Mill Seat Landfill Expansion

Facility ID No. 8-2648-00014

Town of Riga, New York

Draft Supplemental Environmental Impact Statement

Attachment I

Traffic Report

Mill Seat Landfill Expansion
Facility ID No. 8-2648-00014

Town of Riga, New York

Traffic Report

WASTE MANAGEMENT

November 2014

Barton & Loguidice

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GLOSSARY OF TERMS

B&L – Barton & Loguidice

BUD – Beneficial Use Determination

County – Monroe County, New York.

Disposal Capacity – The amount of capacity available in the solid waste management facility available for the disposal of waste.

Landfill Lease Agreement – The Agreement by and between Monroe County, New York (Lessor) and WMNY (Lessee) dated January 14, 2002 and any Amendments thereafter.

Lessee – In an agreement between Monroe County, New York and WMNY, WMNY took responsibility for landfill operations for a 49-year period. WMNY operates the landfill on behalf of Monroe County.

LOS – Level of Service

Mill Seat Landfill – Currently permitted landfill and associated operations.

NYSDEC – New York State Department of Environmental Conservation.

NYSDOT – New York State Department of Transportation

Owner – Monroe County is the owner of the Mill Seat Landfill.

6 NYCRR Part 360 – NYSDEC's solid waste management regulations, codified at 6 NYCRR Part 360 (Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York), effective May 12, 2006.

Permitted Footprint – The existing 98.6 acres of the Permitted Site allocated for solid waste disposal within a double composite liner system.

Permitted Site – The land on which the Permitted Footprint and associated support features (including a Maintenance Building, Administration Building, Scale House, LFG collection system, leachate collection and storage facility, stormwater management features, access roadways, two (2) soil borrow areas and a LFGTE Facility) is located, and the land included as part of the Landfill Lease Agreement. The Permitted Site totals 485 acres.

Permitted Waste Acceptance Rate – The NYSDEC Approved Design Capacity for this landfill is 1,945 tons per day, which equates to 597,000 tons per year. This threshold is a daily average and is based on the quantity of solid wastes accepted at the landfill during a calendar year. Solid wastes that have been approved for use as a beneficial use are not included in this limit.

Proposed Action – The Proposed Landfill Expansion; the proposed wetland impacts and mitigation; the proposed stream impacts and mitigation; as well as required actions, including extension of the Landfill Lease Agreement between Monroe County and WMNY, abandonment of a portion of O'Brien Road and a portion of Brew Road, County and Town of Riga approvals of land transfers, and receipt of noise easements.

Proposed Site – The land on which the Proposed Action would be located, including the 485-acre Permitted Site, the Proposed Wetland Mitigation Area, the O'Brien Road abandonment, and any land acquisitions included in the Proposed Action. The Proposed Site totals approximately 828 acres.

WMNY – Waste Management of New York, LLC operates the Mill Seat Landfill under a lease agreement with Monroe County.

I. EXECUTIVE SUMMARY

A. Overview

The County is the Owner and permittee of the Mill Seat Landfill. The Mill Seat Landfill is operated by WMNY under a Landfill Lease Agreement with the County. The County and WMNY have been community partners for over 20 years. The Mill Seat Landfill's Solid Waste Management Facility NYSDEC Permit I.D. number is 8-2648-00014. The Permitted Site is located in the Town of Riga, Monroe County, New York. The mailing address is 303 Brew Road, Bergen, New York 14416.

The County is seeking a 6 NYCRR Part 360 Solid Waste Management Permit modification from the NYSDEC to construct and operate portions of the Proposed Action. The Proposed Action would allow the Mill Seat Landfill to continue to operate beyond the permitted disposal capacity, providing sufficient capacity to satisfy the community's long-term disposal needs. The Proposed Action is expected to include 118.3 acres of additional lined landfill directly south of the Permitted Footprint, 39.2 acres of overlay on the Permitted Footprint, and approximately 30 acres of disturbance associated with additional support facilities for operation of the Mill Seat Landfill including the stormwater management structures, access roads, LFG collection and control infrastructure, and leachate conveyance infrastructure. Other aspects of this Proposed Action include the proposed wetland impacts and mitigation; the proposed RG-6 Tail impacts and mitigation; as well as required actions, including extension of the Landfill Lease Agreement between the County and WMNY, abandonment of a portion of O'Brien Road, abandonment of a portion of Brew Road, County and Town of Riga approvals of land transfers, and receipt of noise easements. The "Proposed Site", excluding the Proposed Stream Mitigation Area, is the land on which the Proposed Action would be located and includes the Permitted Site.

The purpose of this report is to identify current traffic conditions, compare to previous projections, and forecast future traffic volumes associated with the Proposed Action. This report investigates the existing and future weekday AM and PM peak hour travel conditions at intersections and highway segments surrounding the Mill Seat Landfill. Additionally, this study will evaluate the impacts from construction vehicles for the Proposed Action.

The main haul route for the Mill Seat Landfill includes the use of US I-490, NYS Route 33A, and the north portion of Brew Road between NYS Route 33A and the Mill Seat Landfill. The Mill Seat Landfill entrance is located at the southern terminus of northern Brew Road, approximately three-quarter (0.75) miles south of NYS Route 33A. The O'Brien Road/southern Brew Road entrance is no longer used except for periodic maintenance activities.

The NYSDEC issued the Mill Seat Landfill a 6 NYCRR Part 360 construction permit in 1990 and landfilling operations began in 1993.

II. OBJECTIVE

The objective of this study is to identify current traffic conditions and forecast future traffic volumes and levels of service on the surrounding highway system for the Proposed Action.

III. AFFECTED HIGHWAY SYSTEM

The roadway system identified for investigation includes the portion of Brew Road from the Mill Seat Landfill to Route 33A and Route 33A from Brew Road to I-490. Refer to Figure 1 for the project location map. The intersections of Brew Road with Route 33A as well as the intersections of Route 33A with the I-490 Westbound and Eastbound Off-ramps are included in this analysis.

In the area of the Route 33A interchange, I-490 is functionally classified as a rural principal arterial interstate type highway with full control of access under the jurisdiction of the NYSDOT. The interstate is a divided highway consisting of two (2) travel lanes in each direction with a speed limit of 65 MPH. I-490 provides a major highway connection between the NYS Thruway (I-90) in LeRoy to the west and the City of Rochester to the northeast. The estimated Annual Average Daily Traffic on I-490 between the County Line and the Route 33A interchange was 16,190 vehicles per day in 2010, and approximately 17,380 vehicles per day between the Route 33A interchange and the Route 36 interchange in 2008.

Although it is designated as an east/west route, I-490 actually runs north and south at its intersection with Route 33A to form an expressway interchange. The eastbound off ramp, located on the south side of Route 33A, consists of one lane at its intersection with Route 33A and is controlled by a stop sign. The I-490 westbound off-ramp, located on the north side of Route 33A, consists of a right turn lane controlled by a yield sign and a separate left turn lane controlled by a stop sign. The interchange also supports directional on-ramps (two each), which are not analyzed due to their geometric design. These components are designed as slip ramps without vehicular control which allows continual free-flow movement.

NYS Route 33A is functionally classified as a rural minor arterial from Route 33 to the County line and a rural major collector from the County line to Route 36 under the jurisdiction of the NYSDOT. The highway consists of two (2) travel lanes in each direction in the vicinity of the Proposed Site. The highway narrows to one (1) travel lane per direction to the east of Brew Road. Route 33A provides a highway connection between Route 33 in Rochester to the east and Route 33 near the Town of Bergen to the West. The posted speed limit on Route 33A is 55 MPH in the vicinity of the Proposed Site. The estimated Annual Average Daily Traffic between Route 33 and the County line was 8,640 vehicles per day in 2010, and 2,390 vehicles per day between the County line and Route 36 overlap in 2011.

Brew Road is a north/south County road. In the vicinity of the Route 33A intersection, the highway consists of one (1) travel lane in each direction. The Brew Road intersection with Route 33A is controlled by a stop sign on the minor/side street approach.

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MILL SEAT LANDFILL

PROJECT LOCATION MAP

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure

1

Project No.

1242.022.013

IV. EXISTING TRAFFIC CONDITIONS

A. Peak Intervals for Analysis

Given the functional characteristics of the study area roadways, the operational characteristics of the Mill Seat Landfill land use, and to be consistent with all previous studies for this Permitted Site, the peak hours selected for analysis are the weekday AM and PM "commuter" peaks. The combination of site traffic and adjacent through traffic produces the greatest demand during these time periods.

B. Existing Peak Hour Volumes

Peak weekday turning movement counts were obtained at the three (3) existing intersections in the study area and are included with this report as Appendix B. The peak hour volumes were determined by turning movement counts including vehicle classification performed by B&L between 6:30-8:30 AM and 3:30-5:30 PM on Wednesday, September 25, 2013. The collected data indicated that during these periods, the peak hours of traffic at the study intersections were generally 7:00-8:00 AM and 3:45-4:45 PM.

Peak hour volumes, depicting the existing vehicular movements at each study intersection, are illustrated in Figures 2 & 3. These figures indicate the total volume of traffic for each movement as well as volume associated with each vehicle type classified during the data collection.

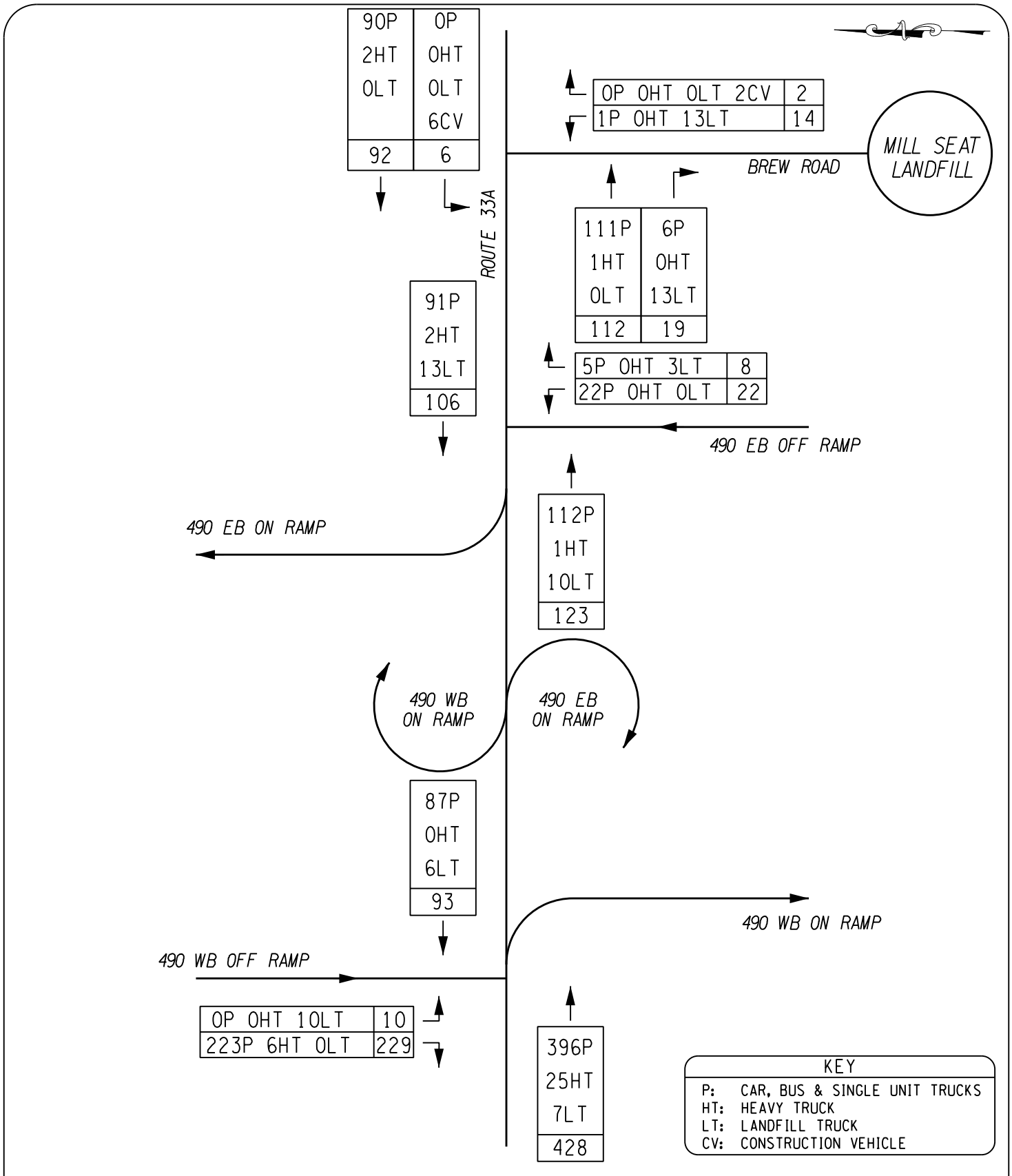
C. Area Growth

A growth rate of one and a half (1.5) percent per year was applied to all existing traffic volumes that are unrelated to activities at the Mill Seat Landfill to account for potential growth in the area that can be expected from the time the turning movement counts were performed to the opening of the Proposed Action. This rate, recommended by the County, is considered a conservative estimate for short duration growth that can be expected for the Town of Riga. Background traffic is not projected to the life of the Proposed Action as it is growth that may or may not be realized and is unrelated to the Proposed Action or the existing landfill operations. Actual traffic growth over the past 20 years was found to be three-tenths (0.3) percent per year based on NYSDOT Traffic Volume Reports on Route 33A. Historic traffic counts on Route 33A and growth rate calculations are included in Appendix A. Background traffic volumes are shown in Figures 4 and 5.

V. PROPOSED DEVELOPMENT

A. Description

The Proposed Action does not modify the Permitted Waste Acceptance Rate. For the purpose of the traffic analysis, a worst case scenario was analyzed that takes into account the maximum estimated number of trucks combined with the maximum estimated number of construction vehicles anticipated for the Proposed Action.



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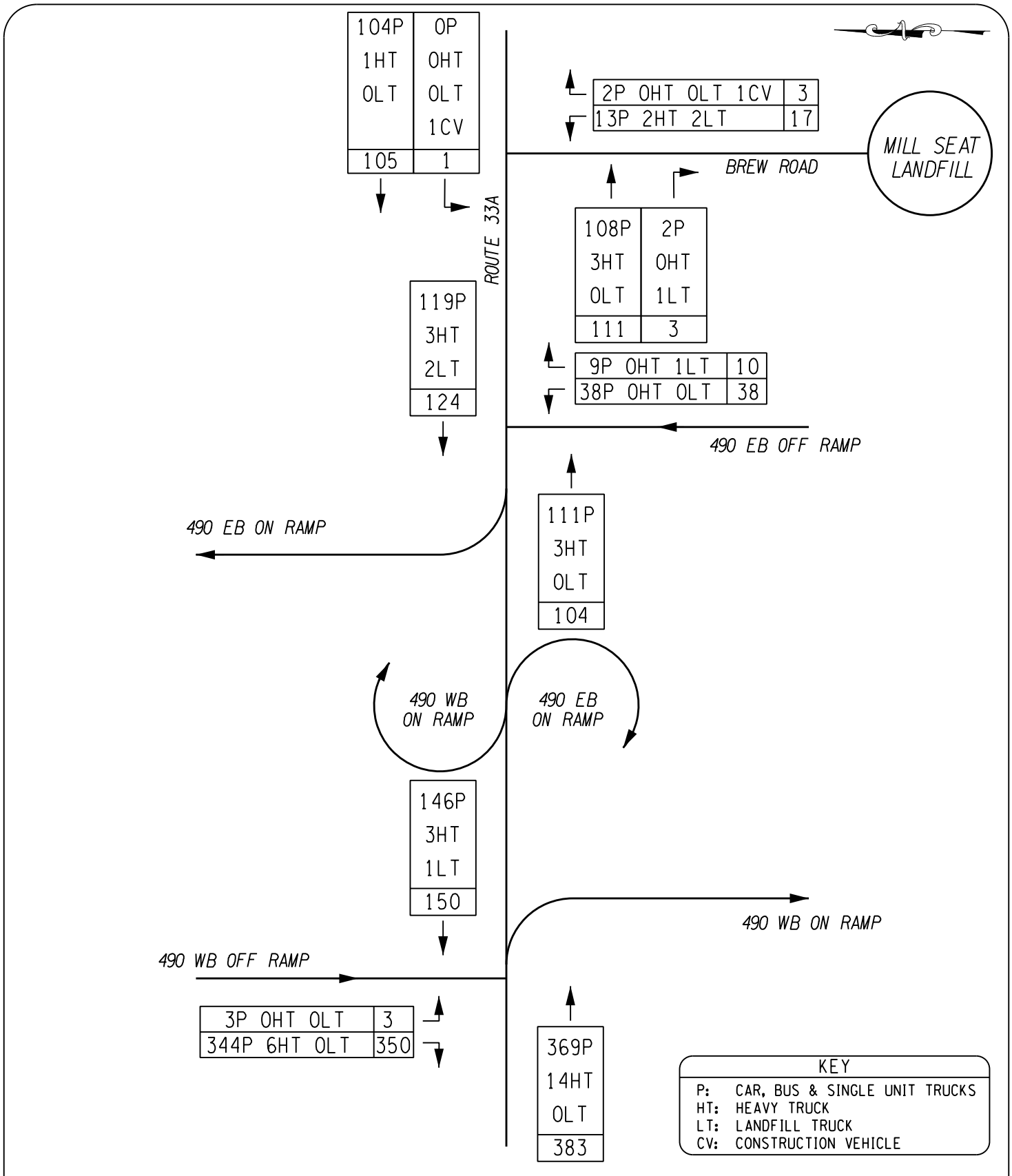
MILL SEAT LANDFILL

EXISTING CONDITIONS (2013) - AM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 2

Project No. 1242.022.013



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MILL SEAT LANDFILL

EXISTING CONDITIONS (2013) - PM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 3

Project No. 1242.022.013

B. Site Traffic Generation

1. Maximum Operating Volume

Truck ticket data from 2012 was collected and reviewed to identify the peak daily truck volumes for Mill Seat Landfill (See Appendix C). This data indicates that the highest daily truck volume for 2012 was 251 trucks delivering 3,893 tons of material on October 3, 2012. Data provided by Mill Seat Landfill personnel indicates that 524,874 tons of disposal material was delivered to the Mill Seat Landfill in 2012. This is 87.7 percent of the Permitted Waste Acceptance Rate. For the traffic analysis, the ratio of the maximum permitted amount to actual accepted amount of material (597,000 to 524,874) was used to forecast the maximum daily truck volume to 286 trucks. This includes trucks delivering waste, covers soils, and BUD materials. As the Proposed Action will not modify the Permitted Waste Acceptance Rate, this maximum daily volume will be valid for the life of the permit.

The day of the intersection counts, Wednesday, September 25, 2013, 162 trucks delivered 2,576 tons of material. The *maximum* daily to *actual* daily ratio (286 to 162) is used to extrapolate the maximum peak hour truck volumes.

2. Temporary Construction Traffic

Construction traffic will consist primarily of dump trucks hauling stone and clay material for new cell construction, liner construction, and cover materials. Construction activities associated with the Proposed Landfill Expansion are expected to occur every two (2) or three (3) years over the life of the permit as existing cells reach capacity and new cells are constructed. The forecasted construction traffic will be the same as existing traffic that already occurs under the current permit.

Construction traffic data was collected by Mill Seat Landfill for the week of the intersection counts. The highest daily truck count was 58 trucks occurring on Tuesday, September 24, 2013 and again on Friday, September 27, 2013. Interviews with Mill Seat Landfill personnel indicate these daily highs are typical for current construction traffic, but as construction operations vary, a maximum of 75 trucks per day can be expected. This estimate includes 16 additional trucks per day which will haul cover material from off site.

The day of the intersection counts, Wednesday, September 25, 2013, 38 construction trucks delivered clay and stone to the Permitted Site. The *maximum* daily to *actual* daily ratio (75 to 38) is used to extrapolate the maximum peak hour construction volumes.

Table I illustrates the peak hour trip generation estimates derived from the existing peak hour truck volumes.

TABLE I				
DESCRIPTION	**AM PEAK**		**PM PEAK**	
	ENTER	**EXIT**	**ENTER**	**EXIT**
Existing Landfill Truck Traffic (162 trucks per day)	13	13	2	2
Existing Construction Traffic (38 trucks per day)	6	2	1	1
Additional Landfill Truck Traffic including cover soils (based on an additional 124 trucks/day)	10	10	2	2
Additional Construction Traffic (based on an additional 37 trips/day)	6	2	1	1
Total	***35***	***27***	***6***	***6***

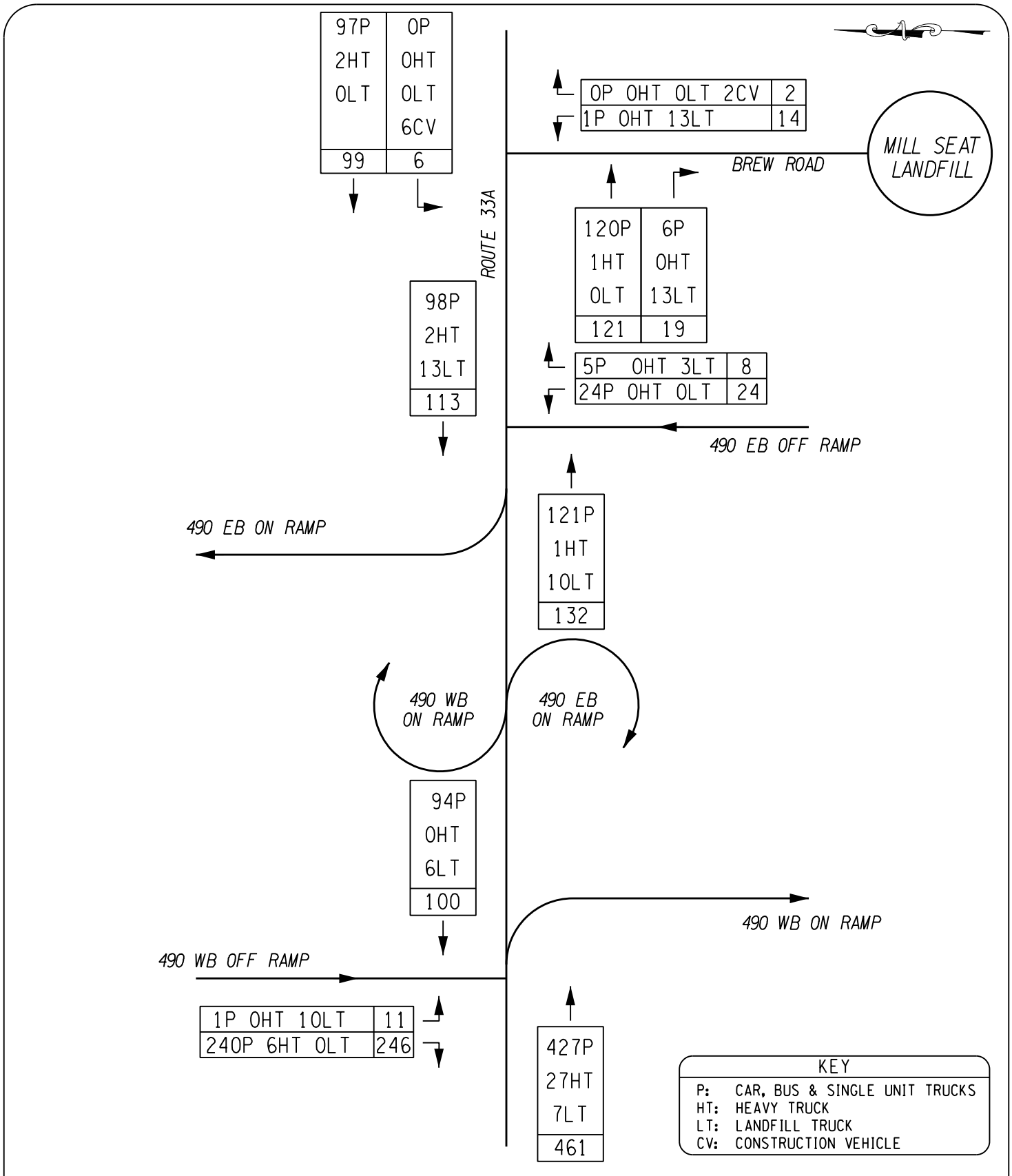
C. Site Traffic Distribution

It is anticipated that newly generated landfill traffic volumes will follow existing travel patterns of vehicles accessing the Mill Seat Landfill; these patterns were found to be consistent with the pattern proposed in the original Traffic Impact Analysis for the Permitted Site.

Construction traffic destined for the Proposed Site will be travelling from the east and will utilize I-490 and Route 33A eastbound to Brew Road. Construction vehicles leaving the Proposed Site would take the reverse route (Brew Road to Route 33A westbound to I-490). Figures 6 and 7 show the combined site generated traffic as assigned to the study area intersections.

VI. PROJECTED DESIGN HOUR VOLUMES

The projected design hour traffic volumes were developed for each peak by combining the background traffic conditions (Figures 4 and 5) and newly created traffic generations (Figures 6 and 7) to yield the total traffic conditions expected as a result of the maximum truck traffic accessing the Proposed Site. Figures 8 and 9 show the total weekday peak hour volumes for the projected traffic forecasted to the end of the permit.



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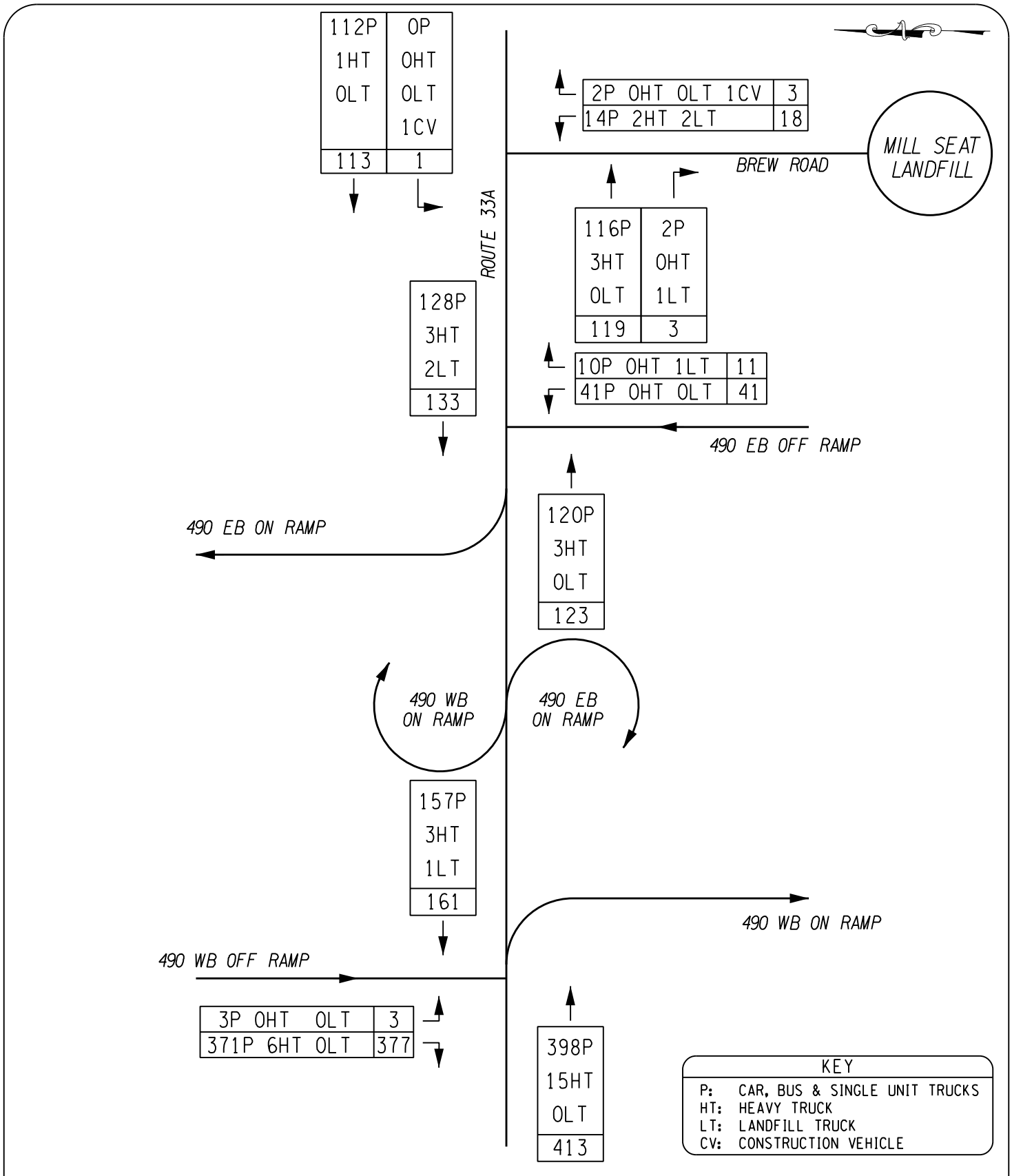
MILL SEAT LANDFILL

BACKGROUND CONDITIONS (2018) - AM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 4

Project No. 1242.022.013



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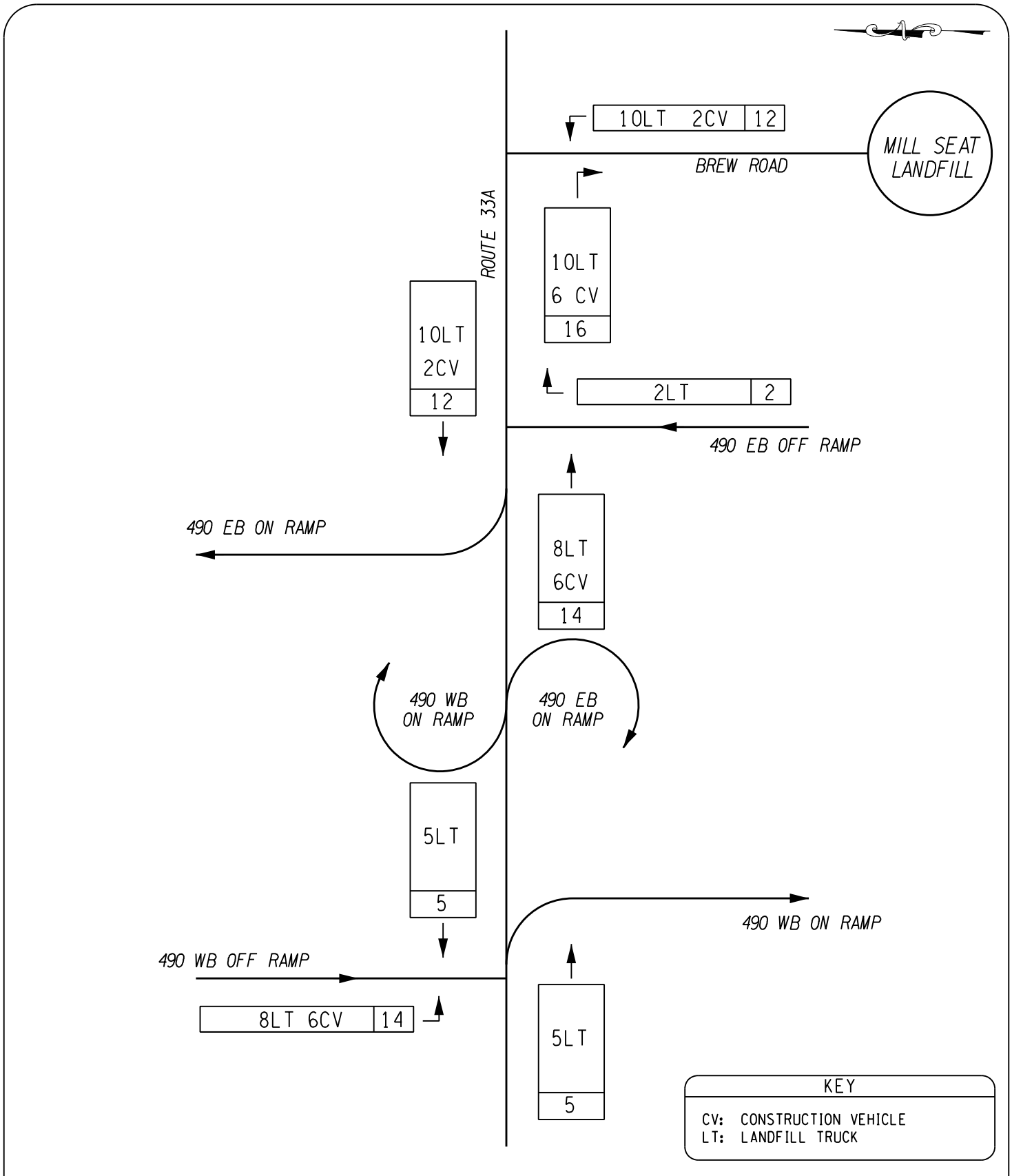
BACKGROUND CONDITIONS (2018) - PM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 5

Project No. 1242.022.013



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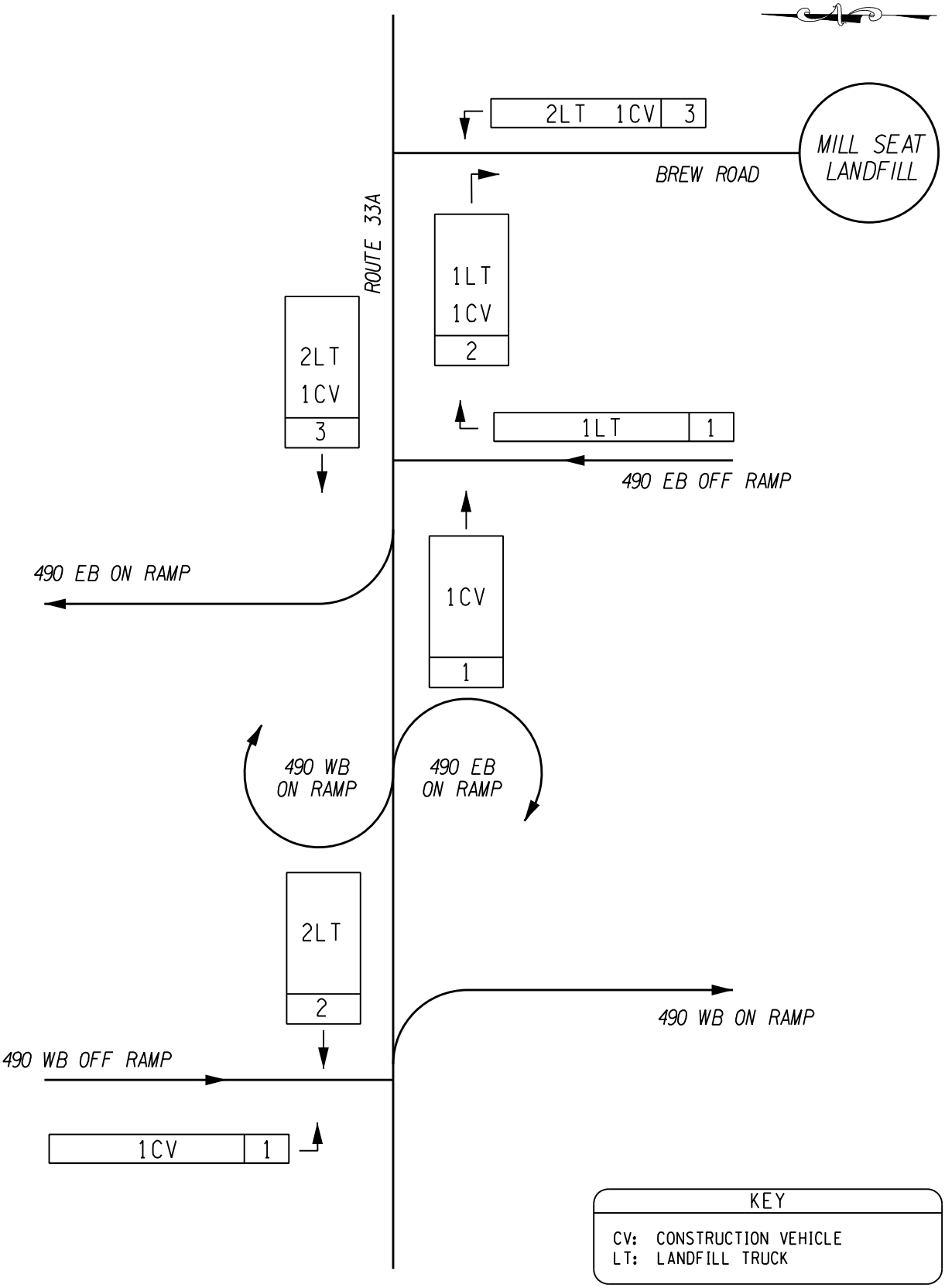
MILL SEAT LANDFILL

SITE GENERATION - AM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 6

Project No. 1242.022.013



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MILL SEAT LANDFILL

SITE GENERATION - PM PEAK

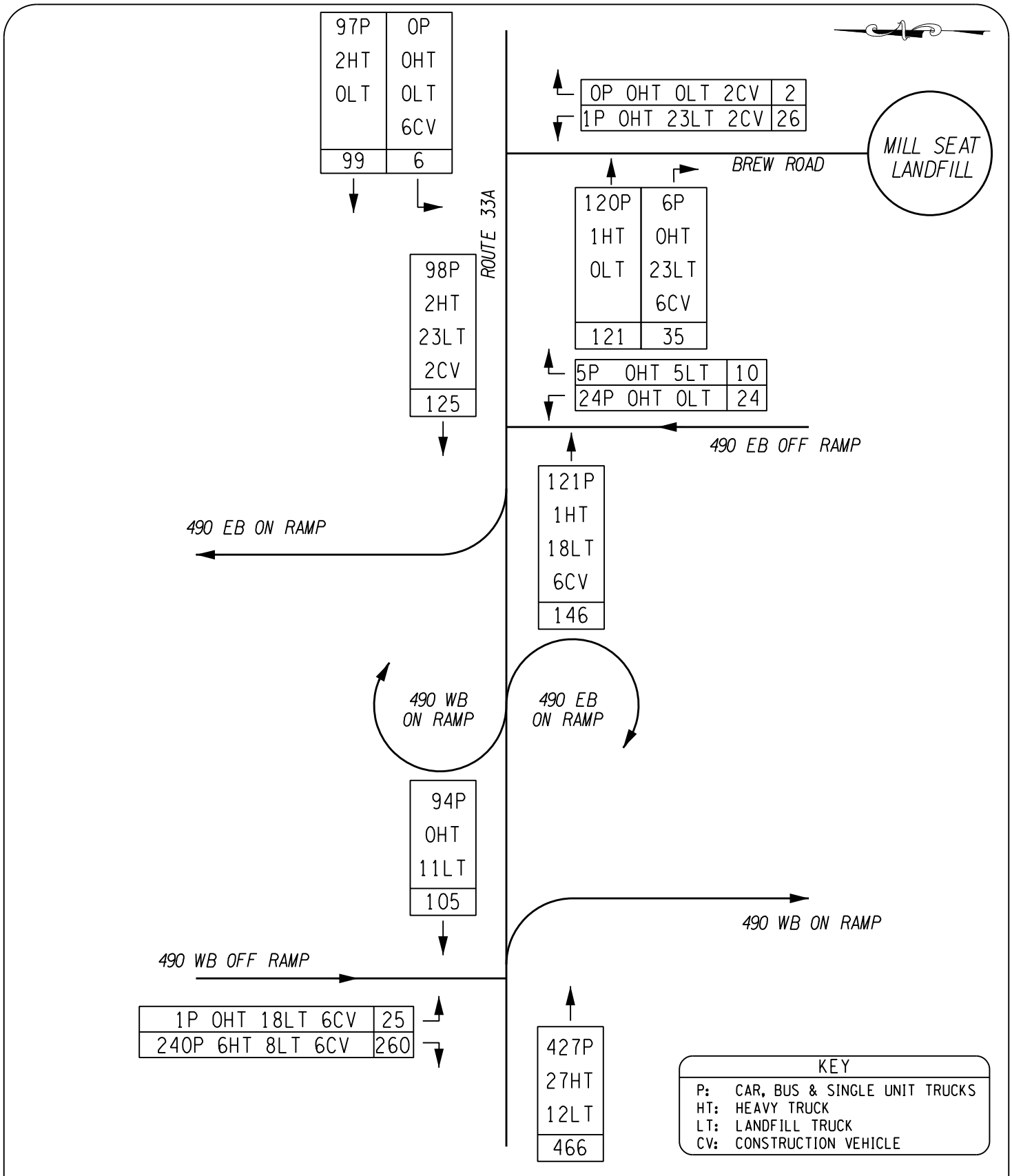
TOWN OF RIGA MONROE COUNTY NEW YORK

Figure

7

Project No.

1242.022.013



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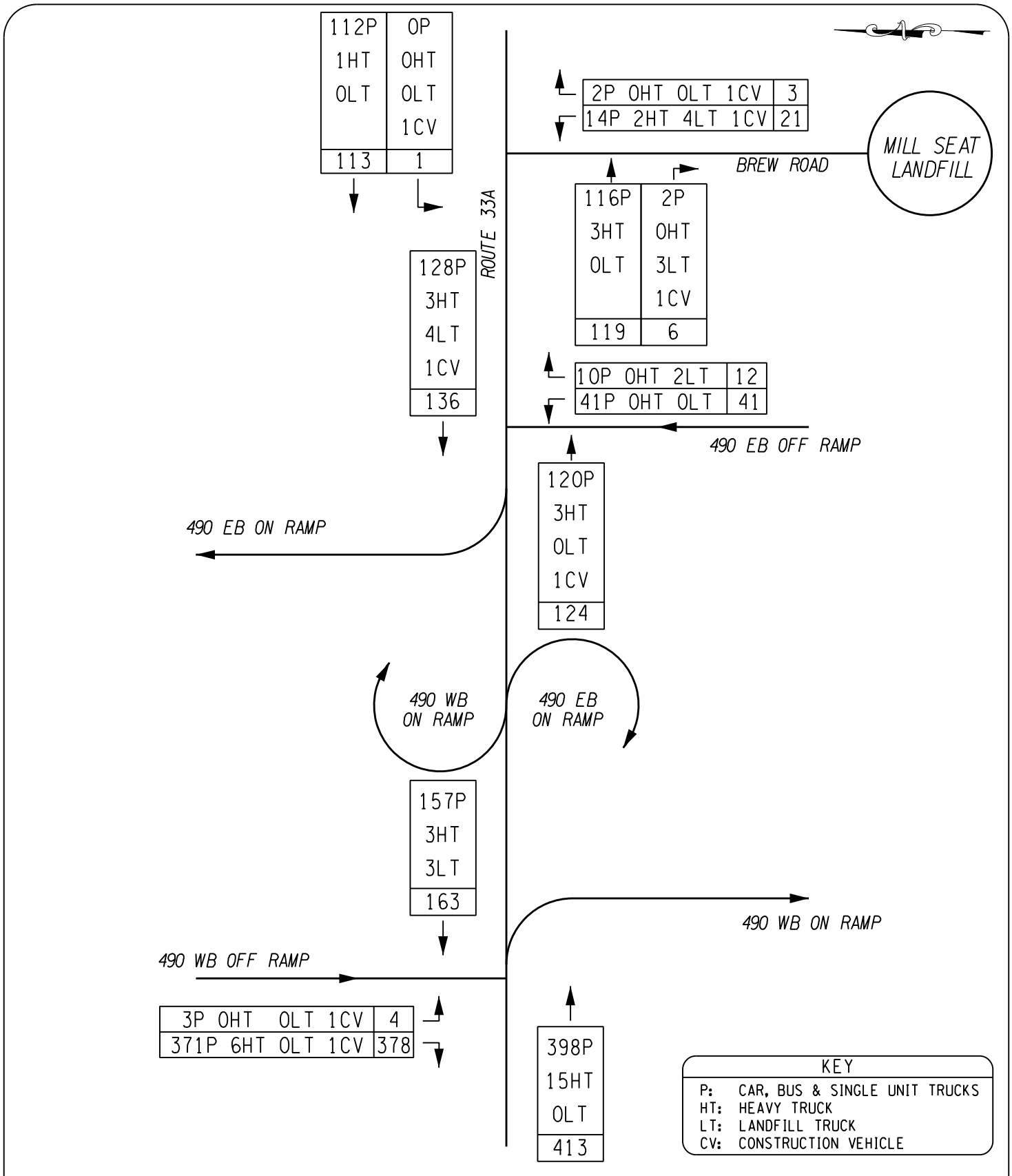
MILL SEAT LANDFILL

FUTURE CONDITIONS (2018) - AM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 8

Project No. 1242.022.013



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MILL SEAT LANDFILL

FUTURE CONDITIONS (2018) - PM PEAK

TOWN OF RIGA MONROE COUNTY NEW YORK

Figure 9

Project No. 1242.022.013

VII. CAPACITY ANALYSIS

The capacity of the highway system is predicated on two (2) components: the capacity of the included roadway sections and the capacity of the affected intersections along the route. The roadway sections involved can accommodate the proposed increase in traffic projected with very little impact to through traffic based on the analysis in this Report.

Intersecting roadways generally provide the initial constraint on a system's capacity. Efficiency at the intersections becomes the critical constraint for capacity. Vehicle interactions at these points must therefore be analyzed to assess the projected capacity levels.

The standard procedure for capacity analysis of signalized and unsignalized intersections is outlined in the 2010 Highway Capacity Manual published by the Transportation Research Board. Version 6.3 of the 2010 Highway Capacity Software was used to analyze operating conditions at study area intersections. The procedure yields a LOS as an indicator of how well intersections operate. LOS is defined in terms of delay which is a measure of driver discomfort, frustration, fuel consumptions, and lost travel time.

The concept of LOS is defined as a qualitative measure describing operating conditions within a traffic stream, and their perception by motorists and/or passengers. Six (6) LOS are defined for analysis purposes. They are assigned letter designations, from "A" to "F", with LOS "A" representing the best conditions and LOS "F" the worst. Suggested ranges of service capacity and an explanation of LOS are included in Appendix H.

The projected traffic conditions generated by the Proposed Action were analyzed to assess the operations of the study intersections. Capacity results including LOS and average delay in seconds of the existing, background, and projected conditions are listed in Table II. All capacity analysis calculations are included in Appendices E, F, and G. The discussion following Table II summarizes the existing, background, and projected capacity conditions. The PM peak hour results for the projected conditions include the superimposed site generated traffic as discussed earlier.

TABLE II

DESCRIPTION	EXISTING CONDITIONS		BACKGROUND CONDITIONS		PROJECTED CONDITIONS	
	AM Peak LOS (sec)	PM Peak LOS (sec)	AM Peak LOS (sec)	PM Peak LOS (sec)	AM Peak LOS (sec)	PM Peak LOS (sec)
Route 33A/WB Off Ramp Southbound	B (10.2)	B (11.6)	B (10.5)	B (12.1)	B (10.9)	B (12.2)
Route 33A/ EB Off Ramp Northbound	A (9.6)	A (9.9)	A (9.8)	B (10.1)	A (9.9)	B (10.2)
Route 33A/ Brew Road Northbound Westbound Left	B (12.0) A (8.8)	B (10.5) A (7.4)	B (12.3) A (8.9)	B (10.9) A (8.8)	B (12.9) A (9.0)	B (11.2) A (8.8)

All resulting capacity levels represent acceptable LOS ("B" or better). The results of the capacity analyses indicate that the background traffic growth (1.5% per year) coupled with any additional landfill traffic will have little or no effect on the peak operation of the 490 off-ramps and on Route 33A. The LOS theoretically changes from "A" to "B" for the eastbound 490 off-ramp under the Proposed Action conditions. Two (2) points are noted about this theoretical increase:

1. The existing delay (9.6 seconds AM, 9.9 seconds PM) for this movement is already at the upper range of LOS "A". The delay threshold between LOS "A" and "B" is 10.0 seconds. The actual increase in average delay is three-tenths (0.3) seconds for the AM Peak and three-tenths (0.3) seconds for the PM Peak.

2. The increase in delay is due mostly to background traffic growth forecasted to the end of the permit; accounting for two-tenths (0.2) seconds for the AM Peak and two-tenths (0.2) seconds for the PM Peak.

The above projected results are based on the Permitted Waste Acceptance Rate, which is represented by the worst case scenario of 266 trucks per day. It is important to note that the average daily condition is 200 trucks or less.

VIII. TRAFFIC PATTERN IMPACTS

Traffic patterns, unrelated to the Proposed Action traffic, may be impacted in the area surrounding the Proposed Site. The western end of O'Brien Road intersects Brew Road within the limits of the Proposed Action. A portion of Brew Road intersects the permitted eastern borrow area, where soil borrow activities have already begun. There is currently one (1) driveway access off of this southern portion of Brew Road and seven (7) driveway accesses on O'Brien Road. The abandonment of approximately seven-tenths (0.7) miles of Brew Road from O'Brien Road to Bovee Road will include providing a new driveway access off of Bovee Road for the Brew Road residence. Approximately four-tenths (0.4) miles of O'Brien Road will be abandoned.

The remaining portion of O'Brien Road will remain open and a turn-around will be installed by the Town of Riga as a separate action to maintain the existing driveways and traffic on O'Brien Road. The abandonment of the southern portion of Brew Road, and the de-mapping of the aforementioned roadway and Brew Road will be terminated in an approved manner. Brew Road and O'Brien Road are both low volume rural roadways and the proposed traffic changes will have negligible impact to the surrounding roadway network.

IX. SAFETY INVESTIGATION

Review of accident data for the most recent ten(10) years available (February 28, 2003 through February 28, 2013) indicated two (2) accidents occurred on Route 33A at Brew Road: one (1) involving a collision with a deer and another a collision with a utility pole. Neither accidents involved injury and neither resulted in more than $1,000 in damage. The collision with utility pole occurred during freezing conditions and was attributed to unsafe speed. These are considered "non-reportable" type accidents in NYSDOT's Accident Location Information System.

X. CONCLUSIONS

This report has addressed the combined traffic impact that can be expected on the surrounding roadway network as a result of the Proposed Action. It has been documented that the existing transportation network can accommodate the projected truck traffic volumes, and will not adversely impact traffic on the adjacent roadways. No noticeable changes in operating conditions are anticipated at any of the study area intersections as a result of the Proposed Action and no modifications to the study area intersections are warranted or recommended.

APPENDIX A

NYSDOT Traffic Counts

County Order	End Mile Point	Count LOC Reference Marker	Section Length	Section End Description	LATEST COUNT EST AADT	YR	PREVIOUS COUNTS EST AADT	YR	EST AADT	YR	EST AADT	YR	Count Station Number	YR
			Route	**NY481 County 075 OSWEGO**	**Region**	**03**								
2	12.56		00.13	FULTON CITY LN	11890	**	11870	10	11280	07	13770	04	0008	
2	19.75	481 34022024	07.19	OSWEGO S CITY LN	11870	**	11760	06	10320	03	10780	00	0007	
2	21.23	481 34023072	01.48	SYRACUSE AVE	12580	**	12470	06	12350	03	13040	02	0034	
2	21.96	481 34024015	00.73	UTICA ST	8770	**	8750	10	9250	05	9640	01	0035	
2	22.25	481 34024023	00.29	RT 104 END 481	9580	**	9470	05	9930	04	9740	01	0019	
			Route	**NY488 County 069 ONTARIO**	**Region**	**04**								
1	00.00		00.00	RT 21 CHAPIN										
1	09.53	88 44012023	09.53	RT 96 END 488	1920	11	1940	08	2180	05	1870	02	0255	
			Route	**I490 County 037 GENESEE**	**Region**	**04**								
1	00.00		00.00	RT 90I INTER 47										
1	00.19	490I41011000	00.19	ACC RT 19 VALLANCE RD	14340	11	14260	10	13250	08	13860	07	0019	
1	01.38	490I41011002	01.19	MONROE CO LINE	11860	**	11750	08	14550	04	12340	02	0059	
			Route	**I490 County 055 MONROE**	**Region**	**04**								
2	02.00	490I41011013	02.00	RT 33A IS OVER WITH CONN EXIT 2	16240	**	16190	10	14270	07	13970	04	0086	
2	04.97	490I43021021	02.97	RT 36 IS OVER WITH CONN EXIT 3	17540	**	17380	08	21910	05	16890	02	0587	
2	09.40	490I43021051	04.43	RT 259 UNION ST IS OVER WITH CONN EXIT 4	19940	**	19820	09	22020	06	21180	04	0570	
2	12.71	490I43021095	03.31	RT 386 IS UNDER WITH CONN EXIT 5	25330	**	25190	08	31550	04	24010	02	0575	
2	14.40	490I43021128	01.69	RT 204 AIRPORT IS UNDER WITH CONN EXIT 6	34910	**	34720	08	39850	05	37380	03	0576	
2	15.20	490I43021145	00.80	RT 33 IS UNDER WITH CONN EXIT 7	55690	**	55480	09	44690	05	39170	02	0577	
2	15.79	490I43021153	00.59	RT 531 EXIT 8	48250	**	48080	09	46570	02	42310	99	0580	
2	17.64	490I43021159	01.85	ACC 390I 390 OUTER LOOP EXIT 9	119680	**	119240	09	89280	02	89070	01	0579	
2	18.79	490I43021177	01.15	MT READ BLVD UNDER WITH CONN EXIT 10	101280	**	99620	02	100880	01			0578	
2	19.57	490I43022007	00.78	RAMPS AMES ST OVER WITH CONN EXIT 11	99770	**	98680	05	86470	02	102430	97	0153	
2	19.83	490I43022015	00.26	RAMPS CHILD ST OVER CONN EXIT 11	85440	**	84510	05	92230	02	97530	97	0154	
2	20.47	490I43022018	00.64	BROWN ST UNDER WITH CONN EXIT 12	96170	**	94430	01	97290	97			0155	
2	20.87	490I43022024	00.40	ACC INNER LOOP 1ST TM	95920	**	94360	02	84050	97			0027	
2	21.38	490I43022028	00.51	PLYMOUTH AVE	54680	**	54080	05	68810	02	69090	97	0156	
2	21.56	490I43022033	00.18	INNER LOOP & RT 15	69430	**	68290	02	113080	97			0540	
2	22.54	490I43022035	00.98	GOODMAN ST OVER WITH CONN	84990	11	87950	10	77440	09	76070	08	0541	CC
2	22.99	490I43022045	00.45	RT 31 MONROE AVE OVER WITH CONN	87500	**	86860	07	95970	04	80440	03	0542	
2	23.53	490I43022050	00.54	CULVER RD OVER WITH CONN	84370	**	83440	05	98000	02	96460	98	0543	
2	24.53	490I43022055	01.00	ACC WINTON RD	110990	**	108200	97					0544	
2	24.82	490I43022065	00.29	RT 590I	88350	**	88020	09	99780	02	107530	97	0646	
2	25.06	490I43022068	00.24	RT 590	85330	**	84240	04	111600	03			0654	
2	25.65	490I43023001	00.59	PENFIELD RD	105010	**	104430	08	118490	01	119570	97	0545	
2	26.44	490I43023007	00.79	RT 441 LINDEN RD	99520	**	98790	07	104230	04	106530	98	0546	
2	27.76	490I43023015	01.32	E ROCHESTER CONN	79460	**	79160	09	72170	05	74710	02	0547	
2	28.17	490I43023028	00.41	RT 31F	66620	**	65770	04	62300	03	67960	98	0548	
2	30.75	490I43023032	02.58	RT 31	43800	11	62530	09	71840	03			0549	

County Order	End Mile Point	Count LOC Reference Marker	Section Length	Section End Description	LATEST COUNT EST AADT	YR	PREVIOUS COUNTS EST AADT	YR	EST AADT	YR	EST AADT	YR	Count Station Number	YR
			Route	**NY33 County 029 ERIE**	**Region**	**05**								
1	16.19	33 53012089	02.04	CR 155 RANSOM RD	8080	**	8190	09	7440	06	7040	05	0141	
1	19.52	33 53012110	03.33	JCT RT 952Q WALDEN AVE	3140	**	3150	10	3080	07	2540	04	0142	
1	22.81	33 53012143	03.29	GENESEE CO LINE	7140	11	7930	08	7800	05	7860	02	0143	
			Route	**NY33 County 037 GENESEE**	**Region**	**04**								
2	03.07	33 53012175	03.07	RT 77 CORFU	4750	**	4780	09	7720	05	4840	02	0289	
2	10.70	33 41021031	07.63	WORTENDYKE RD CR 37	3580	**	3630	07	2780	04	5180	01	0026	
2	13.30	33 41021108	02.60	BATAVIA W CITY LN	3780	**	3810	09	4610	06	5760	05	0421	
2	14.24	33 41021133	00.94	START 98 OLAP	5090	11	5240	08	5640	05	6830	03	0422	
2	14.32		00.08	END 98 START 5 63 OLAPS	16030	**	16060	08	13950	05	12580	03	0423	
2	14.59	33 41022010	00.27	END 63 OLAP	31970	**	31760	08	38200	02	33230	99	0424	
2	15.79	5 41032011	01.20	END 5 OLAP	17400	**	17410	10	18760	06	16540	03	0006	
2	16.42	33 41022026	00.63	BATAVIA E CITY LN	7630	**	7650	08	10100	05	14430	02	0208	
2	18.59	33 41022031	02.17	PROLE RD CR 19B	7390	**	7400	09	5590	06	6360	03	0027	
2	21.33	33 41023022	02.74	RT 237	5540	**	5570	09	5730	05	5900	99	0425	
2	28.16	33 41023050	06.83	RT 19	5870	**	5910	09	5420	06	5870	03	0427	
2	28.53	33 41023118	00.37	RT 33A	7050	**	7090	09	10090	06	7450	04	0428	
2	29.36	33 41023122	00.83	ROCHESTER ST	2050	**	2070	09	1820	06	2150	05	0429	
2	29.56	33 41023129	00.20	MONROE CO LINE	2250	11	2420	07	2810	04	4030	01	0017	
			Route	**NY33 County 055 MONROE**	**Region**	**04**								
3	02.63	33 41023130	02.63	START 36 OLAP CHURCHVILLE	3160	**	3190	09	2440	05	4780	02	0174	
3	03.46	33 43031027	00.83	END 36 OLAP	4550	**	4600	07	4260	04	4570	00	0417	
3	06.83	33 43031035	03.37	RT 259 N CHILI	7030	**	7070	09	6560	04	8700	01	0430	
3	08.67	33 43031069	01.84	STONY PT RD CR 169	8720	**	8730	09	8060	04	9870	01	0182	
3	10.77	33 43031087	02.10	START RT 386 OLAP	10580	**	10600	09	10990	05	11440	97	0572	
3	10.97	33 43031108	00.20	END RT 386 OLAP	16350	11	17320	07	17160	04	15780	01	0431	
3	11.72	33 43031110	00.75	RT 490I IS OVER WITH CONN	14950	**	14970	09	15910	05	19680	04	0573	
3	13.13	33 43031118	01.41	HOWARD RD	13450	11	16290	08	13730	06	15210	03	0015	
3	14.12	33 43031132	00.99	ROCHESTER W CITY LN	11660	**	11680	08	10790	07	11180	04	0432	
3	14.74	33 43031141	00.62	MOUNT READ BLVD	10300	**	10300	10	12770	07	13240	04	0433	
3	15.97	33 43032007	01.23	RT 33A	12340	**	12350	10	15740	07	10480	04	0434	
3	16.89	33 43032020	00.92	RT 31 END RT 33	18180	**	18250	05	19890	02	17100	98	0435	
			Route	**NY33A County 037 GENESEE**	**Region**	**04**								
1	00.00		00.00	RT 33										
1	00.28	33A41011000	00.28	MONROE CO LN ACC 490I	8610	**	8640	10	9130	07	8700	04	0522	
			Route	**NY33A County 055 MONROE**	**Region**	**04**								
2	02.65	33A41011003	02.65	START 36 OLAP RIGA	2390	11	2950	07	2640	04	2610	01	0523	
2	02.88	33A43021027	00.23	END 36 OLAP RIGA	3100	**	3120	09	4470	05	5500	02	0415	
2	07.63	33A43021030	04.75	RT 259 W CHILI	2600	**	2620	09	3490	06	3820	05	0524	

ROUTE NUMBER	END MILE POINT	COUNT LOC REFERENCE MARKER	SECTION LENGTH	SECTION ENDS AT	LATEST COUNT EST AADT	YR	PREVIOUS COUNTS EST AADT	YR	EST AADT	YR	EST AADT	YR	COUNT STATION NUMBER	
				REGION 5 COUNTY 3 ERIE										
33	0110764	33 53012021	0.67	ACC RT 277 UNION RD	65000	**	63000	02	65800	97	63400	91	0085	
33	0110818	33 53012023	0.54	ACC CAYUGA DICK RDS	51900	04	55400	03	51300	02	50200	97	0166	CC
33	0110852	33 53012030	0.34	ACC GENESEE ST JCT 952A AC	33600	**	33100	02	30500	98	33600	95	0086	
33	0110909	33 53012036	0.57	ACC AIRPORT E ENT	44500	**	43600	01	38700	98	44000	96	0168	
33	0110964	33 53012041	0.55	ACC CR 539 HOLTZ RD	41200	**	40600	02	41700	99	40700	98	0169	
33	0111073	33 53012051	1.09	ACC RT 78 TRANSIT RD	31600	**	31200	02	31000	99	30800	96	0005	
33	0111186	33 53012057	1.13	CR 57 HARRIS HILL RD	16500	**	16400	03	21900	01	18300	99	0167	
33	0111415	33 53012076	2.29	CR 288 GUNVILLE RD	14800	**	14700	03	13800	02	13800	99	0383	
33	0111619	33 53012100	2.04	CR 155 RANSOM RD	8800	**	8700	02	7500	97	7450	94	0141	
33	0111952	33 53012141	3.33	JCT RT 952Q WALDEN AVE	2550	04	3400	02	4100	98	3450	91	0142	
33	0112281	33 53012145	3.29	GENESEE CO LINE	8600	**	8450	02	8150	99	8300	98	0143	
				REGION 4 COUNTY 1 GENESEE										
33	0210307	33 41021015	3.07	RT 77 CORFU	5050	**	4850	02	6300	01	5850	99	0289	
33	0211070	33 41021090	7.63	WORTENDYKE RD CR 37	2800	04	5200	01	4050	96	3850	90	0026	
33	0211330	33 41021133	2.60	BATAVIA W CITY LN	4850	**	4500	99	3650	94	5100	91	0421	
33	0211424	33 41022002	0.94	START 98 OLAP	6950	**	6850	03	6950	00	6050	98	0422	
33	0211432	33 41022010	0.08	END 98 START 5 63 OLAPS	12800	**	12600	03	12400	00	13000	98	0423	
33	0211459	5 41032008	0.27	END 63 OLAP	39300	**	38200	02	33200	99	33900	96	0424	
33	0211579	5 41032019	1.20	END 5 OLAP	16800	**	16500	03	19400	00	19400	97	0006	
33	0211642	33 41023001	0.63	BATAVIA E CITY LN	14900	**	14400	02	11100	98	8250	95	0208	
33	0211859	33 41023021	2.17	PROLE RD CR 19B	6500	**	6350	03	6150	00	7900	97	0027	
33	0212133	33 41023027	2.74	RT 237	8350	**	8050	02	5900	99	5450	96	0425	
33	0212816	33 41023094	6.83	RT 19	6000	**	5850	03	6350	00	6450	97	0427	
33	0212853	33 41023119	0.37	RT 33A	7450	04	7300	01	7850	98	5950	94	0428	
33	0212936	33 41023124	0.83	ROCHESTER ST	2150	**	2050	02	1500	99	2550	96	0429	
33	0212956	33 43031000	0.20	MONROE CO LINE	2800	04	3750	01	2950	98	2500	94	0017	
				REGION 4 COUNTY 3 MONROE										
33	0310263	33 43021013	2.63	START 36 OLAP CHURCHVILLE	5000	**	4800	02	3550	99	2950	98	0174	
33	0310346	33 43031034	0.83	END 36 OLAP	4250	04	4550	00	5900	98	4800	94	0417	
33	0310683	33 43031055	3.37	RT 259 N CHILI	6550	04	11600	03	8150	01	7400	98	0430	
33	0310867	33 43031073	1.84	STONY PT RD CR 169	8050	04	9850	01	8800	00	9650	97	0182	
33	0311077	33 43031095	2.10	START RT 386 OLAP	12700	**	11400	97	12200	94	13900	92	0572	
33	0311097	33 43031108	0.20	END RT 386 OLAP	17200	04	15400	01	16100	98	14800	95	0431	
33	0311172	33 43031115	0.75	RT 490I IS OVER WITH CONN	19700	04	17400	01	18600	97	18000	94	0573	
33	0311313	33 43031124	1.41	HOWARD RD	15400	**	15200	03	15500	99	19300	98	0015	
33	0311412	33 43031134	0.99	ROCHESTER W CITY LN	11200	04	14500	01	10800	97	9300	94	0432	
33	0311474	33 43032003	0.62	MOUNT READ BLVD	13200	04	10000	01	11400	97	9900	94	0433	
33	0311597		1.23	RT 33A	10500	04	9850	01	8900	98	7700	93	0434	
33	0311689	33 43032025	0.92	RT 31 END RT 33	20500	**	19900	02	17100	98	16800	95	0435	
				REGION 4 COUNTY 1 GENESEE										
33A			0.00	RT 33										
33A	0110028	33A41011000	0.28	MONROE CO LN ACC 490I	8700	04	8300	01	5650	98	8500	95	0522	

ROUTE NUMBER	END MILE POINT	COUNT LOC REFERENCE MARKER	SECTION LENGTH	SECTION ENDS AT	LATEST COUNT EST AADT	YR	PREVIOUS COUNTS EST AADT	YR	EST AADT	YR	EST AADT	YR	COUNT STATION NUMBER	
				REGION 4 COUNTY 8 MONROE										
33A	0210265	33A43021015	2.65	START 36 OLAP RIGA	2650	04	2450	01	2450	98	2450	95	0523	
[illegible]														
33A	0210763	33A43021047	4.75	RT 259 W CHILI	3100	**	3000	02	3100	99	3450	96	0524	
33A	0210929	33A43021088	1.66	RT 252	11500	**	11300	03	15000	01	10100	98	0571	
33A	0210960	33A43021096	0.31	START 386 OLAP	7450	**	7200	02	7800	99	5950	96	0062	
33A	0211061	33A43021103	1.01	RT 252A END 386 OLAP	14200	**	13800	02	13200	99	11100	96	0359	
33A	0211318	33A43021120	2.57	START 204 OLAP	12000	04	11800	01	11500	98	9800	95	0574	
33A	0211388	33A43021135	0.70	HOWARD RD	20300	04	18200	01	19000	96	17700	95	0525	
33A	0211403	33A43021140	0.15	END 204 OLAP	25800	04	29600	01	23300	97	21200	94	0013	
33A	0211513	33A43021149	1.10	RT 390I OUTER LOOP	14200	04	11400	01	13100	98	15000	93	0789	
33A	0211530	33A43021153	0.17	ROCHESTER W CITY LN	16800	04	14100	01	13100	98	12600	95	0790	
33A	0211687	33A43022029	1.57	RT 33 END 33A	13700	**	13100	01	10300	93	9350	90	0063	
				REGION 6 COUNTY 5 TIOGA										
34			0.00	RT 17 WAVERLY										
34	0110072	34 65011203	0.72	RT 17 C	7000	04	10500	00	6950	97	6800	94	0018	
34	0110082	17 65011022	0.10	N CHEMUNG ST	7700	**	7550	03	6950	00	6850	97	0092	
34	0110109	34 65011001	0.27	VILLAGE OF WAVERLY	6350	**	6250	03	5800	00	5450	97	0093	
34	0110681	34 62011028	5.72	MAIN ST LOCKWOOD	3950	**	3650	99	3350	96	3350	93	0094	
34	0111133	34 65011082	4.52	CHEMUNG CO LINE	2150	**	1950	98	1800	95	1550	92	0095	
				REGION 6 COUNTY 2 CHEMUNG										
34	0210332	34 62021020	3.32	RT 224 VAN ETTEN	2050	**	1850	99	2100	96	1800	93	0295	
34	0210414	34 62021037	0.82	TIOGA CO LN 2ND TIME	4650	**	4500	02	4500	99	4250	96	0012	
				REGION 6 COUNTY 5 TIOGA										
34	0310224	34 65031009	2.24	START 96 OLAP SPENCER	5600	**	5150	99	4600	93	4000	90	0200	
34	0310575	34 65031038	3.51	CR 1 MICHIGAN HOLLOW RD	4100	**	4000	03	3450	00	3600	97	0004	
34	0310750	34 65031068	1.75	TOMPKINS CO LINE	3300	**	3200	03	2700	00	2850	97	0005	
				REGION 3 COUNTY 6 TOMPKINS										
34	0410660	34 36041050	6.60	CR 130 NEWFIELD STA	4050	**	4000	03	3900	00	3650	97	0483	
34	0410869	34 36041084	2.09	START 13 OLAP	6250	**	6100	02	5700	99	5250	96	0482	
34	0410919	13 36031110	0.50	RT 327	18600	**	17900	01	15200	98	16000	97	0480	
34	0411033	13 36031118	1.14	RT 13A	15600	04	18600	01	16600	98	17800	97	0477	
34	0411082	13 36031126	0.49	ITHACA S CITY LN	17000	**	16300	01	16600	98	18100	97	0475	
34	0411237	13 36032013	1.55	RT 96B	26500	**	25400	01	22600	98	19900	90	0004	
34	0411248	13 36032016	0.11	RT 79 EB GREEN ST	29800	04	29200	01	26700	98	20600	93	0003	
34	0411260	13 36032017	0.12	RT 79 WB SENECA ST	31100	04	32200	01	29600	98	25600	93	0016	
34	0411267	13 36032018	0.07	END RT 96 OLAP BUFFALO ST	38400	04	36800	01	32800	98	22600	93	0023	
34	0411418	13 36032031	1.51	ITHACA N CITY LN	36200	**	35400	03	32900	02	32800	01	0576	
34	0411428	13 36033001	0.10	END 13 OLAP	32200	04	34100	03	32500	02	25100	99	0029	CC
34	0411995	34 36043006	5.67	STRT 34B OLAP S LANSING	8600	**	8450	03	8100	00	7700	97	0457	
34	0412043	34 36043059	0.48	END 34B OLAP	8550	**	7950	99	6900	96	8250	91	0571	
34	0412674	34 36043122	6.31	CAYUGA CO LINE	2650	**	2600	03	2200	00	2100	98	0570	

APPENDIX B

Turning Movement Counts

Barton & Loguidice, P.C.

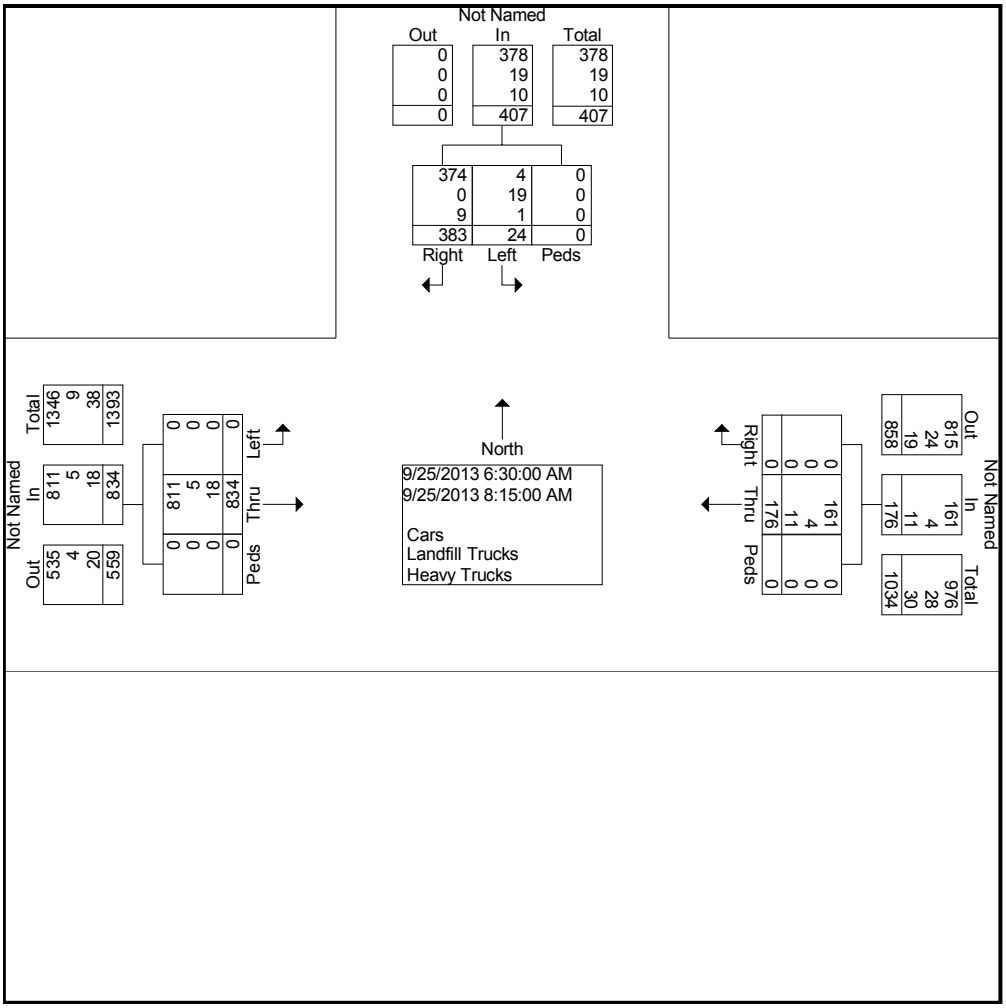
11 Centre Park
Suite 203
Rochester, NY 14614

I-490 WB Off-Ramp
AM Count

File Name : 003W6-~E
Site Code : 00000001
Start Date : 9/25/2013
Page No : 1

Groups Printed- Cars - Landfill Trucks - Heavy Trucks

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	22	0	2	0	24	0	12	0	0	12	0	0	0	0	0	0	121	0	0	121	157
06:45 AM	35	0	5	0	40	0	23	0	0	23	0	0	0	0	0	0	116	0	0	116	179
Total	57	0	7	0	64	0	35	0	0	35	0	0	0	0	0	0	237	0	0	237	336
07:00 AM	47	0	2	0	49	0	16	0	0	16	0	0	0	0	0	0	101	0	0	101	166
07:15 AM	58	0	1	0	59	0	30	0	0	30	0	0	0	0	0	0	120	0	0	120	209
07:30 AM	66	0	3	0	69	0	21	0	0	21	0	0	0	0	0	0	117	0	0	117	207
07:45 AM	58	0	4	0	62	0	26	0	0	26	0	0	0	0	0	0	90	0	0	90	178
Total	229	0	10	0	239	0	93	0	0	93	0	0	0	0	0	0	428	0	0	428	760
08:00 AM	54	0	2	0	56	0	21	0	0	21	0	0	0	0	0	0	86	0	0	86	163
08:15 AM	43	0	5	0	48	0	27	0	0	27	0	0	0	0	0	0	83	0	0	83	158
Grand Total	383	0	24	0	407	0	176	0	0	176	0	0	0	0	0	0	834	0	0	834	1417
Apprch %	94.1	0.0	5.9	0.0		0.0	100.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		
Total %	27.0	0.0	1.7	0.0	28.7	0.0	12.4	0.0	0.0	12.4	0.0	0.0	0.0	0.0	0.0	0.0	58.9	0.0	0.0	58.9	



Barton & Loguidice, P.C.

11 Centre Park
Suite 203
Rochester, NY 14614

I-490 WB Off-Ramp
AM Count

File Name : 003W6-~E
Site Code : 00000001
Start Date : 9/25/2013
Page No : 2

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	06:45 AM																				
Volume	206	0	11	0	217	0	90	0	0	90	0	0	0	0	0	0	454	0	0	454	761
Percent	94.9	0.0	5.1	0.0		0.0	100.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		
07:15 Volume	58	0	1	0	59	0	30	0	0	30	0	0	0	0	0	0	120	0	0	120	209
Peak Factor																					0.910
High Int.	07:30 AM					07:15 AM					6:15:00 AM					07:15 AM					
Volume	66	0	3	0	69	0	30	0	0	30	0	0	0	0	0	0	120	0	0	120	
Peak Factor					0.786					0.750										0.946	

Barton & Loguidice, P.C.

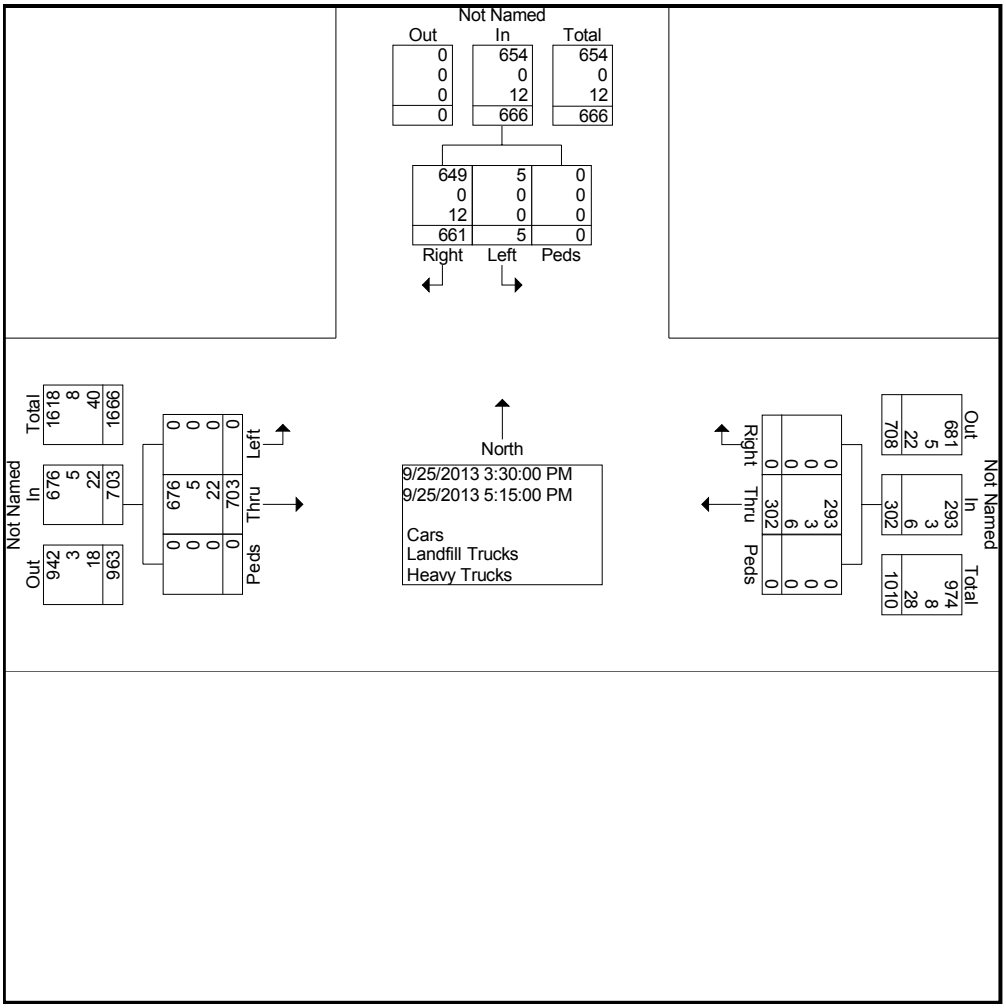
11 Centre Park
Suite 203
Rochester, NY 14614

I-490 WB Off-Ramp
PM Count

File Name : 003'#H~E
Site Code : 00000001
Start Date : 9/25/2013
Page No : 1

Groups Printed- Cars - Landfill Trucks - Heavy Trucks

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
03:30 PM	69	0	1	0	70	0	38	0	0	38	0	0	0	0	0	0	80	0	0	80	188
03:45 PM	102	0	2	0	104	0	28	0	0	28	0	0	0	0	0	0	87	0	0	87	219
Total	171	0	3	0	174	0	66	0	0	66	0	0	0	0	0	0	167	0	0	167	407
04:00 PM	77	0	0	0	77	0	47	0	0	47	0	0	0	0	0	0	100	0	0	100	224
04:15 PM	91	0	1	0	92	0	39	0	0	39	0	0	0	0	0	0	83	0	0	83	214
04:30 PM	80	0	0	0	80	0	36	0	0	36	0	0	0	0	0	0	113	0	0	113	229
04:45 PM	76	0	0	0	76	0	36	0	0	36	0	0	0	0	0	0	64	0	0	64	176
Total	324	0	1	0	325	0	158	0	0	158	0	0	0	0	0	0	360	0	0	360	843
05:00 PM	89	0	1	0	90	0	45	0	0	45	0	0	0	0	0	0	84	0	0	84	219
05:15 PM	77	0	0	0	77	0	33	0	0	33	0	0	0	0	0	0	92	0	0	92	202
Grand Total	661	0	5	0	666	0	302	0	0	302	0	0	0	0	0	0	703	0	0	703	1671
Apprch %	99.2	0.0	0.8	0.0		0.0	100.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		
Total %	39.6	0.0	0.3	0.0	39.9	0.0	18.1	0.0	0.0	18.1	0.0	0.0	0.0	0.0	0.0	0.0	42.1	0.0	0.0	42.1	



Barton & Loguidice, P.C.

11 Centre Park
Suite 203
Rochester, NY 14614

I-490 WB Off-Ramp
PM Count

File Name : 003'#H~E
Site Code : 00000001
Start Date : 9/25/2013
Page No : 2

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Intersection	03:45 PM																				
Volume	350	0	3	0	353	0	150	0	0	150	0	0	0	0	0	0	383	0	0	383	886
Percent	99.2	0.0	0.8	0.0		0.0	100.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		
04:30 Volume	80	0	0	0	80	0	36	0	0	36	0	0	0	0	0	0	113	0	0	113	229
Peak Factor																					0.967
High Int.	03:45 PM					04:00 PM					3:15:00 PM					04:30 PM					
Volume	102	0	2	0	104	0	47	0	0	47	0	0	0	0	0	0	113	0	0	113	
Peak Factor					0.849					0.798										0.847	

Barton & Loguidice, P.C.

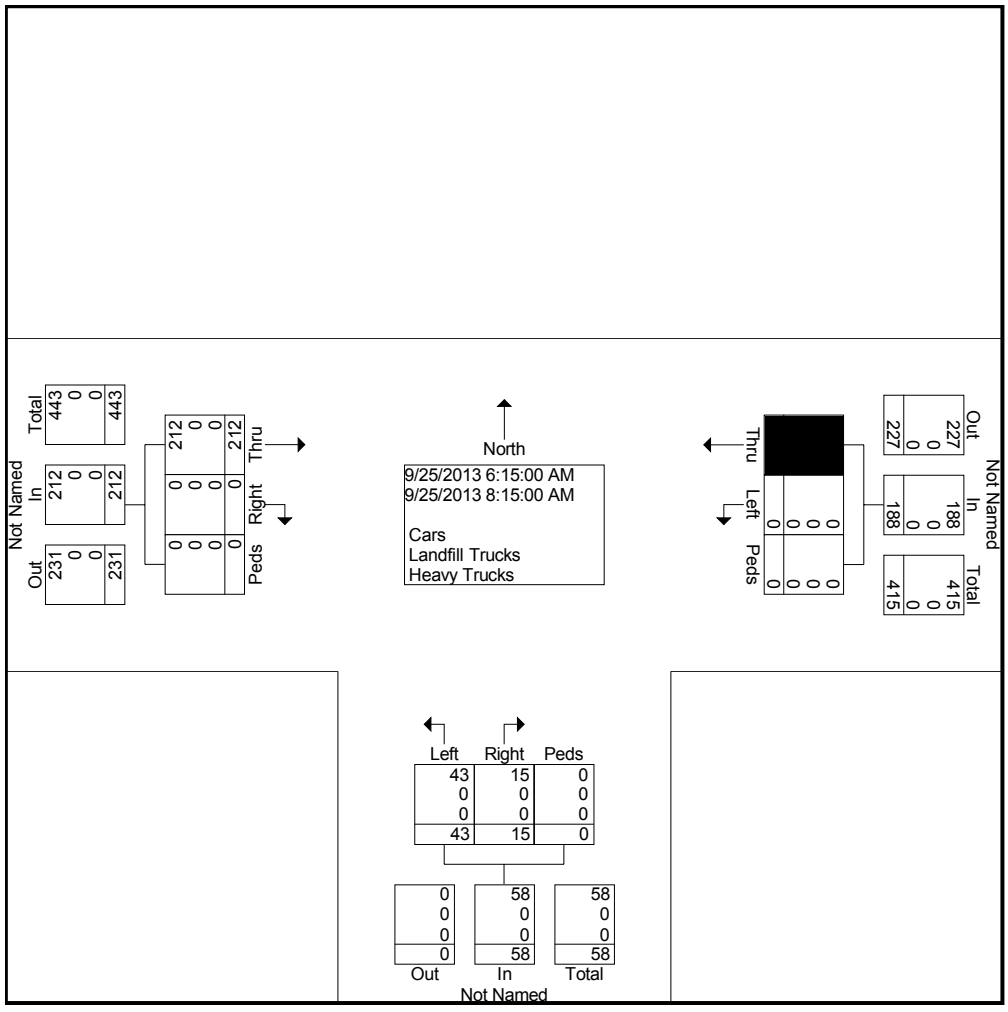
11 Centre Park
Suite 203
Rochester, NY 14614

I-490 EB Off-Ramp
AM Count

File Name : 003W6&~E
Site Code : 00000002
Start Date : 9/25/2013
Page No : 1

Groups Printed- Cars - Landfill Trucks - Heavy Trucks

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 AM	0	0	0	0	0	0	15	0	0	15	2	0	2	0	4	0	29	0	0	29	48
06:45 AM	0	0	0	0	0	0	19	0	0	19	3	0	5	0	8	0	28	0	0	28	55
Total	0	0	0	0	0	0	34	0	0	34	5	0	7	0	12	0	57	0	0	57	103
07:00 AM	0	0	0	0	0	0	17	0	0	17	2	0	4	0	6	0	30	0	0	30	53
07:15 AM	0	0	0	0	0	0	29	0	0	29	2	0	7	0	9	0	34	0	0	34	72
07:30 AM	0	0	0	0	0	0	27	0	0	27	2	0	8	0	10	0	28	0	0	28	65
07:45 AM	0	0	0	0	0	0	29	0	0	29	2	0	3	0	5	0	30	0	0	30	64
Total	0	0	0	0	0	0	102	0	0	102	8	0	22	0	30	0	122	0	0	122	254
08:00 AM	0	0	0	0	0	0	25	0	0	25	2	0	5	0	7	0	14	0	0	14	46
08:15 AM	0	0	0	0	0	0	27	0	0	27	0	0	9	0	9	0	19	0	0	19	55
Grand Total	0	0	0	0	0	0	188	0	0	188	15	0	43	0	58	0	212	0	0	212	458
Apprch %	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		25.9	0.0	74.1	0.0		0.0	100.0	0.0	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	41.0	0.0	0.0	41.0	3.3	0.0	9.4	0.0	12.7	0.0	46.3	0.0	0.0	46.3	



Barton & Loguidice, P.C.

11 Centre Park
Suite 203
Rochester, NY 14614

I-490 EB Off-Ramp
AM Count

File Name : 003W6&~E
Site Code : 00000002
Start Date : 9/25/2013
Page No : 2

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 06:15 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	0	0	0	0	0	0	102	0	0	102	8	0	22	0	30	0	122	0	0	122	254
Percent	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		26.7	0.0	73.3	0.0		0.0	100.0	0.0	0.0		
07:15 Volume	0	0	0	0	0	0	29	0	0	29	2	0	7	0	9	0	34	0	0	34	72
Peak Factor																					0.882
High Int.	6:00:00 AM					07:15 AM					07:30 AM					07:15 AM					
Volume	0	0	0	0	0	0	29	0	0	29	2	0	8	0	10	0	34	0	0	34	
Peak Factor										0.879					0.750					0.897	

Barton & Loguidice, P.C.

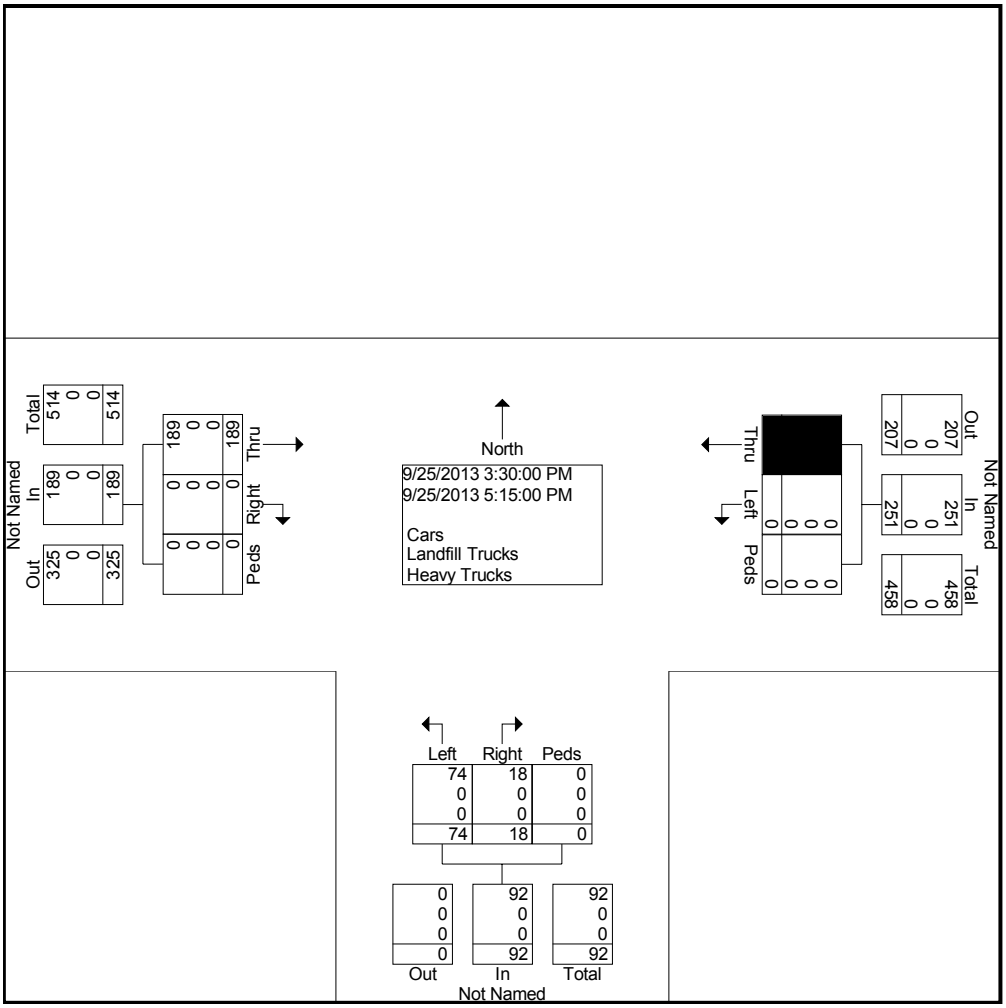
11 Centre Park
Suite 203
Rochester, NY 14614

I-490 EB Off-Ramp
PM Count

File Name : EBOFF-~1
Site Code : 00000002
Start Date : 9/25/2013
Page No : 1

Groups Printed- Cars - Landfill Trucks - Heavy Trucks

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
03:30 PM	0	0	0	0	0	0	36	0	0	36	0	0	8	0	8	0	25	0	0	25	69
03:45 PM	0	0	0	0	0	0	26	0	0	26	3	0	7	0	10	0	26	0	0	26	62
Total	0	0	0	0	0	0	62	0	0	62	3	0	15	0	18	0	51	0	0	51	131
04:00 PM	0	0	0	0	0	0	42	0	0	42	2	0	7	0	9	0	28	0	0	28	79
04:15 PM	0	0	0	0	0	0	25	0	0	25	2	0	17	0	19	0	20	0	0	20	64
04:30 PM	0	0	0	0	0	0	31	0	0	31	3	0	7	0	10	0	28	0	0	28	69
04:45 PM	0	0	0	0	0	0	29	0	0	29	2	0	8	0	10	0	15	0	0	15	54
Total	0	0	0	0	0	0	127	0	0	127	9	0	39	0	48	0	91	0	0	91	266
05:00 PM	0	0	0	0	0	0	38	0	0	38	4	0	10	0	14	0	20	0	0	20	72
05:15 PM	0	0	0	0	0	0	24	0	0	24	2	0	10	0	12	0	27	0	0	27	63
Grand Total	0	0	0	0	0	0	251	0	0	251	18	0	74	0	92	0	189	0	0	189	532
Apprch %	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		19.6	0.0	80.4	0.0		0.0	100.0	0.0	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	47.2	0.0	0.0	47.2	3.4	0.0	13.9	0.0	17.3	0.0	35.5	0.0	0.0	35.5	



Barton & Loguidice, P.C.

11 Centre Park
Suite 203
Rochester, NY 14614

I-490 EB Off-Ramp
PM Count

File Name : EBOFF-~1
Site Code : 00000002
Start Date : 9/25/2013

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	0	0	0	0	0	0	129	0	0	129	7	0	39	0	46	0	99	0	0	99	274
Percent	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		15.2	0.0	84.8	0.0		0.0	100.0	0.0	0.0		
04:00 Volume	0	0	0	0	0	0	42	0	0	42	2	0	7	0	9	0	28	0	0	28	79
Peak Factor																					0.867
High Int.	3:15:00 PM					04:00 PM					04:15 PM					04:00 PM					
Volume	0	0	0	0	0	0	42	0	0	42	2	0	17	0	19	0	28	0	0	28	
Peak Factor										0.768					0.605					0.884	

Barton & Loguidice, P.C.

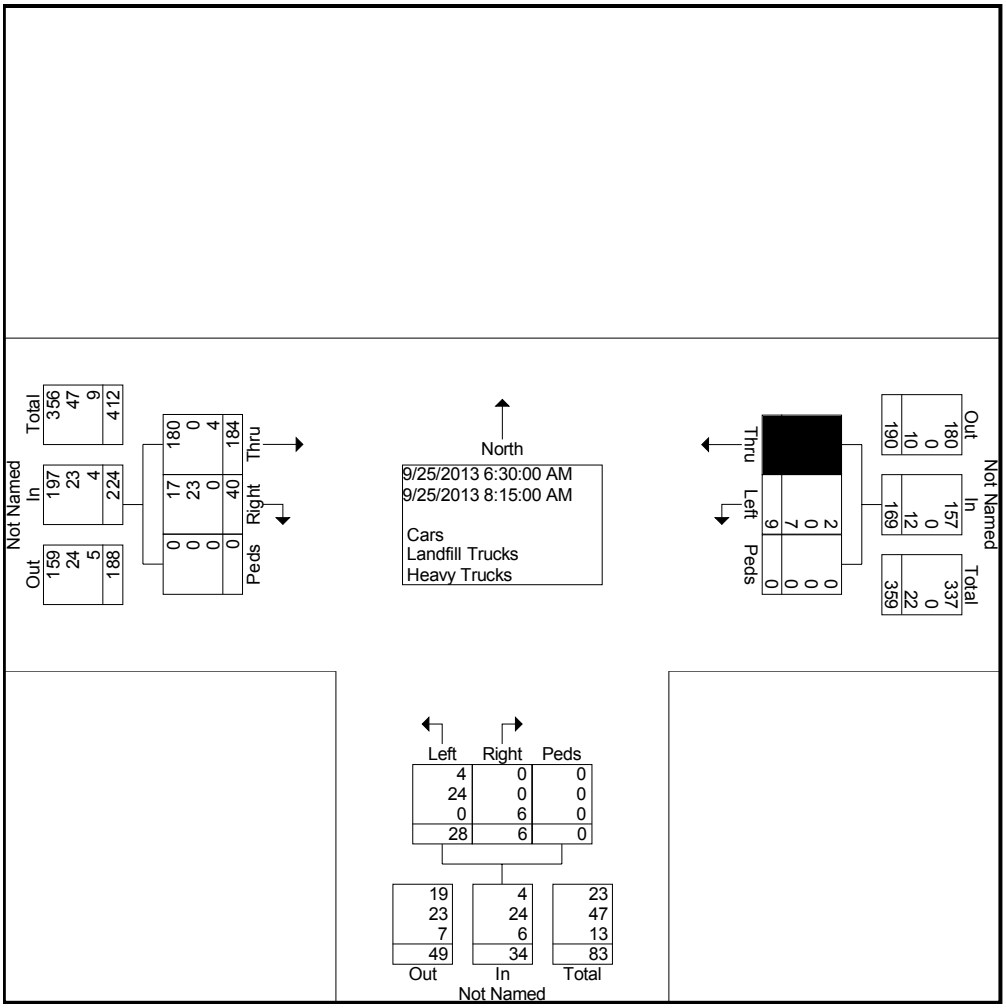
11 Centre Park
Suite 203
Rochester, NY 14614

Brew Road
AM Count

File Name : 003W6%~E
Site Code : 00000003
Start Date : 9/25/2013
Page No : 1

Groups Printed- Cars - Landfill Trucks - Heavy Trucks

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	0	0	0	0	0	0	16	0	0	16	0	0	2	0	2	7	23	0	0	30	48
06:45 AM	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	7	20	0	0	27	40
Total	0	0	0	0	0	0	29	0	0	29	0	0	2	0	2	14	43	0	0	57	88
07:00 AM	0	0	0	0	0	0	27	0	0	27	0	0	0	0	0	3	31	0	0	34	61
07:15 AM	0	0	0	0	0	0	22	1	0	23	0	0	7	0	7	2	32	0	0	34	64
07:30 AM	0	0	0	0	0	0	23	3	0	26	0	0	6	0	6	3	25	0	0	28	60
07:45 AM	0	0	0	0	0	0	20	2	0	22	2	0	1	0	3	11	24	0	0	35	60
Total	0	0	0	0	0	0	92	6	0	98	2	0	14	0	16	19	112	0	0	131	245
08:00 AM	0	0	0	0	0	0	21	1	0	22	3	0	8	0	11	1	16	0	0	17	50
08:15 AM	0	0	0	0	0	0	18	2	0	20	1	0	4	0	5	6	13	0	0	19	44
Grand Total	0	0	0	0	0	0	160	9	0	169	6	0	28	0	34	40	184	0	0	224	427
Apprch %	0.0	0.0	0.0	0.0		0.0	94.7	5.3	0.0		17.6	0.0	82.4	0.0		17.9	82.1	0.0	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	37.5	2.1	0.0	39.6	1.4	0.0	6.6	0.0	8.0	9.4	43.1	0.0	0.0	52.5	



Barton & Loguidice, P.C.

11 Centre Park
Suite 203
Rochester, NY 14614

File Name : 003W6%~E
Site Code : 00000003
Start Date : 9/25/2013

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	0	0	0	0	0	0	92	6	0	98	2	0	14	0	16	19	112	0	0	131	245
Percent	0.0	0.0	0.0	0.0		0.0	93.9	6.1	0.0		12.5	0.0	87.5	0.0		14.5	85.5	0.0	0.0		
07:15 Volume	0	0	0	0	0	0	22	1	0	23	0	0	7	0	7	2	32	0	0	34	64
Peak Factor																					0.957
High Int.	6:15:00 AM					07:00 AM					07:15 AM					07:45 AM					
Volume	0	0	0	0	0	0	27	0	0	27	0	0	7	0	7	11	24	0	0	35	
Peak Factor										0.907					0.571					0.936	

Barton & Loguidice, P.C.

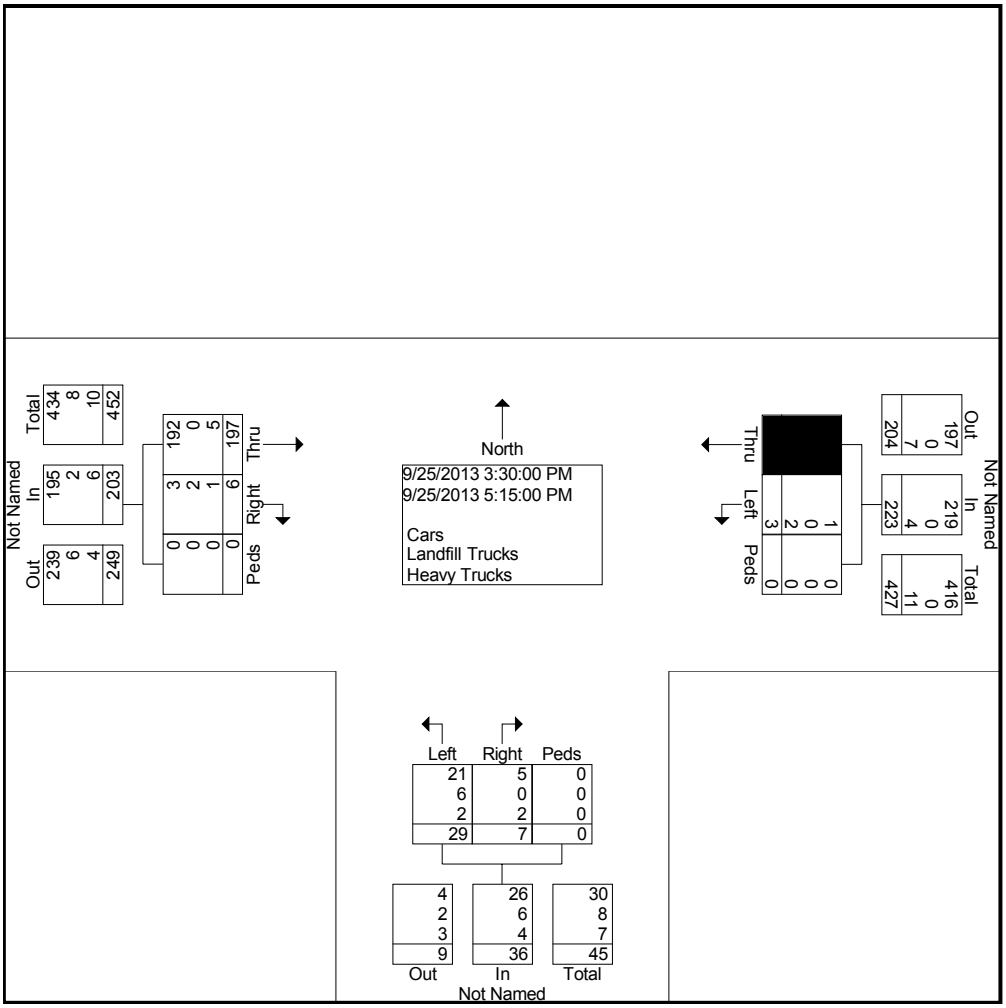
11 Centre Park
Suite 203
Rochester, NY 14614

Brew Road
PM Count

File Name : BREWRO~1
Site Code : 00000003
Start Date : 9/25/2013
Page No : 1

Groups Printed- Cars - Landfill Trucks - Heavy Trucks

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
03:30 PM	0	0	0	0	0	0	28	2	0	30	1	0	8	0	9	3	19	0	0	22	61
03:45 PM	0	0	0	0	0	0	23	1	0	24	0	0	2	0	2	1	30	0	0	31	57
Total	0	0	0	0	0	0	51	3	0	54	1	0	10	0	11	4	49	0	0	53	118
04:00 PM	0	0	0	0	0	0	31	0	0	31	2	0	10	0	12	1	27	0	0	28	71
04:15 PM	0	0	0	0	0	0	22	0	0	22	0	0	3	0	3	1	23	0	0	24	49
04:30 PM	0	0	0	0	0	0	29	0	0	29	1	0	2	0	3	0	31	0	0	31	63
04:45 PM	0	0	0	0	0	0	29	0	0	29	0	0	2	0	2	0	15	0	0	15	46
Total	0	0	0	0	0	0	111	0	0	111	3	0	17	0	20	2	96	0	0	98	229
05:00 PM	0	0	0	0	0	0	37	0	0	37	0	0	1	0	1	0	23	0	0	23	61
05:15 PM	0	0	0	0	0	0	21	0	0	21	3	0	1	0	4	0	29	0	0	29	54
Grand Total	0	0	0	0	0	0	220	3	0	223	7	0	29	0	36	6	197	0	0	203	462
Apprch %	0.0	0.0	0.0	0.0		0.0	98.7	1.3	0.0		19.4	0.0	80.6	0.0		3.0	97.0	0.0	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	47.6	0.6	0.0	48.3	1.5	0.0	6.3	0.0	7.8	1.3	42.6	0.0	0.0	43.9	



Barton & Loguidice, P.C.

11 Centre Park
Suite 203
Rochester, NY 14614

Brew Road
PM Count

File Name : BREWRO~1
Site Code : 00000003
Start Date : 9/25/2013

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Intersection	03:45 PM																				
Volume	0	0	0	0	0	0	105	1	0	106	3	0	17	0	20	3	111	0	0	114	240
Percent	0.0	0.0	0.0	0.0		0.0	99.1	0.9	0.0		15.0	0.0	85.0	0.0		2.6	97.4	0.0	0.0		
04:00 Volume	0	0	0	0	0	0	31	0	0	31	2	0	10	0	12	1	27	0	0	28	71
Peak Factor																					0.845
High Int.	3:15:00 PM					04:00 PM					04:00 PM					03:45 PM					
Volume	0	0	0	0	0	0	31	0	0	31	2	0	10	0	12	1	30	0	0	31	
Peak Factor										0.855					0.417					0.919	

APPENDIX C

Mill Seat Landfill Truck Ticket Data

2012

Ticket Date	Load	Total Tons
11/16/2012	241	4283.03
12/19/2012	221	4070.89
8/16/2012	247	3997.88
10/5/2012	238	3906.62
10/3/2012	251	3893.46
10/2/2012	244	3863.59
7/27/2012	213	3743.73
7/18/2012	219	3719.37
8/7/2012	210	3671.91
11/27/2012	240	3655.82
11/15/2012	209	3591.55
8/8/2012	214	3543.71
10/4/2012	223	3462.01
7/17/2012	217	3437.59
5/9/2012	196	3390.36
12/10/2012	213	3357.08
10/1/2012	211	3356.81
12/14/2012	207	3316.57
12/12/2012	213	3303.01
12/17/2012	207	3300.34
10/26/2012	216	3289.49
11/26/2012	216	3233.2
10/8/2012	209	3128.77
1/10/2012	201	3126.71
8/23/2012	204	3103.74
7/13/2012	208	3097.53
7/9/2012	202	3056.87
7/30/2012	194	3042.72
7/12/2012	201	3021.97
12/18/2012	193	3015.89
5/16/2012	195	3012.48
8/22/2012	202	3011.72
11/19/2012	194	3010.09
10/9/2012	196	2996.67
8/29/2012	193	2985.88
7/25/2012	211	2975.46
11/14/2012	185	2960.1
9/26/2012	203	2959.08
5/8/2012	178	2954.95
9/6/2012	172	2953.02
11/6/2012	200	2944.74
2/20/2012	184	2935.65
8/10/2012	186	2931.92
5/1/2012	189	2916.1
11/30/2012	194	2904.59
8/21/2012	203	2893.01
5/2/2012	175	2875.63
11/20/2012	187	2859.2
12/7/2012	187	2855.07
7/11/2012	192	2853.65
8/30/2012	184	2848.23
10/18/2012	185	2834.16
2/7/2012	173	2823.07

2012 Most Trucks.

Ticket Date	Load	Total Tons
10/3/2012	251	3893.46
8/16/2012	247	3997.88
10/2/2012	244	3863.59
11/16/2012	241	4283.03
11/27/2012	240	3655.82
10/5/2012	238	3906.62
10/4/2012	223	3462.01
12/19/2012	221	4070.89
7/18/2012	219	3719.37
7/17/2012	217	3437.59

2012 Most Tons

Ticket Date	Load	Total Tons
11/16/2012	241	4283.03
12/19/2012	221	4070.89
8/16/2012	247	3997.88
10/5/2012	238	3906.62
10/3/2012	251	3893.46
10/2/2012	244	3863.59
7/27/2012	213	3743.73
7/18/2012	219	3719.37
8/7/2012	210	3671.91
11/27/2012	240	3655.82

11/9/2012	180	2821.55
2/21/2012	193	2820.6
7/2/2012	190	2817.25
5/24/2012	197	2813.38
11/23/2012	184	2807.2
5/17/2012	184	2806.32
5/31/2012	184	2799.41
8/13/2012	191	2795.62
8/27/2012	199	2793.03
7/10/2012	190	2793.03
11/28/2012	189	2792.67
10/11/2012	189	2791.93
8/20/2012	187	2791.89
12/26/2012	177	2776.86
9/7/2012	171	2775.7
8/24/2012	193	2774.87
10/22/2012	182	2773.14
9/4/2012	186	2772.73
8/14/2012	191	2770.98
12/4/2012	176	2768.65
8/28/2012	181	2767.65
8/17/2012	175	2767.5
3/1/2012	175	2764.57
12/3/2012	186	2755.06
11/13/2012	177	2755.05
12/11/2012	175	2754.97
9/5/2012	174	2750.58
3/29/2012	178	2744.68
11/29/2012	185	2743.25
8/6/2012	176	2737.05
10/23/2012	185	2735.03
7/3/2012	178	2723.54
6/29/2012	182	2722.88
10/25/2012	187	2718.88
6/22/2012	177	2705.92
4/24/2012	170	2705.31
7/24/2012	188	2703.98
5/30/2012	179	2691.87
10/24/2012	179	2681.65
7/5/2012	186	2680.32
11/21/2012	181	2668.51
8/2/2012	177	2666.97
6/1/2012	171	2665.14
5/25/2012	164	2664.52
4/11/2012	183	2660.73
2/8/2012	184	2652.32
9/24/2012	173	2642.2
6/18/2012	172	2627.27
8/15/2012	177	2622.95
5/18/2012	168	2620.8
2/2/2012	168	2620.64
6/28/2012	188	2619.15
6/14/2012	188	2615.3
12/5/2012	175	2607.46
9/19/2012	178	2604.52
3/16/2012	165	2603.46

10/10/2012	182	2603.34
7/20/2012	182	2595.59
4/6/2012	158	2592.73
5/10/2012	166	2590.84
12/13/2012	172	2584.39
9/28/2012	168	2583.23
9/10/2012	176	2578.39
5/23/2012	175	2571.75
6/6/2012	197	2568.59
7/19/2012	184	2568.18
11/1/2012	168	2567.84
6/26/2012	189	2567.29
11/7/2012	187	2564.4
9/18/2012	164	2564.38
5/3/2012	165	2563.13
11/8/2012	196	2555.01
9/20/2012	172	2548.64
6/4/2012	163	2548.64
7/31/2012	167	2545.44
8/1/2012	165	2544.4
11/5/2012	166	2543.63
6/13/2012	168	2537.69
11/2/2012	164	2518.31
4/10/2012	176	2512.27
6/19/2012	164	2511.55
9/21/2012	179	2508.55
6/27/2012	177	2508.4
1/11/2012	174	2506.05
7/23/2012	179	2504.7
9/25/2012	166	2503.74
12/6/2012	172	2502.06
9/13/2012	181	2501.32
3/23/2012	158	2489.25
9/14/2012	183	2487.12
2/6/2012	158	2485.61
4/26/2012	162	2481.36
5/11/2012	164	2474.53
6/15/2012	159	2470.32
9/27/2012	185	2469.89
4/25/2012	164	2468.5
9/12/2012	182	2462.45
10/29/2012	156	2461
8/3/2012	163	2460.3
3/21/2012	157	2458.64
6/8/2012	166	2456.17
11/12/2012	167	2456.07
1/24/2012	165	2455.43
6/21/2012	168	2449
9/11/2012	160	2447.49
1/18/2012	165	2445.51
4/17/2012	170	2437.9
6/7/2012	170	2436.84
6/20/2012	160	2433
2/9/2012	175	2429.82
4/4/2012	177	2427.61
3/15/2012	166	2425.48

5/4/2012	151	2420.99
3/26/2012	167	2420.01
12/31/2012	157	2419.73
2/16/2012	171	2417.95
6/5/2012	153	2416.07
8/9/2012	175	2412.77
3/22/2012	160	2409.31
10/15/2012	166	2408.31
1/16/2012	154	2383.93
3/14/2012	158	2367
7/6/2012	156	2363.5
4/20/2012	172	2354.72
4/30/2012	172	2347.06
10/19/2012	160	2347.05
7/16/2012	176	2345.1
6/25/2012	173	2333.42
5/22/2012	167	2329.77
4/16/2012	160	2327.87
6/11/2012	165	2327.06
7/26/2012	164	2326.34
10/12/2012	162	2318.11
3/28/2012	155	2317.13
1/17/2012	154	2302
9/17/2012	175	2294.35
5/15/2012	162	2288.9
5/7/2012	158	2277.43
4/13/2012	156	2274.37
12/21/2012	162	2271.56
3/20/2012	153	2269.95
4/12/2012	156	2265.16
8/31/2012	165	2261.8
10/31/2012	156	2256.05
1/25/2012	151	2253.42
6/12/2012	135	2246.78
12/20/2012	146	2246.17
4/2/2012	153	2242.02
10/17/2012	153	2235.91
3/2/2012	142	2225.84
4/18/2012	164	2222.46
5/29/2012	153	2219.61
1/19/2012	156	2216.55
5/14/2012	151	2211.34
3/12/2012	157	2208.75
10/30/2012	135	2196.62
1/23/2012	158	2195.24
4/27/2012	152	2191.25
5/21/2012	157	2184.14
3/30/2012	139	2154.94
3/7/2012	150	2142.37
4/5/2012	156	2140.44
3/13/2012	154	2137.12
3/19/2012	145	2134.2
1/30/2012	142	2117.79
4/19/2012	149	2116.72
3/27/2012	138	2095.85
4/23/2012	130	2072.61

2/3/2012	141	2044.75
1/12/2012	139	2031.61
1/26/2012	145	2025.44
12/28/2012	124	2015.73
4/3/2012	145	2005.44
2/15/2012	139	2001.42
1/6/2012	138	1992.94
2/14/2012	158	1977.62
2/10/2012	143	1948.43
2/28/2012	144	1929.03
2/17/2012	135	1927.4
1/5/2012	140	1921.56
2/22/2012	145	1916.41
1/27/2012	131	1914.12
1/9/2012	139	1861.93
3/8/2012	129	1852.93
1/31/2012	140	1841.59
2/1/2012	134	1828.17
3/9/2012	124	1823.82
1/20/2012	128	1786.29
10/16/2012	135	1777.79
2/27/2012	143	1735.71
2/24/2012	115	1728.89
3/5/2012	128	1714.1
2/23/2012	124	1643.91
1/3/2012	123	1639.05
2/13/2012	138	1630.86
3/6/2012	128	1612.13
1/4/2012	132	1609.9
12/24/2012	113	1521.62
4/9/2012	85	1373.87
6/2/2012	55	1254.24
9/8/2012	63	1243.15
1/2/2012	99	1138.66
12/27/2012	59	1090.86
1/13/2012	70	994.12
7/7/2012	59	948.99
11/24/2012	52	915.51
12/29/2012	45	901.62
11/3/2012	43	798.39
11/17/2012	53	730.91
9/1/2012	31	271.18
8/4/2012	24	199.1
5/5/2012	25	195.57
8/25/2012	24	190.97
12/22/2012	17	183.23
6/30/2012	20	176.37
12/15/2012	23	172.11
5/26/2012	17	167.45
9/29/2012	18	165.91
8/18/2012	22	157.26
10/27/2012	24	153.67
8/11/2012	18	135.59
10/20/2012	21	134.96
11/10/2012	18	134.15
5/19/2012	19	133.46

6/23/2012	20	131.25
10/6/2012	23	119.15
7/28/2012	18	116.29
12/1/2012	16	108.9
9/15/2012	17	105.39
9/22/2012	13	96.28
10/13/2012	18	94.05
7/14/2012	14	93.13
4/7/2012	17	88.92
2/4/2012	12	84.68
5/12/2012	15	79.05
12/8/2012	14	78.1
3/10/2012	11	74.28
7/21/2012	10	72.33
4/14/2012	17	70.51
1/21/2012	11	70.43
3/31/2012	13	70.14
3/24/2012	12	69.14
6/16/2012	18	67.8
2/11/2012	10	66.63
1/28/2012	10	63.06
6/9/2012	10	62.63
3/17/2012	13	61.66
1/7/2012	10	61.47
4/28/2012	12	60.17
4/21/2012	11	57.96
2/18/2012	11	57.53
1/14/2012	8	56.5
2/25/2012	9	55.36

Truck Traffic during Cell Construction
September 23-27, 2013

Stone and Clay Trucks only

Date	# Trucks
9/23/2013	16
9/24/2013	58
9/25/2013	38
9/26/2013	52
9/27/2013	58
	222

APPENDIX D

Traffic Computations

Barton & Loguidice, P.C.
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JOB MILL SEAT LF
SHEET NO. 1 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY MCB DATE 11-5-14
DESCRIPTION INTERSECTION COUNT SUMMARY

33A / 490 WB - EXISTING

USE PHF FROM TURN MOVEMENT COUNTS

AM

INT PEAK HOUR 7:00 - 8:00 AM
V (HOURLY RATE) 760 VPH
V_{15} (PEAK RATE) 4 x 209 = 836 VPH
~~PHF = 760/836 = 0.91~~
% TRUCKS = 32/760 = 4.2%
LF TRUCKS = 3 VPH

EBT V = 428 VPH
V_{15} = 120 x 4 = 480 VPH
~~PHF = 428/480 = 0.89~~ 0.94
% TRUCKS = 32/428 = 7.5%
LF TRUCKS = 3 VPH

WBT V = 93 VPH
V_{15} = 30 x 4 = 120 VPH
~~PHF = 93/120 = 0.78~~ 0.75
% TRUCKS = 6/93 = 6.5%
LF TRUCKS = 0 VPH

SBL V = 10 VPH
V_{15} = 4 x 4 = 16 VPH
~~PHF = 10/16 = 0.63~~ 0.78
% TRUCKS = 10/10 = 100%
LF TRUCKS = 10 VPH

SBR V = 229 VPH
V_{15} = 66 x 4 = 264 VPH
~~PHF = 229/264 = 0.87~~
% TRUCKS = 6/229 = 2.6%
LF TRUCKS = 0 VPH

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JOB MILL SEAT LF
SHEET NO. 2 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY MCB DATE 11-5-14
DESCRIPTION INTERSECTION COUNT SUMMARY

33A/490 WB - EXISTING

PM

INT

PEAK HOUR = 3:45-4:45 PM
V = 886 VPH
V_{15} = 229 x 4 = 916 VPH
~~PHF = 886/916 = 0.97~~
% TRUCKS = 24/886 = 2.7%
LF TRUCKS = 1

EBT

V = 383 VPH
V_{15} = 113 x 4 = 452 VPH
~~PHF = 383/452 = 0.85~~ **0.84**
% TRUCKS = 14/383 = 3.7%
LF TRUCKS = 0

WBT

V = 150 VPH
V_{15} = 47 x 4 = 188 VPH
~~PHF = 150/188 = 0.80~~ **0.79**
% TRUCKS = 4/150 = 2.7%
LF TRUCKS = 1

SBL

V = 3 VPH
V_{15} = 2 x 4 = 8 VPH
~~PHF = 3/8 = 0.38~~
% TRUCKS = 0/3 = 0%
LF TRUCKS = 0

SBR

V = 350 VPH
V_{15} = 102 x 4 = 408 VPH
~~PHF = 350/408 = 0.86~~ **0.84**
% TRUCKS = 6/350 = 1.7%
LF TRUCKS = 0

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JOB MILL SEAT LF
SHEET NO. 3 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY DATE 11-5-14
DESCRIPTION INTERSECTION COUNT SUMMARY

33A / 490 EB - EXISTING *

AM

INT
PEAK HOUR = 7:00 - 8:00 AM
V = 259 VPH (ACTUAL WAS 254)
V_{15} = 73 x 4 = 292 VPH
~~PHF = 259 / 291 = 0.88~~
% TRUCKS = 29/259 = 11.2%
LF TRUCKS = 26 VPH

EBT
V = 123 VPH (ACTUAL WAS 122)
V_{15} = 34 x 4 = 136 VPH
~~PHF = 103 / 136 = 0.90~~ 0.89
% TRUCKS = 11/123 = 8.9%
LF TRUCKS = 10 VPH

WBT
V = 106 VPH (ACTUAL WAS 102)
V_{15} = 30 x 4 = 120 VPH
~~PHF = 106 / 120 = 0.88~~ 0.87
% TRUCKS = 15/106 = 14.2%
LF TRUCKS = 13 VPH

NBL
V = 22 VPH
V_{15} = 8 x 4 = 32 VPH
~~PHF = 22 / 32 = 0.69~~ 0.75
% TRUCKS = 0/22 = 0%
LF TRUCKS = 0 VPH

NBR
V = 8 VPH
V_{15} = 2 x 4 = 8 VPH
~~PHF = 8 / 8 = 1.0~~ 0.75
% TRUCKS = 3/8 = 3.8%
LF TRUCKS = 3 VPH

* TRAFFIC COLLECTION ERROR AT THIS INTERSECTION. SEE SHEET 5 FOR ASSUMPTIONS.

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JOB MILL SEAT LF
SHEET NO. 4 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY MCB DATE
DESCRIPTION INTERSECTION COUNT SUMMARY

33A / 490 EB - EXISTING *

PM

INT

PEAK HOUR : 3:45 - 4:45 PM
V : 276 VPH (274 ACTUAL)
V_{15} : 79 x 4 = 316 VPH
~~PHF : 276/316 = 0.87~~
% TRUCKS : 9 / 276 = 3.3%
LF TRUCKS : 3

EBT

V : 104 VPH (102 ACTUAL)
V_{15} : 28 x 4 = 112 VPH
~~PHF : 104/112 = 0.93~~ 0.88
% TRUCKS : 3 / 104 = 2.9%
LF TRUCKS : 0

WBT

V : 124 VPH
V_{15} : 42 x 4 = 168 VPH
~~PHF : 124 / 168 = 0.74~~ 0.76
% TRUCKS : 5 / 124 = 4.0%
LF TRUCKS : 2

NBL

V : 38 VPH
V_{15} : 17 x 4 = 68 VPH
~~PHF : 38 / 68 = 0.56~~ 0.60
% TRUCKS : 0 %
LF TRUCKS : 0

NBR

V : 10 VPH
V_{15} : 3 x 4 = 12 VPH
~~PHF : 10 / 12 = 0.83~~ 0.60
% TRUCKS : 1 / 10 = 10%
LF TRUCKS : 1

* TRAFFIC COLLECTION ERROR AT THIS INTERSECTION. SEE SHEET 5 FOR ASSUMPTIONS.

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JOB MILL SEAT LF
SHEET NO. 5 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY MCB DATE
DESCRIPTION INTERSECTION COUNT SUMMARY

TRAFFIC COLLECTION ERROR AT 33A/490 EB OFF RAMP

ALL TRUCKS (BOTH HT & LT) WERE RECORDED AS PASSENGER VEHICLES AT THIS INTERSECTION FOR BOTH AM & PM COUNTS. GIVEN THAT THE ADJACENT COUNTS AT 33A/BREW RD AND 33A/490 WB OFF RAMP WERE DONE CORRECTLY AND THE OVERALL COUNTS FOR 33A/490 EB WERE CONSISTENT WITH THE ADJACENT INTERSECTIONS, THE VEHICLE CLASS BREAKDOWN AND DISTRIBUTION CAN BE ASSUMED.

THE FOLLOWING ASSUMPTIONS WERE MADE:

AM
- → 10 LT FOR EBT MOVEMENT
- → 1 HT FOR EBT MOVEMENT
- → 3 LT FOR NBR MOVEMENT
- → 13 LT FOR WBT MOVEMENT
- → 2 HT FOR WBT MOVEMENT
- → TOTAL WBT WAS 102 COUNTED, BUT INCREASED TO 106 TO BE CONSISTENT WITH BREW/33A
- → TOTAL EBT WAS 122, BUT INCREASED TO 123 TO BE CONSISTENT WITH BREW/33A

PM
- → 3HT FOR EBT
- → 1 LT FOR NBR
- → 3 HT FOR WBT
- → 2 LT FOR WBT
- → TOTAL EBT WAS 102, BUT INCREASED 104 TO BE CONSISTENT WITH BREW/33A.

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JOB MILL SEAT LF
SHEET NO. 6 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY MCB DATE
DESCRIPTION INTERSECTION COUNT SUMMARY

33A / BREW RD - EXISTING

AM

INT PEAK HOUR 7:00 - 8:00 AM

V	=	245 VPH
V_{15}	=	64 x 4 = 256 VPH
~~PHF~~	=	~~245 / 256 = 0.96~~
% TRUCKS	=	37 / 245 = 15.1 %
LF TRUCKS	=	26

EBT

V	=	112 VPH
V_{15}	=	32 x 4 = 128 VPH
~~PHF~~	=	~~112 / 128 = 0.88~~ 0.93
% TRUCKS	=	1 / 112 = 0.1 %
LF TRUCKS	=	0

EBR

V	=	19 VPH
V_{15}	=	11 x 4 = 44 VPH
~~PHF~~	=	~~19 / 44 = 0.43~~ 0.93
% TRUCKS	=	13 / 19 = 68.4 %
LF TRUCKS	=	13

WBT

V	=	92 VPH
V_{15}	=	27 x 4 = 108 VPH
~~PHF~~	=	~~92 / 108 = 0.85~~ 0.90
% TRUCKS	=	2 / 92 = 2.2 %
LF TRUCKS	=	0

WBL

V	=	6 VPH
V_{15}	=	3 x 4 = 12 VPH
~~PHF~~	=	~~6 / 12 = 0.50~~ 0.90
% TRUCKS	=	6 / 6 = 100 %
LF TRUCKS	=	0

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JOB MILL SEAT LF
SHEET NO. 7 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY DATE
DESCRIPTION INTERSECTION COUNT SUMMARY

33A / BREW RD - EXISTING (CONTINUED)

AM

NBL

V	=	14 VPH
V_{15}	=	7 x 4 = 28 VPH
~~PHF~~	=	~~14/28 = 0.5~~ 0.57
%TRUCKS	=	13/14 = 92.9%
LF TRUCKS	=	13

NBR

V	=	2 VPH
V_{15}	=	2 x 4 = 8 VPH
~~PHF~~	=	~~2/8 = 0.25~~ 0.57
%TRUCKS	=	2/2 = 100%
LF TRUCKS	=	0

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JOB MILL SCAT LF
SHEET NO. 8 OF 29
CALCULATED BY JMW DATE 12/17/2013
CHECKED BY DATE
DESCRIPTION INTERSECTION COUNT SUMMARY

33A/BREW RD - EXISTING

PM

NT PEAK HOUR 3:45-4:45 PM

V	=	240 VPH
V_{15}	=	71 x 4 = 284 VPH
~~PHF~~	=	~~240/284 = 0.85~~
% TRUCKS	=	11/240 = 4.6%
LF TRUCKS	=	3

EBT

V	=	111 VPH
V_{15}	=	31 x 4 = 124 VPH
~~PHF~~	=	~~111/124 = 0.90~~ 0.91
% TRUCKS	=	3/111 = 2.7%
LF TRUCKS	=	0

EBR

V	=	3 VPH
V_{15}	=	1 x 4 = 4 VPH
~~PHF~~	=	~~3/4 = 0.75~~ 0.91
% TRUCKS	=	1/3 = 33.3%
LF TRUCKS	=	1

WBT

V	=	105 VPH
V_{15}	=	31 x 4 = 124 VPH
~~PHF~~	=	~~105/124 = 0.85~~ 0.85
% TRUCKS	=	1/105 = 0.9%
LF TRUCKS	=	0

WBL

V	=	1 VPH
V_{15}	=	1 x 4 = 4 VPH
~~PHF~~	=	~~1/4 = 0.25~~ 0.85
% TRUCKS	=	1/1 = 100%
LF TRUCKS	=	0

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JOB MILL SEAT LF
SHEET NO. 9 OF 29
CALCULATED BY JMW DATE 12/17/2015
CHECKED BY DATE
DESCRIPTION INTERSECTION COUNT SUMMARY

33A / BREW RD - EXISTING

PM

NBL

V	=	17 VPH
V_{15}	=	10 x 4 = 40 VPH
~~PHF~~	=	~~17/40 = 0.43~~ 0.41
% TRUCKS	=	4/17 = 23.5%
LF TRUCKS	=	2

NBR

V	=	3 VPH
V_{15}	=	2 x 4 = 8 VPH
~~PHF~~	=	~~3/8 = 0.38~~ 0.41
% TRUCKS	=	1/3 = 33.3%
LF TRUCKS	=	0

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JOB MILL SEAT LF
SHEET NO. 10 OF 29
CALCULATED BY JMW DATE 1/23/2014
CHECKED BY MCB DATE
DESCRIPTION BACKGROUND GROWTH

BACKGROUND TRAFFIC GROWTH ON ROUTE 33A

ROUTE 33 TO COUNTY LINE (GENESEE COUNTY)

x YEAR	y AADT
1995	8500
2001	8300
2004	8700
2007	9130
2010	8640

EXPONENTIAL TRENDLINE:

$y = 12217 e^{0.0033x}$

GROWTH = 0.33% per year

COUNTY LINE TO ROUTE 36 (MONROE COUNTY)

x YEAR	y AADT
1995	2450
1998	2450
2001	2610
2004	2640
2007	2950
2011	2390

EXPONENTIAL TRENDLINE:

$y = 2.7464 e^{0.0034x}$

GROWTH = 0.34% per year

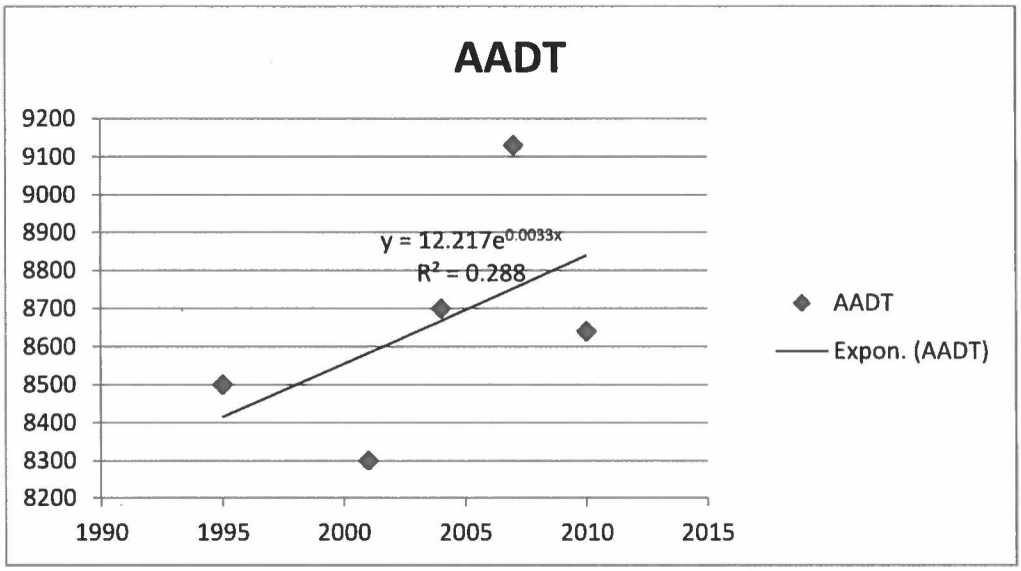
USE 0.34% per growth

11/29

BACKGROUND GROWTH FORECAST

YEAR	AADT
1995	8500
2001	8300
2004	8700
2007	9130
2010	8640

Genesee County from Route 33 to County Line

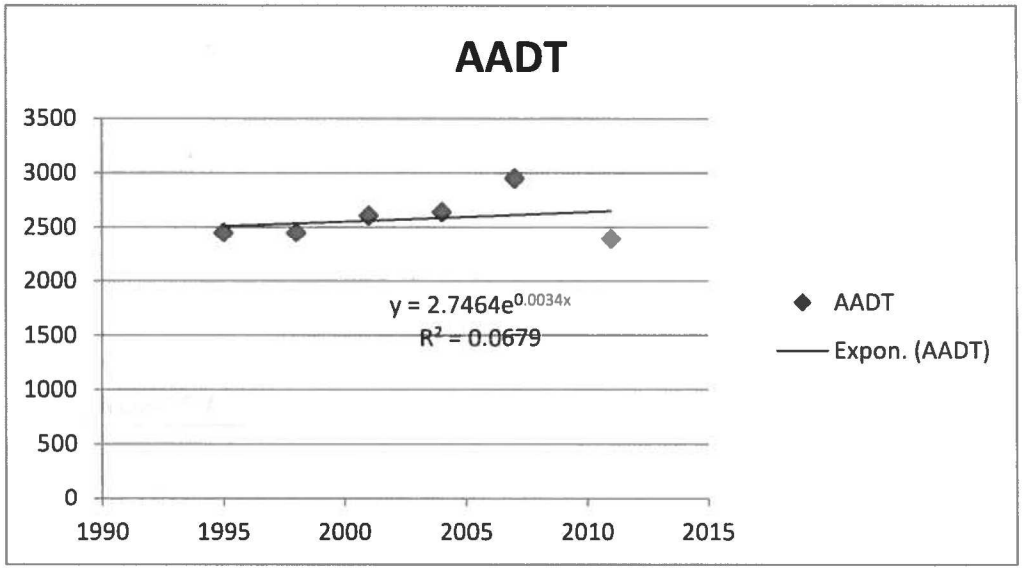


12-1-09

BACKGROUND GROWTH FORECAST

YEAR	AADT
1995	2450
1998	2450
2001	2610
2004	2640
2007	2950
2011	2390

Monroe County from County Line to Route 36



PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - 490 WB Off Ramp - AM Peak (P vehicles)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	SB Right (vph)	SB Left (vph)	Comments
0	**2013**	**396**	**87**	**223**	**1**	**Existing Conditions**
1	2014	402	88	226	1	
2	2015	408	90	230	1	
3	2016	414	91	233	1	
4	2017	420	92	237	1	
5	**2018**	**427**	**94**	**240**	**1**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
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JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - 490 EB Off Ramp - AM Peak (P vehicles)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**112**	**91**	**5**	**22**	**Existing Conditions**
1	2014	114	92	5	22	
2	2015	115	94	5	23	
3	2016	117	95	5	23	
4	2017	119	97	5	23	
5	**2018**	**121**	**98**	**5**	**24**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - Brew Road - AM Peak (P vehicles)

Growth Rate = 1.5%

	Year	EBT (vph)	EBR (vph)	WBT (vph)	WBL (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**111**	**6**	**90**	**0**	**0**	**1**	**Existing Conditions**
1	2014	113	6	91	0	0	1	
2	2015	114	6	93	0	0	1	
3	2016	116	6	94	0	0	1	
4	2017	118	6	96	0	0	1	
5	**2018**	**120**	**6**	**97**	**0**	**0**	**1**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - 490 WB Off Ramp - AM Peak (Heavy Trucks)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	SB Right (vph)	SB Left (vph)	Comments
0	**2013**	**25**	**0**	**6**	**0**	**Existing Conditions**
1	2014	25	0	6	0	
2	2015	26	0	6	0	
3	2016	26	0	6	0	
4	2017	27	0	6	0	
5	**2018**	**27**	**0**	**6**	**0**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - 490 EB Off Ramp - AM Peak (Heavy Trucks)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**1**	**2**	**0**	**0**	**Existing Conditions**
1	2014	1	2	0	0	
2	2015	1	2	0	0	
3	2016	1	2	0	0	
4	2017	1	2	0	0	
5	**2018**	**1**	**2**	**0**	**0**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

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ROAD NAME - Brew Road - AM Peak (Heavy Trucks)

Growth Rate =	1.5%

	Year	EBT (vph)	EBR (vph)	WBT (vph)	WBL (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**1**	**0**	**2**	**0**	**0**	**0**	**Existing Conditions**
1	2014	1	0	2	0	0	0	
2	2015	1	0	2	0	0	0	
3	2016	1	0	2	0	0	0	
4	2017	1	0	2	0	0	0	
5	**2018**	**1**	**0**	**2**	**0**	**0**	**0**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - 490 WB Off Ramp - PM Peak (P vehicles)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	SB Right (vph)	SB Left (vph)	Comments
0	**2013**	**369**	**146**	**344**	**3**	**Existing Conditions**
1	2014	375	148	349	3	
2	2015	380	150	354	3	
3	2016	386	153	360	3	
4	2017	392	155	365	3	
5	**2018**	**398**	**157**	**371**	**3**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - 490 EB Off Ramp - PM Peak (P vehicles)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**111**	**119**	**9**	**38**	**Existing Conditions**
1	2014	113	121	9	39	
2	2015	114	123	9	39	
3	2016	116	124	9	40	
4	2017	118	126	10	40	
5	**2018**	**120**	**128**	**10**	**41**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

ROAD NAME - Brew Road - PM Peak (P vehicles)

Growth Rate =	1.5%

	Year	EBT (vph)	EBR (vph)	WBT (vph)	WBL (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**108**	**2**	**104**	**0**	**2**	**13**	**Existing Conditions**
1	2014	110	2	106	0	2	13	
2	2015	111	2	107	0	2	13	
3	2016	113	2	109	0	2	14	
4	2017	115	2	110	0	2	14	
5	**2018**	**116**	**2**	**112**	**0**	**2**	**14**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

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ROAD NAME - 490 WB Off Ramp - PM Peak (Heavy Trucks)

Growth Rate =	1.5%

	Year	EB (vph)	WB (vph)	SB Right (vph)	SB Left (vph)	Comments
0	**2013**	**14**	**3**	**6**	**0**	**Existing Conditions**
1	2014	14	3	6	0	
2	2015	14	3	6	0	
3	2016	15	3	6	0	
4	2017	15	3	6	0	
5	**2018**	**15**	**3**	**6**	**0**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

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ROAD NAME - 490 EB Off Ramp - PM Peak (Heavy Trucks)

Growth Rate = 1.5%

	Year	EB (vph)	WB (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**3**	**3**	**0**	**0**	**Existing Conditions**
1	2014	3	3	0	0	
2	2015	3	3	0	0	
3	2016	3	3	0	0	
4	2017	3	3	0	0	
5	**2018**	**3**	**3**	**0**	**0**	**Begin Permit**

PROJECT NAME: MILL SEAT LANDFILL
PIN
JN 1242.022.013
Calc. By: JMW **Date:** 12/17/2013
Checked: MCB **Date:**

Barton & Loguidice, P.C.
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ROAD NAME - Brew Road - PM Peak (Heavy Trucks)

Growth Rate =	1.5%

	Year	EBT (vph)	EBR (vph)	WBT (vph)	WBL (vph)	NB Right (vph)	NB Left (vph)	Comments
0	**2013**	**3**	**0**	**1**	**0**	**0**	**2**	**Existing Conditions**
1	2014	3	0	1	0	0	2	
2	2015	3	0	1	0	0	2	
3	2016	3	0	1	0	0	2	
4	2017	3	0	1	0	0	2	
5	**2018**	**3**	**0**	**1**	**0**	**0**	**2**	**Begin Permit**

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects
11 Centre Park • Suite 203 • Rochester, NY 14614
Telephone: (585) 325-7190 • Facsimile (585) 325-4856

JOB MILL SEAT LF
SHEET NO. 25 OF 29
CALCULATED BY JMW DATE 1/23/2014
CHECKED BY MCB DATE
DESCRIPTION TRIP GENERATION

LANDFILL TRAFFIC - GENERATION

MAX DAILY TRAFFIC = 286
ACTUAL DAILY TRAFFIC FOR 9/25/13 = 162 vpd

PEAK HOUR GENERATION TRAFFIC FROM EXISTING COUNTS

BREW RD / 33A

AM
NBL = 13 LT × 286/162 = 23 LT (10 LT)
EBR = 13 LT × 286/162 = 23 LT (10)

PM
NBL = 2 LT × 286/162 = 4 LT (2)
EBR = 1 LT × 286/162 = 2 LT (1)

490 EB / 33A

AM
NBR = 3 LT × 286/162 = 5 LT (2)
EBT = 10 LT × 286/162 = 18 LT (8)
WBT = 13 LT × 286/162 = 23 LT (10)

PM
NBR = 1 LT × 286/162 = 2 LT (1)
EBT = 0 LT × 286/162 = 0 LT (0)
WBT = 2 LT × 286/162 = 4 LT (2)

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JOB MILL SCAT LF
SHEET NO. 26 OF 29
CALCULATED BY JMW DATE 1/23/2014
CHECKED BY MCB DATE
DESCRIPTION TRIP GENERATION

490 WB / 33A

AM	SBL	= 10 LT	× 286/162	=	18	LT	(8)
	EBT	= 7 LT	× 286/162	=	12	LT	(5)
	WBT	= 6 LT	× 286/162	=	11	LT	(5)
PM	SBL	= 0 LT	× 286/162	=	0	LT	(0)
	EBT	= 0 LT	× 286/162	=	0	LT	(0)
	WBT	= 1 LT	× 286/162	=	2	LT	(1)

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JOB MILL SEAT CF
SHEET NO. 27 OF 29
CALCULATED BY JMW DATE 1/23/2014
CHECKED BY MCB DATE
DESCRIPTION TRIP GENERATION

CONSTRUCTION TRAFFIC - GENERATION

MAX DAILY TRAFFIC = 75 vpd (WMNY)
ACTUAL DAILY TRAFFIC FOR 9/25/13 = 38 vpd

PEAK HOUR VOLUMES ESTIMATED FROM EXISTING COUNTS

BREW RD / BSA

AM

WBL = 6 CV x $\frac{75}{38}$ = 12 CV (ADDITIONAL 6)

NBR = 2 CV x 75/38 = 4 CV (ADDITIONAL 2)

PM

WBL = 1 CV x 75/38 = 2 CV (ADDITIONAL 1)

NBR = 1 CV x 75/38 = 2 CV (ADDITIONAL 1)

PERCENT TRUCKS - BACKGROUND							
490 EB		V	HV+LF+CV	% TRUCKS			
AM	NBL	25	0	0%			
	NBR	9	3	33%			
	EBT	139	11	8%			
	WBT	119	15	13%			
PM	NBL	43	0	0%			
	NBR	11	1	9%			
	EBT	130	3	2%			
	WBT	141	5	4%			
490 WB							
AM	SBL	11	10	91%			
	SBR	262	7	3%			
	EBT	492	36	7%			
	WBT	105	6	6%			
PM	SBL	3	0	0%			
	SBR	400	7	2%			
	EBT	437	16	4%			
	WBT	171	4	2%			
BREW							
AM	NBL	14	13	93%			
	NBR	2	2	100%			
	EBT	128	1	1%			
	EBR	20	13	65%			
	WBT	105	2	2%			
	WBL	6	6	100%			
PM	NBL	19	5	26%			
	NBR	3	1	33%			
	EBT	126	3	2%			
	EBR	3	1	33%			
	WBT	120	1	1%			
	WBL	1	1	100%			

PERCENT TRUCKS - PROJECTED							
		BACKGROUND			PROJECTED		
490 EB		V	HV+LF+CV	Generation	Total V	Total Trucks	% TRUCKS
AM	NBL	25	0		25	0	0%
	NBR	9	3	2	11	5	45%
	EBT	139	11	8	147	19	13%
	WBT	119	15	10	129	25	19%
PM	NBL	43	0		43	0	0%
	NBR	11	1	1	12	2	17%
	EBT	130	3	0	130	3	2%
	WBT	141	5	2	143	7	5%
490 WB			0				
AM	SBL	11	10	8	19	18	95%
	SBR	262	7		262	7	3%
	EBT	492	36	5	497	41	8%
	WBT	105	6	5	110	11	10%
PM	SBL	3	0		3	0	0%
	SBR	400	7		400	7	2%
	EBT	437	16		437	16	4%
	WBT	171	4	2	173	6	3%
BREW			0				
AM	NBL	14	13	10	24	23	96%
	NBR	2	2	2	4	4	100%
	EBT	128	1		128	1	1%
	EBR	20	13	10	30	23	77%
	WBT	105	2		105	2	2%
	WBL	6	6	6	12	12	100%
PM	NBL	19	5	2	21	7	33%
	NBR	3	1	1	4	2	50%
	EBT	126	3		126	3	2%
	EBR	3	1	1	4	2	50%
	WBT	120	1		120	1	1%
	WBL	1	1	1	2	2	100%

APPENDIX E

Capacity Analysis – Existing Conditions

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		428			93	
Peak-Hour Factor, PHF		0.94			0.75	
Hourly Flow Rate, HFR		455			124	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		229
Peak Hour Factor, PHF				0.78		0.78
Hourly Flow Rate, HFR				12		293
Percent Heavy Vehicles				100		3
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						12		293
C(m) (vph)						419		999
v/c						0.03		0.29
95% queue length						0.09		1.23
Control Delay						13.8		10.1
LOS						B		B
Approach Delay							10.2	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		428			93	
Peak-Hour Factor, PHF		0.94			0.75	
Peak-15 Minute Volume		114			31	
Hourly Flow Rate, HFR		455			124	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		229
Peak Hour Factor, PHF				0.78		0.78
Peak-15 Minute Volume				3		73
Hourly Flow Rate, HFR				12		293
Percent Heavy Vehicles				100		3
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)						7.5		6.2
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)						100		3
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)						0.70		0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage						8.8		6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)						3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)						100		3
t(f)						4.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x						351		62
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						3000		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9		12	
Conflicting Flows							62	
Potential Capacity							999	
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity							999	
Probability of Queue free St.					1.00		0.71	
Step 2: LT from Major St.					4		1	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.					8		11	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Step 4: LT from Minor St.					7		10	
Conflicting Flows							351	
Potential Capacity							419	
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor					1.00			
Maj. L, Min T Adj. Imp Factor.					1.00			
Cap. Adj. factor due to Impeding mvmnt					0.71		1.00	
Movement Capacity							419	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.					8		11	
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		351
Potential Capacity		419
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.71	1.00
Movement Capacity		419
Results for Two-stage process:		
a		
y		
C t		419

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				12		293
Movement Capacity (vph)				419		999
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				419		999
Volume				12		293
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						12		293
C(m) (vph)						419		999
v/c						0.03		0.29
95% queue length						0.09		1.23
Control Delay						13.8		10.1
LOS						B		B
Approach Delay							10.2	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		383			150	
Peak-Hour Factor, PHF		0.84			0.79	
Hourly Flow Rate, HFR		455			189	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				3		350
Peak Hour Factor, PHF				0.84		0.84
Hourly Flow Rate, HFR				3		416
Percent Heavy Vehicles				0		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						3		416
C(m) (vph)						570		962
v/c						0.01		0.43
95% queue length						0.02		2.21
Control Delay						11.3		11.6
LOS						B		B
Approach Delay							11.6	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		383			150	
Peak-Hour Factor, PHF		0.84			0.79	
Peak-15 Minute Volume		114			47	
Hourly Flow Rate, HFR		455			189	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				3		350
Peak Hour Factor, PHF				0.84		0.84
Peak-15 Minute Volume				1		104
Hourly Flow Rate, HFR				3		416
Percent Heavy Vehicles				0		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)						7.5		6.2
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)						0		2
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)						0.70		0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage						6.8		6.2
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)						3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)						0		2
t(f)						3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)								
Arrival Type								
Effective Green, g (sec)								
Cycle Length, C (sec)								
Rp (from Exhibit 16-11)								
Proportion vehicles arriving on green P								
g(q1)								
g(q2)								
g(q)								

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x						416		94
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						3000		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9		12	
Conflicting Flows							94	
Potential Capacity							962	
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity							962	
Probability of Queue free St.					1.00		0.57	
Step 2: LT from Major St.					4		1	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.					8		11	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Step 4: LT from Minor St.					7		10	
Conflicting Flows							416	
Potential Capacity							570	
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor					1.00			
Maj. L, Min T Adj. Imp Factor.					1.00			
Cap. Adj. factor due to Impeding mvmnt					0.57		1.00	
Movement Capacity							570	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.					8		11	
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		416
Potential Capacity		570
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.57	1.00
Movement Capacity		570
Results for Two-stage process:		
a		
y		
C t		570

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				3		416
Movement Capacity (vph)				570		962
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				570		962
Volume				3		416
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						3		416
C(m) (vph)						570		962
v/c						0.01		0.43
95% queue length						0.02		2.21
Control Delay						11.3		11.6
LOS						B		B
Approach Delay							11.6	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		123			106	
Peak-Hour Factor, PHF		0.89			0.87	
Hourly Flow Rate, HFR		138			121	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	22		8			
Peak Hour Factor, PHF	0.75		0.75			
Hourly Flow Rate, HFR	29		10			
Percent Heavy Vehicles	0		4			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				39				
C(m) (vph)				823				
v/c				0.05				
95% queue length				0.15				
Control Delay				9.6				
LOS				A				
Approach Delay				9.6				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		123			106	
Peak-Hour Factor, PHF		0.89			0.87	
Peak-15 Minute Volume		35			30	
Hourly Flow Rate, HFR		138			121	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	22		8			
Peak Hour Factor, PHF	0.75		0.75			
Peak-15 Minute Volume	7		3			
Hourly Flow Rate, HFR	29		10			
Percent Heavy Vehicles	0		4			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)			0		4			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage			6.8		6.3			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)			3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)			0		4			
t(f)			3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x			198		69			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.			9			12		
Conflicting Flows			69					
Potential Capacity			987					
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity			987					
Probability of Queue free St.			0.99			1.00		
Step 2: LT from Major St.			**4**			**1**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.			**8**			**11**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Step 4: LT from Minor St.			**7**			**10**		
Conflicting Flows			198					
Potential Capacity			778					
Pedestrian Impedance Factor			1.00			1.00		
Maj. L, Min T Impedance factor						1.00		
Maj. L, Min T Adj. Imp Factor.						1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			0.99		
Movement Capacity			778					

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.			8			11		
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	198	
Potential Capacity	778	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	778	

Results for Two-stage process:	
a	
y	
C t	778

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	29		10			
Movement Capacity (vph)	778		987			
Shared Lane Capacity (vph)		823				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	778		987			
Volume	29		10			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		823				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				39				
C(m) (vph)				823				
v/c				0.05				
95% queue length				0.15				
Control Delay				9.6				
LOS				A				
Approach Delay				9.6				
Approach LOS				A				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		104			124	
Peak-Hour Factor, PHF		0.88			0.76	
Hourly Flow Rate, HFR		118			163	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	38		10			
Peak Hour Factor, PHF	0.60		0.60			
Hourly Flow Rate, HFR	63		16			
Percent Heavy Vehicles	0		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				79				
C(m) (vph)				815				
v/c				0.10				
95% queue length				0.32				
Control Delay				9.9				
LOS				A				
Approach Delay				9.9				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		104			124	
Peak-Hour Factor, PHF		0.88			0.76	
Peak-15 Minute Volume		30			41	
Hourly Flow Rate, HFR		118			163	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	38		10			
Peak Hour Factor, PHF	0.60		0.60			
Peak-15 Minute Volume	16		4			
Hourly Flow Rate, HFR	63		16			
Percent Heavy Vehicles	0		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)			0		0			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage			6.8		6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)			3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)			0		0			
t(f)			3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x			199		59			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.			9			12		
Conflicting Flows			59					
Potential Capacity			1012					
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity			1012					
Probability of Queue free St.			0.98			1.00		
Step 2: LT from Major St.			**4**			**1**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.			**8**			**11**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Step 4: LT from Minor St.			**7**			**10**		
Conflicting Flows			199					
Potential Capacity			777					
Pedestrian Impedance Factor			1.00			1.00		
Maj. L, Min T Impedance factor						1.00		
Maj. L, Min T Adj. Imp Factor.						1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			0.98		
Movement Capacity			777					

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.			8			11		
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	199	
Potential Capacity	777	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	777	
Results for Two-stage process:		
a		
y		
C t	777	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	63		16			
Movement Capacity (vph)	777		1012			
Shared Lane Capacity (vph)		815				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	777		1012			
Volume	63		16			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		815				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				79				
C(m) (vph)				815				
v/c				0.10				
95% queue length				0.32				
Control Delay				9.9				
LOS				A				
Approach Delay				9.9				
Approach LOS				A				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		112	19	6	92	
Peak-Hour Factor, PHF		0.93	0.93	0.90	0.90	
Hourly Flow Rate, HFR		120	20	6	102	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	14		2			
Peak Hour Factor, PHF	0.57		0.57			
Hourly Flow Rate, HFR	24		3			
Percent Heavy Vehicles	93		100			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		6		27				
C(m) (vph)		944		538				
v/c		0.01		0.05				
95% queue length		0.02		0.16				
Control Delay		8.8		12.0				
LOS		A		B				
Approach Delay				12.0				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		112	19	6	92	
Peak-Hour Factor, PHF		0.93	0.93	0.90	0.90	
Peak-15 Minute Volume		30	5	2	26	
Hourly Flow Rate, HFR		120	20	6	102	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	14		2			
Peak Hour Factor, PHF	0.57		0.57			
Peak-15 Minute Volume	6		1			
Hourly Flow Rate, HFR	24		3			
Percent Heavy Vehicles	93		100			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		102
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		100	93		100			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		6.1	8.7		8.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)		100	93		100			
t(f)		3.2	4.4		4.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		140	244		70			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	70	
Potential Capacity	744	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	744	
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	140	
Potential Capacity	944	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	944	
Probability of Queue free St.	0.99	1.00
Maj L-Shared Prob Q free St.	0.99	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	244	
Potential Capacity	523	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	520	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	244	
Potential Capacity	523	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	520	
Results for Two-stage process:		
a		
y		
C t	520	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	24		3			
Movement Capacity (vph)	520		744			
Shared Lane Capacity (vph)		538				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	520		744			
Volume	24		3			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		538				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		6		27				
C(m) (vph)		944		538				
v/c		0.01		0.05				
95% queue length		0.02		0.16				
Control Delay		8.8		12.0				
LOS		A		B				
Approach Delay				12.0				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.99
v(il), Volume for stream 2 or 5		102
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.8
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period:
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		111	3	1	105	
Peak-Hour Factor, PHF		0.91	0.91	0.85	0.85	
Hourly Flow Rate, HFR		121	3	1	123	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	17		3			
Peak Hour Factor, PHF	0.41		0.41			
Hourly Flow Rate, HFR	41		7			
Percent Heavy Vehicles	24		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		1		48				
C(m) (vph)		1475		697				
v/c		0.00		0.07				
95% queue length		0.00		0.22				
Control Delay		7.4		10.5				
LOS		A		B				
Approach Delay				10.5				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period:
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		111	3	1	105	
Peak-Hour Factor, PHF		0.91	0.91	0.85	0.85	
Peak-15 Minute Volume		30	1	0	31	
Hourly Flow Rate, HFR		121	3	1	123	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	17		3			
Peak Hour Factor, PHF	0.41		0.41			
Peak-15 Minute Volume	10		2			
Hourly Flow Rate, HFR	41		7			
Percent Heavy Vehicles	24		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		123
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		0	24		0			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	7.3		6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)		0	24		0			
t(f)		2.2	3.7		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)								
Arrival Type								
Effective Green, g (sec)								
Cycle Length, C (sec)								
Rp (from Exhibit 16-11)								
Proportion vehicles arriving on green P								
g(q1)								
g(q2)								
g(q)								

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		124	247		62			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.		9		12
Conflicting Flows		62		
Potential Capacity		1009		
Pedestrian Impedance Factor		1.00		1.00
Movement Capacity		1009		
Probability of Queue free St.		0.99		1.00
Step 2: LT from Major St.		**4**		**1**
Conflicting Flows		124		
Potential Capacity		1475		
Pedestrian Impedance Factor		1.00		1.00
Movement Capacity		1475		
Probability of Queue free St.		1.00		1.00
Maj L-Shared Prob Q free St.		1.00		
Step 3: TH from Minor St.		**8**		**11**
Conflicting Flows				
Potential Capacity				
Pedestrian Impedance Factor		1.00		1.00
Cap. Adj. factor due to Impeding mvmnt		1.00		1.00
Movement Capacity				
Probability of Queue free St.		1.00		1.00
Step 4: LT from Minor St.		**7**		**10**
Conflicting Flows		247		
Potential Capacity		662		
Pedestrian Impedance Factor		1.00		1.00
Maj. L, Min T Impedance factor				1.00
Maj. L, Min T Adj. Imp Factor.				1.00
Cap. Adj. factor due to Impeding mvmnt		1.00		0.99
Movement Capacity		662		

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.		8		11
Part 1 - First Stage				
Conflicting Flows				
Potential Capacity				
Pedestrian Impedance Factor				
Cap. Adj. factor due to Impeding mvmnt				
Movement Capacity				
Probability of Queue free St.				

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	247	
Potential Capacity	662	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	662	
Results for Two-stage process:		
a		
y		
C t	662	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	41		7			
Movement Capacity (vph)	662		1009			
Shared Lane Capacity (vph)		697				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	662		1009			
Volume	41		7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		697				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		1		48				
C(m) (vph)		1475		697				
v/c		0.00		0.07				
95% queue length		0.00		0.22				
Control Delay		7.4		10.5				
LOS		A		B				
Approach Delay				10.5				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		123
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4		7.4
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.0

APPENDIX F

Capacity Analysis – Background Conditions

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		461			100	
Peak-Hour Factor, PHF		0.94			0.75	
Hourly Flow Rate, HFR		490			133	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				11		246
Peak Hour Factor, PHF				0.78		0.78
Hourly Flow Rate, HFR				14		315
Percent Heavy Vehicles				90		3
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						14		315
C(m) (vph)						414		994
v/c						0.03		0.32
95% queue length						0.10		1.37
Control Delay						14.0		10.3
LOS						B		B
Approach Delay							10.5	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		461			100	
Peak-Hour Factor, PHF		0.94			0.75	
Peak-15 Minute Volume		123			33	
Hourly Flow Rate, HFR		490			133	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				11		246
Peak Hour Factor, PHF				0.78		0.78
Peak-15 Minute Volume				4		79
Hourly Flow Rate, HFR				14		315
Percent Heavy Vehicles				90		3
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)						7.5		6.2
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)						90		3
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)						0.70		0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage						8.6		6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)						3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)						90		3
t(f)						4.4		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x						378		66
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
7	8	10	11	

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						3000		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9		12	
Conflicting Flows							66	
Potential Capacity							994	
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity							994	
Probability of Queue free St.					1.00		0.68	
Step 2: LT from Major St.					4		1	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.					8		11	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Step 4: LT from Minor St.					7		10	
Conflicting Flows							378	
Potential Capacity							414	
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor					1.00			
Maj. L, Min T Adj. Imp Factor.					1.00			
Cap. Adj. factor due to Impeding mvmnt					0.68		1.00	
Movement Capacity							414	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.					8		11	
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		378
Potential Capacity		414
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.68	1.00
Movement Capacity		414
Results for Two-stage process:		
a		
y		
C t		414

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				14		315
Movement Capacity (vph)				414		994
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				414		994
Volume				14		315
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						14		315
C(m) (vph)						414		994
v/c						0.03		0.32
95% queue length						0.10		1.37
Control Delay						14.0		10.3
LOS						B		B
Approach Delay							10.5	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		413			161	
Peak-Hour Factor, PHF		0.84			0.79	
Hourly Flow Rate, HFR		491			203	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				3		377
Peak Hour Factor, PHF				0.84		0.84
Hourly Flow Rate, HFR				3		448
Percent Heavy Vehicles				0		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						3		448
C(m) (vph)						544		952
v/c						0.01		0.47
95% queue length						0.02		2.56
Control Delay						11.7		12.1
LOS						B		B
Approach Delay							12.1	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		413			161	
Peak-Hour Factor, PHF		0.84			0.79	
Peak-15 Minute Volume		123			51	
Hourly Flow Rate, HFR		491			203	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				3		377
Peak Hour Factor, PHF				0.84		0.84
Peak-15 Minute Volume				1		112
Hourly Flow Rate, HFR				3		448
Percent Heavy Vehicles				0		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)						7.5		6.2
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)						0		2
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)						0.70		0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage						6.8		6.2
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)						3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)						0		2
t(f)						3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x						448		102
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						3000		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9		12	
Conflicting Flows							102	
Potential Capacity							952	
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity							952	
Probability of Queue free St.					1.00		0.53	
Step 2: LT from Major St.					4		1	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.					8		11	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Step 4: LT from Minor St.					7		10	
Conflicting Flows							448	
Potential Capacity							544	
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor					1.00			
Maj. L, Min T Adj. Imp Factor.					1.00			
Cap. Adj. factor due to Impeding mvmnt					0.53		1.00	
Movement Capacity							544	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.					8		11	
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		448
Potential Capacity		544
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.53	1.00
Movement Capacity		544
Results for Two-stage process:		
a		
y		
C t		544

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				3		448
Movement Capacity (vph)				544		952
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				544		952
Volume				3		448
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						3		448
C(m) (vph)						544		952
v/c						0.01		0.47
95% queue length						0.02		2.56
Control Delay						11.7		12.1
LOS						B		B
Approach Delay							12.1	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		132			113	
Peak-Hour Factor, PHF		0.89			0.87	
Hourly Flow Rate, HFR		148			129	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	24		8			
Peak Hour Factor, PHF	0.75		0.75			
Hourly Flow Rate, HFR	32		10			
Percent Heavy Vehicles	0		30			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				42				
C(m) (vph)				792				
v/c				0.05				
95% queue length				0.17				
Control Delay				9.8				
LOS				A				
Approach Delay				9.8				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		132			113	
Peak-Hour Factor, PHF		0.89			0.87	
Peak-15 Minute Volume		37			32	
Hourly Flow Rate, HFR		148			129	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	24		8			
Peak Hour Factor, PHF	0.75		0.75			
Peak-15 Minute Volume	8		3			
Hourly Flow Rate, HFR	32		10			
Percent Heavy Vehicles	0		30			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)			0		30			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage			6.8		6.8			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)			3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)			0		30			
t(f)			3.5		3.6			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x			212		74			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
7	8	10	11	

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.			9			12		
Conflicting Flows			74					
Potential Capacity			902					
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity			902					
Probability of Queue free St.			0.99			1.00		
Step 2: LT from Major St.			**4**			**1**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.			**8**			**11**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Step 4: LT from Minor St.			**7**			**10**		
Conflicting Flows			212					
Potential Capacity			763					
Pedestrian Impedance Factor			1.00			1.00		
Maj. L, Min T Impedance factor						1.00		
Maj. L, Min T Adj. Imp Factor.						1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			0.99		
Movement Capacity			763					

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.			8			11		
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	212	
Potential Capacity	763	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	763	
Results for Two-stage process:		
a		
y		
C t	763	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	32		10			
Movement Capacity (vph)	763		902			
Shared Lane Capacity (vph)		792				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	763		902			
Volume	32		10			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		792				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				42				
C(m) (vph)				792				
v/c				0.05				
95% queue length				0.17				
Control Delay				9.8				
LOS				A				
Approach Delay				9.8				
Approach LOS				A				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		123			133	
Peak-Hour Factor, PHF		0.88			0.76	
Hourly Flow Rate, HFR		139			175	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	41		11			
Peak Hour Factor, PHF	0.60		0.60			
Hourly Flow Rate, HFR	68		18			
Percent Heavy Vehicles	0		7			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				86				
C(m) (vph)				786				
v/c				0.11				
95% queue length				0.37				
Control Delay				10.1				
LOS				B				
Approach Delay				10.1				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		123			133	
Peak-Hour Factor, PHF		0.88			0.76	
Peak-15 Minute Volume		35			44	
Hourly Flow Rate, HFR		139			175	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	41		11			
Peak Hour Factor, PHF	0.60		0.60			
Peak-15 Minute Volume	17		5			
Hourly Flow Rate, HFR	68		18			
Percent Heavy Vehicles	0		7			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)			0		7			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage			6.8		6.3			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)			3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)			0		7			
t(f)			3.5		3.4			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x			226		70			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.			9			12		
Conflicting Flows			70					
Potential Capacity			976					
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity			976					
Probability of Queue free St.			0.98			1.00		
Step 2: LT from Major St.			**4**			**1**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.			**8**			**11**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Step 4: LT from Minor St.			**7**			**10**		
Conflicting Flows			226					
Potential Capacity			748					
Pedestrian Impedance Factor			1.00			1.00		
Maj. L, Min T Impedance factor						1.00		
Maj. L, Min T Adj. Imp Factor.						1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			0.98		
Movement Capacity			748					

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.			8			11		
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	226	
Potential Capacity	748	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	748	

Results for Two-stage process:	
a	
y	
C t	748

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	68		18			
Movement Capacity (vph)	748		976			
Shared Lane Capacity (vph)		786				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	748		976			
Volume	68		18			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		786				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				86				
C(m) (vph)				786				
v/c				0.11				
95% queue length				0.37				
Control Delay				10.1				
LOS				B				
Approach Delay				10.1				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		121	19	6	99	
Peak-Hour Factor, PHF		0.93	0.93	0.90	0.90	
Hourly Flow Rate, HFR		130	20	6	110	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	14		2			
Peak Hour Factor, PHF	0.57		0.57			
Hourly Flow Rate, HFR	24		3			
Percent Heavy Vehicles	93		100			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		6		27				
C(m) (vph)		932		521				
v/c		0.01		0.05				
95% queue length		0.02		0.16				
Control Delay		8.9		12.3				
LOS		A		B				
Approach Delay				12.3				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		121	19	6	99	
Peak-Hour Factor, PHF		0.93	0.93	0.90	0.90	
Peak-15 Minute Volume		33	5	2	28	
Hourly Flow Rate, HFR		130	20	6	110	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	14		2			
Peak Hour Factor, PHF	0.57		0.57			
Peak-15 Minute Volume	6		1			
Hourly Flow Rate, HFR	24		3			
Percent Heavy Vehicles	93		100			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		110
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		100	93		100			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		6.1	8.7		8.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)		100	93		100			
t(f)		3.2	4.4		4.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		150	262		75			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.		9		12
Conflicting Flows		75		
Potential Capacity		738		
Pedestrian Impedance Factor		1.00		1.00
Movement Capacity		738		
Probability of Queue free St.		1.00		1.00
Step 2: LT from Major St.		**4**		**1**
Conflicting Flows		150		
Potential Capacity		932		
Pedestrian Impedance Factor		1.00		1.00
Movement Capacity		932		
Probability of Queue free St.		0.99		1.00
Maj L-Shared Prob Q free St.		0.99		
Step 3: TH from Minor St.		**8**		**11**
Conflicting Flows				
Potential Capacity				
Pedestrian Impedance Factor		1.00		1.00
Cap. Adj. factor due to Impeding mvmnt		0.99		0.99
Movement Capacity				
Probability of Queue free St.		1.00		1.00
Step 4: LT from Minor St.		**7**		**10**
Conflicting Flows		262		
Potential Capacity		506		
Pedestrian Impedance Factor		1.00		1.00
Maj. L, Min T Impedance factor				0.99
Maj. L, Min T Adj. Imp Factor.				0.99
Cap. Adj. factor due to Impeding mvmnt		0.99		0.99
Movement Capacity		503		

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.		8		11
Part 1 - First Stage				
Conflicting Flows				
Potential Capacity				
Pedestrian Impedance Factor				
Cap. Adj. factor due to Impeding mvmnt				
Movement Capacity				
Probability of Queue free St.				

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	262	
Potential Capacity	506	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	503	

Results for Two-stage process:	
a	
y	
C t	503

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	24		3			
Movement Capacity (vph)	503		738			
Shared Lane Capacity (vph)		521				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	503		738			
Volume	24		3			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		521				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		6		27				
C(m) (vph)		932		521				
v/c		0.01		0.05				
95% queue length		0.02		0.16				
Control Delay		8.9		12.3				
LOS		A		B				
Approach Delay				12.3				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.99
v(il), Volume for stream 2 or 5		110
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.9
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		119	3	1	113	
Peak-Hour Factor, PHF		0.91	0.91	0.85	0.85	
Hourly Flow Rate, HFR		130	3	1	132	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	18		3			
Peak Hour Factor, PHF	0.41		0.41			
Hourly Flow Rate, HFR	43		7			
Percent Heavy Vehicles	26		33			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		1		50				
C(m) (vph)		952		664				
v/c		0.00		0.08				
95% queue length		0.00		0.24				
Control Delay		8.8		10.9				
LOS		A		B				
Approach Delay				10.9				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: BACKGROUND
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		119	3	1	113	
Peak-Hour Factor, PHF		0.91	0.91	0.85	0.85	
Peak-15 Minute Volume		33	1	0	33	
Hourly Flow Rate, HFR		130	3	1	132	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	18		3			
Peak Hour Factor, PHF	0.41		0.41			
Peak-15 Minute Volume	11		2			
Hourly Flow Rate, HFR	43		7			
Percent Heavy Vehicles	26		33			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		132
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		100	26		33			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		6.1	7.3		6.9			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)		100	26		33			
t(f)		3.2	3.8		3.6			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		133	266		66			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.		9		12
Conflicting Flows		66		
Potential Capacity		904		
Pedestrian Impedance Factor		1.00		1.00
Movement Capacity		904		
Probability of Queue free St.		0.99		1.00
Step 2: LT from Major St.		**4**		**1**
Conflicting Flows		133		
Potential Capacity		952		
Pedestrian Impedance Factor		1.00		1.00
Movement Capacity		952		
Probability of Queue free St.		1.00		1.00
Maj L-Shared Prob Q free St.		1.00		
Step 3: TH from Minor St.		**8**		**11**
Conflicting Flows				
Potential Capacity				
Pedestrian Impedance Factor		1.00		1.00
Cap. Adj. factor due to Impeding mvmnt		1.00		1.00
Movement Capacity				
Probability of Queue free St.		1.00		1.00
Step 4: LT from Minor St.		**7**		**10**
Conflicting Flows		266		
Potential Capacity		638		
Pedestrian Impedance Factor		1.00		1.00
Maj. L, Min T Impedance factor				1.00
Maj. L, Min T Adj. Imp Factor.				1.00
Cap. Adj. factor due to Impeding mvmnt		1.00		0.99
Movement Capacity		637		

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.		8		11
Part 1 - First Stage				
Conflicting Flows				
Potential Capacity				
Pedestrian Impedance Factor				
Cap. Adj. factor due to Impeding mvmnt				
Movement Capacity				
Probability of Queue free St.				

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	266	
Potential Capacity	638	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	637	

Results for Two-stage process:	
a	
y	
C t	637

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	43		7			
Movement Capacity (vph)	637		904			
Shared Lane Capacity (vph)		664				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	637		904			
Volume	43		7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		664				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		1		50				
C(m) (vph)		952		664				
v/c		0.00		0.08				
95% queue length		0.00		0.24				
Control Delay		8.8		10.9				
LOS		A		B				
Approach Delay				10.9				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		132
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4		8.8
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.0

APPENDIX G

Capacity Analysis – Projected Conditions

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		466			105	
Peak-Hour Factor, PHF		0.94			0.75	
Hourly Flow Rate, HFR		495			140	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				25		260
Peak Hour Factor, PHF				0.78		0.78
Hourly Flow Rate, HFR				32		333
Percent Heavy Vehicles				96		3
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						32		333
C(m) (vph)						398		989
v/c						0.08		0.34
95% queue length						0.26		1.50
Control Delay						14.8		10.5
LOS						B		B
Approach Delay							10.9	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		466			105	
Peak-Hour Factor, PHF		0.94			0.75	
Peak-15 Minute Volume		124			35	
Hourly Flow Rate, HFR		495			140	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				25		260
Peak Hour Factor, PHF				0.78		0.78
Peak-15 Minute Volume				8		83
Hourly Flow Rate, HFR				32		333
Percent Heavy Vehicles				96		3
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)						7.5		6.2
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)						96		3
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)						0.70		0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage						8.7		6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)						3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)						96		3
t(f)						4.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x						387		70
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						3000		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9		12	
Conflicting Flows							70	
Potential Capacity							989	
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity							989	
Probability of Queue free St.					1.00		0.66	
Step 2: LT from Major St.					4		1	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.					8		11	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Step 4: LT from Minor St.					7		10	
Conflicting Flows							387	
Potential Capacity							398	
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor					1.00			
Maj. L, Min T Adj. Imp Factor.					1.00			
Cap. Adj. factor due to Impeding mvmnt					0.66		1.00	
Movement Capacity							398	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.					8		11	
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		387
Potential Capacity		398
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.66	1.00
Movement Capacity		398
Results for Two-stage process:		
a		
y		
C t		398

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				32		333
Movement Capacity (vph)				398		989
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				398		989
Volume				32		333
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						32		333
C(m) (vph)						398		989
v/c						0.08		0.34
95% queue length						0.26		1.50
Control Delay						14.8		10.5
LOS						B		B
Approach Delay							10.9	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		413			163	
Peak-Hour Factor, PHF		0.84			0.79	
Hourly Flow Rate, HFR		491			206	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				4		378
Peak Hour Factor, PHF				0.84		0.84
Hourly Flow Rate, HFR				4		450
Percent Heavy Vehicles				58		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						4		450
C(m) (vph)						416		951
v/c						0.01		0.47
95% queue length						0.03		2.59
Control Delay						13.7		12.1
LOS						B		B
Approach Delay							12.2	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 WB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 WB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		413			163	
Peak-Hour Factor, PHF		0.84			0.79	
Peak-15 Minute Volume		123			52	
Hourly Flow Rate, HFR		491			206	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				4		378
Peak Hour Factor, PHF				0.84		0.84
Peak-15 Minute Volume				1		112
Hourly Flow Rate, HFR				4		450
Percent Heavy Vehicles				58		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)						7.5		6.2
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)						58		2
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)						0.70		0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage						8.0		6.2
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)						3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)						58		2
t(f)						4.1		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x						451		103
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
7	8	10	11	

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						3000		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9		12	
Conflicting Flows							103	
Potential Capacity							951	
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity							951	
Probability of Queue free St.					1.00		0.53	
Step 2: LT from Major St.					4		1	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.					8		11	
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Step 4: LT from Minor St.					7		10	
Conflicting Flows							451	
Potential Capacity							416	
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor					1.00			
Maj. L, Min T Adj. Imp Factor.					1.00			
Cap. Adj. factor due to Impeding mvmnt					0.53		1.00	
Movement Capacity							416	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.					8		11	
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		451
Potential Capacity		416
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.53	1.00
Movement Capacity		416
Results for Two-stage process:		
a		
y		
C t		416

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				4		450
Movement Capacity (vph)				416		951
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				416		951
Volume				4		450
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config						L		R
v (vph)						4		450
C(m) (vph)						416		951
v/c						0.01		0.47
95% queue length						0.03		2.59
Control Delay						13.7		12.1
LOS						B		B
Approach Delay							12.2	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		146			125	
Peak-Hour Factor, PHF		0.89			0.87	
Hourly Flow Rate, HFR		164			143	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	24		10			
Peak Hour Factor, PHF	0.75		0.75			
Hourly Flow Rate, HFR	32		13			
Percent Heavy Vehicles	0		30			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				45				
C(m) (vph)				777				
v/c				0.06				
95% queue length				0.18				
Control Delay				9.9				
LOS				A				
Approach Delay				9.9				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		146			125	
Peak-Hour Factor, PHF		0.89			0.87	
Peak-15 Minute Volume		41			36	
Hourly Flow Rate, HFR		164			143	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	24		10			
Peak Hour Factor, PHF	0.75		0.75			
Peak-15 Minute Volume	8		3			
Hourly Flow Rate, HFR	32		13			
Percent Heavy Vehicles	0		30			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)			0		30			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage			6.8		6.8			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)			3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)			0		30			
t(f)			3.5		3.6			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x			235		82			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.			9			12	
Conflicting Flows			82				
Potential Capacity			892				
Pedestrian Impedance Factor			1.00			1.00	
Movement Capacity			892				
Probability of Queue free St.			0.99			1.00	
Step 2: LT from Major St.			**4**			**1**	
Conflicting Flows							
Potential Capacity							
Pedestrian Impedance Factor			1.00			1.00	
Movement Capacity							
Probability of Queue free St.			1.00			1.00	
Maj L-Shared Prob Q free St.							
Step 3: TH from Minor St.			**8**			**11**	
Conflicting Flows							
Potential Capacity							
Pedestrian Impedance Factor			1.00			1.00	
Cap. Adj. factor due to Impeding mvmnt			1.00			1.00	
Movement Capacity							
Probability of Queue free St.			1.00			1.00	
Step 4: LT from Minor St.			**7**			**10**	
Conflicting Flows			235				
Potential Capacity			738				
Pedestrian Impedance Factor			1.00			1.00	
Maj. L, Min T Impedance factor						1.00	
Maj. L, Min T Adj. Imp Factor.						1.00	
Cap. Adj. factor due to Impeding mvmnt			1.00			0.99	
Movement Capacity			738				

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.			8			11	
Part 1 - First Stage							
Conflicting Flows							
Potential Capacity							
Pedestrian Impedance Factor							
Cap. Adj. factor due to Impeding mvmnt							
Movement Capacity							
Probability of Queue free St.							

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	235	
Potential Capacity	738	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	738	
Results for Two-stage process:		
a		
y		
C t	738	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	32		13			
Movement Capacity (vph)	738		892			
Shared Lane Capacity (vph)		777				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	738		892			
Volume	32		13			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		777				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				45				
C(m) (vph)				777				
v/c				0.06				
95% queue length				0.18				
Control Delay				9.9				
LOS				A				
Approach Delay				9.9				
Approach LOS				A				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: PROJECTED
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		124			136	
Peak-Hour Factor, PHF		0.88			0.76	
Hourly Flow Rate, HFR		140			178	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	41		12			
Peak Hour Factor, PHF	0.60		1.00			
Hourly Flow Rate, HFR	68		12			
Percent Heavy Vehicles	0		7			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				80				
C(m) (vph)				772				
v/c				0.10				
95% queue length				0.35				
Control Delay				10.2				
LOS				B				
Approach Delay				10.2				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / 490 EB Off-Ramp
Jurisdiction:
Units: U. S. Customary
Analysis Year: PROJECTED
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: 490 EB Off-Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		124			136	
Peak-Hour Factor, PHF		0.88			0.76	
Peak-15 Minute Volume		35			45	
Hourly Flow Rate, HFR		140			178	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2			2	
Configuration		T			T	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	41		12			
Peak Hour Factor, PHF	0.60		1.00			
Peak-15 Minute Volume	17		3			
Hourly Flow Rate, HFR	68		12			
Percent Heavy Vehicles	0		7			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)			0		7			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage			6.8		6.3			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)			3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)			0		7			
t(f)			3.5		3.4			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)								
Arrival Type								
Effective Green, g (sec)								
Cycle Length, C (sec)								
Rp (from Exhibit 16-11)								
Proportion vehicles arriving on green P								
g(q1)								
g(q2)								
g(q)								

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x			229		70			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.			9			12		
Conflicting Flows			70					
Potential Capacity			976					
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity			976					
Probability of Queue free St.			0.99			1.00		
Step 2: LT from Major St.			**4**			**1**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.			**8**			**11**		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor			1.00			1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			1.00		
Movement Capacity								
Probability of Queue free St.			1.00			1.00		
Step 4: LT from Minor St.			**7**			**10**		
Conflicting Flows			229					
Potential Capacity			744					
Pedestrian Impedance Factor			1.00			1.00		
Maj. L, Min T Impedance factor						1.00		
Maj. L, Min T Adj. Imp Factor.						1.00		
Cap. Adj. factor due to Impeding mvmnt			1.00			0.99		
Movement Capacity			744					

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.			8			11		
Part 1 - First Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	229	
Potential Capacity	744	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	744	
Results for Two-stage process:		
a		
y		
C t	744	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	68		12			
Movement Capacity (vph)	744		976			
Shared Lane Capacity (vph)		772				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	744		976			
Volume	68		12			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		772				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config				LR				
v (vph)				80				
C(m) (vph)				772				
v/c				0.10				
95% queue length				0.35				
Control Delay				10.2				
LOS				B				
Approach Delay				10.2				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: PROJECTED
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		121	35	6	99	
Peak-Hour Factor, PHF		0.93	0.93	0.90	0.90	
Hourly Flow Rate, HFR		130	37	6	110	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	26		2			
Peak Hour Factor, PHF	0.57		0.57			
Hourly Flow Rate, HFR	45		3			
Percent Heavy Vehicles	96		100			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		6		48				
C(m) (vph)		912		501				
v/c		0.01		0.10				
95% queue length		0.02		0.32				
Control Delay		9.0		12.9				
LOS		A		B				
Approach Delay				12.9				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: AM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: PROJECTED
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		121	35	6	99	
Peak-Hour Factor, PHF		0.93	0.93	0.90	0.90	
Peak-15 Minute Volume		33	9	2	28	
Hourly Flow Rate, HFR		130	37	6	110	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	26		2			
Peak Hour Factor, PHF	0.57		0.57			
Peak-15 Minute Volume	11		1			
Hourly Flow Rate, HFR	45		3			
Percent Heavy Vehicles	96		100			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		110
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		100	96		100			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		6.1	8.7		8.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)		100	96		100			
t(f)		3.2	4.5		4.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)								
Arrival Type								
Effective Green, g (sec)								
Cycle Length, C (sec)								
Rp (from Exhibit 16-11)								
Proportion vehicles arriving on green P								
g(q1)								
g(q2)								
g(q)								

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		167	270		84			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
7	8	10	11	

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	84	
Potential Capacity	727	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	727	
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	167	
Potential Capacity	912	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	912	
Probability of Queue free St.	0.99	1.00
Maj L-Shared Prob Q free St.	0.99	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	270	
Potential Capacity	494	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	491	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	270	
Potential Capacity	494	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	491	
Results for Two-stage process:		
a		
y		
C t	491	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	45		3			
Movement Capacity (vph)	491		727			
Shared Lane Capacity (vph)		501				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	491		727			
Volume	45		3			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		501				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		6		48				
C(m) (vph)		912		501				
v/c		0.01		0.10				
95% queue length		0.02		0.32				
Control Delay		9.0		12.9				
LOS		A		B				
Approach Delay				12.9				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.99
v(il), Volume for stream 2 or 5		110
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		9.0
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: PROJECTED
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		119	6	1	113	
Peak-Hour Factor, PHF		0.91	0.91	0.85	0.85	
Hourly Flow Rate, HFR		130	6	1	132	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	21		3			
Peak Hour Factor, PHF	0.41		0.41			
Hourly Flow Rate, HFR	51		7			
Percent Heavy Vehicles	33		50			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		1		58				
C(m) (vph)		949		641				
v/c		0.00		0.09				
95% queue length		0.00		0.30				
Control Delay		8.8		11.2				
LOS		A		B				
Approach Delay				11.2				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Jonathan Walczak
Agency/Co.: Barton & Loguidice, P.C.
Date Performed: 12/17/2013
Analysis Time Period: PM
Intersection: Route 33A / Brew Road
Jurisdiction:
Units: U. S. Customary
Analysis Year: PROJECTED
Project ID: Mill Seat Landfill
East/West Street: Route 33A
North/South Street: Brew Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		119	6	1	113	
Peak-Hour Factor, PHF		0.91	0.91	0.85	0.85	
Peak-15 Minute Volume		33	2	0	33	
Hourly Flow Rate, HFR		130	6	1	132	
Percent Heavy Vehicles		--	--	100	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	0	1	
Configuration		T	TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	21		3			
Peak Hour Factor, PHF	0.41		0.41			
Peak-15 Minute Volume	13		2			
Hourly Flow Rate, HFR	51		7			
Percent Heavy Vehicles	33		50			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		132
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.5		6.2			
t(c,hv)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		100	33		50			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		6.1	7.5		7.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)		100	33		50			
t(f)		3.2	3.8		3.8			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		136	267		68			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	68	
Potential Capacity	857	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	857	
Probability of Queue free St.	0.99	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	136	
Potential Capacity	949	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	949	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	1.00	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	267	
Potential Capacity	621	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	620	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	267	
Potential Capacity	621	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity	620	
Results for Two-stage process:		
a		
y		
C t	620	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	51		7			
Movement Capacity (vph)	620		857			
Shared Lane Capacity (vph)		641				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	620		857			
Volume	51		7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		641				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		1		58				
C(m) (vph)		949		641				
v/c		0.00		0.09				
95% queue length		0.00		0.30				
Control Delay		8.8		11.2				
LOS		A		B				
Approach Delay				11.2				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		132
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4		8.8
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.0

APPENDIX H

HCM Level of Service Descriptions

HCM Level of Service (LOS) Descriptions

Intersection Level of Service (LOS)

LOS A describes driving conditions with average delays of 10 seconds or less per vehicle. When traffic signals are synchronized, this level of service allows for most vehicles to arrive during the green light. The majority of through traffic on the main street does not stop at all.

LOS B describes driving conditions where more vehicles have to stop at red lights and average delays increase up to 20 seconds per vehicle. Synchronized traffic signals can still provide good progression for through traffic on the major street.

LOS C describes driving conditions at intersections where the red signal lights stay on noticeably longer and the average delays per vehicle increases to 35 seconds. At this level of congestion some cars must wait through multiple green lights to get through the intersection. With synchronized traffic signals, some through traffic on the main street can still pass through the intersection without stopping.

LOS D describes congested driving conditions with more stops and delays averaging up to 55 seconds per vehicle. Most cars have to stop at red lights and more vehicles have to wait for more than one green light before passing through the intersection.

LOS E describes very congested driving conditions with delays averaging up to 80 seconds per vehicle. This high congestion allows for very poor progression down the main street and green lights are frequently not long enough to clear stopped vehicles.

LOS F describes very congested driving conditions where the number of vehicles arriving at an intersection exceeds the capacity of the intersection. Average delays exceed 80 seconds and most drivers have to wait for multiple green lights before they get through the intersection. Long queues of left turning vehicles stack out of the left turn pockets and block adjacent through lanes.

Roadway Level of Service (LOS)

LOS A describes driving conditions with average travel speeds around 90 percent of free-flow conditions. Drivers can freely maneuver within the flow of traffic and stopped delay at signalized intersections is minimal.

LOS B describes reasonably unimpeded driving conditions at average travel speeds around 70 percent of free-flow conditions. The ability to maneuver within the flow of traffic is only slightly restricted and stopped delays at signals are not bothersome. Drivers are not generally subjected to appreciable tension under these conditions.

LOS C describes a stable driving environment, however the ability to maneuver and change lanes in midblock locations may feel more restricted. Longer traffic queues begin to build up at signalized intersections and getting through on the green light is getting tighter. Driving speeds drop to 50 percent of free-flow conditions and motorists experience appreciable tension while driving.

LOS D describes driving conditions with substantial delays and travel speeds drop to 40 percent of free-flow conditions. It becomes very difficult to arrive on two green lights in a row and you often have to drive around left turn traffic that has backed out of the left turn pocket and into the through lanes.

LOS E describes driving conditions that are characterized by significant delays and average speeds of one-third of free-flow conditions or less. There are extensive traffic queues at intersections and you have to wait for more than one green to clear the intersection.

LOS F describes extreme congestion with maximum driving speeds of one-third to one quarter of the free-flow conditions. All major signalized intersections are congested with long delays and extensive queues.