Transit Oriented Development (TOD) for Mega Cities

Is TOD an Effective Solution for Mega City’s Traffic Congestions?
Case Study of Shenzhen (SZ), China

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Supervisor: Dr.-Ing. Wulf-Holger Arndt
1. Introduction
2. Case Study Shenzhen (SZ)
3. Methodology
4. Findings
5. Analysis
6. Conclusions
Research Background

1. Urbanization and Motorization in China

![Graph showing the comparison between production of automobiles (in millions) and registered number of automobiles (in millions) from 2000 to 2007. The production line is black and the registered line is gray. The production shows a steady increase each year, while the registered number also increases but at a slightly slower rate.]
1. Purpose:
   • TOD Feasibility in SZ?
   • TOD Effectiveness for Traffic Congestion in SZ
   • TOD Transferability for Other Chinese Cities in Future

2. Objectives:
   • Current Barriers for Shenzhen TOD approach in promoting transit accessibility
   • Increase Transit Ridership and improve its Service
   • Missing Components in SZ TOD approach
Transit Oriented Development (TOD) Theory

Initiate:
• 1970s-1980s
• U.S. Urban Design

Background:
• Prevent Urban Sprawl

Principles:
• High Capacity Mobility Mode
• Walkable Environment
• Connectivity
• Mixed-Use
• High Density around Station

rail
rail station
low density
high density
Shenzhen Geographical Location

Map showing the geographical location of Shenzhen in relation to Hong Kong.
Source: Shenzhen Statistic Year Book 2009
Shenzhen Urban Expansion (1978-2005)

Source: Shenzhen Statistic Year Book 2009

**Population**
1978: 300,000
2009: 8,912,300

**Total Area**
1991.64 (sq.km)
Shenzhen Metro Network (2011)

Metro Phase I:
22km (2004)

Metro Phase II:
178km (2011)

Metro Phase III:
another 169.6km (2011-2016)

Source: Shenzhen Metro 2011
Methodology Integration

**Step 1**
- Literature Review
  - 1-Sustainable Urban Transport
  - 2-New Urbanism / TOD Theory
  - 3- Land Use Reform (China)
  - 4- Shenzhen TOD Planning

**Framework Design for SZ Case**
- Stakeholder Interview
- Catchment Area Mapping
- Station Questionnaire

**Step 2**
- Field Work Design

**Step 3**
- Analysis
  - TOD Improve Supply

TOD do not fulfill Demand

Conclusion

TOD Example Analysis
Shenzhen TOD Key Findings

Time: 2004

TOD Types / Distance

- A / 400-500 m
- B / 500-600 m
- C / 600-1000 m
- D / --------------

Source: Shenzhen Urban Transport Planning Design Research Center
Shenzhen TOD Analysis

1. Transit Accessibility
   1. Interpretation
   2. Cooperation Gap
   3. Land Leasing Mechanism

2. Transport
   1. Transit Service Evaluation
   2. Transport Mode Connection
   3. Non Transport Mode

3. Missing Instruments
   1. Integration with Land Use
   2. Travel Demand Management
   3. Governance
      1. Participation
      2. Financial
      3. Legislation System
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Planning Authority

- Network Scale
- Length of Lines
- Numbers of Transit Lines
- Financial budget for Transit
- Land Resource Availability

Civil Society

- Total Cost per Trip
- Total Travel Time per Trip
- Convenience of Transit Mode
- Other Mobility Choice
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Public Transport Data in Shenzhen (2004-2008)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Buses</th>
<th>Taxi</th>
<th>Mini and Medium Buses</th>
<th>Motorcycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>13604</td>
<td></td>
<td></td>
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<tr>
<td>2005</td>
<td>10800</td>
<td>5376</td>
<td></td>
<td></td>
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<tr>
<td>2006</td>
<td>10800</td>
<td>6091</td>
<td></td>
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<tr>
<td>2007</td>
<td>11205</td>
<td>6091</td>
<td></td>
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<tr>
<td>2008</td>
<td>12991</td>
<td>7839</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Walking</th>
<th>Biking</th>
<th>Motorization</th>
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<tbody>
<tr>
<td>1995</td>
<td>46.6</td>
<td>29.8</td>
<td>23.6</td>
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<tr>
<td>2001</td>
<td>53.4</td>
<td>92.9</td>
<td>14.3</td>
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<tr>
<td>2005</td>
<td>55</td>
<td>41</td>
<td>4</td>
</tr>
</tbody>
</table>
Futian District Transit Catchment Area (500m)

Source: ShenZhen Futian Goverment online (2011) / Shezhen Statistic Office
Travel Demand Management (TDM) Comparison between Singapore & SZ

Pull

Transit Accessibility

Singapore Government

TDM Instruments
Vehicle Related Taxes
Area Licensing Scheme
Electronic Road Pricing
Vehicle Quota System

Push

Motorization Accessibility

Shenzhen Government

TDM Instruments
Parking Charging

Legend:
- Road Infrastructure
- Transit Line
- Sub-Urban Core
- Urban Center
Financial Mechanism Comparison between HK & SZ

Land Use Policy
- Hong Kong Government
  - Compact Land Use Policy
- Public Transport Priority and Transit Accessibility

Transport Policy
- Shenzhen Government
  - Urban Expansion / Land Leasing
  - Vehicle Mobility Enhancing Priority

Revenues
- Mass Rapid Transit Company (MRT)
  - Land Use Development Right around Station
  - Fare Autonomy
  - commercial
  - Property Sell

Financial Resources
- Mass Rapid Transit Company (MRT)
  - Metro Construction Subsidy
  - Fare Autonomy

Policy Instrument
- Capital Flow
Conclusion and Recommendation

1. Walkability VS Mobility

Hong Kong  
Shenzhen
# Shenzhen TOD Analysis

## Shenzhen Vehicle Numbers (2004-2009)

<table>
<thead>
<tr>
<th>Year</th>
<th>Numbers</th>
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<tbody>
<tr>
<td>2004</td>
<td>647069</td>
</tr>
<tr>
<td>2005</td>
<td>770877</td>
</tr>
<tr>
<td>2006</td>
<td>936369</td>
</tr>
<tr>
<td>2007</td>
<td>1124520</td>
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<tr>
<td>2008</td>
<td>1252747</td>
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<tr>
<td>2009</td>
<td>1419015</td>
</tr>
</tbody>
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## Metro Phase I

![Graph showing Shenzhen Vehicle Numbers (2004-2009)](chart.png)

**Graph Details:**
- **Y-axis:** Numbers ranging from 0 to 1,500,000
- **X-axis:** Years 2004 to 2009
- **Legend:**
  - Blue line: Year
  - Red line: Numbers

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Conclusion

Land Use Level

- Mono-Functional Zoning Planning
- Urban blocks’ size and density

Transport Level

- Car compressing scheme /TDM
- Transit accessibility enhancing scheme
- Transport Integration Planning scheme

Governance Level

- Legislation of TOD
- Financial Mechanism
- Participation Process
- Public Private Partnership (PPP)

Comprehensive TOD
Thank You!
Vielen Dank!
谢谢！