Big Data in Transport Case Study: Open Traffic

Purpose: Information
Submitted by: World Bank Group
Big Data in Transport
Case Study: Open Traffic

On-going World Bank regional collaboration with GrabTaxi

Overview
Background

• Traffic congestion affects everyone – all social and income classes – and can exacerbate pollution and GHG emissions, as well as restrict urban economic growth.

• Resource-constrained traffic management agencies are challenged to mitigate congestion.

• Starting in 2011, the project team worked with the Cebu City Government to develop an open-source platform for collecting, visualizing, and analyzing traffic speed data derived from taxi drivers’ smartphones.

• This pilot project successfully achieved a proof of concept and the platform, Cebu Traffic, won first prize in the 2013 Philippines National E-Governance Competition.

Background

• With this success, the project team then sought to use these proven methodologies to support the development of a replicable, inexpensive alternative to traditional travel time and congestion data collection and analysis.

• **Objective**: Empower resource-constrained agencies to make better, evidence-based decisions that previously had been out of reach – decisions about traffic signal timing plans, public transit provision, roadway infrastructure needs, emergency traffic management, and travel demand management.
Background

• To this end, the team partnered with GrabTaxi, an on-demand taxi service that generates taxi GPS data in countries the Bank supports, as well as Conveyal, an open-source transport software development firm.

• With these partnerships and support from the World Bank’s Big Data Challenge Innovation Grant, the team improved upon the initial pilot platform, tested it with data from six countries, and deployed the platform in Cebu City for live testing.

The Difference

Big Data Makes
1/3 of the global population is expected to have a smartphone by 2017
Think of Smartphones as Traffic Probes

GPS and Wi-Fi pings create a sensor network that:
- is not limited to specific corridors
- is continuously updated in real time
- does not require any maintenance or upkeep

Rise in Taxi Hailing Apps and TNCs

These companies maintain databases of millions of GPS points that crisscross urban areas, and each company’s individual database may span more than a hundred cities, across many countries.

Do you realize what this means?
1 web-based, open-source application + 1 regional data partnership = traffic monitoring and management across dozens of APEC cities

Open Traffic Methodology
Density of GPS location points captured from participating taxis during Cebu Traffic pilot (2013)

Three Step Methodology:

1. Calling of the relevant Open Street Map (OSM) tiles.
2. Assigning virtual “detectors” to the OSM tiles.
1. Calling OSM Tiles

What is Open Street Map?

- OSM is a free, global geographic dataset populated by volunteers.
- This map is considered “open data” and has no licensing requirements.
- The OSM may be freely updated and improved by transport agencies and others, per a project's particular needs, using free and open-source editing tools made available by the OSM Foundation.
1. Calling OSM Tiles

• The Open Traffic platform links average traffic speed calculations to OSM road segments.
• “Calling” the relevant OSM “tiles” means downloading the relevant portion of the global OSM map for use in calculating average traffic speeds.
• While it is possible to download the entire global OSM map for these analyses, for the sake of speed and efficiency, only those tiles that are needed to estimate traffic speed for a given set of GPS points are called.

2. Assigning Virtual Detectors
3. Estimating Travel Time

Illustration of how GPS points are used to estimate timestamps for virtual detectors

\[
\text{Time at D}_2 = \left[\frac{1.0 \text{ km}}{1.5 \text{ km}} \times (0:30 - 0:10)\right] + 0:10 = 0:23 \\
\text{Travel Time from D}_1 \text{ to D}_2 = 0:23 - 0:05 = 18 \text{ minutes}
\]
"Driving Economic Growth through Inclusive Mobility and Sustainable Transport Systems."

Let’s Try It!

(APECTM9)
Initial Results

Peak Hour Analysis
Congestion Variability
Screenshot from First Iteration of Open Traffic Platform under the Big Data Challenge Project, with EDSA 7.4 km Stretch

Vulnerability Analysis
Northbound Trip - Average Travel Time and Speed on Fridays at 6:00 p.m.

Northbound Trip – Average Travel Time and Speed for Friday, July 24, 2015
Southbound Trip – Average Travel Time and Speed on Friday, July 24, at 6:00 p.m.

Travel Time Survey
Travel Time Survey Comparison for Cebu South Road to Mactan Airport: 2009
Traditional Travel Time Survey vs. Open Traffic Output (kph)
Next Steps

Software Development Completion

Phase I
• User Interface Improvement
• Administrative Interface Development
• Confidence Intervals
• Aggregated Traffic Speed Data Export

Phase II
• Critical Road Segment Analysis
• Comparative Cost of Congestion Analysis
Optimizing Traffic Signals

Cebu Pilot Program Objective
Develop a methodology for improving traffic signal timing plans for select corridors in Cebu, without the need for regularly updated turning counts and/or fully-functioning detectors / sensors.

Emergency Service Dispatch
Combine DRIVER with traffic speed data to derive optimal ambulance and emergency services stations and dispatch.
Open Traffic for All

As part of the World Bank’s mission and GrabTaxi’s corporate social responsibility mandate, we would like to make this open-source platform available to all transport agencies and ministries in APEC countries where GrabTaxi operates, without charge.

Open Traffic for All

In return, we ask that you try Open Traffic. That you use these data to support evidence-based decisions that will improve traffic, for the public good.
For More Information:

Interim Project Report

Contacts
Holly Krambeck, hkrambeck@worldbank.org
Natasha Beshorner, nbeschorner@worldbank.org
Atty. Rafael Yap, rclyap@yahoo.com
Deevya Desai, deevya.desai@grabtaxi.com

Thank you!
Extra Slides

Optimizing Traffic Signals

Methodology
1. Using turning counts conducted by Cebu City Transportation Office from February through March, 2015, update the SCATS timing plan for N. Bacalso Ave., using traditional signal optimization methods.
2. Using only taxi GPS data provided by GrabTaxi, develop a new algorithm for optimization. Iterate.
3. Compare:
   1. Business-as-Usual
   2. Brief period when signals turned off (January 2015)
   3. Updated signal timing, traditional method (July 2015)
   4. Updated signal timing, GPS method (tbc)