Shared Mobility Systems

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Shared Mobility

Making better use of available resources

For a better quality of life
• Transport is a discrete-event on-demand service.
• A traveller requests a resource, is allocated the resource, makes use of the resource, and releases the resource.
• Resources are vehicles, road connections and parking lots...and drivers
• Auto mobility costs money and the environment and therefore optimization of resources is desirable.
Quality of Service
in
Discrete Event On-Demand Services

Trip Time
No parking available
Waiting Time

So we need to find an equilibrium
Shared mobility systems should *lessen* cars on the roads and not merely fill in ‘EMPTY SEATS’

This leads to

- Less congestion
- Less CO$_2$
- Less parking bays required
Three Types

• Private Taxi Share (Taxi Pooling)
• Private Car Pooling
• Private Car Share
Taxi Share – Dial-a-Ride

• Taxi is shared between independent passengers.
• Similar to PTS, but with flexible routes and timetables.
• Five star PTS.
• Taxi picks-up or drops-off passengers on the way.
• Taxi fleet and taxi drivers owned by a company.
• Promises a reduction of standard taxi fares to competing levels, comparable to the cost of owning and operating a private car.
• Can contribute significantly to a reduction in car ownership.
Routes are defined by the demand. So system is auto adaptive.
Dynamic Dial-a-Ride (Taxi share)
Mean cost per passenger is 1.45/1.90 Euro. (8/6 seat)
Promises a reduction of standard taxi fares to competing levels, comparable to the cost of owning and operating a private car.

<table>
<thead>
<tr>
<th>Trip Length</th>
<th>2km</th>
<th>4km</th>
<th>6km</th>
<th>8km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private car Fuel only</td>
<td>0.25</td>
<td>0.50</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td>Private car</td>
<td>0.60</td>
<td>1.20</td>
<td>1.80</td>
<td>2.40</td>
</tr>
<tr>
<td>+ parking</td>
<td>2.00 - 9.00</td>
<td>2.00 - 9.00</td>
<td>2.00 - 9.00</td>
<td>2.00 - 9.00</td>
</tr>
<tr>
<td>DaRS 8 seat car</td>
<td>0.80</td>
<td>1.20</td>
<td>1.40</td>
<td>1.80</td>
</tr>
</tbody>
</table>
Dynamic Taxi Share

• Requires full ICT infrastructure, including smart phones and micro-payment systems.

• Can run at high efficiencies and at relatively low-cost.

• Great for commuters with flexible hours
Static Taxi Share

- Static taxi share requires basic ICT infrastructure and human operator.
- Low efficiency and costly.
- Good to support other shared systems when disruptive events occur.
- Good for off-peak hours, to replace private car ownership, and provides accessibility to all.
Car Pool

• In its simplest form...A group of private car owners share rides with similar ODs on an agreed roster basis....thus saving on fuel and parking costs, if any.

• Additionally relieves traffic and overall trip times.

• No Monetary transactions are carried out.
Three classes

- Small group Car Pool
- Large Company Car Pool
- Public Car Pool
Technology

• Basic ICT – personal phone.

• Web Based
  – Peer-to-Peer
  – Pattern recognition

• Smart Phone and Wireless Communication Systems
Gain

Technology Complexity

Participant’s Pool Size
Problems inherent in car pooling

• Variability among participants in morning departure and evening leave.
  – Jobs characterized by a strict timetable
  – Large subscription to a car pool
  – Dynamic allocation algorithms with instant updates
Problems inherent in car pooling

• Most systems in place do not have a fair regulated system that keeps track of the roster such that costs are distributed.
  – Simple manual on-line log is a solution.
  – Advanced technology can automate the process
Problems inherent in car pooling

• Lack of Trust in Quality of Service or Experience
  – Some people are always late!
  – Some people do not wait!
Problems inherent in car pooling

- Legal and Fiscal Issues
  - Car Pooling is a peer-to-peer business model based on bartering....where overheads are kept to a minimum.
  - Bartering limits subscriptions to car owners.
  - Variability in OD undermines car pooling.
  - To solve some inherent car pool problems a legal framework is required....unless payment is done with goods.
  - Current Businesses in Transport do not like car pooling.
Problems inherent in car pooling

- Security issues. Some participants might have bad intentions.
  - Is more likely to happen in mass car pooling
  - Requires constant screening of drivers and passengers
  - Variability
- Variability in cultural and habitual backgrounds
People may need an added incentive to join car pool

• Reward scheme or penalty scheme.
• A reward scheme may be difficult, from savings or from city council
• Penalty scheme is easier...parking charge
Benefits

• One car instead of three/four on the road
  – Less congestion, less CO₂
• 60% savings on fuel and car park costs
• Increased socialisation and sharing
• Better quality of life
Current-state-of-the-art in R&D

- Car pool is integrated with Taxi-share and legally regulated
  - Taxi share is a full-time backbone resource
  - Car-pool is a part time resource
  - Car-pool monetary / barter rewards
- Mass public subscription is necessary
- Real-Time on-demand service
- Basic access is via web-site
- Full-service is via smart phone app
Minimum that can be Done

- Large company based car pool
- Study current travel patterns and predict post travel patterns
  - Some employees will adapt in exchange of a reward
- Set reasonable target
- Maintain on-line website with email notifications
No of Employees using a private car = 1000
Employees opting for car pool = 600

<table>
<thead>
<tr>
<th>Car occupancy (passengers)</th>
<th>Parking bays required</th>
<th>Fuel saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600</td>
<td>-0%</td>
</tr>
<tr>
<td>2</td>
<td>300</td>
<td>-30%</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>-40%</td>
</tr>
<tr>
<td>4</td>
<td>150</td>
<td>-45%</td>
</tr>
</tbody>
</table>
Minimum target = share a ride once a week, and offer a ride once a week
Thank You
Car Share

- An alternative to full car ownership.
- Car ownership is divided among a number of owners.
- May reduce congestion and parking problems, but not $\text{CO}_2$.
- Operated by a company, with part-owners contributing to fund car fleet.
- Dynamic and static versions – depending on ICT infrastructure.