

Letter of Transmittal

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Dear whomever this may concern,

This is a technical report completed for the course ENG 2003 titled *Transit-Oriented Development: On Track for a Public Metropolis*, April 4th, 2024.

The report focuses on transit-oriented development (TOD) as a solution to the grand challenge proposed by Vishaan Chakrabarti: creating a “Public Metropolis. TOD is a development strategy that brings significant improvements to sustainability, social equity, and quality of life, essential for the urban planning and development of future cities.

If there are any questions, comments, or concerns, please reach out by email:
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Thank you,

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Transit-Oriented Development: On Track for a Public Metropolis

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Executive Summary

In the 2017 BBC article titled "50 Grand Challenges for the 21st Century," Vishaan Chakrabarti states this significant challenge: the creation of what he calls the "Public Metropolis." These are cities that emphasize ecological integrity, social equity, advanced infrastructure, and embody a free, diverse, and open global society. Building better cities is one of the most impactful improvements we can make a society as it improves the quality of life for every single person.

Current North American cities are not meeting necessary sustainability goals and have significant room for improvement in social equity. These urban areas have high levels of greenhouse gas emissions, excessive reliance on automobiles, and a lack of social equity across many sectors.

Many North American cities are designed around auto-transport and have public transit as an afterthought, leading to long commutes, high transportation costs, and increased pollution. This car dependency not only harms the environment but also increases the social inequalities that stem from a high cost of auto transport and limited access to efficient public transit that is currently affecting low-income communities.

Transit-Oriented Development (TOD) is a viable solution to these issues as it promotes high-frequency transit services, mixed land uses, and pedestrian-friendly environments. The effects of TOD reduce automobile dependency, decrease greenhouse gas emissions, and create inclusive communities by focusing on sustainable and equitable urban development. Successful development with TOD is achievable and can significantly improve the livability and environmental footprint of cities. This report explores what TOD is, its benefits for sustainability, and its role in enhancing social equity and livability emphasizing how TOD can improve urban areas into more sustainable and equitable environments.

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1.0 Introduction and Background

A major challenge for cities and global development is to build what Vishaan Chakrabarti calls the “Public Metropolis” - urban areas that prioritize sustainability, social equity, robust infrastructure, and a free and diverse society for all citizens. Current North American cities are not sustainable for either the environment or their citizens. Now more than ever, development must prioritize ecological sustainability and, most importantly, social equity. Chakrabarti states “the question that remains is not whether to build better cities, but how”, and the proposed means to do so is through transit-oriented development (TOD).

TOD aims to create urban spaces that are more sustainable and equitable by promoting high-frequency transit services, mixed land uses, and pedestrian-friendly environments. This approach not only reduces reliance on automobiles but also brings vibrant, livable communities. The following sections explore what TOD is, its benefits for sustainability, and its role in enhancing social equity and livability.

2.0 What is Transit Oriented Development?

To put it simply, transit-oriented development (TOD) is “careful coordination of urban structure around the public transport network” [1]. To expand in a more detailed sense, “TOD can be described as land-use and transportation planning that makes cycling, walking, and transit use convenient and desirable, and that maximizes the efficiency of existing public transit services by focusing development around public stations, stops, and exchanges” [1].

The concept of TOD was introduced in the late 1980s after urban planners and researchers were observing the downfalls of car-oriented developments and were looking for a solution to balance vehicular traffic with other modes of transportation. TOD sought to reduce the reliance on automobiles, shorten commutes, and promote alternative methods of transport such as walking, cycling, and public transit [1].

The original three characteristics of TOD are: “*Density* with high density of dwelling units, population, jobs and activity sites; *Diversity* with multiple forms of land use; and *Design* with dense urban grids and pedestrian friendly environments” [2]. In the following years, researchers added four more characteristics that are required for successful TOD: *Distance* to access transit; *Destination Accessibility*; *Demand Management* of urban car traffic; and *High Frequency* transit services [2].

Table 1. Key characteristics and planning elements of successful transit-oriented development [2].

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|--|
| <ol style="list-style-type: none">1. Density: high density of dwelling units, population, jobs, and activity sites2. Diversity: multiple forms of land use3. Design: dense urban grids and pedestrian friendly |
|--|

4. Distance to transit stations and stops: thresholds for walking
5. Destination accessibility: thresholds for walking
6. Demand management of road transport
7. High Frequency, Speed and Capacity of peak and off-peak heavy rail, light rail and/or bus rapid transit services

2.1 Sustainability and The Urban Environment

In all aspects of developing anything, sustainability should always be in mind. This is also true for the development of cities, and TOD is a promising solution for more sustainable cities. With improved public transportation, mixed-use developments, and increased density, TOD reduces the environmental impact of entire cities. The promotion of alternative methods to auto transportation reduces the number of cars on the road and in turn improves sustainability.

Proper transportation and higher density land use development can achieve significant environmental benefits by reducing automobile dependency. TOD can reduce greenhouse gas emissions and building life-cycle energy consumption by 9%-25%, overall GHG impact by 36%, respiratory impacts by 8.4%, and smog by 25% [3]. Figure 1 shows the correlation of higher urban density and lower transport-related energy consumption with Hong Kong having the highest urban density as well as the lowest transport-related energy consumption.

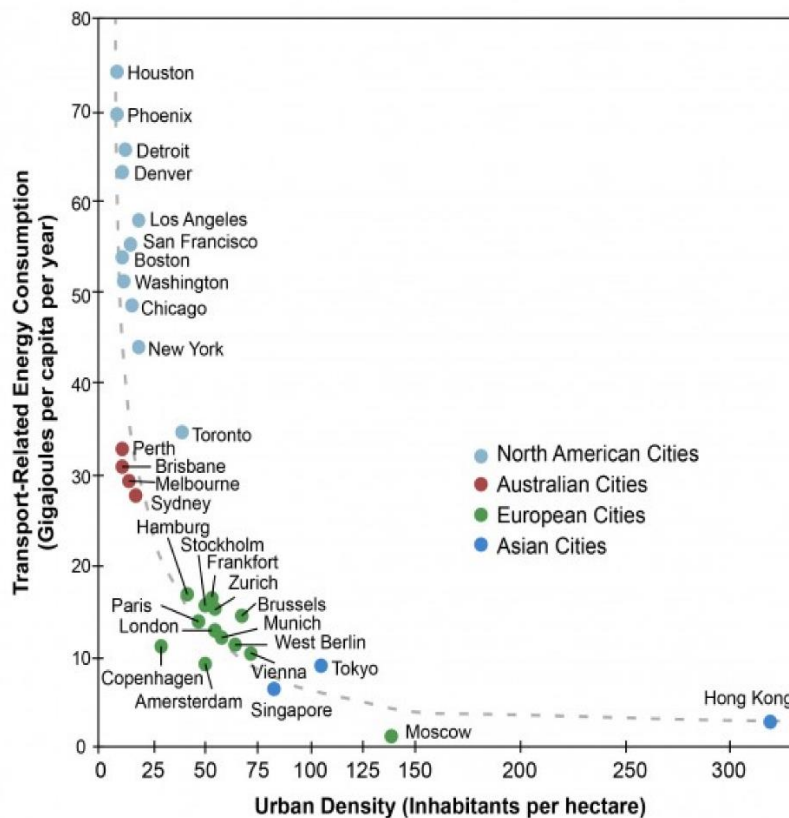


Figure 1: Urban density and transport-related energy consumptions [3].

The development, infrastructure, and transportation of urban areas significantly impact greenhouse gas (GHG) production. Transportation contributes an estimated 28% of all GHG emissions, and even 40% in some states [3]. TOD combines residential and commercial development within walking distance of public transportation which greatly reduces GHG emissions. A study in the Chicago Metropolitan Area found that households that are living in communities within a half-mile of public transit have 43% lower transportation related GHG emissions compared to those living in typical suburban areas. [3] In downtown areas, where there is a high concentration of transit options, jobs, housing, shopping, and other amenities, emissions are even lower, by up to 78% [3]. To effectively reduce GHG emissions, it is essential to minimize driving which can be achieved through TOD by creating communities that promote walking, biking, and the use of public transit.

2.2 Social Equity and Livability

TOD plays a crucial role in improving social equity and livability in urban areas. This section explores TOD's influence on quality of life (QOL) indicators, using a study of over 350 light rail transit (LRT) stations throughout the US [6]. All findings were done outside of central business districts (CBD) as they are unique to urban areas. This study defined three categories of LRT station study areas: Emerging (low transit frequency and connectivity, segregated land uses), Transitioning (moderate transit and connectivity, mixed uses), and Coordinating (high transit frequency and connectivity, diverse uses). Tables 2 and 3 emphasize the stark differences between emerging and coordinating LRT stations. Coordinating LRT stations have lower amounts of driving and an increase of non-auto modes, decreased transportation spending, more opportunity for civil involvement, as well as an increased access to cultural, arts, and entertainment institutions. There are also numerous health benefits around coordinating LRT station areas with a decrease in obesity rates, cardiovascular diseases, and asthma. Finally, coordinating LRT stations also have various improvements in the social sector with a decrease of unemployment, increased education, decreased poverty, and decreased linguistic isolation.

Table 2: ANOVA results comparing coordinating and emerging average proxy QOL indicator scores for LRT stations, outside of CBDs [6].

Proxy QOL Outcome Indicators	Emerging	Coordinating	Difference	% Difference
Drove Alone	69.45%	49.55%	-19.90%	-28.65%
Public Transportation	7.48%	13.97%	+6.49%	+86.76%
Bicycle	1.71%	4.35%	+2.64%	+154.39%
Walked	3.83%	18.05%	+14.22%	+371.28%
Household Annual Vehicle Miles Traveled	23,028	17,239	-5,789	-25.13%
Auto Ownership Per HH	1.97	1.62	-0.35	-21.60%
HH Transportation Costs % of M Income	19.08%	15.34%	-3.74%	-19.60%

Proxy QOL Outcome Indicators	Emerging	Coordinating	Difference	% Difference
HH Housing & Transportation Costs % of M Income	46.48%	41.51%	-4.97%	-10.69%
Median Square Foot Sale 2010	\$158.8	\$219.2	+\$60.4	+38.03%
Opportunity for Civic Involvement	6.05	7.20	+1.15	+19.00%
Access to Cultural, Arts, and Entertainment Institutions	0.69	1.06	+0.36	+52.01%
Household Carbon Footprint from Transport	14.05	10.21	-3.84	-27.33%
Total Household Carbon Footprint	42.70	34.53	-8.17	-19.13%
Obesity Rates	23.52%	22.79%	-0.73%	-3.10%

Table 3. ANOVA results comparing emerging and transitioning vs. coordinating average proxy QOL outcome scores for light rail transit stations, outside of CBDs [6].

Proxy QOL Outcome Indicators	Emerging & Transitioning	Coordinating	Difference	% Difference
Obesity Rate	26.28%	20.78%	-5.5	-20.92%
Cardiovascular Disease	7.92	5.87	-2.05	-25.88%
Asthma	58.45	39.90	-18.55	-31.73%
Unemployment	12.03%	6.87%	-5.16	-42.89%
Education	16.64%	8.98%	-7.66	-46.03%
Poverty	40.40%	28%	-12.4	-30.69%
Linguistic Isolation	10.12%	5.79%	-4.33	-42.78%

2.3 Policy and Implementation

For many, the concept of TOD may seem appealing in theory, but it in practice the implementation often falls short. This is simply not the case. There are many challenges in its implementation but with the proper land use policies and designation around effective transit services, TOD can be the solution that cities need. To Maximize TOD's potential, there are some best practice policy recommendations [2]:

- Implement specific planning mechanisms to enhance the impact of transit investments.
- Move beyond integrated transport and urban planning to include policies that discourage car use and support affordable housing for diverse socio-economic groups.
- Promote truly mixed land uses that integrate residential, commercial, leisure, and employment areas to minimize long-distance travel.
- Create attractive, livable cities with aesthetic, open, and green spaces.
- Provide a symbiotic relationship between different transport modes to create a cohesive network of sustainable mobility options.
- Integrate future transport developments, including autonomous and connected transport and vehicle sharing hubs, with TOD planning.

Discussion and Conclusion

From the studies in this report, it is concluded that TOD is an effective and viable approach to addressing the needs of sustainability, social equity, and livability in urban environments. When cities prioritize transit services, mixed land uses, and increased density, the reliance on cars is reduced while vibrant and inclusive communities are born. The studies presented in this report highlight the significant benefits of TOD, including reduced greenhouse gas emissions, improved public health outcomes, and enhanced social equity.

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