Platform and Toolbox for Mobility Improvement and Performance Monitoring

Big Data for Automated Driving Technology, Transportation Planning, and Engineering
2018 10th SF Bay Area ITE/ITS CA Joint Transportation Workshop
Outline

1. Relevance and ampleness of traffic data
2. Ticon platform for data collection and analysis
3. Ticon Customer-oriented reporting system (on the example of ‘BEFORE-AFTER’ analysis
4. Cyclical workflow for successful ITS implementation and mobility improvement
5. Forensic retrospective analysis
Traffic data virtual space

Data resolution

Road network coverage

Time coverage
Traffic data virtual space

- Data resolution
- Road network coverage
- Time coverage

Permanent detection
Traffic data virtual space

Data resolution

Permanent detection

Portable detection
Traffic data virtual space

Data resolution

Road network coverage

Time coverage

Hardware inaccuracy

Usual AADT inaccuracy

Relative error

Time coverage

year
month
week
2 days

0%
10%
20%
30%
-10%
-20%
-30%
-40%
-50%
-60%
Traffic data virtual space

Data resolution

Permanent detection

Portable detection

GPS-based methods

Road network coverage

Time coverage
Traffic data virtual space

- Permanent detection
- Portable detection
- GPS-based methods
- Ticon

Data resolution

Road network coverage

Time coverage
Our Mission

To deliver ample, accurate and available traffic data to the industry. These data should be:

1. Available for any road
2. Ample to ensure true understanding of traffic changes and traffic regularities over time and space
3. Accurate enough for the task they are used
4. Affordable enough to prevent the loss of ITS quality due to attempts to reduce the data collection expense
5. Arranged and aggregated for decision-making
Ticon platform

MyTraffic
- Business site analysis
  - Speed-volume analysis
  - Saturation analysis

Trafficscope
- Before-after analysis
  - Capacity analysis

Congestion analysis
- Before-after analysis

T4/SA
- Retrospective analysis

Virtual transportation model

AI modules
- RNM, RCBM, RNMX, DSD, CM

Data types
- GIS, GPS, TO, TEM, LBS, DD, TC, TD

Reports
- Analytical Tools
- Model
- AI Modules
- Data
<table>
<thead>
<tr>
<th>Data Type</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS</td>
<td>Road configuration, federal road classes...</td>
</tr>
<tr>
<td>TO (traffic organization)</td>
<td>Traffic signs, signals, lanes, public transport, crossings...</td>
</tr>
<tr>
<td>TEM (events &amp; management)</td>
<td>Traffic incidents, events, repairs, etc.</td>
</tr>
<tr>
<td>GPS</td>
<td>Speed distribution, sample sizes, aggregated tracks, etc.</td>
</tr>
<tr>
<td>LBS (location based services)</td>
<td>Mobile phones requests information. Secondary, functionally relevant to people, not vehicles</td>
</tr>
<tr>
<td>Demographics</td>
<td>Mobile phones requests information. Secondary, functionally relevant to people, not roads</td>
</tr>
<tr>
<td>Traffic Counters</td>
<td>AADT based on 1-7 days counting</td>
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<tr>
<td>Traffic Detectors</td>
<td>Volume data based on continuous monitoring</td>
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## Ticon AI Modules

<table>
<thead>
<tr>
<th>Ticon AI Modules</th>
<th>Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road network module</td>
<td>Connected routes and passes</td>
</tr>
<tr>
<td>Road class behavioral module</td>
<td>Drivers’ behavior depending on the specifics of the road and surrounding</td>
</tr>
<tr>
<td>Road network matrix</td>
<td>Roads with control equipment, signs and marking</td>
</tr>
<tr>
<td>Dynamic speed-density module</td>
<td>Traffic flow</td>
</tr>
<tr>
<td>Congestion module</td>
<td>Vehicles behavior under saturated and oversaturated conditions</td>
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</table>
## Ticon Analytical Tools and Outcomes

<table>
<thead>
<tr>
<th>Tool</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Speed – volume analysis</td>
<td>Traffic flow volume and speed distribution for each section, for chosen time intervals</td>
</tr>
<tr>
<td>Saturation analysis</td>
<td>Saturation degree for segments, intersections and approaches for chosen time periods</td>
</tr>
<tr>
<td>Capacity analysis</td>
<td>Degree of use and capacity limits for road sections and intersections for chosen time periods</td>
</tr>
<tr>
<td>Before-after analysis</td>
<td>Comparative data and improvements’ efficiency</td>
</tr>
<tr>
<td>Retrospective analysis</td>
<td>Temporal changes in areal traffic conditions</td>
</tr>
<tr>
<td>More tools to arrive ...</td>
<td>Cover Customers needs</td>
</tr>
</tbody>
</table>
# Ticon Reports

<table>
<thead>
<tr>
<th><strong>Ticon Reports</strong></th>
<th><strong>Features</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MyTraffic</strong></td>
<td>Delivers temporal parameters of traffic flows for business site analysis, incl. evaluation of site locations and operation planning</td>
</tr>
<tr>
<td>** Trafficscope**</td>
<td>Determines improvement efficiency for smart cities and mobility improvement challenges through ‘before-after’ analysis</td>
</tr>
<tr>
<td><strong>T3/CA</strong></td>
<td>Helps in transportation planning through capacity analysis</td>
</tr>
<tr>
<td><strong>T4/SA</strong></td>
<td>Helps in signal timing optimization and traffic management through saturation analysis</td>
</tr>
<tr>
<td><strong>T5/RED</strong></td>
<td>Helps in real estate development through retrospective analysis and forecast of transportation conditions</td>
</tr>
<tr>
<td><strong>More products to arrive...</strong></td>
<td>Comes from Customers’ feedback</td>
</tr>
</tbody>
</table>
Example: Before-After analysis by Trafficscope

# Before-after analysis report structure

<table>
<thead>
<tr>
<th>Report section</th>
<th>Content</th>
<th>Intended for</th>
</tr>
</thead>
</table>
| Benefits at a glance         | - Travel time reduction
                           - Traffic delay benefits                                                  | Project leader to overlook total outcome at one page                         |
| Performance analysis         | - Distribution of traffic delay over time and space
                           - Speed-VOLUME changes along the corridor                                  | Project manager to understand problematic time slots and road sections       |
| Detailed performance study   | - Detailed Speed-VOLUME changes along the corridor
                           - Saturation degree for all intersections
                           - Set of data for further analysis and export to preferred traffic modelling and optimization software | Traffic engineer for detailed analysis and further improvements’ implementation |
Benefits at a glance: Traffic delay matrix

Traffic delay benefit
Eastbound

Statistics:
- Maximal hourly gain: 168.96 s/veh
- Maximal hourly loss: 0.88 s/veh
- Average daily gain: 19.39 s/veh
- Average gain for AM peak: 19.02 s/veh
- Average gain for PM peak: 22.37 s/veh
- Average Traffic Delay Before: 77.11 s/veh
- Average Traffic Delay After: 57.72 s/veh
- Average Traffic Delay benefit: 25%
Traffic delay along the corridor

Eastbound Friday
4 pm - 6 pm

Distance, ft (0...13638 ft from Strong St NW to Freedom Pkwy NE)

Delay Before
Delay After
Parkway Dr NE - North Ave NE.
Saturation analysis

Reference period: Friday from 12 AM to 12 PM
Average speed gain: 22.91%
Average speed gain from 4 pm to 6 pm: -6.85%
Traffic Speed and Volume changes evaluation

Eastbound Friday
4 pm - 6 pm

Distance, ft (0\...13609 ft from Strong St NW to Freedom Pkwy NE)

- Speed Before
- Speed After
- Volume Before
- Volume After
Traffic Speed and Volume changes evaluation

Techwood Dr. NW – North Ave NE
Wednesday, Eastbound
Workflow on the example of signal timing update

- Data exchange with decision-maker
- Identification of problematic time periods
- Identification of problematic road segments
- Traffic delay benefits analysis
- Speed / volume analysis
- ITC tune-ups
- Saturation analysis
Forensic and historic capabilities: "Back to the future"
Conclusions

1. Ticon opens new possibilities for mobility improvements due to its ample data model, comprehensive processing algorithm and Customer-oriented reporting system. Good performance of Ticon algorithm is fueled by the use of multi-sourced, high resolution data processed by comprehensive proprietary algorithm (patents pending).

2. Ticon platform is “affordably unlimited”, which allows fast scaled implementation of Smart city philosophy, as well as effective tune-ups of implemented ITS.

3. Ticon areal study of road capacity along with forensic retrospective analysis allows for choosing most efficient projects and transportation planning aimed for fast mobility improvement.

4. Ticon allows for performance based pricing model for ITS implementation.