delphiMRC

# Highway 113 : A Demand and Strategic Context Focus Study

*This study examines the demand and strategic context of the potential transportation impacts resulting from the proposed Highway 113, Nova Scotia.*

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## ***Delphi-MRC Project Team***

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# 1 INTRODUCTION & UNDERSTANDING

## 1.1 The Context and Scope

This transportation demand and strategic context focus study is a component of the Department of Transportation and Public Works' (TPW) strategic and long-term transportation planning process that is intended to improve transportation throughout Nova Scotia's key highway corridors. It is integral to the long-term planning process and is one of the preliminary steps to ensuring transportation investment is made where it's needed, when required, and implemented in a cost-effective way.

The Department of Transportation and Public Works (TPW) carried out a preliminary transportation demand analysis for the proposed Highway 113 some years ago. This report was commissioned by TPW to provide an independent transportation demand analysis that does not rely on previous work completed to date and is intended to provide information for future strategic-level decisions which may have to be taken to help preserve a corridor.

In this study we examine the transportation demand and strategic contexts specific to the proposed Highway 113 for the planning horizon year 2026. This horizon year aligns with the Halifax Regional Municipality's Regional Plan and the population and employment information used in the travel demand component of this study.

## 1.2 The Regional Context

The focus of this analysis is in the vicinity of the proposed Highway 113. It encompasses mainland Halifax and areas to the south-west and north to Hammonds Plains Road (Route 213). A map illustrating the general study area is illustrated in Figure 1.

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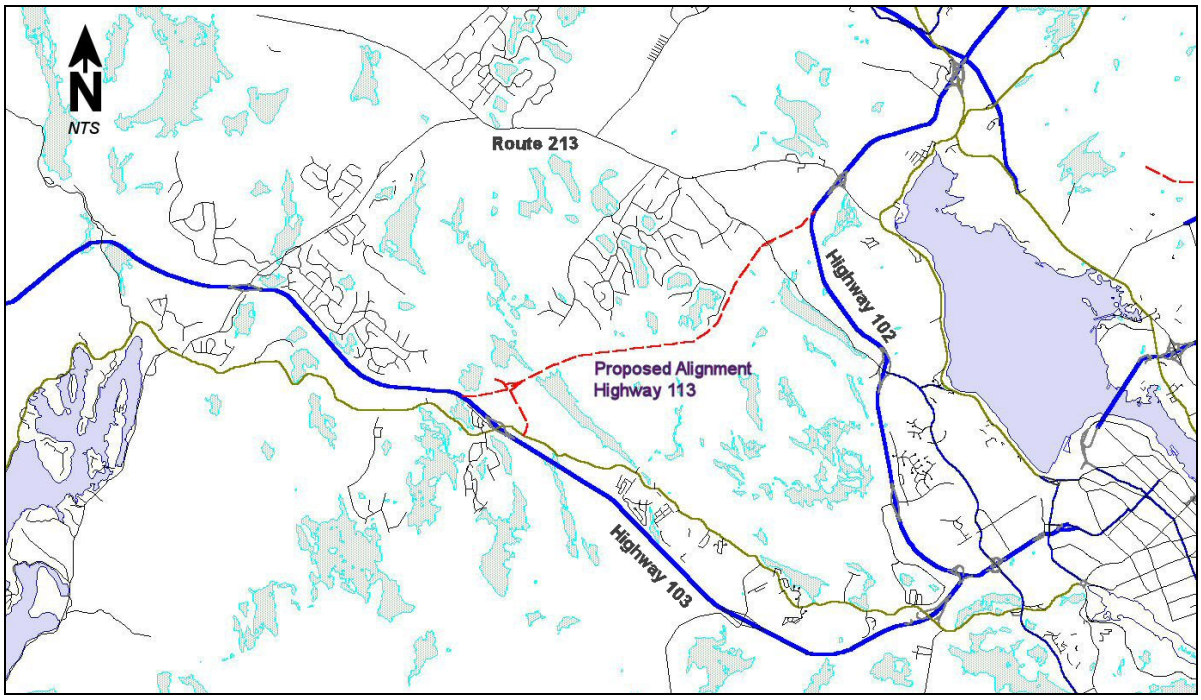
*Figure 1: Regional Context*




Although we describe the Regional Context as being in the vicinity of the proposed Highway 113, we cannot overlook the evaluation of the total regional context when dealing with travel demand for a controlled-access facility such as the proposed Highway 113. Therefore, in Section 4 we provide a discussion of transportation modelling under the regional context, which expands on our study area to include the entire Halifax Regional Municipality (HRM).

## 1.3 Report Organization

Our analysis begins with a review of existing conditions as they relate to ground transportation in the Halifax area and it includes discussions on historic population growth, historic traffic growth, travel desire lines, infrastructure constraints and historical safety performance. This is followed by a discussion of the Halifax Regional Municipality's proposed Regional Plan and its policy-level considerations. Section 4 provides a discussion of the forecast travel demand for Highway 113, should it be constructed. Truck routing changes in the face of the provision of Highway 113 is contained in Section 5, and the final section summarizes the principle findings of our work.

## 1.4 Our Findings

### *1.4.1 Travel Demand*

Based on the transportation modelling effort, we found that at the horizon year (2026) there is significant demand for a high-speed corridor linking Highway 102 and Highway 103. The forecast base demand is **8,000** to **14,500** daily trips. Given that the travel demand

modelling approach used in this exercise does *not* consider the effects of external-to-external trips (including through goods movements), induced travel demand, and the potential for the extension of the Highway 107 corridor (completing the freeway network around the harbour) we expect that this forecast may *underestimate* the actual horizon year traffic volumes forecast using the model. The modelled demand is illustrated in Figure 10.

The findings discussed above confirm the initial review of existing conditions. We conclude that the following may contribute in part to the significant demand forecast for Highway 113:

- Traffic growth on the major regional highways in the vicinity of the proposed Highway 113 appears to have reached a plateau, indicating that these facilities may be nearing their potential capacity. This could present a major infrastructure capacity issue for both TPW and HRM and planning for this trend should be undertaken immediately.

- Route 213 (Hammonds Plains Road) has been recognized by both the HRM and TPW as a facility that is nearing capacity. Widening of this roadway could have a severe impact on the adjacent properties.

- Safety performance conditions appear to have deteriorated on the study area facilities in recent years, indicating that near-capacity conditions may be contributing in part to increased safety risks.

#### *1.4.2 Regional Plan Considerations*

HRM forecasts that there would be modest and sustained population and employment growth in the Study Area over the planning horizon to 2026. More specifically, it is understood in the latest Draft Regional Plan that HRM acknowledges the capacity constraints on Route 213 (Hammonds Plains Road).

The Regional Plan's Map 7[1] identifies Highway 113 for future development but anticipates that it would not be required within the 25-year planning horizon. To off-set the demand for additional capacity, HRM intends to control growth in the Hammonds Plains area; and also to increase the level of transit service to the corridor, in hopes of reducing overall vehicular trip demand. These initiatives may address local sources of traffic on Route 213 (Hammonds Plains Road). Further south and west in the St. Margaret's Bay area, vehicle trip demand may be served in part by the planned rural express bus service to Tantallon.

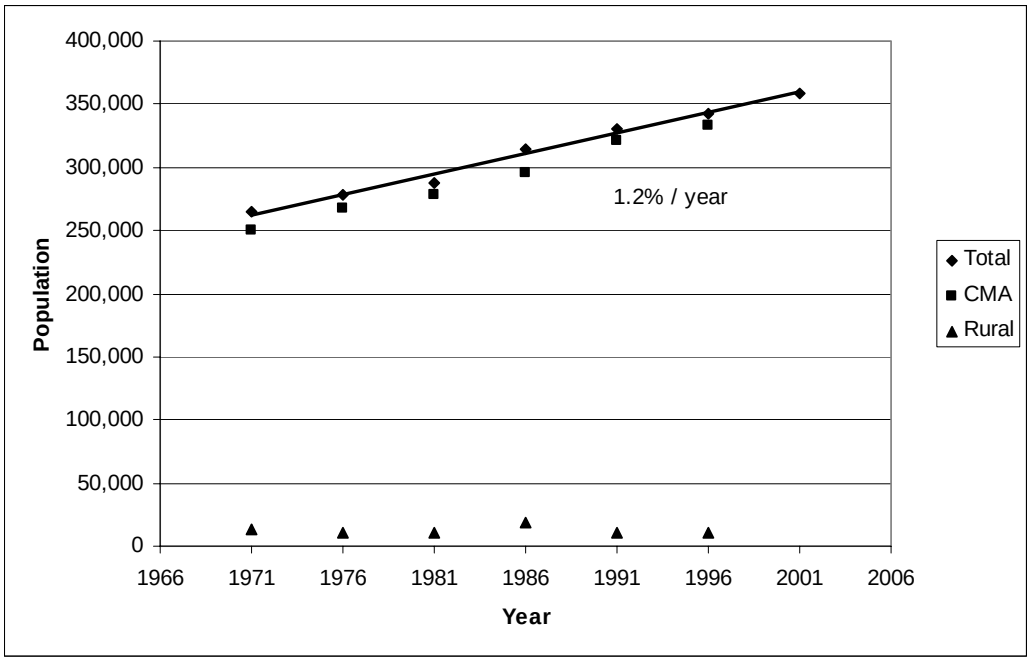
[1] http://www.halifax.ca/regionalplanning/documents/Future_Transit_and_Transportation.pdf

# 2 EXISTING CONDITIONS

## 2.1 Historic Population Growth

Using information provided by Statistics Canada, Figure 2 plots the historic population trend over the last 30 years (between 1971 and 2001). Population levels were listed separately for the rural areas and for the metropolitan area (CMA) until 1996 – the year after amalgamation occurred. The annual growth rate has been 1.2 percent.

*Figure 2: Historical Population Growth in HRM*




## 2.2 Historic Traffic Growth

Historic traffic growth provides an indication of the trend of travel demand. It is typically measured as an average daily volume measured over an entire year and expressed as an Average Annual Daily Traffic volume (AADT). This information was provided by TPW[2].

### *2.2.1 Regional Growth*

From the historically recorded traffic it was possible to determine an average annual traffic growth rate that is considered representative of regional traffic growth. This is shown in the following Table.

[2] Traffic Volumes: Primary Highway System 1994-2003. Published by the Nova Scotia Department of Transportation and Public Works. 2004.

*Table 1: Regional Traffic Growth on the Major Highways in HRM (1994-2003)*

| Highway | Description | Annual Growth Rate | Regional Average |
|---|---|---|---|
| **101** | Between Exits 2 & 3 | 2.9% | **5.1%** |
| **102** | Average between Exits 1A & 3[A] | 9.0% | |
| **103** | Between Exits 2 & 3 | 3.9% | |
| **118** | Between Hwy 107 & Hwy 102 | 3.8% | |
| **213** | Between Lucasville & Hwy 103 | 5.9% | |

The results indicate a Regional average traffic growth rate on the major HRM highways of just over 5 percent annually. Typically, long term average growth rates on North American highways range between 1 and 2 percent - with rates above the 2 percent mark being considered aggressive. The 5.1 percent figure noted in this case certainly merits that description.

One indicator of travel demand is population growth, and these are often strongly correlated. More people residing in a region create a greater propensity for trip making (*i.e.* trips to work, shopping trips, and other activity-based trips). If we recall the population growth rate over the last 30 years was approximately 1.2 percent annually, and compare it to the traffic growth rate (of just over 5.1 percent), it appears that travel demand is increasing at a rate substantially above that of population. If this is indeed the case, it could present a major infrastructure capacity issue for both TPW and HRM and planning for this trend should be undertaken immediately.

#### *2.2.2 Highway 102 & Hammonds Plains Road (Route 213)*

Table 1 identifies two arterial roads with significantly higher annual growth rates: Highway 102 and Hammonds Plains Road. These are important arterial links in our study area and are worthy of discussion.

*Highway 102*

Volume data for Highway 102 between 1972 and 2005 was provided by TPW and indicated a growth trend of about 9 percent per annum. The rate of growth appears to have reached a plateau over the last 3-5 years and may be an indication that the highway is nearing capacity.

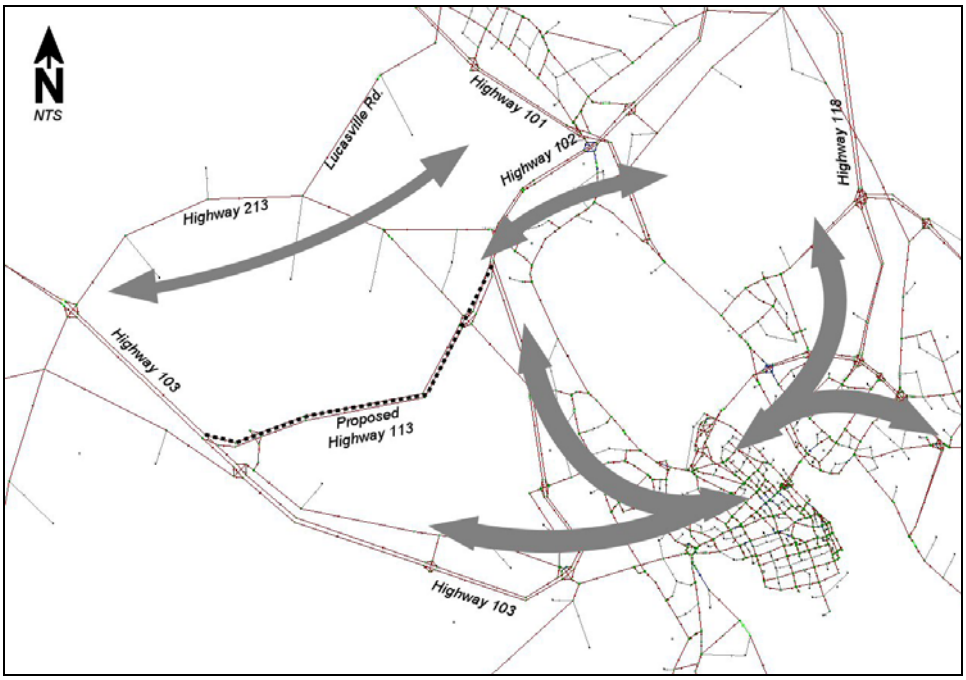
*Hammonds Plains Road (Route 213)*

Hammonds Plains Road has an annual growth rate less than Highway 102. While the volumes on this facility do not yet appear to have leveled off, they are not infinitely sustainable, and as the roadway approaches its capacity, traffic volumes will begin to flatten. At that point, demand management considerations become an important element of any overall transportation strategy, unless further roadway infrastructure investment is contemplated.

## 2.3 Regional Travel Desire Lines

Desire lines are simply lines on a map that indicate the flow of people or goods from a point of origin to a destination (and vice-versa). They do not necessarily represent the exact routing that people would follow traveling between these points. Typically the width of a desire line quantifies the magnitude of the flow being illustrated (*i.e.* a larger line indicates a greater desire to follow the particular desire line).

*Figure 3: Regional Travel Desire Lines*




As we can see, the Halifax peninsula represents the major trip gravitational centre in the Region from which a significant portion of trips originate, or to which they are destined. To a lesser extent, the travel corridor around the Bedford Basin also represents an important desire line created by the topography of the Region. These of course are not all the significant desire lines in the HRM and we have only illustrated the lines relevant to this study - including a line between the St. Margaret's Bay District (Tantallon and points south) and the Bedford/Sackville area.

We can use these desire lines to develop a better understanding of the service function of each of the major travel routes in the vicinity of Highway 113. These facilities include Highway 102, Highway 103 and Route 213 (Hammonds Plains Road):

*Highway 102 & Highway 103* – Each of these freeway facilities provides a predominant commuter function to/from Halifax peninsula. This corridor also provides a regional travel route between the St. Margaret's Bay area and Bedford/Sackville but this function appears to be much less significant relative to its commuter function. We note however, that these routes do provide an important route for truck traffic and goods movements in the Region due to the restrictions for heavy vehicle use

on Hammonds Plains Road.

*Hammonds Plains Road (Route 213)* – This two-lane, two-way highway provides the dual functions of serving both cross-regional travel and commuter trips for the communities located along the corridor. The Lucasville Road is also part of this corridor and is used by travellers to the Annapolis Valley area. The cross-regional travel function provides an alternative to the Highway 102/103 corridor except for heavy vehicles.

In light of this subjective analysis, it appears that the implementation of the proposed Highway 113 would have an impact on commuter trips travelling between Bedford/Sackville/Dartmouth and points south and west of the Region. It would also help alleviate capacity constraints.

## 2.4 Current Highway Constraints

Identification of existing system constraints provides insight into current problems and assists in identifying potential future solutions. In this strategic analysis, we deal only with the main highways in the study area where significant constraints exist as discussed below. Figure 3 provides a summary constraints map.

### *2.4.1 Highway 102*

Highway 102 between Hammonds Plains Road and Highway 103 is a four-lane divided freeway with a posted speed limit of 100km/h. Highway 102 is nearing capacity due to a sustained and aggressive annual growth rate of 9 percent. Compounding this issue is the fact that significant residential developments are planned in Bedford South and Bedford West that will contribute to increased travel demand between Bedford and the Halifax Peninsula.

As the only north-south freeway connection to the Halifax Peninsula, and as this highway reaches capacity, further volume growth could result in any of the following:

- Traffic will divert to other arterial streets in the corridor (many are already at capacity),
- Users may switch to other modes such as transit (if the mode is providing adequate service levels), or
- Businesses may seek to locate outside of the downtown areas altogether - putting significant pressure on the suburban arterial and freeway road network.

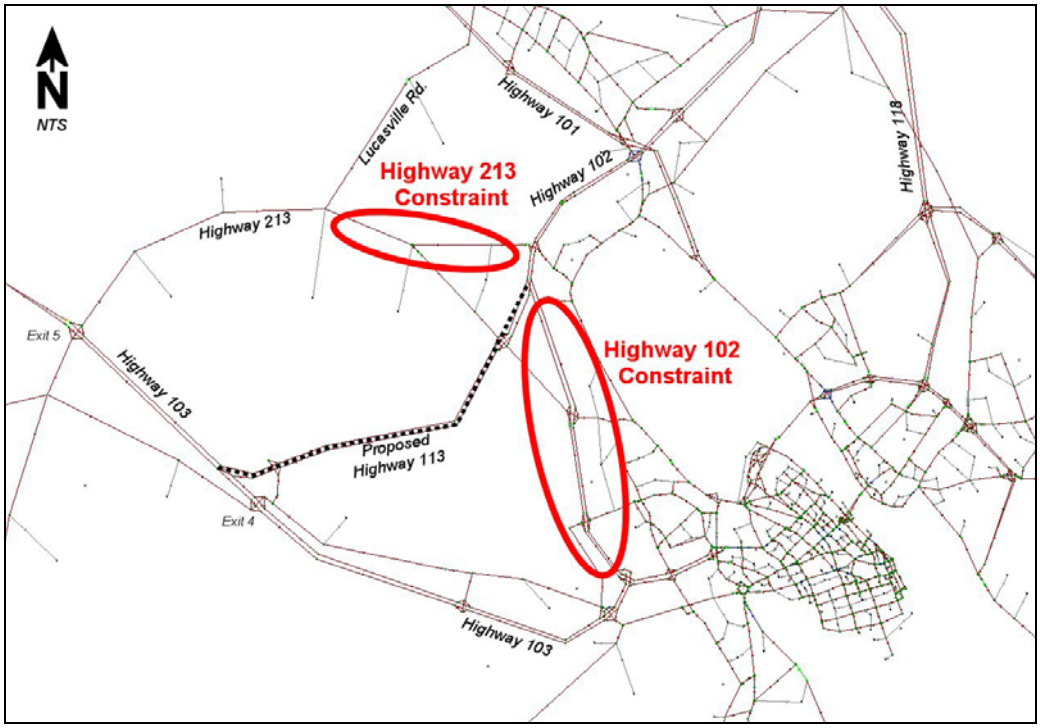
The latter is of considerable concern for HRM and is contrary to the Regional Plan policy. However, the policy actually favours the use of transit. The capacity constraint would, in fact, likely contribute to greater transit use provided that transit service expansion keeps up with travel demands. It is also notable that development has progressively encroached along this section of Highway 102 and now represents a significant constraint to any future expansion. There are currently no

plans to widen Highway 102.

### *2.4.2 Hammonds Plains Road (Route 213)*

The two-lane, two-way Hammonds Plains Road connects Highway 102 at the Hammonds Plains Road interchange to Highway 103 in Upper Tantallon (Exit 5). This is viewed by many commuters as a more convenient route than the Highway 102/103 corridor and as a result is nearing capacity. While TPW has made efforts in recent years to impose access control between Upper Tantallon and the Pockwock Road, development has continued between Pockwock Road and Highway 102. This has resulted in several suburban subdivisions developing along this route, which add to the volume levels and increased safety risks. There are no plans to widen Hammonds Plains Road and to do so would create significant property impacts.

*Figure 4: Existing Study Area Constraints Map*




## 2.5 Historic Safety Conditions

A review of TPW's collision data for the study area was carried out. We looked at collision rates, frequencies and severity in this analysis. This analysis should not be considered a comprehensive safety performance review and is only intended to provide insight into recent road safety trends. The results of the collision rate review are contained in Table 2.

*Table 2: Historic Collision Rates on the Study Area Highways*

| Highway | Control Section | Facility Type | Length (km) | Avg AADT Volume | 1998-2002 Rate (hmvk) | 1999-2003 Rate (hmvk) | Section Trend | Highway Trend |
|---|---|---|---|---|---|---|---|---|
| 102 | Exit 1A to Exit 2A | Class 2 - 4-lane freeway | 2.37 | 35,576 | 20.8 | 23.4 | ↑ | ↑ |
| | Exit 2A to Exit 2 | Class 2 - 4-lane freeway | 3.22 | 37,180 | 82.4 | 87.9 | ↑ | |
| | Exit 2 to Exit 3 | Class 2 - 4-lane freeway | 5.03 | 33,700 | 54.0 | 52.4 | ↓ | |
| 103 | Exit 1 to Exit 2 | Class 2 - 4-lane freeway | 1.22 | 22,960 | 127.2 | 140.8 | ↑ | ↑ |
| | Exit 2 to Exit 3 | Class 1 - 4-lane freeway | 4.42 | 17,368 | 30.0 | 25.7 | ↓ | |
| | Exit 3 to Exit 4 | Class 5 - 2-lane arterial highway | 7.21 | 14,104 | 19.9 | 24.8 | ↑ | |
| | Exit 4 to Exit 5 | Class 5 - 2-lane arterial highway | 6.86 | 12,434 | 45.6 | 43.7 | ↓ | |
| 213 | Hwy 102 to Lucasville | Class 11 - 2-lane collector highway | 1.35 | 16,286 | 256.7 | 264.2 | ↑ | ↓ |
| | Lucasville to Hwy 103 | Class 11 - 2-lane collector highway | 5.93 | 12,268 | 126.5 | 119.8 | ↓ | |

Collision rates are measured in "collisions/hundred million vehicle kilometres" or hmvk.

The trends shown in Table 2 indicate an increase in the collision rates on Highways 102 and 103 and a decrease in rates on Hammonds Plains Road. The increase in collision rates on Highways 102 and 103 indicates a worsening of safety performance. A review of the frequency and/or the severity of these collisions provided additional insight.

*Table 3: Collision Frequency and Severity on the Study Area Highways*

| Highway | Control Section | 1998-2002 PDO Collisions | 1998-2002 Injury Collisions | 1998-2002 Fatal Collisions | 1998-2002 Total Collisions | 1999-2003 PDO Collisions | 1999-2003 Injury Collisions | 1999-2003 Fatal Collisions | 1999-2003 Total Collisions |
|---|---|---|---|---|---|---|---|---|---|
| 102 | Exit 1A to Exit 2A | 22 | 10 | 0 | 32 | 24 | 12 | 0 | 36 |
| | Exit 2A to Exit 2 | 124 | 56 | 0 | 180 | 136 | 56 | 0 | 192 |
| | Exit 2 to Exit 3 | 108 | 59 | 0 | 167 | 105 | 57 | 0 | 162 |
| 103 | Exit 1 to Exit 2 | 43 | 21 | 1 | 65 | 50 | 22 | 0 | 72 |
| | Exit 2 to Exit 3 | 33 | 8 | 1 | 42 | 29 | 6 | 1 | 36 |
| | Exit 3 to Exit 4 | 25 | 11 | 1 | 37 | 32 | 12 | 2 | 46 |
| | Exit 4 to Exit 5 | 38 | 30 | 3 | 71 | 34 | 30 | 4 | 68 |
| 213 | Hwy 102 to Lucasville | 78 | 25 | 0 | 103 | 79 | 27 | 0 | 106 |
| | Lucasville to Hwy 103 | 101 | 66 | 1 | 168 | 98 | 61 | 0 | 159 |
| | | **572** | **286** | **7** | **865** | **587** | **283** | **7** | **877** |

The information in Table 3 was gleaned from safety statistics published by TPW and uses the same data sets discussed above for the collision rate calculations. Results indicate that collision frequency has increased by 12 collisions from the 1998-2002 period to the 1999-2003 period. This may be considered a marginal increase; however, the growth rate of traffic volumes (a measure of risk) has flattened in recent years. This in fact, indicates that the relative safety performance on these routes has worsened – resulting in an overall increased risk to drivers. We attribute the increase in collision rates to the increase in frequency.

Collision severity is an important metric to consider in that higher severities increase societal costs (loss of life, health care costs, *etc.*). Collision severity trends for the study area highways indicate that the number of fatalities remained the same and the number of injury collisions dropped slightly. Thus the source for the increase in frequency between the two data sets can be attributed to the increase in property damage only (PDO) collisions – considered to be a low-severity collision type.

# 3 REGIONAL PLAN CONSIDERATIONS

## 3.1 HRM's Policy for Highway 113

In the HRM policies, the following key highlights are relevant:

The Highway 113 alignment is included in the overall Plan's Transportation and Transit Map (Map 7) but the Plan anticipates that it would not be required within the 25-year planning horizon. Instead, HRM intends to control growth along the corridor (Hammonds Plains area) and also increase the level of transit service to ease pressure on the existing Route 213.

It is worth noting that the transportation policy noted above is a change from the First Draft of the Regional Plan which anticipated a requirement for Highway 113 within the planning period. The change is based on **Section 3.5.2** of the Plan, entitled *Other Growth Management Mechanisms*. This section notes (page 57), "*Traffic capacity along the Hammonds Plains Road ... is either at or nearing the point where restrictions on further subdivision activity are warranted. Until a substantive change is made in the infrastructure capacity within these areas, all further residential subdivision activity shall be curtailed."*

This statement is supported by HRM **Draft Policy S-22**, which states: *"HRM shall, through the subdivision By-law, limit development within portions of the Hammonds Plains … community to prohibit residential development on new roads."* Subdivisions already approved or already in the approval process at the time of Plan adoption will be permitted to expand at a rate of up to 25 lots per year. Where streets already exist, new lot development would be limited to a rate of eight per year.

Other Regional Plan initiatives relate to transportation demand management with a focus on improved transit. HRM proposes to introduce a rural express bus service to Tantallon which could be implemented as early as 2009 (based on current budgets). There is also a commitment to meeting minimum service standards for transit. This means that the existing Transit Route No. 33 will have increased frequency in the future.

## 3.2 Forecast Population & Traffic Growth

Obviously, the population and employment within any region will directly affect travel demand in the area. This section provides an overview of the HRM plan assumptions regarding population and employment distributions for the future HRM.

### *3.2.1 Forecast Population Growth*

**Section 3** of the Plan, which focuses on the topic of *Settlement and Housing*, provides an overview of the expected population increase in the Region. The Regional Plan assumes a likely population increase of 84,400 persons and a total population in 2026 of about 446,000. This growth is expected to be by means of natural increase (24,000) and by net inflow (60,000) from other parts of Canada and from immigration.

This equates to an average annual growth rate of 1 percent[3]. This average rate accounts for the cumulative growth over the entire region, over a 25 year period. The Regional Plan proposes the following balance of new settlement in the future:

*Table 4: HRM Forecast Population Growth based on the Regional Plan Scenario*

| Area | Share of Growth (%) | Likely Increase (calculated) |
|---|---|---|
| Halifax Peninsula/Dartmouth inside the Circumferential Highway (Capital District) | 25 | 21,100 |
| Suburban areas | 50 | 42,200 |
| Rural areas | 25 | 21,100 |

Table 4 indicates that the most significant population growth is expected to occur in the suburban areas of the Region. In the vicinity of the proposed Highway 113, the majority of suburban development will likely occur in two areas: Bedford West and the Piercey's lands. These proposed developments are located along the Highway 113 corridor and have reserved lands for the construction of this facility.

If Highway 113 is constructed it is planned that interchanges would serve both the Bedford West and the Piercey's developments at the western end. The Bedford West interchange would connect to Kearney Lake Road (in the vicinity of the Atlantic Acres Business Park) and the Piercy's interchange would connect to Route 3 (in the vicinity of the existing Exit 4 on Highway 103). The transportation demand modelling analysis included these developments and the interchanges that serve them.

It has been contemplated that there may be an opportunity to serve the Kingswood development area with a Highway 113 interchange. If built, the interchange would create access to a high-speed facility. The forecast population in Kingswood may be better served by this access and reduce the demand on Hammonds Plains Road.

### *3.2.2 Forecast Traffic Growth*

Based on the planning forecasts for the Regional Plan growth scenario and knowing the correlation between population growth and trips per person, we expect overall traffic volumes on the entire regional road network to increase by rates similar to that of the population forecast – a conservative average of approximately 1 percent per year over the long term. This growth rate is intended to be descriptive of an average regional rate and may not necessarily be appropriate for the high demand highways.

[3] It is worth noting that the Conference Board of Canada forecasts a higher rate of growth. The Board predicts that the population will reach 450,000 by the year 2020. (Source: Greater Halifax Partnership)

# 4 REGIONAL TRAVEL DEMAND – IS THERE DEMAND FOR HIGHWAY 113?

Future travel demand is forecast using complex transportation models - computerized mathematical forecasting tools – similar in concept to weather models or earthquake prediction models. They provide a means to determine approximate future traffic volumes on the road network based on a "snapshot" of the existing road and traffic conditions, and future predictions of population and employment growth. The model used for this analysis is the Halifax Regional Municipality's Quick Response Software II (QRSII) model.

The QRS II transportation model follows generally accepted methodologies and practices for engineers and planners throughout North America. It is a common tool used to predict corridor-level (coarse) travel demand and is appropriate for long-term planning purposes. A more detailed discussion on the model is provided in Appendix A.

## 4.1 The Transportation Model Results

A "select link analysis" is carried out during a transportation modelling process in order to derive information that pertains to a selected roadway segment (in this case Highway 113). We used such a technique to help us determine:

1. The origins of trips based in HRM that would utilize Highway 113 in the horizon planning year (2026), and

2. The projected shift in travel demand on key routes as a result of implementing Highway 113.

The findings are discussed in the following Sections.

### *4.1.1 Trip Origins*

Figure 5 provides a schematic summary of our select link analysis on Highway 113.

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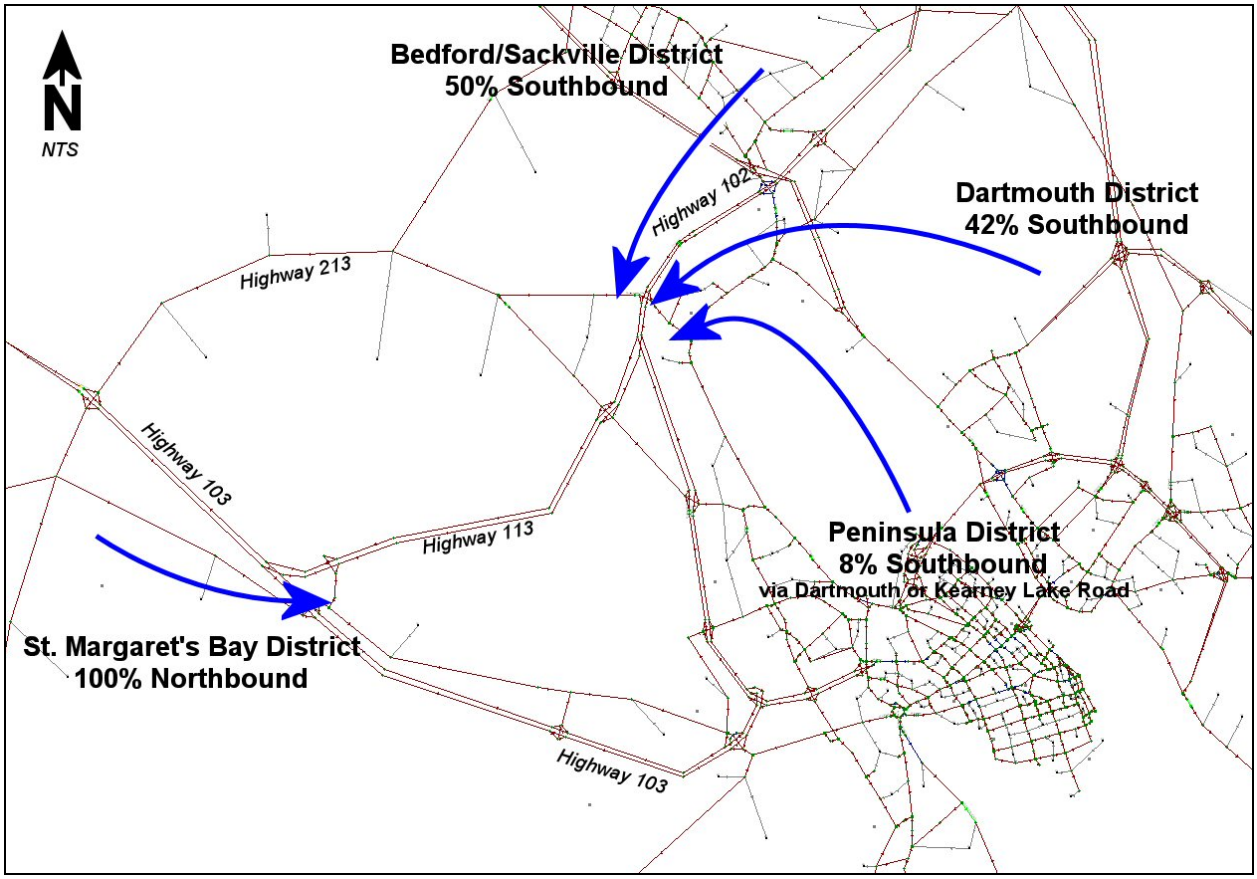
*Figure 5: Origins of Trips Likely to use Highway 113 in 2026*



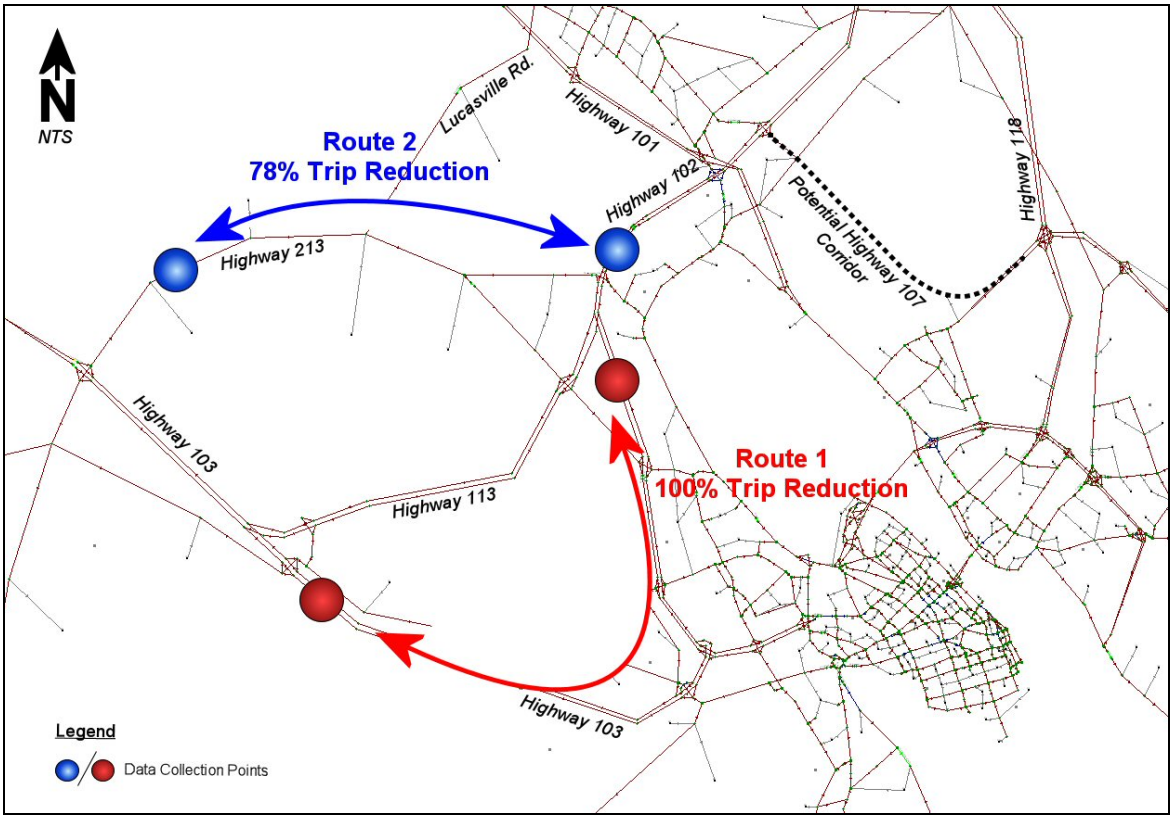

The majority of trips forecast to utilize Highway 113 (in the southbound or outbound direction) are originating in the northern and eastern areas of the HRM (Bedford/Sackville 50 percent and Dartmouth/Eastern Shore 42 percent).

### *4.1.2 The Shift in Travel Demand*

Our second analysis attempted to quantify the shift in travel patterns from the Highway 102/103 and the Route 213 corridors to the proposed Highway 113 in the planning horizon year 2026.

The Highway 102/103 corridor was identified as “Route 1” and the Route 213 corridor was denoted “Route 2”. The analysis reviewed the number of trips between the start and end of each route, both before and after implementation of the proposed Highway 113. This process provided insight into the changes in route choice behaviour as a direct result of Highway 113. Figure 6 illustrates the results of this analysis.

*Figure 6: Select Link Analysis: Observed Travel Demand Shift with Highway 113 in 2026*




The results indicate that the Highway 102/103 corridor (Route 1) would experience a 100 percent reduction in trips. Route 2 is also expected to experience a significant reduction of trips – a 75 to 80 percent reduction. It is clear from these results that the proposed Highway 113 provides an attractive alternative route.

A further review was carried out to determine the number of daily trips that are forecast to shift away from Route 1 and 2. The results are contained in Table 5.

*Table 5: Expected Daily Volume Shift as a Result of Highway 113*

| | 2026 Regional Plan Scenario | | |
|---|---|---|---|
| **Corridor** | **Before** (No Highway 113) | **After** (Highway 113 in place) | **Volume Change** |
| Route 1 | 250 vpd | 0 vpd | -250 vpd |
| Route 2 | 2,500 vpd | 550 vpd | -1,950 vpd |

vpd – vehicles per day

The results in Table 5 are consistent with our reviews of both the Regional desire line patterns and the select link analysis regarding the origin of Highway 113 trips. They indicate that the total volume of traffic currently using the Highway 102/103 corridor for cross-regional travel is

relatively insignificant (approximately 250 daily trips). In addition notwithstanding the fact that 100 percent of the “divertable” trips from this particular corridor are expected to use Highway 113 when constructed, the shift is not expected to result in a notable increase in residual capacity on Highway 102.

Having said this, we note that the HRM Model does not consider "external trips" - travel that moves completely through the Region without stopping (with both origins and destinations outside of the Region). These types of trips may include commercial truck traffic or tourism and commuter vehicle trips. The percentage of these trips that may or may not be "divertable" to Highway 113, and their magnitude as a proportion of all Highway 102 traffic is simply not available from our QRS II modelling efforts. While they would most certainly be present and represent a further diversion of traffic to Highway 113, we simply don't know whether that diversion would be significant in freeing up additional residual capacity on Highway 102.

#### *4.1.3 A Summary of the Modelling Results*

The following points summarize the findings from this analysis:

- Nearly 100 percent of all trips that are forecast to use Highway 113 are cross-regional trips that originate in either Bedford/Sackville, Dartmouth or the peninsula and are destined to the St. Margaret’s bay area or points beyond;

- The Highway 102/103 corridor (Route 1 in this analysis) is considered a circuitous route and adds considerable length to a cross-regional trip. This likely contributes to the fact that the model forecasts a minimal amount of traffic on this route both before and after the proposed Highway 113 is in place.

- Highway 113 provides an attractive high-speed route choice and is expected to attract a significant *percentage* of cross-regional trips from both the Highway 102/103 and Highway 102/213 corridors;

It is also important to note that there are long-term plans for a high-speed facility linking Highway 107 to Highway 102 (in the vicinity of the Burnside Industrial Park). If this facility (sometimes referred to as the Highway 107 Extension) is constructed, and if the proposed Highway 113 is in place, a regional freeway “ring road” circumnavigating the harbour would be complete. As a result, we would expect that the connection between Highway 107 and 102 may attract a greater number of trips to Highway 113 – beyond that forecast by the model.

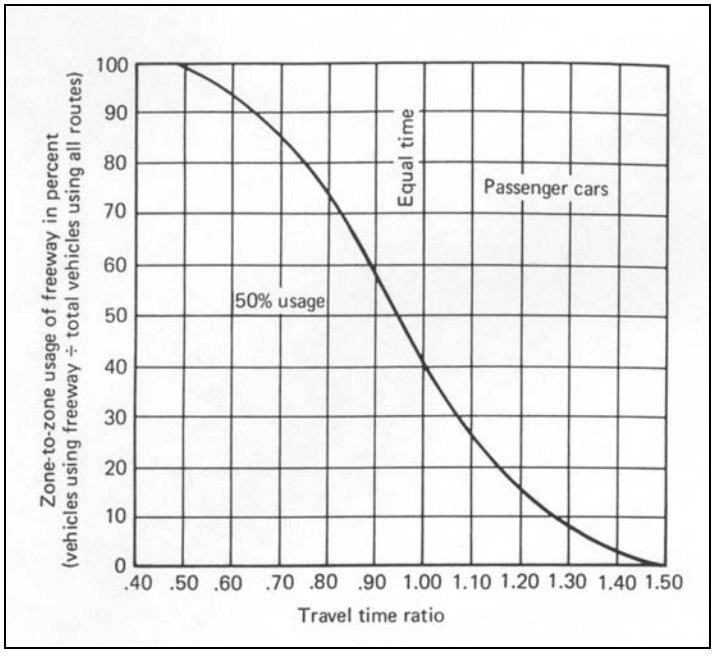
## 4.2 An Alternative Assignment Technique

In order to provide an additional but independent evaluation of the volumes forecast for Highway 113 in the planning horizon year we carried out an alternative travel assignment technique. The process is founded on Dial's research[4] in the proportional stochastic assignment process that uses travel time ratios between routes as the basis for determining trip diversions between route alternatives. This type of high-level planning is an efficient and useful supplementary method to determine estimates of diversion to new corridors as an additional line of evidence to the traditional transportation modelling approach.

Dial developed a logit relationship describing route choice behaviour based on travel time ratios. This is illustrated in Figure 7. Using this relationship and the modelled travel times for each route choice[5], travel time ratios were calculated for the alternative routes under consideration and shown in Table 6.

In order to carry out the analysis, a cross-regional origin-destination (OD) pair must be identified. We selected the Burnside Industrial Park and Tantallon pair for the cross-regional travel behaviour and the plausibility that this type of trip interchange may occur. The potential major route choices between this OD pair are shown in Figure 8.

*Figure 7: Dial's Proportional Stochastic Assignment Curve*




[4] Dial, R. US Department of Commerce, *Traffic Assignment Manual*. Bureau of Public Roads. 1964.
[5] Travel times were determined using the QRS II model.

*Figure 8: Location of the Three Route Choices for Travel*

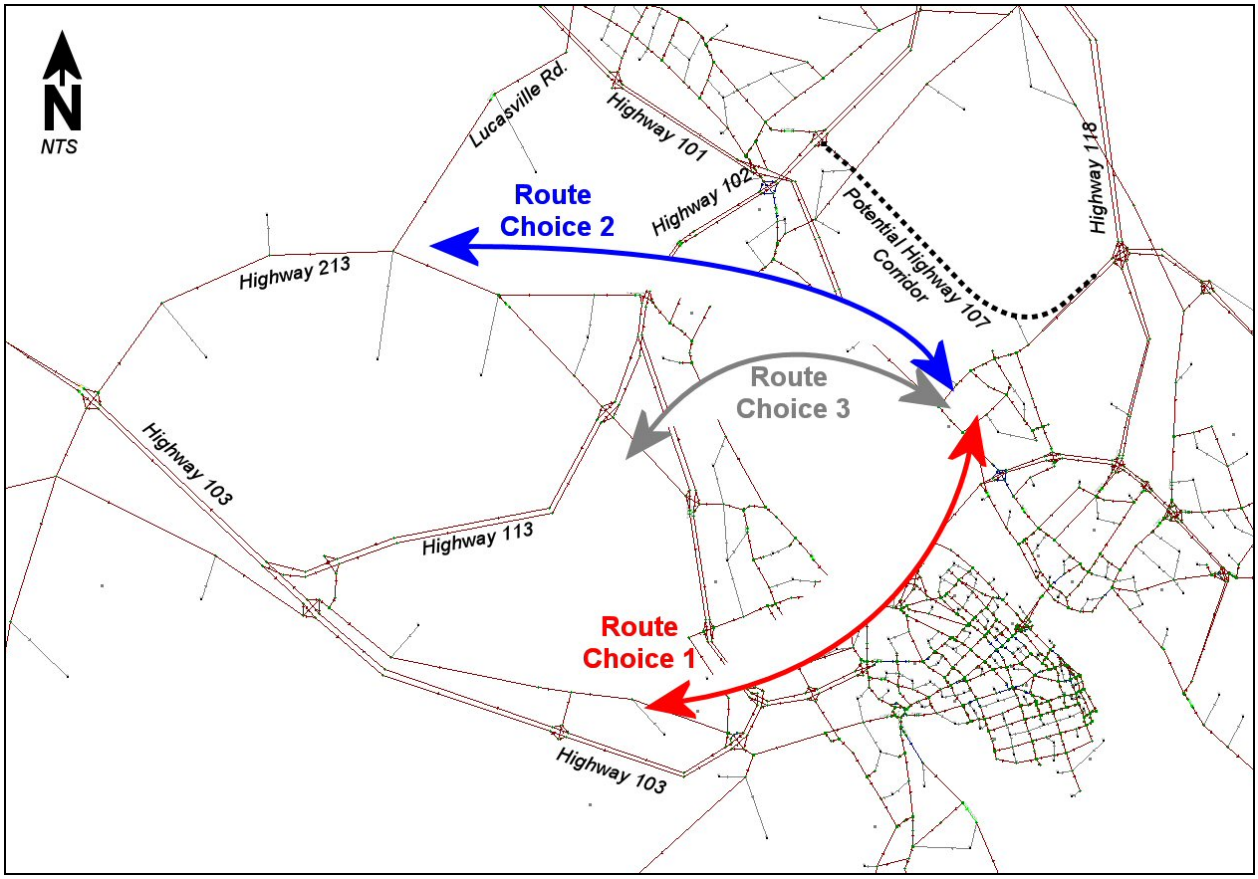



*Table 6: PM Peak Hour Travel Time Ratios for Routes 1, 2 & 3*

| | 2026 Horizon Year | |
|---|---|---|
| | **No Highway 113 in Place**<br><br>**Route 1 vs. Route 2** | **With Highway 113**<br>**Route 1 vs. Route 2**<br>**+time savings (Route 3)** |
| Travel Time Ratio | 0.901 | 1.009 |
| Route 1 Percent Usage[A] | 58% | 40% |

A – These values are taken from Dial's proportional stochastic curve

As shown in the table, the estimated difference in the percentage of traffic is 18 percent. This is considered our "attractiveness" factor that is applied to the 2026 corridor volumes for each route choice. Volume estimates of diverted traffic to Highway 113 are contained in Table 7.

*Table 7: Estimates of Daily Volume Diversion*

| | Route 1: Hwy 103 | Route 2: Hwy 213 |
|---|---|---|
| 2026 Volume (outbound direction only)[A] | 16,500 vehicles | 9,000 vehicles |
| Attractiveness Factor | 18% | 18% |
| **Volume Reduction (vehicles/hour)** | **2,970** | **1,620** |

A – Forecast 2026 volumes were calculated using the HRM QRS II model and then converted to daily volumes

Based on the proportional stochastic calculation process it is expected that volumes would be reduced on Highway 103 by approximately 3,000 vehicles per day (outbound); the QRS II model predicted a reduction of 2,200 vehicles per day.

Using the proportional stochastic calculation process on Route 213 a reduction of approximately 1,600 vehicles per day (outbound) is expected. The QRS II model estimated that this reduction would amount to 1,500 vehicles per day.

In summary, the estimated trip diversion from Highway 103 and Route 213 using both the QRS II model and the proportional stochastic assignment methodology yields similar results and the two independent processes appear to corroborate one another.

## 4.3 Effects of Induced Travel and Latent Demand

When a new transportation facility is opened for use, traffic begins to move upon it. The majority of this traffic is the "base" or "diverted" traffic that would have continued to use old infrastructure if the new facility had not been opened. Most conventional travel demand models (including QRSII) focus their prediction efforts on this component of increased travel, and the component associated with continuing growth of population and employment over time in the region being modelled.

However, there is a well-defined additional component of travel demand that shifts to the new facility as well - something that transportation economists call the "induced" demand. Without going into the complexities of the economic definition of this additional component of demand on the facility, suffice it to say that the "inducement" for travel on this facility is economic in nature - flowing from the (presumably) improved user benefits that result from the new facility and thus attract travelers that might not otherwise have traveled on the facility because they would not have made the trip (by that mode) under the earlier conditions. They may have traveled by another mode, or they may simply not have traveled at all because it was not convenient. The presence of the new facility, and its convenience and cost effectiveness "induce" the person to make the trip. Hence the term "induced demand". Estimating induced demand is difficult, but there is ample

empirical evidence of its existence. Strathman *et al.*[6] describe induced travel as contributing to an overall net increase in travel demand. Litman discusses induced travel demand effects and notes that most current transportation models do not account for its existence and hence underestimate the amount of traffic likely to be generated when new facilities are opened or congested roads are expanded[7].

To help us estimate the level of induced travel we carried out a literature review of research studies in North America. A short summary of these findings is contained in Table 8.

*Table 8: Literature Review Results for Induced Traffic (As cited in Litman[8])*

| | **Short Term (0-3 years)** | **Long Term (>3 years)** |
|---|---|---|
| Fulton *et al.* | 10-40% | 50-80% |
| Goodwin | 28% | 57% |
| Johnson and Ceerla | ~ | 60-90% |

The results of this review are obviously highly variable. Nonetheless, they do provide some general guidance in respect of ranges of induced demand that might be expected over time on Highway 113.

The effects of induced demand do extend across both short and longer term periods (as theory predicts), and vary greatly in magnitude. Nonetheless, all are relatively substantial – with the short term range spanning from 10 to 40 percent additional demand on the facility in the first three years. As a prudent measure we recommend that the forecast trips from the QRS II model be increased to a range value between 10 and 40 percent higher than the actual discrete predicted value.

[6] Strathman, J. *et al*. *Analysis of Induced Travel in the 1995 NPTS*. Centre for Urban Studies, Portland State University. 2000.
[7] Litman, T., *Generated Traffic and Induced Travel: Implications for Transport Planning*. Victoria Transport Policy Institute. May 2005.
[8] Ibid.

# 5 TRUCK ROUTE IMPLICATIONS

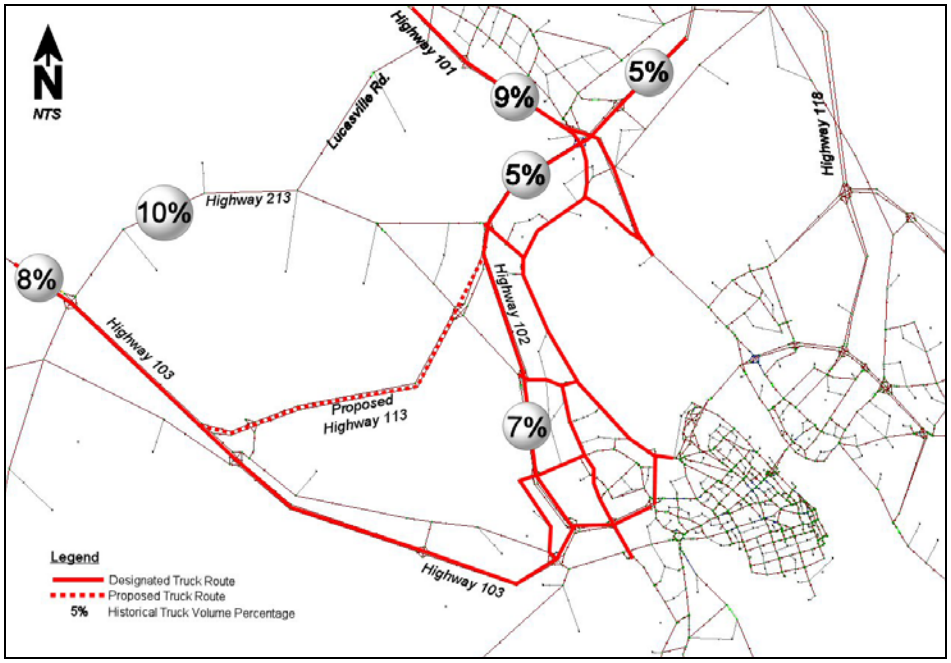
In Canada, the movement of goods via commercial vehicles has become the most dominant method of freight shipment in the last 30 years – surpassing that of rail freight[9]. The amounts of freight on our highways have a significant impact on system infrastructure deterioration rates including pavement conditions, operational characteristics and safety.

## 5.1 Existing Study Area Truck Routes

Currently, through-trucking movements in the study area (for example, from Truro to Bridgewater) must use the Highway 102/103 corridor to by-pass Halifax – a long and circuitous route. The most direct route may be along Route 213 but through-trucking is restricted on this facility. Due to the constraints on Highway 102 identified earlier, through truck traffic on this Highway may have a substantial deleterious effect on both capacity and safety conditions.

Figure 9 shows the truck route network in the vicinity of the study area. The routes are highlighted in red and truck percentages are supplied at locations where they were available – primarily on facilities belonging to TPW. HRM generally does not carry out vehicle classification counts. Figure 9 illustrates the circuitous route required by through-trucking movements in the Region.

*Figure 9: Designated Study Area Truck Routes & Truck Percentages*




[9] As cited from the Ontario Trucking Association. http://www.ontruck.org/issues/docs/railcoop.htm. Accessed on March 16, 2006.

Historical goods movement data is available through Statistics Canada and is collected as part of the census process. This information would provide an accurate indication of the number of commercial truck interchanges in and through the Region and could be used as the foundation for determining an approximate peak hour truck volume on the Highway 102/103 corridor. This type of analysis was not carried out for this study due to budget and time constraints but we expect the number of *peak hour* trips to be less than 10 percent of the existing volume.

## 5.2 Truck Routes and Highway 113

The implementation of Highway 113 as a truck route could likely attract through-trucking trips and would allow Highway 102 (between Highway 113 and the peninsula) to operate primarily as a commuter freeway servicing the Halifax Peninsula. This would likely improve short-term capacity constraints and more importantly it would reduce safety risks associated with larger vehicles.

Route 213 currently has a relatively high truck percentage considering that through-trucking is not permitted. This is likely due in part to the Atlantic Acres Business Park that attracts and generates commercial truck traffic. It is expected that if Highway 113 is constructed and an interchange is built at Kearney Lake Road, a significant reduction of the percentage of heavy trucks would likely occur. This would improve long-term capacity through the removal of the truck traffic constraints and again, could contribute to reductions in the risks associated with the interaction of conventional passenger vehicles with heavy trucks.

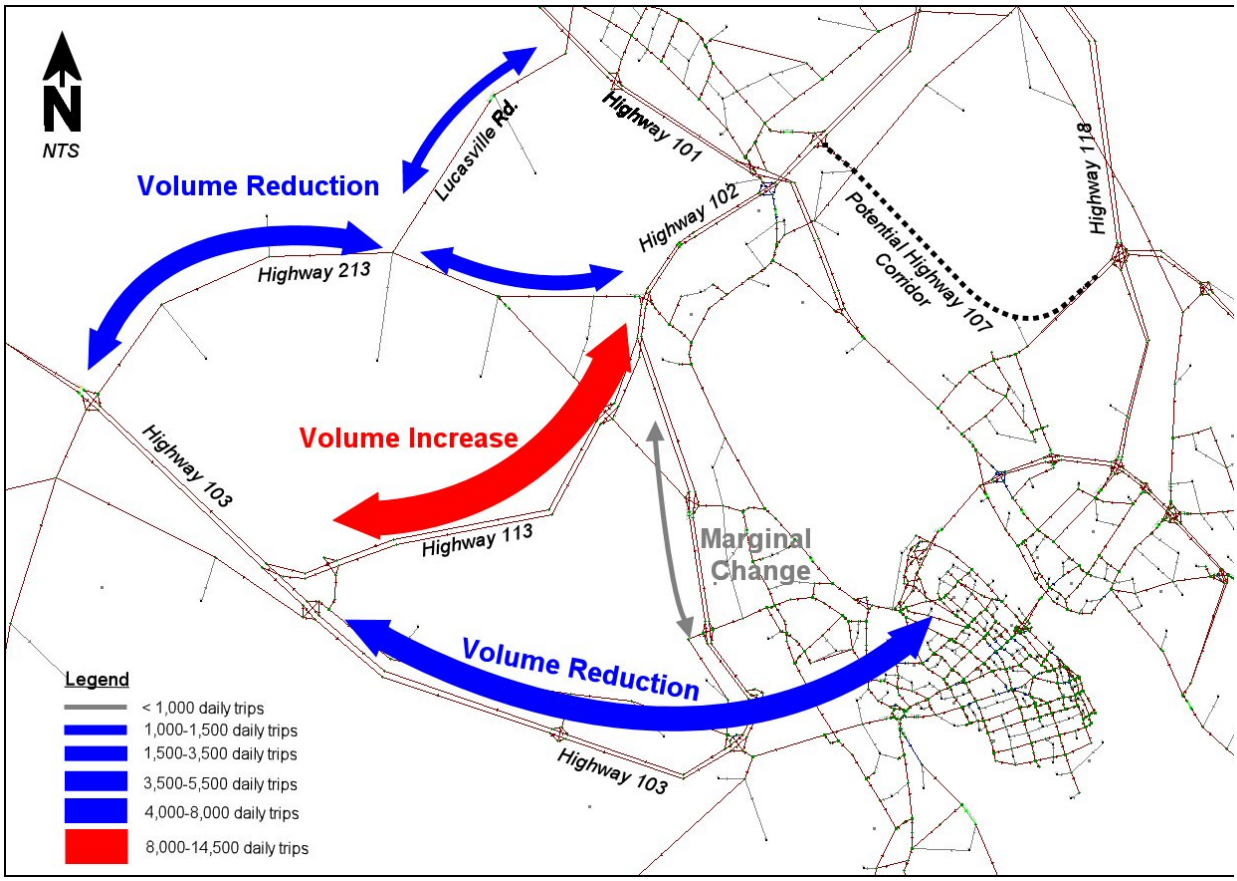
# 6 FINDINGS & CONCLUSIONS

## 6.1 Travel Demand

Based on the transportation modelling effort, we found that at the horizon year (2026) there is significant demand for a high-speed corridor linking Highway 102 and Highway 103. The forecast base demand is 8,000 to 14,500 daily trips. Given the effects of external trips (including through goods movements), induced travel demand, and the potential construction of key infrastructure (such as the completion of Highway 107 and an interchange connection to the Kingswood subdivision) we believe that longer term planning should aim to accommodate substantially higher volumes than these baseline predictions.

The base horizon year demand is illustrated in Figure 10 and does not include the additional supplementary demand effects mentioned immediately above. These findings confirm our initial review of existing conditions and were corroborated using an alternative modelling process.

*Figure 10: 2026 Travel Demand Modelling Results with Highway 113*



## 6.2 Regional Plan Considerations

HRM forecasts that there will be modest and sustained population and employment growth in the Study Area up to the planning horizon of 2026. More specifically, we note that in the latest Draft Regional Plan, HRM acknowledges the capacity constraints that are currently being approached on Hammonds Plains Road (Route 213) and, the need to deal with this reality in the long term.

The Regional Plan's Map 7 identifies Highway 113 for future development but anticipates that it would not be required within the 25-year planning horizon. To off-set the demand for a new corridor, HRM plans to control growth in the Hammonds Plains area; and also to increase the level of transit service to the corridor, in hopes of reducing overall vehicular trip demand. These initiatives may address local sources of traffic on Route 213 (Hammonds Plains Road). Further south and west in the St. Margaret's Bay area, vehicle trip demand may be served in part by the planned rural express bus service to Tantallon.

# APPENDIX A – THE TRANSPORTATION MODEL

***Overview***

Traditional four-step models are useful tools for long term, travel demand forecasting over large regional road networks. They are calibrated based on a macroscopic scale using screen lines. Several arterial roadways make up a screen line and contribute to the overall results. As such, a calibrated model may have an accurate screen line volume (relative to existing volumes) but individual links that make up the screen line may experience volume discrepancies. This is the nature of transportation models.

It is these complexities that must be kept in mind when interpreting absolute traffic volume results from a transportation model and engineers and planners should not base major decisions solely on these values. Instead, the volume results of a model should be considered as coarse estimates and weighed against results from other forecasting methods. What is valuable from the modelling exercise is the relative shift in demand that can be expressed as a proportion.

The estimated volumes resulting from the modelling process represent weekday PM peak hour volumes. However, for the purposes of this report and ease of understanding we have expressed volume forecasts as daily volumes. The modelling process calculates the peak hour travel time delay on each link. Once the delay exceeds that of an alternative route the assignment of volumes tends to plateau (a balancing effect between routes). What is not demonstrated by the model, however, is the lengthening of the peak hour when all the route options become congested - termed peak spreading – in which daily volumes would continue to increase over time but the peak hour volume would remain at capacity.

***Model Caveats***

Two particular limitations must be noted regarding the existing HRM QRS II model:

**1)** The model was previously developed without accounting for external-to-external trips. These are simply trips not destined to a location within the region. It was determined that quantifying these trips would be laborious and would not significantly influence the results of this study. Given this conclusion we still deemed these trips important and considered their potential impact in general terms in the concluding discussions.

In general terms, we carried out a literature review to quantify the effect of external-to-external trips. Based on several reports from jurisdictions in the United States, freight studies have indicated a range of 2 to 27 percent of truck trips are external-to-external trips[10,11]. Other studies considering all vehicle types had a range of 3 to 7 percent for all external-to-external trips[12,13]. Of course these numbers may not be directly transferable to the Halifax Regional Municipality but it does provide an order of magnitude indication. Using this general estimate of volumes it is expected that the external-to-external trips for this model represents a volume that is significantly less than the capacity of one travel lane.

[10] Schlappi, Marshall, and Itamura. *Truck Travel in the San Francisco Bay Area*. TRB 72nd Annual Meeting, Paper No. 930477. 1993.

[11] Matherly, D. *Stream of Traffic Interview Truck Survey: Methodology and Recommendations on Traffic Volume Thresholds*. 75th Annual Meeting of the Transportation Research Board. Paper 960581. 1995.

[12] Yuma Metropolitan Planning Organization. *1990 Origin-Destination Survey*. 1990.

[13] Maricopa Association of Governments. *Phoenix External Travel Survey*. Prepared by Parsons Transportation Group, Inc. Phoenix Arizona. 2001.

**2)** The model calibration process followed accepted practices and methodologies and the overall regional demand was calibrated within 2 percent of actual 2001 conditions. However, in our study area the “Bedford-Halifax” screenline (screenline 3) which crosses the harbour (and includes Windmill Road, Bedford Highway, Dunbrack Street and Highway 102) was determined to be modelling 2001 volumes lower than observed. The total screenline volume under 2001 conditions was 11,200 vehicles/hour and the model results yielded 10,200 vehicles/hour. This may contribute in part to the reason for the low forecast 2026 volumes on Highway 102 between Exits 1A and 2A.

## APPENDIX B – THE FORECAST LINK VOLUMES

The following tables contain the link volume results from the QRS II model for each of the study area links under study. The model results are given in peak hour volumes; however, for ease of understanding we have converted these to daily volume estimates. The conversion process was based on the assumption that the peak hour volume represents 10 percent of the daily volume. This value varies from highway to highway (depending on its service function) but the general average is typically near the 10 percent value.

Table B-1 summarizes the travel demand resulting from the HRM's 2026 Regional Plan planning scenario and Table B-2 summarizes the demand resulting from the HRM's 2026 Base Case planning scenario.

| Roadway | Location | 2001 Basecase | | | 2026 Regional Plan Scenario | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Highway 113 | | | No Highway 113 | | | Highway 113 in place | | | *Volume Change (two-way)* |
| | | Inbound | Outbound | Two-way Volume | Inbound | Outbound | Two-way Volume | Inbound | Outbound | Two-way Volume | |
| Highway 113 | - West of Trunk 3 Connector | ~ | ~ | ~ | ~ | ~ | ~ | 2,500 | 3,000 | 5,500 | *5,500* |
| | - West of Kearney Lake Road interchange | ~ | ~ | ~ | ~ | ~ | ~ | 3,500 | 4,500 | 8,000 | *8,000* |
| | - East of Kearney Lake Road interchange | ~ | ~ | ~ | ~ | ~ | ~ | 3,000 | 4,500 | 7,500 | *7,500* |
| Trunk 3 Connector | - Between Trunk 3 & Highway 113 | ~ | ~ | ~ | ~ | ~ | ~ | 1,500 | 1,000 | 2,500 | *2,500* |
| Highway 103 | - Between Exits 5 & 6 | 4,000 | 5,500 | 9,500 | 4,000 | 5,000 | 9,000 | 4,000 | 5,500 | 9,500 | *500* |
| | - Between Exits 4 & 5 | 3,300 | 5,500 | 8,800 | 3,500 | 5,500 | 9,000 | 5,000 | 8,000 | 13,000 | *4,000* |
| | - Between Exits 3 & 4 | 7,000 | 11,000 | 18,000 | 7,000 | 11,500 | 18,500 | 6,000 | 10,000 | 16,000 | *-2,500* |
| | - Between Exits 2 & 3 | 10,000 | 15,500 | 25,500 | 10,000 | 16,500 | 26,500 | 8,500 | 14,000 | 22,500 | *-4,000* |
| | - Between Exits 1A & 2 | 13,500 | 20,000 | 33,500 | 14,000 | 21,500 | 35,500 | 12,500 | 19,000 | 31,500 | *-4,000* |
| Highway 102 | - Between Exits 1A & 2A | 11,500 | 15,500 | 27,000 | 14,000 | 21,500 | 35,500 | 13,000 | 21,500 | 34,500 | *-1,000* |
| | - Between Exits 2A & 2 | 14,000 | 19,500 | 33,500 | 19,000 | 27,000 | 46,000 | 18,000 | 27,500 | 45,500 | *-500* |
| | - Between Exits 2 & 3 | 14,500 | 17,000 | 31,500 | 16,000 | 22,000 | 38,000 | 18,000 | 22,500 | 40,500 | *2,500* |
| Kearney Lake Road | - Between Highways 102 & 113 | 2,000 | 5,500 | 7,500 | 6,000 | 11,000 | 17,000 | 5,500 | 11,000 | 16,500 | *-500* |
| | - West of Highway 113 | 2,000 | 5,500 | 7,500 | 6,000 | 11,000 | 17,000 | 5,500 | 11,500 | 17,000 | *0* |
| Route 213 (Hammonds Plains) | - East of Highway 102 | 3,000 | 4,500 | 7,500 | 5,000 | 4,000 | 9,000 | 5,000 | 4,500 | 9,500 | *500* |
| | - West of Highway 102 | 8,000 | 7,500 | 15,500 | 13,500 | 16,000 | 29,500 | 13,000 | 15,000 | 28,000 | *-1,500* |
| | - East of Lucasville Road | 7,500 | 11,000 | 18,500 | 7,000 | 8,000 | 15,000 | 5,500 | 7,000 | 12,500 | *-2,500* |
| | - West of Lucasville Road | 6,500 | 9,000 | 15,500 | 6,000 | 8,000 | 14,000 | 4,400 | 6,000 | 10,400 | *-3,600* |
| | - East of Highway 103 | 4,500 | 4,000 | 8,500 | 5,000 | 4,000 | 9,000 | 3,000 | 2,000 | 5,000 | *-4,000* |
| | - West of Highway 103 | 1,500 | 2,000 | 3,500 | 2,000 | 2,000 | 4,000 | 2,000 | 2,500 | 4,500 | *500* |
| Lucasville Road | - East of Route 213 | 2,000 | 2,000 | 4,000 | 3,500 | 2,000 | 5,500 | 3,000 | 1,500 | 4,500 | *-1,000* |
| Trunk 3 | - West of Highway 103 | 4,000 | 6,000 | 10,000 | 4,000 | 6,500 | 10,500 | 4,000 | 6,000 | 10,000 | *-500* |
| | - Between Highway 103 & Trunk 3 Connector | 1,000 | 500 | 1,500 | 1,000 | 500 | 1,500 | 1,000 | 1,000 | 2,000 | *500* |
| | - East of Trunk 3 Connector | 1,000 | 500 | 1,500 | 1,000 | 500 | 1,500 | 2,000 | 1,500 | 3,500 | *2,000* |
| | - West of Exit 3 Connector | 4,000 | 6,000 | 10,000 | 4,500 | 6,500 | 11,000 | 3,500 | 5,500 | 9,000 | *-2,000* |
| | - East of Exit 3 Connector | 1,000 | 1,500 | 2,500 | 1,000 | 2,000 | 3,000 | 1,000 | 2,000 | 3,000 | *0* |

| Roadway | Location | 2001 Basecase | | | 2026 Basecase | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Highway 113 | | | No Highway 113 | | | Highway 113 in place | | | *Volume Change (two-way)* |
| | | Inbound | Outbound | Two-way Volume | Inbound | Outbound | Two-way Volume | Inbound | Outbound | Two-way Volume | |
| Highway 113 | - West of Trunk 3 Connector | ~ | ~ | ~ | ~ | ~ | ~ | 3,500 | 5,500 | 9,000 | *9,000* |
| | - West of Kearney Lake Road interchange | ~ | ~ | ~ | ~ | ~ | ~ | 5,500 | 9,000 | 14,500 | *14,500* |
| | - East of Kearney Lake Road interchange | ~ | ~ | ~ | ~ | ~ | ~ | 5,000 | 7,000 | 12,000 | *12,000* |
| Trunk 3 Connector | - Between Trunk 3 & Highway 113 | ~ | ~ | ~ | ~ | ~ | ~ | 3,000 | 2,000 | 5,000 | *5,000* |
| Highway 103 | - Between Exits 5 & 6 | 4,000 | 5,500 | 9,500 | 5,000 | 7,000 | 12,000 | 5,500 | 7,000 | 12,500 | *500* |
| | - Between Exits 4 & 5 | 3,300 | 5,500 | 8,800 | 6,500 | 8,000 | 14,500 | 8,000 | 12,000 | 20,000 | *5,500* |
| | - Between Exits 3 & 4 | 7,000 | 11,000 | 18,000 | 11,500 | 17,000 | 28,500 | 9,500 | 14,000 | 23,500 | *-5,000* |
| | - Between Exits 2 & 3 | 10,000 | 15,500 | 25,500 | 16,500 | 27,000 | 43,500 | 13,500 | 22,000 | 35,500 | *-8,000* |
| | - Between Exits 1A & 2 | 13,500 | 20,000 | 33,500 | 22,000 | 36,000 | 58,000 | 18,500 | 31,500 | 50,000 | *-8,000* |
| Highway 102 | - Between Exits 1A & 2A | 11,500 | 15,500 | 27,000 | 17,000 | 20,000 | 37,000 | 15,000 | 19,500 | 34,500 | *-2,500* |
| | - Between Exits 2A & 2 | 14,000 | 19,500 | 33,500 | 19,000 | 25,500 | 44,500 | 19,000 | 25,500 | 44,500 | *0* |
| | - Between Exits 2 & 3 | 14,500 | 17,000 | 31,500 | 18,500 | 22,000 | 40,500 | 18,500 | 22,000 | 40,500 | *0* |
| Kearney Lake Road | - Between Highways 102 & 113 | 2,000 | 5,500 | 7,500 | 6,000 | 10,000 | 16,000 | 6,000 | 10,500 | 16,500 | *500* |
| | - West of Highway 113 | 2,000 | 5,500 | 7,500 | 6,000 | 10,000 | 16,000 | 5,500 | 9,000 | 14,500 | *-1,500* |
| Route 213 (Hammonds Plains) | - East of Highway 102 | 3,000 | 4,500 | 7,500 | 4,500 | 5,000 | 9,500 | 5,000 | 5,500 | 10,500 | *1,000* |
| | - West of Highway 102 | 8,000 | 7,500 | 15,500 | 12,500 | 15,500 | 28,000 | 12,000 | 14,500 | 26,500 | *-1,500* |
| | - East of Lucasville Road | 7,500 | 11,000 | 18,500 | 10,500 | 14,500 | 25,000 | 9,000 | 12,000 | 21,000 | *-4,000* |
| | - West of Lucasville Road | 6,500 | 9,000 | 15,500 | 10,000 | 16,000 | 26,000 | 8,000 | 12,500 | 20,500 | *-5,500* |
| | - East of Highway 103 | 4,500 | 4,000 | 8,500 | 7,500 | 7,500 | 15,000 | 5,000 | 4,000 | 9,000 | *-6,000* |
| | - West of Highway 103 | 1,500 | 2,000 | 3,500 | 4,500 | 4,000 | 8,500 | 4,000 | 4,500 | 8,500 | *0* |
| Lucasville Road | - East of Route 213 | 2,000 | 2,000 | 4,000 | 5,500 | 2,000 | 7,500 | 4,500 | 1,500 | 6,000 | *-1,500* |
| Trunk 3 | - West of Highway 103 | 4,000 | 6,000 | 10,000 | 5,500 | 9,500 | 15,000 | 6,000 | 9,000 | 15,000 | *0* |
| | - Between Highway 103 & Trunk 3 Connector | 1,000 | 500 | 1,500 | 2,000 | 1,500 | 3,500 | 1,500 | 1,500 | 3,000 | *-500* |
| | - East of Trunk 3 Connector | 1,000 | 500 | 1,500 | 2,000 | 1,500 | 3,500 | 3,500 | 2,500 | 6,000 | *2,500* |
| | - West of Exit 3 Connector | 4,000 | 6,000 | 10,000 | 6,500 | 10,500 | 17,000 | 5,000 | 8,000 | 13,000 | *-4,000* |
| | - East of Exit 3 Connector | 1,000 | 1,500 | 2,500 | 1,500 | 500 | 2,000 | 1,000 | 500 | 1,500 | *-500* |