

บรรยาย เรื่อง “การพัฒนาระบบขนส่งมวลชนและเมือง อย่างยั่งยืน : การพัฒนาพื้นที่โดยรอบสถานีขนส่งมวลชน”

โดย ผู้ช่วยศาสตราจารย์ ดร.สฤษฎ์ ลบแยม

คณะสถาปัตยกรรมศาสตร์

สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง





Transit and Urban Development for Sustainability: Transit- oriented Development

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เนื้อหาบรรยาย

- บทนำ
- ความจำเป็นของระบบราง
- หลักการและการออกแบบ TOD
- ผลกระทบและประโยชน์ของ TOD
- ตัวอย่างการประเมินคุณค่าโครงการ
- ตัวอย่างการพัฒนาเมืองแบบ TOD
- บทสรุป

บทนำ



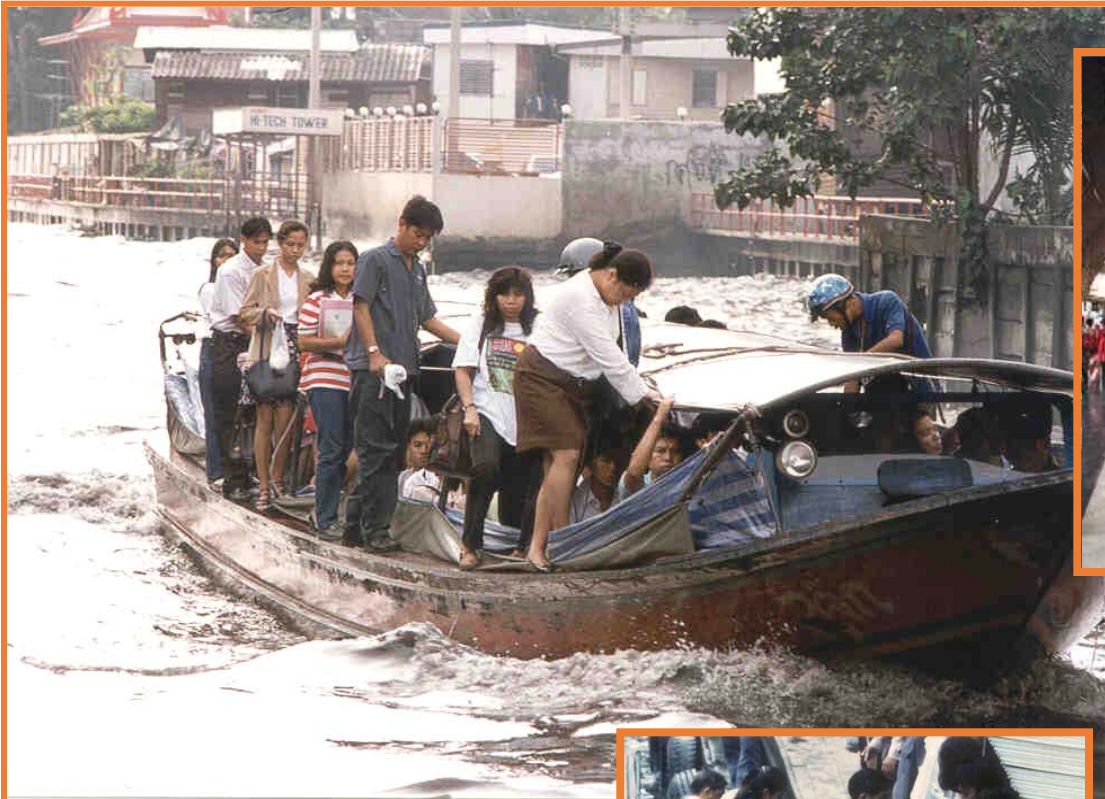


ความไม่สะดวกในการเดินทางด้วยระบบขนส่งสาธารณะ

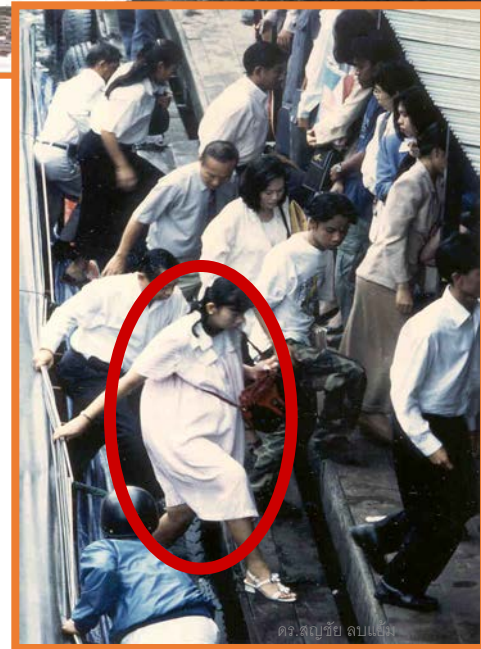


สภาวะแวดล้อมเสื่อมโทรม คุณภาพชีวิตถดถอย





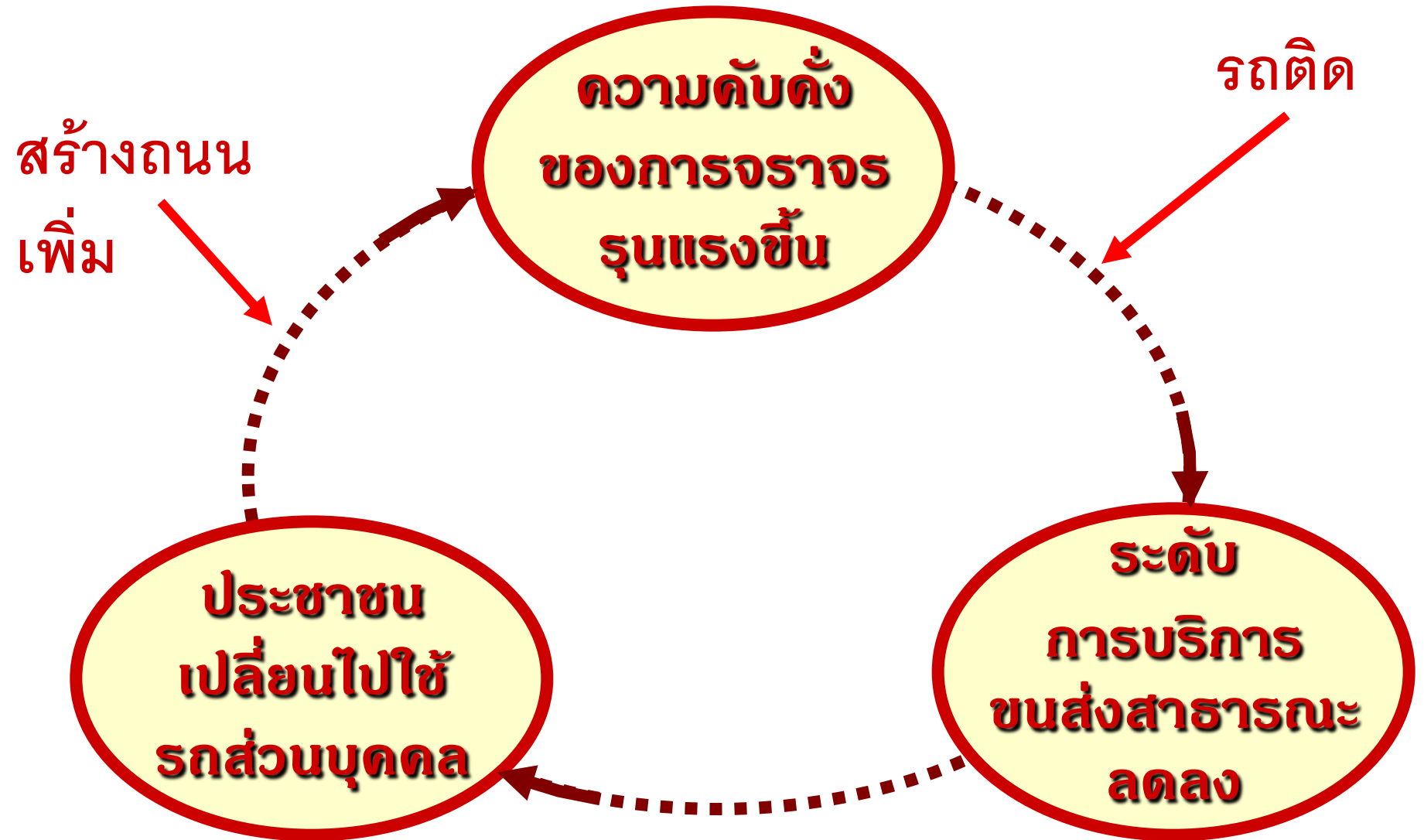
สภาวะแวดล้อม
เสื่อมโทรม
คุณภาพชีวิต
ถดถอย



Traffic Congestion



Vicious Cycle





ปริมาณการขนส่ง 50,000 คน/ชม./ทิศทาง

□ รถยนต์ส่วนบุคคล

▢ ทางด่วน 14 ช่องทาง
เขตทาง 70 เมตร



□ รถโดยสาร

▢ รถเมล์ 4-6 ช่องทาง
เขตทาง 20 เมตร



□ รถไฟฟ้า

▢ รถไฟฟ้า 2 ช่องทาง
เขตทาง 9 เมตร



space required to transport 60 people



car



bus

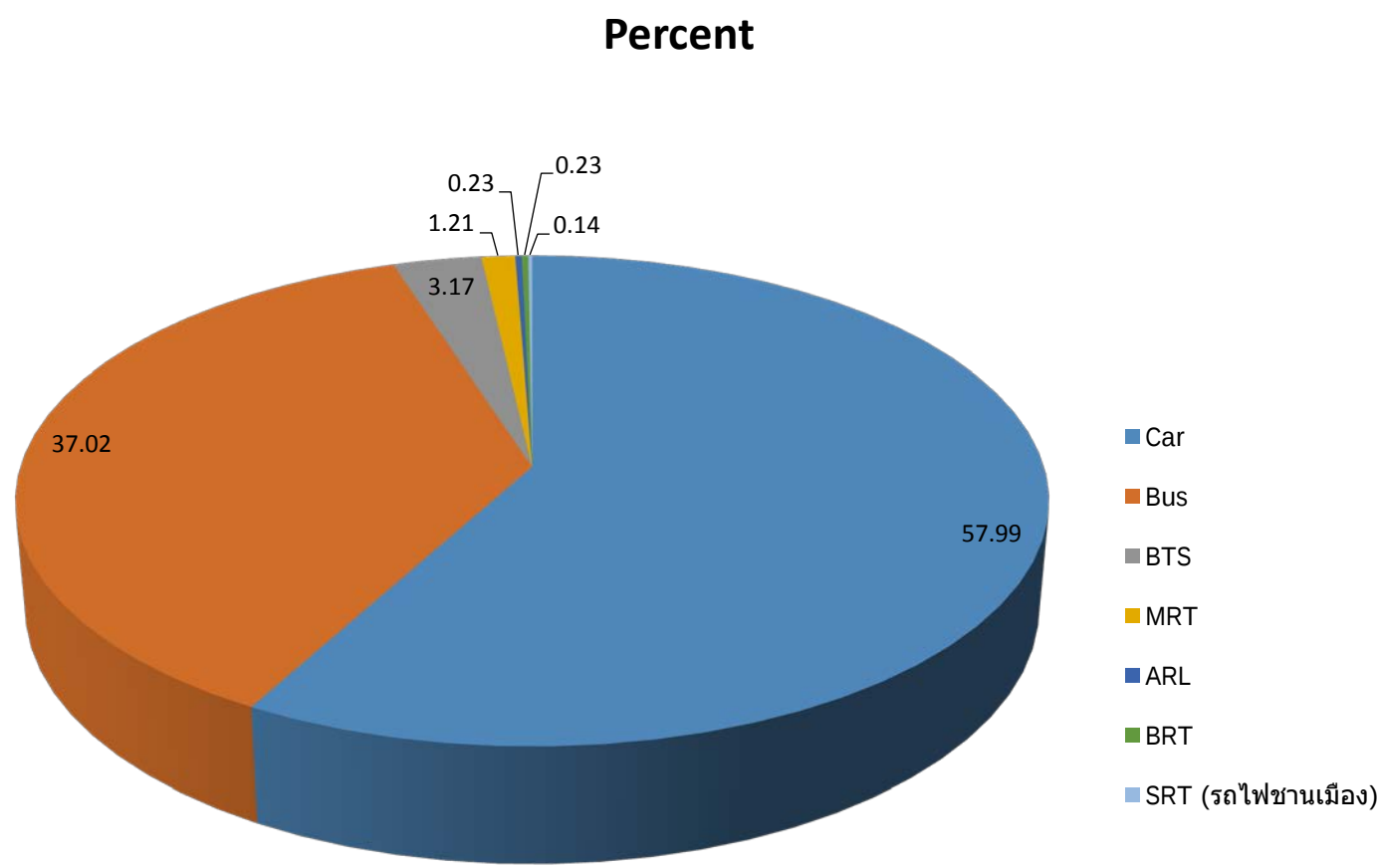


bicycle

Mode Choices

No.	Mode	Share (Million Trips/day)	Percent
1	Car	12.50	57.99
2	Bus	7.98	37.02
3	BTS	0.68	3.17
4	MRT	0.26	1.21
5	ARL	0.05	0.23
6	BRT	0.05	0.23
7	SRT (รถไฟฟ้าชานเมือง)	0.03	0.14
	Total	21.55	100.00

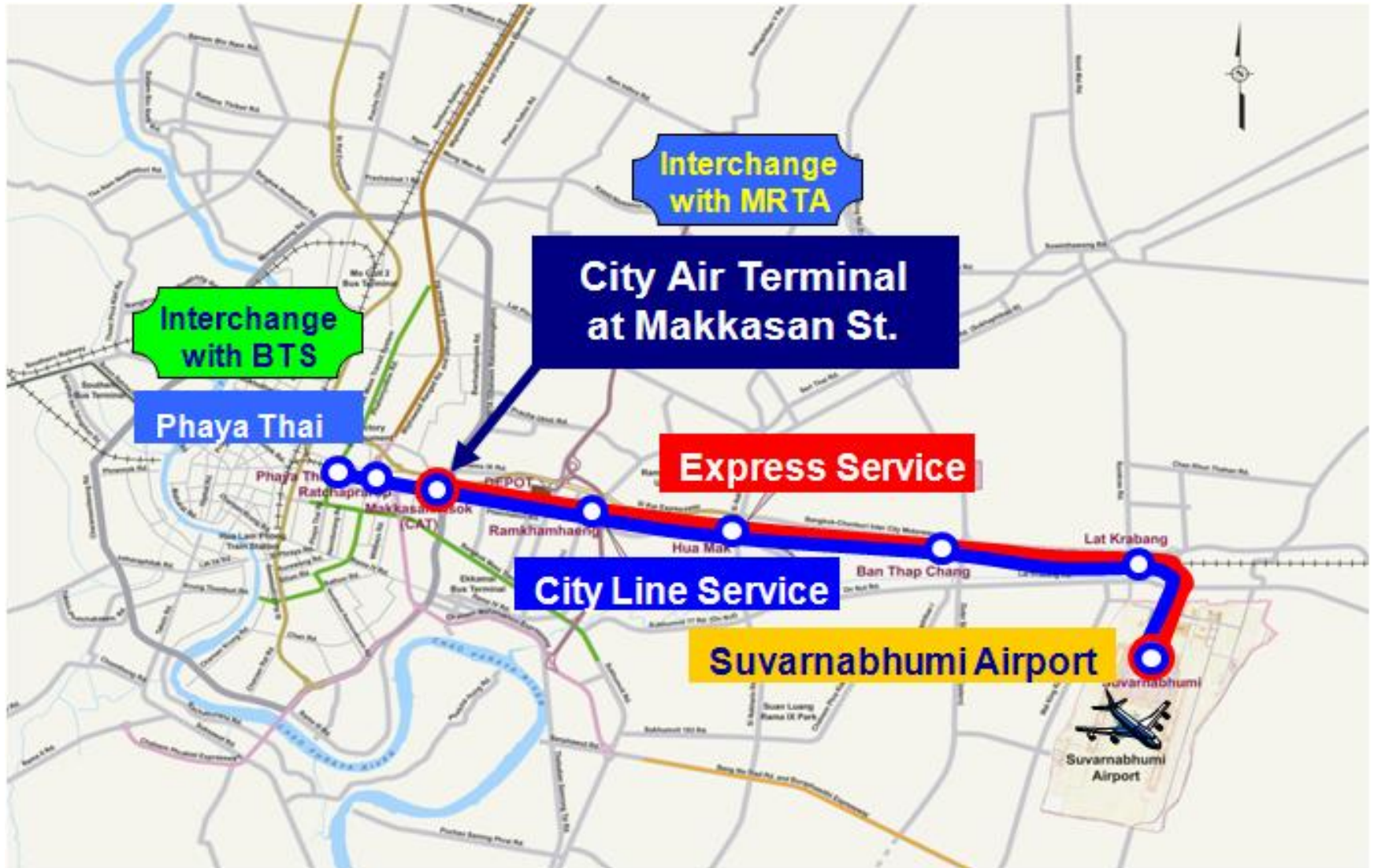
Mode Proportions



MRT



Airport Rail Link (ARL)



All Major Mass Rapid Transits



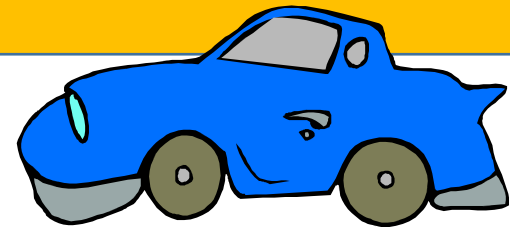
TOD Principle & design



Land Use



Travel Demand



Travel Demand Management (TDM)

Improves Transport Options	Incentives	Land Use Management	Policies and Programs
<u>Transit improvements</u> <u>Nonmotorized improvements</u> <u>Rideshare programs</u> <u>Flextime</u> <u>Car sharing</u> <u>Telework</u> <u>Taxi improvements</u> <u>Bike/transit integration</u> <u>Guaranteed ride home</u> <u>HOV Priority</u>	<u>Road pricing</u> <u>Distance-based fees</u> <u>Commuter financial incentives</u> <u>Parking pricing</u> <u>Pay-as-you-drive vehicle insurance</u> <u>Fuel tax increases</u> <u>Nonmotorized encouragement</u>	<u>Smart growth</u> <u>New urbanism</u> <u>Location-efficient development</u> <u>Parking management</u> <u>Transit oriented development</u> <u>Car free planning</u> <u>Traffic calming</u>	<u>TDM Programs</u> <u>Commute trip reduction</u> <u>Campus transport management</u> <u>Freight transport management</u> <u>Tourist transport management</u> <u>TDM marketing</u> <u>Least-Cost planning</u> <u>Market reforms</u> <u>Performance Evaluation</u>

TOD Principle

Transit-oriented Development (TOD) refers to

- 1) Residential and commercial centers designed to maximize access by transit and non-motorized transportation and**
- 2) Other features to encourage transit ridership.**

A typical TOD has a rail or bus station at its center, surrounded by relatively high-density development, with progressively lower-density spreading outwards 1/4 mile to 1/2 mile, which represents pedestrian scale distance.

Source: Renne, 2009

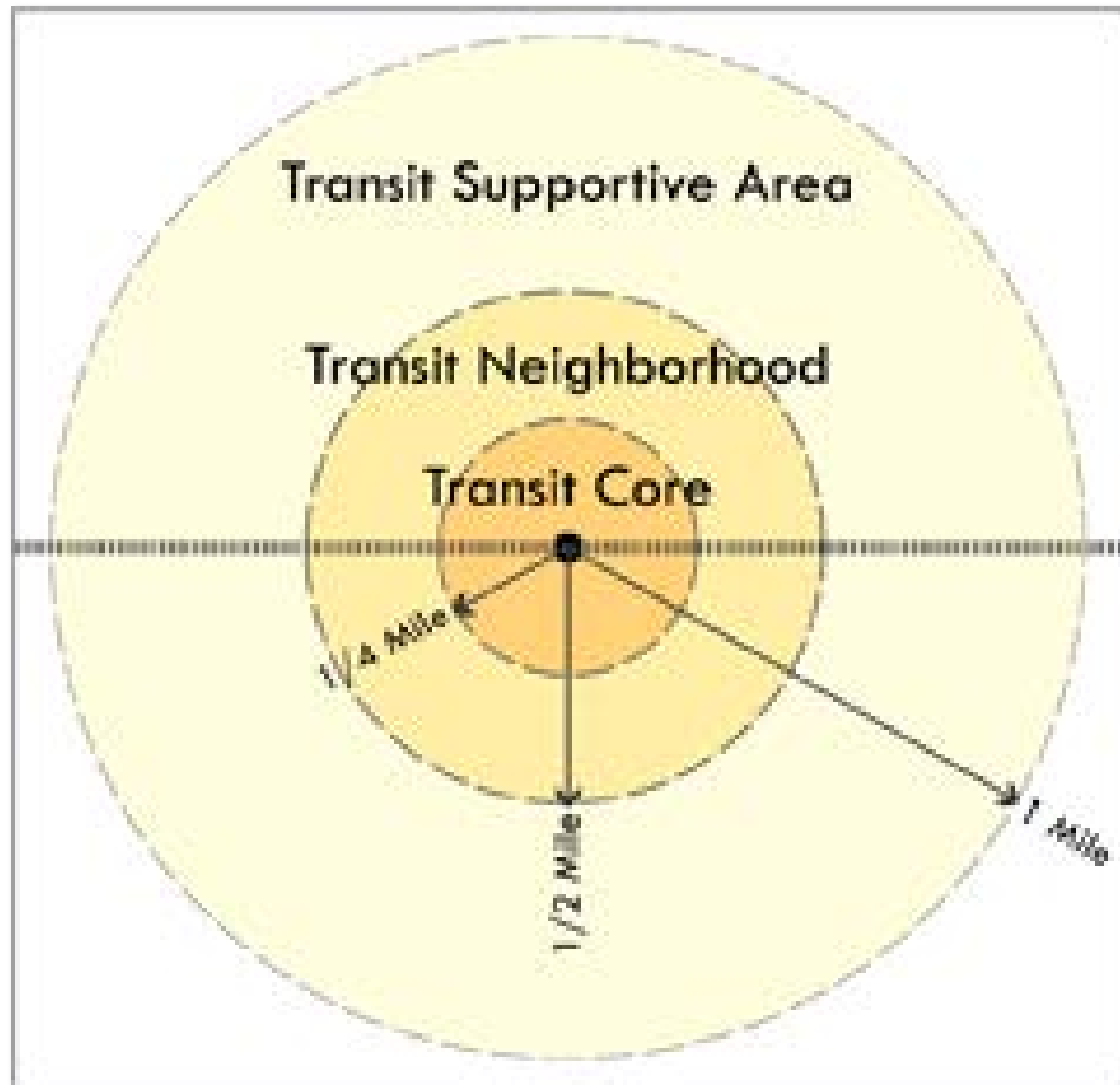
TOD Design

- Emphasize transit system
- Compact (radius 400 – 800 m)
- Mixed Use (vertical & horizontal)
- Density (moderate – high)

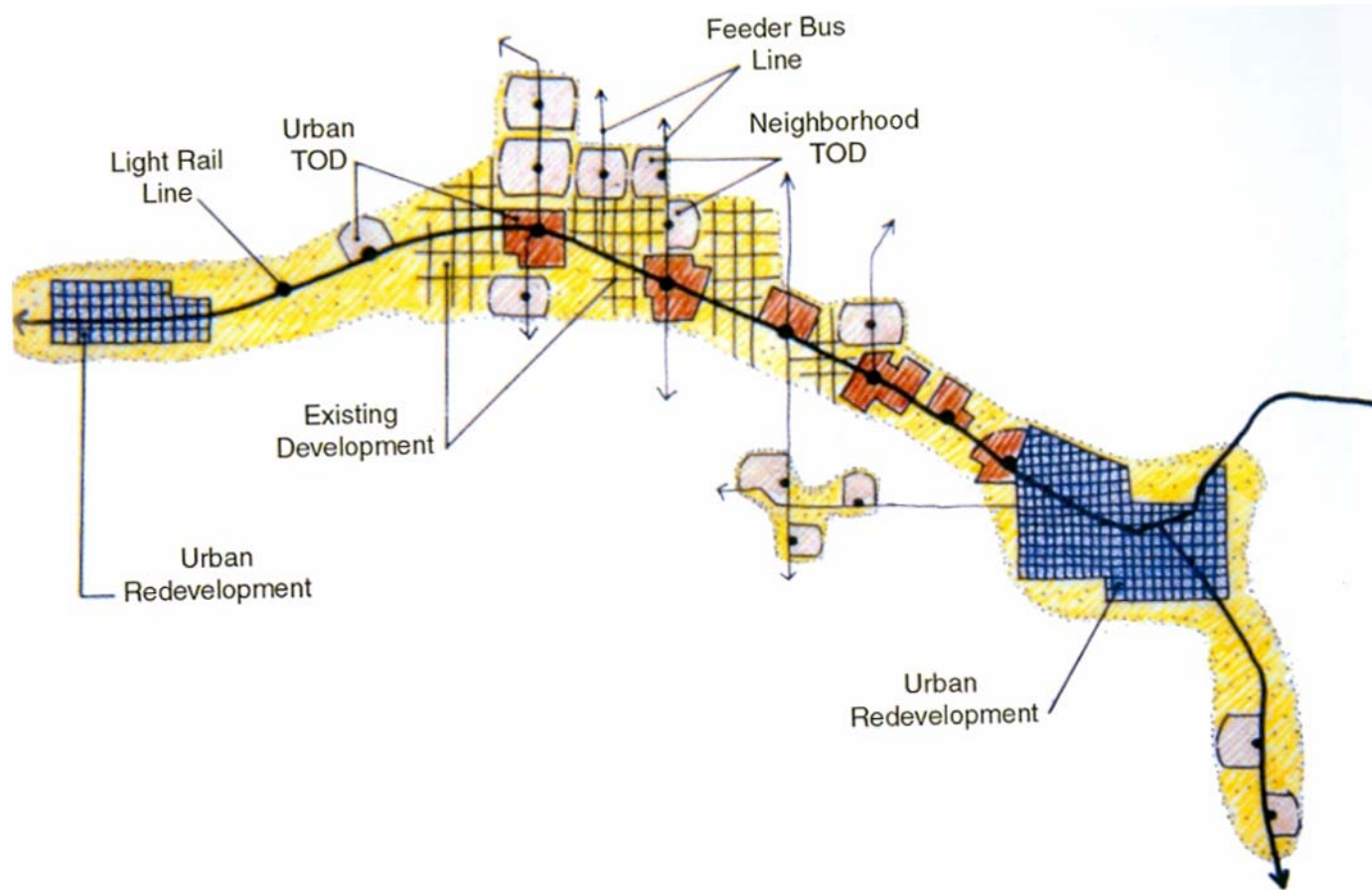
TOD Design (ต่อ)

- Encourage alternative travel modes (walking!)
- Parking demand management
- Street connectivity & Traffic calming
- Transit stops/stations design: convenient, comfortable, and secure

TOD Design



TOD Design



TOD



TOD Housing

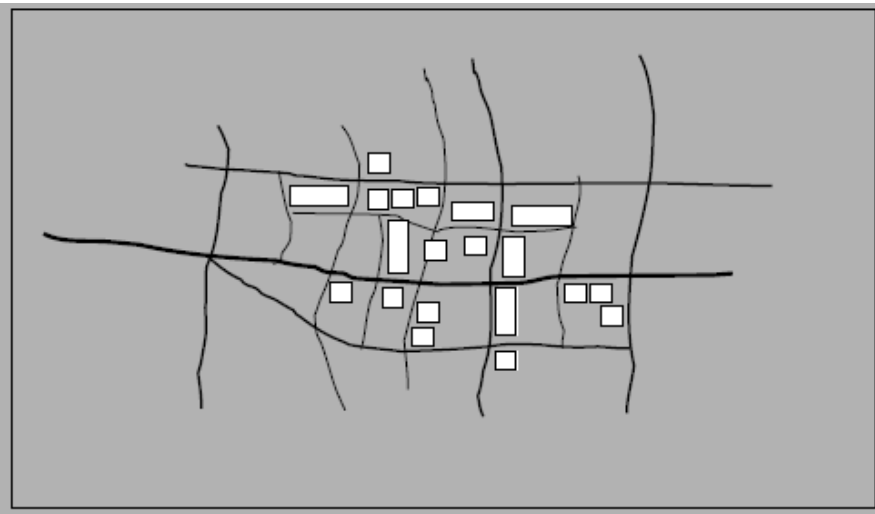


Open Space / Public Area

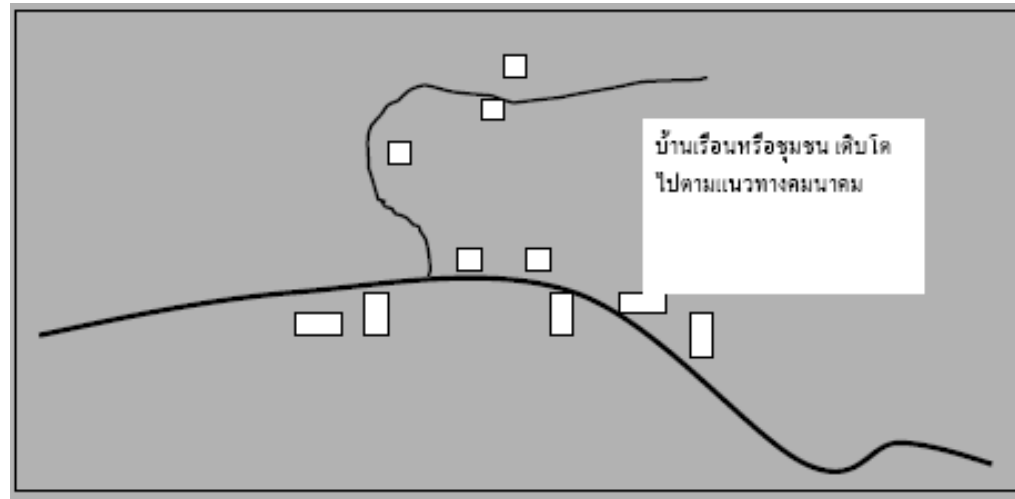


Road Connectivity

Grid Pattern



Linear Pattern



TOD vs TAD

Transit Oriented Development	Transit Adjacent Development
▪ Grid street pattern ▪ Higher densities ▪ Limited surface parking and efficient parking management ▪ Pedestrian- and bicycle-oriented design ▪ Mixed housing types, including multi-family ▪ Horizontal (side-by-side) and vertical (within the same building) mixed use ▪ Office and retail, particularly on main streets.	▪ Suburban street pattern ▪ Lower densities ▪ Dominance of surface parking ▪ Limited pedestrian and cycling access ▪ Mainly single-family homes ▪ Segregated land uses ▪ Gas stations, car dealerships, drive-through stores and other automobile-focused land uses.

เกณฑ์ความหนาแน่นขั้นต่ำ (Density Threshold)

Mode	Service Type	Minimum Density (Dwelling Units Per Acre)	Area and Location
Dial-a-Bus	Demand response serving general public (not just people with disabilities).	3.5 to 6	Community-wide
"Minimum" Local Bus	1/2-mile route spacing, 20 buses per day	4	Neighborhood
"Intermediate" Local Bus	1/2-mile route spacing, 40 buses per day	7	Neighborhood
"Frequent" Local Bus	1/2-mile route spacing, 120 buses per day	15	Neighborhood
Express Bus – Foot access	Five buses during two-hour peak period	15	Average density over 20-square-mile area within 10 to 15 miles of a large downtown
Express Bus – Auto access	Five to ten buses during two-hour peak period	15	Average density over 20-square-mile tributary area, within 10 to 15 miles of a large downtown
Light Rail	Five minute headways or better during peak hour.	9	Within walking distance of transit line, serving large downtown.
Rapid Transit	Five minute headways or better during peak hour.	12	Within walking distance of transit stations serving large downtown.
Commuter Rail	Twenty trains a day.	1 to 2	Serving very large downtown.

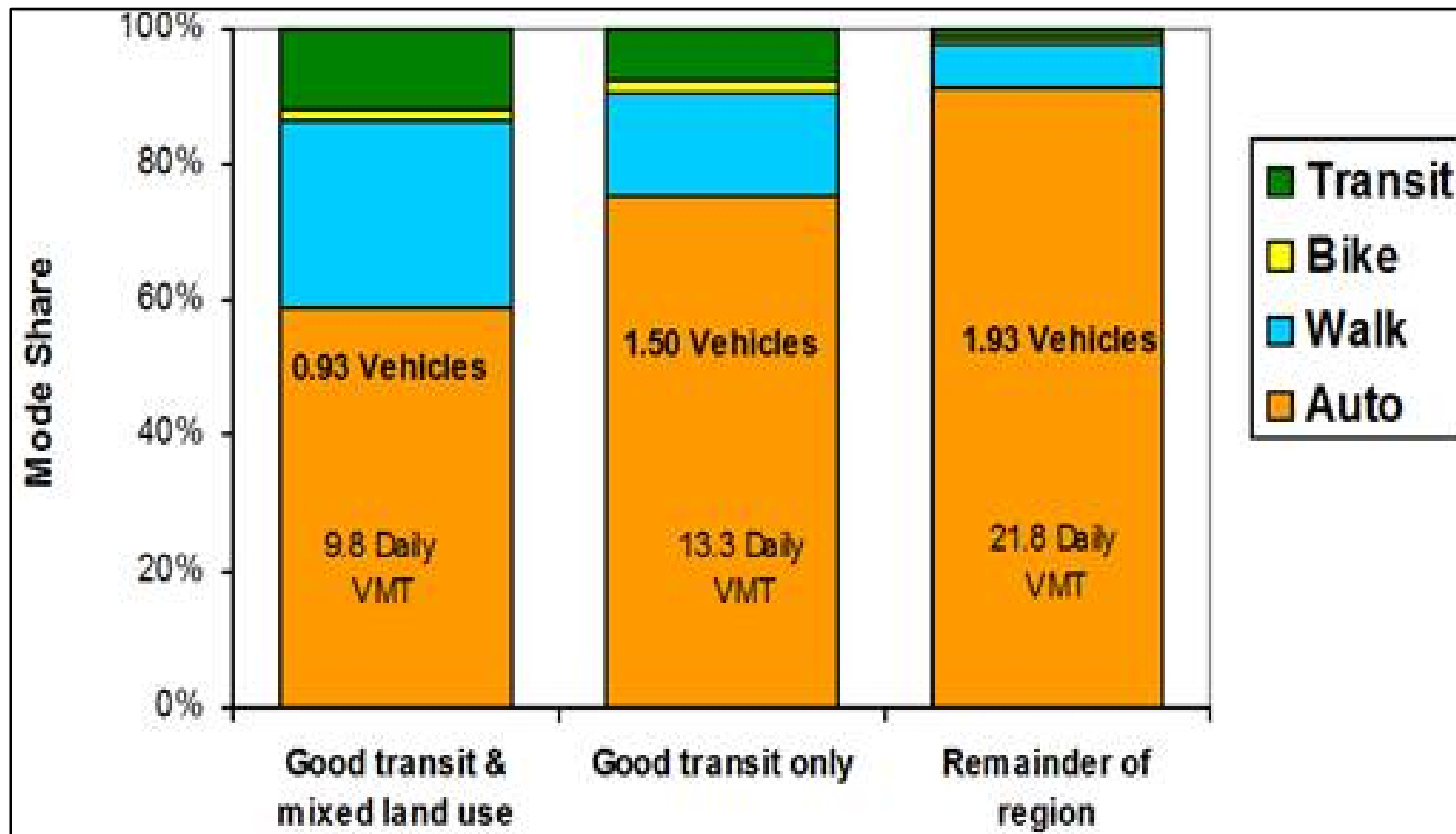
TOD impact & benefit



ผลกระทบจาก TOD (TOD Impacts on Travel)

Land Use Type	Auto Ownership	Daily VMT	Mode Split				
	Per Household	Per Capita	Auto	Walk	Transit	Bike	Other
Good transit/Mixed use	0.93	9.8	58%	27%	12%	1.9%	1.5%
Good transit only	1.50	13.3	74%	15%	7.9%	1.4%	1.1%
Remainder of county	1.74	17.3	82%	10%	3.5%	1.6%	3.7%
Remainder of region	1.93	21.8	87%	6.1%	1.2%	0.8%	4.0%

TOD Impact on Mode Shares



TOD Impact on Property Values

Single Family Residential	+2% w/in 200 ft of station to +32% w/in 100 ft of station
Condominium	+2% to 18% w/in 2,640 ft of station
Apartment	+0% to 4% w/in 2,640 ft of station to +45% w/in 1,320 ft of station
Office	+9% w/in 300 ft of station to +120% w/in 1,320 ft of station
Retail	+1% w/in 500 ft of station to +167% w/in 200 ft of station

ตัวอย่างการประเมินคุณค่า โครงการ (Performance evaluation)



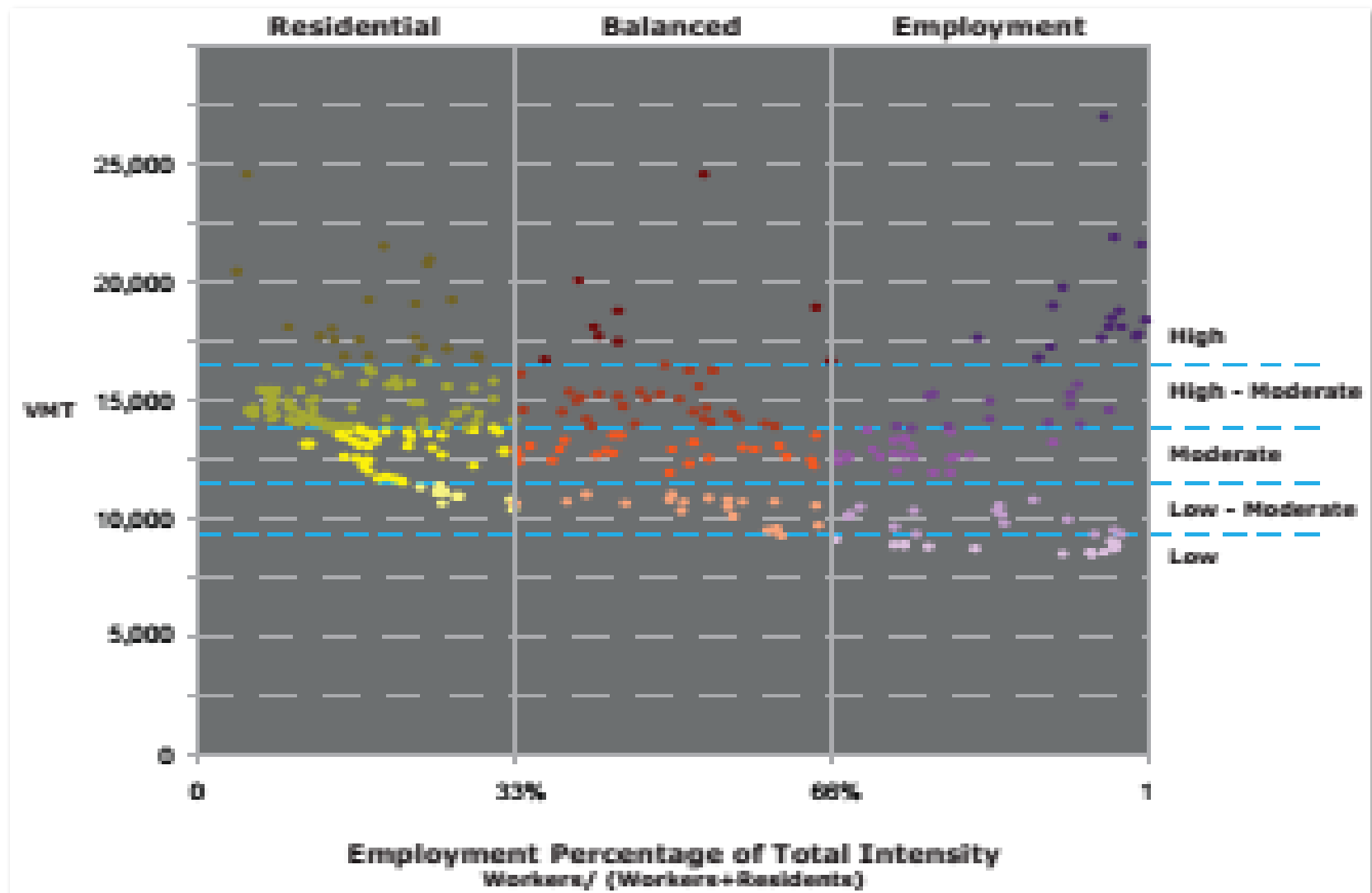
Performance (Travel) vs. Place (Land Use)



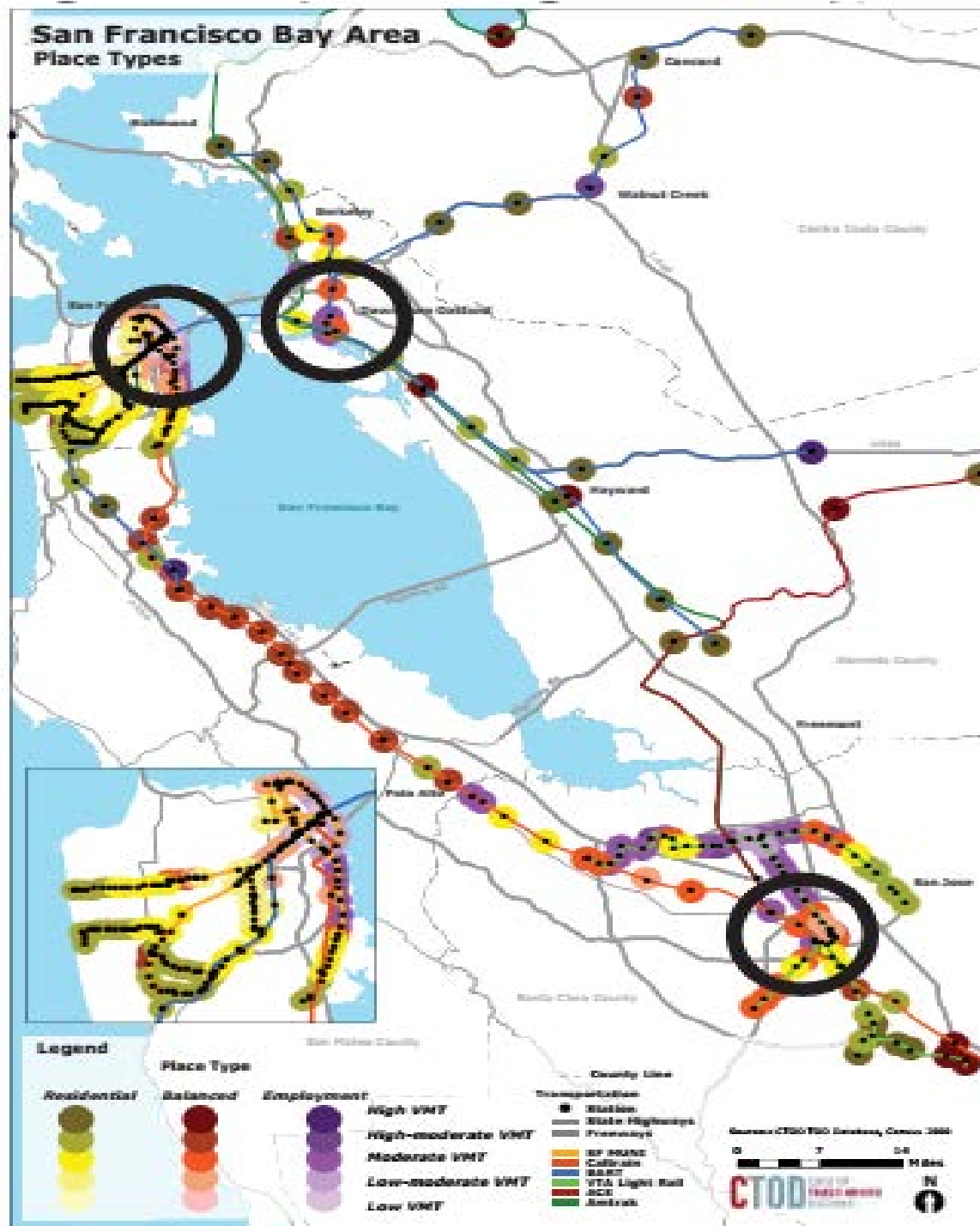
Land Use Type (Jobs and Housing Balance - JHB)

Use Mix Type	Percentage of workers relative to workers and residents
1 primarily residential	33.3% or less
2 balanced	33.3% to 66.7%
3 primarily employment	66.7% or more

VMT vs. JHB



San Francisco Bay Area Place Types

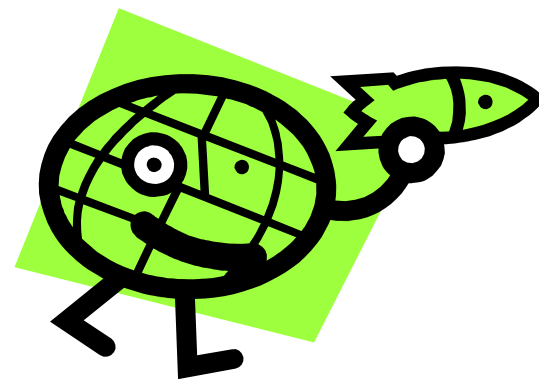


VMT Measurement

VMT Category	VMT Range	Width
Low	< 9,100	
Low-Moderate	9,100-11,600	2,500
Moderate	11,600-14,300	2,700
High-Moderate	14,300-17,200	2,900
High	>17,200	

เกณฑ์กลาง (Normative Matrix)

Place Types	Residential Places					Balanced Places					Employment Places				
	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT
Total Intensity (residents + workers)	54,216	24,718	12,580	7,708	3,429	64,155	21,763	11,600	6,867	3,242	109,306	34,914	13,009	5,969	2,325
Residents	44,293	20,106	10,229	6,292	2,716	29,875	10,732	5,884	3,695	1,764	12,581	5,103	2,065	1,154	321
Workers	9,923	4,612	2,351	1,416	713	34,280	11,031	5,716	3,172	1,478	96,725	29,811	10,944	4,815	2,004
Workers/Residents	18.3%	19.5%	19.6%	20.3%	19.6%	51.6%	49.7%	48.2%	46.0%	46.2%	86.5%	83.9%	84.2%	83.0%	87.1%
Households	16,214	7,684	3,906	2,253	974	15,466	4,646	2,429	1,467	670	6,828	2,524	861	467	120
Household Size	2.71	2.61	2.62	2.71	2.68	1.95	2.21	2.41	2.43	2.60	1.58	1.67	2.22	2.28	2.64
Gross Density (units/acre)	50.0	21.6	10.3	5.7	2.2	48.7	16.4	7.6	4.0	1.9	28.5	10.3	4.6	2.2	0.9
Residential Density (units/acre)	53.2	23.6	12.1	6.7	3.4	55.6	20.9	10.5	5.8	3.5	51.4	20.6	10.8	6.0	2.9
Block Size (acres)	4.2	4.1	5.7	7.7	18.8	3.7	5.8	8.5	9.9	23.7	3.7	6.4	14.2	69.9	86.7
Monthly T Cost	\$422	\$563	\$688	\$781	\$906	\$394	\$597	\$721	\$794	\$900	\$463	\$613	\$713	\$793	\$920
Yearly T Cost	\$5,064	\$6,756	\$8,256	\$9,372	\$10,872	\$4,728	\$7,164	\$8,652	\$9,528	\$10,800	\$5,556	\$7,356	\$8,556	\$9,516	\$11,040
Average Median Income (1999)	\$31,713	\$35,643	\$41,344	\$53,492	\$62,069	\$43,997	\$37,364	\$43,395	\$51,138	\$65,544	\$41,875	\$34,183	\$43,935	\$40,985	\$57,562
Travel Time to Work (minutes)	35.6	31.4	27.4	25.5	24.7	23.5	22.1	21.4	21.6	22.9	18.0	17.1	18.7	19.0	21.5
Employment Proximity	233,890	127,448	65,640	42,260	20,788	451,725	152,310	73,393	41,335	27,131	396,277	159,118	99,648	58,747	32,167
Transit Access Index	31	19	13	10	3	56	28	11	9	4	85	45	19	10	4
Autos/Household	0.45	0.82	1.18	1.47	1.71	0.52	0.87	1.22	1.41	1.68	0.48	0.74	1.11	1.18	1.61
Home Journey to Work Transit	58%	39%	23%	15%	8%	43%	25%	14%	10%	8%	25%	16%	13%	9%	5%
Home Journey to Work Walk/Bike/ Transit	68%	47%	27%	18%	10%	64%	40%	23%	15%	11%	58%	37%	24%	18%	9%
Workplace Journey to Work Transit	33%	20%	11%	7%	2%	38%	17%	8%	5%	3%	38%	16%	9%	5%	3%
Workplace Journey to Work Walk/Bike/ Transit	47%	30%	18%	12%	6%	48%	23%	12%	8%	5%	43%	19%	11%	7%	5%



ตัวอย่างการพัฒนาเมืองแบบ TOD

Curitiba, Brazil



Vancouver, Canada



Toronto, Canada



Hong Kong, China



Guatemala City, Guatemala



San Francisco Bay Area



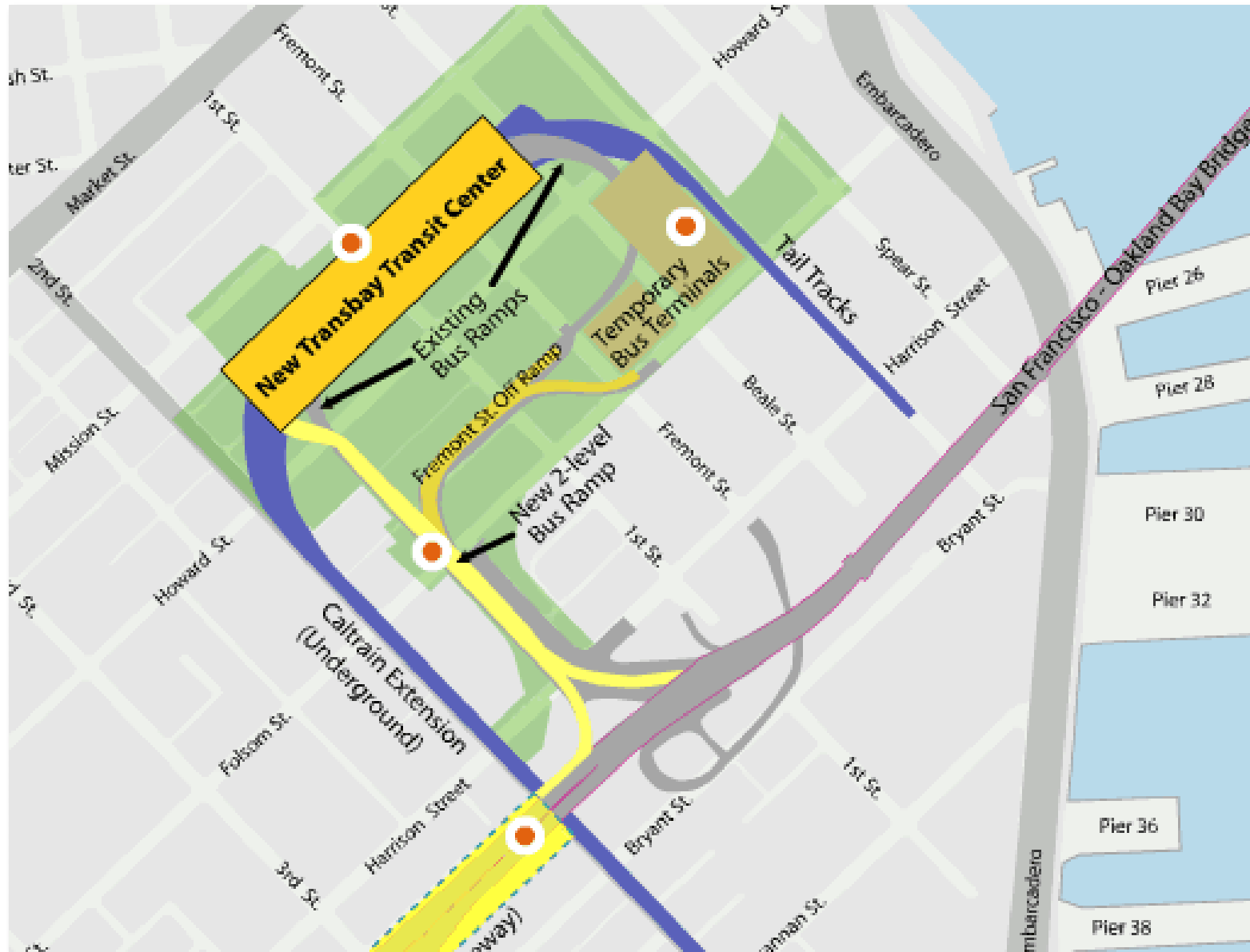
Portland, Oregon



Transbay Transit Center, USA



Transbay Transit Center (๓๑)



บทสรุป



สรุปประโยชน์ TOD

1. Compact, Dense Development
2. Mixed Use (both vertical & horizontal development)
3. Increasing travel options through urban design/form
4. Reduced VMT, Vehicle Ownership
5. Boosted Transit Ridership

สรุปประโยชน์ TOD (ต่อ)

6. Reduced Green-House Gas (GHG) Emissions
7. Reduced Trip Generation
8. Reduced Urban Sprawl
9. Minimized Parking Space
10. Increase Property Value
11. Better quality of life

ประเด็นขบคิด

- ลดค่าใช้จ่ายการเดินทาง!
(Reduced transportation cost)
- ประหยัดค่าใช้จ่ายบ้าน: ค่าบ้านหรือค่าเช่า!
(Reduced housing cost)

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