What kind ITS menu is suitable for Hanoi?

−Seed of Contemplation based on Global Trend−

Hiroshi WARITA
Table of Contents

- Global Trend of ITS
- Traffic Control System for Urban Expressway in Japan
- Advanced Utilization of Floating Car Data
- What Kind ITS Menu is Suitable for Hanoi?
Global Trend of ITS
Location Based Data

- from Passive (One-way) to Active (Two-Way) Communication
  - Drastic Spread of Smartphones
  - Smartphones as Powerful Tool of SNS & FCD (Floating Car Data)
    - not only Information Collection but also Data Provision
    - Need Good Internet Condition for always-on Connection
  - Reliable Information
    - Can be Used for TV Traffic NEWS

- for Motorcyclist
  - Useful Information for Motorcyclist based on Vehicle’s System

http://www.waze.com/
http://www.honda.co.jp/internavi/
Location Based Data

➢ for Getting More Probe Data
  ■ Traffic Flow Monitoring by using Probe Vehicles with Spacing Measuring Equipment
  ■ Develop a Traffic Volume Estimation Method that Based on the Sensing Target Vehicles
  ■ Decrease the Burden on Road Authority
    • Reducing Road Side Equipment

Spacing

(c) Fuji Heavy Industries

Source: Asakura-Lab., Transport Studies Unit, Tokyo Institute of Technology (http://transport-titech.jp/)
Road Asset Management (Over-Loaded Control)

- Soundness of Road Infrastructure
  - Reduced Damage caused by Overloaded Vehicles
  - Can also be used for Tracking of Vehicles Carrying Dangerous Goods

http://www.oregon.gov/ODOT/HWY/OIPP/Pages/TRUE.aspx
Transportation Fare Collection

- VMT (Vehicle Miles Traveled) Fee
  - Paying Our Way’s Maintenance Cost
  - To Push Modal Shift
  - Payment According to Value
    - Motivation to use ITS Technology
Transportation Fare Collection

Inter Modal

- Convenience of Transit
  - Physical and Payment
  - Un-Integrated between Public Transportation and ETC
- For More Convenience
  - Idea of the True Integrated Total Transportation
  - Feasible Technology

http://mtecheng.co.za/
TCS for Urban Expressway in Japan
in Service: 301.3 km
under Construction: 21.2 km
Total: 322.5 km

Traffic Volume: 400 M/y
Freight Traffic: 35%
VIP’s Passage: 440/y
Accident: 11,000/y
Breakdown: 12,000/y
Fallen Objects: 32,000/y
Traffic Condition of MEX

- Occurrence of Serious Congestion (in Particular, Inner Circular Route)
Devices of TCS

Collection

- Vehicle Detector
- Anemometer
- CCTV Camera
- Emergency call
- Patrol Car

Processing Exchange

- Processing System
- Exchange System
- Traffic Control Center

Provision

- Variable Message
- Travel Time
- Graphic
- Wind Speed
- Graphic Information on street
- MEX Navigation
- ITS Spot (VICS)
Traffic Control Room

for Find, Dispatch & Removal Incidents ASAP

Operator’s Console
Advanced Utilization of FCD
### Traffic Information Provision for Surface Streets

- It is provided only for the major arterial roads…
  - on which the sensors are installed.
- Poor explanation on the traffic situations…
  - for pre-trip drivers.
- Low accessibility to the sensor data…
  - owned by the government.
- Few works for the incident detection…
  - comparing with the case in ‘sensor-rich’ expressways.

---

**Real network in Tokyo**

**Traffic information (JARTIC)**
Use of Probe Data

- Wide coverage over the surface street network.

However…

- Only the ‘link-wised’ aggregated data is used.
  - Low update frequency for minor streets.
  - No guarantees on the free flow conditions on ‘non-colored’ links.

Therefore…

- Traffic Condition is defined by each grid using Macroscopic Fundamental Diagram
  That is called…

Traffic Scope ~ for Better Understanding of Urban Traffic Conditions

Area Based Traffic Information using FCD
Evaluation of Near-Miss using FCD

- **Background**
  - Black Spot (Car Crash occurs frequently)
  - Improvement of Lane Mark

Before: \(2+2 \Rightarrow 2\)

After: \(1+1 \Rightarrow 2\)

Simplification
Evaluation of Near-Miss using FCD

- **Evaluation**
  - Reduction of Rapid Deceleration as Quick Announcement
    - Before: 16/month → After: 5/month
  - In Fact...
  - Reduction of Accident
    - Before: 11/11months → After: 1/11months … 90% reduction!!!
What Kind ITS Menu is Suitable for Hanoi?
- Instead of Conclusion -
What Kind ITS Menu is suitable for Hanoi?

Which do you want?

or

or

and

?
Data Integration

- Characterized of Devices using Time-Space Diagram
  - No Universal Device
  - Should Choose Devices for Purpose

- Space
- Probe Data
- Vehicle Detector
- DSRC ETC
- Time

- collect the travel speed of limited vehicles on all trajectory
- collect the travel speed of limited vehicles on the section
- collect the travel speed of all vehicles on the point
Data Integration

Visualization

Layer Structure

- Integrated Many Kinds of Data depending on Purpose
Making Full Use of Rich Data

Data Collection → Data Processing → Data Exchange → Info. Provision → Analysis Assessment R & D
Full Use of Rich Data (Analysis)

Traffic Phenomena

- Fundamental Diagram based on Rainfall Level
  - Integrated Many Kinds of Data depending on Purpose

Source: “DOES WEATHER AFFECT HIGHWAY CAPACITY?”
5th TRB International Symposium on Highway Capacity and Quality of Service
**Full Use of Rich Data (Assessment)**

- **Performance Index**
  - e.g. Annual Report of Road (Traffic) Performance

---

**Congested Corridors (U.S. Only for 2011)**

![Congested Corridors Table]

<table>
<thead>
<tr>
<th>2011 Rank</th>
<th>Metro</th>
<th>2016 Rank</th>
<th>Roadway From -&gt; To</th>
<th>Length (Miles)</th>
<th>Worst Peak (AM/PM)</th>
<th>Travel Time (Mins)</th>
<th>Average Speed (Mph)</th>
<th>Delay (Mins)</th>
<th>INRIX Index</th>
<th>Index change 2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Los Angeles</td>
<td>4</td>
<td>I-105 NB from I-105 IMPERIAL HWY to GETTY</td>
<td>13.1 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>New York</td>
<td>1</td>
<td>Long Island Expwy EB from MARIAN AV/EDST</td>
<td>15.0 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Los Angeles</td>
<td>7</td>
<td>I-10 EB from CA-MUNICOL DIVIDEND 15 to A.</td>
<td>14.9 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>New York</td>
<td>9</td>
<td>Van Wyck Expwy NB from BEL年 HOWZINE to A</td>
<td>3.1 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Los Angeles</td>
<td>3</td>
<td>I-6 WB from EAST CAESAR CHAVEZ AVE to VA.</td>
<td>17.5 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>New York</td>
<td>8</td>
<td>Brooklyn Queens Expwy SB from NY-254/HOWZINE</td>
<td>10.2 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Los Angeles</td>
<td>24</td>
<td>I-405 EB from NORDHOFF ST to MULHOLLAN.</td>
<td>8.1 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>New York</td>
<td>6</td>
<td>Van Wyck Expwy SB from HORACE HARDING E.</td>
<td>6.2 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Pittsburgh</td>
<td>15</td>
<td>I-279 NB from LYNDIA EXIT 2 to US-19 TK RT.</td>
<td>3.4 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>San Francisco</td>
<td>13</td>
<td>CA-4 EB from BAILEY RD to SOMERSVILLE RD</td>
<td>5.5 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Riverside</td>
<td>5</td>
<td>CA-51 EB from CA-55/COSTA MESA FWY to M.</td>
<td>20.7 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Los Angeles</td>
<td>20</td>
<td>CA-110 NB from I-105 SANTA MONICA FWY to S</td>
<td>3.1 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Miami</td>
<td>40</td>
<td>Dolphin Expwy WB from I-95 to FL-96RED RD</td>
<td>5.5 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Chicago</td>
<td>4</td>
<td>I-655/44 WB (Dan Ryan/Kennedy Expwy) from P.</td>
<td>15.9 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Boston</td>
<td>16</td>
<td>I-93 NB from MA-28/BURLINGTON AVE/EXIT 5 to .</td>
<td>10.4 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Los Angeles</td>
<td>19</td>
<td>I-10 EB from NLRP ST to I-605</td>
<td>17.6 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Chicago</td>
<td>34</td>
<td>Stevenson SB from STATE ST/EXIT 200 to RU</td>
<td>5.7 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Los Angeles</td>
<td>10</td>
<td>I-10 EB from CITY TERRACE DR/HERBERT AV.</td>
<td>12.8 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Honolulu</td>
<td>30</td>
<td>I-11 EB from 11-12 to S VINEYARD DR/VANOWEN</td>
<td>3.9 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>New York</td>
<td>11</td>
<td>Cross Bronx Expwy WB from CONNER ST/EXIT 1.</td>
<td>11.3 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Washington</td>
<td>14</td>
<td>I-55 EB from I-355 to RUSSELL RD/EXIT 140</td>
<td>23.9 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Chicago</td>
<td>93</td>
<td>Eisenhower WY from S ASHLAND AVE/EXIT 28</td>
<td>0.9 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Los Angeles</td>
<td>36</td>
<td>I-10 WB from I-50/GOLDEN STATE FWY to NAT1</td>
<td>12.6 AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Full Use of Rich Data (R&D)

➢ Traffic Condition Prediction
  ■ Improved Prediction Technology
    • On-Demand Optimum Travel Time with Trend
    • Expectation to Distribute Traffic Demand: Time & Route
Full Use of Rich Data (R&D)

- Traffic Condition Prediction
  - Improved Prediction Technology
    - High Accurate Mass data


http://www.honda.co.jp/internavi/pickup/flood/

20140526_ITS Workshop @ Hanoi_Hiroshi WARITA
Full Use of Rich Data (R&D)

- Visualization
  - Utilized for the Benefit of the Public
  - Effective Method for Easily Understanding of the Complex Data
    - e.g. Driving Result on Map by FCD Record in Case of Huge Disaster

http://www.honda.co.jp/

Congestion Level

Passable Route

http://www.nhk.or.jp/
for Finding Best Solution

What is Meaning of Capacity (Ability)?

- Tool should be used to obtain effectiveness
  - It's amazing how much space we use when we drive.
  - Using bikes more can cut congestion & CO2 emissions, space!

http://www.mobilityweek.eu/
Small and Smart Community

- Different Transport Modes between Inter and Intra City
  - Different Function of Expressway and Street?

- BRT as Mass Transit
  - Consideration for Accessibility, Demand Balance and Operation

[Images and links to http://brt.mercedes-benz.com/ and http://tehranlive.org/]

(for Finding Best Solution)
Let’s Find Best Solution for Hanoi!

warita@iis.u-tokyo.ac.jp