

**ROUTE 33 - KENSINGTON EXPRESSWAY
SAFETY STUDY REPORT**

Prepared for

**GREATER BUFFALO NIAGARA REGIONAL TRANSPORTATION
COUNCIL
&
NEW YORK STATE DEPARTMENT OF TRANSPORTATION**

Prepared by

**Bergmann Associates
40 La Riviere Drive
Buffalo, New York
14202**

In Cooperation with

**Nussbaumer and Clarke, Inc.
Synectic Transportation Consultants, Inc.
Eng-Wong Taub and Associates**

August 2002

Table of Contents

I.	INTRODUCTION AND PURPOSE OF STUDY	1
II.	DATA COLLECTION.....	2
A.	ACCIDENT INFORMATION.....	2
B.	TRAVEL TIME & DELAY STUDY	3
C.	SPOT SPEED STUDY.....	5
D.	RECORD PLAN REVIEW	5
E.	VIDEOS.....	10
F.	PHOTOGRAPHS.....	10
G.	CONDITION DIAGRAM AND FIELD REPORT FORMS	10
H.	TRAFFIC COUNTS	11
III.	ACCIDENT ANALYSIS METHODS	11
A.	ACCIDENT RATES	11
B.	RISK ANALYSIS METHOD.....	12
IV.	PRIORITIZED SAFETY LOCATIONS IDENTIFIED	13
V.	ACCIDENT REDUCTION IMPROVEMENTS	16
A.	PRELIMINARY ALTERNATIVES.....	16
B.	FEASIBLE ALTERNATIVES.....	16
VI.	BENEFITS - COSTS OF ALTERNATIVES	24
A.	BENEFITS	24
B.	COSTS	24
C.	BENEFIT/COST RATIOS	25
VII.	SUMMARY AND FINDINGS	26

Table of Tables

TABLE 1 - TRAVEL TIME & DELAY STUDY – ROUTE 33.....	6
TABLE 2 - SPOT SPEED STUDY SUMMARY	7
TABLE 2 cont. - SPOT SPEED STUDY SUMMARY	8
TABLE 2 cont. - SPOT SPEED STUDY SUMMARY	9
TABLE 3 - TOP 20 LOCATIONS OF EXISTING ACCIDENT RATE COMPARED TO STATEWIDE AVERAGE RATE	12
TABLE 4 - PRIORITIZED SAFETY LOCATIONS	15
TABLE 5 - PRELIMINARY LIST OF ALTERNATIVES FOR EACH SAFETY LOCATION	17
TABLE 5 cont. -PRELIMINARY LIST OF ALTERNATIVES FOR EACH SAFETY LOCATION	18
TABLE 5 cont - PRELIMINARY LIST OF ALTERNATIVES FOR EACH SAFETY LOCATION	19
TABLE 6 -FEASIBLE ALTERNATIVES FOR EACH SAFETY LOCATION	20
TABLE 6 cont.- FEASIBLE ALTERNATIVES FOR EACH SAFETY LOCATION.....	21
TABLE 7 - CORSIM EXPRESSWAY RESULTS NEAR FILLMORE AVENUE RAMP.....	22
TABLE 8 - SERVICE LIFE BY ALTERNATIVE	23
TABLE 9 - ANNUALIZED BENEFITS & COSTS BY ALTERNATIVE.....	25
TABLE 10 - ALTERNATIVES RANKED BY SAFETY BENEFIT / COST RATIO.....	27

Table of Figures

FIGURE 1 - ACCIDENTS BY TYPE – ROUTE 33	3
FIGURE 2 - EASTBOUND TRAVEL TIME SUMMARY - ROUTE 33	4
FIGURE 3 - WESTBOUND TRAVEL TIME SUMMARY - ROUTE 33	5
FIGURE 4 - PRIORITIZED SAFETY LOCATIONS	14

Table of Appendices

APPENDIX A - PIL LOCATIONS IDENTIFIED BY REFERENCE MARKERS
APPENDIX B - ACCIDENT SUMMARIES BY PIL
APPENDIX C - DETAILED ACCIDENT SUMMARIES BY INTERSECTION/SEGMENT
APPENDIX D - COLLISION DIAGRAMS –TE-56 FORMS
APPENDIX E - DETAILS OF EACH ACCIDENT –TE-213 FORMS
APPENDIX F - TRAVEL TIME & DELAY DATA
APPENDIX G - SPOT SPEED DATA
APPENDIX H - RECORD PLAN REVIEW
APPENDIX I - CONDITION DIAGRAM & FIELD REPORT FORM for Each Priority Safety Location
APPENDIX J - AVERAGE ANNUAL DAILY TRAFFIC
APPENDIX K - ACCIDENT RATES, NYSDOT PIL's, & RISK ANALYSIS RESULTS
APPENDIX L - COMPARATIVE LISTING OF CORRIDOR LOCATIONS BASED ON ACCIDENT
RATE & GLOBAL RISK VALUE
APPENDIX M - FEASIBLE ALTERNATIVES
APPENDIX N - SIMULATION RESULTS
APPENDIX O - TE-156A FORMS
APPENDIX P - TE-164a FORMS
APPENDIX Q - COST OF ALTERNATIVES – PES
APPENDIX R - TE-204a FORMS

I. INTRODUCTION AND PURPOSE OF STUDY

The Greater Buffalo Niagara Regional Transportation Council (GBNRTC) is the interagency transportation planning group which establishes policies and programs for the Niagara Frontier. GBNRTC is the Metropolitan Planning Organization (MPO) for the Greater Buffalo-Niagara Region. The organization provides a regional decision-making forum for the development of a multi-modal, integrated transportation system that best fits the Niagara Frontier.

The Unified Planning Work Program (UPWP) describes the planning activities of the GBNRTC in Erie and Niagara Counties. It is developed annually in cooperation with federal, state and local agencies to document and provide a comprehensive overview of the annual agency's short and long-range transportation planning activities. The UPWP identifies the transportation planning activities, which are to be undertaken in support of the vision, goals, objectives, and policies identified in the Long-Range Plan.

In the fall of 2001, GBNRTC and the New York State Department of Transportation (NYSDOT) initiated a corridor safety study for New York State Route 33 Expressway in Erie County. Limits of the corridor study extended from reference marker 33-5301-1008 (western limit of expressway, vicinity of Goodell/Tupper and Elm/Oak, City of Buffalo) to 33-5301-2033 (eastern limit of expressway Genesee Street/Buell Avenue, Town of Cheektowaga). The western limit of the study corridor includes the intersections of Goodell @ Main/Pearl/Edward, Washington, and Ellicott and the intersections of Tupper @ Pearl, Main, Washington, and Ellicott. The expressway is commonly known as the Kensington Expressway.

The subject 9-mile corridor of the Kensington Expressway accommodates significant daily volumes exceeding 100,000 vehicles in the 4-mile segment between Fillmore Avenue and I-90. The 6-lane expressway has a posted speed limit of 50 mph. Vehicle operating speeds average 65 mph at the 85th percentile level between Jefferson Avenue and Union Road during off-peak periods. Average operating speeds during peak traffic periods in the peak travel direction are less, at approximately 50 mph eastbound during the PM peak period with a ± 3 mph variation depending on expressway segment. Operating speed westbound during the AM peak period averaged approximately 45 mph with a ± 5 mph variation, depending on expressway segment.

In accordance with current design standards or "*standards of the day*", several sections of the expressway have non-standard geometrics. They include weave lengths, stopping sight distance, headlight sight distance, horizontal radius, and acceleration and deceleration lane lengths.

There has been a history of numerous accidents with injuries and occasional fatalities along the expressway corridor. These severe type crashes have historically occurred in clusters. Contributing factors included speed, congestion and geometrics either singularly or in combinations.

The purpose of the corridor safety study was to identify high accident locations and methods to reduce accidents in the corridor. This was accomplished by analyzing the most recent available three-year period of accident history, 1997 - 1999. Using this data, the most severe safety locations and alternatives to mitigate accidents at the locations were identified. Alternatives considered elimination of weaving sections, closure of ramps, extension of local streets, implementation of

pavement treatments, additional signing, and inclusion of intelligent transportation systems (ITS) technologies.

II. DATA COLLECTION

Data collection included acquiring three years of accident information, identifying expressway geometrics, photo logging existing conditions, conducting travel time and delay studies, conducting spot speed studies, acquiring existing traffic volume count information, conducting field observations and collection existing condition information.

A. ACCIDENT INFORMATION

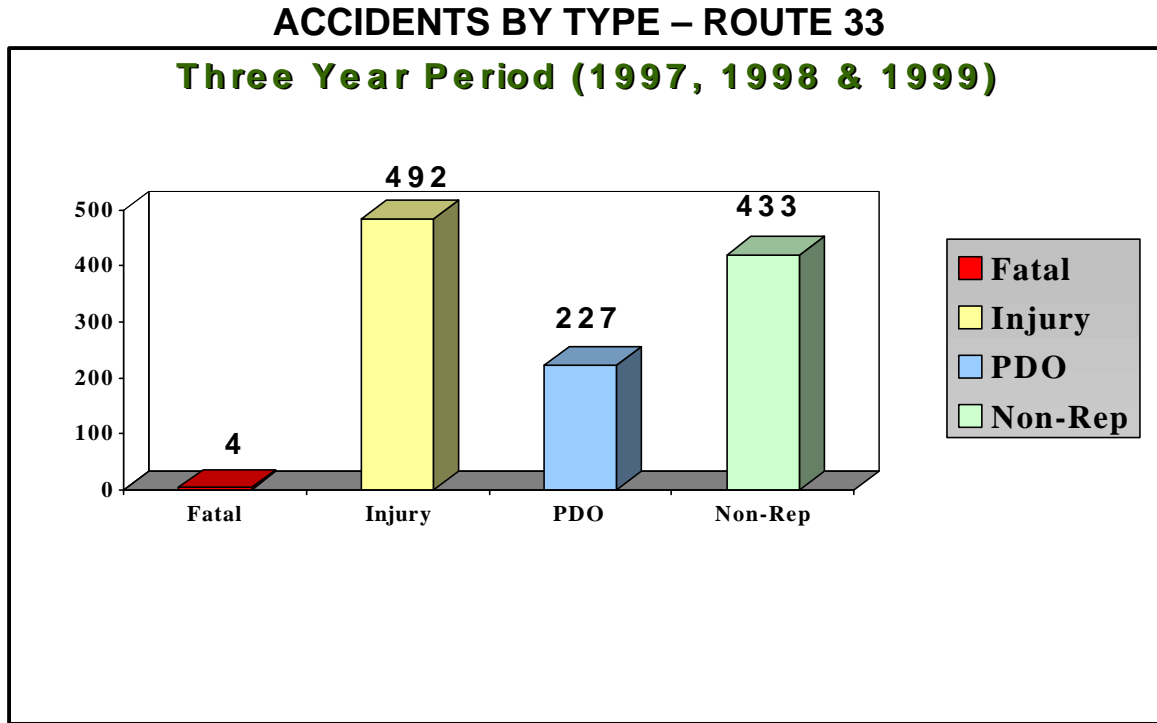
The NYSDOT provided accident information for years 1997 through 1999. The information consisted of police reports that identified various aspects of each crash, including date, time, severity, number of vehicles, crash type, and road conditions.

Accident information was provided for the expressway mainline, ramps, and street intersections at the termini of the ramps. The accident information was researched and provided by the NSYDOT from both the State Accident Surveillance System (SASS) and the Centralized Local Accident Surveillance System (CLASS). This was performed for both the expressway mainline, ramps and local roads intersecting ramp termini. Accident information was also provided for the limits of Goodell and Tupper Streets.

Accidents were coded to a reference marker system for Route 33. The reference marker map was provided by NYSDOT.

Accidents were coded to a Microsoft Access accident analysis database according to guidelines contained in the NYSDOT Safety Investigations Procedures Manual. A total of 1156 accidents were coded. The accidents consisted of **4 fatalities, 492 injury, 227 property damage only, and 433 non-reportable** crashes as shown in Figure 1.

FIGURE 1



Summaries of coded accidents were prepared for the entire length of the corridor by uniform lengths of the expressway, ramps, and intersections. Expressway segments, ramps, and intersections are identified and labeled in Appendix A. A total of 124 specific locations were utilized and are comprised of 36 mainline expressway segments, 14 intersections, 22 diverge locations, 19 merge locations, 7 off-ramps, 5 on-ramps, and 21 ramp intersections with local streets. The locations were consolidated into groups characterized as Priority Investigation Locations (PIL). Total accidents by PIL are summarized in Appendix B.

Detailed summaries of accidents by specific intersection/segment are contained in Appendix C. Details include crash severity, type, date, time, weather condition, road condition, vehicle type, light condition, and vehicle travel direction.

The location of each accident is shown on collision diagrams (Form TE-56) for the entire length of the corridor. Collision diagrams are in Appendix D.

The history of accidents over the three year period of 1997 through 1999 is contained on the TE-213 Forms in Appendix E. Details of each of the 1156 accidents are provided.

B. TRAVEL TIME & DELAY STUDY

A travel time and delay study was conducted for Route 33. It was conducted during three time periods: AM peak period (7 a.m. – 9 a.m.), Mid-Day period (11 a.m. – 1 p.m.), and PM peak period (4

p.m. – 6 p.m.). The study was conducted between Genesee Street in the Central Business District of the City of Buffalo and Genesee Street in the Town of Cheektowaga.

The study was conducted by making a minimum of 3 complete round trips during each time period. Only 3 round trips were made during the AM peak period due to congestion, 4 were made during the PM peak period, and 5 were made during the Mid-Day period.

The study was conducted utilizing the guidelines of the Institute of Transportation Engineers (ITE) Manual for conducting Transportation Engineering Studies. A test vehicle was utilized to travel with traffic in the center lane of the 3-lane section of Route 33 and in the right lane of the 2-lane section.

Overall results of the study are summarized in Table 1 and Figures 2 and 3. Detailed results for each travel trip by direction for each peak period are contained in Appendix F.

FIGURE 2

EASTBOUND TRAVEL TIME SUMMARY – ROUTE 33

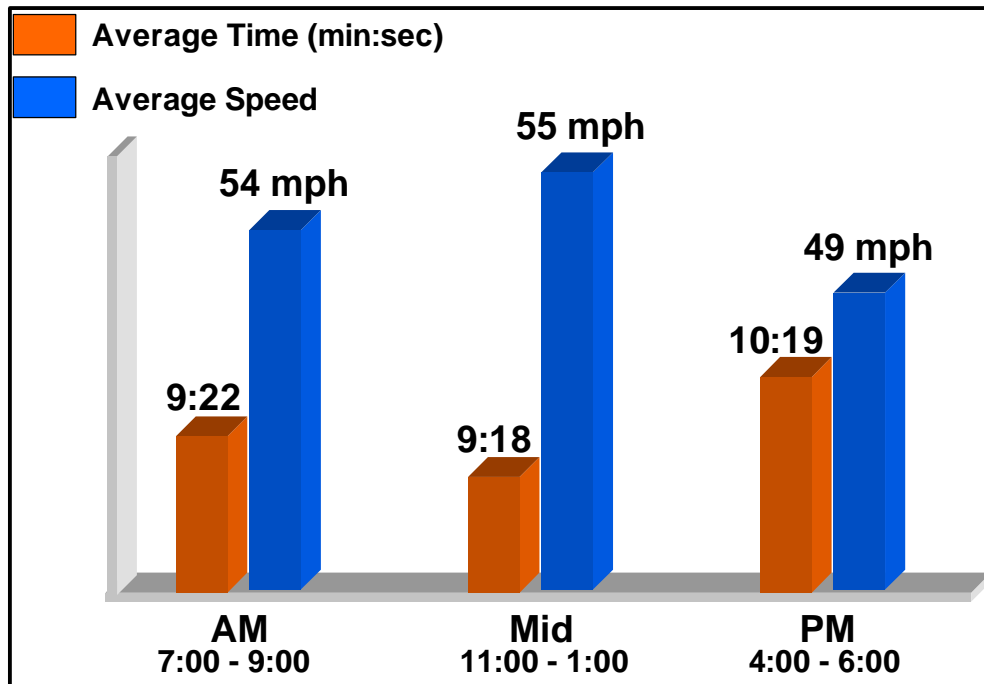
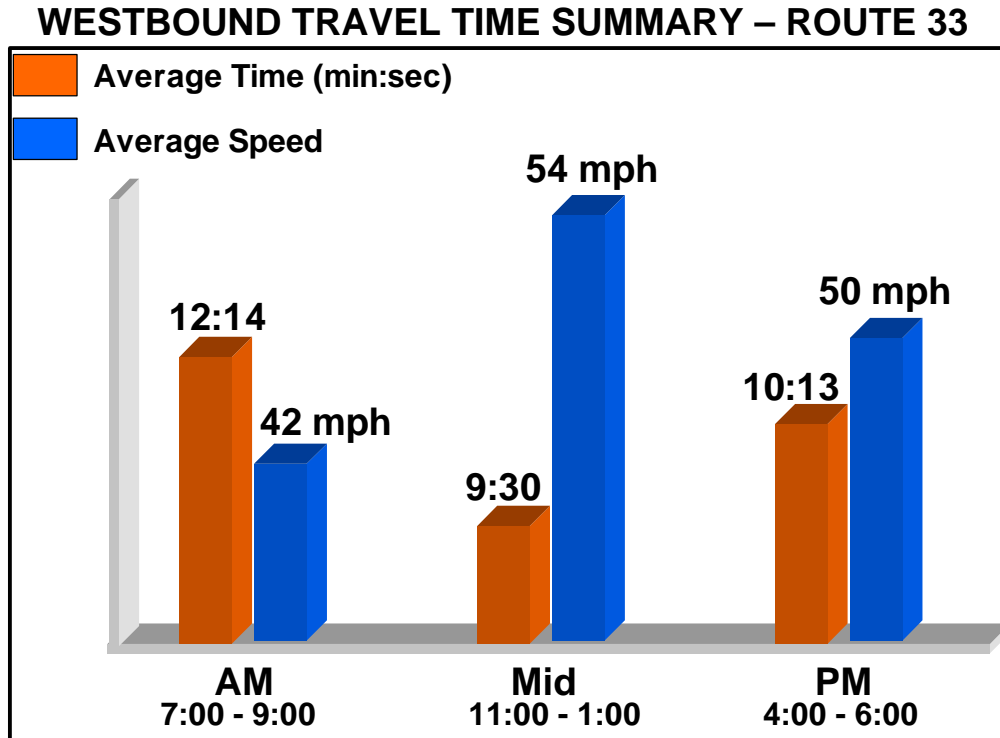


FIGURE 3



C. SPOT SPEED STUDY

A spot speed study was conducted along the corridor at 24 locations. The study was conducted utilizing the guidelines of the ITE manual for conducting Transportation Engineering Studies. The spot speed study was conducted during off-peak traffic periods – between 9:30 a.m. and 3:30 p.m.

The locations where speeds were collected consisted of 12 locations for eastbound traffic and 12 locations for westbound traffic. A radar gun was utilized to record spot speeds. A minimum of 100 speed samples was recorded for each location.

Overall results of the study are summarized in Table 2. Detailed speed data recorded is contained in Appendix G.

D. RECORD PLAN REVIEW

A review of the record plans for construction of the Kensington Expressway and the Pearl Street Connector was undertaken in order to identify locations where the standard values for the critical design elements are not achieved. In order to identify these locations of non-standard values, New York State's geometric design standards for the critical design elements were identified and applied. A detailed report of Record Plan Review is contained in Appendix H. It identifies record plans

reviewed, standards utilized for each road, design criteria, non-standard elements, and selected photos of non-standard features.

**TABLE 1
TRAVEL TIME & DELAY STUDY – ROUTE 33**

AVERAGE TRAVEL SPEED (MPH)							
SEGMENT	EASTBOUND			SEGMENT	WESTBOUND		
	AM	MID-DAY	PM		AM	MID-DAY	PM
Genesee	49	53	48	Genesee	37	41	38
Jefferson Overpass				Dick Rd Overpass			
"	55	59	49	"	44	51	48
Best Overpass				Union Overpass			
"	52	60	51	"	50	56	51
Rte 198 WB Exit Gore				Exit Ramp to I-90 EB			
"	53	55	50	"	43	51	41
Fillmore Overpass				Ent. Ramp from I-90 WB			
"	56	57	55	"	51	55	52
Grider Overpass				Harlem Underpass			
"	58	58	54	"	48	59	56
Olympic Underpass				Eggert Overpass			
"	61	56	54	"	36	60	58
Suffolk Underpass				Suffolk Underpass			
"	60	60	52	"	36	55	55
Eggert Overpass				Olympic Overpass			
"	57	57	53	"	49	60	55
Pine Ridge Overpass				Grider Overpass			
"	55	54	47	"	42	58	55
Maryvale On-ramp				Fillmore Overpass			
"	55	48	47	"	39	55	50
I-90 WB ent ramp				Exit Ramp-Humboldt SB			
"	51	47	42	"	52	55	53
I-90 EB exit ramp				Best St Overpass			
"	59	53	54	"	54	56	52
Union Overpass				Jefferson Overpass			
"	59	54	58	"	51	52	50
Dick Rd Overpass				Goodell Exit			
"	30	25	27	"	26	36	36
Genesee				Genesee			

TABLE 2

**ROUTE 33 - KENSINGTON EXPRESSWAY
SPOT SPEED STUDY SUMMARY**

SITE LOCATION AT	TRAFFIC FLOW DIRECTION	TRAVEL LANE	SPEED			PERCENT IN PACE	PERCENT OVER 50 MPH
			AVERAGE	85 th PERCENTILE	10 MPH PACE		
HIGH STREET OVERPASS (1)	EASTBOUND	PASSING	63	68	59-68	71	100
		MIDDLE	60	63	54-63	83	100
		DRIVE	57	61	52-61	77	91
		ALL	60	66	54-63	69	97
	WESTBOUND	PASSING	64	68	58-67	77	100
		MIDDLE	59	64	54-63	77	100
		DRIVE	57	61	52-61	80	91
		ALL	60	66	55-64	68	97
DODGE STREET OVERPASS (2)	EASTBOUND	PASSING	62	67	59-68	69	100
		MIDDLE	58	63	54-63	77	97
		DRIVE	53	58	49-58	63	69
		ALL	58	64	54-63	62	89
	WESTBOUND	PASSING	62	66	56-65	80	100
		MIDDLE	57	62	50-59	71	94
		DRIVE	55	60	48-57	71	83
		ALL	58	63	53-62	65	92
E. UTICA STREET OVERPASS (3)	EASTBOUND	PASSING	64	69	57-66	68	100
		MIDDLE	59	64	53-62	62	97
		DRIVE	57	63	51-60	71	97
		ALL	60	67	55-64	62	98
	WESTBOUND	PASSING	63	66	59-68	79	100
		MIDDLE	58	62	53-62	85	97
		DRIVE	53	59	47-56	66	60
		ALL	58	63	53-62	67	85
E. FERRY STREET OVERPASS (4)	EASTBOUND	PASSING	63	68	58-67	64	94
		MIDDLE	60	67	56-65	61	89
		DRIVE	61	69	52-61	57	97
		ALL	61	67	58-67	55	93
	WESTBOUND	PASSING	61	64	56-65	83	100
		MIDDLE	59	65	53-62	69	97
		DRIVE	53	58	51-60	66	71
		ALL	58	64	53-62	63	90

TABLE 2 cont.

**ROUTE 33 - KENSINGTON EXPRESSWAY
SPOT SPEED STUDY SUMMARY**

SITE LOCATION AT	TRAFFIC FLOW DIRECTION	TRAVEL LANE	SPEED			PERCENT IN PACE	PERCENT OVER 50 MPH
			AVERAGE	85 th PERCENTILE	10 MPH PACE		
FILLMORE AVENUE OVERPASS (5)	EASTBOUND	PASSING	61	66	56-65	71	97
		MIDDLE	55	60	49-58	71	82
		DRIVE	51	55	46-55	82	47
		ALL	56	62	48-57	53	75
	WESTBOUND	PASSING	62	65	57-66	85	100
		MIDDLE	61	66	58-67	71	100
		DRIVE	58	64	55-64	71	94
		ALL	60	65	56-65	74	98
ERIE CO. MEDICAL ACCESS OVERPASS (6)	EASTBOUND	PASSING	63	68	57-66	68	100
		MIDDLE	59	63	54-63	79	100
		DRIVE	57	61	54-63	85	97
		ALL	60	65	54-63	73	99
	WESTBOUND	PASSING	63	67	56-65	82	100
		MIDDLE	60	65	56-65	79	100
		DRIVE	58	61	53-62	88	97
		ALL	61	65	56-65	78	99
DEERFIELD AVENUE OVERPASS (7)	EASTBOUND	PASSING	66	70	60-69	71	100
		MIDDLE	63	69	56-65	76	100
		DRIVE	60	65	54-63	76	97
		ALL	63	69	56-65	63	99
	WESTBOUND	PASSING	63	67	58-67	82	100
		MIDDLE	60	64	56-65	79	100
		DRIVE	58	62	56-65	85	91
		ALL	60	65	56-65	77	97
BAILEY AVENUE RAMPS (8)	EASTBOUND	PASSING	66	70	61-70	74	100
		MIDDLE	62	68	55-64	76	100
		DRIVE	60	63	55-64	82	97
		ALL	63	70	55-64	64	99
	WESTBOUND	PASSING	61	65	56-65	79	97
		MIDDLE	59	63	55-64	76	97
		DRIVE	54	57	48-57	76	79
		ALL	58	63	55-64	63	91

TABLE 2 cont.

**ROUTE 33 - KENSINGTON EXPRESSWAY
SPOT SPEED STUDY SUMMARY**

SITE LOCATION AT	TRAFFIC FLOW DIRECTION	TRAVEL LANE	SPEED			PERCENT IN PACE	PERCENT OVER 50 MPH
			AVERAGE	85 th PERCENTILE	10 MPH PACE		
EDISON AVENUE OVERPASS (9)	EASTBOUND	PASSING	62	66	57-66	80	100
		MIDDLE	60	64	54-63	74	97
		DRIVE	56	60	50-59	74	89
		ALL	59	65	56-65	69	95
	WESTBOUND	PASSING	65	69	60-69	78	100
		MIDDLE	61	65	55-64	76	100
		DRIVE	59	63	56-65	86	100
		ALL	61	66	56-65	76	100
PINE RIDGE ROAD OVERPASS (10)	EASTBOUND	PASSING	62	68	56-65	74	100
		MIDDLE	58	61	53-62	77	89
		DRIVE	56	59	51-60	82	91
		ALL	58	64	53-62	68	93
	WESTBOUND	PASSING	63	67	58-67	82	100
		MIDDLE	60	66	52-61	74	100
		DRIVE	60	66	58-67	68	94
		ALL	61	66	58-67	73	98
UNION ROAD OVERPASS (11)	EASTBOUND	PASSING	61	64	57-66	88	100
		DRIVE	59	63	54-63	81	100
		ALL	60	64	56-65	84	100
	WESTBOUND	PASSING	60	63	54-63	74	98
		DRIVE	56	58	50-59	82	92
		ALL	58	62	51-60	69	95
GENESEE/ DICK/ CAYUGA OVERPASS (12)	EASTBOUND	PASSING	56	60	51-60	76	86
		DRIVE	54	59	47-56	61	71
		ALL	55	60	51-60	67	78
	WESTBOUND	PASSING	50	56	44-53	65	49
		DRIVE	47	52	40-49	76	22
		ALL	49	54	43-52	70	35

Non-standard features for Route 33 include stopping and headlight sight distance, minimum horizontal curves, combined lane and curb offset, shoulder and curb offsets, minimum vertical clearance (structures), minimum median width, maximum rate of superelevation, minimum weave length, acceleration and deceleration speed change length, all elements of ramps, and gutter sections.

Locations of non-standard features are described in detail in Appendix H and comparisons of existing conditions to standards are provided.

E. VIDEOS

Videos of the Route 33 expressway were made documenting traveling conditions for both directions of the corridor during 4 time periods. The time periods were AM peak period (7 a.m. – 9 a.m.), Mid-Day period (11:30 a.m. – 1:30 p.m.), PM peak period (4 p.m. – 5 p.m.), and evening period (after 7 p.m.).

A copy of the videos (2 VHS tapes) is retained in the offices of GBNRTC. One tape contains the AM and Mid-Day trips, and the other contains the PM and evening trips.

F. PHOTOGRAPHS

Still photographs were taken at critical locations in the study corridor. They were taken to document non-standard features and for preparation of Condition Diagrams and Field Report Forms. In excess of 200 photos were taken.

Additional photos were extracted from the NYSDOT photolog images of the Kensington Expressway corridor. These photos are dated July 1998.

All photos are retained in data files provided to GBNRTC as record copies. Many photos are inserts to the record plan review document contained in Appendix H.

G. CONDITION DIAGRAM AND FIELD REPORT FORMS

A priority list of safety locations to be analyzed for alternative improvements was identified during the corridor study. Field investigations were conducted for each priority location to document existing conditions and collect information to prepare Condition Diagram and Field Report Forms. The existing geometry and signing was documented and photographs were taken to provide visual documentation of existing conditions.

A Condition Diagram and Field Report Form was completed for each priority safety location and additional information in the context of photographs, accident summaries, detailed information about each accident that occurred at the location, and collision diagrams were combined into one report. The report for each priority safety location is contained in Appendix I.

H. TRAFFIC COUNTS

GBNRTC and NYSDOT researched their data files for traffic counts germane to the study corridor and provided them for the study. Counts included those of continuous machine and intersection turning movement type data.

The Consultant collected additional intersection turning movement counts at the following intersections:

- Fillmore @ Kensington,
- Fillmore @ Rte 33 WB entrance ramp,
- Grider @ Kensington,
- Grider @ Warwick,
- Delavan @ Humboldt Pkwy EB/Rte 33 EB entrance ramp,
- Pembroke @ William Gaiter Parkway.

The NYSDOT conducted additional machine counts at the Suffolk Street interchange with Route 33. The counts were conducted on each ramp and on Suffolk Street within the interchange.

Copies of all counts selected and conducted for the study corridor are retained in record files at the GBNRTC office.

A summary of machine counts reflecting Average Annual Daily Traffic (AADT) is contained in Appendix J.

III. ACCIDENT ANALYSIS METHODS

Accidents were analyzed from two general overall perspectives. One analysis technique involved the customary process followed by NYSDOT of computing accident rates and comparing to statewide average rates for similar facilities.

The second analysis process involved a new technique that examined the risk of an accident occurring and how it compared to the actual occurrence of accidents. The Risk Analysis Method (RAM) compared actual crash occurrences to probabilistic crash occurrence for each specific Route 33 road section. The analysis process produced a Global Risk Value that was utilized to establish a relative ranking of roadway sections based on a safety risk evaluation procedure.

A. ACCIDENT RATES

Accident rates were calculated for intersections based on million entering vehicles per year (MEV). Rates for highway segments were calculated based on million vehicle miles of travel (MVT) per year.

The accident rates for each investigation location are summarized in Appendix K. A comparison of the rate to the statewide average rate for each location is also contained in Appendix K.

The top 20 locations that exceed the statewide average rate are summarized in Table 3. Priority investigation locations (PIL) and Safety Deficient Locations (SDL) provided by NYSDOT from previous analyses over intervening years is provided in Appendix K. The information provided by NYSDOT was utilized later in the study to identify prioritized safety deficient locations for this study.

**TABLE 3
TOP 20 LOCATIONS OF EXISTING ACCIDENT RATE
COMPARED TO STATEWIDE AVERAGE RATE**

AREA TYPE	PIL LOCATION	DESCRIPTION	Location Accident Rate (1)	NYSDOT Statewide Average Accident Rate (2)	RATIO (1) / (2)
On-Ramp	25_4	EB Rt 33 from Suffolk St	0.30	0.06	5.00
Off-Ramp	15_1	WB Rt 33 to Oak St	0.75	0.15	5.00
Off-Ramp	17_6	WB Rt 33 to Jefferson Ave	0.66	0.15	4.40
Off-Ramp	18_8	WB Rt 33 to Best St	0.59	0.15	3.93
On-Ramp	15_4	EB Rt 33 from Elm/Tupper	0.19	0.06	3.17
Intersection	14	Goodell St @ Michigan Ave	2.13	0.72	2.96
Intersection	4	Tupper St @ Main St	2.00	0.72	2.78
Highway Section	20	Mainline Pil. # 20	3.73	1.39	2.68
Intersection	13	Goodell St @ Elm St	0.42	0.16	2.63
Intersection	1	Genesee St @ Oak St	1.74	0.72	2.42
Intersection	11	Goodell St @ Ellicott St	1.71	0.72	2.38
Off-Ramp	16_6	WB Rt 33 to Michigan Ave	0.35	0.15	2.33
Intersection	6	Tupper St @ Ellicott St	1.43	0.72	1.99
Intersection	10	Goodell St @ Washington St	1.39	0.72	1.93
Intersection	3	Tupper St @ Pearl St	1.38	0.72	1.92
Intersection	9	Goodell St @ Main St	1.18	0.72	1.64
Ramp Intersection	18_5	EB Rt 33 Ramp @ Best St	1.09	0.72	1.51
On-Ramp	15_3	EB Rt 33 from Genesee	0.09	0.06	1.50
Intersection	12	Goodell St @ Oak St	0.99	0.72	1.38
Ramp Intersection	18_6	WB Rt 33 Ramp @ Best	0.95	0.72	1.32

B. RISK ANALYSIS METHOD

The Risk Analysis Method (RAM) for analyzing accident data was used to identify priority accident locations. The method utilized historical record of accidents and exposure to risk (daily traffic).

The RAM methodology was described and approved by NYSDOT and GBNRTC as an acceptable alternative methodology of evaluating the severity of safety locations. The methodology compares accidents and type of accidents with roadway features. The Risk Model correlates causal factors contributing to accident occurrence.

The RAM methodology evaluates the likelihood of a particular severity type accident occurring at a particular PIL and compares it to actual occurrence. The methodology also evaluates the relative risk of a particular severity type accident occurring at a particular location and compares it to the relative risk of the same severity type accident occurring on average for all other similar type locations (intersections, highway segments, diverge, merge, ramp, etc).

The relative risk process results in a mathematical process that defines a global risk value for each PIL. The global risk value for each PIL is relative to the value for all other PIL's. The magnitude of the global risk value is important only to the extent that it is compared to the global risk value for other locations for severity risk of accidents.

The results of the RAM are contained in Appendix K. The 124 PIL's are sorted in order from highest global risk value to lowest.

IV. PRIORITIZED SAFETY LOCATIONS IDENTIFIED

A comparative process of high accident (safety) locations was utilized to identify prioritized corridor safety locations. The process utilized NYSDOT PIL listing of historically identified locations of safety concern based on a combination of number of accidents and accident rates. These locations are identified in Appendix K.

A second component of the process was the listing of corridor locations based on the accident rate for the three-year period of 1997 – 1999 and a comparison of the rate to statewide average rate for similar type facility. A ranked listing based on the ratio of accident rate to statewide average accident rate is in Appendix K.

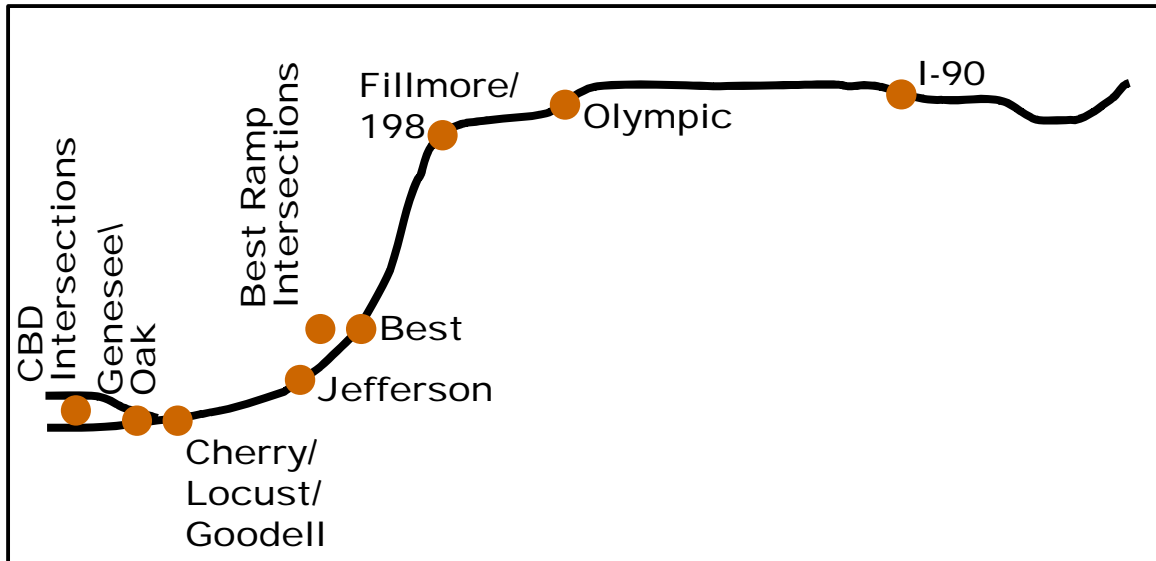
The third component of the process was the listing of corridor locations based on the global risk value determined from the Risk Analysis Method. A ranked listing of corridor locations based on the global risk value is contained in Appendix K.

The three listings were compared and reviewed by NYSDOT, GBNRTC and consultant team members in a joint meeting to determine a priority list of corridor safety locations. A comparative listing of all 124-corridor locations based on raw accident rate numbers and global risk value is contained in Appendix L.

A consensus was achieved by team members on nine (9) prioritized safety locations for the Kensington Expressway corridor study. These were investigated for alternative treatments and evaluation. The locations are summarized in Table 4 and shown graphically in Figure 4.

FIGURE 4

PRIORITIZED SAFETY LOCATIONS



Individual roadway PIL's comprising each location is based on the NYSDOT PIL list, a comparison of project locations calculated accident rate to NYSDOT statewide average rate, and project locations ranked based on Risk Analysis Method.

TABLE 4
PRIORITIZED SAFETY LOCATIONS

PRIORITIZED SAFETY LOCATIONS	AVERAGE GLOBAL RISK SCORE	ROADWAY SEGMENT PIL'S	REFERENCE MARKERS	ROADWAY DESCRIPTION	TOTAL CRASHES
1	7.05	15-1, 15-2, 1	1014	Route 33 WB exit ramp to Genesee Street and Genesee / Oak Intersection	82
2	9.88	20-1, 20-2, 20-3, 20-11, 20-12, 21-1	1037 – 1042	Route 33 WB between Fillmore Street overpass and Rte 198 interchange, Route 33 EB entrance ramp from Rte 198 EB ramp merge with Delevan Street ramp, Rte 198 EB ramp merge with Rte 33 EB mainline.	189
3	6.55	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	1010 – 1014	CBD intersections of Goodell and Tupper Streets between Pearl/Main and Michigan/Elm	275
4	4.20	18-1, 18-2, 18-3, 18-4, 18-7	1025 – 1028	Route 33 EB & WB mainline and interchange ramps at Best Street	56
5	5.21	17-1, 17-2, 17-3, 17-6	1020 - 1023	Route 33 EB & WB mainline and interchange ramps at Jefferson Street	32
6	13.60	30 –2	2015 – 2018	Route 33 EB & WB mainline overpass of I-90 and interchange ramps with I-90	55
7	5.97	18-5 & 18-6	1026	Best Street intersections with Route 33 interchange ramps	36
8	2.86	23-1, 23-2, 23-3, 23-4, 23-5	1052 – 1054	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	29
9	1.92	16-3, 16-4, 16-5, 16-6	1015 – 1017	Route 33 EB & WB merge and diverge ramps with Cherry Street, Locust Street and Goodell Street	22
TOTAL CRASHES					776

The prioritized list is structured according to the average Global Risk Indicator score for each location. The average Global Risk Indicator score for each location is the average score for the PIL's contained in each location.

V. ACCIDENT REDUCTION IMPROVEMENTS

Various types of accidents occurred during the three-year period (1997-1999) for the safety study. An initial review of information for each crash was made to understand the factor(s) that contributed to collisions at each safety location.

Evaluation of contributing factors promulgated a preliminary list of proposed alternatives to improve safety. NYSDOT, GBNRTC and team members reviewed the preliminary list to consider either combining alternatives or eliminating alternatives because they were not considered practical or feasible.

The review process resulted in a condensed or feasible list of alternatives. The feasible list was utilized to perform comparative evaluation of alternatives from a benefit/cost perspective.

A. PRELIMINARY ALTERNATIVES

A list of preliminary alternatives was developed for each safety location. The alternatives are briefly summarized in Table 5.

The alternatives were developed based on the type of accident occurrences. Alternatives address potential remediation measures at different levels of cost and degrees of resolving safety problems or improving safety.

B. FEASIBLE ALTERNATIVES

The review process produced a list of feasible alternatives either by consolidating preliminary alternatives into a lesser number or by eliminating some from further consideration. Consolidation was performed when it was logical from an integrated systems perspective; when individual alternatives were appropriate and did not conflict with each other and collectively produce a viable solution, such as combining striping, signing and signal modification into one overall program to improve safety.

Alternatives were eliminated when they were not considered viable options. This was based on consideration of anticipated relative construction costs, impacts to neighborhoods stemming from traffic diversion, likely requirement of displacements, need for extensive reconstruction of existing roads/streets to accommodate diverted traffic, and right-of-way acquisition associated with widening to achieve reconstruction.

An example includes the closure of access to eastbound Route 33 at Delavan/Humboldt intersection which would then require diversion of approximately 600 vehicles an hour during the PM peak hour that currently utilize the ramp. Diversion of this traffic, even at a reduced volume due to dispersion, would not be achievable along Delavan Avenue east and north to Pembroke to gain access to eastbound Route 33 without required modifications to Delavan Avenue. Modifications to Delavan Avenue would be needed to accommodate added volume, implementation of intersection widening to provide one or more left turn lanes. Additional modification of Grider/Deerfield would be needed to accommodate turning vehicles.

TABLE 5

PRELIMINARY LIST OF ALTERNATIVES FOR EACH SAFETY LOCATION

SAFETY LOCATION #	DESCRIPTION	ALTERNATIVE #	DESCRIPTION
1	Route 33 WB exit ramp to Genesee Street and Genesee / Oak Intersection	1 – Westbound Kensington Expressway to Oak	Install a 40 mph speed zone, Install a permanent speed reporting sign, and Install “ICY PAVEMENT ZONE” signs
		2 – Westbound Connector’s Intersection with Oak Street	Install yield sign on Oak Street
		3 – Genesee Street Intersection with Oak Street	Install a white partial barrier solid white pavement marking, Restrict parking on Oak Street, Install an “INTERSECTION LANE USE” sign, Install “SIGNAL AHEAD” signs, Install “GENESEE STREET” name signs, and Install latest traffic signal system
2	Route 33 WB between Fillmore Street overpass and Rte 198 interchange, Route 33 EB entrance ramp from Rte 198 EB ramp merge with Delevan Street ramp, Rte 198 EB ramp merge with Rte 33 EB mainline.	1 – Fillmore Avenue entrance ramp removal with traffic diversion	Close/remove Rte 33 EB entrance ramp from Fillmore Avenue
		2 – Fillmore Ave. ramp removal and replacement with new ramp from Kensington Avenue	Close/remove existing ramp Rte 33 EB entrance ramp from Fillmore and construct new ramp for EB traffic from Kensington Avenue adjacent to Burgard High School
		3 – Fillmore Ave. ramp relocation along Fillmore Ave.	Close/remove existing ramp and replace with new ramp from Fillmore and construct new Rte 33 EB right lane – these two elements would be transposed from their existing configuration
		4 –Median barrier extension at existing Fillmore Ave ramp terminus	Install a concrete barrier wall between the entrance ramp and Kensington Expressway right lane
		5 – Fillmore Ave ramp metering on existing Fillmore Ave. ramp	Install signalized control of ramp traffic entering Rte 33 EB traffic
		6 – Improved signing, advance warning, lane marking and/or road changes	Install dedicated lane notification signs for NY Route 33 West/Downtown and EXIT ONLY at 1 mile, ½ mile distances west of gore to NY Route 198 and at the gore; Install flashing beacons, Install pavement markings that would be more permanent and have greater retroreflective properties, Remove concrete gutter section, and Install overhead variable message signs
		7 – Kensington Expressway west of westbound NY Route 198 exit ramp	Install rumble strips
		8 – Delavan Avenue Entrance Ramp Removal with Traffic Diversion	Remove the eastbound entrance ramp from Delavan Avenue/Humboldt Parkway
		9 – Delavan Avenue Entrance Ramp temporary closure with Traffic diversion	Temporarily close ramp when the following occurs: traffic entering exceeds a predetermined flow rate, level of service at merge point with EB Rte 198 ramp traffic becomes unacceptable, as part of Incident Management for Kensington Expressway
		10 – Eastbound Kensington Expressway at Merge with eastbound Route 198	Remove pavement and replace to eliminate existing joint line

TABLE 5 cont.

PRELIMINARY LIST OF ALTERNATIVES FOR EACH SAFETY LOCATION

3	CBD intersections of Goodell and Tupper Streets between Pearl/Main and Michigan/Elm	1 – Coordinated Signal System along Goodell Street and Tupper Street	Update the time-based coordinated traffic signal system along each arterial
		2 – Advance Signing and Pavement Markings along Tupper Street	Add custom guide sign for EB approach of Tupper Street to pearl Street, Add a custom guide sign before for EB approach of Tupper Street at Ellicott Street, Add solid white line and pavement symbols and letters to delineate right-turn lane from through lanes of SB Pearl at Tupper, Install new pavement markings for EB Tupper at Main to delineate 12-foot left turn lane, Replace existing Street Name signs with larger signs, and Maintain pavement marking to ensure high visibility
		3 – East Tupper at Ellicott Street	Install new traffic signal with 12 inch lens, Change pavement markings to delineate through/right lane, and Install a solid white stop bar on SB Ellicott Street
		4 – Advance Signing and Pavement Markings along Goodell street	Add a custom guide sign on WB approach, Replace existing Street Name sign with larger signs, and Maintain pavement markings to ensure high visibility
		5 – Goodell Street at Ellicott Street	Install new traffic signal system with 12 inch lens
		6 – Goodell Street at Oak Street	Install traffic signal actuation for vehicles on Oak Street
		7 – Goodell street at Michigan Avenue	Adjust traffic signal clearances, Install left green arrow for NB Michigan, Install overhead “INTERSECTION LANE USE” signs, Modify pavement markings to supplement overhead signs, and Install pavement markings for pedestrian crosswalk
4	Route 33 EB & WB mainline and interchange ramps at Best Street	1 – Pavement Countermeasures along Kensington Expressway Mainline	Provide skid treatment to pavement
		2 – Accident Countermeasures along Kensington Expressway Mainline	Install transverse pavement grooves
5	Route 33 EB & WB mainline and interchange ramps at Jefferson Street	1 – Accident Countermeasures along Kensington Expressway Mainline	Provide flashing beacons on advance exit signing
		2 – Variable Message Signs for Incident/Congestion Management	Install variable message signs between Cherry Street and NY Route 198 interchange in both directions to inform drivers of traffic and road conditions
6	Route 33 EB & WB mainline overpass of I-90 and interchange ramps with I-90	NYSDOT and NYSTA are conducting a study of I-90 corridor that will address queuing on EB I-90 through interchange that affects EB Rte 33 traffic	Results of ongoing NYSDOT/NYSTA I-90 study will be considered for potential alternatives
7	Best Street intersections with Route 33 interchange ramps	1 – Traffic Signal Modifications at Ramp Intersections	Modify signal phasing and/or timing

TABLE 5 cont.

PRELIMINARY LIST OF ALTERNATIVES FOR EACH SAFETY LOCATION

8	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	1 – Ramp Removal with New Service Road	Close and remove existing EB Rte 33 exit ramp to Olympic Ave and construct new road between William Gaiter Pkwy and Olympic Ave.
		2 – Ramp Removal with Traffic Diversion	Close and remove existing EB Rte 33 exit ramp to Olympic Ave.
		3 – Re-alignment of Ramp Terminus	Re-align EB Rte 33 exit ramp terminus to align opposite Warrick Ave and remove existing slip ramp at Olympic Ave for right turns
		4 – Removal of Slip Ramp	Remove existing slip ramp at Olympic Ave for right turns
		5 – Replacement of Bridge over William L. Gaiter Parkway	Remove and replace the existing bridges of EB and WB Rte 33 over William L. Gaiter Parkway to improve vertical profile
9	Route 33 EB & WB merge and diverge ramps with Cherry Street, Locust Street and Goodell Street	1 – Pavement Countermeasures for Adverse Weather Conditions	Provide skid treatment, and Install variable message signs for EB and WB traffic
		2 – Operational Countermeasures Against Excessive Speeds	Install permanent speed reporting sign

The feasible alternatives utilized for benefit/cost analysis are summarized in Table 6. They have been renumbered after the review process to be sequential. Greater detail about each alternative and its purpose is described in Appendix M.

Traffic Simulation

Potential issues of traffic operations caused by traffic diversion for selected alternatives were investigated by use of traffic simulation programs. Traffic operations were investigated for Alternatives 1, 2, and 3 for Safety Location 2 and Alternatives 1 and 2 for Safety Location 8. Traffic operations were reviewed using CORSIM for all alternatives of Location 2 and SYNCHRO for each alternative of Location 8.

Detailed description and results of simulation for alternatives 1 – 3 (Corsim) for Locations 2 and each alternative (Synchro) of Location 8 is provided in Appendix N.

In summary, street intersections of Kensington at Fillmore and Grider and of Grider at Warrick operate at Level of Service B or better for all alternatives. A summary of the expressway traffic operation results and conclusions of simulation for Alternatives 1 – 3 for Location 2 is contained in Table 7. Queuing for westbound Route 33 is most severe for Alternative 2 (relocation of Fillmore Avenue ramp along Fillmore Avenue – no diversion of traffic) and the least for Alternative 3 (Partial closure).

**TABLE 6
FEASIBLE ALTERNATIVES
FOR EACH SAFETY LOCATION**

SAFETY LOCATION #	DESCRIPTION	ALTERNATIVE #	DESCRIPTION
1	Route 33 WB exit ramp to Genesee Street and Genesee / Oak Intersection	1 – Westbound Kensington Expressway to Oak – Westbound Connector’s Intersection with Oak Street – Genesee Street Intersection with Oak Street	Install a 40 mph speed zone, Install a permanent speed reporting sign, and Install “ICY PAVEMENT ZONE” signs, Install yield sign on Oak Street, Install a white partial barrier solid white pavement marking, Restrict parking on Oak Street, Install an “INTERSECTION LANE USE” sign, Install “SIGNAL AHEAD” signs, Install “GENESEE STREET” name signs, and Install latest traffic signal system
2	Route 33 WB between Fillmore Street overpass and Rte 198 interchange, Route 33 EB entrance ramp from Rte 198 EB ramp merge with Delevan Street ramp, Rte 198 EB ramp merge with Rte 33 EB mainline.	1 – Fillmore Avenue entrance ramp removal with traffic diversion	Close/remove Rte 33 EB entrance ramp from Fillmore Avenue
		2 – Fillmore Ave. ramp relocation along Fillmore Ave.	Close/remove existing ramp and replace with new ramp from Fillmore and construct new Rte 33 EB right lane – these two elements would be transposed from their existing configuration
		3 –Median barrier extension at existing Fillmore Ave ramp terminus	Install a concrete barrier wall between the entrance ramp and Kensington Expressway right lane
		4 – Delavan Avenue – Pavement Markings	Install pavement markings on entrance ramp from Delavan Avenue/Humboldt Parkway.
3	CBD intersections of Goodell and Tupper Streets between Pearl/Main and Michigan/Elm	1 – Coordinated Signal System along Goodell Street and Tupper Street – Advance Signing and Pavement Markings along Tupper Street – East Tupper at Ellicott Street – Advance Signing and Pavement Markings along Goodell street – Goodell Street at Ellicott Street – Goodell Street at Oak Street – Goodell street at Michigan Avenue	Update the time-based coordinated traffic signal system along each arterial, Add custom guide sign for EB approach of Tupper Street to pearl Street, Add a custom guide sign before for EB approach of Tupper Street at Ellicott Street, Add solid white line and pavement symbols and letters to delineate right-turn lane from through lanes of SB Pearl at Tupper, Install new pavement markings for EB Tupper at Main to delineate 12-foot left turn lane, Replace existing Street Name signs with larger signs, and Maintain pavement marking to ensure high visibility Install new traffic signal with 12 inch lens, Change pavement markings to delineate through/right lane, and Install a solid white stop bar on SB Ellicott Street, Add a custom guide sign on WB approach, Replace existing Street Name sign with larger signs, and Maintain pavement markings to ensure high visibility, Install new traffic signal system with 12 inch lens, Install traffic signal actuation for vehicles on Oak Street, Adjust traffic signal clearances, Install left green arrow for NB Michigan, Install overhead “INTERSECTION LANE USE” signs, Modify pavement markings to supplement overhead signs, and Install pavement markings for pedestrian crosswalk
4	Route 33 EB & WB mainline and interchange ramps at Best Street	1 – Pavement Countermeasures along Kensington Expressway Mainline – Accident Countermeasures along Kensington Expressway Mainline	Provide skid treatment to pavement, Install transverse pavement grooves,

TABLE 6 cont.

FEASIBLE ALTERNATIVES FOR EACH SAFETY LOCATION

5	Route 33 EB & WB mainline and interchange ramps at Jefferson Street	1 – Accident Countermeasures along Kensington Expressway Mainline – Variable Message Signs for Incident/Congestion Management	Provide flashing beacons on advance exit signing, Install variable message signs between Cherry Street and NY Route 198 interchange in both directions to inform drivers of traffic and road conditions
6	Route 33 EB & WB mainline overpass of I-90 and interchange ramps with I-90	NYSDOT and NYSTA are conducting a study of I-90 corridor that will address queuing on EB I-90 through interchange that affects EB Rte 33 traffic	Results of ongoing NYSDOT/NYSTA I-90 study will be considered for potential alternatives
7	Best Street intersections with Route 33 interchange ramps	1 – Traffic Signal Modifications at Ramp Intersections	Modify signal phasing and/or timing
8	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	1 – Ramp Removal with New Service Road	Close and remove existing EB Rte 33 exit ramp to Olympic Ave and construct new road between William Gaiter Pkwy and Olympic Ave.
		2 – Ramp Removal with Traffic Diversion	Close and remove existing EB Rte 33 exit ramp to Olympic Ave.
9	Route 33 EB & WB merge and diverge ramps with Cherry Street, Locust Street and Goodell Street	1 – Pavement Countermeasures for Adverse Weather Conditions – Operational Countermeasures Against Excessive Speeds	Install variable message signs for EB and WB traffic, Install permanent speed reporting signs for EB and WB traffic.

At location 8, capacity analysis was performed. Overall, the HCS analysis results for the two alternatives indicate the closure of the eastbound Route 33 exit ramp to Olympic Avenue without a new connector road between Pembroke Avenue and Olympic Avenue (Alternative 2) is expected to produce the least delay at the intersection of Pembroke Avenue and William Gaiter Parkway. However, overall travel time to access Olympic Avenue and excess travel through residential neighborhoods would increase due to the discontinuity of the local street network.

Additional detail about safety location, history of accident occurrence, and description of each feasible alternative is provided on TE-156A Forms. The Forms are provided in Appendix O.

Composition of these alternatives is the basis of benefit/cost analysis presented in the next section of this report.

TABLE 7
CORSIM EXPRESSWAY RESULTS
NEAR FILLMORE AVENUE RAMP

Route 33 Expressway Section - Westbound	Level Of Service (LOS) / Density (veh/ln/mi) / Speed (mph)			
	Existing Condition	Alt 1 – Full Ramp Closure w/lt*	Alt 2 – Relocate Fillmore Ramp	Alt 3 – Partial Ramp Closure w/lt*
East of Grider St. to Grider St. On Ramp	D / 31.1 / 54.2	D / 34.8 / 48.4	D / 32.9 / 52.7	D / 33.6 / 50.3
Grider St. On Ramp to Fillmore Ave. On Ramp	E / 44.2 / 38.7	F / 55.6 / 31.9	F / 48.7 / 36.5	F / 55.8 / 31.7
Fillmore Ave. On Ramp to Rte. 198 Off Ramp	F / 47.8 / 30.3	E / 40.0 / 34.8	E / 41.5 / 34.9	E / 41.6 / 34.3
Rte. 198 Off Ramp to West	F / 58.2 / 35.6	F / 55.7 / 36.4	F / 54.4 / 37.3	F / 56.6 / 36.0

* With southbound left turn lane for Fillmore Avenue at Kensington Avenue.

**TABLE 8
SERVICE LIFE
BY ALTERNATIVE**

SAFETY LOCATION	ROADWAY DESCRIPTION	ALTERNATIVE IMPROVEMENT	MAJOR IMPROVEMENT	SUGGESTED SERVICE LIFE (yrs)
1	Route 33 WB exit ramp to Genesee Street and Genesee / Oak Intersection	Traffic signs, ITS signs, pavement markings, signal changes	ITS signs and signal changes	10
2	Route 33 WB between Fillmore Street overpass and Rte 198 interchange, Route 33 EB entrance ramp from Rte 198 EB ramp merge with Delevan Street ramp, Rte 198 EB ramp merge with Rte 33 EB mainline.	1 - Fillmore Ramp closure	Ramp closure	20
		2 - New Ramp	New Ramp	20
		3 - Median barrier	Median barrier	20
		4 - Delavan Ramp pavement markings	Pavement markings	5
3	CBD intersections of Goodell and Tupper Streets between Pearl/Main and Michigan/Elm	Signal changes, pavement markings, signing	Signal changes	10
4	Route 33 EB & WB mainline and interchange ramps at Best Street	Skid treatment, pavement grooves, ITS signs	ITS signs	10
5	Route 33 EB & WB mainline and interchange ramps at Jefferson Street	Flashing beacons, ITS signs, VMS signs	ITS signs & VMS signs	10
6	Route 33 EB & WB mainline overpass of I-90 and interchange ramps with I-90	Contingent on I-90 / I-290 corridor study	N/A	N/A
7	Best Street intersections with Route 33 interchange ramps	Signal changes	Signal changes	10
8	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	1 - Ramp closure & new road	Ramp closure & new road	20
		2 - Ramp closure	Ramp closure	20
9	Route 33 EB & WB merge and diverge ramps with Cherry Street, Locust Street and Goodell Street	Skid treatment, VMS signs, ITS signs	ITS signs, VMS signs	10

VI. BENEFITS - COSTS OF ALTERNATIVES

The “Risk Analysis Method” for determining the expected reduction in accidents by type and severity was used to determine the expected number of accidents at each of the locations involved in the overall prioritized location. For example, for Location 3 (downtown intersections) there are intersection locations 3 through 14 all being evaluated separately for collision reductions (by severity) and the associated societal cost savings. These results are then aggregated for all 12 intersections to estimate the total societal cost savings. The fatality, injury, PDO, and non-reportable collisions affected at each of the intersection locations are different, and the countermeasures being implemented are not exactly the same at all of them.

A. BENEFITS

Safety benefits of each alternative were determined utilizing discount rate, service life, accident reduction factors, and dollar value per type of accident provided by NYSDOT. Specifically, the following was utilized for each factor:

Discount rate = 4%

Life Cycle = Table 1 (which follows page B.4) of Appendix B of the "NYSDOT SAFETY PROGRAM MANAGEMENT MANUAL" Second Draft Edition, August 1997. Specific service life utilized for each alternative approved by NYSDOT is summarized in Table 8 of this report.

Accident reduction rate = Accident Reduction Factors (RF) of the Traffic Engineering and Safety Division, Safety Program Management Bureau, NYS DOT Revision 5/00.

Dollar value per accident reduced = "AVERAGE ACCIDENT COSTS/SEVERITY DISTRIBUTION STATE HIGHWAYS 1999", NYSDOT-Safety Information Management System, 4/06/2001.

Summary of annualized benefits by alternative is summarized in Table 9. Details of the calculations are provided in Appendix P. TE-164a Forms are provided in Appendix P that summarizes aspects of benefit calculations. Additional support computations are provided in Appendix P showing the derivation of dollar benefits for each alternative.

B. COSTS

Cost of alternatives was developed utilizing NYSDOT guidelines and procedures. The Preliminary Estimate System (PES) was utilized to estimate project cost for each alternative. Supporting software and data files were provided by NYSDOT.

A summary of annualized costs for each alternative is summarized in Table 9. Detailed cost computations from PES are provided in Appendix Q. Discount rate and service life utilized to determine benefits for each alternative were utilized to determine annualized cost.

C. BENEFIT/COST RATIOS

Annualized benefits and costs for each alternative were utilized to determine the ratio of the two parameters. Benefit/cost ratios for each alternative are summarized in Table 9. Detailed derivation of the ratios is summarized on TE-204a Forms contained in Appendix R.

TABLE 9
ANNUALIZED BENEFITS & COSTS
BY ALTERNATIVE

SAFETY LOCATION	ROADWAY DESCRIPTION	ALTERNATIVE IMPROVEMENT	ANNUALIZED BENEFITS (\$)	ANNUALIZED COSTS (\$)	B/C RATIO
1	Route 33 WB exit ramp to Genesee Street and Genesee / Oak Intersection	Traffic signs, ITS signs, pavement markings, signal changes	625,557.61	68,917.13	9.08
2	Route 33 WB between Fillmore Street overpass and Rte 198 interchange, Route 33 EB entrance ramp from Rte 198 EB ramp merge with Delevan Street ramp, Rte 198 EB ramp merge with Rte 33 EB mainline.	1 - Fillmore Ramp closure	750,636.69	25,094.25	29.91
		2 - New Ramp at Fillmore Ave.	880,359.68	236,313.03	8.59
		3 - Median barrier	893,569.52	27,713.82	32.24
		4 - Delavan Ramp Pavement Markings	80,931	423.81	190.96
3	CBD intersections of Goodell and Tupper Streets between Pearl/Main and Michigan/Elm	Signal changes, pavement markings, signing	2,029,604.00	655,305.41	1.34
4	Route 33 EB & WB mainline and interchange ramps at Best Street	Skid treatment, pavement grooves, ITS signs	681,434.74	78,951.31	8.63
5	Route 33 EB & WB mainline and interchange ramps at Jefferson Street	Flashing beacons, ITS signs, VMS signs	244,922.18	137,339.08	1.78
6	Route 33 EB & WB mainline overpass of I-90 and interchange ramps with I-90	Contingent on I-90 / I-290 corridor study	N/A	N/A	N/A
7	Best Street intersections with Route 33 interchange ramps	Signal changes	358,590.28	15,581.49	23.01
8	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	1 - Ramp closure & new road	86,547.89	161,410.81	0.54
		2 - Ramp closure	201,694.56	122,330.78	1.65
9	Route 33 EB & WB merge and diverge ramps with Cherry Street, Locust Street and Goodell Street	Skid treatment, VMS signs, ITS signs	346,095.33	179,028.03	1.93

VII. SUMMARY AND FINDINGS

The 9-mile corridor of the Kensington Expressway between Genesee Street to the east and Main Street in the Central Business District of the City of Buffalo to the west accommodates significant daily volumes exceeding 100,000 vehicles in some sections of the six-lane facility.

A history of numerous accidents with injuries and occasional fatalities exists along the expressway corridor. Severe type crashes have historically occurred in clusters. Contributing factors included speed, congestion and geometrics either singularly or in combinations.

The purpose of the corridor safety study was to identify high accident locations and methods to reduce accidents in the corridor. This was accomplished by analyzing the most recent three-year period of accident history, 1997 - 1999. Accidents consisted of **4 fatalities, 492 injury, 227 property damage only, and 433 non-reportable** crashes.

The most severe safety locations were identified utilizing two techniques of analyses. One analysis technique involved the customary process followed by NYSDOT of computing accident rates and comparing to statewide average rates for similar facilities. The second analysis process involved a new technique that examined the risk of an accident occurring and how it compared to the actual occurrence of accidents. Nine (9) Prioritized Safety Locations were identified.

Alternatives to mitigate accidents at the safety locations were identified. Alternatives considered elimination of weaving sections, closure of ramps, extension of local streets, implementation of pavement treatments, additional signing, and inclusion of intelligent transportation systems (ITS) technologies to provide advance notification to motorists of highway conditions. A significant operational benefit is the control of speed and reduction in speed variance between vehicles.

The Consultant team developed a series of preliminary alternatives to address safety issues of the 9 Prioritized Safety Locations. The preliminary alternatives defined different levels of improvements.

Staff members of NYSDOT and GBNRTC along with Consultant team members reviewed the preliminary alternatives. The review process examined each alternative for feasibility and reasonableness. Alternatives were reviewed in the context of combining them to represent one single option for implementation.

The review of preliminary alternatives produced a list of feasible alternatives that were utilized to determine benefits and costs. Annualized benefits and costs for each alternative were estimated to compute benefit/cost ratios. The objective of the ratios is to establish a relative basis of determining the potential safety benefits for each dollar of investment.

Cost estimates were developed utilizing the Preliminary Estimate (PES) procedures provided by NYSDOT. Service life for each alternative improvement and discount rate of 4% was provided by NYSDOT.

Benefits were determined based on accident modification factors (AMF) and dollar value by type of accident provided by NYSDOT. The number of accidents reduced by type was estimated for each alternative and the total dollar benefits were calculated.

Benefits and cost were annualized utilizing discount rate and service life. The benefit/cost ratio for each alternative was determined. Alternatives listed in order by benefit/cost ratio are contained in Table 10. The initial cost of the alternative is provided.

TABLE 10
ALTERNATIVES RANKED
BY SAFETY BENEFIT / COST RATIO

ALTERNATIVE RANK	SAFETY LOCATION	ALTERNATIVE IMPROVEMENT	ROADWAY DESCRIPTION	INITIAL COSTS (\$1,000)	B/C RATIO
1	2	4 – Delavan Ramp Pavement Markings	Route 33 WB between Fillmore Street overpass and Rte 198 interchange	2	190.96
2	2	3 - Median barrier	Route 33 WB between Fillmore Street overpass and Rte 198 interchange	377	32.24
3	2	1 - Fillmore Ramp closure	Route 33 WB between Fillmore Street overpass and Rte 198 interchange	341	29.91
4	7	Signal changes	Best Street intersections with Route 33 interchange ramps	126	23.01
5	1	Traffic signs, ITS signs, pavement markings, signal changes	Route 33 WB exit ramp to Genesee Street and Genesee / Oak Intersection	559	9.08
6	4	Skid treatment, pavement grooves, ITS signs	Route 33 EB & WB mainline and interchange ramps at Best Street	640	8.63
7	2	2 - New Ramp at Fillmore Ave.	Route 33 WB between Fillmore Street overpass and Rte 198 interchange	8,906	8.59
8	9	Skid treatment, VMS signs, ITS signs	Route 33 EB & WB merge and diverge ramps with Cherry Street, Locust Street and Goodell Street	1,452	1.93
9	5	Flashing beacons, ITS signs, VMS signs	Route 33 EB & WB mainline and interchange ramps at Jefferson Street	1,114	1.78
10	8	2 - Ramp closure	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	1,663	1.65
11	3	Signal changes, pavement markings, signing	CBD intersections of Goodell and Tupper Streets between Pearl/Main and Michigan/Elm	1,930	1.34
12	8	1 - Ramp closure & new road	Route 33 EB & WB mainline and interchange ramps with Olympic Avenue.	2,194	0.54
13	6	N/A	Route 33 EB & WB mainline overpass of I-90 and interchange ramps with I-90	0	N/A

**ROUTE 33 - KENSINGTON EXPRESSWAY
SAFETY STUDY**

APPENDICIES A – H, J - R

Prepared for

**GREATER BUFFALO NIAGARA REGIONAL TRANSPORTATION
COUNCIL
&
NEW YORK STATE DEPARTMENT OF TRANSPORTATION**

Prepared by

**Bergmann Associates
40 La Riviere Drive
Buffalo, New York
14202**

In Cooperation with

**Nussbaumer and Clarke, Inc.
Synectic Transportation Consultants, Inc.
Eng-Wong Taub and Associates**

August 2002

**ROUTE 33 - KENSINGTON EXPRESSWAY
SAFETY STUDY**

APPENDIX I

Prepared for

**GREATER BUFFALO NIAGARA REGIONAL TRANSPORTATION
COUNCIL
&
NEW YORK STATE DEPARTMENT OF TRANSPORTATION**

Prepared by

**Bergmann Associates
40 La Riviere Drive
Buffalo, New York
14202**

In Cooperation with

**Nussbaumer and Clarke, Inc.
Synectic Transportation Consultants, Inc.
Eng-Wong Taub and Associates**

August 2002

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX A

PIL LOCATIONS IDENTIFIED BY
REFERENCE MARKERS

DRAFT

**Route 33 – Kensington Expressway Safety
Study**

APPENDIX B

ACCIDENT SUMMARIES BY PIL

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX C

DETAILED ACCIDENT SUMMARIES
BY INTERSECTION/SEGMENT

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX D

COLLISION DIAGRAMS –
TE-56 FORMS

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX E

DETAILS OF EACH ACCIDENT –
TE-213 FORMS

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX F

TRAVEL TIME & DELAY DATA

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX G

SPOT SPEED DATA

DRAFT

**Route 33 – Kensington Expressway Safety
Study**

APPENDIX H

RECORD PLAN REVIEW

DRAFT

**Route 33 – Kensington Expressway Safety
Study**

APPENDIX I

CONDITION DIAGRAM &
FIELD REPORT FORM for
Each Priority Safety Location

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX J

AVERAGE ANNUAL DAILY TRAFFIC

DRAFT

**Route 33 – Kensington Expressway Safety
Study**

APPENDIX K

ACCIDENT RATES, NYSDOT PIL'S,
& RISK ANALYSIS RESULTS

APPENDIX L

COMPARATIVE LISTING OF CORRIDOR LOCATIONS BASED ON
ACCIDENT RATE & GLOBAL RISK VALUE

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX M

FEASIBLE ALTERNATIVES

DRAFT

**Route 33 – Kensington Expressway Safety
Study**

APPENDIX N

SIMULATION RESULTS

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX O

TE-156A FORMS

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX P

TE-164a FORMS

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX Q

COST OF ALTERNATIVES – PES

DRAFT

Route 33 – Kensington Expressway Safety
Study

APPENDIX R

TE-204a FORMS