

**NHDOT 16188
NH Route 106 Interim Corridor Study**

Engineering Report

March 2012

Prepared For:

New Hampshire Department of Transportation



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STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: March 26, 2012

FROM: Michael J. Dugas, P.E. **AT (OFFICE):** Bureau of Highway Design
Chief of Preliminary Design

SUBJECT: LOUDON
16188
(NH Route 106 – Evaluation of Interim Improvements)

TO: Keith A. Cota, P.E.
Chief Project Manager

THRU: William J. Oldenburg, P.E.
Administrator, Bureau of Highway Design

ENGINEERING REPORT

I. **INTRODUCTION**

In the early 1990's, the NH Route 106 corridor was studied between the cities of Concord and Laconia culminating in a final report in 1995. The goal of the initial report was to develop an alternative corridor to Interstate 93. The goal of the current project is to consider interim improvements within the limits of the 1995 report corridor.

As part of the current project, a traffic study was conducted between Interstate 393 in Concord and NH Route 140 in Belmont. The intent of this traffic study was to determine the actual traffic growth since 1995 and compare it to the projected growth shown in the 1995 report. After finding that the actual traffic growth was significantly less than the anticipated growth, the interim corridor study limits were refined to better match the areas that would need improvements within the design life of the project.

This report and the related environmental study focus on the NH Route 106 corridor between Interstate 393 in the City of Concord to a point approximately 0.5 miles north of Shaw Road in the Town of Canterbury. The process included reviewing a list of reasonable alternatives including:

1. No Build (Baseline)
2. Transportation Demand Management (TDM)
3. Transportation System Management (TSM)
4. Upgrades
5. Interim Improvements

The Selected Alternative would provide improved capacity and safety along the corridor. All of the above alternatives were reviewed in detail during the preparation of the Traffic Study and a Preferred Alternative was chosen based upon best meeting the requirements of adequate design-life capacity and improved safety. The Preferred Alternative will provide an Interim Typical Section which includes the widening of NH Route 106 in order to provide a 3-lane typical section along the corridor with additional width at intersections to provide a 5-lane typical section, and signalization of two existing intersections. In addition, the 3-lane typical section can be modified to provide a passing lane typical section where there are little or no conflicts with existing access points.

II. EXISTING CONDITIONS

A. NH Route 106 – Rocky Pond Road

1. Functional Class: Rural Minor Arterial
2. Roadway – Two 12-foot travel lanes with variable width shoulders (4-12 feet)
3. Alignment – Minimum existing horizontal curve radius = 1,909 feet [Acceptable for 60 mph, $e_{\max} = 8\%$]

The existing “Legacy” alignment provided by the NHDOT runs along the existing center line of NH Route 106 for the majority of the roadway. However, at most of the intersections where left-turn lanes have been constructed, the center line alignment runs along the approximate center of the turn lane. Adjusting the alignment to follow the edge line of the turn lane on one side of the intersection and the double yellow line on the other would require shifting the crown line of the roadway at the intersection. After reviewing the inherent issues with shifting the crown line at every intersection where turn lanes are present, it was decided to leave the crown line in the center of the lane as it would have little to no effect on the drivability or maintenance of the roadway.

4. Profile – Maximum existing grade = 3.0%
5. Posted Speed: 55 mph from Autumn Drive north to Stone Road (with 40 mph postings at the signalized intersections of NH Route 129 and 45 mph at Shaker Road)
40 mph from Stone Road north to NH Route 140
6. Pavement Condition:

Based upon the 2010 Pavement Condition data collected by the Department, the Ride Comfort Index (RCI) for the section of NH Route 106 between I-393 and the Canterbury Town Line is between 2.51 and 5.0, indicating that even without the improvements described in this report, some portions of the roadway along this segment will soon require maintenance, with about 50% of the road surface due for a pavement overlay. There is one area north of Shaker Road near the Loudon Country Club that will likely require pavement rehabilitation.

From the Canterbury Town Line north to NH Route 140 the majority of the

roadway has an RCI in the range of 3.5-5.0 indicating that the pavement is generally in good condition at this time.

B. Local Roads

1. Staniels Road – Class V (maintained by the Town of Loudon), approximately 26 feet of pavement including 2-foot shoulders.
2. Josiah Bartlett Road – Class V (maintained by the Town of Loudon), approximately 22 feet of pavement with no shoulders.
3. Chichester Road – Class V (maintained by the Town of Loudon), approximately 30 feet of pavement including 4-foot shoulders.
4. South Village Road - Class V (maintained by the Town of Loudon), approximately 26 feet of pavement with no shoulders.
5. NH Route 129 – Class II (maintained by NHDOT), approximately 36 feet of pavement including 4-foot shoulders.
6. Shaker Road – Class II (maintained by NHDOT), approximately 26 feet of pavement including 1-foot shoulders.
7. Mudgett Hill Road – Class V (maintained by the Town of Loudon), approximately 24 feet of pavement with no shoulders.
8. Clough Hill Road – Class V (maintained by the Town of Loudon), approximately 26 feet of pavement including 4-foot shoulders.
9. NH Route 140 – Class II (maintained by NHDOT), approximately 28 feet of pavement including 2-foot shoulders.

III. PROBLEMS AND SOLUTIONS

Problem: Capacity and safety issues during Peak Hours along NH Route 106, especially within the segment from the I-393 westbound ramps to Shaker Road.

Solution: Widen to a 3-lane typical section with center two-way left-turn lane and alternating passing lanes (Two northbound and Two southbound).

Problem: Capacity issues at the intersection of NH Route 129 resulting in long delays, queuing, and poor LOS.

Solution: Widen the intersection to provide additional through lanes on both the northbound/southbound approaches to increase capacity and improve overall operations of the intersection.

Problem: Long delays on Staniels Road and Josiah Bartlett Road due to the high volume of traffic on NH Route 106 resulting in difficulty making left-turn movements from the side streets and increased crash potential.

Solution: Recommend installation of a traffic signal based on meeting the Traffic Signal Warrant. Widen the intersection to provide additional through lanes on both the northbound/southbound approaches to increase capacity and improve overall operations of the intersection. Reduced delays on the side streets and safer cross movements from the side streets can be anticipated.

Problem: Long delays on Chichester Road and South Village Road due to the high volume of traffic on NH Route 106 resulting in difficulty making left-turn movements from the side streets and increased crash potential.

Solution: Recommend installation of a traffic signal based on meeting the Traffic Signal Warrant. Widen the intersection to provide additional through lanes on both the northbound/southbound approaches to increase capacity and improve overall operations of the intersection. Reduced delays on the side streets and safer cross movements from the side streets can be anticipated.

Problem: Proposed roadway widening will result in widening of the bridge over Shaker Brook, impacts to the Soucook River, impacts to the River buffer along the west side of NH Route 106 where the river parallels the roadway at the existing toe of slope, impacts to the culturally significant Lovering Mill Site on the west side of NH Route 106 adjacent to Shaker Brook just north of Clough Pond Road, and impacts to an existing mobile home park on the west side of NH Route 106.

Solution: Shift the centerline alignment of NH Route 106 in this area easterly such that the proposed edge of pavement lines up with the existing western edge of pavement. All widening will be accomplished on the east side of NH Route 106.

Problem: Proposed roadway widening will result in impacts to the Soucook River, impacts to the River buffer, and impacts to the steep slopes between the roadway and the river on the east side of NH Route 106 across from Wales Bridge Road.

Solution: Shift the centerline alignment of NH Route 106 in this area westerly such that the proposed edge of pavement lines up with the existing eastern edge of pavement. All widening will be constructed on the west side of NH Route 106.

Problem: Proposed roadway widening will result in impacts to existing unnamed pond on the east side of NH Route 106 south of Clough Hill Road.

Solution: Shift the centerline alignment of NH Route 106 in this area westerly such that the proposed edge of pavement lines up with the existing eastern edge of pavement. All widening will be constructed on the west side of NH Route 106.

Problem: Special events at the track require specialized traffic control and additional capacity that is not available with only a single lane in each direction and variable width shoulders.

Solution: For normal traffic conditions the proposed roadway typical section provides three lanes with two wide shoulders, but for specialized traffic control, the 12-foot shoulders provide for additional travel lanes as needed. In addition, roundabouts were excluded from consideration due to the inability to accommodate the required free-flow travel lanes in the current traffic control plan for special events.

IV. DESIGN RECOMMENDATIONS AND CONSIDERATIONS

A. Design Speeds:

NH Route 106 – 60 mph, $e_{max} = 0.08$

Local Roads – 30 mph, $e_{max} = 0.04$

B. Typical Section:

Road	Type	Typical Section	Pavement Depth		Structural Section*
			Travel Way	Shoulder	
NH Route 106	Primary	Two 12' travel lanes 12' Center turn/passing lane Two 12' shoulders	6"	6"	8" Cr. Stone (Fine) 8" Cr. Stone (Coarse) 8" Sand
Local Roads	Secondary	Two 12' travel lanes	3.5"	3.5"	6" Cr. Stone (Fine) 12" Cr. Stone (Coarse)

* These depths are based on a review of existing plans. Additional consideration should be given to providing a 20" sand layer in order to provide 36" of overall frost protection for the road. Final Design to verify structural section with the Bureau of Materials and Research.

C. Design Exceptions:

None at this time.

D. Traffic Control Devices:

Existing traffic signals are located within the corridor at the following locations:

- NH Route 106 at NH Route 129 – Some modifications to the existing signal head layout and timings will be required as well as the installation of additional signal heads. The mast arm on the southwest corner of the intersection may need to be relocated.
- NH Route 106 at Shaker Road – Modifications to the existing signal timings will be required. The mast arm on the southwest corner of the intersection may need to be relocated.

Traffic signals are proposed at the following locations:

- NH Route 106 at Staniels Road/Josiah Bartlett Road
- NH Route 106 at Chichester Road/South Village Road

Signal warrants should be verified by Final Design with updated traffic volumes. Due to the distance between the existing and proposed signals, no signal coordination is recommended.

E. Signing:

There are a number of existing overhead sign structures used during special events at NHMS that will need to be replaced as part of the project. Some consideration should be given to upgrading these signs to incorporate variable message capabilities. Additional signage needs or replacements will need to be evaluated during final design.

The existing Quick-punch sign bases along NH Route 106 that are used for temporary signing during special events at the track will need to be relocated as a result of the proposed improvements.

F. Traffic Control Plan:

Alternating one-way traffic will be necessary for reconstruction of NH Route 106 during daylight hours. Two-way traffic will be restored by the end of each work day. Access to all driveways will be maintained subject to short periods of construction work during the day. Traffic control plans will need to be developed to address special events within the corridor including events such as NASCAR Weekends and Motorcycle Weekend at the New Hampshire Motor Speedway (NHMS) in Loudon. Specifically, no roadwork will be allowed along NH Route 106 starting the Monday before an event at the track and continuing through the Friday following an event at the track. In addition, NH Route 106 must have a minimum of four travel lanes available for use by traffic starting the Monday before an event at the track and continuing through the Friday following an event at the track.

G. Drainage and Stormwater Treatment:

Existing culverts crossing NH Route 106 will require extensions or replacement. The roadway widening will relocate the existing ditch line from approximately 5 feet to 12 feet from the edge of the existing pavement. A conceptual drainage study and layout was done for the Interim Improvement Alternative. The approximate amount of new impervious area created as a result of the project is 22 Acres. The intent of the conceptual drainage treatment areas shown on the base plan is to provide for the treatment of an impervious area matching the new impervious area or greater.

In addition, there are several Tier 1 and Tier 2 stream crossing through existing culverts that should be checked during the final design stage to determine if they meet current hydraulic requirements.

H. Bridges:

Several bridge structures will need to be widened or replaced along the corridor in conformance with the current stream crossing rules including:

- NH Route 106 over Soucook River north of Wales Bridge Road - Bridge #056/063
- NH Route 106 over Soucook River north of NH Route 129 - Bridge #074/086
- Recreational Trail Underpass north of NH Route 129 - Bridge #074/087
- NH Route 106 over Shaker Brook north of Clough Pond Road - Bridge #100/114
- NH Route 106 over Gues Meadow Brook at southern Track entrance - Bridge #137/132
- NH Route 106 over Gues Meadow Brook at Loudon\Canterbury Town Line – Bridge #227/122

The existing recreational trail crossing just north of NH Route 129 and the Soucook River that consists of a corrugated steel arch pipe. The existing pipe has an internal vertical clearance of approximately 6 feet which is considered inadequate for future recreational trail use. The recommended dimensions of a recreational trail underpass are 10 feet wide by 10 feet high to accommodate bicycles and snowmobile trail grooming equipment.

There are two 72” reinforced concrete pipes that convey Gues Meadow Brook under NH Route 106 north of the south track entrance that are not classified as a bridge, however the crossing is classified as a Tier 3 stream crossing.

Consideration should be given to providing wildlife crossings where appropriate during the replacement of any structures.

There is one existing cattle crossing that passes underneath NH Route 106 at the Bartlett Farm in Concord that will need to be extended.

I. Stream Crossing Rules

For bridge locations and larger drainage crossings, it will be important to design structures to meet the current New Hampshire Department of Environmental Services stream crossing rules. During final design close coordination with the environmental agencies will be required.

Tier 1 Stream Crossings – Total of three locations:

- Station 1157+00 - unnamed stream approximately 1,000 feet north of Lobster Pool Restaurant in Concord
- Station 1505+50 - unnamed stream approximately 1,850 feet north of Beck Road in Loudon.

- Station 1687+00 – unnamed stream approximately 1,450 feet north of north entrance to NHMS in Canterbury.

Tier 2 Stream Crossings – Total of four locations:

- Station 1160+50 - unnamed stream approximately 1,250 feet north of the Lobster Pool Restaurant in Concord.
- Station 1192+00 - unnamed stream approximately 1,200 feet south of Staniels Road in Loudon.
- Station 1396+50 – unnamed stream approximately 800 feet north of Goshen Drive in Loudon.
- Station 1597+00 – unnamed stream approximately 700 feet north of Hollow Root Road in Loudon.

Tier 3 Stream Crossings – Total of six locations:

- Station 1266+50 - Soucook River Crossing approximately 650 feet north of Wales Bridge Road in Loudon.
- Station 1339+50 – Soucook River Crossing approximately 700 feet north of NH Route 129 in Loudon.
- Station 1445+50 – Shaker Brook Crossing approximately 200 feet north of Clough Pond Road in Loudon.
- Station 1556+00 – Gues Meadow Brook Crossing approximately 100 feet south of south entrance to NHMS in Loudon.
- Station 1568+00 – Gues Meadow Brook Crossing approximately 1,100 feet north of south entrance to NHMS in Loudon.
- Station 1625+50 – Gues Meadow Brook Crossing at the Loudon/Canterbury Town Line.

J. Environmental:

1. Wetlands – Widening the roadway to include an additional 8 feet to 24 feet of paved roadway will result in approximately five (5) acres of permanent wetland impacts.
2. Historic Resources – Several properties have been identified as eligible for the National Register. It is anticipated that there will be some minor impacts to these parcels as a result of the proposed widening. Impacts should be minimized to the extent possible.
3. Archeological Resources – One archeological site has been located adjacent to Shaker Brook on the west side of NH Route 106 north of Clough Pond Road. (Lovering Mill Site)
4. Contaminated Soils – No contaminated soils are anticipated.

K. Utilities:

Aerial utilities include power, telephone, and cable television on existing wood poles that run along both sides of NH Route 106. A majority of these poles will need to be relocated as a result of the project because they will either fall within a proposed ditch line or fall within the back slope of a cut section. There is an underground gas line that runs along the west side of the roadway for a portion of NH Route 106.

In addition, there are some underground telephone utilities near the New Hampshire Motor Speedway. Utility coordination and relocation will be required as part of the final design process.

L. Right-of-Way:

The Bureau of Right-of-Way is in the process of abstracting the project corridor. This information will not be available until the Spring of 2012. Once abstracting is available, there will need to be a public hearing to discuss the status of the project and identify any additional property impacts since the 1994 public hearing. As a minimum these impacts will include potential mitigation sites, stormwater Best Management Practices (BMP), and any other areas of impact outside the 1994 hearing plan footprint.

M. Traffic:

NH Route 106:

Year	AADT (8.5% Trucks)	ADT Peak Month
2010	16,371 vpd	19,835 vpd
2015 (Opening Year)	17,206 vpd	20,847 vpd
2035 (Design Year)	20,995 vpd	25,437 vpd

Additional traffic data can be found in the Traffic Study Document.

N. Crashes:

A crash report on file cites that 211 crashes occurred between January 2002 and December 2009. Approximately 40% of those crashes produced injuries and the remaining 40% resulted in property damage only. About 64% of the crashes involved two or more vehicles. Additional crash data can be found in the Appendix of the Traffic Study Document.

O. Soils:

Within the corridor, a formal geotechnical program should be conducted to provide a reasonable estimate of ledge and unsuitable soils. In addition, soil investigations and analysis will be required at the following locations:

- New or relocated mast arms
- New or relocated overhead sign structures
- The location of proposed water quality treatment areas.

- Bridges and major culvert crossings including any proposed dry crossings for wildlife passage.

P. Earthwork:

The intent of this project is to construct a step box widening of NH Route 106 while maintaining the existing horizontal and vertical profile of the existing roadway. Even within the three horizontal realignment areas, the existing profile will be generally maintained. It is anticipated that the amount of excavated material and the amount of fill material will generally balance within the 11 mile long project corridor.

Q. Lighting:

Design Services should review the addition or improvement of lighting on NH Route 106 at the intersections especially in conjunction with the installation of traffic signals during the final design.

R. Survey:

Existing aerial detail information was collected by and processed by NHDOT. Additional ground survey will be required prior to final design.

S. Estimate:

Construction (roadway)*	\$11,000,000
Traffic Signals*	\$600,000
Bridges*	\$7,000,000
<u>Right-of-Way**</u>	<u>Not Determined</u>
Total	\$20,000,000

*Cost does not include Engineering Design

**No specific parcel impacts have been determined at this time because the property lines for each parcel have not been determined.

T. Available Material:

1. CADD (Microstation/InRoads)

- Geometric base plan
- Existing Right-of-Way lines (approximate)
- 1994 Hearing Plan Right-of-Way lines
- Aerial Photography
- Conceptual plans
- Conceptual profiles

2. Hard Copy Plots

- CADD plots available upon request
- Traffic Study

- Environmental Study

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