

# 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 MS SQL 2012 or 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.

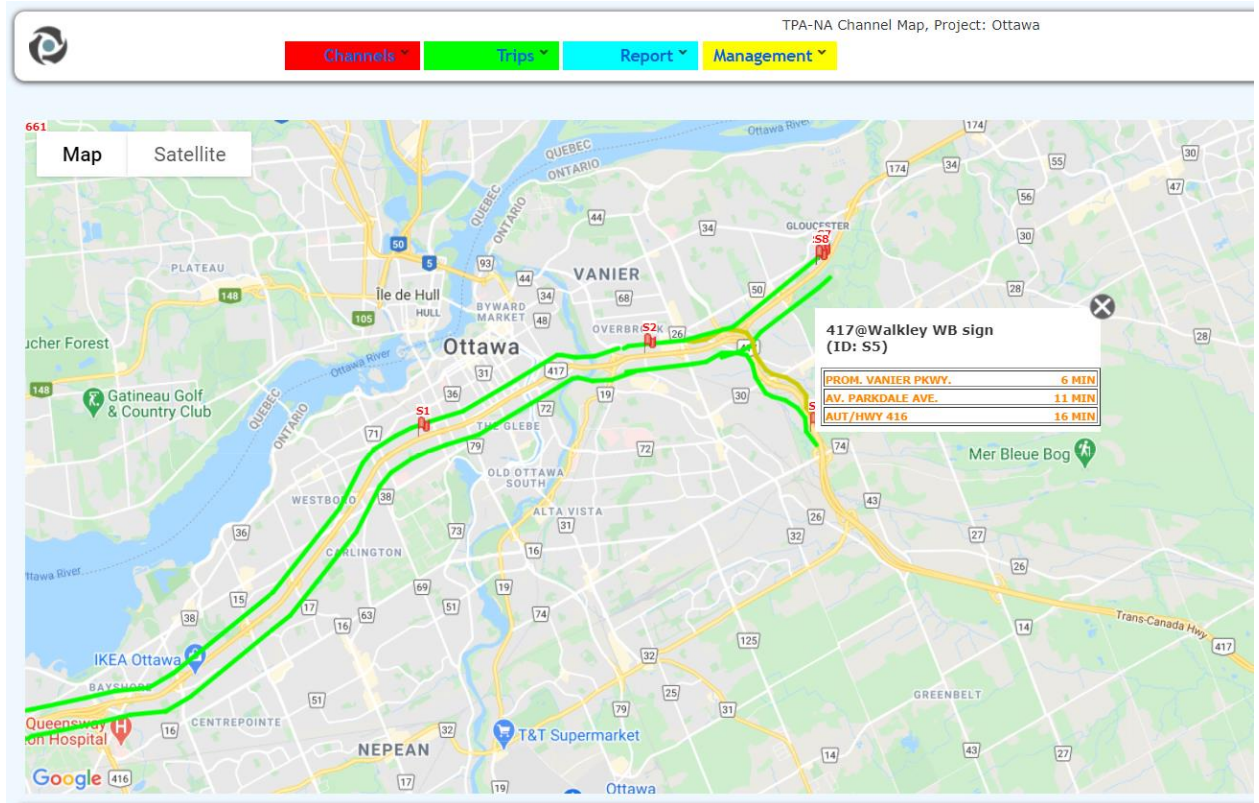


Figure 1 TPANACollector Map interface

## LINK AND ROUTE CHART

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

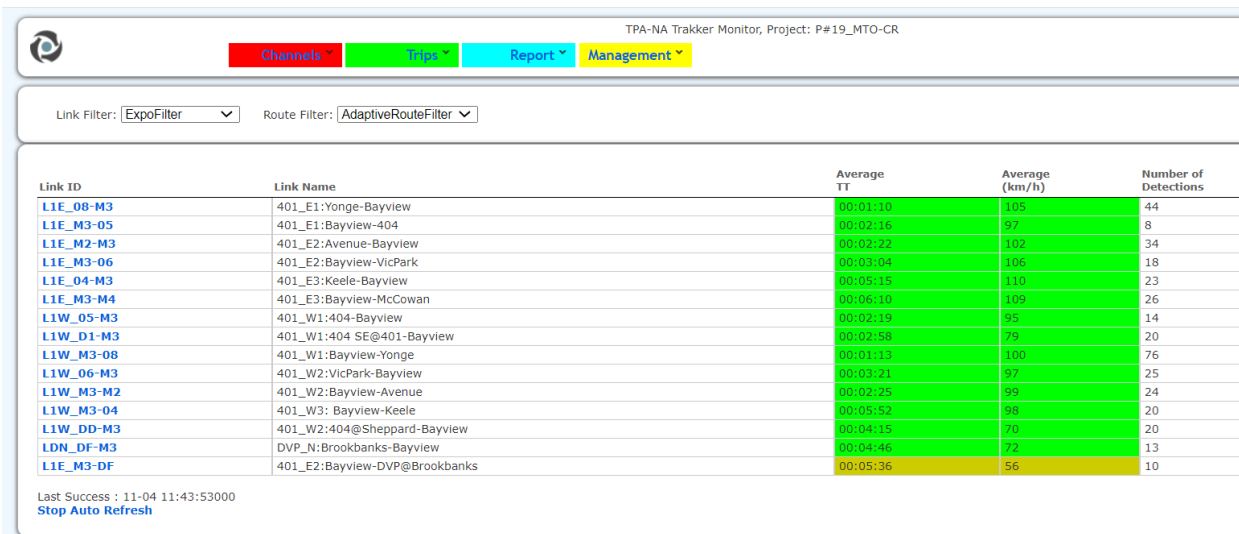


Figure 2 Summary of Links travel time and speed



Figure 3: Bluetooth detections

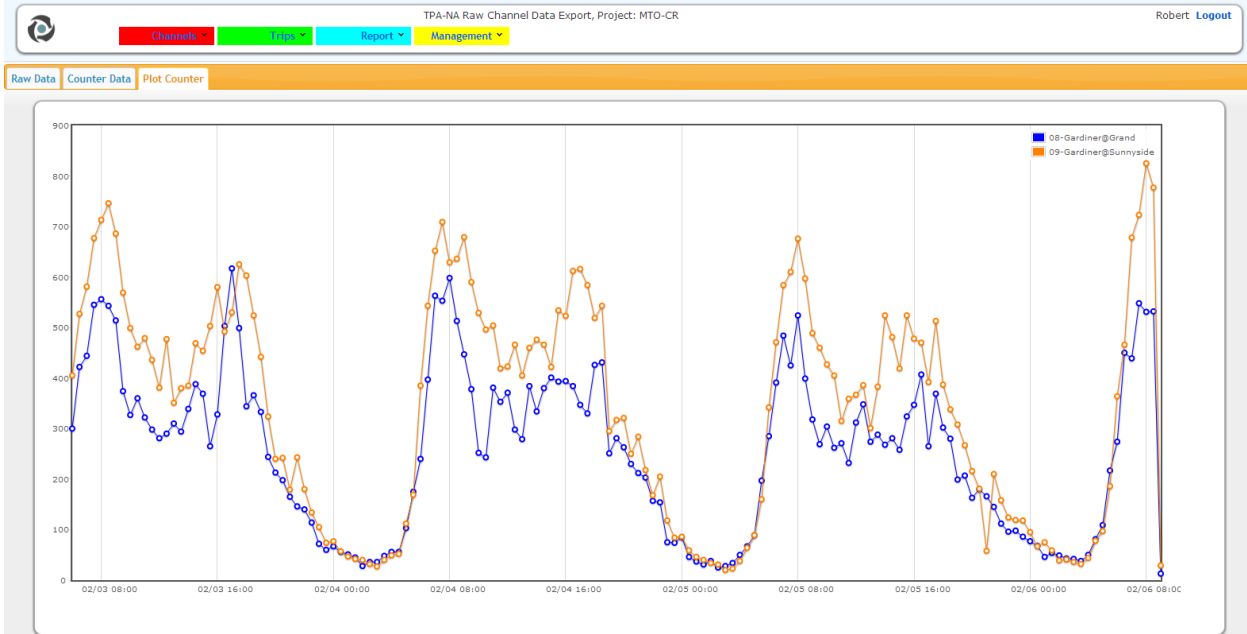


Figure 4 Bluetooth detection chart

<b>Y22:XML 401VW0010VEE:401 Eastbound EXP West of 400</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 8 MIN TO BAYVIEW 10 MIN TO 404/DVP 15 MIN TO MCCOWAN	<b>Y33:XML 401VW0010VVC:401 Westbound COLL at Weston</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 5 MIN TO AIRPORT VIA 409 8 MIN TO FINCH VIA 409/427 16 MIN TO 401 / MAVIS RD	<b>Y09:XML 401VW0010VVE:401 Westbound Exp at Weston</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 3 MIN TO DIXON RD 6 MIN TO RENFORTH DR 16 MIN TO MAVIS RD
<b>Y58:XML 401VW0020VES: 401 Eastbound East of Dixon</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 5 MIN TO HWY 400 5 MIN TO ALLER RD 12 MIN TO YONGE	<b>Y24:XML 401VW0020VSF:400 Southbound South of Sheppard</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 12 MIN TO 404 VIA 401 E 8 MIN TO 427 VIA 401 W 12 MIN TO QEW VIA 401/427	<b>Y07:XML 401VW0020VVC:401 Westbound COLL West of Renforth</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 6 MIN TO 410 / STEELES 15 MIN TO 403 / DUNDAS 21 MIN TO 401/TRAFALGAR
<b>Y10:XML 401VW0020VVS:401 Westbound West of Dixon</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 5 MIN TO 410 / 403 6 MIN TO QEW VIA 427 S	<b>Y03:XML 401VW0030VEC 401 Eastbound COLL East of Dixie</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 10 MIN TO 400 VIA 401 E 5 MIN TO 409 VIA 427 N 8 MIN TO QEW VIA 427 S	<b>Y57:XML 401VW0030VEE:401 Eastbound EXP East of Dixie</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 10 MIN TO 400 VIA 401 E 5 MIN TO 409 VIA 427 N 8 MIN TO QEW VIA 427 S
<b>Y35:XML 401VW0030VVE:401 Westbound Coll West of HWY 410</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 28 MIN TO GUELPH LINE 38 MIN TO HWY 6 NORTH 47 MIN TO HWY 8 KITCHENER	<b>Y21:XML 401VW0030VVE:401 Westbound Exp West of Renforth</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 21 MIN TO TRAFALGAR 27 MIN TO HWY 25 19 MIN TO QEW/TRAFALGAR	<b>Y04:XML 401VW0031VEE:401 Eastbound West of Renforth</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 6 MIN TO HWY 400 13 MIN TO AVENUE RD 18 MIN TO HWY 404
<b>Y37:XML 401VW0040VEC:401Eastbound East of Hurontario</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 5 MIN TO 410 / STEELES 8 MIN TO 409 / 427 14 MIN TO 400 / 403	<b>Y25:XML 401VW0040VEF:409 Eastbound at 409/ Kipling</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 4 MIN TO HWY 400 9 MIN TO AVENUE RD 14 MIN TO HWY 404	<b>Y36:XML 401VW0040VVE:401 Westbound Exp West of HWY 410</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 26 MIN TO GUELPH LINE 35 MIN TO HWY 6 NORTH 45 MIN TO HWY 8 KITCHENER
<b>Y19:XML 403VN0010VEF:7B - 403 Toronto bound at King Rd</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 12 MIN TO QEW/FORD DR 31 MIN TO HWY 406 VIA QEW NIAGARA	<b>Y08:XML 404HOV1:404 HOV Tunnel</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 5 MIN TO AVENUE RD 10 MIN TO 400	<b>Y69:XML 410VN0010VSS: CourtneyPark@410</b> 2020-11-04 13:35 Voltage 0.01 Message Owner Priority 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:

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