Transport Planning for Low Carbon Mobility in Secondary Cities: The Case of Chiang Mai

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Basic Principles

- **Transportation networks normally dominant shaper of Urban Form**
- Accessibility should be goal, not mobility
  - Accessibility: “ability of people to reach & take part in activities normal for that society”
  - Mobility: “average distance traveled in city per capita”
- “Everyone” agrees land use & transportation planning must be integrated: In reality: Separate land use planning & transportation planning / engineering bureaucracies distort urban form efficiency
  - Disconnect in aligning FARs, Zoning, Public Investment, etc.
Socio-economic Costs of Congestion

- Human time
  - Economic + social (family stress) costs
- GDP Loss
  - As high as 20% of potential GCP
- Discourages dense business centers: face-to-face innovation transactions
Environmental / Human Costs of Motorization

- Energy
  - Electric trains most energy efficient
- Conventional Pollution
  - E.g., Nano particulates
- GREEN HOUSE gases
  - E.g., CO2
- Health: China 750K Premature Deaths / Year
- Leading cause of Death & Injury
  - Thailand >25K deaths per year (WHO)
    - 3rd Highest Per Capita in World
  - Especially among young (motorcycles)
  - 2 Wheel Deaths: 75% (Cyclists 2%)
### Action Plan on Global Warming
Mitigation 2007 - 2012

**Executive Summary**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Year 2007</th>
<th>Year 2012</th>
<th>Year 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>21.18</td>
<td>25.30</td>
<td>19.77</td>
</tr>
<tr>
<td>Biofuels Energy (reduced GHG)</td>
<td></td>
<td>(-0.61)</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>14.86</td>
<td>16</td>
<td>13.75</td>
</tr>
<tr>
<td>Waste / Wastewater</td>
<td>1.13</td>
<td>1.13</td>
<td>0.95</td>
</tr>
<tr>
<td>Waste Recycle (reduced GHG)</td>
<td></td>
<td>(-0.28)</td>
<td></td>
</tr>
<tr>
<td>Others (estimate 15% of total GHG emission from other sectors)</td>
<td>5.58</td>
<td>6.36</td>
<td>6.36</td>
</tr>
<tr>
<td>Green Area (reduced GHG)</td>
<td>(-0.10)</td>
<td>(-0.10)</td>
<td>(-1.00)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>42.65</td>
<td>48.69</td>
<td>38.94</td>
</tr>
</tbody>
</table>

**Source:** BMA, 2007
Carbon Reduction

• Electric trains best, followed by bicycling, walking, electric motorbikes

• Individual Petrol Vehicles & 2-Cycle Motorcycles Problematic

• But Technological Change will dramatically reduce Petrol Vehicles: Thailand: BOI: HEVs, PHEVs, EVs
  • Volvo

• Carbon Reduction: Product of
  • 1. Mode Share
  • 2. Mode Technology / Vehicle Utilization Rate
  • 3. Kilometers Travelled related to Urban Form / Distribution of Activities, Density / Variation, Compactness, Nodality
  • 4. Consumer Travel Preferences
Secondary Cities Challenges

- Lack diversified economies – vulnerable
- If Tourist Cities: Peaking problems (seasonal visitors, second homes); public services overwhelmed
- Inefficient land use:
  - Lower densities
  - Lack of Nodes & Clearly Defined Axis
- Traffic congestion: car dependent & poor public transit systems
  - Lack but need appropriate rapid transit
  - Lack but need improved road systems, e.g., overpasses, direct arterials
- Urban expansion: Leap-frogging & fast falling densities
- Prematurely apply metropolitan urban form concepts: e.g., Satellite towns
- Lack of: (i) Individual attention (tendency to generalize group); (ii) Bargaining power with national govt, (iii) Access to best practice expertise
Mass Transit Trajectory

- Heavy Rail not suitable for secondary cities
- Bus Rapid Transit (BRT) can be initial step (Curitiba, Bogota, Jakarta, Kunming): 1/5 or less cost per km of LRT
  - Bogota BRT system reduced 1-way commute times from 70-42 minutes
  - BRT: $5-10 million USD per km
- Can upgrade to Light Rail (LRT)
Transport Development Principles

- Support Smart Growth: Density & Nodality managed well
- Aim for Necklace Structure (Corridors/Nodes) With Grid & Green Corridor Infill, e.g., Copenhagen Finger Plan
- Target balanced inter-modal transportation systems: Road, Rail / BRT, Feeder Bus, Cycling, Walking: Avoid auto dependency
- Use technologies appropriate to level of economic development
Nodality and FAR Potential: Tianjin, China

Source: Alain Bertaud
Nodality

- Justifies transportation investment
- Lowers unit infrastructure costs
- Creates Vital innovation / leisure environments
- Saves human time
- Saves energy
- Enables accessible affordable housing
Copenhagen Finger Plan
Necklace Form

Transit City
- Mixed Density
- Mixed Use
- Grid based
- Centralized

Source: Jeff Kenworthy
Taking Action

• Fuel Quality: National
• Fuel & Vehicle Taxes: National
• Congestion pricing / management
  • Zones: e.g., Singapore
    • Can be low tech
• Attempt smart growth
  • Density, Nodes / Corridors, Limit Leap-Frogging
Taking Action: Roads

• Proper management: Maximize Effectiveness of Current Road System
  • Traffic management: computer control of signals, electronic signage (congestion, parking)
  • Enforce Parking Regulations; Do not underprice
  • Relatively inexpensive for low income cities
• Cost effective hard infrastructure
  • Overpasses (aesthetic issues), combined with:
  • Super arterials
Road Overpass: Naples, FL

Source: MCM
Taking Action: Roads (con’t)

• Cost effective capacity: Do not design for fast flows at peak
• 24 hour road usage: Incentives to truck deliveries at night – timed entry ban
• Do not under price parking
Explore New Systems / Technologies

- CONSIDERABLE FLUX: Transport Planning Very Difficult
  - New Propulsion Systems: Source of Electricity, Carbon in Manufacturing
  - Autonomous Vehicles: Communal Vs Private
- Electric vehicles / carts in high density areas
  - “Orbit” Systems
- Para-transit (Vans, Jeepneys): Fastest growing form of transport in world
  - Manila: EV Jeepneys
- Driverless Vehicles, e.g., buses (in operation in Helsinki)
- Electric Motorcycles as Feeders?
Driverless Buses in Helsinki

Source: Wonder Discovery
Achieving Balanced Systems

- Incentivize appropriate modal mixes
  - Transit, walking, biking to work: 14% US; 56% Europe; 80% Wealthy Asian cities

- Investment mix
  - By utilizing Innovative Finance (BOT, BOO, etc.) + appropriate borrowing long term benefits can be pursued
  - Long time horizon: Road & MT Systems last centuries
Chiang Mai Built-up Area
Chiang Mai Element Map
Chiang Mai Challenges

- Large Fluctuations in Demand: Tourism
- Very slow population growth makes reshaping urban form more difficult
- Natural & Historical Barriers
- Unclear Spatial Development: Low-Density Leapfrogging
- Lack of Strong Axes & Nodes Make Feasibility of Rapid Transit Difficult
- Difficult Pedestrian Environments
- Congested Core Difficult to Retrofit for Different Modes, e.g., NMT
- Ring Road Emphasis Encouraged Sprawl
Chiang Mai: Going Forward

- Encourage Urban Form Conducive to BRT on a Few Radials (Super Arterials)
- E Buses Operating Orbit Routes
- Electric Motorcycle Taxis as Feeders?
- Close Selected Roads at Peak Season
- Improve Pedestrian Environments
- Cycling: Poor Record in Thailand: BKK has failed since 90s: Climate, Culture
  - Pun Pun Bike in BKK: Down to 300 Users
  - Considerable Recreational Potential
- Petrol Motorbike Ban?: Hanoi
Coastally Oriented Transportation Corridor

High speed rail system just opened: potential to reshape urban form
Current airport vastly operating vastly over capacity: new site will impact urban form
HSR on Sanya Edge