

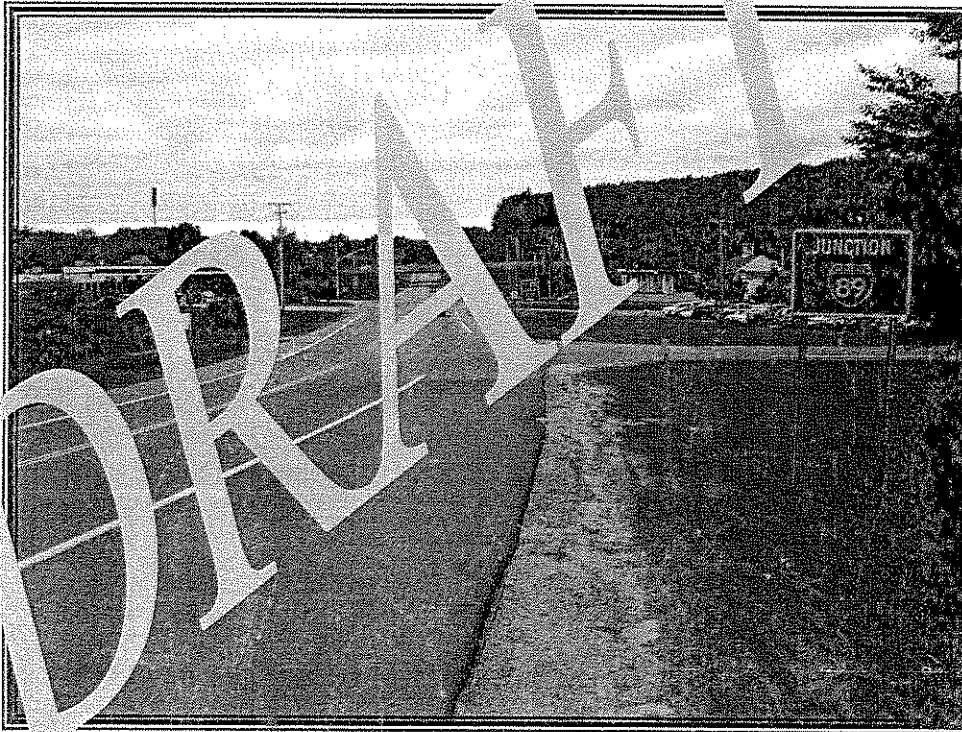
**ALTERNATIVES EVALUATION REPORT**

*For*

**NH ROUTE 103 IMPROVEMENTS**

**IN**

**WARNER, NH**



Prepared By:

**Hoyle, Tanner** 150 Dow Street  
& Associates, Inc. Manchester, NH 03101

Prepared for:



Town of  
Warner

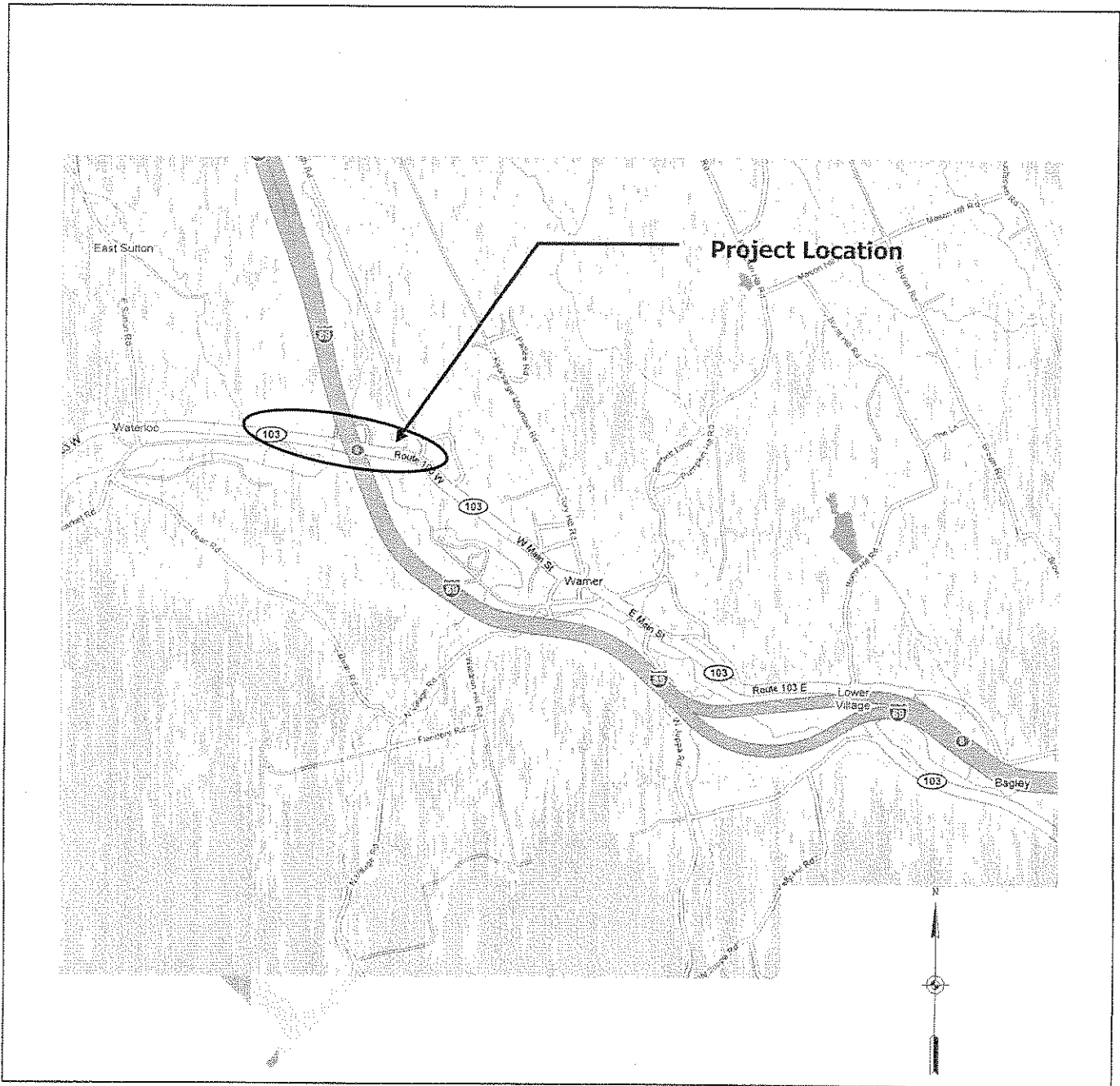
Project No. 915901

November 2008

## TABLE OF CONTENTS

<b>LOCATION MAP</b> .....	<b>1</b>
<b>1 INTRODUCTION AND PURPOSE</b> .....	<b>2</b>
<b>2 EXISTING CONDITIONS</b> .....	<b>3</b>
2.1 PHYSICAL LAYOUT .....	3
2.2 TRAFFIC VOLUMES .....	4
2.3 ACCIDENT HISTORY .....	5
<b>3 TRAFFIC CAPACITY ANALYSIS</b> .....	<b>6</b>
3.1 CAPACITY ANALYSIS METHODOLOGY .....	6
3.2 EXISTING TRAFFIC OPERATIONS .....	6
3.3 TRAFFIC SIGNAL WARRANT .....	6
<b>4 PROPOSED IMPROVEMENTS</b> .....	<b>8</b>
4.1 ALTERNATIVES .....	8
4.1.1 Alternative 1A – Stop Control at Market Basket Plaza Drive.....	8
4.1.2 Alternative 1B - Traffic Signal at Market Basket Plaza Drive.....	9
4.1.3 Alternative 2 - Roundabout at Market Basket Plaza Drive .....	9
4.1.4 SB On-Ramp Reconfiguration Improvements.....	9
4.2 ASSOCIATED DESIGN CONSIDERATIONS .....	10
4.2.1 Pedestrian Facilities .....	10
4.2.2 Utility Impacts or Relocation Needs .....	10
4.2.3 Abutter Impacts.....	10
4.2.4 Environmental Impacts.....	10
4.3 FUTURE TRAFFIC OPERATIONS .....	10
4.4 PRELIMINARY CONSTRUCTION COST ESTIMATE .....	12
<b>5 RECOMMENDATIONS</b> .....	<b>13</b>
<b>APPENDICES</b>	
A. Traffic Figures and Supporting Data	
B. Base Plan, Conceptual Improvement Alternatives, and Roadway Typical Section	
C. Engineer's Estimate of Probable Construction Costs	
D. Referenced Reports	
E. Aerial Image	

# LOCATION MAP



NH Route 103  
Warner, NH

**Hoyle, Tanner**  
& Associates, Inc.

File Name:  
Evaluation Report.DOC

DATE:  
10/08

Page 1

## 1 INTRODUCTION AND PURPOSE

Hoyle, Tanner and Associates, Inc. has entered into a contract with the Town of Warner to evaluate and advance the concepts of proposed improvements recommended within the "NH 103 Access Management Study" prepared in August 2005 by the Central New Hampshire Regional Planning Commission (CNHRPC) and the Waterfield Design Group, Inc. We are tasked with assembling available information to:

1. Compile a more advanced plan of existing conditions;
2. Analyze traffic data;
3. Evaluate two alternatives for improvement;
4. Make recommendations to advance the design of a NH Route 103 improvement project;
5. Prepare cost estimates;
6. Compile a summary report for use by the town.

The purpose of this effort is to create a NH Route 103 Improvement Plan for submission to the NHDOT as part of the application for funding assistance under the Municipally-Managed State Highway Aid Program

## 2 EXISTING CONDITIONS

### 2.1 PHYSICAL LAYOUT

The area of study for this report is an approximately 3000' section of NH Route 103 located within the Town of Warner. This segment of roadway, which begins at North Road and terminates just west of the I-89 SB ramps at Waterloo Road, carries approximately 8000 vehicles per day and provides access to the town's main commercial district, several residential neighborhoods, an NH Park and Ride, and Interstate I-89.

NH Route 103 is a North/South two lane arterial, NHDOT maintained highway with a 35 mph posted between I-89 and North Road, 50 mph posted west of I-89, and 30 mph posted east of North Road. Within the study area, this roadway provides access to Interstate I-89 for the Towns of Warner, Sutton, and Bradford.

The pavement width is 44' between Stevens Brook and North Road, narrows to 24' east of North Road, widens to 48' between I-89 ramps, narrows to 32' west of Waterloo Road. A minimum of two 12' lanes with 4' to 10' shoulders are provided throughout the study area. Listed below are some more specific characteristics of the corridor:

- Stop controlled intersections with the I-89 Ramps, Waterloo Road, North Road, Market Basket Plaza/Citgo, and Park and Ride Facility;
- Two points of access and egress to/from the Citgo Service Station and the NH Park and Ride facility exist;
- There are many closely spaced driveways between Stevens Brook and the Warner Police Department. A total of 9 driveways gain access to NH Route 103 within this 1000' segment of the roadway;
- Left Turn bays are provided at I-89 Ramps, the Market Basket Plaza Drive, and at the Citgo Drive;
- The pavement appears to be in good condition based on field observations made during our 9/16/2008 site visit;
- Poor lane balance, no striping, short queue space, and wide driveways on Market Basket plaza Drive;
- Difficult internal circulation in Citgo Parcel due to the gas pump layout and driveway locations;
- The I-89 SB On-Ramp allows for high speed entry from eastbound direction. This presents an undesirable speed differential between the two movements (EB and WB).

The existing corridor provides very few accommodations for pedestrians and bicycles. There is an existing sidewalk located on the east side of the plaza drive from the Park and Ride up to McDonalds as well as sidewalks on North and South side of Stevens Brook bridge (NHDOT No. 165/106). There are no crosswalks provided across Route 103. NH

Route 103 does have a minimum 4' shoulder on each side that could facilitate bicycle traffic but it is not specifically marked.

Stevens Brook flows underneath NH 103 between I-89 NB ramps and plaza drive. The confluence with the Warner River is located 500' south along this brook. This river which is flowing from west to east parallels NH Route 103 within the corridor. As a result, the 100 Year flood plain is located close to the road along the river and Stevens Brook.

The corridor is commercially zoned and developed between I-89 and North Road. There are parcels located opposite the NH Park and Ride and the Warner Police Department that have Planning Board approval. A third parcel, a commercial subdivision, located immediately west of I-89 is in the final stages of approval. There is also the potential for future development at the corner of North Road and Route 103 and further up along North Road. It is mostly residential development west of Waterloo Road and East of North Road with some small businesses.

A large NHDOT ROW is provided for much of the corridor, which stretches to 200' to 300' wide between I-89 NB Ramps and North Road. The NHDOT also maintains Limited Access Right of Way between Waterloo Road and Market Basket Plaza Drive

While the extent of the existing utilities has not been determined, it has been observed that there are overhead utilities located a minimum 25' off NH 103 edge of pavement between I-89 NB Ramps and North Road. There are also several small drainage culverts flow underneath NH 103 and driveways.

The base plan information is a compilation of field measurement, orthophotography, GIS Cadd files from CNHRPC, NHDOT 103 and Park and Ride as-built drawings, and site specific construction drawings supplied by the Town of Warner

## 2.2 TRAFFIC VOLUMES

The traffic volumes used for this report and alternatives development have been taken from the NH 103 Access Management study. For that study, turning movement counts were conducted within the corridor for the PM and SAT peak traffic periods. The study also included 7-Day Automatic Traffic Recorder counts along the corridor roadways. The collected traffic data showed that the Saturday peak hour was the critical time period for this corridor. For this reason, Hoyle Tanner has chosen to solely adjust and analyze the SAT peak count conducted on November 19, 2005.

During the 2005 SAT count, traffic data was not collected at the NH Park and Ride driveways and at the North Road intersection. These volumes will be necessary for a more thorough analysis of the proposed improvements. Using the Institute of Transportation Engineers (ITE) Trip Generation Manual, Hoyle Tanner has approximated the traffic associated with these roadways based on the appropriate ITE Land Use Codes. This additional data was then added to the 2005 traffic count.

Using the same process for growth and seasonal variation defined in the Access Management Study, the 2005 traffic data has been adjusted to the peak month and also

the current year using factors from the nearest I-89 permanent counter. This results in establishing the 2008 Existing Saturday Peak traffic volumes.

The effectiveness of a given improvement to handle traffic must be analyzed for opening year and future conditions. For this reason, the existing traffic volumes have been adjusted to reflect an assumed opening year of 2010 and a 10-year design horizon out to 2020 utilizing the same growth factor. The 2010 Opening Year and 2020 Design year Saturday Peak traffic volumes show the corridor in its proposed layout and incorporated traffic from the RAW Site Development along the southern side of Route 103. Traffic figures and ITE trip generation worksheets can be found in appendix A.

### 2.3 ACCIDENT HISTORY

Accident data for the NH 103 corridor was provided by the NHDOT Bureau of Planning and Community Assistance. The Bureau has electronic data for all reportable crashes, those involving personal injury or \$1000.00 in damage, within the State of New Hampshire between 1995 and 2007. If available, the accident date, location, vehicles involved, injuries, weather, and accident specifics are reported.

Hoyle, Tanner has chosen to review the data for the most recent five-year period. The amount of locatable accidents within the NH 103 corridor for this time period averages out to 7.8 incidents per year. According to the most recent available data, the Statewide crash rate is 2.66 crashes per million vehicle miles of travel (MVMT). Using the available traffic data and an approximation of the vehicle miles of travel, the crash rate along Route 103 is assumed to be 3.63 MVMT or 137% of the Statewide average.

Based on the provided accident descriptions, 59% of crashes within the corridor are intersection related and 33% result in personal injury. While the accident descriptions do not provide enough information to recommend specific intersection improvements or provide the basis for a traffic signal warrant, the above average accident rate does suggest that safety improvements to the existing conditions are needed. The corridor accident data can be found in appendix A.

### 3 TRAFFIC CAPACITY ANALYSIS

#### 3.1 CAPACITY ANALYSIS METHODOLOGY

The capacity analysis methodology for this report is based on the procedures used in the 2000 Highway Capacity Manual (HCM). The HCM provides techniques and guidelines for the evaluation of the quality of service on highway and street facilities. The manual rates the quality of traffic flow for intersections by assigning Level of Service (LOS). The LOS is based on the average stopped delay in seconds per vehicle. For signalized intersections, the HCM provides levels of service ranging from A - F corresponding to 0 - 80+ seconds of delay. The HCM does not provide an overall intersection LOS for stop controlled intersections, but rather for individual movements on each approach. The HCM also provides procedures for determining the queuing of vehicles.

The Level of Service and queue lengths for this report were calculated using the industry accepted Synchro 7.0 software. These results were then confirmed using the microscopic traffic modeler software, SimTraffic.

#### 3.2 EXISTING TRAFFIC OPERATIONS

The key component of establishing necessary corridor improvements is to determine the existing traffic related deficiencies. First, a Synchro network was created utilizing the existing geometry and intersection layouts. Next, the 2008 SAT Exist traffic volumes were entered and analyzed to highlight problem areas.

The major trouble spot is the intersection of NH Route 103 and the Market Basket Plaza Drive. During the SAT Peak hour, the SB approach to this intersection experiences long delay and large queues due to the volume of traffic turning onto Route 103. This can result in impatience and the selection of improper gaps on the main road. The NB and SB driveway approaches to this intersection are currently operating at LOS F.

The I-89 NB and SB Off-ramps also experience a small amount of delay and queuing during this peak hour, with LOS of C and D respectively. However, these approaches do appear to function adequately under the estimated existing traffic volumes.

The North Road intersection functions with minimal delay at a LOS B for the SB approach. A table showing level of service, delay, queuing, and volume/capacity for the 2008 Existing traffic can be found in the appendix A.

#### 3.3 TRAFFIC SIGNAL WARRANT

The Manual on Uniform Traffic Control Devices (MUTCD) provides guidelines for determining whether an intersection meets established minimum conditions to justify installation of a traffic signal. This is done by checking existing data against a set of eight warrants. For this corridor, the eight-hour vehicular volume, four-hour vehicular volume, peak hour, and crash experience warrants may apply.



In the Access Management study, it was suggested that a traffic signal at NH Route 103 and the Market Basket Plaza Drive could improve intersection operations. The MUTCD and the NHDOT recommend collecting 12-hr turning movement counts (TMC) for the each intersection to be analyzed. Since 12-hr counts have not been collected for this intersection, Hoyle, Tanner, using engineering judgment, has adapted the 7-day Automatic Traffic Recorder (ATR) counts taken June 7-14, 2005 for use in evaluating the signal warrants.

The MUTCD and NHDOT also recommend using engineering judgment to determine what percentage, if any, of the right turn traffic volume on the minor street approach can be removed when evaluating against a signal warrant. Since ATR counts do not provide turning movement data, the SAT count was used to determine the percentage of right turns at the SB approach to the intersection. Based on the NCHRP Report 457, 100% of the SB right turns can be removed from the warrant evaluation. Finally, the traffic volumes were grown to 2008 to represent the current year.

The results of the warrant analysis are described below. Also, see appendix A for the supporting traffic signal warrant worksheets.

- *Warrant 1 - Eight-Hour:* This warrant requires that the major and minor street volumes exceed a certain volume for each of any 8 hours of an average day. The NH Route 103 / Market Basket Plaza drive did not meet this warrant during any of the hours of an average day.
- *Warrant 2 - Four-Hour:* This warrant requires that the major and minor street volumes exceed a certain volume for each of any 4 hours of an average day. This intersection did not meet Condition A of the warrant for any hours of an average day. However, this warrant also has a condition B, which can be used in communities with a population of less than 10,000. The intersection would meet this condition of the warrant for 4 hours of an average day and therefore may justify the installation of a traffic signal.
- *Warrant 3 - Peak-Hour:* This warrant requires that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. This intersection does not meet this warrant.
- *Warrant 7 - Crash Experience:* This warrant requires that 5 accidents within a 12-month reported at the intersection are deemed correctable by a traffic signal. Do to the vague description of most of the reported accidents, it is difficult to determine the cause of most of each accident and thus determine if this warrant is met.

At this point, it appears that the intersection may meet the requirements for justifying a traffic signal based on Condition B of Warrant 2. However, it is recommended that during the design process, 12-hr turning movement counts are conducted and the traffic signal warrants re-evaluated.

#### 4 PROPOSED IMPROVEMENTS

As a result of our evaluation of available information and analysis efforts, alternatives for conceptual level roadway improvements were developed. As depicted on plan sheets in appendix B, several types of improvements can be made. These are:

1. Increased traffic channelization;
2. Reducing conflict points via installation of a raised median;
3. Improving operations by adding turn lanes along the major road – NH 103;
4. Improving operations by adding turn lanes along the minor road – Plaza Drive;
5. Re-aligning access points to oppose.

Explained in more detail below are several improvements that are currently feasible. Within each alternative, we briefly describe the alternative's unique features and the Pro's and Con's of the each.

#### 4.1 ALTERNATIVES

##### 4.1.1 Alternative 1A – Stop Control at Market Basket Plaza Drive

- Continue to provide 12' Lanes and 4' Right Shoulders between I-89 NB Ramps and North Road with added left turn pockets at all median breaks;
- Construct 6' raised concrete median with 2' striped shoulders between I-89 NB Ramps and North Road;
- Realign and improve safety and operations at Market Basket and Citgo drives;
- Align Park and Ride entrance with proposed shopping plaza drive;
- Block Left turn entrance and restrict movement from Citgo secondary drive to Right Out only, remove secondary Park and Ride drive;
- **PROS:**
  - Reduces conflict points
  - Provides left turning pockets
  - Can be easily upgraded to traffic signal
  - Cheaper than a traffic signal
  - Minimal impact to NH 103 operations
- **CONS:**
  - Does not improve Plaza Drive delay and queuing
  - Does not improve left turning safety to and from Plaza

#### 4.1.2 Alternative 1B - Traffic Signal at Market Basket Plaza Drive

- Construct 3-Phase Traffic Signal with protected EB/WB lefts and permissive NB/SB left, right turn overlap for heavy SB right turn movement
- Add WB Right Turn lane to reduce WB Thru queue blockage along NH 103 at plaza drive
- **PROS:**
  - Works with unsignalized intersection geometry
  - Reduces SB queue
  - Improves left turning safety to and from Plaza
  - Consistent with commercial development traffic control measures
  - Good Visibility
  - Can be coordinated with additional future signals
- **CONS:**
  - Queue storage/blocking east of Plaza Drive
  - Adds delay to EB/WB thru movements
  - Most costly alternative

#### 4.1.3 Alternative 2 - Roundabout at Market Basket Plaza Drive

- Construct a single lane roundabout with 115' inscribed circle diameter and 20' approach widths
- **PROS:**
  - Handles Volume with minimal delay (LOS A)
  - Allows for U-Turn to access median blocked drives
  - Fits within exist. ROW
  - Eliminates need for left turn storage
  - Becoming a more common solution
- **CONS:**
  - Inconsistent with traffic control measures within the corridor
  - Difficult to reduce approach speeds on NH 103
  - Difficult to increase capacity in the future
  - Queue lengths/blockage difficult to predict
  - Complicated Geometry with close proximity to driveways

#### 4.1.4 SB On-Ramp Reconfiguration Improvements

- Reconstruct I-89 SB On-Ramp as a parallel decel-lane and change to yield condition;
- Provide striped left turn pocket for Hudson Lane Subdivision;
- Incorporates future development at Hudson Lane Subdivision, RAW Investment Plaza, and Begin Homes.

## 4.2 ASSOCIATED DESIGN CONSIDERATIONS

### 4.2.1 Pedestrian Facilities

- No new sidewalk construction planned, reconstruct existing sidewalk east of Market Basket Plaza Drive;
- Provide pedestrian signal heads and push buttons if a traffic signal is constructed, but no crosswalks.

### 4.2.2 Utility Impacts or Relocation Needs

- No apparent Utility pole impacts or relocations;
- Stormwater culvert extensions and closed drainage-system construction.

### 4.2.3 Abutter Impacts

- No ROW takings are necessary. A construction easement would be needed for the Plaza drive work;
- Driveway reconfiguration at Market Basket Plaza and Citgo Drives;
- Slight Reconfiguration of Citgo parking lot to allow circulation;
- Access restrictions consistent with 2005 Access Management Study.

### 4.2.4 Environmental Impacts

- Increased Pavement Area – Therefore stormwater Best Management Practices (BMP's) will be required;
- Possible impact to 100 Year flood plain south of NH 103;
- No major historical/archeological/Haz-mat obstacles are foreseen.

## 4.3 FUTURE TRAFFIC OPERATIONS

Once the NH 103 improvement alternatives have been defined, it is important to analyze these alternatives under future traffic conditions to determine their effectiveness. Hoyle, Tanner has evaluated each alternative for 2010 Opening year and 2020 Design year traffic volumes. The results of this analysis are summarized below and a table showing level of service, delay, queuing, and volume/capacity is provided in the appendix.

- **2010 SAT Opening Year (Alternative 1A)**

This alternative which maintains the two-way stop control at the Market Basket Plaza

Drive will not improve this intersection's operations. As traffic continues to grow on NH Route 103 as well as on the plaza drive itself, the SB delay will increase with a queue building to 424' during this peak period. The I-89 NB and SB ramp intersections will continue to build delay but will still function at acceptable levels of service of D and E respectively.

The recently constructed NH Park and Ride and RAW development driveway will function well with the greatest delay experienced by the NB left turn with a LOS C and 21 seconds of delay. The North Road intersection is minimally effected.

- **2010 SAT Opening Year (Alternative 1B)**

The construction of a traffic signal at the Market Basket Plaza drive will greatly improve the overall traffic operations at this intersection. While a traffic signal will add delay to the NH Route 103 approaches, it will drastically reduce the delay on the plaza drive and will shrink the SB LT/Thru queue to 155'. However, the analysis predicts this signal will result in a WB approach queue length that blocks the WB left turn pocket and eventually the new Park and Ride driveway; the addition of a WB right turn pocket mitigates this situation.

The construction of a traffic signal will have minimal effects on the adjacent intersections and may provide larger gaps between traffic platoons to facilitate traffic access on to NH Route 103 from adjacent properties.

- **2010 SAT Opening Year (Alternative 2)**

For the analysis of a roundabout at the Market Basket Plaza drive, the NHDOT Roundabout Analysis Worksheet was used. According to this worksheet, a roundabout at this intersection will function at a LOS A with minimal delay and queuing at all approaches.

The construction of a roundabout will have minimal effects on the adjacent intersections and will allow for u-turns to access driveways that may be blocked by the raised median. However, the roundabout may also reduce gaps in traffic on NH Route 103 making it more difficult for turning traffic.

- **2020 SAT Design Year (Alternative 1A)**

As it did in 2010, the SB approach to the Market Basket Plaza intersection will continue to add delay and traffic queue in 2020. This will continue to reduce safety at the intersection as well as on the plaza drive itself as the queue blocks other driveways.

At this point, the NB and SB I-89 ramp intersection approaches will be nearing and exceeding failure with delay ranging from 45 to 82 seconds for left turning traffic. At this time these intersections would need to be evaluated to determine possible improvements including additional turn lanes or signalization.

The NH Park and Ride and RAW development driveway will continue to function well with the NB left turn lane at LOS D with 26 seconds of delay. The North Road intersection will experience minimal delay out to 2020 pending further development along the south side of NH Route 103 and along North Road.

- **2020 SAT Design Year (Alternative 1B)**

The signalized intersection at the Market Basket Plaza drive will function well out to 2020 with approach levels of service for the NH 103 at C and LOS B for the driveways. The EB left turn traffic may begin to fill its turn pocket at this point. Possible improvements may include closing the median break at the NH Park and Ride as noted in the long term improvements in the Access Management Study and retiming the traffic signal.

- **2020 SAT Design Year (Alternative 2)**

A roundabout at the Market Basket Plaza drive is predicted to function well out to the year 2020. The NHDOT worksheet reports a LOS A at all approaches with delay and queue remaining minimal.

#### 4.4 PRELIMINARY CONSTRUCTION COST ESTIMATE

##### Estimate Assumptions

- All alternatives include cold plane and overlay of existing pavement surface
- All estimates carry a 20% Drainage Line Item
- Step box widening assumed to match existing condition of 1.5" Wearing Course, 2.5" Binder Course, 8" each of crushed gravel, gravel, and sand
- Leveling course used on existing shoulders
- The removal of a cold plane and overlay could remove up to \$130,000 from each alternative

The estimated cost of improvements is as follows below. An itemized breakdown for each alternative is provided in the appendix.

- **Alternative 1A – Stop Control** = \$1,220,000
- **Alternative 1B – Traffic Signal** = \$1,370,000
- **Alternative 2 - Roundabout** = \$1,130,000
- **SB On-Ramp Reconfiguration** = \$320,000

# **APPENDIX A**

## **Traffic Figures and Supporting Data**

## 5 RECOMMENDATIONS

With the submittal of this Evaluation of Alternatives report to the Town for review and discussion, Hoyle, Tanner will then submit the draft report to the New Hampshire Department of Transportation. Once reviewed by the NHDOT, Hoyle Tanner will be able to provide recommendations for safety and traffic operation improvements to the NH 103 corridor based on the input of all parties and available funding.

DRAFT



ITE TRIP GENERATION WORKSHEET

North Road Traffic Estimate

Five Building Apartment/Condo Complex – Assume 50 Units

Twelve Single Family Homes

**Saturday Peak Traffic Generation**

ITE Code 230: Residential Condominium/Townhouse

Saturday Peak: 0.47 Trips per Unit, 54% Entering – 46% Exiting

$0.47 * 50 = 23.5$  Trips, SAY 24 (13 Enter, 11 Exit)

ITE Code 210: Single-Family Detached Housing

Saturday Peak: 0.94 Trips per Unit, 54% Entering – 46% Existing

$0.94 * 12 = 11.28$  Trips, SAY 11 (6 Enter, 5 Exit)

Saturday Total = 35 Trips (19 Enter, 16 Exit)

**PM Peak Traffic Generation**

ITE Code 230: Residential Condominium/Townhouse

PM Peak: 0.52 Trips per Unit, 64% Entering – 66% Exiting

$0.52 * 50 = 26$  Trips, SAY 26 (17 Enter, 9 Exit)

ITE Code 210: Single-Family Detached Housing

PM Peak: 1.02 Trips per Unit, 64% Entering – 36% Existing

$1.02 * 12 = 12.24$  Trips, SAY 12 (8 Enter, 4 Exit)

PM Total = 38 Trips (25 Enter, 13 Exit)

ITE TRIP GENERATION WORKSHEET

Park-and-Ride Traffic Estimate

23 Parking Spaces (Bus/Shuttle Service Unknown)

**PM Peak Traffic Generation**

ITE Code 090: Park-and-Ride Lot with Bus Service

PM Peak: 0.62 Trips per Space, 23% Entering – 77% Exiting

$0.62 * 23 = 14.26$  Trips

SAY 14 (3 Enter, 11 Exit)

**Saturday Peak Traffic Generation**

ITE Code 090: Park-and-Ride Lot with Bus Service

Saturday Peak: None Provided (Assume 50% of PM, with 40/60 split)

$0.31 * 23 = 7.13$  Trips

SAY 7 (3 Enter, 4 Exit)

**NH 103 ACCIDENT DATA**

2007 Accident Data

Intersection	Date	Vehicles	Injuries	Collision Description	Int. Related	Weather
I-89 NB Off-Ramp @ 103	5/6/2007	1	0	Overtum	Yes	Dry
103 WB @ I-89 Off-Ramp	6/25/2007	2	0	Unknown	Yes	Dry
103 WB @ I-89 Exit 9	7/27/2007	1	0	Animal	No	Dry
I-89 SB Off-Ramp	8/29/2007	2	0	Unknown	Yes	Dry
I-89 NB Off-Ramp @ 103	9/1/2007	2	1	Unknown	Yes	Dry
Market Basket Plaza Drive	11/16/2007	2	0	Unknown	No	Dry
Market Basket Plaza Drive @ 103	12/19/2007	2	0	Unknown	No	Snow
103 WB @ I-89 SB On-Ramp	12/19/2007	2	0	Unknown	Yes	Dry
103 WB @ I-89 NB Off-Ramp	12/20/2007	3	0	Unknown	Yes	Snow
103 @ Market Basket Plaza Drive	12/29/2007	2	0	Right Angle	Yes	Wet

2006 Accident Data

Intersection	Date	Vehicles	Injuries	Collision Description	Int. Related	Weather
103 WB @ Market Basket Plaza Drive	2/7/2006	2	0	Unknown	Yes	Dry
103 @ I-89 Exit 9	3/10/2006	1	0	Fixed Object	No	Ice
103 @ I-89 Exit 9	3/13/2006	1	0	Fixed Object	No	Ice
103 WB @ I-89 Exit 9	4/4/2006	2	0	Unknown	Yes	Wet
103 WB @ I-89 Exit 9	6/3/2006	1	1	Fixed Object	No	Dry
103 WB @ I-89 On-Ramp	7/6/2006	2	1	Unknown	Yes	Dry
103 EB @ I-89 Exit 9	8/6/2006	1	0	Animal	No	Dry
103 @ I-89 Exit 9	12/30/2006	2	0	Right Angle	Yes	Snow

2005 Accident Data

Intersection	Date	Vehicles	Injuries	Collision Description	Int. Related	Weather
103 WB @ I-89 SB On-Ramp	3/27/2005	2	1	RT Turn, Head On	Yes	Dry
103 @ I-89 Exit 9	5/26/2005	1	0	Animal	No	Wet
I-89 On Ramp @ 103	7/9/2005	1	0	Animal	No	Wet
103 @ Market Basket Plaza Drive	7/19/2005	2	0	Unknown	Yes	Dry
I-89 Off-Ramp @ 103	9/2/2005	2	1	Unknown	Yes	Dry

2004 Accident Data

Intersection	Date	Vehicles	Injuries	Collision Description	Int. Related	Weather
I-89 @ 103	1/21/2004	2	0	Unknown	Yes	Dry
Market Basket Plaza @ 103	4/22/2004	2	0	Unknown	No	Dry
Mobile Parking Lot	9/28/2004	2	0	Unknown	No	Wet
103 @ Mcdonalds	10/16/2004	2	0	Unknown	Yes	Dry
I-89 NB Off-Ramp @ 103	12/7/2004	1	0	Fixed Object	Yes	Snow

2003 Accident Data

Intersection	Date	Vehicles	Injuries	Collision Description	Int. Related	Weather
103 EB @ I-89 Ramp	1/5/2003	2	0	Unknown	Yes	Wet
103 WB @ I-89 Ramp	1/5/2003	2	2	Unknown	Yes	Wet
103 @ Waterloo Rd	3/16/2003	1	1	Overtum	No	Dry
103 @ I-89 Ramp	4/12/2003	1	1	Overtum	No	Dry
I-89 Ramp @ 103	4/15/2003	2	1	Rear End	Yes	Dry
103 EB @ I-89 NB Ramp	5/24/2003	2	0	Fixed Object	Yes	Dry
103 @ Mobil	6/21/2003	2	0	Unknown	No	Dry
103 WB @ I-89 Ramp	7/18/2003	1	0	Animal	No	Dry
103 WB @ I-89 Off-Ramp	7/24/2003	2	0	Unknown	Yes	Wet
I-89 NB Off-Ramp @ 103	11/17/2003	2	1	Unknown	Yes	Dry
103 @ I-89 SB On-Ramp	12/1/2003	2	2 F	Unknown	No	Dry

	Accident Total	Int. Related	Injuries	Fatalities
2007	10	7	1	0
2006	8	4	2	0
2005	5	3	2	0
2004	5	3	0	0
2003	11	6	6	2
Avg. Per Year	7.8	4.6	2.6	0.4

2005 State Wide Accident Rate (crashes/million veh miles/year):	2.66			
Route 103 Study Length (miles):	0.67			
Route 103 ADT (Based on EB/WB ATR June 2005):	8780			
Corridor veh miles (million per year):	2.15			
103 Corridor Accident Rate:	3.63	137%	State Average	



HTA PROJECT NO. 915901 SHEET      OF       
 PROJECT DESCRIPTION NH Route 103 Improvement Plan  
 TASK LOS/Delay Table  
 CALCULATED BY SBH DATE 10/28/08  
 CHECKED BY      DATE     

Existing LOS / Delay Table

Location	2008 SAT Exist.			
	V/C <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>3</sup>	95% <sup>4</sup>
<b>I-89 SB Ramps</b>				
EB THRU	0.18	0	A	0
WB LT	0.09	8.2	A	8
WB THRU	0.21	0	A	0
SB LT/RT	0.46	31.1	D	57
<b>I-89 NB Ramps</b>				
EB LT	0.01	8.5	A	1
EB THRU	0.24	0	A	0
WB THRU/RT	0.31	0	A	0
SB LT	0.38	23.6	C	43
SB RT	0.12	11.8	B	10
<b>Market Basket Plaza / Citgo Drive</b>				
EB LT	0.29	9.2	A	30
EB THRU/RT	0.12	0	A	0
WB LT	0.02	7.7	A	1
WB THRU/RT	0.22	0	A	0
NB LT/THRU	0.74	162	F	80
NB RT	0.04	9.3	A	3
SB LT/THRU	1.7	421.5	F	360
SB RT	0.42	13.1	B	53
<b>Park N Ride</b>				
EB LT/THRU	0	0	A	0
WB THRU/RT	0.23	0	A	0
SB LT/RT	0.01	12.5	B	1
<b>North Road</b>				
EB LT/THRU	0.01	0.3	A	1
WB THRU/RT	0.23	0	A	0
SB LT/RT	0.04	12.9	B	3

- 1 = Volume to Capacity Ratio for Lane Group
- 2 = Delay in Seconds for Lane Group
- 3 = Level of Service for Lane Group
- 4 = 95% Queue in feet

Future LOS / Delay Table

Location	2010 SAT			2010 SAT (Signal)			2010 SAT (Signal w/ WB RT)			2020 SAT			2020 SAT (Signal)			2020 SAT (Signal w/ WB RT)		
	V/C	Delay	LOS <sup>1</sup>	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
I-89 SB Ramps	EB THRU	0.2	0	A	0	A	0	0	A	0.23	0	A	0	0	A	0.09	0	A
	EB RT	0.08	0	A	0	A	0	0	A	0.09	0	A	0	0	A	0.09	0	A
	WB THRU	0.1	8.3	A	9	A	9	0	A	0.12	8.5	A	10	0	A	0.26	0	A
	WB RT	0.23	0	A	0	A	0	0	A	0.26	0	A	0	0	A	0.26	0	A
I-89 NB Ramps	SB LTR	0.59	42.4	E	82	E	82	0	F	0.83	81.9	F	143	0	F	0.83	81.9	F
	EB LT	0.01	8.6	A	1	A	1	0	A	0.02	8.9	A	1	0	A	0.02	8.9	A
	EB THRU	0.26	0	A	0	A	0	0	A	0.3	0	A	0	0	A	0.3	0	A
	WB THRU	0.34	0	A	0	A	0	0	A	0.38	0	A	0	0	A	0.38	0	A
Market Basket Plaza / Ohio Drive	SB LT	0.47	28.2	D	69	D	69	0	E	0.54	44.9	E	8	0	E	0.54	44.9	E
	SB RT	0.13	12.2	B	11	B	11	0	B	0.16	13.2	B	0	0	B	0.16	13.2	B
	EB LT	0.31	9.5	A	33	A	33	0	B	0.36	10.2	B	42	0	B	0.36	10.2	B
	EB THRU	0.14	0	A	0	A	0	0	A	0.16	0	A	0	0	A	0.16	0	A
Overall Intersection <sup>6</sup>	WB LT	0.02	7.8	A	2	A	2	0	C	0.03	7.9	C	2	0	C	0.03	7.9	C
	WB THRU	0.24	0	A	0	A	0	0	A	0.28	0	A	0	0	A	0.28	0	A
	WB RT <sup>5</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WB THRU <sup>5</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WB RT <sup>5</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NB LTR	0.99	289.5	F	101	F	101	0	F	1.87	782	F	153	0	F	1.87	782	F
	NB THRU	0.04	9.6	A	3	A	3	0	A	0.05	9.8	A	4	0	A	0.05	9.8	A
	NB RT	2.16	633.6	F	424	F	424	0	F	3.71	Error	F	Error	0	F	3.71	Error	F
	SB LTR	0.46	14.2	B	60	B	60	0	C	0.55	16.5	C	83	0	C	0.55	16.5	C
	SB RT	0.46	14.2	B	60	B	60	0	C	0.55	16.5	C	83	0	C	0.55	16.5	C
Park N. Ride / RAW Plaza	Overall Intersection <sup>6</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	EB LT	0	8.1	A	0	A	0	0	A	0	8.2	A	0	0	A	0	8.2	A
	EB THRU	0.24	0	A	0	A	0	0	A	0.27	0	A	0	0	A	0.27	0	A
	WB LT	0.04	8.3	A	3	A	3	0	A	0.04	8.4	A	3	0	A	0.04	8.4	A
North Road	WB THRU	0.23	0	A	0	A	0	0	A	0.26	0	A	0	0	A	0.26	0	A
	NB LTR	0.18	21.2	C	16	C	16	0	D	0.24	26	D	23	0	D	0.24	26	D
	NB RT	0.05	10.7	B	4	B	4	0	B	0.05	11.2	B	5	0	B	0.05	11.2	B
	SB LTR	0.01	14.9	B	1	B	1	0	C	0.01	15.6	C	1	0	C	0.01	15.6	C

1 = Volume to Capacity Ratio for Lane Group  
 2 = Delay in Seconds for Lane Group  
 3 = Level of Service for Lane Group  
 4 = 95% Queue in feet  
 5 = Lane Group only used for WB RT scenarios  
 6 = Applies to Signalized Intersections only  
 # = Indicates that volume for 95% Queue exceeds capacity  
 Error = Synchro Could not calculate

Route 103/ Market Basket Drive  
Roundabout Analysis

Time	Approach	Raw turning volumes			PHF	Adj turning volumes (PHF=.9)			Roundabout volumes			Approach Capacity <sup>2</sup>	Single lane roundabout			Double lane roundabout					
		U-turn	Left	Through		Right	U-turn	Left	Through	Right	Circulating		Entering	Exiting <sup>3</sup>	Saturation	Control Delay (s) <sup>4</sup>	LOS <sup>5</sup>	95% <sup>6</sup> queue	Approach Capacity <sup>2</sup>	Saturation	Control Delay (s) <sup>4</sup>
2010 AM	NB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	SB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	EB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	WB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	Overall <sup>8</sup>													#DIV/0!	#####				#DIV/0!	#####	
2010 PM	NB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	SB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	EB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	WB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	Overall													#DIV/0!	#####				#DIV/0!	#####	
2010 SAT	NB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	SB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	EB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	WB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	Overall													#DIV/0!	#####				#DIV/0!	#####	
2020 AM	NB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	SB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	EB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	WB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	Overall													#DIV/0!	#####				#DIV/0!	#####	
2020 PM	NB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	SB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	EB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	WB approach	0	0	0	0	0	0	0	0	0	0	1212	0.00	3.0	A	0.0	2424	0.00	1.5	A	0.0
	Overall													#DIV/0!	#####				#DIV/0!	#####	
2020 SAT	NB approach	0	0	0	0	0	0	0	0	0	0	756	0.12	5.4	A	0.4	1825	0.05	2.1	A	0.2
	SB approach	0	0	0	0	0	0	0	0	0	0	1030	0.57	8.0	A	3.7	2185	0.27	2.3	A	1.1
	EB approach	0	0	0	0	0	0	0	0	0	0	1076	0.63	8.8	A	4.6	2246	0.30	2.3	A	1.3
	WB approach	0	0	0	0	0	0	0	0	0	0	969	0.52	7.7	A	3.1	2104	0.24	2.2	A	0.9
	Overall													8.1	A				2.26	A	

Notes

1. From Roundabouts: An Informational Guide, exhibit 4-3
2. Ibid, exhibit 4-4.
3. For information only; volume is not used in computations.
4. From eqs 4-7, 15 min analysis time period
5. From HCM exhibit 17-2.
6. Based on weighted average of entering volume and delay for all approaches
7. Peak queue per lane, in vehicles. Ibid, equation 4-9, 15 min analysis time period

**Saturation legend**  
 0.00 - 0.85 (recommended range of operation)  
 0.86 - 1.00 (approach is nearing capacity)  
 > 1.00 (approach is over capacity)

2008 Eight-Hour Signal Warrant - Market Basket -Citgo Intersection

Raw Traffic Data Used: June 7-14, 2005 Pneumatic Tube Counts  
(12-Hour Turning Movement Counts unavailable)

Daily and Seasonal Adjustments: Not Used (Traffic to represent an average day)

Background Growth: 1.25% per year from I-89 Permanent Recorder (Grown to 2008)

Right Turn Reduction (RTR): Used NCHRP 457 (Based on % Right Turns during Saturday November 19, 2005 Count)  
100% Right Turn Reduction on Minor Street, Right Turns equal 63% of approach Volume

Count: Saturday June 11, 2005		9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00
Major Street	2005 Count	722	822	728	736	627	594	579	548
	2008	750	854	756	763	651	617	601	569
Minor Street	2005 Count	262	268	286	294	286	257	242	250
	RTR	166	169	181	186	181	162	153	158
	Count - RTR	96	99	105	108	105	95	89	92
	2008	100	103	109	113	109	99	93	96

**Warrant 1, Eight-Hour Vehicular Volume**

**A. Minimum Vehicular Volume**

If vehicles per hour on both the major and minor streets exceed what's shown for each of any 8 hours of an average day, a traffic signal may be warranted.

Meets Warrant: NO

**B. Interruption of Continuous Traffic**

If vehicles per hour on both the major and minor streets exceed what's shown for each of any 8 hours of an average day, a traffic signal may be warranted.

Meets Warrant: NO

	Required (VPH)	Counted (VPH)							
VPH Major Street (Both Directions)	600	750	854	756	763	651	617	601	569
VPH Minor Street (One Way Higher Vol.)	150	100	103	109	113	109	99	93	96
VPH Major Street (Both Directions)	900	750	854	756	763	651	617	601	569
VPH Minor Street (One Way Higher Vol.)	75	100	103	109	113	109	99	93	96

 Volumes Meet Warrant

**2008 Four-Hour Signal Warrant - Market Basket -Citgo Intersection**

Raw Traffic Data Used: June 7-14, 2005 Pneumatic Tube Counts  
(12-Hour Turning Movement Counts unavailable)

Daily and Seasonal Adjustments: Not Used (Traffic to represent an average day)

Background Growth: 1.25% per year from I-89 Permanent Recorder (Grown to 2008)

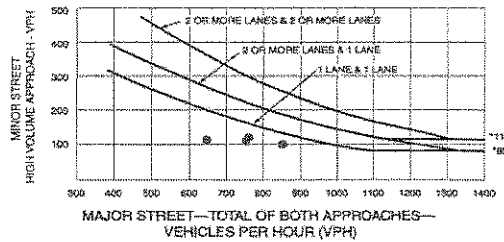
Right Turn Reduction (RTR): Used NCHRP 457 (Based on % Right Turns during Saturday November 19, 2005 Count)  
100% Right Turn Reduction on Minor Street, Right Turns equal 63% of approach Volume

Count: Saturday June 11, 2005		10:00	11:00	12:00	1:00
Major Street	2005 Count	822	728	735	627
	2008	854	756	763	651
Minor Street	2005 Count	268	266	294	286
	RTR	169	181	186	181
	Count - RTR	99	105	108	105
	2008	103	109	113	109

**Warrant 2, Four-Hour Vehicular Volume**

**A. Minimum Vehicular Volume**  
If the plotted point of the major and minor street traffic is above the line corresponding to the number of lanes on each approach, as traffic signal may be warranted.

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



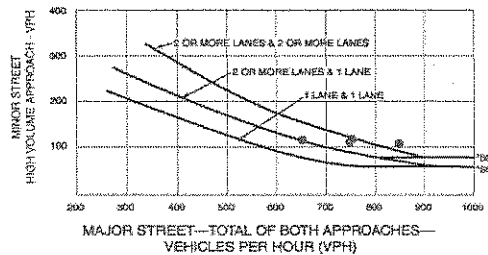
854	756	763	651	VPH Major Street (Both Directions)
103	109	113	109	VPH Minor Street (One Way Higher Vol.)

Meets Warrant: NO

**B. 70% Factor**

Same as Condition A, except in a community with less than 10,000 people or where the major street speed limit is above 40 mph.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)  
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



854	756	763	651	VPH Major Street (Both Directions)
103	109	113	109	VPH Minor Street (One Way Higher Vol.)

Meets Warrant: YES

Volumes Meet Warrant



# **APPENDIX B**

**Base Plan, Conceptual Improvement  
Alternatives, and Roadway Typical Section**

**2008 Peak-Hour Signal Warrant - Market Basket -Citgo Intersection**

Raw Traffic Data Used: June 7-14, 2005 Pneumatic Tube Counts  
(12-Hour Turning Movement Counts unavailable)

Daily and Seasonal Adjustments: Not Used (Traffic to represent an average day)

Background Growth: 1.25% per year from I-89 Permanent Recorder (Grown to 2008)

Right Turn Reduction (RTR): Used NCHRP 457 (Based on % Right Turns during Saturday November 19, 2005 Count)  
100% Right Turn Reduction on Minor Street, Right Turns equal 63% of approach Volume

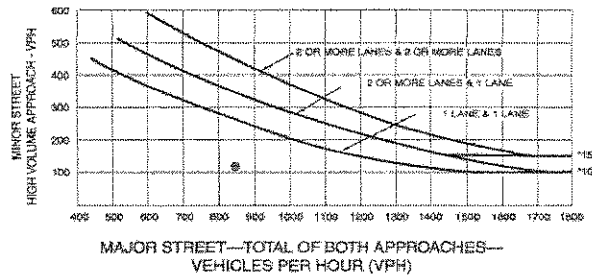
Count: Saturday June 11, 2005		10:00
Major Street	2005 Count	822
	2008	854
Minor Street	2005 Count	268
	RTR	169
	Count - RTR	99
	2008	103

**Warrant 3, Peak Hour Vehicular Volume**

**A. Minimum Vehicular Volume**

If the plotted point of the major and minor street traffic is above the line corresponding to the number of lanes on each approach, as traffic signal may be warranted.

Figure 4C-3. Warrant 3, Peak Hour



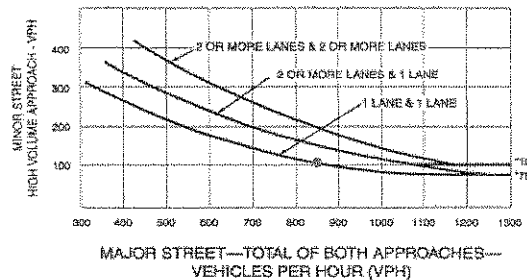
854	VPH Major Street (Both Directions)
103	VPH Minor Street (One Way Higher Vol.)

Meets Warrant: NO

**B. 70% Factor**

Same as Condition A, except in a community with less than 10,000 people or where the major street speed limit is above 40 mph.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)  
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



854	VPH Major Street (Both Directions)
103	VPH Minor Street (One Way Higher Vol.)

Meets Warrant: NO

Volumes Meet Warrant

# **APPENDIX C**

**Engineer's Estimate of Probable  
Construction Costs**



Town of Warner - NH Route 103 Improvements  
 PRELIMINARY OPINION OF CONSTRUCTION COST  
 ROADWAY CONSTRUCTION  
 ALTERNATIVE 1A - STOP CONTROL

HTA Project No. 915901  
 10-28-2008

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
201.1	CLEARING AND GRUBBING	AC	0.0	\$ 10,000.00	\$ -
203.1	COMMON EXCAVATION	CY	8335	\$ 15.00	\$ 125,025
203.2	ROCK EXCAVATION	CY	0	\$ 50.00	\$ -
203.6	EMBANKMENT-IN-PLACE	CY	7500	\$ 12.00	\$ 90,000
214	FINE GRADING	LS	1	\$ 5,750.00	\$ 5,750
304.1	SAND	CY	2175	\$ 20.00	\$ 43,500
304.2	GRAVEL	CY	1750	\$ 25.00	\$ 43,750
304.3	CRUSHED GRAVEL	CY	2550	\$ 25.00	\$ 63,750
304.35	CRUSHED GRAVEL FOR DRIVES	CY	850	\$ 35.00	\$ 29,750
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	1000	\$ 85.00	\$ 85,000
403.12	HOT BITUMINOUS PAVEMENT, HAND METHOD	TON	150	\$ 105.00	\$ 15,750
403.98	HOT BITUMINOUS CONCRETE LEVELING, MACHINE METHOD	TON	50	\$ 85.00	\$ 4,250
417	COLD PLANING BITUM. SURFACES	SY	7725	\$ 1.00	\$ 7,725
606.91	RESETTING OR SETTING GUARDRAIL	LF	700	\$ 10.00	\$ 7,000
608.12	2" BITUMINOUS SIDEWALK (F)	SY	100	\$ 15.00	\$ 1,500
608.240	4" CONCRETE SIDEWALK (F)	SY	1050	\$ 45.00	\$ 47,250
609.01	STRAIGHT GRANITE CURB	LF	685	\$ 18.00	\$ 12,330
609.21	STRAIGHT GRANITE SLOPE CURB	LF	3025	\$ 15.00	\$ 45,375
628.2	SAWCUTTING BITUM. PAVEMENT	LF	275	\$ 3.00	\$ 825
	<b>SUBTOTAL A</b>				<b>\$ 628,530</b>
	MISC. ITEMS (MARKINGS, LOAM, SEED, SIGNS) (15% Sub A)	LS	1	\$ 94,279.50	\$ 94,280
	<b>SUBTOTAL B</b>				<b>\$ 722,810</b>
	DRAINAGE ITEMS (PIPE, CB, UNDERDRAIN, DHM) (20% Sub B)	LS	1	\$ 144,561.90	\$ 144,562
	<b>SUBTOTAL C</b>				<b>\$ 867,371</b>
618.610	UNIFORMED OFFICERS WITH VEHICLE	\$	1	\$ 99,747.71	\$ 99,748
619.1	MAINTENANCE OF TRAFFIC	U	1	\$ 43,368.57	\$ 43,369
	EROSION, SEDIMENT, AND POLLUTION CONTROL (10% DRAINAGE (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL)	U	1	\$ 14,456.19	\$ 14,456
	<b>SUBTOTAL D</b>				<b>\$ 1,024,944</b>
	ROADWAY MOBILIZATION	5%			\$ 51,247
	ROADWAY CONTINGENCIES	10%			\$ 102,494
	MISCELLANEOUS (LANDSCAPING, FUEL ADJUST, ALTERATIONS)	5%			\$ 51,247
	<b>TOTAL</b>				<b>\$ 1,229,933</b>

TOTAL ROUNDED = **\$ 1,220,000.00**

Notes:

If a cold plane and overlay is not necessary, the following items could be removed

403.11	HOT BITUMINOUS PAVEMENT, (Wearing Course 1.5")	TON	629	\$ 85.00	\$ 53,465.00
417	COLD PLANING BITUM. SURFACES	SY	7725	\$ 1.00	\$ 7,725.00
				Subtotal =	\$ 61,190.00
				Subtotal (w/factors A+B) =	\$ 84,442.20
				Subtotal (w/factors C) =	\$ 106,819.38
				Subtotal (w/factors D) =	\$ 128,183.26

TOTAL ROUNDED (Without Cold Plane/Overlay) = **\$ 1,100,000.00**



Town of Warner - NH Route 103 Improvements  
 PRELIMINARY OPINION OF CONSTRUCTION COST  
 ROADWAY CONSTRUCTION  
 ALTERNATIVE 1B - TRAFFIC SIGNAL

HTA Project No. 915901  
 10-28-2008

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
201.1	CLEARING AND GRUBBING	AC	0.0	\$ 10,000.00	\$ -
203.1	COMMON EXCAVATION	CY	7900	\$ 15.00	\$ 118,500
203.2	ROCK EXCAVATION	CY	0	\$ 50.00	\$ -
203.6	EMBANKMENT-IN-PLACE	CY	8100	\$ 12.00	\$ 97,200
214	FINE GRADING	LS	1	\$ 6,000.00	\$ 6,000
304.1	SAND	CY	2325	\$ 20.00	\$ 46,500
304.2	GRAVEL	CY	1900	\$ 25.00	\$ 47,500
304.3	CRUSHED GRAVEL	CY	2725	\$ 25.00	\$ 68,125
304.35	CRUSHED GRAVEL FOR DRIVES	CY	850	\$ 35.00	\$ 29,750
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	1050	\$ 85.00	\$ 89,250
403.12	HOT BITUMINOUS PAVEMENT, HAND METHOD	TON	150	\$ 105.00	\$ 15,750
403.98	HOT BITUMINOUS CONCRETE LEVELING, MACHINE METHOD	TON	50	\$ 85.00	\$ 4,250
417	COLD PLANING BITUM. SURFACES	SY	7725	\$ 1.00	\$ 7,725
606.91	RESETTING OR SETTING GUARDRAIL	LF	700	\$ 10.00	\$ 7,000
608.12	2" BITUMINOUS SIDEWALK (F)	SY	90	\$ 15.00	\$ 1,350
608.240	4" CONCRETE SIDEWALK (F)	SY	1050	\$ 45.00	\$ 47,250
609.01	STRAIGHT GRANITE CURB	LF	685	\$ 18.00	\$ 12,330
609.21	STRAIGHT GRANITE SLOPE CURB	LF	3025	\$ 15.00	\$ 45,375
628.2	SAWCUTTING BITUM. PAVEMENT	LF	275	\$ 3.00	\$ 825
	<b>SUBTOTAL A</b>				<b>\$ 644,680</b>
	MISC. ITEMS (MARKINGS, LOAM, SEED, SIGNS) (15% Sub A)	LS	1	\$ 96,702.00	\$ 96,702
	<b>SUBTOTAL B</b>				<b>\$ 741,382</b>
	DRAINAGE ITEMS (PIPE, CB, UNDERDRAIN, DHM) (20% Sub B)	LS	1	\$ 148,276.40	\$ 148,276
	<b>SUBTOTAL C</b>				<b>\$ 889,658</b>
618.610	UNIFORMED OFFICERS WITH VEHICLE	\$	1	\$ 102,310.72	\$ 102,311
619.1	MAINTENANCE OF TRAFFIC	U	1	\$ 44,482.92	\$ 44,483
	EROSION, SEDIMENT, AND POLLUTION CONTROL (10% DRAINAGE (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL)	U	1	\$ 14,827.64	\$ 14,828
	<b>SUBTOTAL D</b>				<b>\$ 1,051,280</b>
	ROADWAY MOBILIZATION	5%			\$ 52,564
	ROADWAY CONTINGENCIES	10%			\$ 105,128
	MISCELLANEOUS (LANDSCAPING, FUEL ADJUST, ALTERATIONS)	5%			\$ 52,564
616.1	TRAFFIC SIGNALS	LS	1	\$ 100,000.00	\$ 100,000
	<b>TOTAL</b>				<b>\$ 1,361,536</b>

TOTAL ROUNDED = **\$ 1,370,000.00**

Notes:

If a cold plane and overlay is not necessary, the following items could be removed

403.11	HOT BITUMINOUS PAVEMENT, (Wearing Course 1.5")	TON	629	\$ 85.00	\$ 53,465.00
417	COLD PLANING BITUM. SURFACES	SY	7725	\$ 1.00	\$ 7,725.00
				Subtotal =	\$ 61,190.00
				Subtotal (w/factors A+B) =	\$ 84,442.20
				Subtotal (w/factors C) =	\$ 106,819.38
				Subtotal (w/factors D) =	\$ 128,183.26

TOTAL ROUNDED (Without Cold Plane/Overlay) = **\$ 1,250,000.00**



Town of Warner - NH Route 103 Improvements  
 PRELIMINARY OPINION OF CONSTRUCTION COST  
 ROADWAY CONSTRUCTION  
 ALTERNATIVE 2 - ROUNDABOUT

HTA Project No. 915901  
 10-28-2008

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
201.1	CLEARING AND GRUBBING	AC	0.0	\$ 10,000.00	\$ -
203.1	COMMON EXCAVATION	CY	8000	\$ 15.00	\$ 120,000
203.2	ROCK EXCAVATION	CY	0	\$ 50.00	\$ -
203.6	EMBANKMENT-IN-PLACE	CY	5360	\$ 12.00	\$ 64,320
214	FINE GRADING	LS	1	\$ 6,000.00	\$ 6,000
304.1	SAND	CY	1725	\$ 20.00	\$ 34,500
304.2	GRAVEL	CY	1470	\$ 25.00	\$ 36,750
304.3	CRUSHED GRAVEL	CY	2675	\$ 25.00	\$ 66,875
304.35	CRUSHED GRAVEL FOR DRIVES	CY	700	\$ 35.00	\$ 24,500
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	950	\$ 85.00	\$ 80,750
403.12	HOT BITUMINOUS PAVEMENT, HAND METHOD	TON	131	\$ 105.00	\$ 13,755
403.98	HOT BITUMINOUS CONCRETE LEVELING, MACHINE METHOD	TON	40	\$ 85.00	\$ 3,400
417	COLD PLANING BITUM. SURFACES	SY	7725	\$ 1.00	\$ 7,725
606.91	RESETTING OR SETTING GUARDRAIL	LF	325	\$ 10.00	\$ 3,250
608.12	2" BITUMINOUS SIDEWALK (F)	SY	105	\$ 15.00	\$ 1,575
608.240	4" CONCRETE SIDEWALK (F)	SY	1255	\$ 45.00	\$ 56,475
609.01	STRAIGHT GRANITE CURB	LF	685	\$ 18.00	\$ 12,330
609.21	STRAIGHT GRANITE SLOPE CURB	LF	2790	\$ 15.00	\$ 41,850
628.2	SAWCUTTING BITUM. PAVEMENT	LF	275	\$ 3.00	\$ 825
	<b>SUBTOTAL A</b>				<b>\$ 574,880</b>
	MISC. ITEMS (MARKINGS, LOAM, SEED, SIGNS) (15% Sub A)	LS	1	\$ 86,232.00	\$ 86,232
	<b>SUBTOTAL B</b>				<b>\$ 661,112</b>
	DRAINAGE ITEMS (PIPE, CB, UNDERDRAIN, DHM) (20% Sub B)	LS	1	\$ 132,222.40	\$ 132,222
	<b>SUBTOTAL C</b>				<b>\$ 793,334</b>
618.610	UNIFORMED OFFICERS WITH VEHICLE	\$	1	\$ 91,233.46	\$ 91,233
619.1	MAINTENANCE OF TRAFFIC	U	1	\$ 39,666.72	\$ 39,667
	EROSION, SEDIMENT, AND POLLUTION CONTROL (10% DRAINAGE (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL)	U	1	\$ 13,222.24	\$ 13,222
	<b>SUBTOTAL D</b>				<b>\$ 937,457</b>
	ROADWAY MOBILIZATION	5%			\$ 46,873
	ROADWAY CONTINGENCIES	10%			\$ 93,746
	MISCELLANEOUS (LANDSCAPING, FUEL ADJUST, ALTERATIONS)	5%			\$ 46,873
	<b>TOTAL</b>				<b>\$ 1,124,948</b>

**TOTAL ROUNDED = \$ 1,130,000.00**

Notes:

If a cold plane and overlay is not necessary, the following items could be removed

403.11	HOT BITUMINOUS PAVEMENT, (Wearing Course 1.5")	TON	629	\$ 85.00	\$ 53,465.00
417	COLD PLANING BITUM. SURFACES	SY	7725	\$ 1.00	\$ 7,725.00
				Subtotal =	\$ 61,190.00
				Subtotal (w/factors A+B) =	\$ 84,442.20
				Subtotal (w/factors C) =	\$ 106,819.38
				Subtotal (w/factors D) =	\$ 128,183.26

**TOTAL ROUNDED (Without Cold Plane/Overlay) = \$ 1,010,000.00**



Town of Warner - NH Route 103 Improvements  
 PRELIMINARY OPINION OF CONSTRUCTION COST  
 ROADWAY CONSTRUCTION  
 SB ON-RAMP RECONFIGURATION

HTA Project No. 915901  
 10-28-2008

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
201.1	CLEARING AND GRUBBING	AC	0.0	\$ 10,000.00	\$ -
202.7	REMOVAL OF GUARDRAIL	LF	290.0	\$ 2.50	\$ 725
203.1	COMMON EXCAVATION	CY	2550	\$ 15.00	\$ 38,250
203.2	ROCK EXCAVATION	CY	120	\$ 50.00	\$ 6,000
203.6	EMBANKMENT-IN-PLACE	CY	730	\$ 12.00	\$ 8,760
214	FINE GRADING	LS	1	\$ 1,000.00	\$ 1,000
304.1	SAND	CY	400	\$ 20.00	\$ 8,000
304.2	GRAVEL	CY	400	\$ 25.00	\$ 10,000
304.3	CRUSHED GRAVEL	CY	400	\$ 25.00	\$ 10,000
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	625	\$ 85.00	\$ 53,125
403.98	HOT BITUMINOUS CONCRETE LEVELING, MACHINE METHOD	TON	45	\$ 85.00	\$ 3,825
417	COLD PLANING BITUM. SURFACES	SY	5750	\$ 1.00	\$ 5,750
609.01	STRAIGHT GRANITE CURB	LF	850	\$ 18.00	\$ 15,300
609.21	STRAIGHT GRANITE SLOPE CURB	LF	150	\$ 15.00	\$ 2,250
628.2	SAWCUTTING BITUM. PAVEMENT	LF	100	\$ 3.00	\$ 300
<b>SUBTOTAL A</b>					<b>\$ 163,285</b>
	MISC. ITEMS (MARKINGS, LOAM, SEED, SIGNS) (15% Sub A)	LS	1	\$ 24,492.75	\$ 24,493
<b>SUBTOTAL B</b>					<b>\$ 187,778</b>
	DRAINAGE ITEMS (PIPE, CB, UNDERDRAIN, DHM) (20% Sub B)	LS	1	\$ 37,555.55	\$ 37,556
<b>SUBTOTAL C</b>					<b>\$ 225,333</b>
618.610	UNIFORMED OFFICERS WITH VEHICLE	\$	1	\$ 25,913.33	\$ 25,913
619.1	MAINTENANCE OF TRAFFIC	U	1	\$ 11,266.67	\$ 11,267
	EROSION, SEDIMENT, AND POLLUTION CONTROL (10% DRAINAGE (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL)	U	1	\$ 3,755.56	\$ 3,756
<b>SUBTOTAL D</b>					<b>\$ 266,269</b>
	ROADWAY MOBILIZATION	5%			\$ 13,313
	ROADWAY CONTINGENCIES	10%			\$ 26,627
	MISCELLANEOUS (LANDSCAPING, FUEL ADJUST, ALTERATIONS)	5%			\$ 13,313
<b>TOTAL</b>					<b>\$ 319,523</b>

TOTAL ROUNDED = **\$ 320,000.00**

Notes:

If a cold plane and overlay is not necessary, the following items could be removed

403.11	HOT BITUMINOUS PAVEMENT, (Wearing Course 1.5")	TON	469	\$ 85.00	\$ 39,865.00
417	COLD PLANING BITUM. SURFACES	SY	5750	\$ 1.00	\$ 5,750.00
				Subtotal =	\$ 45,615.00
				Subtotal (w/factors A+B) =	\$ 62,948.70
				Subtotal (w/factors C) =	\$ 79,630.11
				Subtotal (w/factors D) =	\$ 95,556.13

TOTAL ROUNDED (Without Cold Plane/Overlay) = **\$ 230,000.00**

# **APPENDIX D**

## **Referenced Reports**