Sustainable Transportation Challenge in Singapore

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Early 70s’…
Now…
Singapore

In 2008:

- Population: 4.8million
- Area: 707.1 km²
- Population Density: 6,788 person/km²
Land Transport

In 2008

- Vehicle Population: 894,682
  - Private Cars: 476,634
  - Other Cars: 73,821
  - Taxi: 24,300
  - Buses: 14,976
  - Goods & Other Vehicles: 142,966
  - Motorcycles: 145,288

- Expressways: 153km
- Mass Rapid Transit (MRT): 109.4km, 66 stations
- Light Rapid Transit (LRT): 28.8km, 33 stations
Vehicle Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Private cars</th>
<th>All motor vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>348</td>
<td>630</td>
</tr>
<tr>
<td>2001</td>
<td>349</td>
<td>647</td>
</tr>
<tr>
<td>2002</td>
<td>356</td>
<td>652</td>
</tr>
<tr>
<td>2003</td>
<td>364</td>
<td>655</td>
</tr>
<tr>
<td>2004</td>
<td>372</td>
<td>657</td>
</tr>
<tr>
<td>2005</td>
<td>372</td>
<td>660</td>
</tr>
<tr>
<td>2006</td>
<td>452</td>
<td>851</td>
</tr>
<tr>
<td>2007</td>
<td>476</td>
<td>894</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The data for the year 2008 is not provided in the graph.
Traffic Flow

Expressways
Arterial Roads

Traffic flow: Average speed during peak hours (8AM-9AM–6PM-7PM)
Land Transport

Travel Demand Growth

Average annual kilometers travelled per private car

Private sector


No. of Daily journeys

Average daily ridership (1000 passenger-trips)

2007
Taxi
Bus
LRT
MRT

2006

2005

2004

2003

2002
Singapore’s experiences

- Strictly control on both vehicle ownership and vehicle usage.
- Environmental concern in land transport.
Vehicle ownership control

- Combination of Fiscal and Market-based Measures;
- To own a vehicle in Singapore...

Cost = OMV + ID + GST + RF + ARF + COE + ART

**OMV**: Open Market Value; **ID**: Import Duty;

**GST**: Good and Service Tax; **RF**: Registration Fee;

**ARF**: Additional Registration Fee; **COE**: Certificate Of Entitlement;

**ART**: Annual Road Tax.
Certificate of Entitlement (COE):

- COE is compulsory and valid for 10 years;
- COEs are divided into several (7, 1990-1999; 5, 1999-now) categories;
- **The number of COEs is fixed by government; while the price is determined by the market. (i.e., Vehicle Quota System (VQS));**
- De-registering before the 10 year period, the car owner can get a COE rebate based on the length of unused time;
- On expiration, owner may bid for another COE (10 years or 5 years).
COE and VQS (cont’d)

- **COE categories:**
  1) Small cars up to 1000cc; later became category A
  2) Medium cars from 1001cc to 1600cc; later became category A
  3) Big cars from 1601cc to 2000cc; later became category B
  4) Luxury cars above 2000cc; later became category B
  5) Goods vehicles and buses; later became category C
  6) Motorcycle; later became category D
  7) Open category (for use in any category); later became category E
In determining the number of cars allowed for registration, the government takes into account the prevailing traffic conditions and the number of vehicles taken off the roads permanently;

Annual vehicle population growth rate: 3%.
COE and VQS (cont’d)

- From 2007, as road network expansion will reduce from 1% to 0.5% per annum over the next 15 years, vehicle population growth rate (current 3%) will be lower to 1.5% in quota year 2009, 2010, and 2011;
- Further adjustment will be made in the review after quota year 2011.
## Certificate of entitlement (COE) bidding on 20 November 2002

<table>
<thead>
<tr>
<th>Category</th>
<th>Quota</th>
<th>Quota premium</th>
<th>Total bids received</th>
<th>No. of successful bids</th>
<th>Unused quota carried forward</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category A (Cars 1600cc and below and taxis)</td>
<td>1,334</td>
<td>$29,008</td>
<td>1,942</td>
<td>1,328</td>
<td>6</td>
</tr>
<tr>
<td>Category B (Cars 1601cc and above)</td>
<td>663</td>
<td>$28,001</td>
<td>879</td>
<td>597</td>
<td>66</td>
</tr>
<tr>
<td>Category D (Motorcycles)</td>
<td>835</td>
<td>$1</td>
<td>676</td>
<td>676</td>
<td>159</td>
</tr>
<tr>
<td>Category C (Goods vehicles and buses)</td>
<td>576</td>
<td>$13,789</td>
<td>736</td>
<td>567</td>
<td>9</td>
</tr>
<tr>
<td>Category E (Open)</td>
<td>1,095</td>
<td>$28,005</td>
<td>1,445</td>
<td>1,094</td>
<td>1</td>
</tr>
</tbody>
</table>
COE and VQS (cont’d)

- One of the major problems: **Speculation**
- Limited measurements:
  - All bidders for COEs are allowed only one sealed bid each and they are also required to deposit half their bids;
  - COEs became nontransferable to prevent car dealers from hoarding COEs by getting proxies;
  - “double transfer” is limited (disallow the transfer of passenger cars within the first three months of registration);
  - In July 2001, Closed Bidding was replaced by Open Bidding.
Vehicle Usage Control

- Vehicle Ownership ≠ Vehicle Usage;
- Traffic Congestion, Air Pollution, and Traffic Noise are highly correlated to Vehicle Usage.
- Singapore’s vehicle usage control policy: Road Pricing + Parking Fee + Fuel Tax + Inspection Fee +$+$+$...
There were 2 manual road pricing schemes: Area Licensing Scheme (ALS, 1975-1998) and Road Pricing Scheme (RPS, 1995-1998);

ALS-: Restricted Zone (RZ); RPS-: expressways;

In 1998, these 2 schemes were transformed to an electronic scheme called Electronic Road Pricing (ERP).
Road Pricing in Singapore
(1975-1998)
ALS

Restricted Zone
Road Pricing in Singapore
(1998-2007)
ERP

Components of ERP:
- In-vehicle Unit (IU) and CashCard
- Equipment on ERP gantry
- Central Computer System
- ERP gantries distribution
- ERP charges and its adjustment
Components of ERP

- IU: Different types for different categories of vehicles - allow different road pricing charges for different categories.

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Passenger Car Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Motorcycles</strong></td>
<td>0.5</td>
</tr>
<tr>
<td>Lorries/Buses</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Big Lorries/Buses</strong></td>
<td>2.0</td>
</tr>
</tbody>
</table>
Components of ERP (cont’d)

- **CashCard:**
  - A smart card marketed by consortium of local banks for multiple uses;
  - Top-up at Automated Teller Machines, petrol stations and other outlets;
## ERP gantries distribution

<table>
<thead>
<tr>
<th>Period</th>
<th>Number</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>As of September 1998:</td>
<td>33</td>
<td>(27 in CBD; 6 along ORR)</td>
</tr>
<tr>
<td>Before 1 August 2005:</td>
<td>45</td>
<td>(28 in CBD; 17 along ORR)</td>
</tr>
<tr>
<td>As of 1 August 2005:</td>
<td>46</td>
<td>(the first evening charging gantry at northbound CTE)</td>
</tr>
<tr>
<td>From 3 October 2005:</td>
<td>48</td>
<td>(an Orchard cordon with operating hours to noon to 8pm, Mondays to Saturdays)</td>
</tr>
</tbody>
</table>

**From 23 August 2007...**
ERP charges and its adjustment (cont’d)

- ERP rates are adjusted:
  - To ensure optimal use of road space;
  - Reviewed every 3 months.

Expressways:
- Increase 45 kph
- Decrease 65 kph

Other Roads:
- Increase 20 kph
- Decrease 30 kph
Road Pricing in Singapore
( 2008 onwards)

The latest update
The need for enhancing effectiveness of ERP

- Road growth is slowing, while the vehicle population is growing gradually (40%, from 1997 to 2008);
- Many drivers are not satisfactory to the service that the current ERP system provided.
Principle for the enhancement

- The ERP system must be made more effective and let the road users see the benefit from it.

- The proposed changes in ERP:
  - Refine the method of measuring traffic speeds;
  - Update the ERP rate structure;
  - Manage congestion in the city area.
Refine the method of measuring traffic speeds

- The optimal traffic speed thresholds of current ERP: 45kph (expressways), 20kph (arterial roads);
- However, these threshold speeds were set 10 years ago. Today, when the mean speed is around the threshold speed, the traffic condition would become very sensitive. That is, even a minor disturbance in the traffic flow would influence the traffic speeds drastically.
Refine the method of measuring traffic speeds (cont’d)

- Solution: need to create a buffer between real speed and threshold speed to avoid the “unstable” situation;
- 85th percentile speed measurement method is thus proposed.
Refine the method of measuring traffic speeds (cont’d)

- The traffic speed used in ERP is spot speed;
- Supposing at a certain spot over a specific period, the speed frequency is obtained. Using those information, Mean speed can be calculated (48.1) and cumulative frequency chart can also be generated.

In cumulative frequency chart, it is clear that in this example, only 40% of drivers experience the speed above the mean speed; while using 85th percentile speed criterion, more than 85% of drivers would experience the speed above the 15% speed.

Given a particular threshold speed, using 85th percentile speed, more drivers would benefit from the ERP system. Nevertheless, higher ERP fee should be tolled.
Environmental concern in vehicle usage

Policies stimulate travelers to optimize the usage of cars, change to public transit mode, and environmentally friendly power, therefore protect the environment in return.

- Car pools:

  when ALS was initially implemented, an passenger car carrying 3 or more passengers (excluding the driver) was exempted from the scheme. In order to evade the charge, drivers who intended to enter RZ were encouraged to carry more people even strangers.
Environmental concern in vehicle usage (cont’d)

- Parking-and-Ride System:
  Because of the favor of the special parking fee at the fringe car parks, some travelers were inclined to choose the inconvenient but cheaper mode.

- Levy higher fuel tax on conventional fuel.
Other Alternatives

- Weekend Car and Off-Peak Car
- Car Sharing
Weekend Car and Off-Peak Car

Weekend Car:

- Weekend car was introduced to enable more people to own private cars for use outside congested periods;
- No quota requirement imposed on Weekend car (i.e., No COE requirement);
- To own a Weekend car, car owner only pay the prevailing quota premiums for a COE and would receive a registration rebate.
Off-Peak Car:
- Off-Peak Car was introduced in 1994 to replace Weekend Car;
- Under the conditions as Weekend Car;
- COE requirement;
- Can receive a fixed tax rebate;
- Normal cars can be converted into Off-Peak Cars.
Car Sharing

- Date back to 1948 in Zurich, Switzerland;
- People can directly access to the car at anytime in the carports and return the car to any port;
- Each car is charged by the time and travel distance;
- Singapore:
  - NTUC Income (36 carports, 2007)
  - Honda Diracc (20 carports, 2007)
Challenges ahead…

- **Private sector:**
  - Is COE system working on plan?
  - Singapore seems to lose vehicle ownership control and shift their focus to usage-based control. Is this kind of shift appropriate?

- **Public sector:**
  - As an alternative mode to private cars, public transport still needs further improvements.
Challenges (private sector)

- Is COE system working on plan?
  The annual vehicle population growth rate for COE currently is set to 3%. However, from 2005 to 2008, real annual growth rates for passenger cars ranged from 5 to 8.9 percent.

- Reason:
  To determine the number of COE released each year, the authorities has to predict how many vehicles are likely to be scrapped. If the prediction is not accurate enough, COE system may not work on plan.
Challenges (private sector)

- Singapore seems to lose vehicle ownership control and shift their focus to usage-based control.

To own a car in Singapore has become much easier than before (the cost to own a car is cheaper). Can Singapore still maintain the smooth traffic condition merely depending on usage-based control?
Challenges (private sector)

- Road pricing possesses several limitations to restrain people to use their own cars:
  - Uncertainty about the right level of levies.
  - Uncertainty about the reaction lags.

- There would be a huge challenge in transport if Singapore depends too much upon usage-based control policy.
Challenges (public sector)

- As a worldwide trend, efforts to increase the sustainability of development patterns are being made mainly on the promotion of public transport.

- Especially for Singapore, due to its radical and steep policy to control the ownership and usage of private cars, provision of high quality public transport service is imperative.

- However...
Challenges (public sector)

- According to the latest survey by *Lianhe Zaobao* (a widely circulated newspaper in Singapore), most of the commuters are suffered by the long waiting time for the bus service and over-crowded condition for the MRT/LRT service.
Challenges (public sector)

And,

- “The transfers between different modes today in Singapore are not as seamless and easy as they should be.”

Speech by MR. Raymond LIM
MINISTER FOR TRANSPORT
18 Jan 2008
Challenges ahead

- Although Singapore has achieved notable success in land transport by applying several efficient and effective measures, challenges are still ahead toward a sustainable transport environment.
Thank you!

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