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Transportation: Engineering • Planning • Design

M E M O R A N D U M

Ref: 1831A

To: Jay Bisognano
Torrington Properties, Inc.

From: Stephen G. Pernaw, P.E., PTOE

Subject: Proposed Mixed-Use Site
Portsmouth, New Hampshire

Date: September 25, 2018

On July 18, 2018 our office published the report entitled *"Draft Traffic Impact and Site Access Study - Proposed Mixed-Use Site"* for Torrington Properties, Inc. to assess the traffic impacts associated with the proposed residential/commercial development located on the east side of US1 Bypass at the site of the Frank Jones Center in Portsmouth, New Hampshire. We are now in receipt of peer review comments from The Engineering Corporation (TEC) dated September 7, 2018. The purpose of this memorandum is to provide responses to each of their comments.

TEC Comment 1: Study Area – *"The Traffic Impact and Site Access Study (TISAS) evaluates a reasonable study area for the purposes of evaluating the potential traffic impacts to the surrounding street system with the construction of the proposed development and the realignment/extension of Cate Street. TEC concurs that the scope of the study is in general accordance with NHDOT guidelines; and was previously approved by NHDOT and the City."*

SGP & Company, Inc. Response: Comment acknowledged; no response necessary.

TEC Comment 2: Traffic Counts – *"Traffic counts used within the TISAS were conducted in May 2018 during a period in which area schools were in session. The May counts were seasonally adjusted upward by 7% during the weekday evening peak hour and 8% during the Saturday midday peak hour to reflect peak month conditions, consistent with NHDOT standards. This is generally reflective of summertime volumes in the seacoast area. TEC concurs with the use of these traffic volumes and adjustment factors based on NHDOT guidelines. The weekday evening peak commuter hour and Saturday midday peak commercial*
hour were studied with the TISAS to determine the project's overall effect on the roadway system. While TEC concurs that these selected time periods are generally appropriate for a mixed-use development, Stephen G. Pernaw and Company, Inc. (SGP) should provide justification for not including the weekday morning peak hour within the study as the morning peak hour of the residential dwelling units and office space within the development will typically overlap with the morning peak hours of the adjacent street system."

SGP & Company, Inc. Response: The analysis periods were discussed with the NHDOT and City representatives at the scope meeting conducted on April 27, 2018, and it was determined and agreed upon that the Weekday PM and Saturday Midday peak periods would suffice. The NHDOT automatic traffic recorder counts for the US1 Bypass and Bartlett Street that are included in Appendix B show that the AM peak hour volumes are considerably lower than the PM peak hour volumes on weekdays.

TEC Comment 3: Background Growth – *"The TISAS uses an annual traffic volume growth adjustment factor of 1.0 percent per year based on standard rates approved by NHDOT. SGP concurrently overlaid projected traffic volumes associated with five pending development projects within the study area. TEC concurs with the use of these adjacent development projects and adjustment factors based on NHDOT guidelines. The future conditions in 2020 (opening year) and 2030 (10-year horizon) were studied in conformance with NHDOT requirements."*

SGP & Company, Inc. Response: Comment acknowledged; no response necessary.

TEC Comment 4: Crash Data – *"No motor vehicle crash data was provided within the TISAS. SGP should obtain and review crash data at the study area intersections to determine whether any specific crash trends exist. This is primarily of concern at the two ends of the proposed Cate Street realignment. The crash data typically indicates the number, type, and severity of crashes at the study area intersections for the most recent three years on record. SGP should further provide documentation of other traffic safety related issues/deficiencies at the intersections and subject roadways, such as sight distances, if applicable."*

SGP & Company, Inc. Response: Crash data from the State of New Hampshire Department of Transportation for the most recent three-year period (2013 to 2015) was researched to identify accident rates and patterns in the study area. Over the three-year period, the Location Data Reports indicate that 2,407 crashes were recorded on a city-wide basis. It should be noted that this database is considered to be a subset of the total collisions as not all incidents are required to be reported to the State. Of these, forty-one crashes contained sufficient detail to locate them in the study area. These reports, along with a summary table, are attached (see Attachments 1-3).

Sixteen crashes occurred in the vicinity of the US1 Bypass/Coakley Road/Cottage Street intersection. There were eight collisions that resulted in injuries to eleven persons. The majority (81%) of the crashes involved two or more vehicles. Two collisions were the result of a collision with a fixed object and two crashes were rear-end collisions. Inclement weather or unfavorable surface conditions may have been a contributing factor in four of these sixteen crashes.

Twelve crashes occurred in the vicinity of the US1 Bypass/Borthwick Avenue intersection. These crashes resulted in injuries to six persons. The majority (92%) of the collisions involved two or more vehicles. Inclement weather or unfavorable surface conditions may have been a contributing factor in two of these twelve crashes.

Five crashes occurred in the vicinity of the Bartlett Street/Cate street intersection. There was one collision that resulted in injury to one person and the majority (80%) of the crashes involved two or more vehicles. Inclement weather or unfavorable surface conditions may have been a contributing factor in four of the five collisions.

Eight collisions occurred in the vicinity of the Bartlett Street/Islington Street intersection. There was one crash that resulted in injury to one person. All of the crashes involved two vehicles. Inclement weather or unfavorable surface conditions were not a contributing factor in any of these eight collisions.

No fatalities were reported in this study group. There were no discernible trends in terms of crash frequency as 11 crashes occurred in 2013, 16 occurred in 2014, and 14 occurred in 2015. In terms of monthly variations, August and February were the highest months (8 crashes each) and the lowest months included March, April, September and November (1 crash each). In terms of daily variations, nine crashes over the three-year period occurred on Wednesdays and Fridays, and the lowest day was Saturday with two crashes. The sight distance looking left and right from the Cate Street approach is applicable and is adequate. Although the crash rate at the Bartlett Street/Cate Street intersection is nominal, we share TEC's concern with sight distance on the Bartlett Street northbound approach to the intersection. Providing a left-turn pocket would be helpful, if it is feasible. Alternative configurations for this intersection could eliminate this concern.

TEC Comment 5: Site Trip Generation – *"The TISAS uses data published in the industry standard Institute of Transportation Engineers (ITE) publication, Trip Generation, 10th Edition to estimate the traffic generated by the proposed development. The TISAS uses data found under Land Use Code (LUC) 220 - Multi-Family Housing (Low-Rise) for the townhouse units, LUC 221 - Multi-Family Housing (High Rise) for the apartment units, LUC 710 - General Office Building for the office areas, and LUC 932 - High Turnover (Sit-Down) Restaurant, LUC 930 - Fast Casual Restaurant, and LUC 820 - Shopping Center for the retail areas of the site. TEC concurs with these land uses and general traffic generation methodology.*

The TISAS indicates that a portion of the traffic generated by the commercial areas of the site will be "pass-by" trips, or vehicles generated by the site that are existing on the immediately adjacent roadway system, specifically the US Route 1 Bypass. This is appropriate for the retail and restaurant areas of the site. It appears that some pass-by credit was taken for the office areas of the site within the study. Office land uses are primary trip generators and are not known to attract pass-by trips. While the removal of the pass-by credit will not materially impact the results of the overall analyses due to the relatively small size of the office area proposed, the trip generation calculations should be revised to remove any pass-by trips associated with the office land use.

The ITE publication, Trip Generation Handbook, 3rd Edition, indicates that retail land uses have an average of 34% pass-by trips during the weekday evening peak hour and 26% during the Saturday midday peak hour and high-turnover sit-down restaurants have an average pass-by rate of 43% during the weekday evening peak hour. The TISAS applies a 36.5% pass-by rate during the weekday evening peak hour and 39.8% during the Saturday midday peak hour, which is appropriate for the proposed retail/restaurants on the site.

No internal capture rate was applied between the land uses on the site. TEC concurs that this provides a conservative representation of the trips generated by the site."

SGP & Company, Inc. Response: Page 19 of the report states that *"Restaurants and retail trips are comprised of both primary trips and pass-by trips which are drawn from the existing traffic stream on US1 Bypass."* The 84 (PM) and 126 (SAT) pass-by trips shown on Table 1B (Page 19) are attributable to the restaurants and retail uses only. No pass-by credit was taken for the office space within the development. There is no need to revise the trip generation calculations in the study.

TEC Comment 6: Trip Distribution – *"The traffic generated by the proposed project was distributed onto the adjacent roadway system based upon available Journey-to-Work data published by the US Census Bureau for persons residing in the City of Portsmouth for the residential portions of the development and for persons working in the City of Portsmouth for the office portion of the development. This form of trip distribution calculation is consistent with industry standards and TEC concurs with the methodology."*

"The Site Generated Traffic Volume Figures within Appendix G include both the site generated traffic volumes and the diverted link volumes. TEC requests a figure detailing only the site generated traffic be provided to ensure consistency with the Journey-to-Work distribution and for clarity."

SGP & Company, Inc. Response: The requested figures showing the distribution of the site generated traffic volumes are attached (see Attachments 4-11).

TEC Comment 7: Traffic Diversion – *"With the relocation and extension of Cate Street to intersect US Route 1 Bypass at Borthwick Avenue and close the connection with Cottage Street, traffic will be diverted to use the new roadway connection. The TISAS identifies five different traffic diversion patterns. TEC concurs with the existing patterns that will divert to the new Cate Street extension. The Diverted Traffic Volumes figures within the report are not consistent with the anticipated diversions. SGP should revise and reissue the figures. TEC recommends that SGP provide detailed tables or figures illustrating the volumes of traffic being diverted in each pattern scenario for review to ensure consistency and clarity."*

SGP & Company, Inc. Response: Supplemental figures for each trip diversion pattern are attached. The diverted traffic volume figures in Appendix G have been updated as the draft report inadvertently included a superseded version of that Figure (see Attachments 12-23).

TEC Comment 8: Capacity and Queue Analysis – *"TEC generally concurs with the results of the capacity and queue analysis provided as part of the TISAS; utilizing Highway Capacity Manual 2010 (HCM 2010) methodology as modeled by Synchro 10."*

SGP & Company, Inc. Response: Comment acknowledged; no response necessary.

TEC Comment 9: *"At the intersection of US 1 Bypass / Cottage Street / Coakley Road, the capacity and queue analyses depict significant vehicle delay and queues on various approaches during the weekday evening peak hour in the 2030 No Build and Build condition. The addition of site generated traffic increases the delay and extends queue lengths on the northbound and westbound approaches. Suggested mitigation at this intersection includes the addition of a northbound right turn lane and shortening the northbound left turn lane queueing length to 50 feet. TEC notes that the addition of a northbound right turn lane may not be feasible within the existing US 1 Bypass right-of-way."*

"The report does attempt to document the influence of the Portsmouth Rotary on the operations at intersections along Route 1 Bypass to the south by using reduced lane utilization factors on the northbound approach movement during the peak hour studied. Observations of the operation of this roadway during the evening peak hour indicate that the queues from the rotary often extend beyond the Cottage Street / Coakley Road when the rotary is saturated with traffic. While TEC does not recommend incorporating rotary analysis as part of this application review, it is important to document the interconnected operations of other transportation facilities in this area."

SGP & Company, Inc. Response: Field survey is being conducted to determine the availability of right-of-way along the Bypass for the recommended right-turn lane. The two signalized study area intersections on the US1 Bypass have controllers that are vehicle-actuated and coordinated.

TEC Comment 10: *"At the intersection of US 1 Bypass / Borthwick Avenue / Cate Street Extension, the capacity and queue analyses depict increased vehicle delay and queues along the eastbound Borthwick Avenue approach, westbound Cate Street Extension approach and northbound US 1 Bypass left turn movement during the weekday evening peak hour in the 2020 and 2030 Build conditions. The addition of site generated traffic increases the delay and extends the queues by one to two vehicles. Suggested mitigation at this intersection includes the modification of the westbound Cate Street Extension approach to provide a shared left/through/right turn lane and an exclusive right turn lane and extending the southbound left turn lane queueing length to approximately 200 feet. TEC notes that one of the proposed mitigation items for this intersection is increasing the signal cycle length to 120 seconds. During the weekday evening and Saturday midday peak hours, the existing cycle length is 120 seconds, rendering this mitigation item unnecessary. The improvements proposed will not fully mitigate the impact of the site generated traffic, but do reduce delays on the Borthwick Avenue approach and the Cate Street Extension approach during the weekday evening peak hour."*

SGP & Company, Inc. Response: The existing cycle length at these intersections is 120-seconds during the PM peak hour and 110-seconds during the Saturday peak hour. TEC is correct; the mitigation item concerning cycle length on Page 35 of the report is not applicable.

TEC Comment 11: *"The southbound left turn lane of US 1 Bypass at Borthwick Avenue / Cate Street is projected to have a 95% queue length (the generally accepted maximum queue length) of 11 vehicles, or 275 feet in the weekday evening peak hour and 13 vehicles, or 325 feet, in the Saturday midday peak hour. The left turn queue length may extend past the provided storage length during some signal cycles within peak periods, even with the proposed longer storage length. This increase in delay may encourage vehicles to divert to back to the intersection of US 1 Bypass / Cottage Street / Coakley Road to make a left turn."*

SGP & Company, Inc. Response: We concur, this is certainly a possibility.

TEC Comment 12: *"Should NHDOT execute on their vision to remove the traffic signal and close the median opening at US 1 Bypass / Cottage Street / Coakley Road, the intersection of US 1 Bypass / Borthwick Avenue / Cate Street Extension will require a complete redesign to accommodate the relocated traffic. With the introduction of new development traffic, existing over capacity conditions are aggravated at both US 1 Bypass / Cottage Street / Coakley Road and US 1 Bypass / Borthwick Avenue / Cate Street Extension. TEC recommends that SGP perform an alternative analysis considering the removal of the traffic signal at US 1 Bypass / Cottage Street / Coakley Road and determine the desirable lane configuration at US 1 Bypass / Borthwick Avenue / Cate Street Extension to accommodate development traffic and diverted traffic."*

SGP & Company, Inc. Response: The NHDOT public informational meeting conducted in October 2006 regarding the traffic circle and US1 Bypass for Project 13455 included two concept plans that showed the extension of the existing median island on the Bypass through the Cottage Street/Coakley Road intersection. This would eliminate the existing traffic signal and restrict the turning movements to/from the minor approaches to a right-in/right-out pattern only. This concept plan was discussed at the April 2018 scope meeting and it is no longer being considered by the NHDOT (not included in the NHDOT Ten-Year Plan).

At the request of TEC, we have prepared hypothetical 2030 peak hour Design Hour Volumes for the Borthwick Avenue/Cate Street Extension intersection (see Attachment 24) assuming turn restrictions are in effect at Cottage Street and Coakley Road (due to the median extension). Analysis of these hypothetical projections is summarized in the table below. A more-detailed summary table is found on Attachment 25. The preliminary results indicate that the proposed median has the potential to increase the overall Build V/C ratio from 0.97 to 1.02 during the 2030 PM peak hour period (see Case B). Overall delay would increase by approximately +12 seconds. Recognizing that the southbound left-turn volume would exceed 300 vph with the hypothetical median in place, consideration was given to providing two left-turn lanes on the Bypass southbound approach (for turns onto Cate Street Extension). Case C indicates that future widening of the Bypass to provide an additional southbound lane has the potential to reasonably mitigate the impacts of the hypothetical median extension. It should be noted, Torrington Properties Inc. is not proposing to extend the median island on the Bypass (past Coakley Road and Cottage Street) nor widen US1 Bypass to construct the additional left-turn lane (see Attachment 26-31).

2030 Weekday PM Peak Hour Results

	CASE A	CASE B	CASE C
Overall Intersection Volume-to-Capacity Ratio	0.97	1.02	0.92
Overall Intersection Delay (sec per vehicle)	47	59	46
Overall Intersection Level of Service	D	E	D

CASE A: Previously proposed mitigation for Build Case - See Table 6 in original report

CASE B: Same as Case A with hypothetical median at Cottage & Coakley

CASE C: Same as Case B w/ widening to provide two SB left-turn lanes on the Bypass approach

TEC Comment 13: *"At the intersection of Islington Street / Bartlett Street / Pharmacy Driveway, the capacity and queue analyses depict increased vehicle delay and queues along the eastbound Bartlett Street approach during the weekday evening peak hour in the 2020 and 2030 Build conditions. The addition of site generated traffic increases the delay on this approach, but does not increase the projected queue lengths. Improvements at this intersection are under final design by the City for construction next year. No additional lanes will be provided. Suggested mitigation at this intersection includes increasing the signal cycle length to 120 seconds. The proposed timing change reduces the delays on the Bartlett Street approach; however, the queue lengths increase. The 95% queue length on the Bartlett Street approach is projected to be 17 vehicles, or 425 feet, during the weekday evening*
peak hour. TEC notes that the intersection of Bartlett Street / Cate Street is located approximately 250 feet to the west of this intersection. As a result, it is likely that the intersection of Bartlett Street / Cate Street will be blocked by queueing traffic during peak periods, causing conflicts between queuing vehicles and turning vehicles. TEC does not recommend implementation of this mitigation."

SGP & Company, Inc. Response: The mitigation summary on Page 35 of the report for this intersection is incorrect. The analysis was based on increasing the signal traffic signal cycle length from 80-seconds to 90-seconds during the Saturday peak hour period only. This was offered as a mitigation possibility only, and the City and its consultants will choose whichever cycle lengths they deem appropriate.

TEC Comment 14: *"SGP analyzed the intersection of Bartlett Street / Cate Street using several different geometric layouts for the unsignalized intersection. With the addition of site generated traffic, the Cate Street approach to the intersection increases in delay and degrades in levels of service (LOS) from LOS D to LOS F in the 2030 Build condition in both the weekday evening and Saturday midday peak hours. TEC notes that the condominium development under construction at 30 Cate Street will be widening the Cate Street approach to the intersection to provide an exclusive right turn lane as a condition of their approval. The analyses within the TISAS should be revised to reflect the eastbound right turn lane as constructed within the No Build and Build analyses. Further, constructing this lane should be removed as a recommended mitigation for the subject development."*

SGP & Company, Inc. Response: The No-Build and Build analyses have been updated as requested, and Table 9A has been updated accordingly (see Attachments 32-40).

TEC Comment 15: *"The TISAS recommends maintaining the intersection geometry generally as existing, with the addition of an approach lane on Cate Street to provide a shared through/left turn lane and a right turn lane and provision of a northbound left turn lane along Bartlett Street. Of concern with maintaining this geometry is the sight distance for vehicles traveling north/westbound on Bartlett Street away from Islington Street. The distance between Cate Street and the railroad bridge over Bartlett Street is less than 100 feet, increasing the potential for rear-end accidents at the intersection should 1-2 vehicles queue to turn left into Cate Street. The addition of a left turn lane along northbound Bartlett Street to provide a short queue storage area can aid in relieving this safety concern. Realigning northbound Bartlett Street to become the through movement onto Cate Street (Alternative Configuration B within the TISAS) relocates the delay onto the Bartlett Street southbound movement, but may allow for a safer intersection geometry and increased visibility for turning movements. This configuration would potentially have an added benefit of diverting more traffic from Bartlett Street north of Cate Street and removing additional through vehicles from the neighborhood. SGP should provide additional analyses and a recommendation based not only upon delay but considering safety issues and construction feasibility."*

SGP & Company, Inc. Response: Maintaining the current configuration of this intersection with the additional approach lane on Cate Street (by others) results in the lowest overall intersection delay. To address the sight distance concern and the potential for rear-end crashes, we recommend that additional field survey be conducted to determine if constructing a northbound left-turn pocket on Bartlett Street is feasible. At this juncture, we are not comfortable recommending Alternative Configuration B or Configuration C due to the excessive delays and queuing that are expected to occur on the Bartlett Street southbound approach.

TEC Comment 16: *"The remaining unsignalized intersections: US 1 Bypass / Site Driveway, Bartlett Street / Shared Driveway and Cate Street with the three site driveways will all operate with acceptable levels of service in the 2030 Build condition with the addition of site generated traffic."*

SGP & Company, Inc. Response: Comment acknowledged; no response necessary.

cc: Gregg M. Mikolaities, P.E., August Consulting, PLLC

ATTACHMENTS

Stephen G. Pernaw & Company, Inc.

Crash Summary (2013-2015)[1]

	US 1 ByPass/ Coakley Road- Cottage Street	US 1 ByPass/ Borthwick Avenue	Bartlett Strreet/ Cate Street	Bartlett Strreet/ Islington Street
CRASH FREQUENCY				
Total Crashes	16	12	5	8
Crashes per Year (Ave)	5.33	4.00	1.67	2.67
CRASH SEVERITY				
Property Damage Only	9	8	4	7
Personal Injury	7	4	1	1
Fatalities	0	0	0	0
CRASH TYPE				
Other Motor Vehicle	12	12	4	8
Rear End	2	0	0	0
Head-On	0	0	0	0
Fixed Object	2	0	0	0
Pedestrian	0	0	0	0
Other Object	0	0	1	0
ADVERSE CONDITIONS (%)	(4) 25%	(2) 17%	(4) 80%	(0) 0%

[1] Source: NHDOT - Accident Location Data Report (2013-2015)

SUMMARY OF NHDOT CRASH DATA - 2014, 2015

Stephen G. Pernaw & Company, Inc.

CRASH_DATE	ACCYEAR	ACCDAY	ACCTIME	TOWN_NAME	ACCSTREET	ACCROUTE	INTERSTREE	INTERROUTE	MILESFTFRO	NSEW_TO_IN	MILEMARKER	FEET_TO_MA	NSEW_FROM_	TYPE_OF_AC	FIXED_OBJE	LOCATION_F	NUMVEHICLE	TOTALFATAL	TOTALINJUR	PEDFATALS	PROPDAMAGE	INFONOTREP	SEVERITY	DIAGRAM_CO	POSTEDSPEE	ROAD_ALIGN	ROAD_CONDI	SURFACE_CO	LIGHTING_D	WEATHER_DE	ROAD_DESIG	TRAFFIC_CO
I. Vicinity of US 1 ByPass/Coakley Road/Cottage Street Intersection																																
8/20/2014	14	WED	1314	PORTSMOUTH	1 BYPASS	00001	COTTAGE STREET	00000	00015	N	0142	01500	E	Other Motor Vehicle		Along Road at Driveway Access	002	000	000	000	X		No Apparent Injury	35		Straight and Level	Normal	Dry	Daylight	Clear			None
10/6/2014	14	MON	1530	PORTSMOUTH	1 BYPASS NB	00001	COTTAGE ST	00000	00000	AT	0000	00000		Other Motor Vehicle		Unknown	003	000	003	000			Non_Incapacitating	00		Straight and Level	Other	Dry	Daylight	Clear			Other
7/2/2014	14	WED	1736	PORTSMOUTH	160 COTTAGE ST	00000	RT 1 BY-PASS NB	00000	00200	E	0000	00000		Fixed Object	Telephone/Electric Pole	Along the Road	001	000	000	000		X	No Apparent Injury	00		Straight and Level	Normal	Dry	Daylight	Cloudy	Not Physically Divided (2 Way Traffic)		None
8/3/2014	14	SUN	1758	PORTSMOUTH	160 COTTAGE ST	00000	COTTAGE ST&RT 1 BYPA	00000	00125	E	0000	00000		Fixed Object	Telephone/Electric Pole	Along the Road	001	000	001	000			Non_Incapacitating	30		Straight and Level	Normal	Dry	Daylight	Clear	Not Physically Divided (2 Way Traffic)		Lane Control
6/28/2014	14	SAT	1930	PORTSMOUTH	185 COTTAGE ST	00000	600 RT 1 BY-PASS NB	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	35		Straight and Level	Normal	Dry	Daylight	Clear	Other Divided Highway		Visible Road Markings
10/19/2014	14	SUN	1153	PORTSMOUTH	185 COTTAGE ST	00000		00000	00000		0000	00000		Other Motor Vehicle		Along the Road	002	000	000	000		X	No Apparent Injury	00		Straight and Level	Other	Other	Daylight	Clear	Not Physically Divided (2 Way Traffic)		None
6/17/2014	14	TUE	1447	PORTSMOUTH	RT 1 BYPASS	00001	COTTAGE STREET	00000	00050	S	0000	00000		Other Motor Vehicle			002	000	000	000	X		No Apparent Injury	35		Straight and Level	Normal	Dry	Daylight	Clear			Traffic Signals
2/4/2014	14	TUE	1310	PORTSMOUTH	RT 1 S BY-PASS	00001	COTTAGE STREET/COAKL	00000	00025	W	0014	01000	E	Other Motor Vehicle			003	000	002	000			Non_Incapacitating	35		Straight and Level	Normal	Dry	Daylight	Clear			Traffic Signals
4/10/2015	15	FRI	2137	PORTSMOUTH	1 COTTAGE ST	00000	BYPASS NB	00001	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	Unknown	35		Straight and Level	Normal	Wet	-Street Ligh	Fog	Other Divided Highway		Traffic Signals
7/22/2015	15	WED	1721	PORTSMOUTH	185 COTTAGE ST	00000	600 BY-PASS NB	00001	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	00		Unknown	Normal	Dry	Daylight	Clear			Traffic Signals
II. Vicinity of US 1 ByPass/Borthwick Avenue Intersection																																
5/28/2014	14	WED	1714	PORTSMOUTH	1 BY- PASS	00001	BORTHWICK AVE	00000	00000	N	0000	00000		Other Motor Vehicle			002	000	002	000			Non_Incapacitating	35		Straight and On Grade	Normal	Wet	Daylight	Cloudy			None
12/19/2014	14	FRI	1530	PORTSMOUTH	1 BYPASS	00001	BORTHWICK AVE	00000	00075	S	0000	00000		Other Motor Vehicle		Unknown	002	000	000	000	X		No Apparent Injury	00		Straight and Level	Normal	Dry	Daylight	Clear	Other Divided Highway		Traffic Signals
8/20/2014	14	WED	1604	PORTSMOUTH	ROUTE 1 BYPASS	00001	BORTHWICK AVENUE	00000	00500	S	0000	00000		Other Motor Vehicle		Along Road at Driveway Access	003	000	002	000			Non_Incapacitating	35		Straight and Level	Normal	Dry	Daylight	Clear			Traffic Signals
8/18/2014	14	MON	1114	PORTSMOUTH	ROUTE 1 BYPASS	00001	BORTHWICK AVE	00000	00000	AT	0000	00000		Other Motor Vehicle			002	000	000	000	X		No Apparent Injury	35		Straight and Level	Normal	Dry	Daylight	Clear	Other Divided Highway		Traffic Signals
10/17/2014	14	FRI	1541	PORTSMOUTH	RT 1 BYPASS	00001	BORTHWICK AVE	00000	00000	AT	0000	00000		Other Motor Vehicle			003	000	000	000	X		No Apparent Injury	00		Straight and Level	Normal	Dry	Daylight	Clear			Traffic Signals
2/16/2015	15	MON	0835	PORTSMOUTH	1 BYPASS	00001	BORTHWICK AVENUE	00000	00010	N	0144	00250	E	Other Motor Vehicle		Unknown	002	000	000	000	X		No Apparent Injury	00		Straight and Level	Normal	Ice	Daylight	Fog			None
2/11/2015	15	WED	1618	PORTSMOUTH	1 BYPASS	00001	BORTHWICK AVE	00000	00005	N	0000	00000		Other Motor Vehicle			002	000	001	000			Non_Incapacitating	00		Straight and Level	Normal	Dry	Daylight	Clear	Other Divided Highway		Traffic Signals
1/6/2015	15	TUE	2119	PORTSMOUTH	650 BORTHWICK AVE	00000	505 RT 1 BYPASS SB	00000	00000	AT	0000	00000		Other Motor Vehicle		Intersection Related	002	000	000	000		X	No Apparent Injury	30		Straight and Level	Normal	Dry	-Street Ligh	Clear			Traffic Signals
8/28/2015	15	FRI	1545	PORTSMOUTH	650 BORTHWICK AVE	00000	505 BYPASS SB	00001	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	30		Straight and Level	Normal	Dry	Daylight	Clear	Other Divided Highway		Traffic Signals
2/16/2015	15	MON	0845	PORTSMOUTH	BY-PASS SOUTH	00001	BORTHWICK AVENUE	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	Unknown	00			Normal	Snow/Slush		Clear	Interstate		Traffic Signals
7/31/2015	15	FRI	0624	PORTSMOUTH	ROUTE 1 BYPASS SOU	00001	BORTHWICK AVE	00000	00300	S	0000	00000		Other Motor Vehicle		Unknown	001	000	001	000			Non_Incapacitating	00		Straight and Level	Normal	Dry	Daylight	Clear	Other Divided Highway		Other
III. Vicinity of Bartlett Street/Cate Street Intersection																																
10/24/2014	14	FRI	1634	PORTSMOUTH	54 BARTLETT ST	00000	CATE ST	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	25		Curve and Level	Normal	Wet	Daylight	Rain	Not Physically Divided (2 Way Traffic)		Visible Road Markings
11/28/2014	14	FRI	0750	PORTSMOUTH	54 BARTLETT ST	00000	1 CATE ST	00000	00000	AT	0000	00000		Other Motor Vehicle		Along the Road	002	000	001	000			Possible	25		Curve and Level	Normal	Ice	Daylight	Snow	Not Physically Divided (2 Way Traffic)		Visible Road Markings
8/4/2015	15	TUE	1755	PORTSMOUTH	1 CATE ST	00000	54 BARTLETT ST	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	20		Straight and Level	Normal	Dry	Daylight	Clear	Not Physically Divided (2 Way Traffic)		Stop Sign
2/1/2015	15	SUN	0958	PORTSMOUTH	105 BARTLETT ST	00000	CATE ST	00000	00050	S	0000	00000		Other Object		Unknown	001	000	000	000		X	No Apparent Injury	00		Unknown	Normal	Snow/Slush	Daylight	Snow			None
IV. Vicinity of Bartlett Street/Islington Street Intersection																																
10/10/2014	14	FRI	1924	PORTSMOUTH	674 ISLINGTON ST	00000	BARTLETT ST	00000	00000	AT	0000	00000		Other Motor Vehicle		Intersection Related	002	000	000	000		X	No Apparent Injury	25		Straight and Level	Normal	Dry	-Street Ligh	Clear	Not Physically Divided (2 Way Traffic)		Traffic Signals
9/16/2015	15	WED	1850	PORTSMOUTH	1 BARTLETT ST	00000	653 ISLINGTON ST	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	20		Straight and Level	Normal	Dry	Daylight	Clear	Not Physically Divided (2 Way Traffic)		Traffic Signals
5/6/2015	15	WED	0840	PORTSMOUTH	1 BARTLETT ST	00000	653 ISLINGTON ST	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	No Apparent Injury	00		Unknown	Normal	Dry	Daylight	Clear			Traffic Signals
7/19/2015	15	SUN	1327	PORTSMOUTH	653 ISLINGTON ST	00000	BARTLETT ST	00000	00050	S	0000	00000		Other Motor Vehicle		Unknown	002	000	000	000		X	No Apparent Injury	00		Unknown	Normal	Dry	Daylight	Clear			None
8/31/2015	15	MON	1241	PORTSMOUTH	653 ISLINGTON ST	00000	1 BARTLETT ST	00000	00000	AT	0000	00000		Other Motor Vehicle		At Intersection	002	000	000	000		X	Unknown	30		Straight and Level	Normal	Dry	Daylight	Clear	Not Physically Divided (2 Way Traffic)		Traffic Signals

V. Vicinity of US 1 ByPass/U-Haul Driveway Intersection

NONE

VI. Vicinity of US 1 ByPass/Existing Driveway Intersection

NONE

VII. Vicinity of Bartlett Street/Existing Shared Driveway Intersection

NONE

Attachment 2

SUMMARY OF NHDOT CRASH DATA - 2013

Stephen G. Pernaw & Company, Inc.

ACDYEAR	ACDNUMBER	ACDDATE	ACDTIME	ACDDAY	TOTALFATAL	TOTALINJUR	PEDFATALS	PEDINJURY	PROPDAMAGE	INFONOTREP	NUMVEHICLE	ACDTYPE	OBJECTSTRU	FEETFROMNO	NODE2NODE	FEETTOMARK	NSEWFROMMA	MILEMARKER	ACDROUTE	ACDSTREET	MILESFTFRO	MILEFTIND	NSEWTOINTE	INTERROUTE	INTERSTREE	LOCFIRSTEV	TRAFFICCON	ROADDESIGN	ADLROADFEA	ROADALIGNM	ROADCONDIT	SURFACECON	LIGHTING	WEATHER	POSTEDSPEE	DIAGRAMCOD	TOWN_NAME	SEVERITY
I. Vicinity of US 1 ByPass/Coakley Road/Cottage Street Intersection																																					
13	000432	20130114	0751	MON	000	001	000	000			002	01	00	00000	0000	00000		0000	00001	BYPASS	00050	F	S	00000	COTTAGE STREET	03	02	02	04	01	01	02	01	02	35	01	PORTSMOUTH	4
13	002793	20130219	2100	TUE	000	000	000	000		X	001	01	00	00000	0000	00000		0000	00001	BYPASS	00100	F	E	00000	COTTAGE STREET	02	02	02	04	01	01	02	04	03	35	01	PORTSMOUTH	3
13	500637	20130620	1345	THU	000	000	000	000	X		002	01	96	00000	0883	00000		0000	00001	ROUTE 1 BYPASS	00000		AT	00000	COTTAGE STREET	17	02	08	04	01	01	01	01	01	30	98	PORTSMOUTH	6
13	501073	20130807	1314	WED	000	002	000	000			003	01	96	00000	0000	00000		0000	00001	ROUTE 1 BYPASS	00000		AT	00000	COAKLEY ROAD	17	02	07	04	01	01	01	01	01	35	98	PORTSMOUTH	3
13	502850	20131223	1619	MON	000	001	000	000			003	01	96	00000	0000	00000		0000	00001	ROUTE 1 SOUTH BYPASS	00010	F	S	00000	COAKLEY STREET	18	02	08	04	01	01	02	04	03	35	98	PORTSMOUTH	3
13	006892	20130219	1221	TUE	000	001	000	000			002	01	00	00000	0000	00000		0000	00000	RT 1 BYPASS NB	00000		AT	00000	185 COTTAGE ST	01	02	02	99	01	01	01	01	01	35	98	PORTSMOUTH	4
II. Vicinity of US 1 ByPass/Borthwick Avenue Intersection																																					
13	501049	20130808	0812	THU	000	000	000	000	X		002	01	96	00000	0000	00000		0000	00000	BORTHWICK AVE.	00000		AT	00001	ROUTE 1 BYPASS	17	02	07	04	01	01	01	01	02	35	98	PORTSMOUTH	6
III. Vicinity of Bartlett Street/Cate Street Intersection																																					
13	006856	20130208	0720	FRI	000	000	000	000		X	002	01	00	00000	0000	00000		0000	00000	124 BARTLETT STREET	00100	F	N	00000	CATE STREET	03	06	03	04	04	01	03	01	04	25	98	PORTSMOUTH	6
IV. Vicinity of Bartlett Street/Islington Street Intersection																																					
13	003781	20130310	1749	SUN	000	001	000	000			002	01	00	00000	0000	00000		0000	00000	1 BARTLETT STREET	00100	F	W	00000	ISLINGTON STREET	03	05	03	04	01	01	01	01	01	20	98	PORTSMOUTH	3
13	022095	20131228	1847	SAT	000	000	000	000		X	002	01	00	00000	0000	00000		0000	00000	1 BARTLETT STREET	00000		AT	00000	653 ISLINGTON STREET	02	02	03	99	01	01	01	04	01	30	98	PORTSMOUTH	6
13	021362	20130801	1125	THU	000	000	000	000		X	002	01	00	00000	0000	00000		0000	00000	653 ISLINGTON ST	00000		AT	00000	1 BARTLETT ST	01	02	98	04	01	01	01	01	01	25	98	PORTSMOUTH	6

V. Vicinity of US 1 ByPass/U-Haul Driveway Intersection

NONE

VI. Vicinity of US 1 ByPass/Existing Driveway Intersection

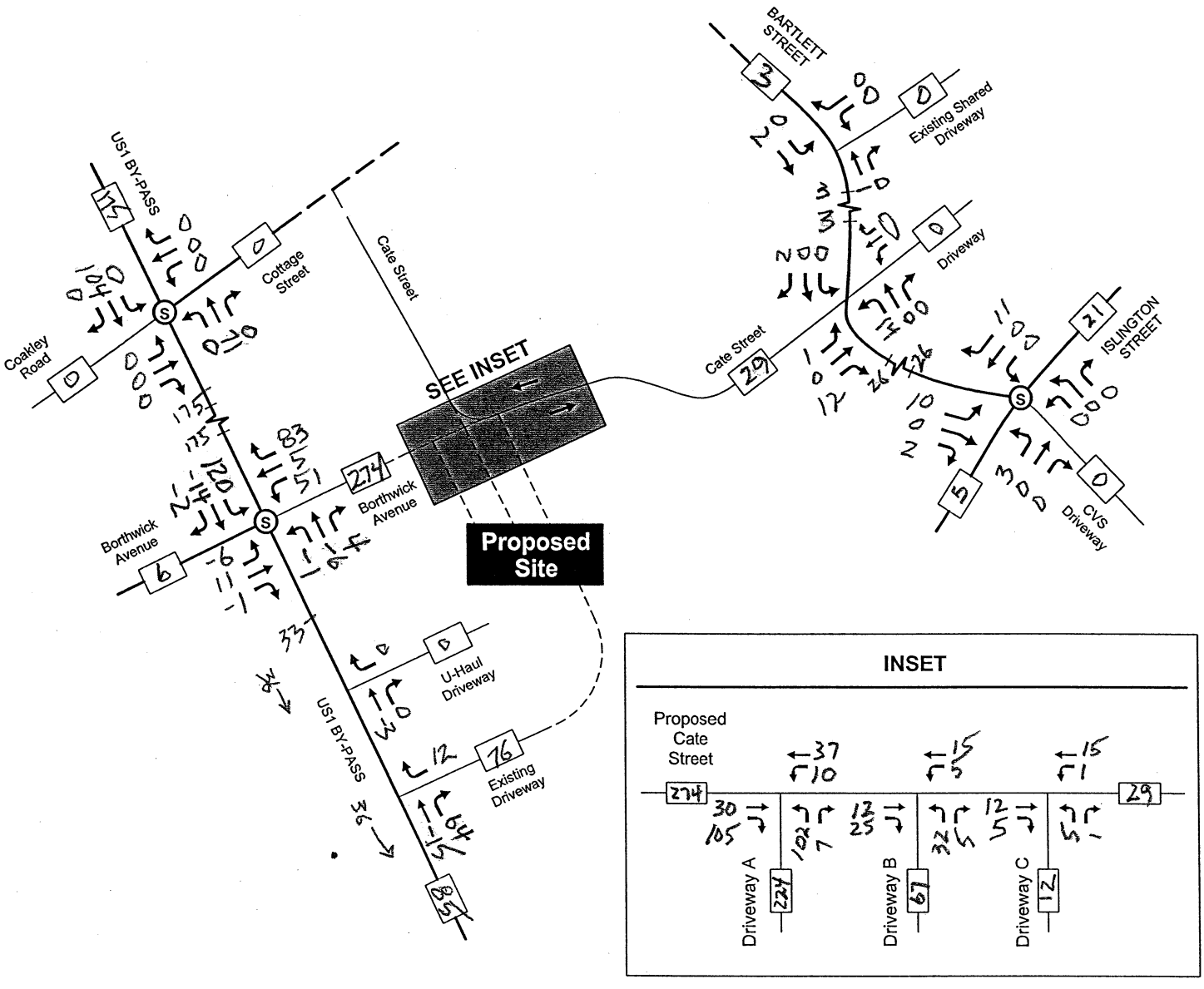
NONE

VII. Vicinity of Bartlett Street/Existing Shared Driveway Intersection

NONE

Attachment 3

Pernaw & Company, Inc.



SITE GEN - PM P|H

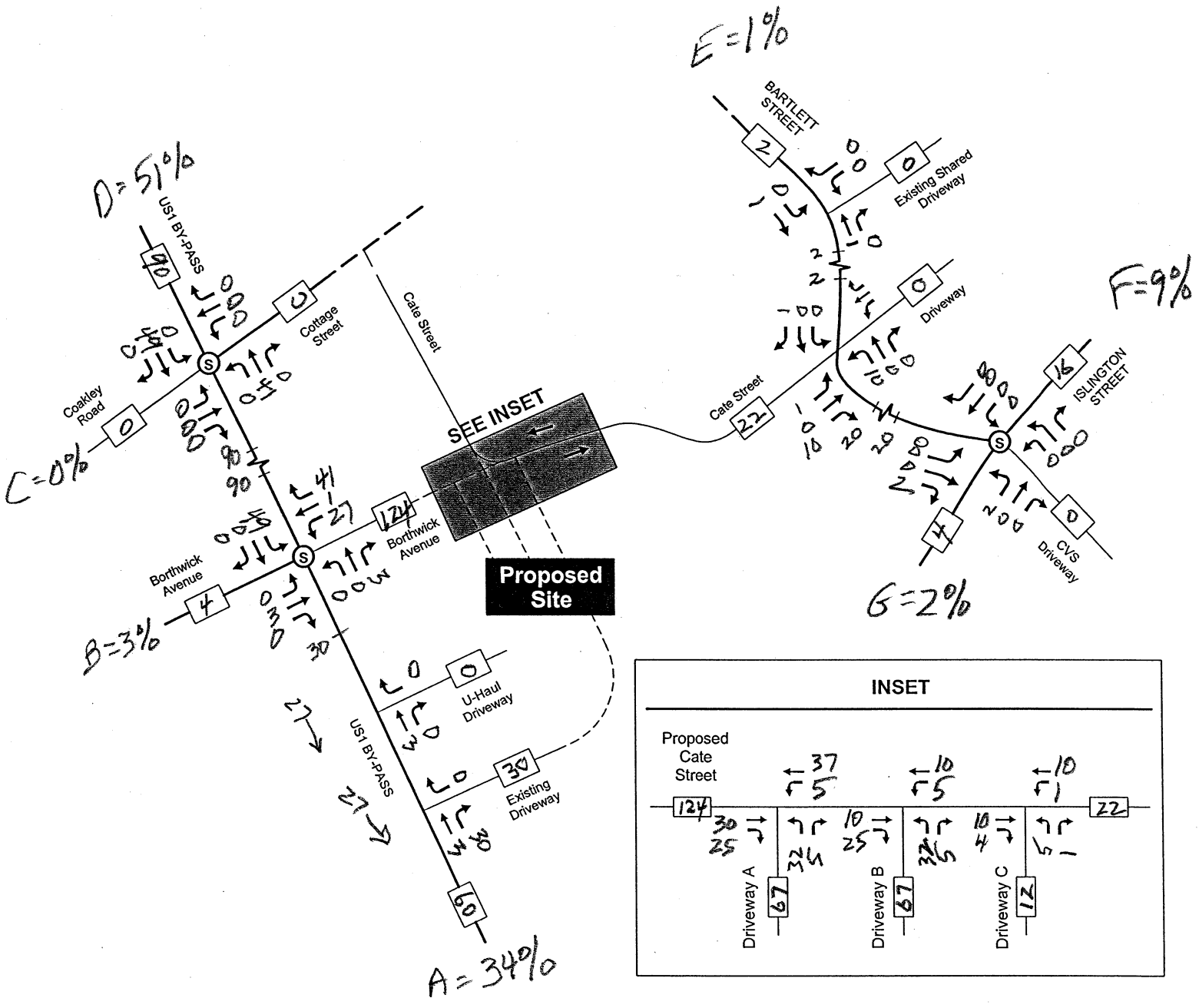
1831A

NORTH

Traffic Impact and Site Access Study, Proposed Mixed-Use Site, Portsmouth, New Hampshire

FROM SS

Pernaw & Company, Inc.



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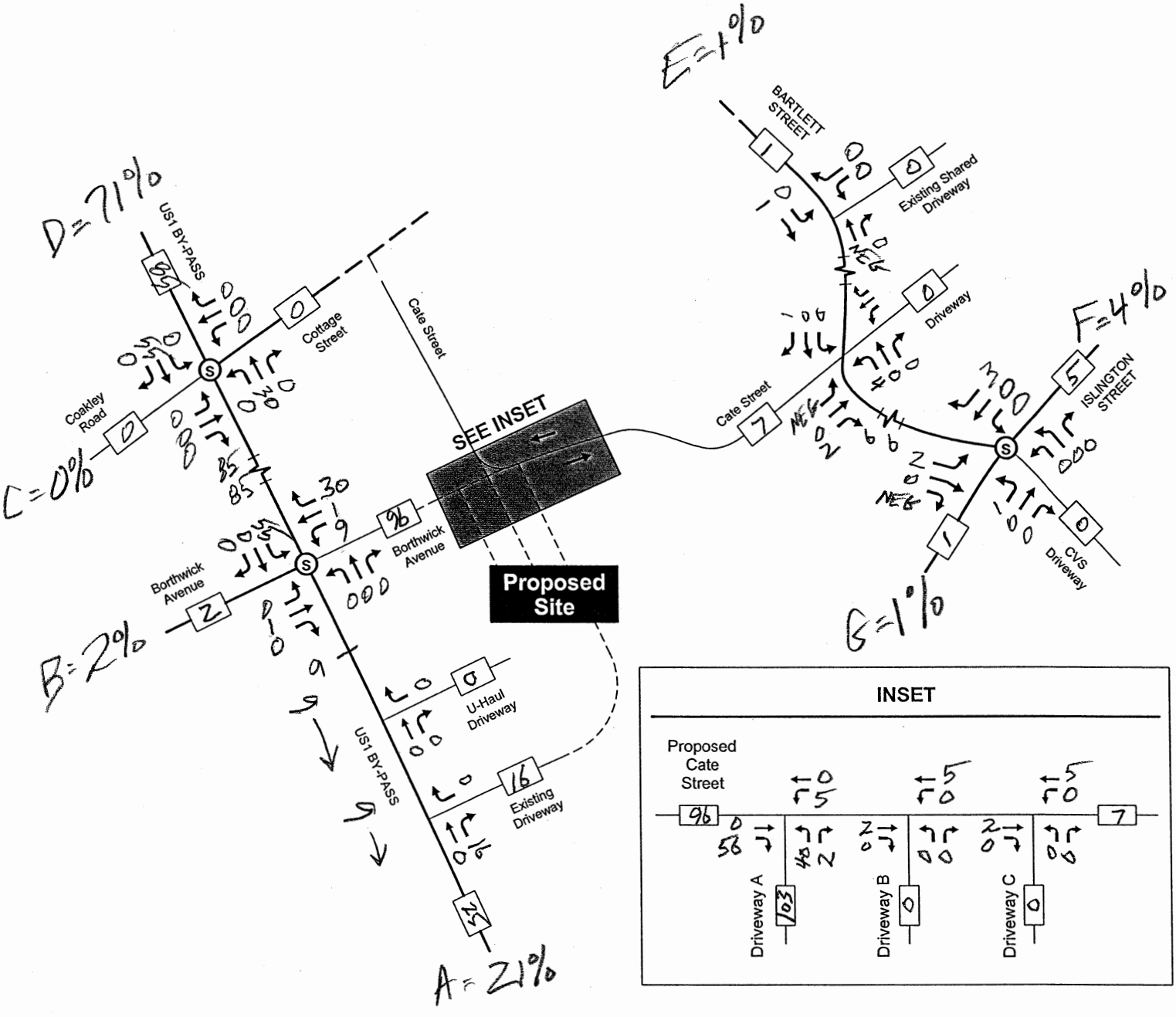
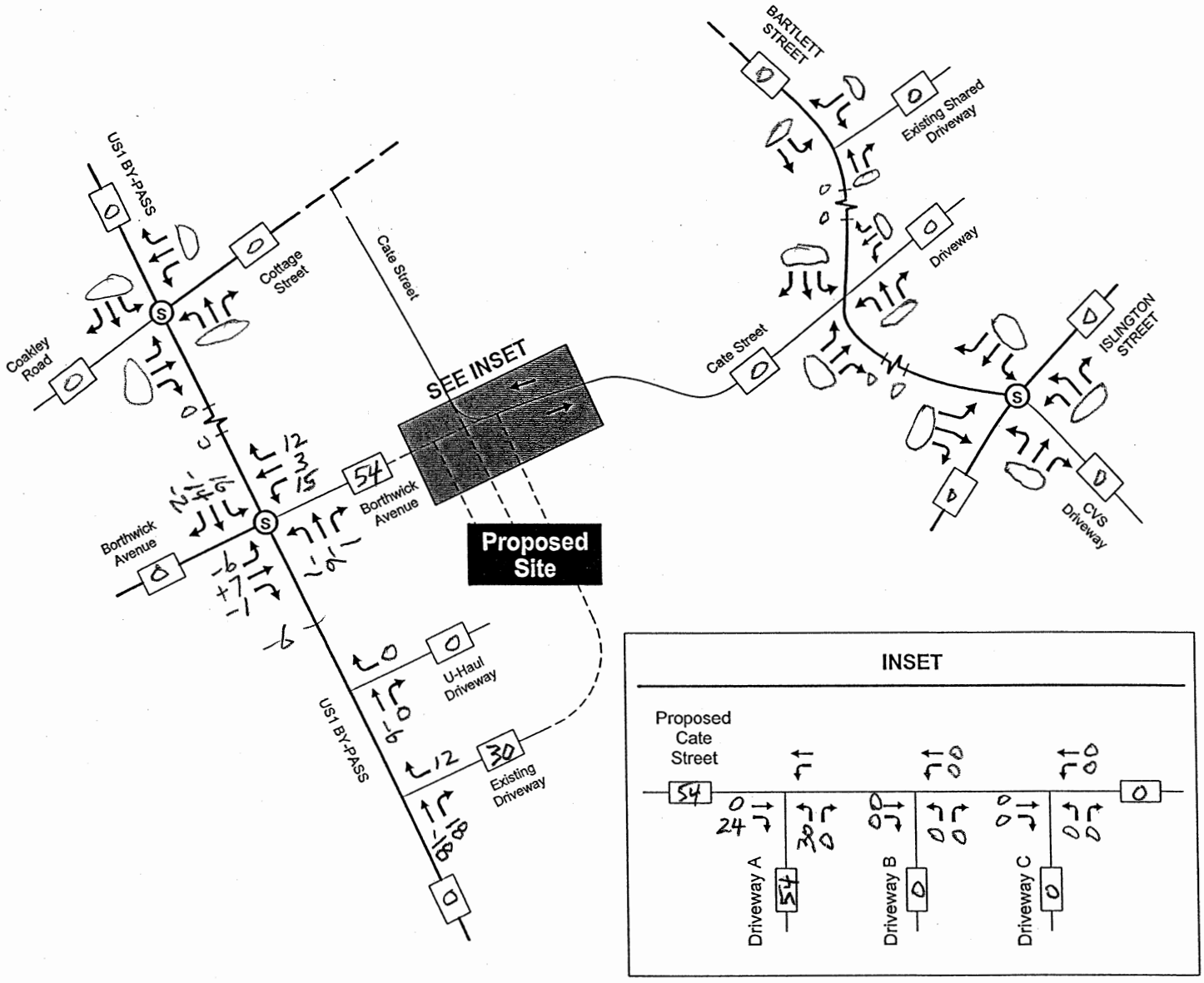


SITE GEN - PM PRIMARY COMMERCIAL

NORTH

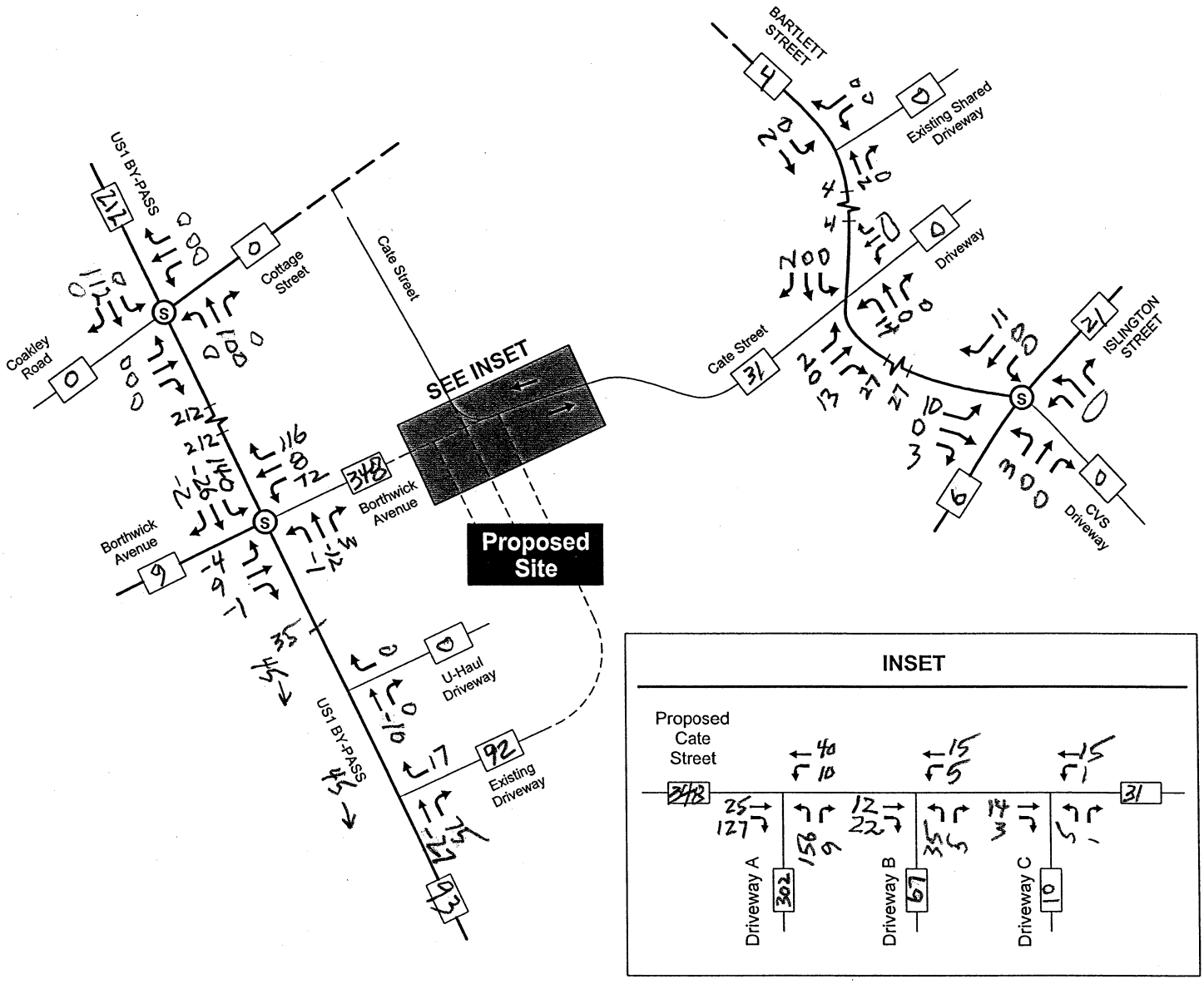
1831A



SITE GEN - PM PASS-BY COMMERCIAL

1831A

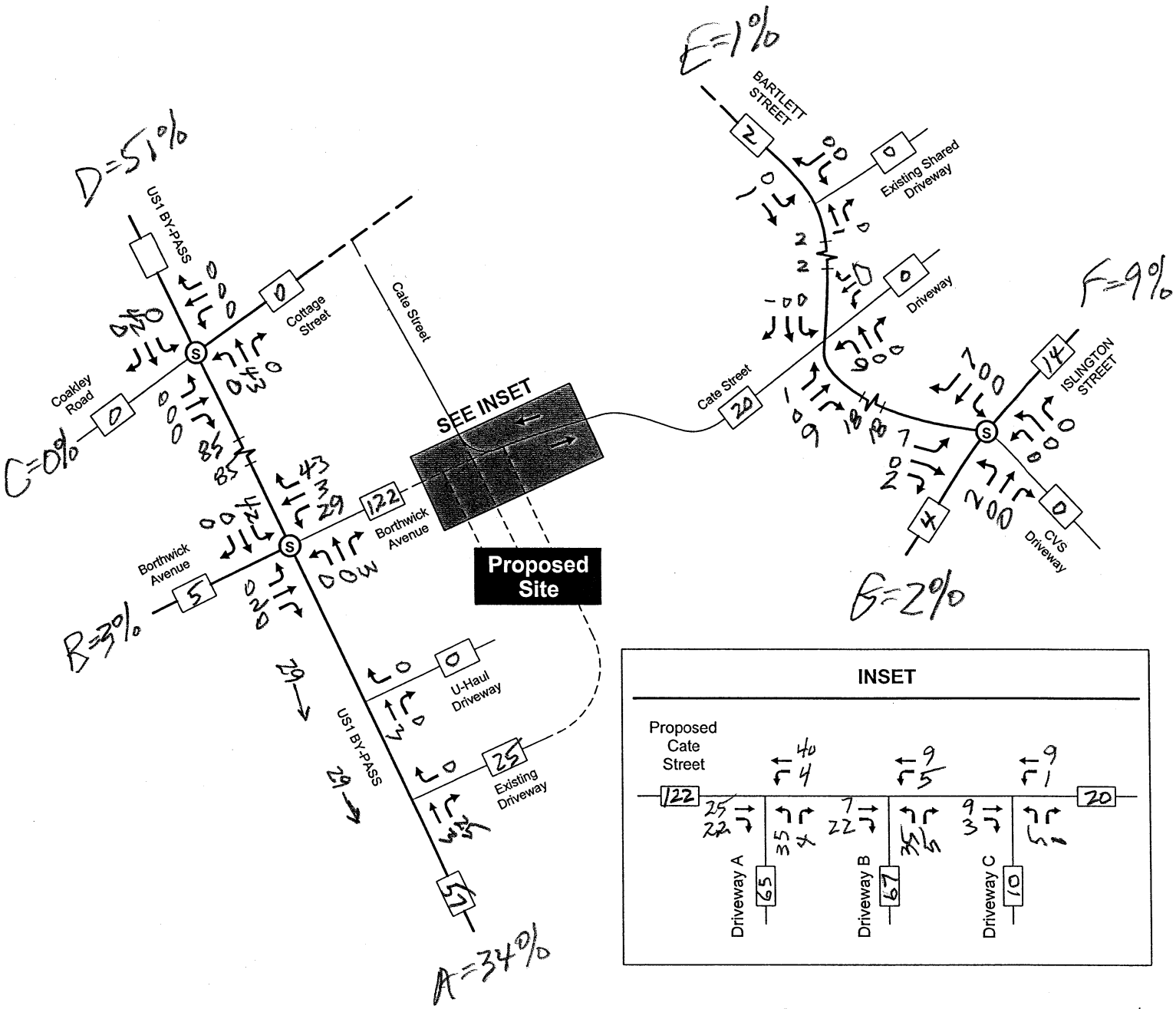
Pernaw & Company, Inc.



SITE GEN - SAT P/H

NORTH

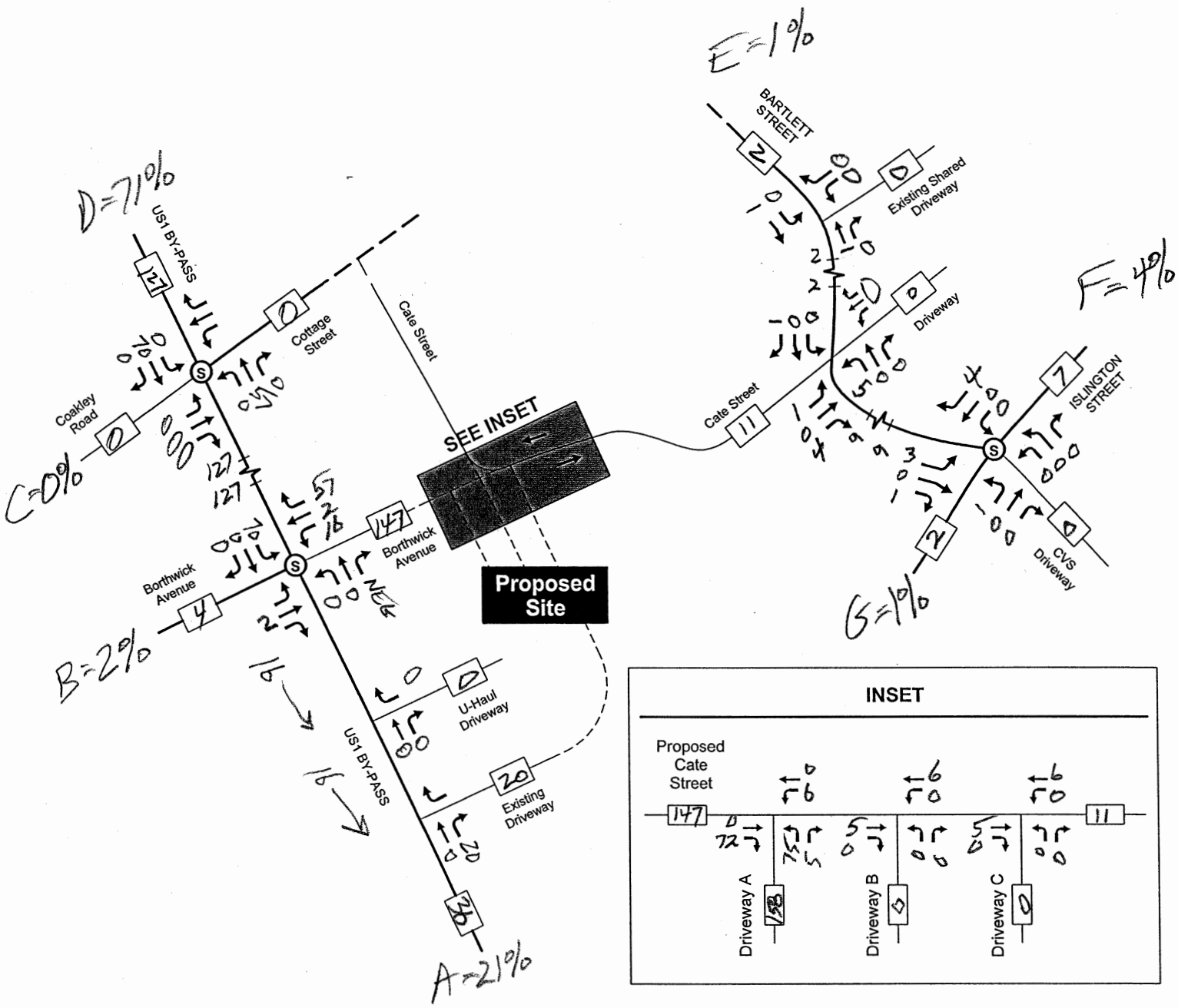
Pernaw & Company, Inc.



SITE GEN. - SAT PRIMARY RESIDENTIAL

NORTH

1831A

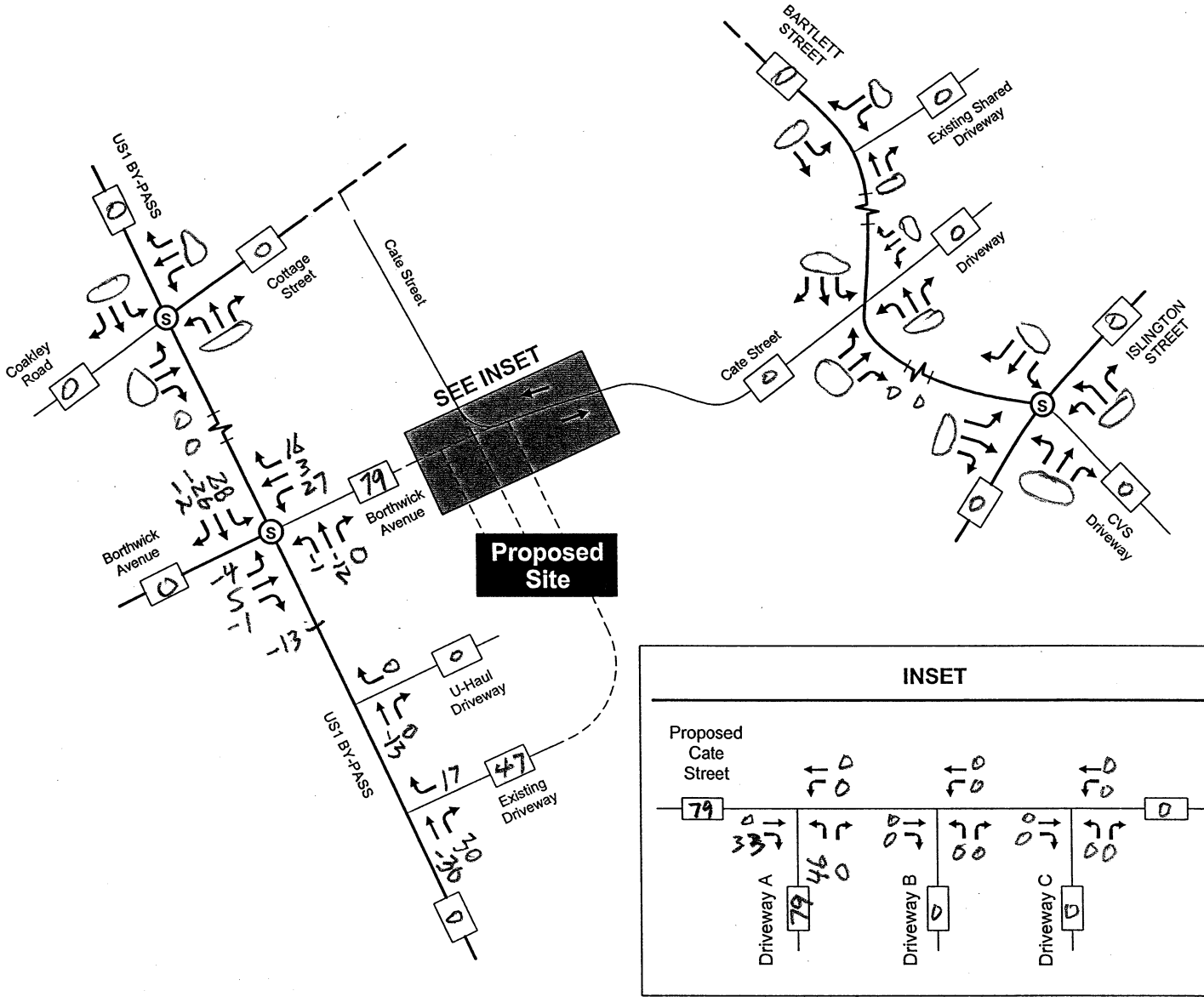


SITE GEN - SAT PRIMARY COMMERCIAL

NORTH

1831A

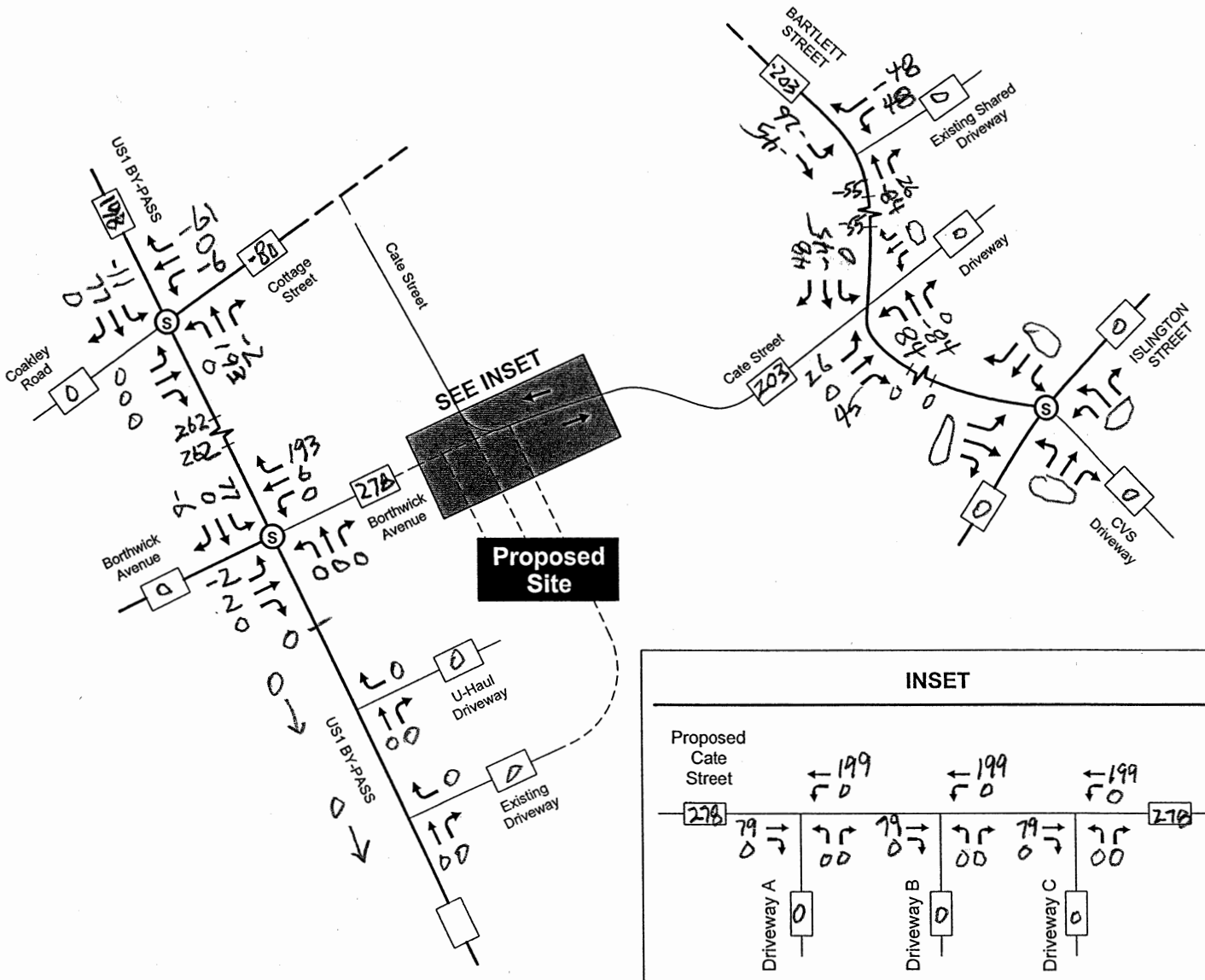
Pernaw & Company, Inc.



SITE GEN - SAT PASS-BY COMMERCIAL

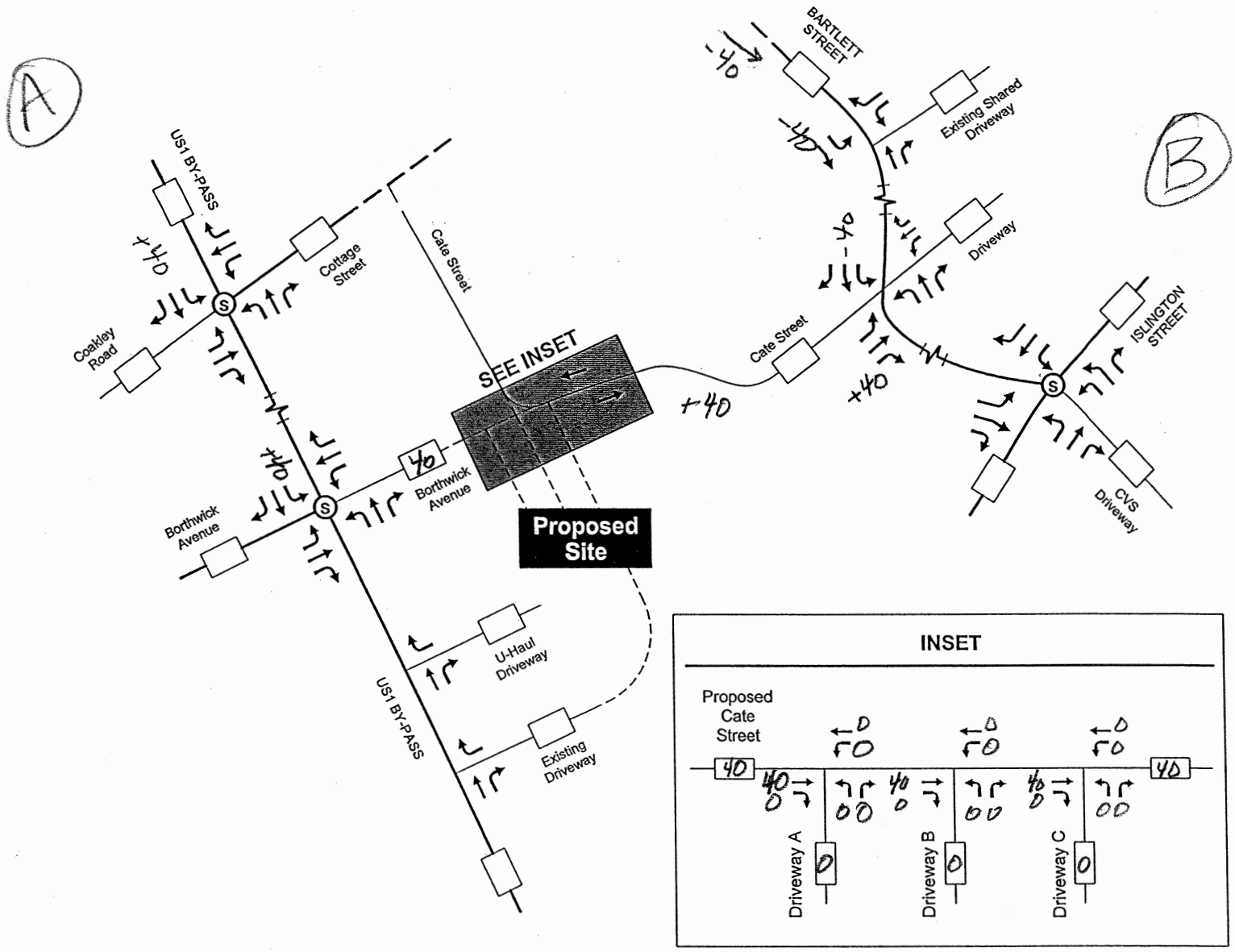
1831A

Pernaw & Company, Inc.



DIVERSION - TOTAL TRIPS (PM P/H)

1831A



TRIP DIVERSION PATT 1 - PM

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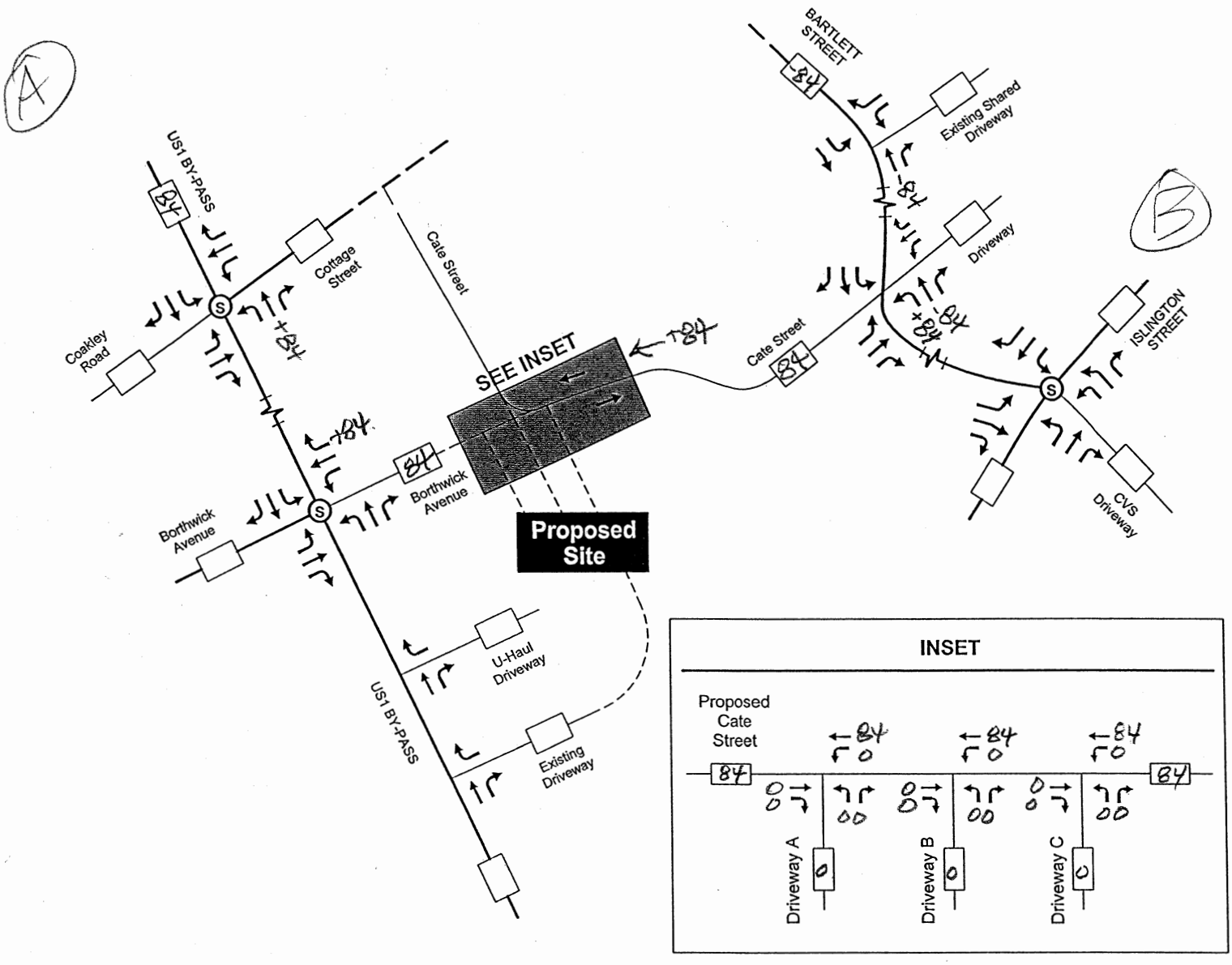
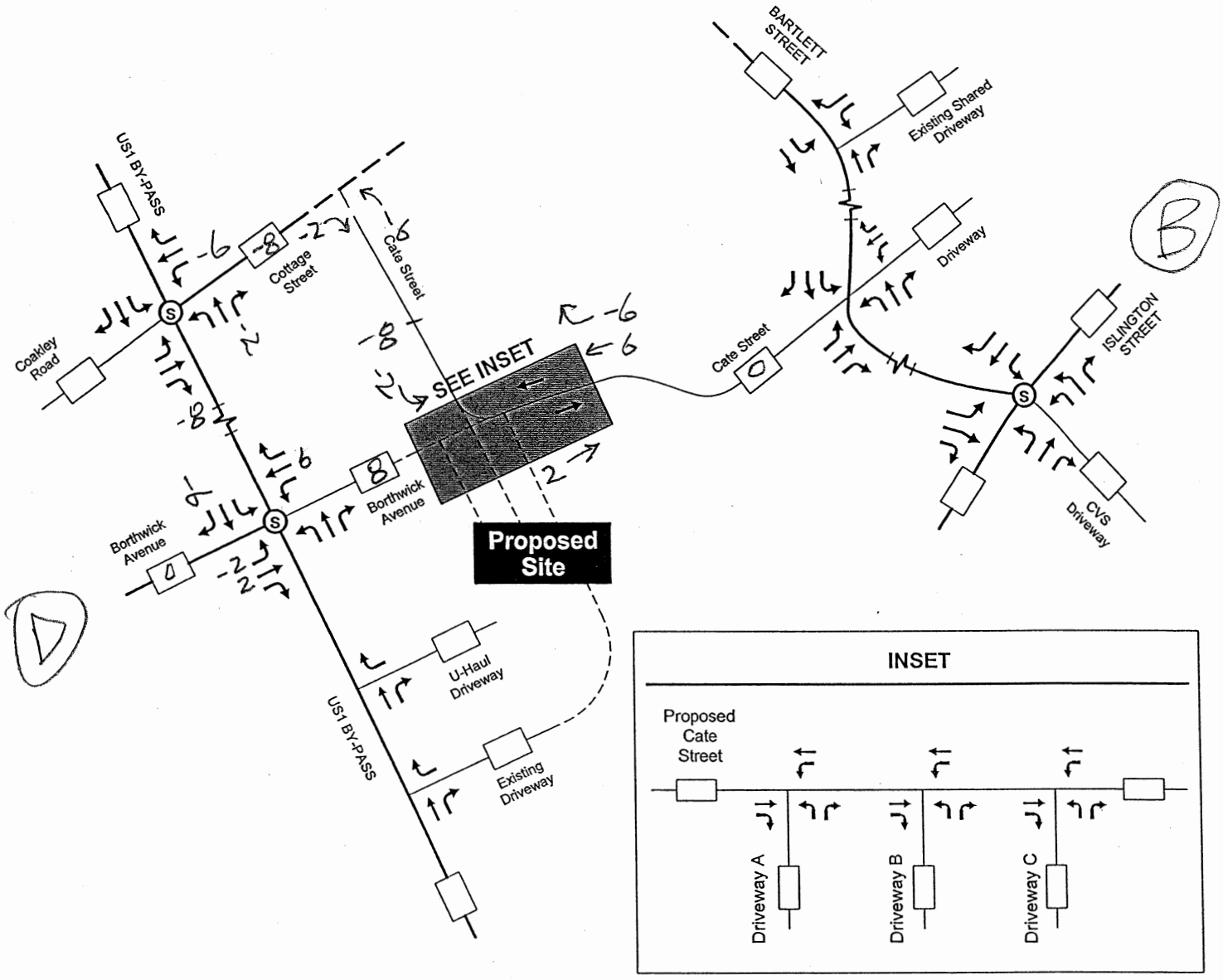

A
B
US1 BY-PASS
Cottage Street
Cate Street
Coakley Road
SEE INSET
Borthwick Avenue
Borthwick Avenue
Proposed Site
U-Haul Driveway
Existing Driveway
US1 BY-PASS
BARTLETT STREET
Existing Shared Driveway
Driveway
Cate Street
ISLINGTON STREET
CVS Driveway
INSET
Proposed Cate Street
Driveway A
Driveway B
Driveway C
TRIP DIVERSION PATT 2 - PM
NORTH

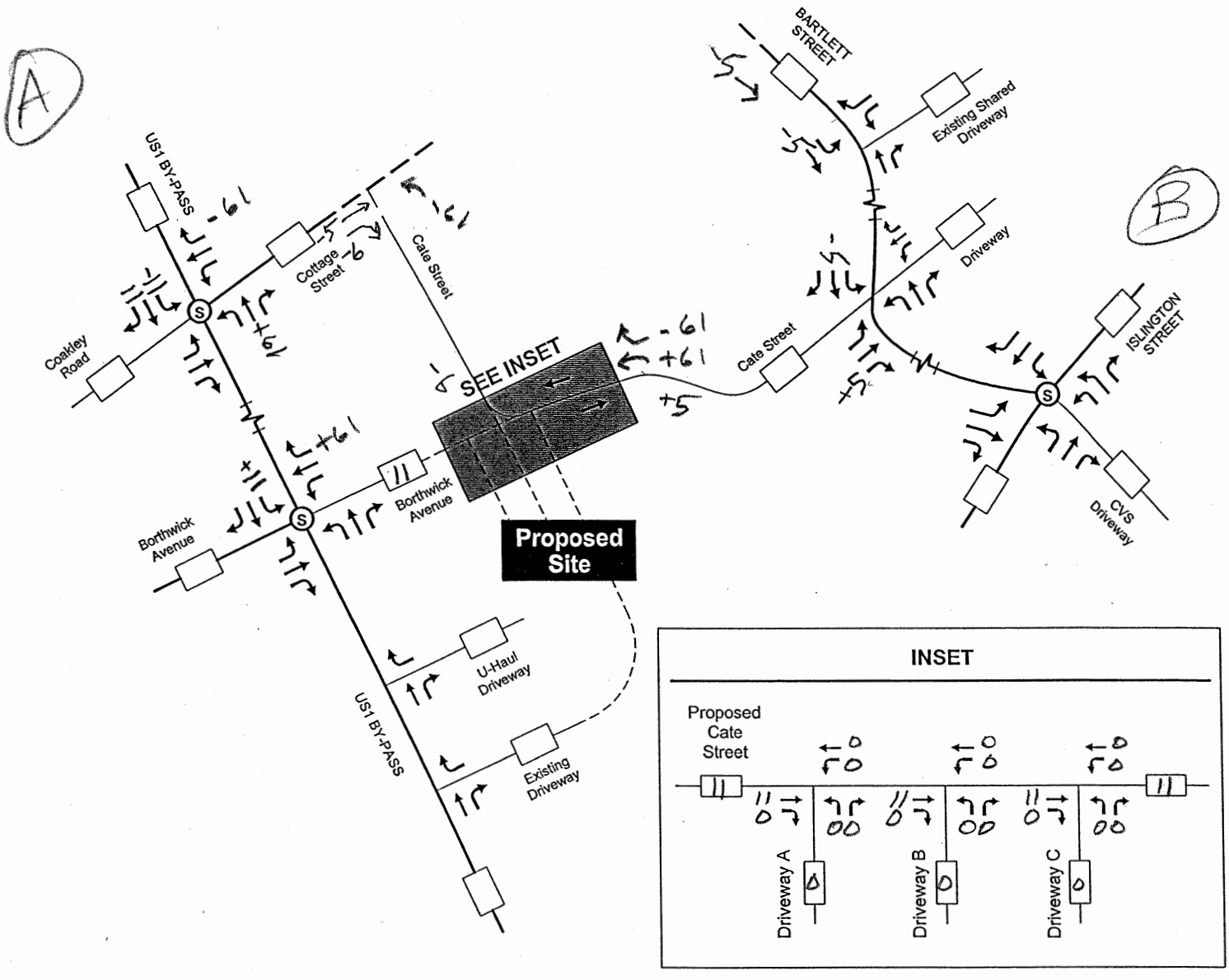
1831A



TRIP DIVERSION PATT 3 - PM

1831A

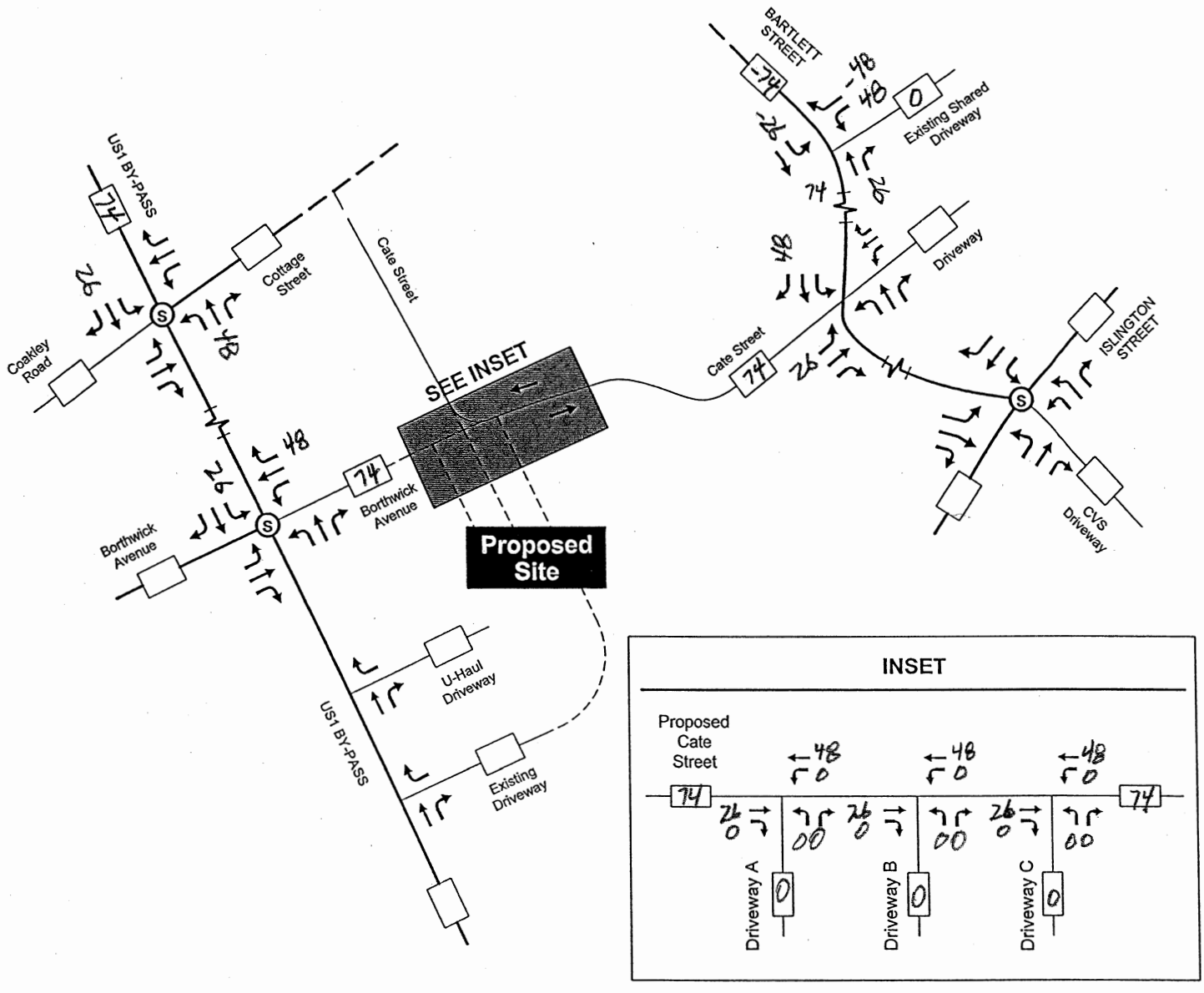
NORTH



TRIP DIVERSION PATT 4 - PM

NORTH

1831A

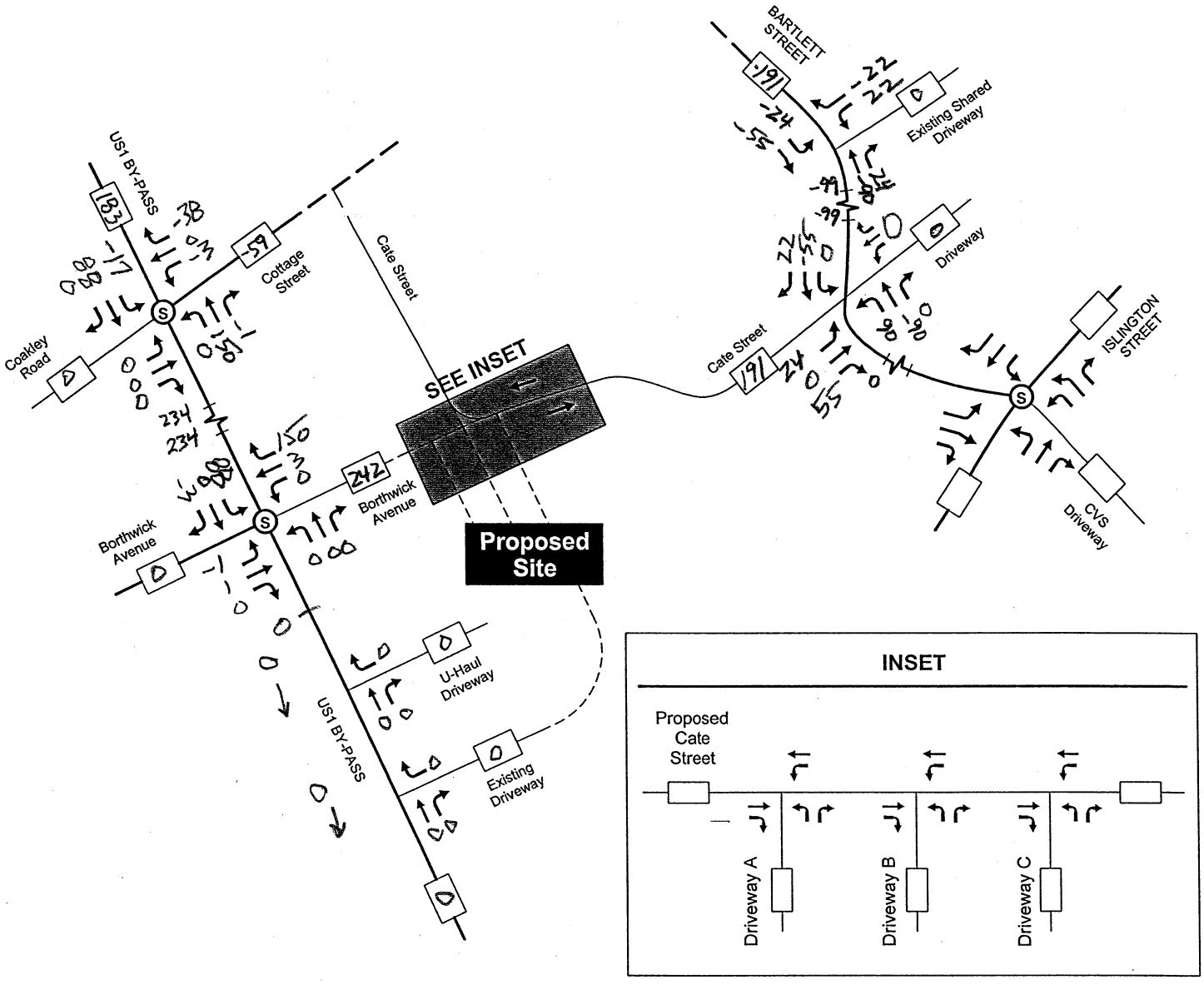


TRIP DIVERSION PATT 5 - PM

NORTH

1831A

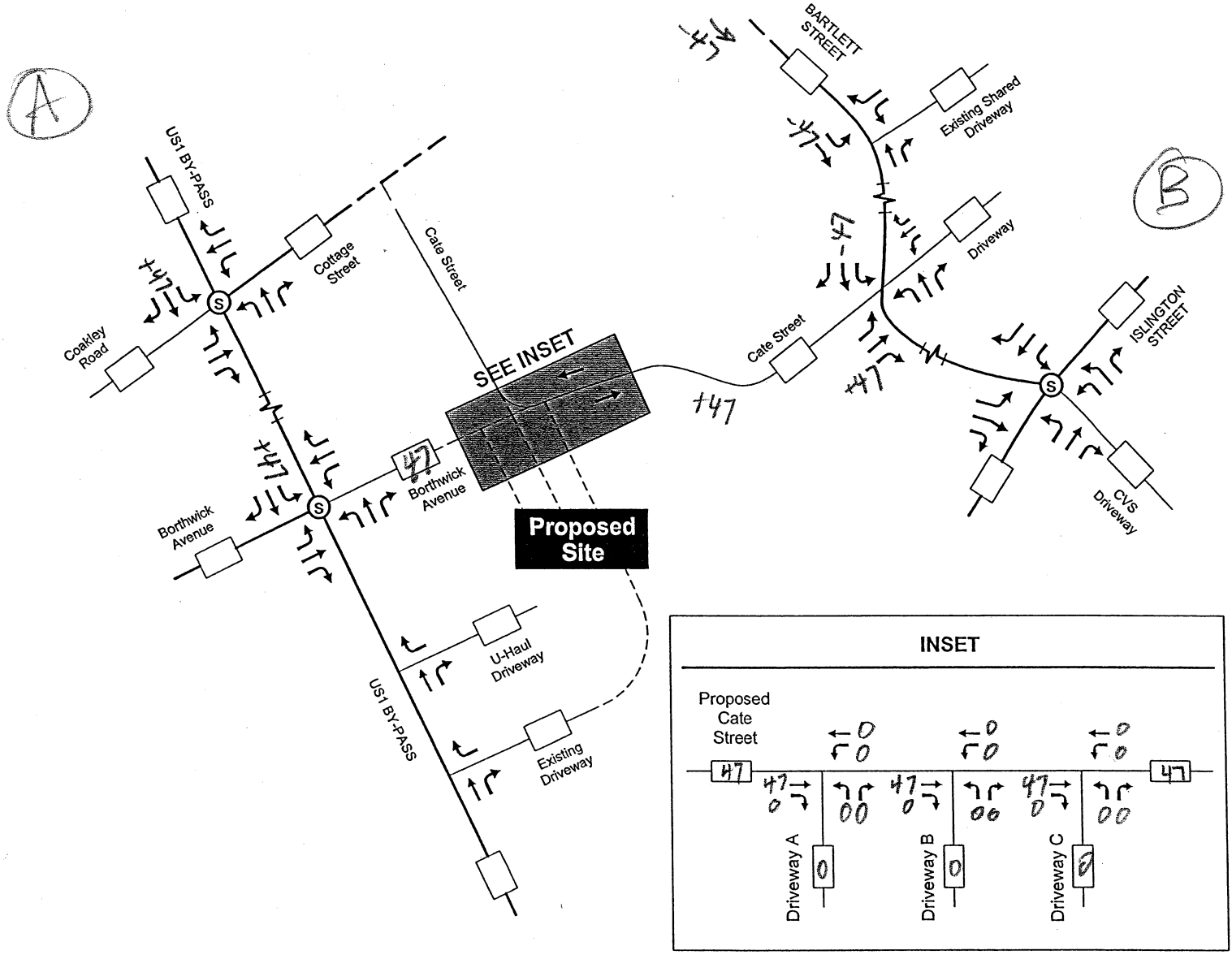
Pernaw & Company, Inc.



DIVERSION - TOTAL TRIPS (SAT P/H)

1831A

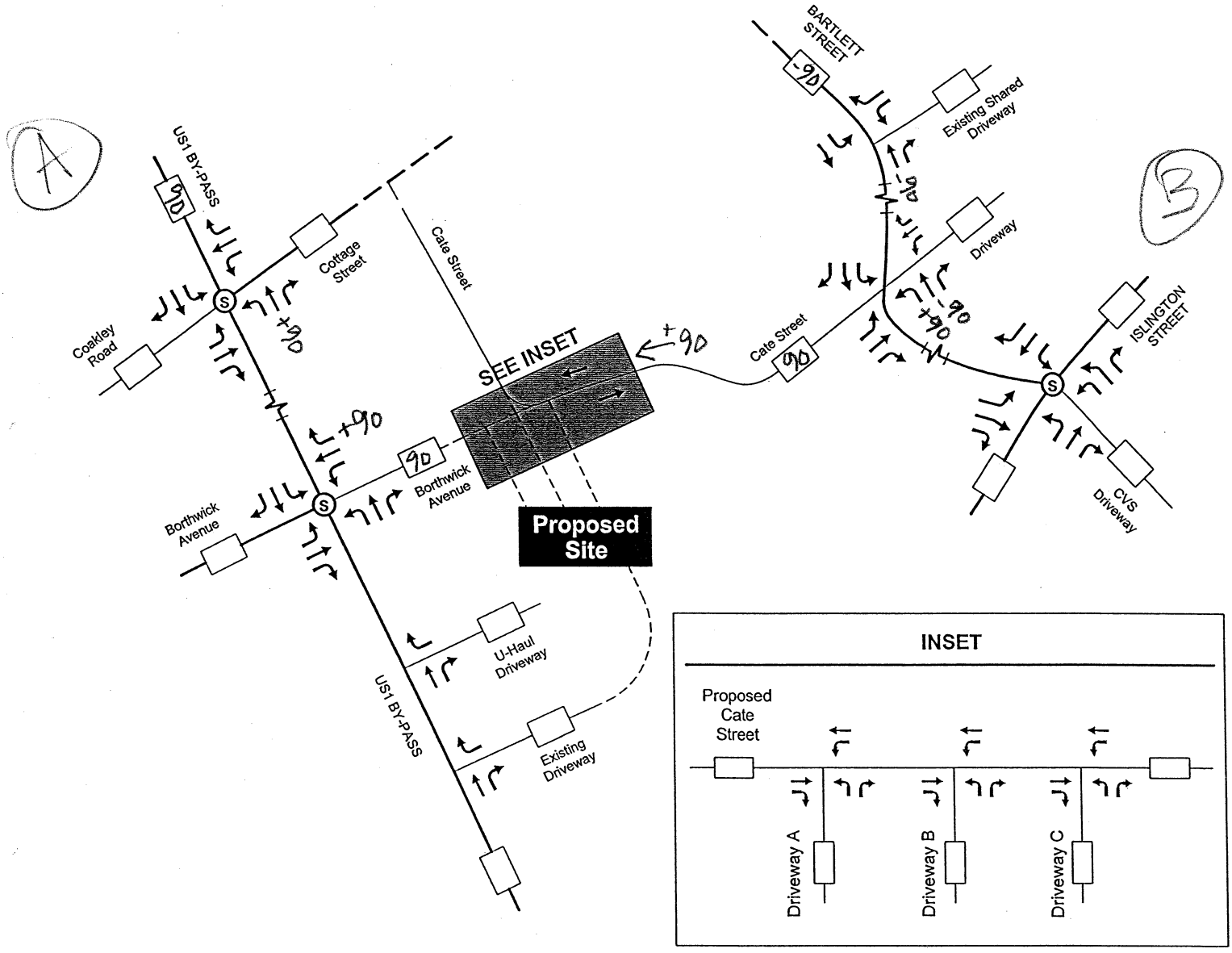
NORTH



TRIP DIVERSION PATH - SAT

1831A

Pernaw & Company, Inc.

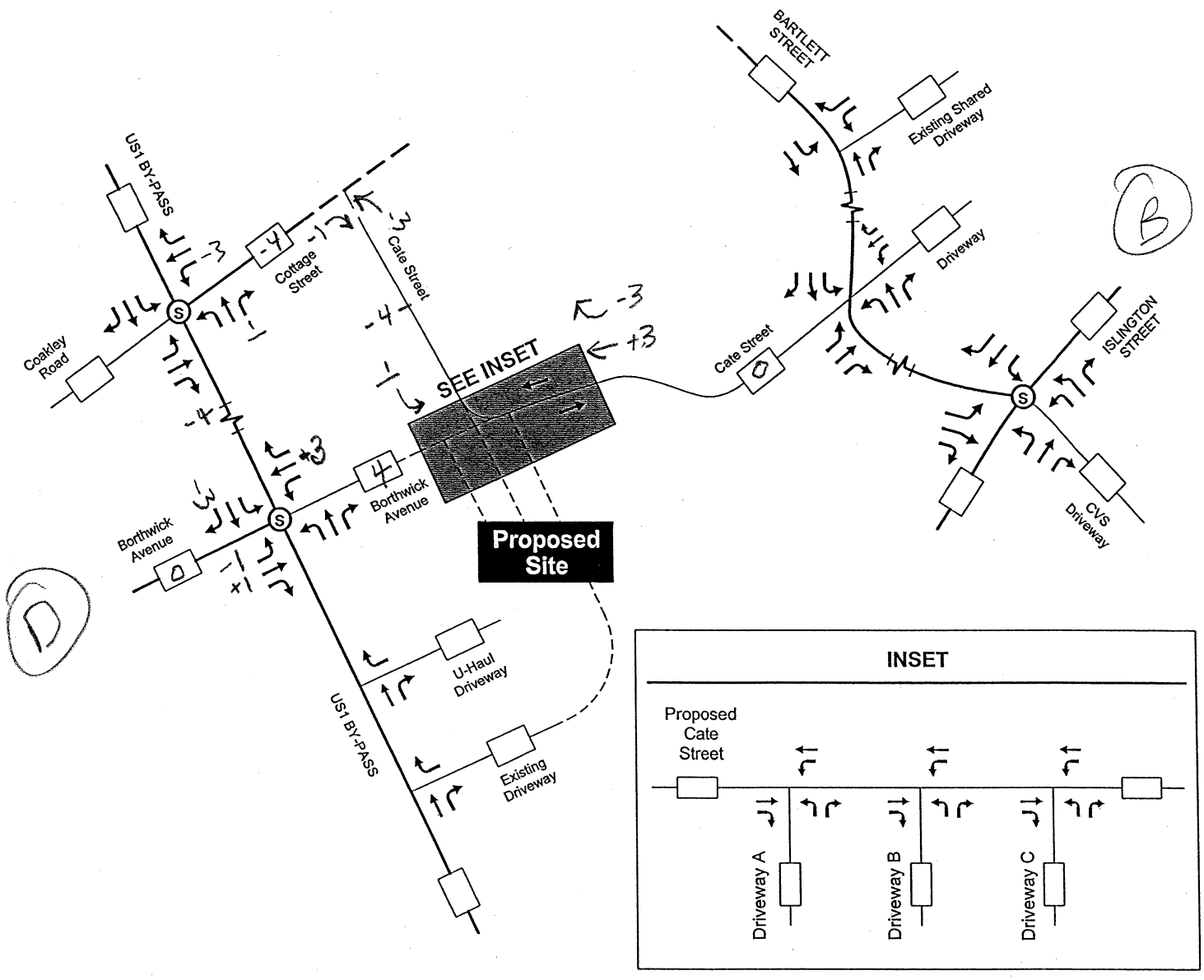


TRIP DIVERSION PATT 2 - SAT

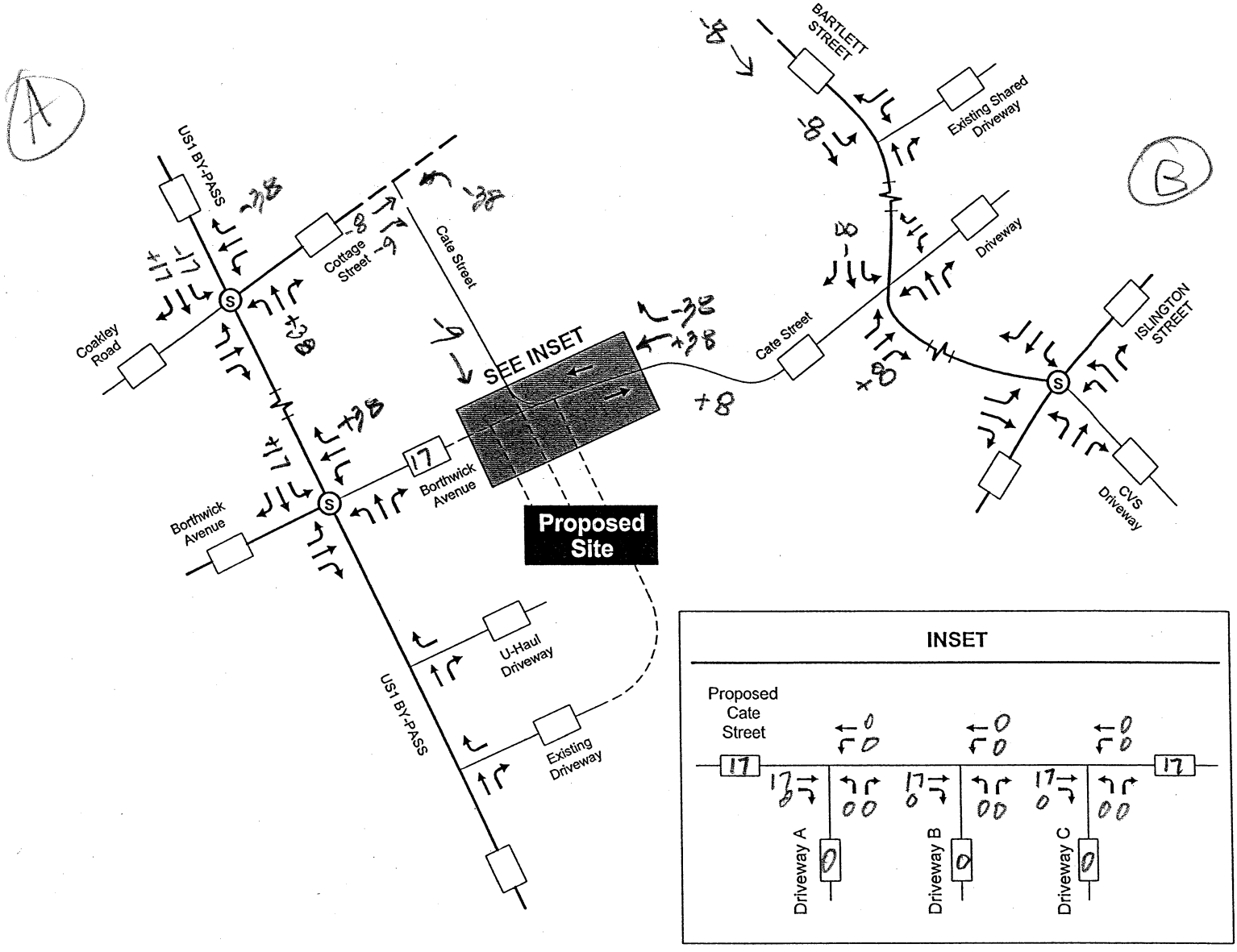
1831A

NORTH

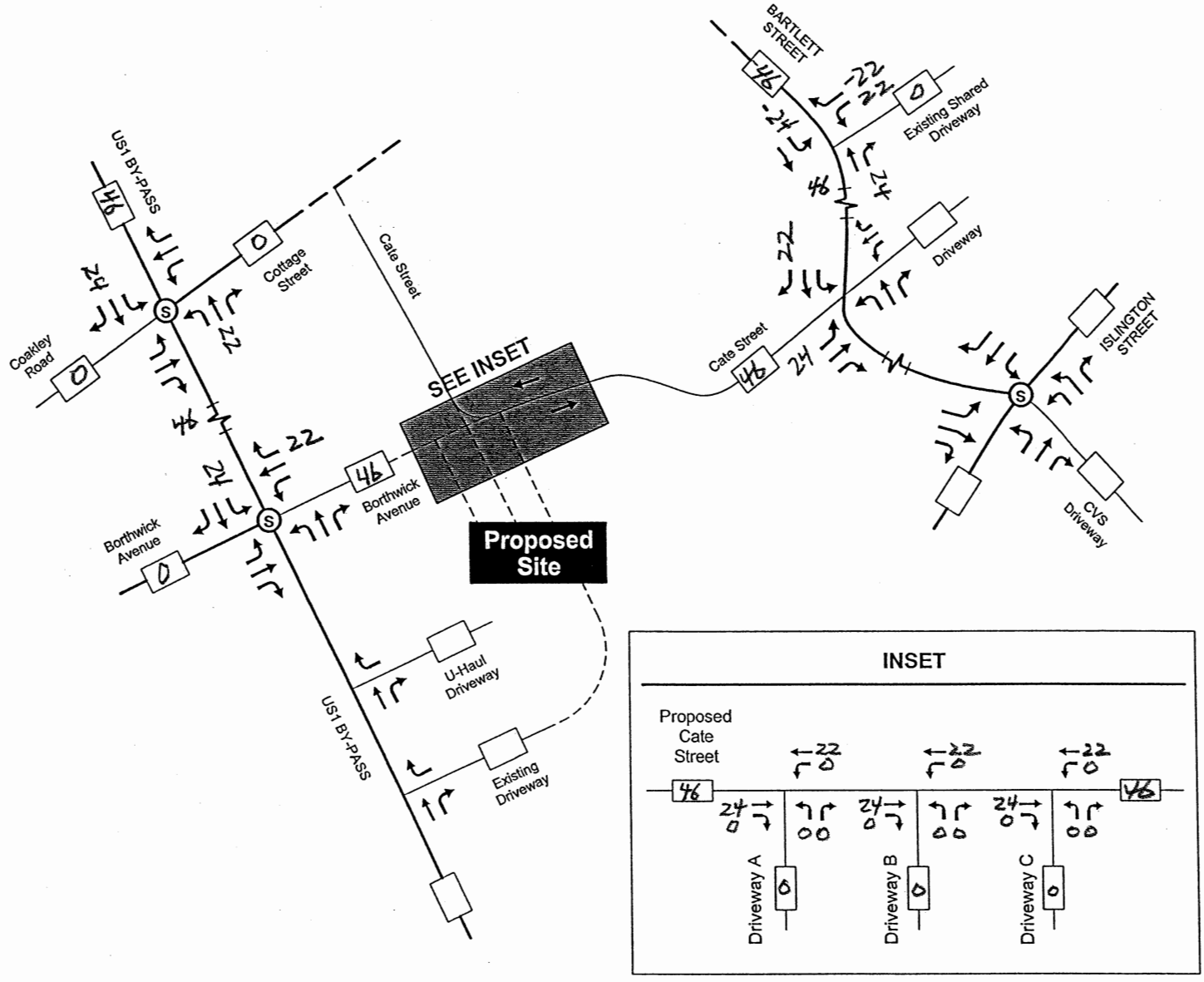
Traffic Impact and Site Access Study, Proposed Mixed-Use Site, Portsmouth, New Hampshire



TRIP DIVERSION PATT 3 - SAT


A
B
US1 BY-PASS
Coakley Road
Cottage Street
Cate Street
SEE INSET
Borthwick Avenue
Borthwick Avenue
Proposed Site
U-Haul Driveway
US1 BY-PASS
Existing Driveway
BARTLETT STREET
Existing Shared Driveway
Driveway
Cate Street
ISLINGTON STREET
CVS Driveway
INSET
Proposed Cate Street
Driveway A
Driveway B
Driveway C
TRIP DIVERSION PATT 4 - SAT
NORTH

1831A

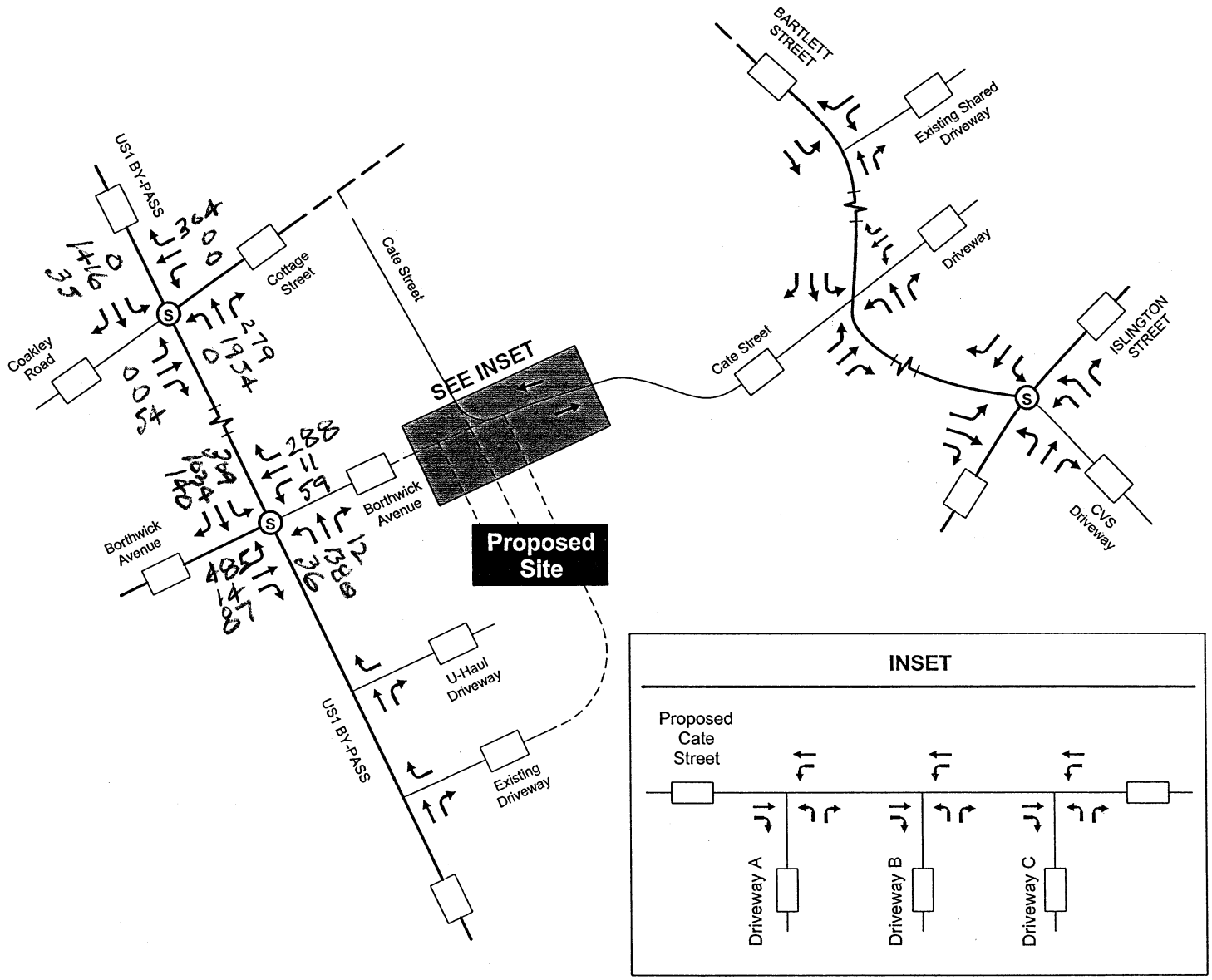


TRIP DIVERSION PATT 5 - SAT

NORTH

1831A

HYPOTHETICAL MEDIAN EXTENSION ON BYPASS THROUGH COAKLEY COTTAGE INT



SUPPLEMENTAL 2030 BUILD TRAFFIC VOLUME - PM PEAK HOUR

NORTH

1831A

Stephen G. Pernaw & Company, Inc.

Attachment

Signal-Controlled Intersection Capacity Analysis Summary - Hypothetical Case
US1 Bypass / Borthwick Avenue / Cate Street Extension

	CASE A 2030 Build w/Mitigation				CASE B 2030 Build w/ Median at #1				CASE C 2030 Build w/ Median & Lanes			
	V/C [1]	Delay [2]	LOS [3]	Queue Avg/95th [4]	V/C [1]	Delay [2]	LOS [3]	Queue Avg/95th [4]	V/C [1]	Delay [2]	LOS [3]	Queue Avg/95th [4]
2030 Weekday PM Peak Hour												
Borthwick Avenue - EB LT	0.92	76.9	E	10 (15)	1.02	109.8	F	10 (15)	0.91	74.5	E	9 (14)
Borthwick Avenue - EB LT&TH	0.93	78.8	E	10 (15)	1.03	112.4	F	10 (16)	0.92	76.3	E	10 (14)
Borthwick Avenue - EB RT	0.07	41.4	D	0 (0)	0.07	44.2	D	0 (0)	0.07	41.3	D	0 (1)
Cate Street Extension - WB LT&TH&RT	0.95	110.0	F	5 (12)	0.98	121.0	F	5 (12)	0.84	80.3	F	5 (11)
Cate Street Extension - WB RT	0.16	51.5	D	0 (3)	0.13	56.6	D	0 (3)	0.48	53.9	D	2 (6)
US1 Bypass - NB LT	0.51	61.7	E	1 (3)	0.52	64.3	E	1 (3)	0.51	62.6	E	1 (3)
US1 Bypass - NB 2TH&RT	0.93	43.6	D	22 (28)	0.98	53.0	D	23 (30)	0.89	36.8	D	21 (27)
US1 Bypass - SB LT	0.94	88.1	F	6 (11)	1.03	107.7	F	10 (18)	0.95	90.4	F	5 (9)
US1 Bypass - SB 2TH&RT	0.65	18.8	B	11 (18)	0.62	18.9	B	13 (16)	0.67	22.5	C	15 (18)
Overall	**0.97**	**47.4**	**D**		**1.02**	**58.8**	**E**		**0.92**	**45.7**	**D**	
Cycle Length	**120.0**				**120.0**				**120.0**			

1) Volume-to-capacity ratio, 2) Delay in vehicles per seconds, 3) Level of Service, 4) Queue length in vehicles

CASE A: Previously proposed mitigiation for Build Case - See Table 6 in original report

CASE B: Same as Case A with hypothetical median at Cottage & Coakly

CASE C: Same as Case B with widening to provide two left-turn lanes on the US1 Bypass southbound approach

Note: The traffic projections used for this hypothetical case (sensativity analysis) are based on a manual re-routing of the prohibited trips at the Cottage-Coakley intersection; further study is needed to determine is the hypotetical median extension would alter other travel patterns in the study area.

HCM Signalized Intersection Capacity Analysis
2: US1 Bypass & Borthwick Avenue/Cate Street Extension

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	485	14	87	59	11	288	36	1380	12	309	1034	140
Future Volume (vph)	485	14	87	59	11	288	36	1380	12	309	1034	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	6.0		4.0	6.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00		0.95	0.95	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85		0.91	0.85	1.00	1.00		1.00	0.98	
Flt Protected	0.95	0.95	1.00		0.98	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1708	1615		1612	1534	1752	3496		1752	3502	
Flt Permitted	0.95	0.95	1.00		0.98	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1698	1708	1615		1612	1534	1752	3496		1752	3502	
Peak-hour factor, PHF	0.83	0.83	0.83	0.90	0.90	0.90	0.97	0.97	0.97	0.96	0.96	0.96
Adj. Flow (vph)	584	17	105	66	12	320	37	1423	12	322	1077	146
RTOR Reduction (vph)	0	0	89	0	48	179	0	1	0	0	8	0
Lane Group Flow (vph)	298	303	16	0	155	16	37	1434	0	322	1215	0
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	3%	3%	17%	3%	1%	3%
Turn Type	Split	NA	Prot	Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	7	7	8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	19.0	19.0	19.0		10.0	10.0	3.0	49.4		20.0	66.4	
Effective Green, g (s)	21.0	21.0	19.0		12.0	10.0	5.0	51.4		22.0	68.4	
Actuated g/C Ratio	0.17	0.17	0.16		0.10	0.08	0.04	0.42		0.18	0.56	
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	291	293	250		158	125	71	1468		314	1957	
v/s Ratio Prot	0.18	c0.18	0.01		c0.10		0.02	c0.41		c0.18	0.35	
v/s Ratio Perm						0.01						
v/c Ratio	1.02	1.03	0.07		0.98	0.13	0.52	0.98		1.03	0.62	
Uniform Delay, d1	50.7	50.7	44.1		55.1	52.2	57.5	34.9		50.2	18.2	
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	59.1	61.7	0.1		65.9	0.5	6.7	18.1		57.5	0.6	
Delay (s)	109.8	112.4	44.2		121.0	52.6	64.3	53.0		107.7	18.9	
Level of Service	F	F	D		F	D	E	D		F	B	
Approach Delay (s)		101.2			87.5			53.3			37.4	
Approach LOS		F			F			D			D	

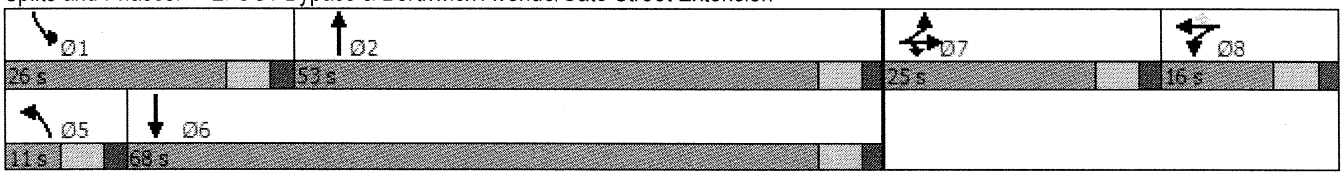
Intersection Summary			
HCM 2000 Control Delay	58.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	122.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Timings
2: US1 Bypass & Borthwick Avenue/Cate Street Extension

Lane Group	EBL	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	485	14	87	11	288	36	1380	309	1034
Future Volume (vph)	485	14	87	11	288	36	1380	309	1034
Turn Type	Split	NA	Prot	NA	Perm	Prot	NA	Prot	NA
Protected Phases	7	7	7	8		5	2	1	6
Permitted Phases					8				
Detector Phase	7	7	7	8	8	5	2	1	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.0	11.0	11.0	11.0	11.0	11.0	16.0	11.0	16.0
Total Split (s)	25.0	25.0	25.0	16.0	16.0	11.0	53.0	26.0	68.0
Total Split (%)	20.8%	20.8%	20.8%	13.3%	13.3%	9.2%	44.2%	21.7%	56.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	0.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	6.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	21.0	21.0	19.0	12.0	10.0	7.0	49.0	22.0	68.4
Actuated g/C Ratio	0.18	0.18	0.16	0.10	0.08	0.06	0.41	0.18	0.57
v/c Ratio	1.00	1.02	0.25	0.97	0.64	0.36	1.00	1.00	0.61
Control Delay	102.9	105.7	1.5	95.5	17.3	64.7	60.7	100.3	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	102.9	105.7	1.5	95.5	17.3	64.7	60.7	100.3	19.1
LOS	F	F	A	F	B	E	E	F	B
Approach Delay		89.0		57.2			60.8		36.1
Approach LOS		F		E			E		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.02	
Intersection Signal Delay: 56.0	Intersection LOS: E
Intersection Capacity Utilization 86.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 2: US1 Bypass & Borthwick Avenue/Cate Street Extension



Queues
2: US1 Bypass & Borthwick Avenue/Cate Street Extension

Lane Group	EBL	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	298	303	105	203	195	37	1435	322	1223
v/c Ratio	1.00	1.02	0.25	0.97	0.64	0.36	1.00	1.00	0.61
Control Delay	102.9	105.7	1.5	95.5	17.3	64.7	60.7	100.3	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	102.9	105.7	1.5	95.5	17.3	64.7	60.7	100.3	19.1
Queue Length 50th (ft)	~246	~254	0	125	0	28	~583	~253	337
Queue Length 95th (ft)	#387	#394	0	#289	77	65	#752	#444	411
Internal Link Dist (ft)		916		388			250		304
Turn Bay Length (ft)	225		225			200		150	
Base Capacity (vph)	297	298	416	209	306	102	1428	321	2004
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.00	1.02	0.25	0.97	0.64	0.36	1.00	1.00	0.61

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
2: US1 Bypass & Borthwick Avenue/Cate Street Extension

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	485	14	87	59	11	288	36	1380	12	309	1034	140
Future Volume (vph)	485	14	87	59	11	288	36	1380	12	309	1034	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	6.0		4.0	6.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00		0.95	0.95	1.00	0.95		0.97	0.95	
Frt	1.00	1.00	0.85		0.91	0.85	1.00	1.00		1.00	0.98	
Flt Protected	0.95	0.95	1.00		0.98	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1708	1615		1612	1534	1752	3496		3400	3502	
Flt Permitted	0.95	0.95	1.00		0.98	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1698	1708	1615		1612	1534	1752	3496		3400	3502	
Peak-hour factor, PHF	0.83	0.83	0.83	0.90	0.90	0.90	0.97	0.97	0.97	0.96	0.96	0.96
Adj. Flow (vph)	584	17	105	66	12	320	37	1423	12	322	1077	146
RTOR Reduction (vph)	0	0	86	0	48	123	0	1	0	0	8	0
Lane Group Flow (vph)	298	303	19	0	155	72	37	1434	0	322	1215	0
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	3%	3%	17%	3%	1%	3%
Turn Type	Split	NA	Prot	Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	7	7	8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	21.4	21.4	21.4		11.8	11.8	3.0	53.3		10.0	60.3	
Effective Green, g (s)	23.4	23.4	21.4		13.8	11.8	5.0	55.3		12.0	62.3	
Actuated g/C Ratio	0.19	0.19	0.18		0.11	0.10	0.04	0.46		0.10	0.52	
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	329	331	286		184	150	72	1604		338	1810	
v/s Ratio Prot	0.18	c0.18	0.01		c0.10		0.02	c0.41		c0.09	0.35	
v/s Ratio Perm						0.05						
v/c Ratio	0.91	0.92	0.07		0.84	0.48	0.51	0.89		0.95	0.67	
Uniform Delay, d1	47.5	47.6	41.2		52.3	51.5	56.6	29.9		54.0	21.5	
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	27.0	28.7	0.1		28.0	2.4	6.1	6.8		36.4	1.0	
Delay (s)	74.5	76.3	41.3		80.3	53.9	62.6	36.8		90.4	22.5	
Level of Service	E	E	D		F	D	E	D		F	C	
Approach Delay (s)		70.3			67.4			37.4			36.7	
Approach LOS		E			E			D			D	

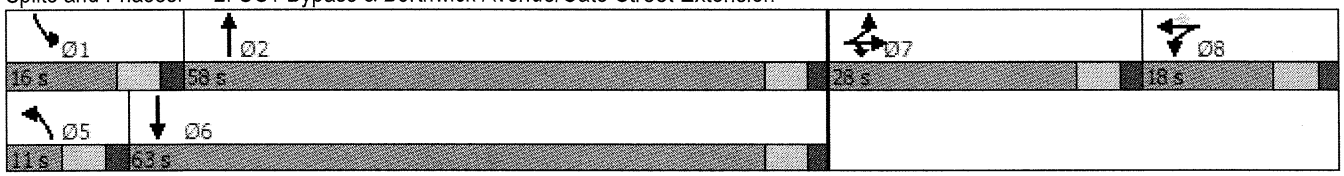
Intersection Summary			
HCM 2000 Control Delay	45.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	120.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Timings
2: US1 Bypass & Borthwick Avenue/Cate Street Extension

Lane Group	EBL	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	485	14	87	11	288	36	1380	309	1034
Future Volume (vph)	485	14	87	11	288	36	1380	309	1034
Turn Type	Split	NA	Prot	NA	Perm	Prot	NA	Prot	NA
Protected Phases	7	7	7	8		5	2	1	6
Permitted Phases					8				
Detector Phase	7	7	7	8	8	5	2	1	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.0	11.0	11.0	11.0	11.0	11.0	16.0	11.0	16.0
Total Split (s)	28.0	28.0	28.0	18.0	18.0	11.0	58.0	16.0	63.0
Total Split (%)	23.3%	23.3%	23.3%	15.0%	15.0%	9.2%	48.3%	13.3%	52.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	0.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	6.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	23.4	23.4	21.4	13.8	11.8	7.0	52.8	12.0	62.3
Actuated g/C Ratio	0.20	0.20	0.18	0.12	0.10	0.06	0.45	0.10	0.53
v/c Ratio	0.89	0.90	0.26	0.86	0.71	0.36	0.92	0.93	0.66
Control Delay	74.1	75.5	4.8	70.3	32.6	64.3	41.1	87.0	23.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.1	75.5	4.8	70.3	32.6	64.3	41.1	87.0	23.0
LOS	E	E	A	E	C	E	D	F	C
Approach Delay		64.4		51.8			41.7		36.3
Approach LOS		E		D			D		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 118	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 44.6	Intersection LOS: D
Intersection Capacity Utilization 77.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: US1 Bypass & Borthwick Avenue/Cate Street Extension



Queues
2: US1 Bypass & Borthwick Avenue/Cate Street Extension

Lane Group	EBL	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	298	303	105	203	195	37	1435	322	1223
v/c Ratio	0.89	0.90	0.26	0.86	0.71	0.36	0.92	0.93	0.66
Control Delay	74.1	75.5	4.8	70.3	32.6	64.3	41.1	87.0	23.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.1	75.5	4.8	70.3	32.6	64.3	41.1	87.0	23.0
Queue Length 50th (ft)	237	242	0	122	45	28	533	129	372
Queue Length 95th (ft)	#351	#357	18	#265	#149	65	#664	#221	453
Internal Link Dist (ft)		916		388			250		304
Turn Bay Length (ft)	225		225			200		150	
Base Capacity (vph)	345	347	412	238	278	104	1602	346	1856
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.87	0.25	0.85	0.70	0.36	0.90	0.93	0.66

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

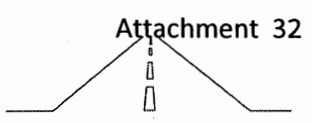


Table 9A

STOP-Controlled Intersection Capacity Analysis - Revised 9/19/18
Bartlett Street / Cate Street / Parking Lot Driveway

	Weekday PM Peak Hour				Saturday Peak Hour			
	Delay [1]	V/C [2]	LOS [3]	Queue [4]	Delay [1]	V/C [2]	LOS [3]	Queue [4]
Bartlett Street - NB Left Turns								
2018 Existing	9.2	0.10	A	<1	8.6	0.05	A	<1
2020 No Build	10.0	0.17	B	1	9.1	0.09	A	<1
2020 Build	11.0	0.31	B	1	9.5	0.20	A	1
2030 No Build	10.5	0.19	B	1	9.3	0.10	A	<1
2030 Build	11.7	0.34	B	2	9.9	0.22	A	1
Cate Street - EB Left-Through								
2018 Existing	16.1	0.19	C	1	12.5	0.06	B	<1
2020 No Build	86.6	0.08	F	<1	35.6	0.01	E	<1
2020 Build	>300.0	1.23	F	4	69.5	0.40	F	2
2030 No Build	120.5	0.11	F	<1	43.4	0.01	E	<1
2030 Build	>300.0	1.88	F	5	99.3	0.51	F	2
Cate Street - EB Right-Turns								
2018 Existing	-	-	-	-	-	-	-	-
2020 No Build	17.0	0.27	C	1	13.2	0.11	B	<1
2020 Build	20.0	0.44	C	2	14.5	0.28	B	1
2030 No Build	19.1	0.32	C	1	14.1	0.13	B	<1
2030 Build	23.5	0.51	C	3	15.7	0.31	C	1
Parking Lot Driveway - WB Left-Through-Right-Turns								
2018 Existing	37.8	0.01	E	<1	24.7	0.02	C	<1
2020 No Build	68.3	0.02	F	<1	36.9	0.03	E	<1
2020 Build	114.4	0.03	F	<1	56.4	0.05	F	<1
2030 No Build	95.2	0.03	F	<1	45.4	0.04	E	<1
2030 Build	169.3	0.05	F	<1	72.9	0.07	F	<1
Bartlett Street - SB Left-Turns								
2018 Existing	8.7	0.00	A	<1	8.2	0.00	A	<1
2020 No Build	9.1	0.00	A	<1	8.5	0.00	A	<1
2020 Build	8.8	0.00	A	<1	8.2	0.00	A	<1
2030 No Build	9.4	0.00	A	<1	8.6	0.00	A	<1
2030 Build	9.0	0.00	A	<1	8.3	0.00	A	<1

[1] HCM Control Delay (seconds per vehicle), [2] HCM Volume to Capacity Ratio, [3] HCM Level of Service, [4] HCM 95th Percentile Queue (vehicles)

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱		↕			↕			↕	
Traffic Vol, veh/h	3	0	86	0	1	0	121	622	0	1	673	13
Future Vol, veh/h	3	0	86	0	1	0	121	622	0	1	673	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	90	90	90	83	83	83	91	91	91
Heavy Vehicles, %	0	0	2	0	0	0	0	2	0	0	1	9
Mvmt Flow	4	0	113	0	1	0	146	749	0	1	740	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1791	1790	747	1847	1797	749	754	0	0	749	0	0
Stage 1	749	749	-	1041	1041	-	-	-	-	-	-	-
Stage 2	1042	1041	-	806	756	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.22	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.318	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	63	82	413	58	81	415	865	-	-	869	-	-
Stage 1	407	422	-	280	310	-	-	-	-	-	-	-
Stage 2	280	310	-	379	419	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	48	58	413	33	58	415	865	-	-	869	-	-
Mov Cap-2 Maneuver	48	58	-	33	58	-	-	-	-	-	-	-
Stage 1	289	421	-	199	220	-	-	-	-	-	-	-
Stage 2	198	220	-	275	418	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.3	68.3	1.6	0
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	865	-	-	48	413	58	869	-	-
HCM Lane V/C Ratio	0.169	-	-	0.082	0.274	0.019	0.001	-	-
HCM Control Delay (s)	10	0	-	86.6	17	68.3	9.1	0	-
HCM Lane LOS	B	A	-	F	C	F	A	A	-
HCM 95th %tile Q(veh)	0.6	-	-	0.3	1.1	0.1	0	-	-

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	12.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	0	143	0	1	0	219	538	0	1	628	63
Future Vol, veh/h	30	0	143	0	1	0	219	538	0	1	628	63
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	90	90	90	83	83	83	91	91	91
Heavy Vehicles, %	0	0	2	0	0	0	0	2	0	0	1	9
Mvmt Flow	39	0	188	0	1	0	264	648	0	1	690	69

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1904	1903	725	1997	1937	648	759	0	0	648	0	0
Stage 1	727	727	-	1176	1176	-	-	-	-	-	-	-
Stage 2	1177	1176	-	821	761	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.22	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.318	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	53	70	425	45	66	474	862	-	-	947	-	-
Stage 1	419	432	-	235	267	-	-	-	-	-	-	-
Stage 2	235	267	-	371	417	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 32	36	425	16	34	474	862	-	-	947	-	-
Mov Cap-2 Maneuver	~ 32	36	-	16	34	-	-	-	-	-	-	-
Stage 1	218	431	-	122	139	-	-	-	-	-	-	-
Stage 2	121	139	-	206	416	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	90.3	114.4	3.2	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	862	-	-	32	425	34	947	-	-
HCM Lane V/C Ratio	0.306	-	-	1.234	0.443	0.033	0.001	-	-
HCM Control Delay (s)	11	0	-	$ 425.4	20	114.4	8.8	0	-
HCM Lane LOS	B	A	-	F	C	F	A	A	-
HCM 95th %tile Q(veh)	1.3	-	-	4.3	2.2	0.1	0	-	-

Notes		
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	92	0	1	0	130	680	0	1	738	14
Future Vol, veh/h	3	0	92	0	1	0	130	680	0	1	738	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	90	90	90	83	83	83	91	91	91
Heavy Vehicles, %	0	0	2	0	0	0	0	2	0	0	1	9
Mvmt Flow	4	0	121	0	1	0	157	819	0	1	811	15

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1955	1954	819	2014	1961	819	826	0	0	819	0	0
Stage 1	821	821	-	1133	1133	-	-	-	-	-	-	-
Stage 2	1134	1133	-	881	828	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.22	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.318	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	49	65	375	44	64	379	813	-	-	818	-	-
Stage 1	371	391	-	249	280	-	-	-	-	-	-	-
Stage 2	249	280	-	344	389	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	35	42	375	22	41	379	813	-	-	818	-	-
Mov Cap-2 Maneuver	35	42	-	22	41	-	-	-	-	-	-	-
Stage 1	240	390	-	161	181	-	-	-	-	-	-	-
Stage 2	160	181	-	232	388	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.3	95.2	1.7	0
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	813	-	-	35	375	41	818	-	-
HCM Lane V/C Ratio	0.193	-	-	0.113	0.323	0.027	0.001	-	-
HCM Control Delay (s)	10.5	0	-	120.5	19.1	95.2	9.4	0	-
HCM Lane LOS	B	A	-	F	C	F	A	A	-
HCM 95th %tile Q(veh)	0.7	-	-	0.3	1.4	0.1	0	-	-

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	19.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	0	149	0	1	0	228	596	0	1	693	64
Future Vol, veh/h	30	0	149	0	1	0	228	596	0	1	693	64
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	90	90	90	83	83	83	91	91	91
Heavy Vehicles, %	0	0	2	0	0	0	0	2	0	0	1	9
Mvmt Flow	39	0	196	0	1	0	275	718	0	1	762	70

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2068	2067	797	2165	2102	718	832	0	0	718	0	0
Stage 1	799	799	-	1268	1268	-	-	-	-	-	-	-
Stage 2	1269	1268	-	897	834	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.22	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.318	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	40	55	387	34	52	432	809	-	-	892	-	-
Stage 1	382	401	-	209	242	-	-	-	-	-	-	-
Stage 2	208	242	-	337	386	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 21	24	387	9	23	432	809	-	-	892	-	-
Mov Cap-2 Maneuver	~ 21	24	-	9	23	-	-	-	-	-	-	-
Stage 1	166	400	-	91	105	-	-	-	-	-	-	-
Stage 2	89	105	-	166	385	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	154.2	169.3	3.2	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	809	-	-	21	387	23	892	-	-
HCM Lane V/C Ratio	0.34	-	-	1.88	0.507	0.048	0.001	-	-
HCM Control Delay (s)	11.7	0	-	$ 803.5	23.5	169.3	9	0	-
HCM Lane LOS	B	A	-	F	C	F	A	A	-
HCM 95th %tile Q(veh)	1.5	-	-	5.2	2.8	0.1	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	41	1	1	0	75	471	1	1	569	4
Future Vol, veh/h	1	0	41	1	1	0	75	471	1	1	569	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	50	50	50	88	88	88	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	1	0
Mvmt Flow	1	0	55	2	2	0	85	535	1	1	618	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1329	1328	620	1356	1330	536	622	0	0	536	0	0
Stage 1	622	622	-	706	706	-	-	-	-	-	-	-
Stage 2	707	706	-	650	624	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	133	157	492	128	156	549	969	-	-	1042	-	-
Stage 1	478	482	-	430	442	-	-	-	-	-	-	-
Stage 2	429	442	-	461	481	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	119	137	492	103	136	549	969	-	-	1042	-	-
Mov Cap-2 Maneuver	119	137	-	103	136	-	-	-	-	-	-	-
Stage 1	418	482	-	376	387	-	-	-	-	-	-	-
Stage 2	373	387	-	409	481	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.7	36.9	1.2	0
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	969	-	-	119	492	117	1042	-	-
HCM Lane V/C Ratio	0.088	-	-	0.011	0.111	0.034	0.001	-	-
HCM Control Delay (s)	9.1	0	-	35.6	13.2	36.9	8.5	0	-
HCM Lane LOS	A	A	-	E	B	E	A	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0	0.4	0.1	0	-	-

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	0	109	1	1	0	179	381	1	1	514	28
Future Vol, veh/h	27	0	109	1	1	0	179	381	1	1	514	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	50	50	50	88	88	88	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	1	0
Mvmt Flow	36	0	145	2	2	0	203	433	1	1	559	30

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1417	1416	574	1489	1431	434	589	0	0	434	0	0
Stage 1	576	576	-	840	840	-	-	-	-	-	-	-
Stage 2	841	840	-	649	591	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	116	139	522	103	136	626	996	-	-	1136	-	-
Stage 1	506	505	-	363	384	-	-	-	-	-	-	-
Stage 2	362	384	-	462	498	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	90	101	522	59	99	626	996	-	-	1136	-	-
Mov Cap-2 Maneuver	90	101	-	59	99	-	-	-	-	-	-	-
Stage 1	370	504	-	265	281	-	-	-	-	-	-	-
Stage 2	263	281	-	333	498	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	25.4	56.4	3	0
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	996	-	-	90	522	74	1136	-	-
HCM Lane V/C Ratio	0.204	-	-	0.4	0.278	0.054	0.001	-	-
HCM Control Delay (s)	9.5	0	-	69.5	14.5	56.4	8.2	0	-
HCM Lane LOS	A	A	-	F	B	F	A	A	-
HCM 95th %tile Q(veh)	0.8	-	-	1.6	1.1	0.2	0	-	-

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	43	1	1	0	81	516	1	1	624	4
Future Vol, veh/h	1	0	43	1	1	0	81	516	1	1	624	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	50	50	50	88	88	88	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	1	0
Mvmt Flow	1	0	57	2	2	0	92	586	1	1	678	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1454	1453	680	1482	1455	587	682	0	0	587	0	0
Stage 1	682	682	-	771	771	-	-	-	-	-	-	-
Stage 2	772	771	-	711	684	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	109	132	454	104	131	513	920	-	-	998	-	-
Stage 1	443	453	-	396	413	-	-	-	-	-	-	-
Stage 2	395	413	-	427	452	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	95	112	454	80	111	513	920	-	-	998	-	-
Mov Cap-2 Maneuver	95	112	-	80	111	-	-	-	-	-	-	-
Stage 1	377	452	-	337	352	-	-	-	-	-	-	-
Stage 2	335	352	-	372	451	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.8	45.4	1.3	0
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	920	-	-	95	454	93	998	-	-
HCM Lane V/C Ratio	0.1	-	-	0.014	0.126	0.043	0.001	-	-
HCM Control Delay (s)	9.3	0	-	43.4	14.1	45.4	8.6	0	-
HCM Lane LOS	A	A	-	E	B	E	A	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0	0.4	0.1	0	-	-

HCM 2010 TWSC
5: Cate Street/Parking Lot Driveway & Bartlett Street

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	0	111	1	1	0	185	426	1	1	569	28
Future Vol, veh/h	27	0	111	1	1	0	185	426	1	1	569	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	250	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	50	50	50	88	88	88	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	1	0
Mvmt Flow	36	0	148	2	2	0	210	484	1	1	618	30

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1541	1540	633	1614	1555	485	648	0	0	485	0	0
Stage 1	635	635	-	905	905	-	-	-	-	-	-	-
Stage 2	906	905	-	709	650	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	95	117	483	85	114	586	947	-	-	1088	-	-
Stage 1	470	476	-	334	358	-	-	-	-	-	-	-
Stage 2	333	358	-	428	468	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	71	81	483	45	79	586	947	-	-	1088	-	-
Mov Cap-2 Maneuver	71	81	-	45	79	-	-	-	-	-	-	-
Stage 1	327	476	-	232	249	-	-	-	-	-	-	-
Stage 2	230	249	-	297	468	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	32.1	72.9	3	0
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	947	-	-	71	483	57	1088	-	-
HCM Lane V/C Ratio	0.222	-	-	0.507	0.306	0.07	0.001	-	-
HCM Control Delay (s)	9.9	0	-	99.3	15.7	72.9	8.3	0	-
HCM Lane LOS	A	A	-	F	C	F	A	A	-
HCM 95th %tile Q(veh)	0.8	-	-	2.1	1.3	0.2	0	-	-