



**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C.**

**HIGHWAY FACTORS GROUP CHAIRMAN'S
FACTUAL REPORT**

A. CRASH INFORMATION

Location: Intersection of Northern Boulevard and Main Street, Flushing, NY
Vehicle #1: 2015 Motor Coach Industries Motorcoach
Operator #1: Dahlia Group Inc., of Flushing, NY
Vehicle #2: 2015 New Flyer Transit Bus
Operator #2: New York City Transit
Vehicle #3: 2009 Honda Odyssey
Operator #3: Parked at curb, not running, unoccupied
Vehicle #4: 2002 Toyota Sequoia
Operator #4: Parked at curb, not running, occupied by two passengers (one in the driver's seat, and one in the right-front passenger seat)
Date: Monday, September 18, 2017
Time: 6:16 a.m. Eastern Daylight Time (EDT)
NTSB #: **HWY17MH015**

B. HIGHWAY FACTORS GROUP

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C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Summary Report* in the docket for this investigation.

D. DETAILS OF THE HIGHWAY FACTORS INVESTIGATION

The Highway Factors Factual Report focused on the prefatory data that included average hourly traffic volumes and a traffic accident summary. The report also focused on roadway data that included roadway design, traffic signal locations, latest resurfacing project, speed limit, roadway signing, stop bar locations, pedestrian crossings, sidewalk locations, hourly turning and through movement counts, and on-street parking regulations. The report documents the number of MTA buses that travel through the Northern Boulevard and Main Street intersection. Finally, the report documents testing that included a speed and vehicle classification study on Northern Boulevard, improvements made by the New York City Department of Transportation (NYCDOT) after the crash, and the approximate damage caused to the building located in the southeast quadrant of the Northern Boulevard and Main Street intersection.

1. Prefatory Data

1.1. Crash Location

The crash occurred at the intersection of Northern Boulevard and Main Street in Flushing, Queens County, New York. **Figure 1** is a crash map that illustrates the crash location was approximately 7.5 miles east of Manhattan.



Figure 1 – Crash map (Source: Google Maps revised)

Figure 2 is a refined satellite image that illustrates the approximate crash location at the Northern Boulevard and Main Street intersection.

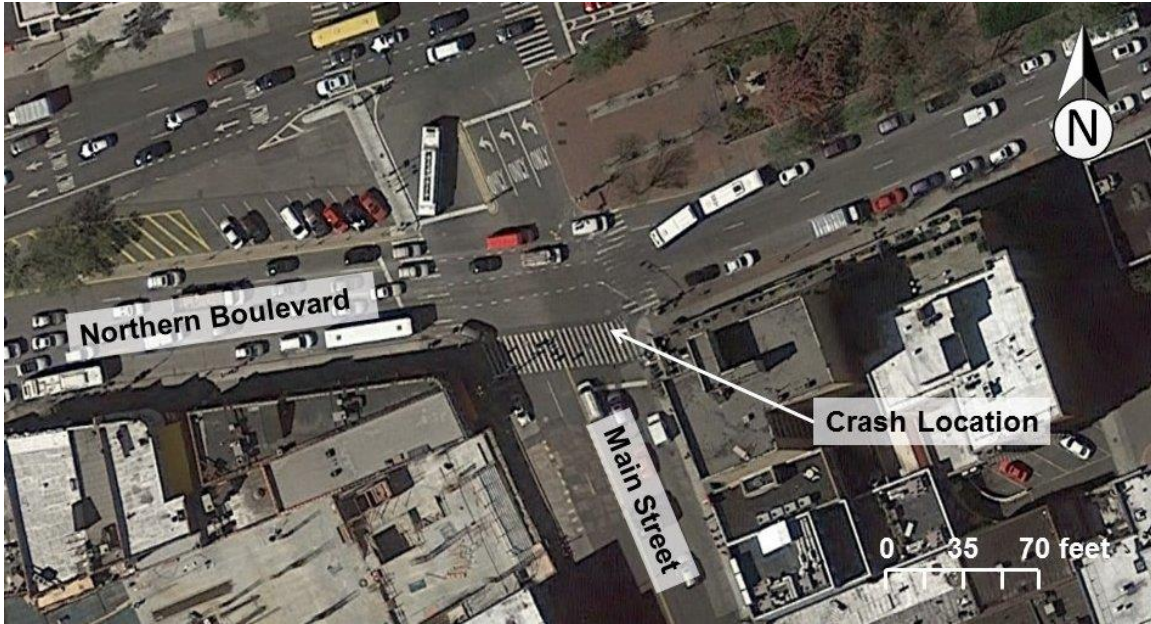


Figure 2 – Refined satellite image that illustrates the approximate crash location (Source: Google Earth Maps revised)

1.2. Average Hourly Traffic Volumes

Table 1 summarizes the average hourly traffic volumes in the eastbound direction of Northern Boulevard in the vicinity of the crash from June 12, 2017 through June 18, 2017.

Table 1 – Average hourly traffic volumes in the eastbound direction of Northern Boulevard

One Hour Interval	Average Hourly Traffic Volumes
AM	
6 – 7 a.m.	617
7 – 8 a.m.	1,150
8 – 9 a.m.	1,584
9 – 10 a.m.	1,346
MID-DAY	
11 – 12 p.m.	1,364
12 – 1 p.m.	1,403
1 – 2 p.m.	1,374
2 – 3 p.m.	1,513
PM	
3 – 4 p.m.	1,671
4 – 5 p.m.	1,734
5 – 6 p.m.	1,707

6 – 7 p.m.	1,625
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1.3. Traffic Accident History

Table 2 summarizes the traffic accident history at the intersection of Northern Boulevard and Main Street for the last 5 years for pedestrians, bicyclists, and motorists. There have not been any fatalities at this intersection from 2010 to present.

Table 2 – Traffic accident history at the intersection of Northern Boulevard and Main Street

Year	Pedestrian Injuries	Bicyclist Injuries	Motor Vehicle Occupant Injuries	Total Number of Injuries
2012	2	1	4	7
2013	1	0	3	4
2014	3	0	1	4
2015	5	0	7	12
2016	4	0	6	10
2017 (YTD)	0	0	5	5
Total	15	1	26	42

2. Roadway Data

2.1. Roadway Design

The cross section for Northern Boulevard in the eastbound direction immediately preceding the intersection of Main Street consisted of four travel lanes. The four travel lanes were composed of three through lanes and one right turn lane. Each of the travel lanes was approximately 11.5-foot wide separated by a dashed white line. The total width of the pavement was approximately 50-feet.

The cross section for Main Street immediately preceding the intersection consisted of six travel lanes. The six travel lanes were composed of three northbound through lanes and three southbound through lanes. The rightmost northbound through lane also functioned as a right turn lane for motorists travelling eastbound on Northern Boulevard. Each of the travel lanes was approximately 12-foot wide. The northbound travel lanes and southbound travel lanes were separated by a solid double yellow line. The total width of the pavement was approximately 76-feet.

2.2. Direction of Travel and Traffic Signal Locations

Figure 3 illustrates an aerial view of Northern Boulevard with Dahlia Travels and Tours Company office located in the lower left corner.¹ The blue color denotes the elevated portion of Northern Boulevard over the Flushing River. The yellow stars denote the locations of traffic signals at the intersections of Northern Boulevard and Prince Street, and Northern Boulevard and

¹ The address for Dahlia Travels and Tours Company office was 12727 34th Street.

Main Street. The crash occurred at the intersection of Northern Boulevard and Main Street located to the far right. The white dashed line denotes the route the motorcoach took on the day of the accident. The driver pulled out onto 127th Street from the Dahlia parking lot and turned right onto Northern Boulevard. From there, the driver proceeded eastbound on Northern Boulevard until colliding with the New York Metropolitan Transit Administration bus at the intersection of Northern Boulevard and Main Street.

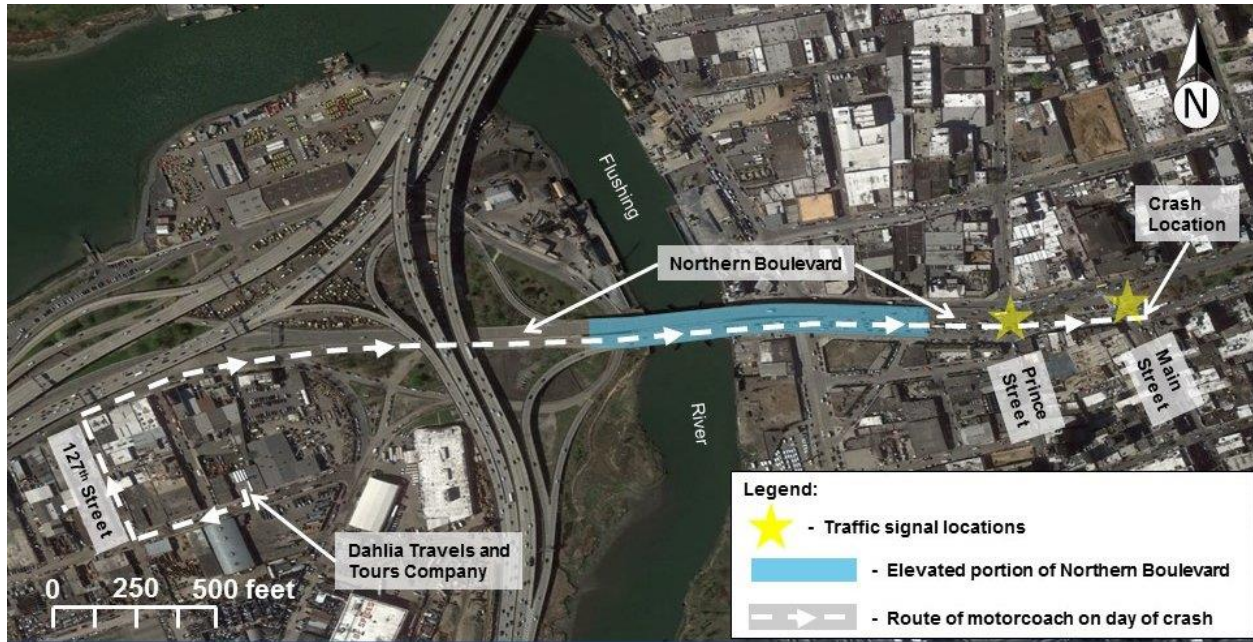


Figure 3 – Traffic signal locations and elevated portion of Northern Boulevard (Source: Google Earth Maps revised)

2.3. Vertical Grades on Elevated Portion of Northern Boulevard

The upper left corner of **Figure 4** shows a view of the positive 5.5% (upward) slope on the elevated portion of Northern Boulevard over the Flushing River. Notice the lane lines were faded and obscured on the positive 5.5% (upward) slope. The lower right corner of **Figure 4** shows a view of the negative 5.3% (downward) slope on the elevated portion of Northern Boulevard looking toward the crash location. The lane lines were also faded and obscured on the negative 5.3% (downward) slope.

Additional information regarding the plan and profile on the elevated portion of Northern Boulevard over the Flushing River can be found in the Technical Reconstruction Group Factual Report.

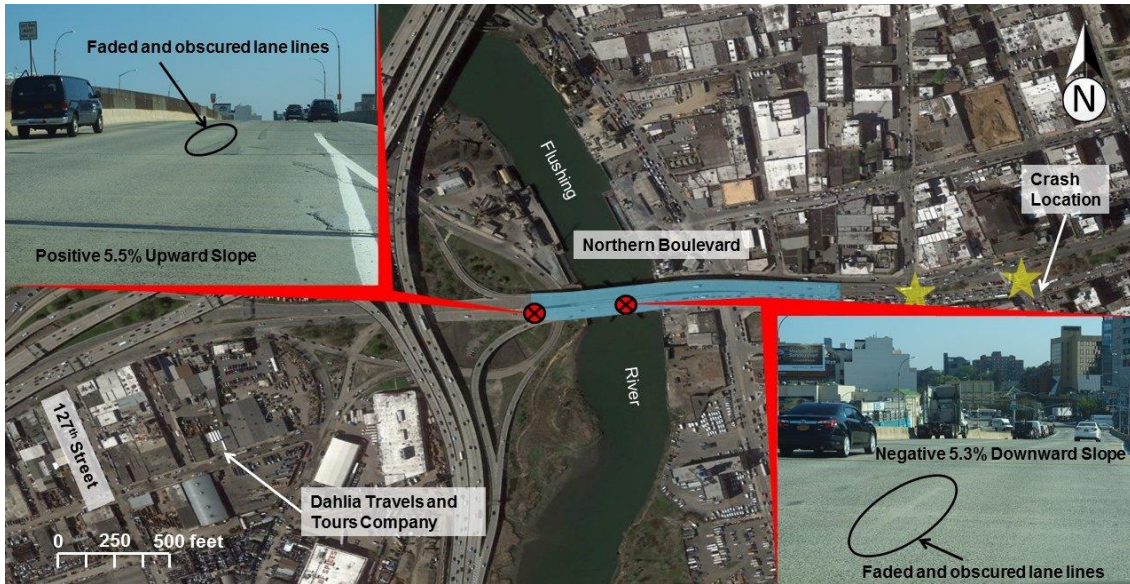


Figure 4 – Vertical grades on elevated portion of Northern Boulevard (Source: Google Earth Maps revised)

2.4. Red Light indications at the time of the crash on Northern Boulevard

Figure 5 shows a view of the Prince Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location. There were 3 red signal light indications facing eastbound traffic at the Prince Street intersection at the time of the crash. Video evidence shows that the motorcoach travelled through the Prince Street intersection when the 3 red lights were activated. The 3 red lights consisted of 12-inch diameter lenses versus the 8-inch diameter lenses for the amber and green indications.

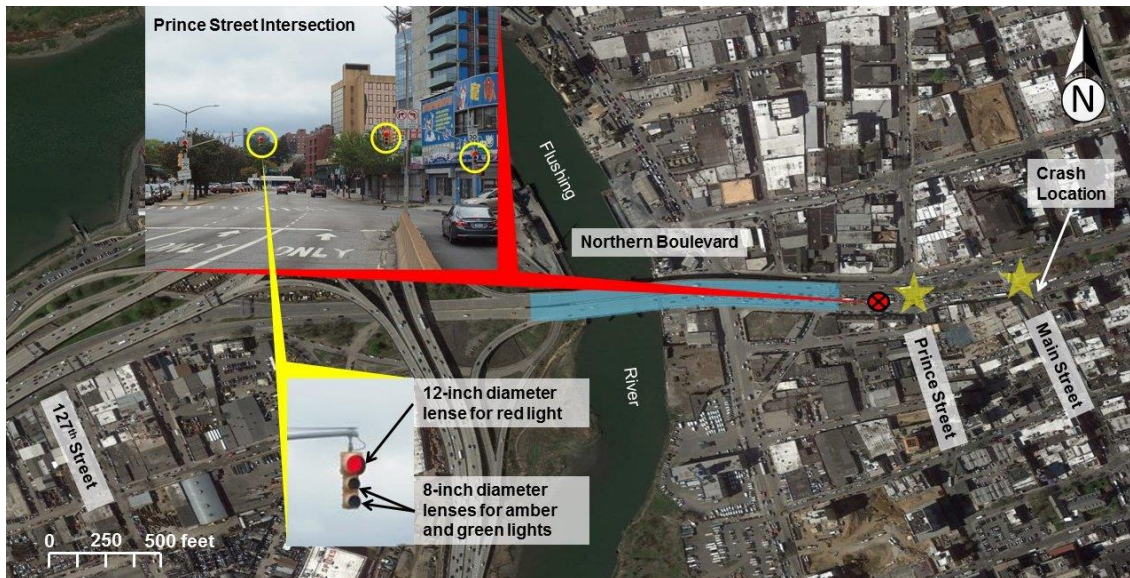


Figure 5 – View of the Prince Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location (Source: Google Earth Maps revised)

Figure 6 shows the approximate location of the New York Metropolitan Transit Administration bus turning right from Main Street onto Northern Boulevard at the time of the crash. The far right slide only shows 1 traffic signal over the travel lanes after the crash. However, at the time of the crash, there were 2 traffic signals over the travel lanes as shown in the far left slide. One signal was demolished as a result of the crash and a temporary signal was installed by the NYCDOT as shown by a yellow X mark in the right slide. Video evidence shows that the motorcoach travelled through the Main Street intersection when the 2 red lights were activated. The 2 red lights consisted of 12-inch diameter lenses versus the 8-inch diameter lenses for the amber and green indications.

The traffic signals at the Prince Street / Northern Boulevard and Main Street / Northern Boulevard intersections were coordinated signals (or timed together) for traffic proceeding eastbound on Northern Boulevard. The signals operate with a separate controller, however, they are coordinated using offsets that are timed by a central management system.

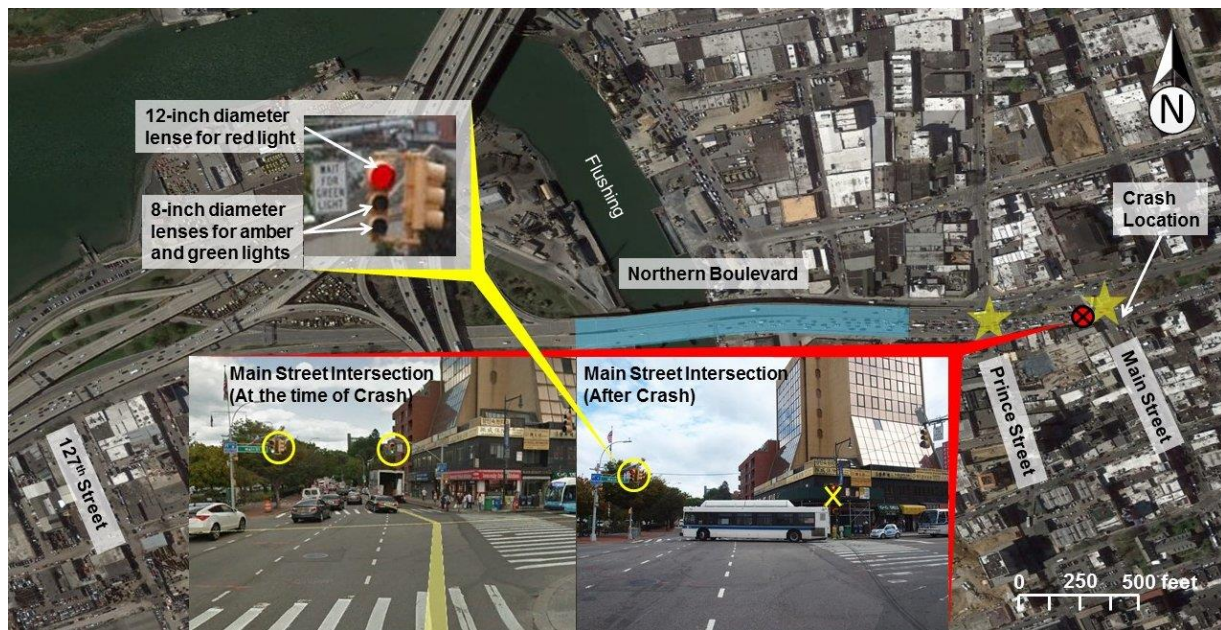


Figure 6 – View of the Main Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location (Source: Google Earth Maps revised)

2.5. Green Right Turn Arrows at the time of the crash on Main Street

Figure 7 shows a view that the driver of the New York Metropolitan Transit Administration bus would have had while turning right from Main Street onto Northern Boulevard at the time of the crash. The driver would have seen the 2 green right turn arrow signal indications. The green and amber right turn arrows were 12-inch diameter lenses versus the 8-inch diameter lenses for the other signal indications.

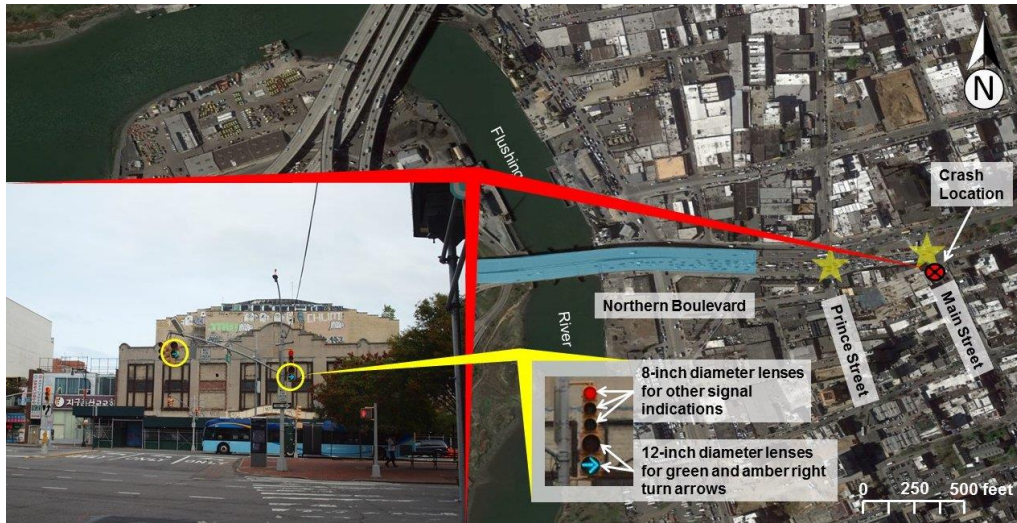


Figure 7 – View of the Northern Boulevard intersection looking in the northbound direction of Main Street toward the crash location (Source: Google Earth Maps revised)

The driver of the of the New York Metropolitan Transit Administration bus proceeded correctly turning right from Main Street onto Northern Boulevard after receiving 2 green right turn arrow indications according to provisions outlined in New York State Vehicle and Traffic Law Section 1111²:

“Traffic, except pedestrians, facing a steady green arrow signal may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time.”

2.6. Latest Resurfacing of the Northern Boulevard and Main Street Intersection

The intersection of Northern Boulevard and Main Street was last paved on July 28, 2008 as part of a resurfacing project that spanned Northern Boulevard from Prince Street to 162nd Street.

2.7. Speed Limit

Figure 8 shows a view of the Prince Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location indicating the speed limit was 30 miles per hour (mph). There were 2 signs that indicated the speed limit was 30 mph.

² New York State Vehicle and Traffic Law Section 1111: Traffic-control signal indications.

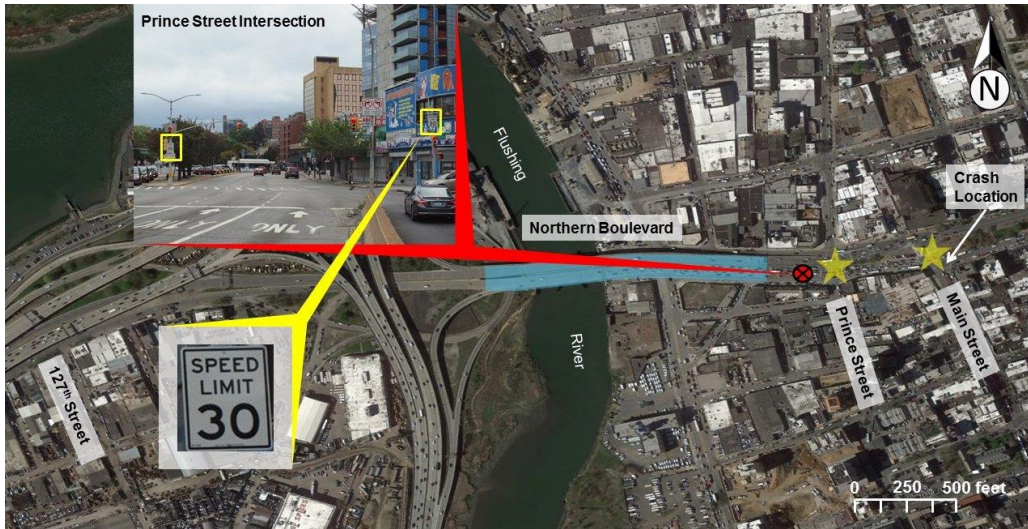



Figure 8 – View of the Prince Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location indicating the speed limit was 30 miles per hour (mph) (Source: Google Earth Maps revised)


2.8. Roadway Signing

Table 3 summarizes the roadway signing in the eastbound direction of Northern Boulevard prior to the crash location.

Table 3 – Roadway signing in the eastbound direction of Northern Boulevard

Sign Type	MUTCD Code	MUTCD Sign Symbol	Condition	Sign Size	Number of Signs	Distances to Crash
Intersection Lane Control	R3-5		Good	30 inch x 36 inch	3	92 feet 200 feet 280 feet
Truck Route Designation	None	“TRUCK ROUTE THRU LOCAL SIGN” ³	Good	30 inch x 36 inch	1	280 feet

³Trucks (and buses) are required to follow truck routes, except to reach a final destination. Relevant portions of the bus rule and truck route rule can be found on New York City’s website.

Speed Limit 30	R2-1		Good	30 inch x 36 inch	2	400 feet (on left in median) 400 feet (on right attached to pole)
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2.9. Stop Bar Locations

Stop bar locations were located on the eastbound approach and northbound approach of the Northern Boulevard and Main Street intersection. The stop bars were a solid white color and measured approximately 2-feet wide. The stop bars were offset from the edge of the pedestrian crossing approximately 8-feet on the eastbound approach and approximately 5-feet on the northbound approach.

2.10. Pedestrian Crossings

Northern Boulevard would be considered an urban street with pedestrian crossings located at the intersections.

Pedestrian crossings were located on the eastbound approach, northbound approach, and eastbound exit of the Northern Boulevard and Main Street intersection. The pedestrian crossings were enhanced with high-visibility crosswalk markings that measured approximately 16-feet wide on the eastbound approach; varied approximately 16-feet wide to 19-feet wide on the northbound approach; and measured approximately 18-feet wide on the eastbound exit of the intersection.

The last time the pedestrian crossings and stop bar locations were refurbished at the Northern Boulevard and Main Street intersection was in August of 2016.

2.11. Sidewalk Locations

Sidewalks were located on the north and south sides of Northern Boulevard and east and west sides of Main Street. The sidewalks on the north side of Northern Boulevard varied from approximately 5-feet to 20-feet wide, and on the south side varied from approximately 14-feet to 16-feet wide. The sidewalks on the east and west sides of Main Street were approximately 15-feet wide.

2.12. Hourly Turning and Through Movement Counts at the Northern Boulevard and Main Street Intersection

Table 4 summarizes the hourly turning and through movement counts at the Northern Boulevard and Main Street intersection.

Table 4 – Hourly turning and through movement counts

One Hour Interval	Vehicle Class	Northbound		Eastbound		Westbound	
		Left	Right	Through	Right	Left	Through
AM							
7 – 8 a.m.	Autos	216	91	884	147	0	1818
	Truck	5	1	68	16	0	70
	Bus	34	36	40	42	34	23
	Bike	4	0	1	1	0	2
	Total	259	128	993	206	34	1913
8 – 9 a.m.	Autos	271	101	1002	298	3	1664
	Truck	7	3	81	9	0	86
	Bus	30	30	17	36	28	30
	Bike	3	0	1	1	0	1
	Total	311	134	1101	344	31	1781
MID-DAY							
12 – 1 p.m.	Autos	196	186	1086	396	5	1111
	Truck	19	7	76	11	0	110
	Bus	16	26	21	27	24	26
	Bike	1	1	1	3	0	3
	Total	232	220	1184	437	29	1250
1 – 2 p.m.	Autos	220	214	1062	374	2	1183
	Truck	20	6	84	12	0	103
	Bus	12	31	19	27	18	17
	Bike	2	1	2	3	0	0
	Total	254	252	1167	416	20	1303
PM							
4 – 5 p.m.	Autos	222	173	1420	256	8	1301
	Truck	15	6	42	12	0	60
	Bus	27	38	3	36	29	13
	Bike	1	0	0	0	2	6
	Total	265	217	1465	304	39	1380
5 – 6 p.m.	Autos	256	228	1487	296	5	1270
	Truck	11	2	29	5	0	70
	Bus	24	41	10	34	46	20
	Bike	0	1	1	0	0	0
	Total	291	272	1527	335	51	1360
6 – 7 p.m.	Autos	245	250	1436	311	0	1233
	Truck	7	2	15	4	0	22
	Bus	19	41	14	27	45	14
	Bike	0	4	0	0	0	0
	Total	271	297	1465	342	45	1269

2.13. On-Street Parking

On-street parking was allowed on Northern Boulevard and Main Street in the vicinity of the intersection at the following times:

- South side of Northern Boulevard from Prince Street to Main Street - No standing anytime, followed by bus stop and no standing anytime at east end of block.
- South side of Northern Boulevard from Main Street to Union Street - No parking street cleaning regulation from 7 a.m. to 8 a.m. except Sunday, 1-hour metered parking 8 a.m. to 10 p.m. except Sunday, parking permitted overnight.
- East side of Main Street from 37th Avenue to Northern Boulevard - No parking street cleaning regulation from 7 a.m. to 7:30 a.m. except Sunday, 1-hour metered parking 7:30 a.m. to 10 p.m. except Sunday, parking permitted overnight, followed by bus stop regulations for remaining 176-feet of block.

2.14. Impact to Traffic Signal Pole and Fire Department Call Box

Figure 9 shows a view of the traffic signal pole and fire department call box before and after the crash. Both the traffic signal pole and fire department call box were demolished as a result of the crash.



Figure 9 – View of the traffic signal pole and fire department call box demolished as a result of the crash (Source: Google Earth Maps revised)

3. Bus Route Locations

According to the New York Metropolitan Transit Administration’s (MTA’s) public route data, thirteen (13) MTA bus routes run (in-service) through the intersection of Northern Boulevard and Main Street.

Q13
Q16
Q19
Q20A
Q20B
Q25
Q28
Q34
Q44+
Q50
Q65



Tests

3.1. NYCDOT speed and vehicle classification study

The NYCDOT conducted vehicle spot speed studies at two locations on Northern Boulevard (see **Figure 10** for site locations). One location was located east of the elevated portion of Northern Boulevard across the Flushing River and the second location was located west of the elevated portion of Northern Boulevard. NTSB investigators requested the studies be conducted at the two locations to help triangulate differences in speeds and determine if vehicles were gaining speed while travelling over the bridge. In addition to the speed study, NYCDOT conducted a vehicle classification study east of the elevated portion of Northern Boulevard. Both locations used road tubes placed over the travel lanes, instead of a radar gun, for better accuracy.

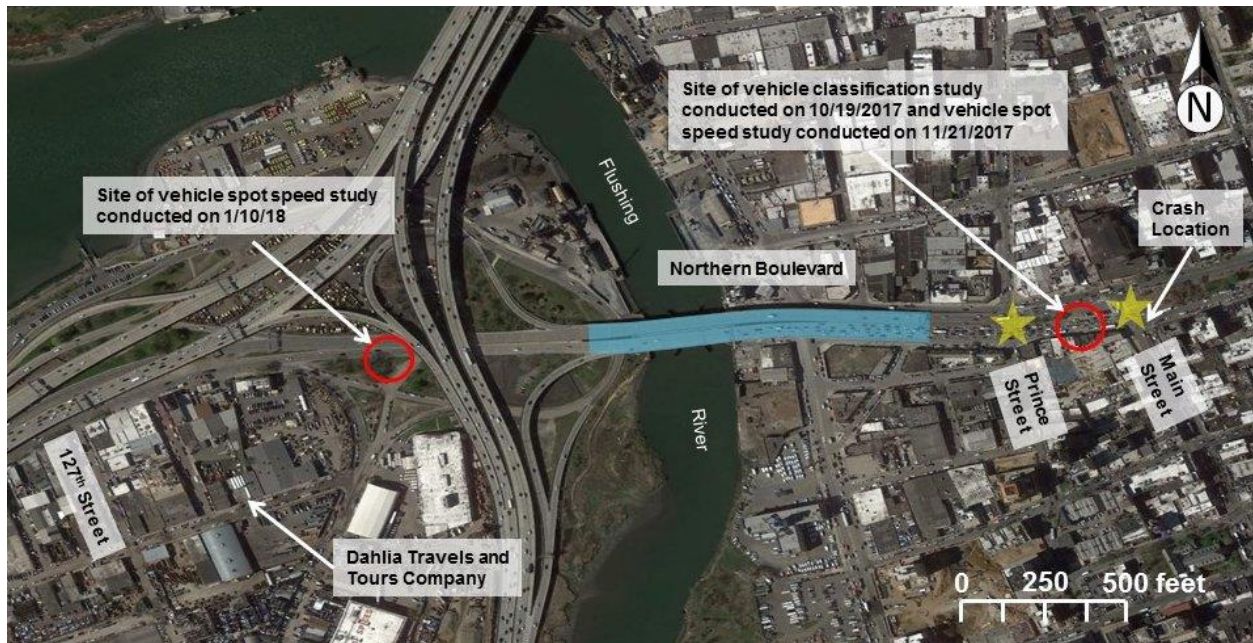


Figure 10 – Site of locations for vehicle spot speed studies and vehicle classification study conducted by NYCDOT (Source: Google Earth Maps revised)

Table 5 summarizes the vehicle spot speed study that was conducted on November 21, 2017 east of the elevated portion of Northern Boulevard across the Flushing River. The vehicle spot speed study was conducted for a 24-hour period and was broken down into the 2 right lanes combined and 2 left lanes combined.

Table 5 – Vehicle spot speed study that was conducted on November 21, 2017 east of the elevated portion of Northern Boulevard across the Flushing River

Speed	East of Elevated Portion of Northern Boulevard conducted on November 21, 2017 (2 right lanes combined)	East of Elevated Portion of Northern Boulevard conducted on November 21, 2017 (2 left lanes combined)
0 to 15 mph	3,588	1,258
15 to 20 mph	2,989	1,643
20 to 25 mph	2,648	2,805
25 to 30 mph	1,474	2,442
30 to 35 mph	597	1,120
35 to 40 mph	191	327
40 to 45 mph	45	88
45 to 50 mph	14	11
50 to 55 mph	6	1
55 to 60 mph	5	1
60 to 65 mph	3	0
65 to 70 mph	5	0

70 mph or greater	9	1
Totals	11,574	9,697
85th Percentile Speed⁴	25 to 30 mph	30 to 35 mph

Table 6 summarizes the vehicle spot speed study that was conducted on January 10, 2018 west of the elevated portion of Northern Boulevard across the Flushing River. The vehicle spot speed study was conducted for a 24-hour period and was broken down into the right and middle lanes.

Table 6 – Vehicle spot speed study that was conducted on January 10, 2018 west of the elevated portion of Northern Boulevard across the Flushing River

Speed	West of Elevated Portion of Northern Boulevard conducted on January 10, 2018 (right lane)	West of Elevated Portion of Northern Boulevard conducted on January 10, 2018 (middle lane)
0 to 15 mph	75	64
15 to 20 mph	313	458
20 to 25 mph	1,297	4,043
25 to 30 mph	1,067	3,048
30 to 35 mph	229	389
35 to 40 mph	19	42
40 to 45 mph	4	4
45 to 50 mph	0	0
50 to 55 mph	0	0
55 to 60 mph	0	1
60 to 65 mph	0	0
65 to 70 mph	0	0
70 mph or greater	0	0
Totals	3,004	8,049
85th Percentile Speed	25 to 30 mph	25 to 30 mph

⁴ The 85th percentile speed is the speed at which 85% of the vehicle traffic is traveling either at or below that speed or, 15% of the vehicle traffic is traveling above that speed.

Table 7 summarizes the vehicle classification study that was conducted on October 19, 2017 east of the elevated portion of Northern Boulevard across the Flushing River. The vehicle classification study was conducted for a 24-hour period over all four travel lanes.

Table 7 – Vehicle classification study that was conducted on October 19, 2017 east of the elevated portion of Northern Boulevard across the Flushing River

Date	Automobiles	Class Trucks	Buses	Totals
October 19, 2017	23,820 (93%)	1,072 (4.2%)	715 (2.8%)	25,607 (100%)

4. Improvements made by the NYCDOT after the crash

4.1. Lane lines on the elevated portion of Northern Boulevard were refreshed by the NYCDOT

The lane lines were refreshed by the NYCDOT on January 4, 2018.

4.2. Street Improvement Project implemented by the NYCDOT

The NYCDOT is developing proposals to enhance safety at the intersections of Northern Boulevard and Prince Street and Northern Boulevard and Main Street. The NYCDOT has a planned Street Improvement Project (SIP) to be implemented in the Spring of 2018. The SIP will include the following:

Street Improvements at the Northern Boulevard and Prince Street intersection

- Convert north crosswalk to high visibility,
- Provide new west crosswalk across westbound service road,
- Provide refuge island in east crosswalk,
- Widen existing median and make more pedestrian friendly, and
- Reallocate signal timing to provide longer crossing time for pedestrians.

Street Improvements at the Northern Boulevard and Main Street intersection

- Provide new crosswalk along Northern Boulevard median at Main Street.

5. Approximate damage caused to the building located in the southeast quadrant of the Northern Boulevard and Main Street intersection as a result of the crash

The approximate damage caused to the building located in the southeast quadrant of the Northern Boulevard and Main Street intersection as a result of the crash was \$500,000.⁵ The damage resulted in a total loss of the business. The owner is currently remodeling the building that includes structural, electrical, and sprinkler system repairs.

E. DOCKET MATERIAL

The following attachments and photographs are included in the docket for this investigation:

LIST OF ATTACHMENTS

Highway Factors Attachment – Vertical Profile of Northern Boulevard over Flushing River

Highway Factors Attachment – Marking Plans for Northern Boulevard from Van Wyck Expressway to Linden Place

Highway Factors Attachment – Marking Plans for Main Street from Northern Boulevard to Franklin Avenue

Highway Factors Attachment – Vehicle classification study conducted on October 19, 2017 east of the elevated portion of Northern Boulevard

Highway Factors Attachment – Vehicle spot speed study that was conducted on November 21, 2017 east of the elevated portion of Northern Boulevard for the 2 right lanes combined

Highway Factors Attachment – Vehicle spot speed study that was conducted on November 21, 2017 east of the elevated portion of Northern Boulevard for the 2 left lanes combined

Highway Factors Attachment – Vehicle spot speed study that was conducted on January 10, 2018 west of the elevated portion of Northern Boulevard for the right lane

Highway Factors Attachment – Vehicle spot speed study that was conducted on January 10, 2018 west of the elevated portion of Northern Boulevard for the middle lane

Highway Factors Attachment – Signal Timing for Northern Boulevard and Prince Street

Highway Factors Attachment – Signal Timing for Northern Boulevard and Main Street

⁵Owner conveyed the approximate damage to building to NTSB investigators in a telephone conversation dated February 1, 2018.

LIST OF PHOTOGRAPHS

Highway Factors Photo 1 – View of the traffic signal locations and elevated portion of Northern Boulevard (Source: Google Earth Maps revised)

Highway Factors Photo 2 – View of the vertical grades on elevated portion of Northern Boulevard (Source: Google Earth Maps revised)

Highway Factors Photo 3 - View of the Prince Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location (Source: Google Earth Maps revised)

Highway Factors Photo 4 - View of the Main Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location (Source: Google Earth Maps revised)

Highway Factors Photo 5 - View of the Northern Boulevard intersection looking in the northbound direction of Main Street toward the crash location (Source: Google Earth Maps revised)

Highway Factors Photo 6 - View of the Prince Street intersection looking in the eastbound direction of Northern Boulevard toward the crash location indicating the speed limit was 30 miles per hour (mph) (Source: Google Earth Maps revised)

Highway Factors Photo 7 - View of the traffic signal pole and fire department call box demolished as a result of the crash (Source: Google Earth Maps revised)

Highway Factors Photo 8 – View of the approximate location of the New York Metropolitan Transit Administration bus turning right from Main Street onto Northern Boulevard at the time of the crash

Highway Factors Photo 9 – View of the scaffolding placed in front of the building located in the southeast corner of the Northern Boulevard and Main Street intersection immediately after the crash

Highway Factors Photo 10 – View of Northern Boulevard in the vicinity of the crash location looking back towards the bridge over the Flushing River

END OF REPORT

Dan Walsh, P.E.

Senior Highway Factors Investigator