
Town Manager

William A. Coyle
Director

Joanna E. Paquin
Assistant Director

Engineering Division
William A. Coyle
Town Engineer

Eilish C. Corey
Senior Civil Engineer

MEMORANDUM

Date: November 23, 2020

To: File

From: Eilish Corey

Subject: FY20 MVP Action Grant – Evaluate "Green" Bridge Design
Bridge Design Criteria

Introduction

In FY20, the Town of Auburn was awarded grant funding from the Municipal Vulnerability Preparedness (MVP) Action Grant Program to analyze and evaluate "green" bridge design concepts for the replacement of an existing culverted stream crossing on Sword Street. This crossing provides a vital transportation link for the community and faces increased threats to flooding as a result of climate-change. The purpose of this memorandum is to summarize the result of discussions related to determining the preferred conceptual design criteria for bridge layout and "green" elements.

Concepts

Three conceptual designs for the bridge were developed by Fuss & O'Neill, based on previous brainstorming and discussions by the project group. Based on the initial concepts presented, the following comments were made:

- Right-of-way impacts will most likely be a large consideration, given the close proximity to the railroad. The exact limits of work should be determined early on.
- Sidewalks should be limited to 6-feet or less in order to try to stay within the existing roadway limits and avoid expanding into wetlands or buffer areas.
- This area currently does not have pedestrian or bicycle facilities and represents a small section of roadway. Any addition of these types of facilities needs to fully consider termination points, safety related to the railroad tracks, and connections to the sidewalk on Southbridge Street.

5 Millbury Street
Auburn, MA 01501
Telephone: (508) 832-7814
Email: wcoyle@town.auburn.ma.us
Web site: www.auburnguide.com

Preferred Concept

Based on a review of the three concepts and the Town's design standards, the Department of Public Works recommends the following design elements be incorporated into the bridge design:

- **11-foot travel lanes.** Given the large volume of truck traffic on the road, smaller lane widths are not advised.
- **5-foot shoulders.** Given the large volume of truck traffic, it is not recommended that the shoulders be marked for bicycle accommodation.
- **6-foot sidewalk.** The sidewalk would run on the south side of the road from the Sword Street pump station to either the railroad right-of-way or the educational outlook located adjacent to the right-of-way.
- **Two Overlooks.** Both to be located on the south side of the bridge. The first to be centered over Kettle Brook, the second adjacent to the railroad right-of-way. The overlook adjacent to the right-of-way should be designed to minimize grading and construction impacts to the nearby wetlands and buffer zones.
- **Restore Brook Channels.** Through clearing out invasive and "nuisance" vegetation and planting a vegetative/natural area on embankments to provide a buffer between the brook and stormwater runoff from the road.
- **"Green" Elements:** Solar lights, educational signs at overlooks, recycled benches, and student art are preferred.
- **Erosion Control.** Depending on the layout of the bridge/culvert, address existing areas of erosion, such as adjacent to the ThermoKing driveway.
- **Consider Driveway Re-alignment.** The ThermoKing driveway is large due to truck usage and current alignment. Consideration should be given to re-aligning the driveway to avoid such a large curb-cut.

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