Transit-Oriented Development
Key Concepts & Best Practices

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KEY MESSAGES

1. Cities do not develop uniformly / densities are naturally uneven
2. New transit corridors offer opportunities for connected and cohesive growth
3. TOD designs focus on pedestrian and multimodal connectivity, less parking
4. Analyzing TOD potential: 3V framework
5. Financing infrastructure through TOD & land value capture
6. Remaining challenges & potential solutions
7. TOD best practices from around the world
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DENSITIES ARE UNEVEN, DEVELOPMENT UNEQUALLY DISTRIBUTED

- Articulated urban densities are shaped by the transport network
- Higher densities are enabled at well-connected nodes that are most accessible to the region
- These areas have the highest demand for space and therefore the highest land values

At right: example of high densities along well-connected Yamanote Line loop in Tokyo
India has a strong heritage of railways being at the center of how people connect…

…which provides a great platform for sustainable growth
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<table>
<thead>
<tr>
<th>WHY TOD?</th>
<th>More Competitive</th>
<th>Access and Mobility</th>
<th>Resilient to Natural Hazards</th>
<th>Partly self financing by capturing value created</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High quality neighborhoods with lower infrastructure costs and lower CO2</td>
<td>Lower Transport and Housing cost</td>
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</tbody>
</table>
By 2030 in Singapore:

- 8 in 10 households living within a 10 minute walk from a train station
- 85% of public transport journeys (less than 20 km) completed within 60 minutes
- 75% of all journeys in peak hours undertaken on public transport

Source: Alain Bertaud

From Land Transport Master Plan 2013
Curitiba has focused its urban growth around their RIT express network of BRT corridors.

CEPAC (tradable air rights) permits for high-density development partially funded construction of new Linha Verde (Green Line).

BRT corridor supports higher density development.

Above: Diagram by Lindau et al. (2010)  
Left: Curitiba Centro, Image by Francisco Anzola
ENVISIONING TRANSIT CORRIDORS: AN EXAMPLE FROM INDONESIA

1. Establishing continuous heritage trail between different historic districts along the corridor
2. Establishing Kampungs passages as part of the heritage trail
3. Boulevard trees providing natural shading for walks along the trail
4. Communication of historic places, sites, and precincts through collateral that 'tells the story'
5. Promoting hawkers along the heritage trail
6. Maintain the continuity of the trail by implementing heritage trail wayfinding signage or plates at most 100m apart
7. Setback regulations to ensure new form does not overwhelm or dominate the heritage asset
Accessibility studies measure effectiveness of transit network for people reaching regional destinations.
MEASURING JOB ACCESSIBILITY

a. Line 1, 2, and 3 and walking: **12%**

b. Scenario a plus bus: **28%**

c. Scenario b plus TOD: **39%**

d. Scenario b plus bicycle: **46%**

Zhengzhou
- Population: 6.4 million
- GDP per capita: US$11k
- Peak hour accessibility

Percent of jobs accessible within 45 minutes by public transit

Source: The 3V Framework (World Bank)
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5 KEY POINTS FOR TOD STATION AREA DESIGN

1. Highly connected street network with space for pedestrians and vehicles
2. Well-designed public spaces at key nodes and intersections
3. Appropriate policies for traffic calming & parking management
4. Mixed use buildings that are oriented to the street, with limited setbacks and pedestrian barriers to separate parcels
5. Sufficient space and facilities for connections to other forms of public transport (e.g. buses, rickshaws, taxis, etc.)
• Local accessibility based on small blocks and on dense and connected street patterns with at least between 80 to 100 street intersections/km².
• Adequate space for streets. Street network occupies at least 30 per cent of the land and with at least 18 km of street length per km².
• High quality public space.
• Good quality pedestrian connections (sidewalks, street crossings).
• Traffic calming, traffic and parking management.

• Density levels over 800-meter area within walking distance of station depend on magnitude of transit investment.
• Densities of at least 15,000 per km² for sustainable neighborhoods.
1. Walking (ensure direct pedestrian pathways)

2. Cycling (provide bicycle access/parking)

3. Connecting transit services & drop-offs

4. Parking (for transit users & project visitors)
## General TOD Design Principles

<table>
<thead>
<tr>
<th>Components</th>
<th>Scales</th>
<th>City</th>
<th>Inter-Neighborhood</th>
<th>Neighborhood</th>
<th>Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Public Transit</td>
<td></td>
<td>Proximity to urban centers</td>
<td>Financial viability of public transit</td>
<td>Access to public transit</td>
<td>Public transit infrastructure</td>
</tr>
<tr>
<td>Non-Motorized Mobility</td>
<td></td>
<td>Continuous street network</td>
<td>Pedestrian and cycling networks</td>
<td>Internal connectivity</td>
<td>Sidewalks and bike paths</td>
</tr>
<tr>
<td>Vehicle Demand Management</td>
<td></td>
<td>Optimization of daily commutes</td>
<td>Safe and orderly roads</td>
<td>Parking management</td>
<td>Road safety for all users</td>
</tr>
<tr>
<td>Mixed-Use and Efficient Buildings</td>
<td></td>
<td>Regional facilities</td>
<td>Public amenities and marketplaces</td>
<td>Efficient buildings</td>
<td>Live streets</td>
</tr>
</tbody>
</table>
JAPAN PROVIDES EXAMPLES OF WELL DESIGNED BUS CONNECTIONS IN “STATION SQUARES”

- Given wide availability of rail transit service, many bus passengers choose to transfer to rail

- Many rail stations have transfer facilities, from small “station squares” to full bus interchanges

- Local bus services & taxi drop-off/pick-up are usually located next to each other in an open-air area in front of the train station

Station squares across Japan (aerial satellite view)

Tsutsujigaoka, Tokyo  |  Kintetsu-Yao, Osaka  |  Higashi-Okayama  |  Shin-Akitsu, Tokyo
NETWORK-DEPENDENT PARKING POLICIES

Core City Districts
- Highly valued land
- Parking should be discouraged at transit stations
- TOD projects should have highly reduced/no parking

Urban Fringe/Inner Suburban
- Medium-high land values
- Transit access primarily by bus, cycling, and walking
- Projects near stations should have reduced parking that is hidden from public spaces

Suburban Transit Stations
- Lower land values
- Many people will be driving and parking to take transit
- Parking can be accommodated in park-n-ride lots and co-developed with real estate projects
3 Approaches for Reforming Parking in TOD Areas

➢ Right-sizing parking
  • Regulate parking supply based on demand
  • Revert to parking maximums instead of minimums
  • Change parking norms to a “per square meter” basis

➢ Parking management approach
  • Walkable “park-once” neighborhoods with shared lots
  • “Proof of parking” for car registration
  • Introduce parking congestion parking

➢ Responsive approach
  • Introduce zero parking maximums in TOD areas
  • Involve local stakeholders
  • Different parking norms for TOD zones and non-TOD zones
  • Unbundle parking & parking norm flexibility (with charges)
  • Lower parking norms for small sites/developments
URBAN DESIGN’S IMPACT ON VALUE: BEYOND JUST TRANSIT-ADJACENT DEVELOPMENT

<table>
<thead>
<tr>
<th>Station</th>
<th>Percent Increase in Land Value</th>
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<tbody>
<tr>
<td>1/4 Mile</td>
<td>35</td>
</tr>
<tr>
<td>1/2 Mile</td>
<td>30</td>
</tr>
<tr>
<td>3/4 Mile</td>
<td>25</td>
</tr>
<tr>
<td>1 Mile</td>
<td>20</td>
</tr>
</tbody>
</table>

TOD: High Quality Pedestrian-Friendly Design
TAD: Low Quality Non Pedestrian-Friendly Design

Source: R. Cervero
Uncoordinated haphazard development vs. well-planned, cohesive urban districts

Image from MoUD TOD Guideline
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**3V: WHAT ARE NODE/PLACE/MARKET POTENTIAL VALUES?**

**Node value** describes the importance of a station in the public transit network based on its centrality (measured by graph theory centrality indexes), passenger traffic volume, and inter-modality.

**Place value** describes the urban quality of a place and its attractiveness in terms of amenities, schools, and health care; the type of urban development; local accessibility to daily needs by walking and cycling; the quality of the urban fabric around the station, in particular its pedestrian accessibility, the small sizing of urban blocks, and the fine mesh of connected streets that create vibrant neighborhoods; and the mixed pattern of land use.

**Market potential value** refers to the unrealized market value of station areas. It is measured through a comparison between demand and supply, that includes *major drivers of demand* including current and future human densities (residential plus employment); and *major drivers of supply*, including developable land, potential changes in zoning (such as increasing floor area ratios (FARs)), and market vibrancy.

**Sources:**
© King’s Cross Central Limited Partnership (top); © Related Oxford (middle); Renne 2014 (bottom).
SUBWAY NETWORKS CONVERGE TOWARDS A CHARACTERISTIC STRUCTURE WITH A DENSE AND INTERCONNECTED CORE WITH BRANCHES

**Degree centrality** describes how connective a station is, that-is how many lines it connects (major interchanges have high degree centrality values)

**Closeness centrality** describes how close a station is from all the other stations in the network (closeness centrality is a measure of accessibility to a station within the network)

**Betweenness centrality** describes how many routes go through a given station (the more routes through the network pass through a station, the more “in between” this station is)

Source: QuantUrb, CASA
TO DECIDE HOW THESE STATIONS WILL DEVELOP, AN EVIDENCE-BASED APPROACH IS USEFUL – THE 3V FRAMEWORK

By understanding station’s position in the urban landscape, you can understand how each can change.

• **Node value**: where it sits within the transit network
• **Place value**: the quality of the urban space around the station
• **Market potential value**: how favorable development is based on market dynamics (e.g. jobs/resident concentration)

Framework can help you decide how to develop around the 38 stations under MUTP3
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When considering financing strategies for TOD corridor development, what needs to be financed?

- **Investment Size: Large**
  - Capital costs for BRT, LRT, or metro systems
  - Often paid by public sector, but funding can be raised through capturing land value uplift and real estate improvements

- **Investment Size: Small-Medium**
  - Local street improvements & sidewalk/NMT infrastructure
  - Can be paid by developers in strong markets or by local government

- **Investment Size: Varies**
  - Consists of construction costs of residential/commercial buildings
  - Most costs to be paid by developer, but public subsidy sometimes required if weak market or affordable housing is required
Funding Sources

Funding sources

Investment revenues
- Service charges
- Land value capture
- Air right sales
- Own source revenue

Investment incentives
- Grants
- Fiscal incentives

Revenues, and other non-reimbursable monetary support, that can be used to repay the costs of the investment components
Sale of air rights: transfer or sale of development rights through the auctioning of development rights. In Sao Paulo, the difference between the basic FAR and the maximum FAR is sold through auctioning. Authorities can also provide density bonuses (FAR increase beyond the zoning code) in exchange of direct payment or provision of affordable housing and public space by private developers.

Funding sources: investment revenues

Faria Lima District, São Paulo, Brazil: a TOD project in which urban authorities mobilized funding through the auction of development rights

Source: Maleronka and Piers (2013)
Metro Group adopted phased strategy for TOD along Line #1, starting from stations in downtown and move on to the suburbs.

As of 2016, estimated profits from TOD will cover 15-20% of the total construction costs of Line #1 and #2.
PROACTIVE PLANNING PROVIDES RESOURCES TO REINVEST

Virtuous TOD cycle

- Capturing increase in value with LVC tools (e.g. selling of air rights, special taxation districts, etc.)
- Allowing new development in station districts to create value (e.g. higher-density residential/office/retail developments with higher economic value)
- Associated infrastructure improvement (e.g. better pedestrian connectivity & public spaces, improved sewers, water systems)
- Transit improvement (e.g. more lines, more frequent trains, better quality service)

Reinvesting funds generated into urban infrastructure (most funds generated should go into further public infrastructure improvements)
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➢ TOD in existing built-up area or greenfield land?
➢ Which agency sponsors project? How do they relate to other government agencies?
➢ Current status of real estate market demand? New transit corridor in a growing or stagnating area of city?
➢ Are incentives aligned to encourage cooperation between public and private sector?
➢ Funding sources for infrastructure?
In developing countries, land tenure is often not well-established, limiting possibility for redevelopment.

Formalization of title and adjustments of parcel configuration often necessary, as well as reform of property taxation system.
UPFRONT INFRASTRUCTURE DESIGN COORDINATION ALLOWS FOR BETTER INTEGRATION WITH TOD PROJECTS

Examples of integrated design from Lima
PARTNERSHIP WITH REAL ESTATE DEVELOPERS IS LIKELY NECESSARY FOR TIMELY IMPLEMENTATION

- Need to gauge interest in development opportunities, to determine level of public involvement for infrastructure development

- Developers need to understand new design standards, to ensure that standard practices are phased out (e.g. barrier walls, super-blocks, etc.)
TOD TIMELINE REQUIRES COLLABORATION ACROSS AGENCIES

**Pre-consultation & strategy development**
- Economic development officials: Determine transit tech
- Economic development officials: Finalize cost estimates for transit infra
- Urban planners: Inventory potential redevelopment sites
- Economic development officials: Assess economy & potential growth areas
- Real-estate developers: Developers assess potential real estate projects in corridor

**Operations plan for transport integration**
- Urban planners: Refine station area plans with stakeholders
- Urban planners: Create branding strategy & market corridor
- Transport planners: Finalize transit service changes for integration

**Finalization**
- Economic development officials: Finalize route and stations
- Economic development officials: Estimate financing gap & propose funding mechanism
- Urban planners: Confirm street infra to be changed
- Operations plan: Refine station designs for transfers & NMT
- Operations plan: Operations plan for transport integration

**Implementation of TOD corridor**
- Economic development officials: Discuss high-potential redev sites at stations
- Economic development officials: Discuss phasing of dev & contribution to infrastructure/incentives needed
CONCLUSION

• Cities have naturally varied densities, which largely follow transport networks – TOD is about shaping this density around new rapid transit
• TOD districts should be designed with a focus on mixed-use buildings, multimodal connections, and high-quality pedestrian and public spaces
• The 3V framework is a new way to prioritize TOD phasing across the rapid transit network
• Governments can use land value capture and other tools to help TOD developments finance needed infrastructure
• Close collaboration is needed across agencies and private sector to implement TOD well and overcome challenges
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OVERVIEW OF ITDP’S TOD STANDARD

- ITDP has developed 8 main categories of TOD to look at the physical design, density, uses, and how much travel mode choice has been changed.
- Project and district-based scoring system determines whether new real-estate projects have contributed along transit-oriented development parameters.
- Current Version 2 was released in 2014; 34 areas have been scored with TOD Standard, majority have been in high-income countries.
- Some good examples have been scored in developing countries.

Award Levels

Gold: 85–100 points
Rewards urban development projects that are global leaders in all aspects of integrated transport and urban design.

Silver: 70–84 points
Marks projects that meet most of the objectives of best practice to a high level of quality and integration.

Bronze: 55–69 points
Indicates projects that satisfy a majority of the objectives of best practice in transit-oriented urban development.
### CENTRO INTERNACIONAL (BOGOTA, COLOMBIA)

<table>
<thead>
<tr>
<th>Type of Transit:</th>
<th>Bus rapid transit (BRT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Uses/Urban Context:</td>
<td>Urban mixed-use district (office, residential, hotels, convention space)</td>
</tr>
<tr>
<td>Built:</td>
<td>1980s-current</td>
</tr>
<tr>
<td>TOD Standard:</td>
<td>Gold (90 points)</td>
</tr>
</tbody>
</table>

- Central district in Bogota with improved streetscape to link developments to BRT system
- Connected pedestrian spaces and crosswalks to enhance walkability
- TOD efforts are also part of Colombia’s National Appropriate Mitigation Actions (NAMA) – see below

*Improvements to streetscape have helped pedestrians connect better to transit*

*Urban district in the center of the city between BRT corridors*
### LIUYUNXIAOQU (GUANGZHOU, CHINA)

<table>
<thead>
<tr>
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<th>Metro rail &amp; bus</th>
</tr>
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<tbody>
<tr>
<td>Land Uses/Urban Context:</td>
<td>Urban high-density mixed-use district (residential, retail)</td>
</tr>
<tr>
<td>Built:</td>
<td>1970s-1980s</td>
</tr>
<tr>
<td>TOD Standard:</td>
<td>Gold (90 points)</td>
</tr>
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</table>

**From ITDP:** Liyun Xiaoqu, in Guangzhou, had been a gated residential complex with clogged streets. The development is now a public center of the Tianhe District’s daily life with car-free, walkable corridors and a lively retail hub that serves residents and shoppers alike.

- Developed to house relocated people in the 1970s and 1980s from an adjacent neighborhood
- Few parking spaces and lots of pedestrian space
- Starting in 2000s, residents started reclaiming streetfront space with small retail businesses and cafes

**Small-scale urban fabric with well-used public spaces and pedestrian pathways**

**Urban district with a mix of local amenities that are walkable for residents**
## REFORMA 222 (MEXICO CITY)

<table>
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<th>Type of Transit:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Land Uses/Urban Context:</td>
<td>Urban high-density mixed-use project (office, retail, residential)</td>
</tr>
<tr>
<td>Built:</td>
<td>2007</td>
</tr>
<tr>
<td>TOD Standard:</td>
<td>Silver (75 points)</td>
</tr>
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</table>

**From ITDP:** Reforma 222 “offers a microcosm of the city with offices, residences, shopping and entertainment in a highly condensed, walkable and connected system. Retail in the development is anchored by a glass-enclosed shopping street that stretches the length of the complex.”

- This redevelopment project started in 2004 and was completed in 2007
- 3 towers with a total of 173,000 square meters of space; heights between 19-31 stories
- Design aimed to blend in with existing vibrant urban streetscape

Central location in Mexico City along main commercial corridor, near metro rail stations

Multi-level retail with high-quality pedestrian environment sheltered from rain
JIANWEI SOHO (BEIJING, CHINA)

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<td>Built:</td>
<td>2007</td>
</tr>
<tr>
<td>TOD Standard:</td>
<td>Silver (83 points)</td>
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</table>

**From ITDP:** Jianwei Soho “is a mixed-use, pedestrian and cycle friendly development, a notable contrast to many of its neighbors in Beijing, which are car-oriented superblocks. All 13 of the JianWai buildings are crisscrossed with open space and pedestrian walkways.”

- Large mixed-use development with office, retail, and residential components
- 700,000 square meters of development on 169,000 square meters of land (4.1 effective FAR)
- Architect cited old cities in North Africa as design inspiration with narrow streets & small public squares

Well-designed alleyways and pedestrian squares enhance walkability of complex

Highly accessible location in high-density area along 3rd ring road and adjacent to Guomao subway station
BAB AL BAHR (RABAT-SALE, MOROCCO)

- Type of Transit: Light rail/tram
- Land Uses/Urban Context: Urban medium-density district
- Built: Construction ongoing
- TOD Standard: Silver (74 points)

- 70-hectare project along the Bou Regreg River, aimed to regenerate the capital city
- Total investment expected of $750 million, including 1,700 residences and over 60,000 square meters of office space
- A marina, hotels, and a cultural district with museums are planned for the area

Design includes public squares, fountains, and activity generating uses

Accessible location on edge of urban development adjacent to new tram line and waterfront

Tram station
Shin-Yokohama District
Urban Development through Inter-City Transport Development

1964

2016
Overview of Land Readjustment Project in Shin-Yokohama District

- Project Implementer: Yokohama City Mayor
- Project Area: 80.4 ha
- Project Period: 1964–1980
- Land Owners: 439
- Project Cost: 3.2 billion JPY (1975)
  (very roughly 32 million USD in 1975 prices, 1 USD = 100 JPY)

<table>
<thead>
<tr>
<th>Comparison of Construction Costs</th>
</tr>
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<tbody>
<tr>
<td>1975</td>
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<tr>
<td>1</td>
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YOKOHAMA URBAN PLANNING BUREAU
Development of Incentive Facilities

Shin-Yokohama Central Building

Yokohama International Stadium

Yokohama Arena
Shin-Yokohama District

Shin-Yokohama Station

80 ha
Central pedestrian axis
Multimodal Node Development TOD
Amsterdam Zuidas
(Credit Venhoeven)
Best Practices & Conclusions

✓ Establish understanding of existing transport and land use context, including how much parking is currently being provided

✓ Determine where TOD district exists within network, to tailor design and parking strategies to its urban context

✓ Examine minimum/maximum parking standards for new developments and audit use of current parking facilities and – what is the average utilization rate?

✓ Look at comprehensive policies to reform parking and improve other ways of accessing stations – learn from other cities’ best practices

✓ Adapt designs to climate, and ensure that walking and cycling are accommodated and are pleasant for local residents and transit passengers