TPANACollector

INTRODUCTION

This document provides an overview of the TPANACollector software solution provided by TPA North America Inc.

The TPANACOLLECTOR accepts MAC Addresses collected by Bluetooth Traffic Monitors (BTM) deployed on the roadside. Outlier algorithms process this data into average travel time data and predicted travel time data in real-time. In addition, the data is archived for later extraction and analysis by other off-line software tools.

ARCHITECTURE

The TPANACollector software runs on the Microsoft Server 2012 Standard Edition or equivalent operating system and uses Microsoft's MSQL 2012 ore equivalent relational database system.

The TPANACollector browser-based interface works with industry standard browsers such as FireFox, Chrome, Safari and Edge.

TPANACOLLECTOR BROWSER INTERFACE

The User interface to the TPANACOLLECTOR software is through industry standard browsers. The features of TPANACollector include:

- 1) User Configuration: Up to 10 users can be defined with UserID / Password protection. Users can access the system simultaneously.
- 2) BTM configuration. This allows for the creation of the database of BTMs.
- 3) Link Configuration. This allows for the create of the database of Links
- 4) Data collection: TPANACollector polls Bluetooth Traffic Monitors (BTM) to collect Bluetooth MAC Addresses.
- 5) Data Display: TPANACollector provides a real-time display of the collected Bluetooth data. Depending on the configuration of the field equipment this can include the MAC Addresses, Voltage, Cell signal strength, Latitude and Longitude, Temperature, etc
- 6) Map: TPANACollector displays the locations of the field BTMs on a map. Red, Green and Yellow lines are configured to display the traffic conditions according to user defined speed intervals.
- 7) Graphs/Charts: TPANACollector can create charts and graphs of the collected data.
- 8) Data Output:
 - a. TPANACollector has a facility for outputting Bluetooth detection data, Bluetooth trip data, and travel time and speed data. The user can create reports according to their desired date and time collection intervals.

- b. TPANACollector has the facility to output an XML file of the collected travel time data for use by other software systems
- 9) NTCIP Sign interface: Communicate and control NTCIP compatible Variable Message Signs.
- 10) Scheduler: schedule messages to NTCIP signs

CHANNEL MAP

The Channel Map provides an overview of the locations of the BTM units on Google Maps. The current real-time travel time for the defined links is displayed when hovering over a BTM. The contents of an NTCIP message sign are shown when hovering over the relevant icon.



Figure 1 TPANACollector Map interface

LINK AND ROUTE CHART

The TPANACollector system can display graphs and charges of the collected data.

	TPA-NA Trakker Monitor, Project: P#19_MTO-CR Channels * Report * Management *							
Link Filter: ExpoFilter	▼ Route Filter: AdaptiveRouteFilter ▼							
Link ID	Link Name	Average TT	Average (km/h)	Number of Detections				
L1E_08-M3	401_E1:Yonge-Bayview	00:01:10	105	44				
L1E_M3-05	401_E1:Bayview-404	00:02:16	97	8				
L1E_M2-M3	401_E2:Avenue-Bayview	00:02:22	102	34				
L1E_M3-06	401_E2:Bayview-VicPark	00:03:04	106	18				
L1E_04-M3	401_E3:Keele-Bayview	00:05:15	110	23				
L1E_M3-M4	401_E3:Bayview-McCowan	00:06:10	109	26				
L1W_05-M3	401_W1:404-Bayview	00:02:19	95	14				
L1W_D1-M3	401_W1:404 SE@401-Bayview	00:02:58	79	20				
L1W_M3-08	401_W1:Bayview-Yonge	00:01:13	100	76				
L1W_06-M3	401_W2:VicPark-Bayview	00:03:21	97	25				
L1W_M3-M2	401_W2:Bayview-Avenue	00:02:25	99	24				
L1W_M3-04	401_W3: Bayview-Keele	00:05:52	98	20				
L1W_DD-M3	401_W2:404@Sheppard-Bayview	00:04:15	70	20				
LDN_DF-M3	DVP_N:Brookbanks-Bayview	00:04:46	72	13				
	401 E2: Bawyiew-DVP@Brookbanks	00:05:36	56	10				

Figure 2 Summary of Links travel time and speed



Figure 3: Bluetooth detections

TPA North America Inc **TPANACollector**



Figure 4 Bluetooth detection chart

Y22:XML 401VW0010VEE:401 Eastbound EXP West of 400			Y33:XML 401VW0010VWC:401 Westbound COLL at Weston			Y09:XML 401VW0010VWE:401 Westbound Exp at Weston				
2020-11-04 13:35			2020-11-04 13:35			2020-11-04 13:35				
Voltage 0.01	Message Owner	Priority	Voltage 0.01	Message Owner	Priority	Voltage 0.01	Message Owner	Priority		
8 MIN TO BAYVIEW			5 MIN TO AIRPORT VIA 409			3 MIN TO DIXON RD				
10 MIN TO 404/DVP			8 MIN TO FINCH VIA 409/427			6 MIN TO RENFORTH DR				
15 MIN TO MCCOWAN			16 MIN TO 401 / MAVIS RD			16 MIN TO MAVIS RD				
Y58:XML 401VW0020VES: 401 Eastbound East of Dixon			Y24:XML 401VW0020VSF:400 Southbound South of Sheppard			Y07:XML 401VW0020VWC:401 Westbound COLL West of				
Voltage	Message Owner	Priority	Voltage	Message Owner	Priority		2020-11-04 13:35			
0.01			0.01			Voltage	Message Owner	Priority		
6 MIN TO HWY 400				12 MIN TO 404 VIA 401 E		0.01				
9 MIN TO ALLEN RD				6 MIN TO 427 VIA 401 W		8 MIN TO 410 / STEELES				
12 MIN TO YONGE				12 MIN TO QEW VIA 401/427		15 MIN TO 403 / DUNDAS	15 MIN TO 403 / DUNDAS			
						21 MIN TO 401/TRAFALGAR	21 MIN TO 401/TRAFALGAR			
Y10:XML 401VW0020VWS:401 Westbound West of Dixon			Y03:XML 401VW003	Y03:XML 401VW0030VEC 401 Eastbound COLL East of Dixie			Y57:XML 401VW0030VEE:401 Eastbound EXP East of Dixie			
Voltage	Message Owner	Priority	Voltage	Message Owner	Priority	Voltage	Message Owner	Priority		
0.01			0.01			0.01				
5 MIN TO 410 / 403			10 MIN TO 400 VIA 401 E.			10 MIN TO 400 VIA 401 E.				
6 MIN TO QEW VIA 427 S			5 MIN TO 409 VIA 427 N.			5 MIN TO 409 VIA 427 N.				
			8 MIN TO QEW VIA 427 S.			8 MIN TO QEW VIA 427 S.				
Y35:XML 401VW0030VWC:401 Westbound Coll West of HWY 410			Y21:XML 401VW0030VWE:401 Westbound Exp West of Renforth			Y04:XML 401VW0031VEE:401 Eastbound West of Renforth 2020-11-04 13:35				
	2020-11-04 13:35			2020-11-04 13:35		Voltage	Message Owner	Priority		
Voltage	Message Owner	Priority	Voltage	Message Owner	Priority	0.01				
0.01			0.01			8 MIN TO HWY 400				
28 MIN TO GUELPH LINE			21 MIN TO TRAFALGAR			13 MIN TO AVENUE RD				
38 MIN TO HWY 6 NORTH			27 MIN TO HWY 25			18 MIN TO HWY 404				
47 MIN TO HWY 8 KITCHENER			19 MIN TO QEW/TRAFALGAR							
Y37:XML 401VW0040VEC:401Eastbound East of Hurontario			Y25:XML 401VW0040VEF:409 Eastbound at 409/Kipling			Y36:XML 401VW0040VWE:401 Westbound Exp West of HWY 410				
Voltage	Message Owner	Priority	Voltage	Message Owner	Priority		2020-11-04 13:35			
0.01			0.01			Voltage	Message Owner	Priority		
5 MIN TO 410 / STEELES			4 MIN TO HWY 400			0.01				
8 MIN TO 409 / 427			9 MIN TO AVENUE RD			26 MIN TO GUELPH LINE				
14 MIN TO 400 / 401			14 MIN TO HWY 404			36 MIN TO HWY 6 NORTH				
						45 MIN TO HWY 8 KITCHENER				
Y19:XML 403VN0010VEF:7B - 403 Toronto bound at King Rd 2020-11-04 13:35			Y08:XM	Y08:XML 404HOV1:404 HOV Tunnel 2020-11-04 13:35			Y69:XML 410VN0010VSS:CourtneyPark@410 2020-11-04 13:35			
Voltage	Message Owner	Priority	Voltage	Message Owner	Priority	Voltage	Message Owner	Priority		
0.01			0.01			0.01				
12 MIN TO QEW/FORD DR. 5 MIN TO					15 MIN T0 401/W.C.B.					
31 MIN TO HWY 406				5 MIN TO			15 MIN TO 401/W.C.B.			
	12 MIN TO QEW/FORD DR 31 MIN TO HWY 406			5 MIN TO AVENUE RD		_	15 MIN TO 401/W.C.B. 6 MIN TO 401/427			
	12 MIN TO QEW/FORD DR 31 MIN TO HWY 406 VIA QEW NIAGARA			5 MIN TO AVENUE RD 10 MIN TO 400			15 MIN TO 401/W.C.B. 6 MIN TO 401/427 9 MIN TO 403/ERIN MILLS			

Figure 5 NTCIP Sign Interface

TPANACOLLECTOR TRAVEL TIME CALCULATION ENGINE

The TPANACollector travel time calculation engine performs the following functions:

- 1) Collects Bluetooth data
- 2) Creates Link travel times and stores the data
- 3) Creates Route travel times and stores the data
- 4) Monitors BTMs for the purpose of capturing Detections in real-time.
- 5) Monitors BTMs for the purpose of identifying problems with power and communications and reporting these in real-time.
- 6) Isolation of valid Detections by grouping multiple Detections of the same Device.
- 7) Recognition of Trips made by a Device by identifying valid pairs of Detections over a pre-defined Link, consisting of an Upstream (Source) BTM and a Downstream (Destination) BTM.
- 8) Filters recognized trips in order to identify and isolate potential "outliers".
- 9) Filters groups of trips to provide Trip Statistics (such as Average Travel Time) in real-time for all Links.
- 10) Filters groups of recognized Trips in order to provide Trip Statistics in real-time for pre-defined sequences on Links known as Routes.
- 11) Monitors system performance and generates and/or clears alarms as appropriate
- 12) Outputs an XML file with real-time travel time information
- 13) Filters data into travel times such as General Purpose Lanes and HOV lanes.
- 14) Detect queue formation and distance to the end of a queue.

SUPPLIER

The supplier of the software system is:

TPA North America Inc. 3335 Yonge Street Suite 405 Toronto, ON M4N 2M1 Telephone : 416-486-8457