Road Safety Audit
Brookline, New Hampshire
NH 13 / NH 130 Intersection

Date RSA Conducted: March 7, 2014

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Date strategies last updated: 9/5/14

Road Safety Audit Report

Table of Contents

I. Executive Summary and Objectives of Study 3

II. Road Safety Audit Process 4

III. Background Information 5

IV. Route 13/130 Intersection 5

V. Traffic Data 6

VI. Crash Data 7

VII. Stakeholder Identified Risk Factors & Site Observations 7

VIII. Assessment Findings and Mitigation Strategies 8

IX. Benefit/Cost Analysis of Improvements 9

X. Audit Response 9

Appendices

I. Executive Summary

Based on the Road Safety Audit conducted on March 7, 2014 at the intersection of NH 13 and NH 130 in the Town of Brookline, the following safety mitigation strategies are recommended.

Short Term Solutions

NHDOT:	1. Evaluate if a flashing traffic beacon is warranted at this intersection. 2. Request new traffic counts to enable signal warrants to be evaluated. 3. Evaluate the traffic signs for the intersection (sign types, location, and materials) to determine if improvements are needed. 4. Request a speed study for this section of NH 13.
Town:	5. Driver Education for this intersection will be done by the Town Police Department.

Medium Term Solutions

NHDOT:	6. Widen pavement in the northwest and southeast corners of the intersection to provide additional area for large truck turning movements. 7. Evaluate the existing pavement markings and improve the pavement markings for the intersection. 8. Widen NH 13 to provide left turn lanes (also consider Post Office Drive). Work will stay within the Right-of-Way. The Post Office driveway onto Route 13 should be restricted to a right in and right out only. (Total cost is $130,000 with a B/c ratio of **32.09**)

Long Term Solutions

NHDOT:	9. Realign NH 130 and Quimby Road to reduce their skew from 50 degrees to 30 degrees. This option impacts two parcels. (Total cost is $200,000 with a B/c ratio of **4.36**) 10. Construct a single lane roundabout. This option impacts two parcels. (Total cost is $1,100,000 with a B/c ratio of **7.64**)
Town & NHDOT:	11. Evaluate access management at the intersection 12. Evaluate discontinuing access to Quimby Road.

II. Road Safety Audit Process:

The intersection of New Hampshire Route 13 (NH 13) and New Hampshire Route 130 (NH 130) has been a safety concern for the Town of Brookline. The objective of this study was to complete a road safety

audit (RSA) of the intersection vicinity. The Study area includes the intersection of NH 13 and NH 130 as shown in Figure 1.

Figure 1: Study Area

The Town of Brookline and the Nashua Regional Planning Commission identified the intersection for the Road Safety Audit.

The RSA was conducted by a team comprised of members with expertise in planning, design, operations and safety, as well as nearby property owners. The RSA team consisted of the following members:

Name	Organization	Name	Organization
Brendan Denehy	Selectman	Peter Crouch	NHDOT - Traffic
Judy Milkowski	Property Owner	George Savell	NHDOT - Traffic
Forrest Milkowski	Property Owner	Martin Calawa	FHWA NH Division
Arthur Kelley	Stove Keepers (Business)	Rich Radwanski	NHDOT – District 5
Shannon Kelley	Stove Keepers (Business)	Michael Dugas	NHDOT – Highway Design
Susan Adams	Selectman	Michelle Marshall	NHDOT – Highway Design
Jerry Farwell	Road Agent	Matt Waitkins	Nashua RPC
Scott Knowles	Brookline Fire	Tad Putney	Town Administrator
Charles Corey Sr.	Brookline Fire	Valerie Rearick	Town Planner
William Quigley	Brookline Police	Wesley Whittier	Brookline Amb/EMD

The eight-step RSA process detailed in the Federal Highway Administration's (FHWA's) *Roadway Safety Audit Guidelines* (FHWA, 2006) was utilized for conducting this RSA. This included a meeting with the RSA team and other stakeholders to review existing information and identify concerns, followed by a

field review to verify concerns and identify other potential safety issues. Based on the field review and crash analysis, the team has suggested improvements to address the identified safety issues. The suggestions have been categorized as short-term, medium-term, and long-term. Short-term improvements can typically be implemented through local or state maintenance forces, while medium and long-term improvements often require additional planning, design, and funding. Conceptual drawings were developed for three general alternatives, and a benefit-cost analysis was conducted for each alternative. Construction costs were estimated from the NHDOT Weighted Average Unit Prices (NHDOT, 2012) and national averages. Expected benefits were based on crash modification factors (CMFs) obtained from the Highway Safety Manual (AASHTO, 2010), FHWA CMF Clearinghouse (www.cmfclearinghouse.org), and other related resources. Crash costs were based on the NHDOT 2013 Highway Safety Improvement Program Guidelines and FHWA Crash Cost Estimates by Maximum Police-Reported Injury Severity within Selected Crash Geometries (FHWA-HRT-05-051).

The Eight step process includes:

1. Identify project
2. Select RSA team
3. Conduct Road safety audit meeting
4. Conduct field review
5. Conduct analysis & prepare report
6. Present strategies and concepts
7. Prepare formal response
8. Incorporate findings

III. Background Information:

Brookline is crossed by New Hampshire Route 13 and New Hampshire Route 130. Originally chartered on March 30, 1769 as the town of "Raby", Brookline has been one of the fastest growing towns in the state over the past 25 years. In 1960, Brookline's population stood at 795 and recently reached 5,000. Located in southern Hillsborough County, Brookline has managed to retain many of the features of its rural past while benefiting from its close proximity to the shopping and employment opportunities afforded by adjacent Milford to the north and nearby Nashua to the east. Brookline is about thirty minutes from Manchester and one hour from Boston.

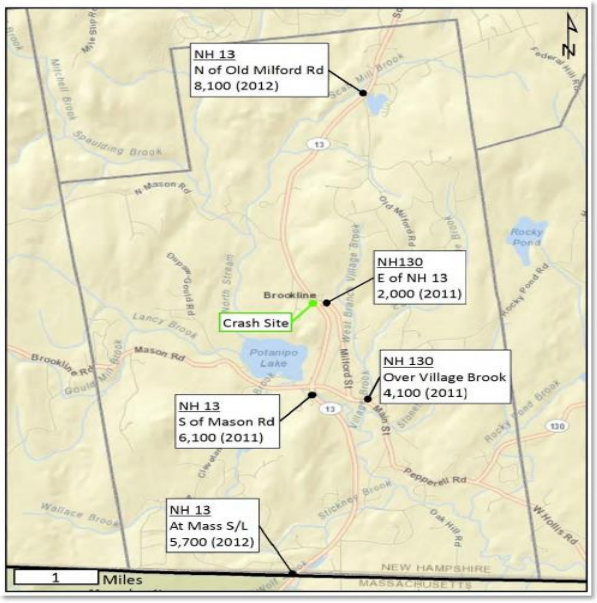
Brookline is in the enviable position of having undeveloped, commercially-zoned land along Route 13, which runs through the center of town. Given its recent growth, available land, and proximity to both Massachusetts and larger NH towns and cities, Brookline recently chartered an Economic Development Committee (EDC) to both proactively support existing Brookline businesses and also take steps to support the addition of more businesses along the Route 13 corridor. The efforts of the EDC are being jointly coordinated with both the Selectboard and Planning Board.

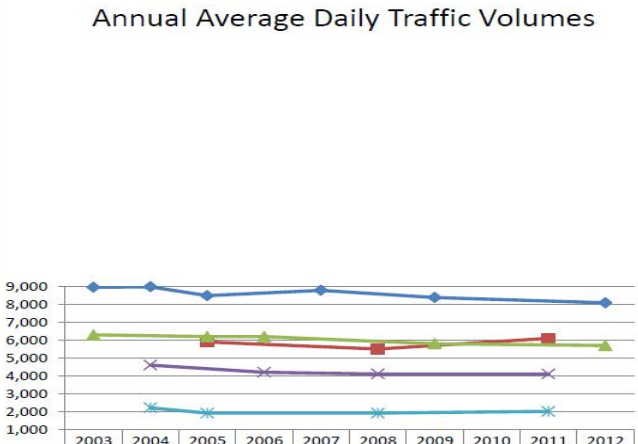
IV. Route 13/130 Intersection

This intersection is in the middle of the town of Brookline. NH 13 is a north-south arterial that traverses south central NH extending from Concord, NH to Leominster, MA, crossing NH 101 in Milford. NH 130 is an east-west collector extending from NH 13 in Brookline to NH 101A in Nashua, and passing through the town center of Brookline. There is a single lane of traffic in each direction on both roads. Post Office Drive, which accesses both the post office and the Town safety complex, is 250' north of NH 130 intersection adding to the complexity of the intersection traffic operations.

V. Traffic Data

The annual average daily traffic (AADT) estimates were obtained from Nashua Regional Planning Commission. The AADT on NH 13 varies from 5,700 at the Massachusetts State line to 8,100 north of Old Milford Road. The AADT on NH 130 is 2,000. The posted speed limit on NH 13 is 50 MPH and on NH 130 is 35 MPH.





	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
NH 13 North of Old Milford Rd	8,975	9,000	8,500		8,800		8,400			8,100
NH 13 South of Mason Rd			5,900			5,500			6,100	
NH 13 At Mass State Line	6,300		6,200	6,200			5,800			5,700
NH 130 (Main St) Over Village Brk		4,600		4,200		4,100			4,100	
NH 130 (Milford St) East of NH 13		2,200	1,900			1,900			2,000	

Figure 2: Average Daily Traffic

Nashua Regional Planning Commission collected turning counts at the intersection of NH 13 and NH 130, shown in Figure 2. The traffic counts show that the AM and PM peak hours for the intersection are from 7:30 to 8:30 am and from 5:00 to 6:00 pm. The counts also indicate that the principal turns occurring at the intersection are southbound lefts and westbound rights.

VI. Crash Data

The state crash data shows there were seven crashes in the 10 years from 2003 through 2012. The crash types include one non-incapacitating injury, one possible injury and five property damage only crashes. The Town of Brookline's data shows there were an additional five crashes in 2013 with one of those crashes resulting in a fatality.

TYPICAL CRASHES EXPECTED (per RSA item)	EXPECTED CRASH SEVERITY	SEVERITY RATING
crashes involving high speeds or heavy vehicles, pedestrians, or bicycles	probable fatality or incapacitating injury	*Extreme*
crashes involving medium to high speed; head-on, crossing, or off-road crashes	moderate to severe injury	*High*
crashes involving medium to low speeds; left-turn and right-turn crashes	minor to moderate injury	*Moderate*
crashes involving low to medium speeds; rear-end or sideswipe crashes	property damage only or minor injury	*Low*

VII. Stakeholder Identified Risk Factors & Site Observations:

A field visit was conducted during the Road Safety Audit meeting. The weather was cold and sunny with a considerable amount of snow on the ground. The following are the concerns identified in the group discussion prior to the field review:

- Driver inattention (improved visibility and more enforcement would help)
- Southbound left turning are vulnerable
- Confusion with post office driveway
- Intersection skew causes left turn conflicts
- Southbound lefts occupy the intersection
- Potential for commercial development on the west side of Route 13 near the intersection
- Speed limit is too high (results in high speed differential for intersection traffic)
- Signs & vegetation (seasonal weeds or invasive species) obstruct sightlines
- New sidewalks will be constructed on NH 130 towards east
- Pedestrians and bicyclists are common at this intersection
- NH 130 will be resurfaced in 2014
- Ponding and wetlands
- Tight right turns (NW & SE corner) due to acute angle

VIII. Assessment Findings and Mitigation Strategies:

Short Term Solutions

NHDOT:	1. Evaluate if a flashing traffic beacon is warranted at this intersection. 2. Request new traffic counts to enable signal warrants to be evaluated. 3. Evaluate the traffic signs for the intersection (sign types, location, and materials) to determine if improvements are needed. 4. Request a speed study for this section of NH 13.
Town:	5. Driver Education for this intersection will be done by the Town Police Department.

Medium Term Solutions

NHDOT:	6. Widen pavement in the northwest and southeast corners of the intersection to provide additional area for large truck turning movements. 7. Evaluate the existing pavement markings and improve the pavement markings for the intersection. 8. Widen NH 13 to provide left turn lanes (also consider Post Office Drive). Work will stay within the Right-of-Way. The Post Office driveway onto Route 13 should be restricted to a right in and right out only. (Total cost is $130,000 with a B/c ratio of **32.09**)

Long Term Solutions

NHDOT:	9. Realign NH 130 and Quimby Road to reduce their skew from 50 degrees to 30 degrees. This option impacts two parcels. (Total cost is $200,000 with a B/c ratio of **4.36**) 10. Construct a single lane roundabout. This option impacts two parcels. (Total cost is $1,100,000 with a B/c ratio of **7.64**)
Town & NHDOT:	11. Evaluate access management at the intersection 12. Evaluate discontinuing access to Quimby Road.

Concept #1: This concept adds left turn lanes to NH 13 and requires widening. This option can be done within the existing Right-of-Way. The Post Office driveway onto Route 13 should be restricted to a right in and right out only. This option provides for $20,000 in Preliminary Engineering to design the project, Construction cost of $110,000 and the Total Cost is $130,000 with a Benefit to Cost ratio of 32.09. (A traffic signal at this intersection would add $150,000 to the total cost of the project.)

Concept #2: This concept realigns the side roads to reduce the skew angle from approximately 50 degrees to 30 degrees. This option impacts two parcels on the side road. The Cost for this project would include $25,000 in Preliminary Engineering to design the project, $50,000 for the Right-of-Way impacts for two parcels, $125,000 for Construction cost and the Total Cost is $200,000 with a Benefit to Cost ratio of 4.36.

Concept #3: This concept constructs a single lane roundabout. This option impacts two parcels on the side roads to construct the approaches into the roundabout. The Cost for this project would include $200,000 in Preliminary Engineering to design the project, $50,000 for the Right-of-Way impacts for two parcels, $850,000 for Construction cost and the Total Cost is $1,100,000 with a Benefit to Cost ratio of 7.64.

IX. Benefit/Cost Analysis of Improvements:

A Benefit/Cost (B/C) Analysis was performed to compare the benefits of risk mitigation strategies identified. The estimated benefits will be calculated based on the number of crashes that each mitigation strategy can prevent multiplied by the cost of that crash type. The anticipated cost of constructing each safety project will be estimated through an engineering estimate.

Concept	total cost	Benefit Cost Ratio	Net Benefit	Crash Reduction	Service Life	Description
1A	$130,000	32.09	$ 4,504,800	0.05	20 year	LTLs and widening
1B	$280,000	20.78	$ 5,832,400	0.06	20 year	LTLs, widening and signal
2	$200,000	4.36	$ 671,816	0.01	20 year	Reduce skew angle from 50 to 30
3	$1,100,000	7.64	$ 7,299,000	0.09	20 year	Roundabout

X. Audit Response:

Submission of this report represents completion of Steps 1 through 6 of the RSA process. The Road Safety Audit team has received a copy via email of the draft Road Safety Audit Report. They were able to make comments on the Report.

Once the Report is finalized, the NHDOT will then present the findings and concepts recommended in the Road Safety Audit report to the HSIP committee, the NHDOT Front Office and then to the Brookline Select board for concurrence with the findings. The Select board will prepare a formal response in the form of a letter identifying which option(s), if any, they support.

The report's finding and recommendations will be presented to the Highway Safety Improvement Program Committee (HSIP Committee), the State of NH Department of Transportation Front Office, and the Town of Brookline Board of Selectmen. Each of these groups must support the same recommendations for a project to move forward. Each group may:

- Agree with the suggestion described by the audit team;

- Disagree with the suggestion described by the audit team (and provide a valid reason as to why they choose not to adopt the audit team's suggestions);

- Choose not to implement certain improvements at all due to financial constraints or disagreement regarding the safety issue, believing that there is no increased risk associated with the concern raised by the audit team.

Once a project is created, funding sources will be identified and obligated, and preliminary design will begin. It is important to understand that the RSA recommendations will not be implemented unless all of the above mentioned bodies concur.

Appendix A – Turning Movement Counts

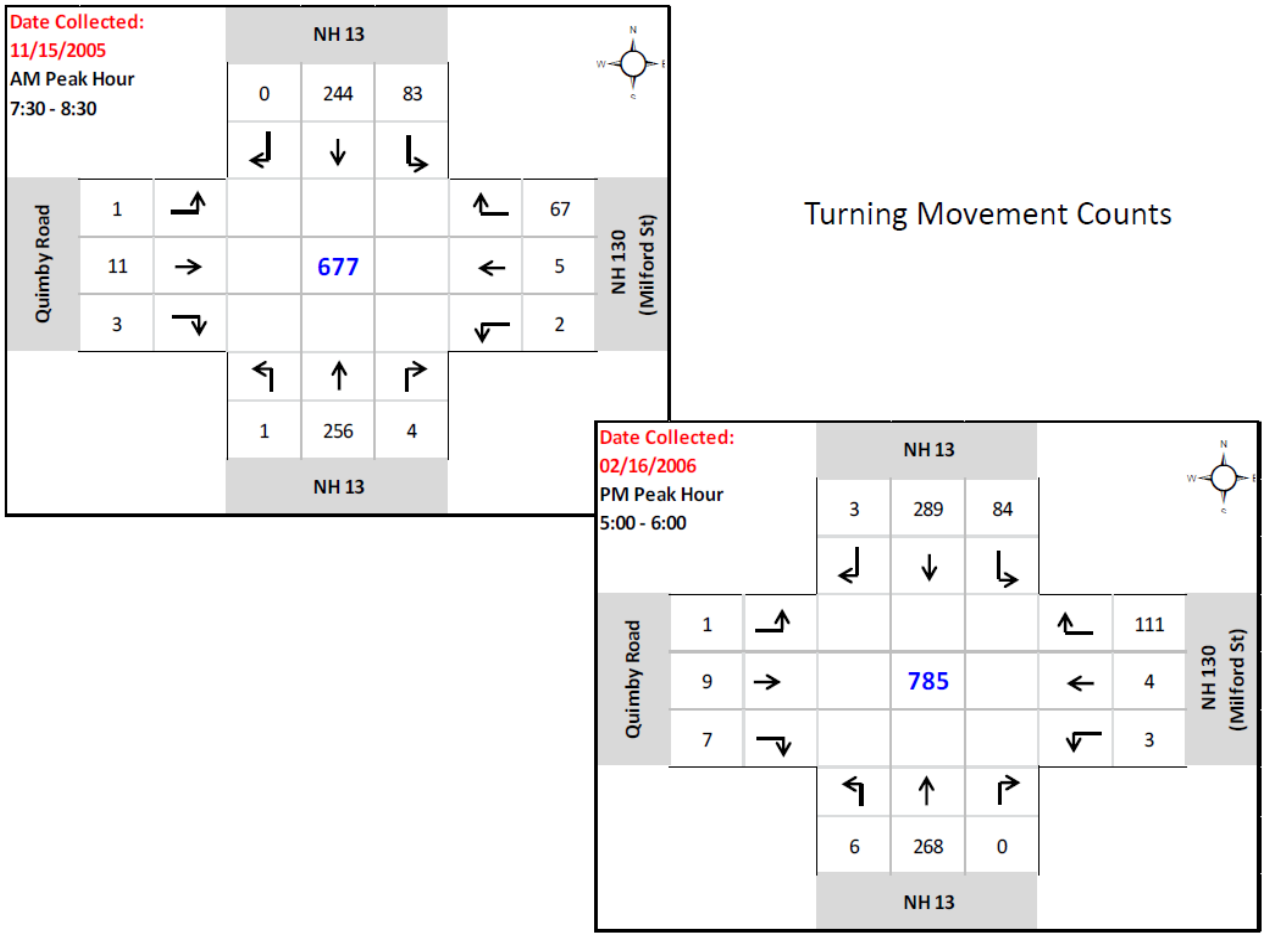


Figure 3: Turning Movement Counts

Appendix B
– B/C Analysis

Concept	BCR	NB	ARKA	Service Life	Description
1A	32.09	$ 4,504,800	0.05	20 year	LTLs and widening
1B	20.78	$ 5,832,400	0.06	20 year	LTLs, widening and signal
2	4.36	$ 671,816	0.01	20 year	Reduce skew angle from 50 to 30
3	7.64	$ 7,299,000	0.09	20 year	Roundabout

Reduce Intersection Skew Angle

(HSM p. 14-17)

Existing Skew	50
Proposed Skew	30
$CMF_{Existing}$	1.24
CMF_{New}	1.18
$CMF_{New}/CMF_{Existing}$	0.95
CRF	5

Appendix C – Summary of strategies

Brookline Route 13/ Route 130 Status Summary

#	Suggested Strategy	Responsible Stake holder	Solutions:	Comments	Date Completed
1	Evaluate if a flashing traffic beacon is warranted at this intersection.	NHDOT Bureau of Traffic	Short Term		Request sent 9/5/14
2	Evaluate the traffic signs for the intersection (sign types, location, and materials) to determine if improvements are needed.	NHDOT Bureau of Traffic	Short Term		Request sent 9/5/14
3	Request a speed study for this section of NH 13.	Regional Planning	Short Term		Request sent 9/5/14
4	Driver Education for this intersection will be done by the Town Police Department.	TOWN	Short Term		
5	Widen pavement in the northwest and southeast corners of the intersection to provide additional area for large truck turning movements.	NHDOT Bureau of Highway Design	Medium Term	Part of design project	
6	Evaluate the existing pavement markings and improve the pavement markings for the intersection. .	NHDOT Bureau of Traffic	Medium Term		Request sent 9/5/14
7	Widen NH 13 to provide left turn lanes (also consider Post Office Drive). Work will stay within the Right-of-Way. The Post Office driveway onto Route 13 should be restricted to a right in and right out only. (Total cost is $130,000 with a B/c	NHDOT Highway Design	Medium Term	This is the concept everyone supports	

	ratio of **32.09**).				
8	Realign NH 130 and Quimby Road to reduce their skew from 50 degrees to 30 degrees. This option impacts two parcels. (Total cost is $200,000 with a B/c ratio of **4.36**)	NHDOT	Long Term	This concept is not supported	Design not selected
9	Realign NH 130 and Quimby Road to reduce their skew from 50 degrees to 30 degrees. This option impacts two parcels. (Total cost is $200,000 with a B/c ratio of 4.36).	NHDOT Bureau of Traffic	LongTerm	This concept is not supported due to the cost of the ROW needed for the project.	Design not selected
10	Construct a single lane roundabout. This option impacts two parcels. (Total cost is $1,100,000 with a B/c ratio of **7.64**)	NHDOT	Long Term	This concept is too expensive and is not supported	Design not selected
11	Evaluate access management at the intersection.	NHDOT & Town	Long Term	This will be an ongoing task	ongoing
12	Evaluate discontinuing access to Quimby Road.	NHDOT & Town	Long Term	This concept is not supported	Design not selected