

Appendix D – Traffic Analysis



Memorandum

Date: November 30, 2017

Project: AVA001

To: Mr. Michael Thomas
ESG Engineering

From: Steve Weinberger
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Subject: Tremont Street – Five Corners Traffic Analysis

As requested, W-Trans has prepared a traffic analysis and recommendations for the “cluster” of intersections on Tremont Street known as “Five Corners.” The intersections are currently arranged in a non-standard fashion with multiple street approaches. The focus of the concept designs would be to serve the varied mix of vehicle traffic while providing safe access for pedestrians and bicycles.

Setting

Avalon lies on Santa Catalina Island off the Southern California coastal shore, approximately 22 miles south-by-southwest of the Los Angeles Harbor, with a population of about 3,700 residences. The city of Avalon is located on the southern half of the island and includes a bay in which most of the waterfront is dominated by tourism-oriented businesses. The older parts of the town on the valley floor consist primarily of small cottages and two and three-story buildings with a mix of commercial and visitors serving facilities. Avalon attracts about 1 million visitors a year and is frequently visited by cruise ships and many tourists alike. The main mode of vehicle transportation within the City of Avalon are what are known as “autoettes” which are similar to golf carts with gasoline or electric engines. Vehicles less than 55 inches (140 cm) wide, 120 inches (300 cm) long, and less than 1,800 pounds (820 kg) may qualify as an autoette. Regular sized vehicles are uncommon in the area due to regulations, however, there are a number of standard vehicles, trucks and buses which are used for ours on the island.

Study Area

The study area consists of Tremont Street and the cluster of intersections with Sumner Avenue, Country Club Drive and Avalon Canyon Road. The “Five Corners” intersection is a common crossroads for many residence and visitors, which provides access between the “flats” and the canyon and to the following uses:

- City Hall
- Avalon Elementary and High School
- City of Avalon Fire Department
- LA County Lifeguard and LA County Fire
- Catalina Island Medical Center
- Botanical Gardens
- Residential housing
- Catalina Island Golf Course
- Catalina Island Holiday Inn Resort
- City warehouse

The Tremont Street “cluster” is configured with three separate intersections:

Tremont Street/Sumner Avenue – The intersection operates as a T Configured all-way stop controlled intersection. However, the Tremont Street approaches are not aligned. Also, there is no sidewalk on the southern sides of Tremont Street, but is served by a crosswalk marking taking the place of the sidewalk.

Tremont Street/Country Club Drive - The intersection operates a T configured “imbalanced stop” control with the northbound Country Club Drive and eastbound Tremont Street movements stopped. This is a non-standard use of stop signs.

Tremont Street/Avalon Canyon Road - The intersection also operates as a T configured “imbalanced stop” control with the northbound Avalon Canyon Road and the westbound Tremont Street movements stopped. This is a non-standard use of stop signs. The northbound approach is also stopped far in advance of the conflict turn area which adds to the confusion of the intersection.

These three intersections are located in such close proximity to each other that the location is perceived as one intersection which lends to driver confusion. The whole “intersection” is awkwardly configured and does not meet design standards. It essentially operates as a 5-legged all-way stop controlled intersection with an elongated section resulting in long diagonal movements by a majority of vehicles travelling between Summer Avenue and Avalon Canyon Road. Tremont Street is extremely wide so that it is not able to channelize traffic properly between entry and exit points. In addition, there is pedestrian activity and crossings occurring through the day. Pedestrians take a variety of routes through the intersection depending on the level of activity and congestion with some in crosswalks and some pedestrians in non-designated areas for pedestrians where traffic is uncontrolled.

Existing Conditions

Traffic Operations

Peak traffic conditions occur in the 15-minute period from 7:45 to 8:00 a.m. when students are going to school as well as many people travelling to work. Expanded out to one-hour traffic counts, these peak volumes represent a vehicle entry rate of 1,148 vehicles per hour. Using standard intersection operational analysis tools and assuming standard vehicle capacity conditions, this a.m. peak period condition would be rated with a Level of Service (LOS) F.¹ These results are attached.

Collison History

Based on information provided by City staff, there have been no reported collisions in the intersection within the last 5 years.

¹ Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation. The study intersection was analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

Site Observations

The following traffic conditions were noted during the site visit of September 21-22, 2017:

- The intersection serves a wide variety of vehicle types, from autoettes, micro cars, standard automobiles, trucks, bicycles, motorcycles, various tour related vehicles which range from vans to buses to Hummers, construction equipment most notably coming from Country Club Road, and emergency response vehicles.
- Vehicle movements through the intersection do not follow a predictable pattern of movement. Vehicles appear to take different paths through the intersection depending on the level of activity and congestion.
- Country Club Drive and Catalina Canyon Road are located in very close proximity, but sight lines between the two are limited because of the grade differences.
- There is a moderate portion of pedestrian trips throughout the day traversing the intersection with increasing volumes of pedestrians during school a.m., lunch, and afternoon peaks. Pedestrians also travel via skateboard, scooter, hoverboards, Segways, and other similar devices. Some of these movements by younger pedestrians were observed travelling at high rates of speeds, downhill through the intersection in a dangerous fashion. Pedestrians take a variety of routes through the intersection depending on the level of activity and congestion with some in crosswalks and some pedestrians in non-designated areas for pedestrians.
- Because of the autoette rental tour maps, a large number of drivers were observed to be either distracted, reading the map while driving, or unsure of where to turn at the intersection. Some drivers stopped in the middle of intersection to determine their route.
- There is an existing Avalon Transit bus stop on Tremont Street between Sumner Avenue and Eucalyptus Avenue which is part of the bus's loop route.
- The majority of calls served by Avalon Fire Department emergency vehicles enter the 5 Points intersection at Avalon Canyon Road adding to the complexity of the intersection.
- Because of the low traffic demand during non-peak times and the use of small maneuverable vehicles, it is acknowledged that the intersection appears to adequately serve traffic demand throughout the majority of the day even with the "free for all" traffic operations. However, during the peak morning period, the heavy vehicle demand results in longer vehicle queues; awkward routes through the intersections; high potential for vehicle conflicts and close conflicts between vehicles and pedestrians.

Traffic Issues to Address

The following characteristics of the intersection should be addressed for safety and standardization:

- Because of the wide expanse of pavement and non-standard nature of the intersection geometrics, vehicles are negotiating paths in a wide variety of areas, speeds and movements. This includes the approach angle of Country Club Dr. and downhill grade.
- With the mix of speeds and maneuvers, the presence of larger vehicles such as buses and Hummers is a safety concern given the unprotected nature of the autoette vehicles. Autoettes and pedestrians are most vulnerable during the high traffic demand time of the a.m. peak. Traffic calming should be used to temper speeds through the intersection.
- Pedestrian safety is of particular concern, especially during school hours with younger unaccompanied pedestrians crossing outside of the marked crosswalks while vehicles are maneuvering in a mix of patterns. This pedestrian activity is expected to increase with housing development near City Hall.

- Autoettes drivers range from residents to short time visitors. Residents have extensive experience in operating these vehicles and have familiarity with their destination and the peculiar nature of the intersection. Visitors mostly have little experience in driving autoettes and are mostly unfamiliar with their destination and this intersection. Many visitors who have a lack of knowledge of the area are found using paper maps while moving through the area causing distractive driving and or walking.
- The intersection has a raised concrete apron which apparently covers a drainage culvert. This 'hump' in the roadway creates some elevation changes in the intersection which adds to the complexity of this non-standard intersection.
- Redesign of the intersection should consider the potential increase in bike use, most notably electric bikes which are more popular for renting now, and may grow with the expanded residential use.

General Recommendations

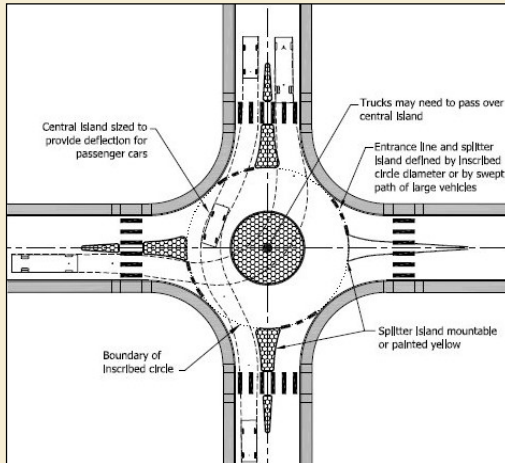
- The intersection should be modified to provide more consistency with travel paths and speeds.
- More channelization should be provided to guide vehicle paths through the intersection.
- The wide expanse of Tremont Street should be narrowed in the area that serves vehicles.
- More convenient and standard crosswalk markings should be provided to serve pedestrian movements.
- The raised concrete apron covering the drainage culvert should be removed or lowered to lessen the effects of the elevation change.
- The intersection entry points should converge closer to adjacent movements to increase awareness of traffic in the intersection.
- The bus stop on Tremont Street should be addressed and accommodated into any redesign of the intersection.

Proposed Solution

The most appropriate traffic mitigation to achieve these recommendations is the creation of a "dual mini-roundabout" intersection. These two intersections would fit within the existing pavement areas of the Tremont Street cluster and create excess space which could be used for landscaping, urban design and expanded sidewalks. In addition, room for a bus pullout could be created at its current stop location.

The two intersections would operate with yield on entry and counter-clockwise movements. Signing, striping and pavement markings would be provided to assist with navigation of the intersection for drivers as well as pedestrians and other modes of transportation.

Mini-Roundabouts are small roundabouts with a fully traversable central island. They are most commonly used in low-speed urban environments with average operating speeds of 30 mph or less. They can be useful in such environments where conventional roundabout design is precluded by right-of-way constraints. In retrofit applications, mini-roundabouts are relatively inexpensive because they typically require minimal additional pavement at intersecting roads and minor widening at the corner curbs. (Roundabouts: An Informational Guide, NCHRP Report 672).



Tremont Street/Sumner Avenue – The northwestern mini roundabout would have an outer diameter of 50 feet with three entry points and a center island with a diameter of 20 feet.

Tremont Street/Country Club Drive-Avalon Canyon Road – The southeastern mini roundabout would have an outer diameter of 60 feet and have four entry points. The center island would have a diameter of 30 feet.

Separation – There would be a 30-foot separation between the two mini-roundabouts. Generally, with standard vehicle traffic, it would not be recommended to provide a pedestrian crosswalk with such a short separation distance at this type of junction. However, in this case, given the short length of autoettes, a crosswalk is possible.

Center Islands - The center islands of the two roundabouts would not have any raised landscaping elements as these are mini-roundabouts which have fully mountable islands. In addition, the “splitter islands” would either be striped or installed as mountable islands.

A sketch is attached showing existing sidewalks, new sidewalks, crosswalk locations, the bus stop, new areas for landscaping, raised and mountable islands and striped islands.



Operating Conditions with Recommendations

This solution will allow a higher capacity of vehicle movements through the area and reduce the number of vehicle conflict points as well as pedestrian conflict points. Using standard intersection operational analysis tools and assuming standard vehicle capacity conditions, the dual mini roundabouts would be expected to operate with a Level of Service A during the a.m. peak period. These results are attached.

Large vehicle maneuverability.

Because of the traversable design of the central island and splitter islands, emergency vehicles will have the ability to traverse all legs of the intersection.

Pedestrian Circulation

All existing crosswalks at the intersection would be removed. There would be five new crosswalks along the outside of the dual roundabout. These crosswalks will allow people to cross the streets of Tremont Street, Sumner Avenue, Avalon Canyon Road, and Country Club Drive. These crosswalks will be placed approximately one vehicle back from the entry of the roundabout. This allows pedestrians to cross the street safely behind vehicles queued to enter the roundabout. Another larger crosswalk will be added in between the two mini roundabouts so that pedestrians can cross diagonally without having to walk all the way around the two intersections.

Bicycle Circulation

Bicyclist will share the road with vehicles, as they would be travelling at similar rates of speed.

Mini Roundabout Benefits

The new design will offer the following benefits:

- Channelize movements
- Speed moderation
- Reduce conflict points
- compact size
- operational efficiency
- traffic safety
- traffic calming
- pedestrian crossings
- access management
- aesthetics
- create additional room for sidewalks
- create room for landscaping
- environmental benefits
- allow room for a bus pullout

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

SJW/AVA001-1.M1-1

Attachments: Existing Intersection Level of service, Intersection LOS with mini roundabouts.

3: Country Club Dr & Avalon Canyon Rd/Sumner Ave & Tremont St Performance by movement

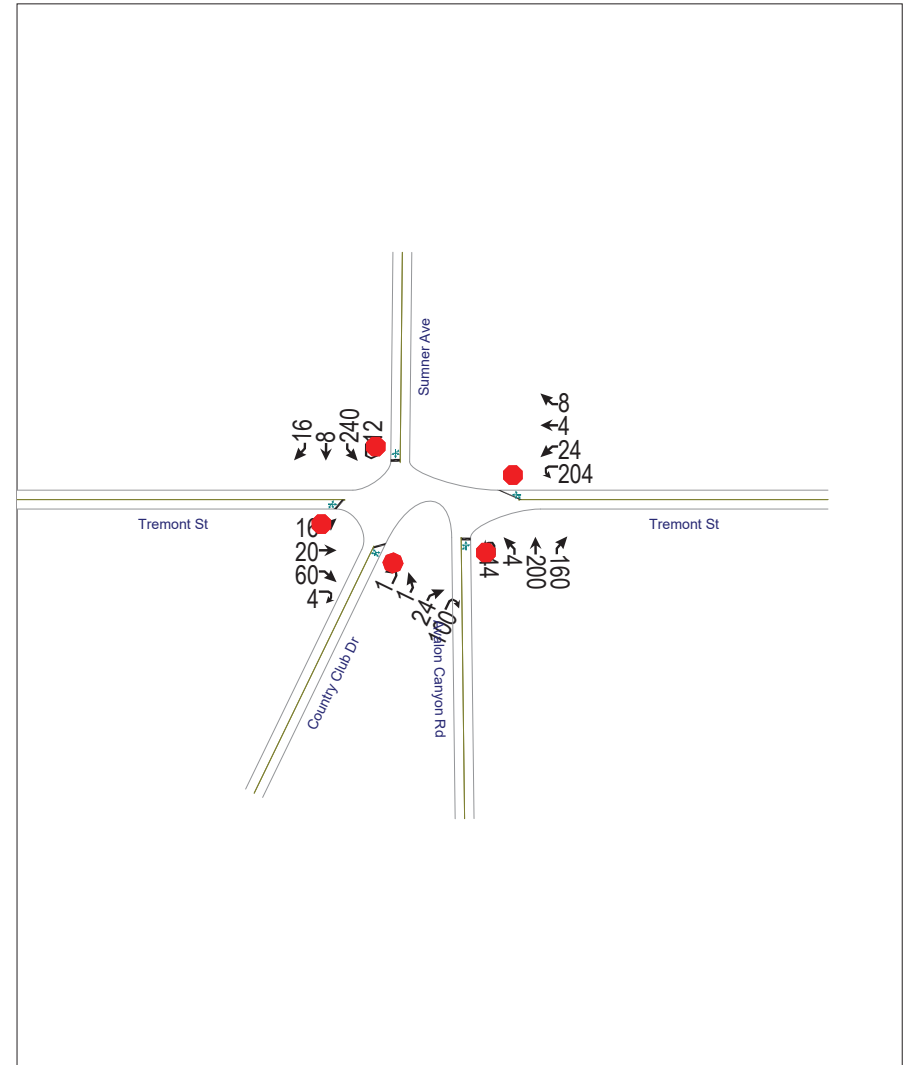
Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Denied Del/Veh (s)	0.1	0.2	0.2	0.1	42.7	43.0	74.9	38.6	240.2	350.0	230.3	231.8
Total Del/Veh (s)	24.7	33.7	28.0	10.4	159.4	177.5	140.5	141.4	156.1	139.8	173.9	170.9

3: Country Club Dr & Avalon Canyon Rd/Sumner Ave & Tremont St Performance by movement

Movement	SBU	SBL	SBT	SBR	NEL2	NEL	NER	NER2	All
Denied Del/Veh (s)	141.5	158.9	106.9	125.7			0.2	0.2	128.7
Total Del/Veh (s)	171.7	152.3	137.0	166.1			30.5	21.5	130.2

Total Network Performance

Denied Del/Veh (s)	128.7
Total Del/Veh (s)	128.2 LOS F



- Existing Sidewalk
- New Sidewalk
- Landscaping

- Pedestrian Crosswalks
- Raised and Mountable
- Bus Stop
- Striped Splitter Islands



TREMONT STREET EVALUATION

TWO ROUNDABOUT SKETCH

1" = 50'

9/22/17

MOVEMENT SUMMARY

Site: 1 [West RB - AM Peak]

Network: N101 [Network1]

Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Arrival Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
East: WB Tremont St													
6	T1	9	0.0	9	0.0	0.161	4.0	LOS A	0.9	13.7	0.10	0.02	17.0
16	R2	209	0.0	209	0.0	0.161	4.0	LOS A	0.9	13.7	0.10	0.02	17.2
Approach		218	0.0	218	0.0	0.161	4.0	LOS A	0.9	13.7	0.10	0.02	17.1
North: SB Summer Ave													
7	L2	260	0.0	260	0.0	0.213	4.6	LOS A	1.1	16.5	0.07	0.01	15.9
14	R2	16	0.0	16	0.0	0.213	4.6	LOS A	1.1	16.5	0.07	0.01	17.6
Approach		276	0.0	276	0.0	0.213	4.6	LOS A	1.1	16.5	0.07	0.01	16.1
West: EB Tremont St													
5	L2	16	0.0	16	0.0	0.100	4.5	LOS A	0.4	6.3	0.40	0.27	18.3
2	T1	84	0.0	84	0.0	0.100	4.5	LOS A	0.4	6.3	0.40	0.27	16.3
Approach		100	0.0	100	0.0	0.100	4.5	LOS A	0.4	6.3	0.40	0.27	16.8
All Vehicles		594	0.0	594	0.0	0.213	4.3	LOS A	1.1	16.5	0.14	0.06	16.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Network tab).
 Roundabout LOS Method: Same as Sign Control.
 Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
 Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
 Roundabout Capacity Model: US HCM 6.
 HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
 Gap-Acceptance Capacity: Traditional M1.
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.6 %
 Number of Iterations: 5 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 1 [East RB - AM Peak]

Network: N101 [Network1]

Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Arrival Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
SouthEast: NB Avalon Canyon Rd													
3x	L2	44	0.0	44	0.0	0.319	5.7	LOS A	2.0	30.6	0.25	0.11	17.8
3ax	L1	204	0.0	204	0.0	0.319	5.7	LOS A	2.0	30.6	0.25	0.11	15.3
18bx	R3	160	0.0	160	0.0	0.319	5.7	LOS A	2.0	30.6	0.25	0.11	17.4
Approach		408	0.0	408	0.0	0.319	5.7	LOS A	2.0	30.6	0.25	0.11	16.7
East: WB Tremont St													
1b	L3	204	0.0	204	0.0	0.230	5.6	LOS A	1.2	17.6	0.46	0.33	17.7
1a	L1	24	0.0	24	0.0	0.230	5.6	LOS A	1.2	17.6	0.46	0.33	17.4
6	T1	12	0.0	12	0.0	0.230	5.6	LOS A	1.2	17.6	0.46	0.33	15.1
Approach		240	0.0	240	0.0	0.230	5.6	LOS A	1.2	17.6	0.46	0.33	17.6
West: EB Tremont St													
2	T1	32	0.0	32	0.0	0.338	7.0	LOS A	2.0	29.4	0.54	0.42	16.7
12a	R1	300	0.0	300	0.0	0.338	7.0	LOS A	2.0	29.4	0.54	0.42	16.5
12b	R3	12	0.0	12	0.0	0.338	7.0	LOS A	2.0	29.4	0.54	0.42	16.1
Approach		344	0.0	344	0.0	0.338	7.0	LOS A	2.0	29.4	0.54	0.42	16.5
SouthWest: NB Country Club Dr													
5bx	L3	2	0.0	2	0.0	0.168	6.6	LOS A	0.8	11.3	0.61	0.56	15.5
12ax	R1	24	0.0	24	0.0	0.168	6.6	LOS A	0.8	11.3	0.61	0.56	17.8
12x	R2	100	0.0	100	0.0	0.168	6.6	LOS A	0.8	11.3	0.61	0.56	17.6
Approach		126	0.0	126	0.0	0.168	6.6	LOS A	0.8	11.3	0.61	0.56	17.6
All Vehicles		1118	0.0	1118	0.0	0.338	6.2	LOS A	2.0	30.6	0.42	0.30	17.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Network tab).
 Roundabout LOS Method: Same as Sign Control.
 Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
 Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
 Roundabout Capacity Model: US HCM 6.
 HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
 Gap-Acceptance Capacity: Traditional M1.
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.6 %
 Number of Iterations: 5 (maximum specified: 10)

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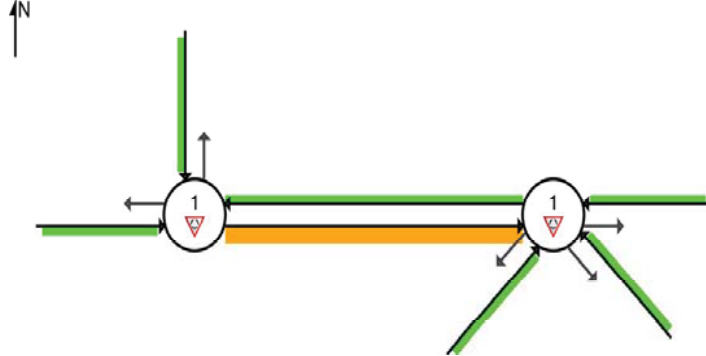
QUEUE STORAGE RATIO (PERCENTILE)

Ratio of the 95% Back of Queue Distance to the available queue storage distance (worst lane for the approach)

☼☼ Network: N101 [Network1]

New Network

Short Lanes not included in determining Approach Queue Storage Ratios.



Colour code based on Queue Storage Ratio

