Overview on transport data and MRV potential in Asia

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Transport Sector and NAMAs: Assessing Data Readiness for MRV
Pasig, Philippines
9 February 2012
Outline

• Background and context
• Overview on transport data management in Asian countries and cities
• Parameters necessary for emissions estimation
• Transport planning – national, regional, and city plans – country experiences
Increasing motorization

Source: 2009. ADB, CAI-Asia, Segment Y Ltd., and IEA

[Graph showing increasing motorization trends for ASEAN (Major Countries), China, India, OECD North America, OECD Europe, and OECD Pacific from 2005 to 2035.]

Source: 2009. ADB, CAI-Asia, Segment Y Ltd., and IEA
Decreasing conventional oil production

Global oil production reaches 96 mb/d in 2035 on the back of rising output of natural gas liquids & unconventional oil, as crude oil production plateaus

Source: OECD/IEA, 2010. In Fulton, L. Global modal shift scenario -complementing Energy and CO2 benefits through implementing the Bangkok 2020 Declaration. Presented at UMI-EST, 4-6 December 2011, New Delhi, India
Data Availability by Mode and Attributes in Selected Asian Countries

<table>
<thead>
<tr>
<th>MODE</th>
<th>Transport Fuel</th>
<th>Vehicle Type</th>
<th>Spatial Scope</th>
<th>Purpose</th>
<th>Vehicle Property</th>
<th>Operation</th>
<th>ALL ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>-</td>
<td>-</td>
<td>13%</td>
<td>13%</td>
<td>-</td>
<td>-</td>
<td>13%</td>
</tr>
<tr>
<td>Bike</td>
<td>-</td>
<td>-</td>
<td>8%</td>
<td>13%</td>
<td>26%</td>
<td>-</td>
<td>16%</td>
</tr>
<tr>
<td>Road</td>
<td>64%</td>
<td>79%</td>
<td>92%</td>
<td>44%</td>
<td>66%</td>
<td>63%</td>
<td>68%</td>
</tr>
<tr>
<td>Rail</td>
<td>71%</td>
<td>81%</td>
<td>83%</td>
<td>34%</td>
<td>88%</td>
<td>50%</td>
<td>68%</td>
</tr>
<tr>
<td>Pipeline</td>
<td>100%</td>
<td>-</td>
<td>75%</td>
<td>-</td>
<td>69%</td>
<td>19%</td>
<td>63%</td>
</tr>
<tr>
<td>Conveyor</td>
<td>67%</td>
<td>-</td>
<td>38%</td>
<td>-</td>
<td>50%</td>
<td>13%</td>
<td>39%</td>
</tr>
<tr>
<td>Water Domestic</td>
<td>57%</td>
<td>75%</td>
<td>88%</td>
<td>-</td>
<td>71%</td>
<td>50%</td>
<td>68%</td>
</tr>
<tr>
<td>Water International</td>
<td>57%</td>
<td>88%</td>
<td>88%</td>
<td>-</td>
<td>88%</td>
<td>50%</td>
<td>74%</td>
</tr>
<tr>
<td>Air Domestic</td>
<td>100%</td>
<td>88%</td>
<td>100%</td>
<td>-</td>
<td>75%</td>
<td>69%</td>
<td>72%</td>
</tr>
<tr>
<td>Air International</td>
<td>100%</td>
<td>88%</td>
<td>88%</td>
<td>-</td>
<td>88%</td>
<td>63%</td>
<td>71%</td>
</tr>
<tr>
<td><strong>ALL MODES</strong></td>
<td><strong>75%</strong></td>
<td><strong>83%</strong></td>
<td><strong>67%</strong></td>
<td><strong>26%</strong></td>
<td><strong>69%</strong></td>
<td><strong>47%</strong></td>
<td><strong>55%</strong></td>
</tr>
</tbody>
</table>

Source: CAI-Asia and ADB. Transport Data in Asia Study (2011, Unpublished)

Note: Assessment included China, India, Indonesia, Nepal, Philippines, Pakistan, Sri Lanka, and Vietnam
Data Quality and Accessibility

Example: Vehicle Registration Data Flow in Sri Lanka

Dept of Census & Statistics

Veh class, Fuel used

Central Bank of SL

Vehicle class

Divisional Secretariat: Data Generator

For annual revenue license: Vehicle class, Fuel used, Vehicle weight, others

Dept of Motor Traffic: Data Generator

New Registrations: Vehicle make, Color, Manufacture year, Model, Veh. No., Engine No., Tire size, Wheel base, Chassis No., Type of body, Gross veh. weight., Veh category, Ownership, Usage, Import license, Overall measurement, Purpose of use, Registration status, Driving side, Country of origin, Fuel used, Payload, Cylinder capacity, Seating capacity, Veh type description by manufacturer

Easily accessible to data users

Data quality checks

Potential errors and uncertainties

Data availability

Ease of accessibility

CAI-Asia, 2010
## Reasons: Need-based Data Collection

### Enforcement & Regulation
- Data Requirements for inspection & regulation of motor vehicles
  - Vehicle registration by type of vehicle-registration; by type of ownership-registration; by type of vehicle-fuel; by type of technology; by type of vehicle
  - Vehicle registration transactions
  - Vehicle make, Motor number, Series, Type of body, color, serial/chassis no., Plate no., Body no., Fuel used, No. of door, Year model, Drive type, Accessories, shipping weight, Passenger capacity, Gross weight, Net weight, Weight empty, No. of axle, Max height

### Policy & Planning
- Route Re-validation Survey (assess demand-supply condition)
  - Average frequency of buses
  - Number of trips
  - Classified bus count
  - Routes and number of units & operators
  - Companies in weekend-day
  - Bus trip origin-destination weekend-day
  - Average travel time
  - Average trip length
  - Average total passengers
  - Average load factor
  - Pattern shift
  - Sample load profiles
  - Bus operating characteristics
  - Passenger load vs. capacity

### Estimating Emissions
- Data Requirements
  - Vehicle Population
  - Vehicle Imports
  - Traffic count
  - Trip length
  - Average vehicle km travelled
  - Travel speed - average
  - Passenger km
  - Trip mode share
  - Freight ton transported per km
  - Freight mode share
  - VKT per vehicle-fuel type
  - Fuel efficiency by vehicle-fuel type
  - Emission factor
  - Ridership/occupancy
  - Population, GDP
  - % Urban Population
  - % Biofuel blend in gasoline, diesel

### Monitoring
- Routinely monitored
- On demand
- Adhoc

*CAI-Asia, 2010*
Reasons: Budget Limitations

CAI-Asia, 2010

Routine Data Collected
- GDP at current prices by economic sector
- GDP at constant 1994 prices by economic sector
- Population and population density by province
- Average urban population by province
- Asphaltered, stone paved, mixed stone, soil road (km)
- Volume of passengers traffic by type of transport
- Volume of passengers traffic by the road by province

By Demand and Adhoc
- Volume of freight traffic by type of transport
- Volume of freight by type of transport
- Volume of freight by transport sector
- Inland waterways (km)
- Total length of bridges (m)
- Number of bridges
- Vehicle registration by vehicle type and by fuel type
- Origin-destination surveys
- Vehicle kilometer travelled (VKT) per veh-fuel type
- In-use veh population by veh type and fuel type
- Traffic count
- Occupancy
- Ridership

Needed for data planning

Investment Needed for data planning
## Reasons: Lack of Coordination

<table>
<thead>
<tr>
<th>Ministry</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transport</strong></td>
<td>• Motor vehicle registration</td>
</tr>
<tr>
<td></td>
<td>• Licenses issued</td>
</tr>
<tr>
<td></td>
<td>• Passenger and freight kilometers</td>
</tr>
<tr>
<td><strong>Rail</strong></td>
<td>• Length of railways</td>
</tr>
<tr>
<td></td>
<td>• Passenger and freight kilometers</td>
</tr>
<tr>
<td><strong>Public Works</strong></td>
<td>• Length of roads</td>
</tr>
<tr>
<td></td>
<td>• Surface type and paved roads</td>
</tr>
<tr>
<td></td>
<td>• Number and length of bridges</td>
</tr>
<tr>
<td></td>
<td>• Road accidents</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>• Fuel consumption by volume and by type of fuel</td>
</tr>
<tr>
<td></td>
<td>• Fuel pump price</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>• Emissions inventories</td>
</tr>
<tr>
<td><strong>Economy/ Trade/ Customs</strong></td>
<td>• Economic growth – , etc.</td>
</tr>
<tr>
<td></td>
<td>• Volume of trade; Vehicle imports</td>
</tr>
<tr>
<td><strong>Finance</strong></td>
<td>• Economic growth and infrastructure growth</td>
</tr>
<tr>
<td></td>
<td>• Transport investment</td>
</tr>
<tr>
<td><strong>Census</strong></td>
<td>• Population</td>
</tr>
</tbody>
</table>

Source: Based on author’s research for Transport Data in Asia Study (2011, Unpublished).
Reasons: Lack of Harmonized Methodologies and Limited Data Sharing

- Private sector databases not shared with government
- Inconsistent government data

CAI-Asia, 2010
Important parameters for emissions estimation – Schipper’s Activity-Structure-Intensity-Fuel

Fuel Use and Emissions from Transport 

\[ A \times S_i \times I_i \times F_{i,j} \]

- **Total Transport Activity**
- **Veh-km and pass-km by mode**
- **Occupancy/Load Factor**
- **Modal Energy Intensity**
- **Emissions per unit of energy or volume or km from fuel J in mode I**
- **Technological energy efficiency**
- **Vehicle characteristics-Weight, power, etc.**
- **Vehicle fuel intensity**
- **Real drive cycles and routing, driver behavior**

Measure each component for making better decisions in future. The current emphasis on CO\(_2\) measurement allows a window of opportunity to generate better data and more logical project decision making !!

Source: Schipper, et.al., 1992
## Activity and vehicle data availability

<table>
<thead>
<tr>
<th>Parameter</th>
<th>National Level Availability</th>
<th>Local Level Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered vehicles</td>
<td>Yes</td>
<td>?</td>
</tr>
<tr>
<td>PARC data (vehicles on road)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fuel split</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Technology split</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Average age</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Emission factor</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average VKT/Year</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Average VKT/Corridor type</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Average speed per Corridor</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Average occupancy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Average loading</td>
<td>Yes (at corridor level)</td>
<td>At corridor level</td>
</tr>
</tbody>
</table>

*Source: Gota. S. (Unpublished) Crunching numbers*
High Variability of Emissions Estimates
National Level: Case of India

India transport emissions baseline and forecast done by more than 20 reputed institutions and publications

Source: Gota. S. (Unpublished) Crunching numbers
High Variability of Emissions Estimates City Level – Case of Bangalore, India

CO₂ Emissions tons/day

- Uses registered Vehicles
- Considers Person Trips
- Includes freight

CO₂ Emissions tons/day

- Bangalore - Metro (forecasts for 2007)
- Bangalore - CTTS 2007
- Bangalore - MOUD 2008
- KSPCB - 2008
- SIM - AIR 24

TRIP MODE SHARE

- Cars
- Motorcycle
- Taxi
- Bus
- Walking
- Bicycle

Source: Gota. S. (Unpublished) Crunching numbers
TEEMP city is an assessment tool to provide guidance on CO₂ and air pollution emissions including fuel consumption and other co-benefits to the policy makers while preparing the mobility plans/low carbon transport plans.

TEEMP city is being developed by CAI Asia and ITDP and financed by Veolia Environnement Institute (would be released in 2012)

It is a simple bottom-up excel spreadsheet (with defaults) tool to:

1. Evaluate the impact of mobility plans/low carbon transport plans on CO₂ emissions
2. Quantify the co-benefits of implementing such transport plan (fuel consumption, air pollution, safety benefits and travel time savings)
3. Assess the adequacy, comprehensiveness and governance related issues with respect to the mobility plan proposal/implementation and possible impact of such a measure.
4. Provide guidance on investment packages i.e. shift in investment pattern impact, increasing/decreasing the investment impact/ changing the proposal schedule etc.
TEEMP City - Evaluating impact of city investments

BAU

With Plan Scenario

Master Plan
CDP
CTTS
CMP
Low carbon Transport Plan

IMPACT – CO2, PM, NOX, Travel time, Fatality, Fuel savings

Projects Proposed/Investment Proposed

Scorecard / Evaluating CMP/CTTS/CDP/Low Carbon Transport Plan

CO2 savings as Predicted (range)?

Final OUTPUT/ Savings/ Investment

Final OUTPUT/ Savings/ Investments/ Project Proposals
TEEMP City - Evaluating impact of city investments (Case of Jaipur, India)

**Total Cost (million)**

- Project Scenario: ~5,074 million
- Revised Project Scenario: ~5,069 million

**Total CO2 Savings (tons)**

- Project Scenario: ~15,000 tons
- Revised Project Scenario: ~20,000 tons

**% of Motorized Trips**

- 2009: 100%
- Baseline 2030: [Graph showing distribution by mode]
- Mobility Plan 2030: [Graph showing distribution by mode]

**VKT (millions) BAU vs Mobility**

- Yearly comparisons from 2009 to 2029

**Fatalities BAU vs Mobility**

- Yearly comparisons from 2009 to 2029

**Hours (millions) BAU vs Mobility**

- Yearly comparisons from 2009 to 2029

Evaluating impact of city investments (Case of Jaipur, India)
Key issues

• Improve transport data collection and management
  – Need for consolidated transport database
  – Better coordination among various government agencies
  – Harmonization of methodologies and definitions
• Use ASIF as a basis for measuring and monitoring emissions – transparent, practical, and logical methodology
• Evaluating implications of city transport plans on emissions and other co-benefits
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