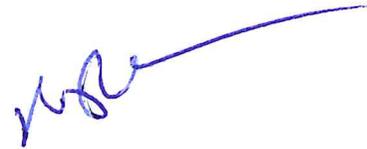


## MEMORANDUM

**DATE:** July 1, 2020

**TO:** Chris Claussen  
Quarry North LLC  
379 Concord Road  
Sudbury, MA 01776

**FROM:** Robert J. Michaud, P.E. – Managing Principal  
Daniel A. Dumais, P.E. – Senior Project Manager



**RE:** Cold Brook Crossing – Off-Site Transportation Mitigation Summary  
North Road, Sudbury, MA

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MDM Transportation Consultants, Inc. (MDM) has prepared this memorandum to identify potential off-site transportation improvements relative to the proposed Cold Brook Crossing development on North Road (Route 117) in Sudbury, MA. We note that the identified improvements are not required to support the limited traffic impacts anticipated for the Cold Brook Crossing residential development as documented in the project's traffic impact assessments<sup>1</sup> and associated peer review documentation<sup>2</sup>. However, identified mitigation as outlined below would not only offset any limited traffic impacts of the project, but would also serve to enhance traffic operations along Route 117 compared to existing conditions. Recommended improvements are generally consistent with prior evaluations conducted independently by McMahon Associates<sup>3</sup> and Ocean State Signal<sup>4</sup> and reflect the most recent field conditions observed by MDM in June 2020.

Recommended off-site transportation improvement measures and associated order of magnitude construction cost estimates are identified for the following intersections along Route 117 as described below:

1. North Road (Route 117) at Pantry Road and Dakin Road (Town of Sudbury)
2. Fitchburg Road (Route 117) at Sudbury Road (Town of Concord)

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<sup>1</sup>TIAS, *Cold Brook Crossing – North Road, Sudbury, MA*, prepared by MDM Transportation Consultants, Inc. (February 2020); and Technical Memorandum: Expanded Analysis (Route 117 at Sudbury Road), prepared by MDM (June 2, 2020).

<sup>2</sup>Peer Review Memoranda by McMahon Associates, Inc. dated May 5, 2020 and June 24, 2020.

<sup>3</sup>*Traffic Mitigation Memorandum, North Road, Sudbury, MA*, prepared by McMahon Associates (October 19, 2018).

<sup>4</sup>*Technical Memorandum, Traffic Signal Evaluation at Eight Locations Associated with the Quarry North at Melone Redevelopment*, prepared by Ocean State Signal (November 21, 2018).

## North Road (Route 117) at Pantry Road and Dakin Road (Town of Sudbury)

North Road meets Dakin Road and Pantry Road to form a four-legged, signalized intersection under local jurisdiction. All approaches to the intersection provide a single shared left/through/right travel lane. Crosswalks are provided on the eastern and southern legs of the intersection. Land uses at the intersection include the Sudbury Fire Department and residential homes.

The existing traffic signal provides two-phase, fully-actuated operation; North Road eastbound and westbound movements operate concurrently followed by the Dakin Road southbound and Pantry Road northbound movements. An emergency traffic signal is located east of the intersection to prevent Route 117 westbound traffic from blocking the fire station driveway during the special preemption phase; the emergency signal is activated by controls located within the adjacent fire station. While crosswalks are provided at the intersection, there are no pedestrian signals or pushbuttons present and pedestrian phasing does not exist as part of the signal operation.

Field review of the signal controller and operations conducted by MDM on June 26, 2020 indicates that signal phasing for Route 117 often “gaps out” (reverts to assigning green time to Dakin Road and Pantry Road) - a result of westbound vehicles stopping well in advance of the intersection at the emergency signal STOP position. Malfunction of the Dakin Road southbound vehicle detection is also noted, resulting in a constant “call” for the side-street signal phase that reduces green time allocation to Route 117. Operations at the signal may be improved through a combination of additional/enhanced vehicle detection equipment, improved signs/markings, and other updates to signal equipment that include new signal cabinet, mast arms, posts and LED-indicators with high visibility backplates. Pedestrian-related improvements include modifications to bring existing crossings to current ADA standards, including ramps, tactile panels, pedestrian indicators/pushbuttons and inclusion of a pedestrian signal phase. A mill/overlay of the intersection would also address noticeable pavement deterioration, and would allow a restriping of the intersection with high visibility (reflective) thermoplastic markings to enhance positive driver guidance and visibility of pedestrian crosswalks at the intersection. Specific improvement features are outlined in **Table 1**.

**TABLE 1**  
**Recommended Intersection Improvements**  
**North Road (Route 117) at Pantry Road and Dakin Road (Town of Sudbury)**

Intersection Improvement Measures
<i>Recommended Improvements</i>
Remove existing granite curbing and replace with vertical granite curbing with 6-inch reveal
Reconstruct two existing wheelchair ramps
Construct new wheelchair ramp in northeast quadrant
Install exclusive pedestrian phasing, APS pushbuttons and countdown pedestrian signals
Replace incandescent traffic signals with LED signals
Replace all backplates with new backplates featuring retroreflective border
Replace antiquated traffic signal equipment including 10-foot signal posts/bases, mast arms/foundations, signal housings and controller cabinet.
Install new vehicle detection system (video based with supplemental back of queue detection)
Close curb opening in front of 267 North Road walkway
Mill and resurface intersection
Re-stripe intersection pavement markings – thermoplastic
Replace faded and outdated traffic signs throughout the intersection
<i>Short-Term Improvements (Early Implementation option)</i>
Address existing vehicle detection malfunction on Dakin Road southbound approach.
Address existing vehicle detection issue on North Road westbound approach in relation to upstream fire station signal/"Stop Here on Red" sign
Trim roadside and overhead vegetation obstructing traffic signals

As outlined in **Table 1**, order-of-magnitude construction costs for recommended improvements is estimated at approximately \$290,000 including anticipated police details, mobilization costs and contingency for miscellaneous items. Design/permitting costs are estimated to be approximately \$85,000 to include survey. Resulting budget for this project is therefore **\$375,000**.

## Fitchburg Road (Route 117) at Sudbury Road (Town of Concord)

Route 117 meets Sudbury Road to form a four-way, signalized intersection. The Route 117 eastbound and westbound approaches provide an exclusive left turn lane, an exclusive through lane, and an exclusive channelized right-turn lane. The Sudbury Road northbound approach provides a single shared left/through/right lane while the southbound approach provides two travel lanes: one exclusive left turn lane and a shared through/right-turn lane. Land use at the intersection consists of a convenience store, a pizzeria, a liquor store and an auto repair service.

The existing traffic signal control generally provides two-phase fully-actuated operation; Fitchburg Road eastbound and westbound movements operating concurrently followed by Sudbury Road northbound and southbound movements. The Fitchburg Road eastbound and westbound right-turn movements operate under Yield control. There are no crosswalks or pedestrian signals provided at the intersection.

Field review of the signal controller and operations conducted by MDM on June 26, 2020 indicates that northbound (Sudbury Road) detection is malfunctioning, resulting in a constant “call” for the side-street signal phase that reduces green time allocation to Route 117. Operations at the signal may be improved through a combination of repaired vehicle detection equipment, improved signs/markings, and other updates to signal equipment that include new signal controller, mast arms, signal posts and LED-indicators with high visibility backplates. A mill/overlay of the intersection would also address noticeable pavement deterioration, and would allow a restriping of the intersection with high visibility (reflective) thermoplastic markings to enhance positive driver guidance. Modification of existing raised islands and curbing at the intersection would also enhance lane alignment and driver guidance. Specific improvement features are outlined in **Table 2**.

**TABLE 2**  
**Recommended Intersection Improvements**  
**Fitchburg Road (Route 117) at Sudbury Road (Town of Concord)**

Intersection Improvement Measure
<i>Recommended Improvements</i>
Replace antiquated traffic signal equipment with new equipment including, mast arms/foundations, fix-mounted overhead signal heads, retroreflective backplates, LED signals and vehicle detection
Consider protected-permissive left-turn phasing for exclusive left-turn movements
Remove existing sloped granite curbing throughout intersection and replace with vertical granite curbing
Modify channelizing islands
Mill and resurface intersection
Replace faded and outdated traffic sign throughout the intersection
Re-stripe intersection pavement markings
<i>Short-Term Improvements (Early Implementation option)</i>
Address existing vehicle detection malfunction on Sudbury Road northbound approach

As outlined in **Table 2**, order-of-magnitude construction costs for recommended improvements is estimated at approximately \$450,000 including anticipated police details, mobilization costs and contingency for miscellaneous items. Design/permitting costs are estimated to be approximately \$95,000 to include survey. Resulting budget for this project is therefore **\$545,000**.

# ORDER OF MAGNITUDE CONSTRUCTION COST ESTIMATE

July 1, 2020

PROJECT: North Road (Route 117) at Pantry Road and Dakin Road, Sudbury, MA

UNIT COSTS WERE DETERMINED BY COMBINING THE RELATED ITEM COSTS FROM SIMILAR ROADWAY AND INTERSECTION RECONSTRUCTION PROJECTS.

LENGTH OF ROADWAY IMPROVEMENTS:  
(INCLUDES ALL STREETS)

350 LF

QUANTIFIED ITEMS	QUANTITY	UNIT COST	AMOUNT	MAJOR ITEMS INCLUDED
<b>PAVEMENT</b>				
2" MILLING & RESURFACING	10,290 SF	\$3.00 /SF	\$30,870.00	All structures, castings, pipes, excavation, and backfill necessary for the installation of a complete closed drainage system.
RECLAMATION	0 SF	\$3.50 /SF	\$0.00	
FULL DEPTH CONSTRUCTION	0 SF	\$20.00 /SF	\$0.00	
<b>SIDEWALK / ISLANDS/WC RAMPS</b>				
CONCRETE	1,050 SF	\$8.00 /SF	\$8,400.00	All bituminous concrete, excavation, subbase, gravel, crushed stone tack coat, cold planing, fine grading and compacting, ect., necessary for the complete pavement treatment desired.
ASPHALT	0 SF	\$10.00 /SF	\$0.00	
PAVERS	0 SF	\$12.25 /SF	\$0.00	
<b>CURB/EDGE</b>				
GRAN. CURB	410 LF	\$90.00 /LF	\$36,900.00	All concrete, bituminous, or paver materials, gravel, excavation, fine grading and compacting, ect., required for complete installation of the sidewalk.
GRAN. EDGING	0 LF	\$25.00 /LF	\$0.00	
ASPHALT	0 LF	\$8.00 /LF	\$0.00	
R&R/R&S	0 LF	\$25.00 /LF	\$0.00	
<b>ITEMS DETERMIED BY ROADWAY LENGTH</b>				
EARTHWORK (EXISTING ROADWAY)	0 LF	\$50.00 /LF	\$0.00	All necessary existing roadside clearing, cut, fill, unclassified excavation, ect..
AVG. SIGNS/MARKINGS	350 LF	\$15.00 /LF	\$5,250.00	
LOAM AND SEED	0 LF	\$20.00 LF	\$0.00	
<b>MISC ITEMS/LUMP SUM ITEMS</b>				
UTILITY POLE RELOCATION	0 LS	\$20,000.00 EA	\$0.00	All pavement markings, standard sized signs, posts, and foundations, ect.
DRAINAGE SYSTEM MODIFICATIONS	0 LS	\$20,000.00 EA	\$0.00	All excavation, loam and grass seed.
TRAFFIC SIGNAL MODIFICATIONS	1 LS	\$125,000.00 EA	\$125,000.00	All excavation, backfill, stone masonry, footings, etc.
<b>SUB-TOTAL</b>				
			<b>\$206,420.00</b>	All signal equipment, structures, mast arms, saw cutting, loops, traffic signals necessary for complete upgrade of a signalized location.
POLICE DETAILS		10.00%	\$20,642.00	
CONSTRUCTION OPERATIONS AND MOBILIZATION		7.00%	\$14,449.40	Maintenance and protection of traffic and mobilization
DESIGN/PERMITTING COSTS	1 LS	\$85,000.00 EA	\$85,000.00	
CONTINGENCY		20.00%	\$48,302.28	Contingency items include, fences, private walkways and private driveways adjustments, small retaining walls, hydrants R&R, etc.
<b>TOTAL</b>			<b>\$374,813.68</b>	
<b>SAY</b>			<b>\$375,000.00</b>	

Prepared By:

MDM Transportation Consultants, Inc.

This Order of Magnitude Construction Cost Estimate is intended to be an approximation of overall construction costs. MDM does not guarantee that the costs shown herein will be reflective of final construction costs.

NOTE: ASSUMES ALL WORK WITHIN EXISTING RIGHT-OF-WAY, NO UTILITY RELOCATIONS/IMPACTS.

# ORDER OF MAGNITUDE CONSTRUCTION COST ESTIMATE

July 1, 2020

PROJECT: Fitchburg Road (Route 117) at Sudbury Road, Concord, MA

UNIT COSTS WERE DETERMINED BY COMBINING THE RELATED ITEM COSTS FROM SIMILAR ROADWAY AND INTERSECTION RECONSTRUCTION PROJECTS.

LENGTH OF ROADWAY IMPROVEMENTS:  
(INCLUDES ALL STREETS)

600 LF

QUANTIFIED ITEMS	QUANTITY	UNIT COST	AMOUNT	MAJOR ITEMS INCLUDED
<b>PAVEMENT</b>				
2" MILLING & RESURFACING	27,200 SF	\$3.00 /SF	\$81,600.00	All structures, castings, pipes, excavation, and backfill necessary for the installation of a complete closed drainage system.
RECLAMATION	0 SF	\$3.50 /SF	\$0.00	
FULL DEPTH CONSTRUCTION	0 SF	\$20.00 /SF	\$0.00	
<b>SIDEWALK / ISLANDS/WC RAMPS</b>				
CONCRETE	500 SF	\$8.00 /SF	\$4,000.00	All bituminous concrete, excavation, subbase, gravel, crushed stone tack coat, cold planing, fine grading and compacting, ect., necessary for the complete pavement treatment desired.
ASPHALT	0 SF	\$10.00 /SF	\$0.00	
PAVERS	0 SF	\$12.25 /SF	\$0.00	
<b>CURB/EDGE</b>				
GRAN. CURB	950 LF	\$90.00 /LF	\$85,500.00	All concrete, bituminous, or paver materials, gravel, excavation, fine grading and compacting, ect., required for complete installation of the sidewalk.
GRAN. EDGING	0 LF	\$25.00 /LF	\$0.00	
ASPHALT	0 LF	\$8.00 /LF	\$0.00	
R&R/R&S	0 LF	\$25.00 /LF	\$0.00	
<b>ITEMS DETERMIED BY ROADWAY LENGTH</b>				
EARTHWORK (EXISTING ROADWAY)	0 LF	\$50.00 /LF	\$0.00	All necessary existing roadside clearing, cut, fill, unclassified excavation, ect..
AVG. SIGNS/MARKINGS	600 LF	\$15.00 /LF	\$9,000.00	
LOAM AND SEED	0 LF	\$20.00 LF	\$0.00	
<b>MISC ITEMS/LUMP SUM ITEMS</b>				
UTILITY POLE RELOCATION	0 LS	\$20,000.00 EA	\$0.00	All pavement markings, standard sized signs, posts, and foundations, ect.
DRAINAGE SYSTEM MODIFICATIONS	0 LS	\$20,000.00 EA	\$0.00	All excavation, loam and grass seed.
TRAFFIC SIGNAL MODIFICATIONS	1 LS	\$140,000.00 EA	\$140,000.00	All excavation, backfill, stone masonry, footings, etc.
<b>SUB-TOTAL</b>				
			<b>\$ 320,100.00</b>	All signal equipment, structures, mast arms, saw cutting, loops, traffic signals necessary for complete upgrade of a signalized location.
POLICE DETAILS		10.00%	\$32,010.00	
CONSTRUCTION OPERATIONS AND MOBILIZATION		7.00%	\$22,407.00	Maintenance and protection of traffic and mobilization
DESIGN/PERMITTING COSTS	1 LS	\$95,000.00 EA	\$95,000.00	Contingency items include, fences, private walkways and private driveways
CONTINGENCY		20.00%	\$74,903.40	adjustments, small retaining walls, hydrants R&R, etc.
<b>TOTAL</b>			<b>\$544,420.40</b>	
<b>SAY</b>			<b>\$545,000.00</b>	

Prepared By:

MDM Transportation Consultants, Inc.

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NOTE: ASSUMES ALL WORK WITHIN EXISTING RIGHT-OF-WAY, NO UTILITY RELOCATIONS/IMPACTS.