

講師のプロフィール

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	台湾地域科学学会 会長
	台湾都市計画学会 会長
	EASTS(アジア交通学会) 理事

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(専門分野)

- 1.都市・地域分析の手法
- 2.交通プロジェクトの評価
- 3.交通政策
- 4.交通と土地利用
- 5.ロジスティクスマネジメント

Urban Transport in Taipei: Lessons and Prospects

Cheng-Min Feng

Professor

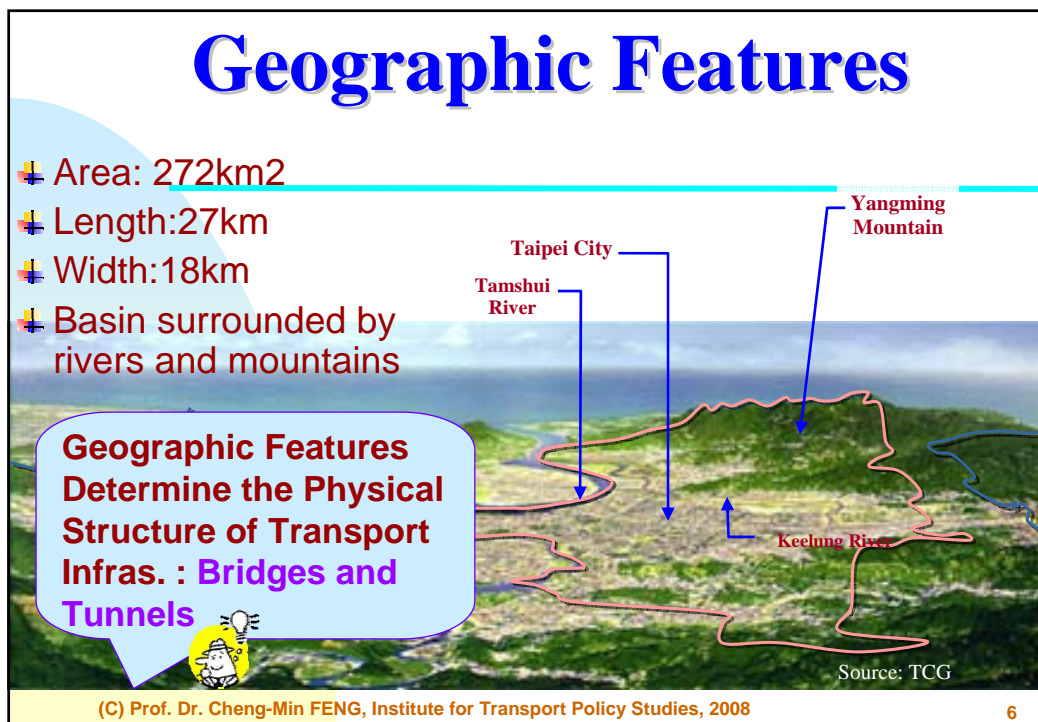
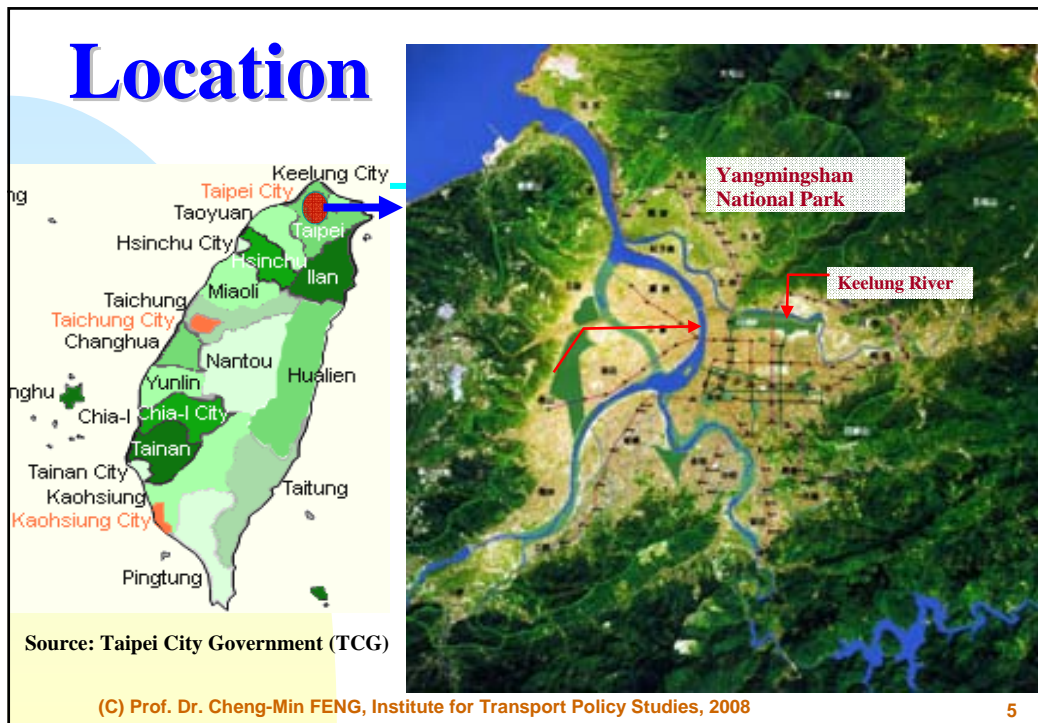
Institute of Traffic and Transportation
National Chiao Tung University

23rd ITPS Research Symposium
22 May 2008 in Tokyo



Background of Taipei City





Urban Development



1625~1895



1. Early Settlement

1625~1895

- Port and village clusters

1895~1945



2. Japanese Occupation

Period, 1895~1945

- Established the city plan

1945~present ~



3. Central Government

repossession of

Taiwan ~ present

- More urbanized



Don't Forget the Historical Development

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Demographic Features

By 2007

- ◆ Population : 2.62 million persons
- ◆ Population Density : 9,700 persons/km²
- ◆ Daily Population: 4.2 million

Living and Daily Population are both Important

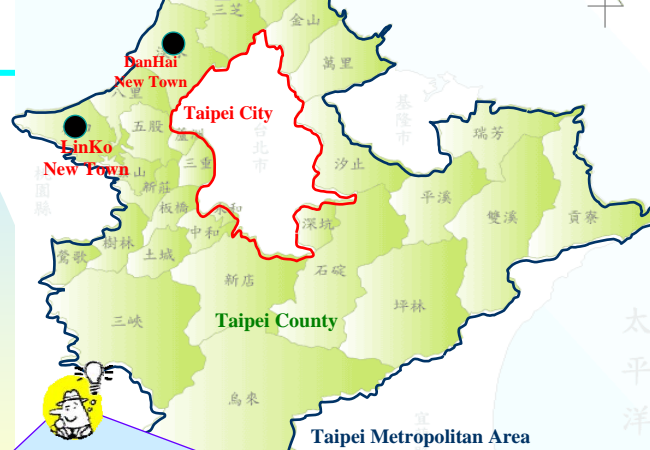


Taipei 101 and Xin-yi District

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Taipei Metropolitan Area (TMA)



Government Structure or Land Use Structure Creates Transport Problems?

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Taipei City and Taipei Metropolitan Area (TMA)

	Taipei City	TMA (Taipei City + Taipei County)
Land Area (Km ²)	272	2,324
Population (Million)	2.63	6.4
Employment (Tertiary %)	80.3	68.4
Family Size (Person/Household)	2.8	2.9
Aging People (%)	11.6	9.1

Changes of Social and Economic Structure will Change the Urban Development Pattern and also the Transportation Needs

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Urban Transportation Characteristics



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Motor Vehicles Growth

	1980	2006	Growth Ratio (1980-2005)
Private Car	105,000	584,000	456%
Motorcycle	351,000	1,046,000	198%
Taxi	26,012	32,824	26%
Total	533,000	1,767,000	232%

28.5 m²/vehicle



High Growth

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Vehicle Ownership

- ✚ Every 4 Persons Own One Car
- ✚ Every 2.5 Persons Own One Motorcycle

Unit: Vehicles/Thousand People

Type	1980	2006
Private Car	47	278
Motorcycle	158	397
Motor Vehicle	240	675



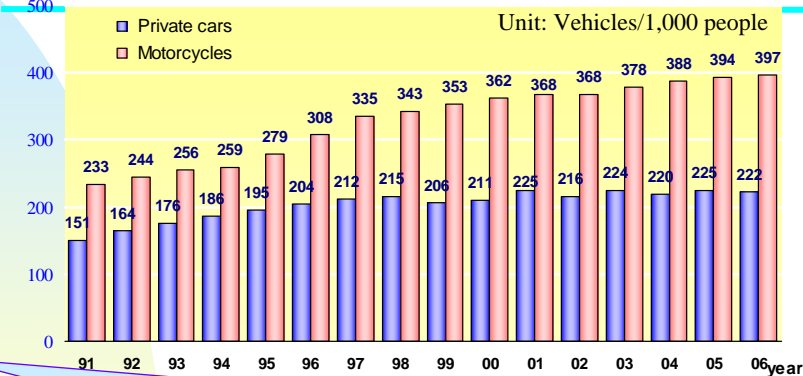
- ✓ **High Dependence on Motorcycle**
- ✓ **Solving Motorcycle Problem is a Political Issue**

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Vehicle Ownership Growth

vehicles



- ✓ **Lowest in Taiwan**
- ✓ **Rapid Growth Started from 1976 (GDP: USD 1,200/per Capita)**
- ✓ **Slow Growth Started from 1997 (GDP: USD 14,000/per Capita)**

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Modal Share

Type		1980	1990	2000	2005	2006
Mass Transit	City Bus	61.8%	26.4%	20.8%	22.8%	47%
	Commuter Rail	1.5%	0.4%	1.0%	0.1%	
	Mass Rapid Transit	—	—	3.7%	17.9%	
	Subtotal	63.3%	26.8%	25.5%	40.8%	
Taxi		3.8%	11.0%	8.6%	2.1%	
Private Transport	Private Car	3.4%	17.9%	29.0%	23.8%	
	Motorcycle	15.2%	32.2%	32.5%	26.5%	
	Subtotal	18.6%	50.1%	61.5%	50.3%	
Others		14.3%	12.1%	4.4%	6.8%	
Total		100.0%	100.0%	100.0%	100.0%	



Bus and MRT are the Major Public Transits

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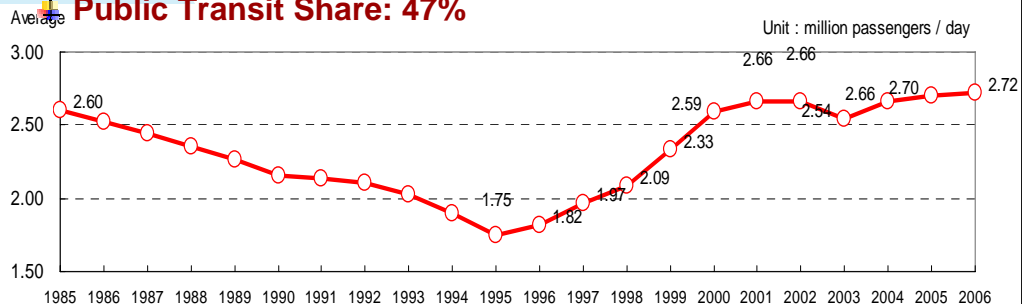
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Daily Passengers by Public Transit

Public Transit: 2.72 M passengers/day (2006)

Bus: 1.67 M passengers/day, MRT: 1.05 M passengers/day

Public Transit Share: 47%



**MRT, Feeder Buses and Exclusive Bus Lanes
Contribute a Lot.**

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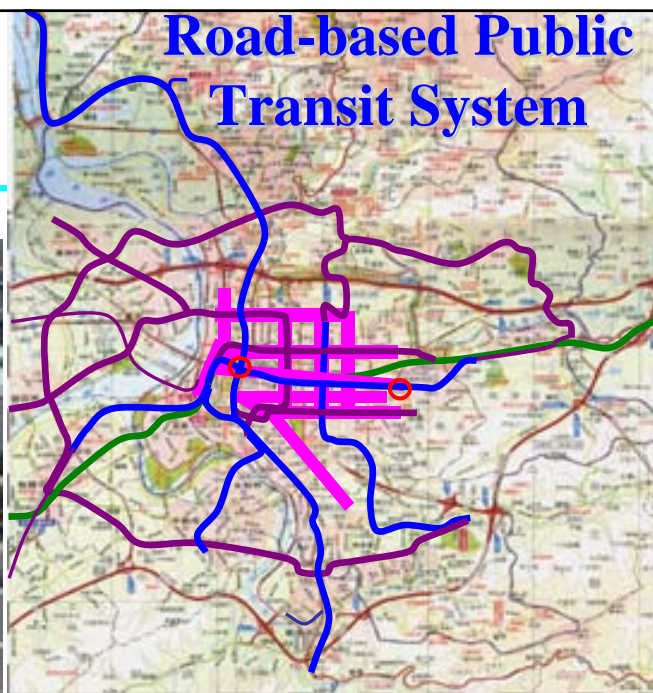
Development of Public Transit System



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- BRT
- MRT/MCT
- MRT (planned)
- Transit Center

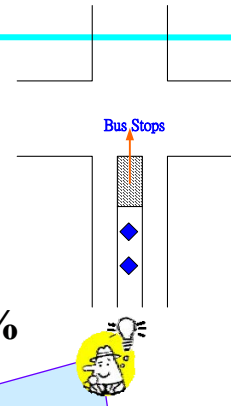


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Exclusive Bus Lanes (BRT)

- ✚ 60 Km, 11 Lines
- ✚ Bus Stops Near Intersections
- ✚ Performance:
 - ◆ Bus Speed: Increased by 35%
 - ◆ Ridership: Increased by 3.85%



Polls: 70% of Taipei Citizens Support

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Exclusive Bus Lanes



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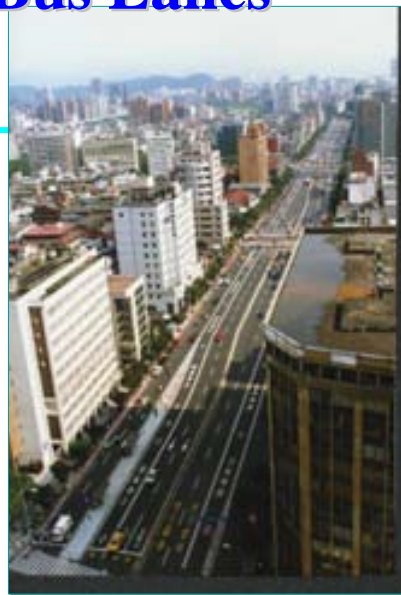
Exclusive Bus Lanes



Reducing Weaving in Traffic Flow



Bus Approaching Station Situation



Bus Exclusive Lanes Deployment

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Why not Curitiba, Brazil?

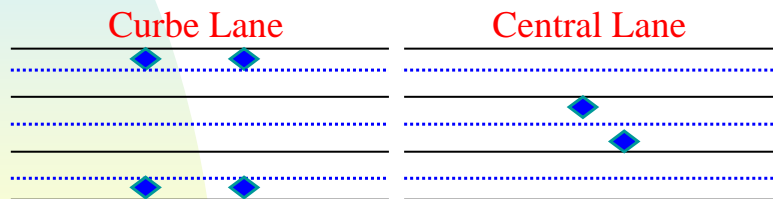


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Lessons for Exclusive Bus Lane

- ✚ Conter-flow, Curbe Lane, Central Lane
- ✚ No Physical Barrier, No Closed Shelter, No Pre-Board Ticketing



L1: Central Lane is Better

L2: E-Ticketing is Not Bad

L3: No Physical Barrier is More Flexible

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Rail-based Public Transit System

Taipei MRT

- ✚ Expand the Network (From 67 Km to 120 Km) to Serve Most of Taipei Surrounding Suburbs (Long Term Network)
- ✚ First Line in 1996 (MCT/AGT Line)
- ✚ 8 Lines (7 MRT Lines+1 MCT/AGT Line), 76.6 Km Long
- ✚ 1.07 M Pax/Day
- ✚ Distance-based Fare Structure (from NT\$ 20- NT\$ 65)
- ✚ 80% Discount with SMART Card)



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Lessons for Taipei MRT

- ✚ Late Coming (1996), 6 Lines Simultaneously
- ✚ 2 Systems: MRT +MCT/AGT
- ✚ Various Station Designs



- L1: Talk too Long, Should Do it Early
- L2: Don't be so Ambitious in Constructing 6 Lines
- L3: Special Design for Some Stations
- L4: Network Effects Increase the Revenue

IF We Don't Do It Today, We Will Regret Tomorrow

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Lessons for Transit Systems Selection

- ✚ L1:
 - ◆ Large City (>1m): MRT First, then LRT, BRT, Bus Only Lane
- ✚ L2:
 - ◆ Median City: BRT, LRT First, then MRT

		Demand	
		High	Low
Budget	More	MRT	BRT, LRT
	Less	BRT, LRT	BRT

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Lessons for MRT Operation

- ✚ $OR < OC \Rightarrow OR \text{ (Revenue)} > OC \text{ (Operation Cost)}$
(Beginning Stage) (Later Stage)



- L1: Networking Effect is the Most Critical Factor**
- L2: Infrastructure Cost is Paid by Gov. (Public Goods)**
- L3: Joint Development is Helpful**
- L4: Discount Fare (50%) between MRT and Bus also has Contribution**

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Integrated Ticketing Systems

- ✚ Contactless IC Smart Card in 2002
- ✚ Integrate MRT, Buses and Public Parkings
- ✚ Contactless within 10 cm Distance, Transaction in 0.4 Seconds
- ✚ Add Value at Convenient Stores, MRT Stations or Automatic Machines
- ✚ BOT Approach
- ✚ 8 Million Cards

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Smart Card



Contactless IC Card



**Speeding Passage in MRT Station
(Touch-and-Go)**

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Discount Fare for Urban Transit Transfer

- ✚ 50% Discount Fare for MRT and Bus (Transfer)
- ✚ Performance:
 - ◆ Increase 344,000/day
- ✚ Who Should Pay This Difference?
 - ◆ Subsidy from Taipei City Gov. or Marketing Fee from Taipei Rapid Transit Corporation

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Lessons for Transit Ticketing System

- ✦ Coin ➔ Stored Value Card ➔ Countless Smart Card
- ✦ Bus ➔ Bus + MRT ➔ Bus + MRT + Public Parking



L1: Location of Adding Value for Smart Card is Important: Convenient Stores
L2: Ticketing Integration for Modes Needs a Ticketing Company



Contactless IC Card



Speeding Passage in MRT Station
(Touch-and-Go)

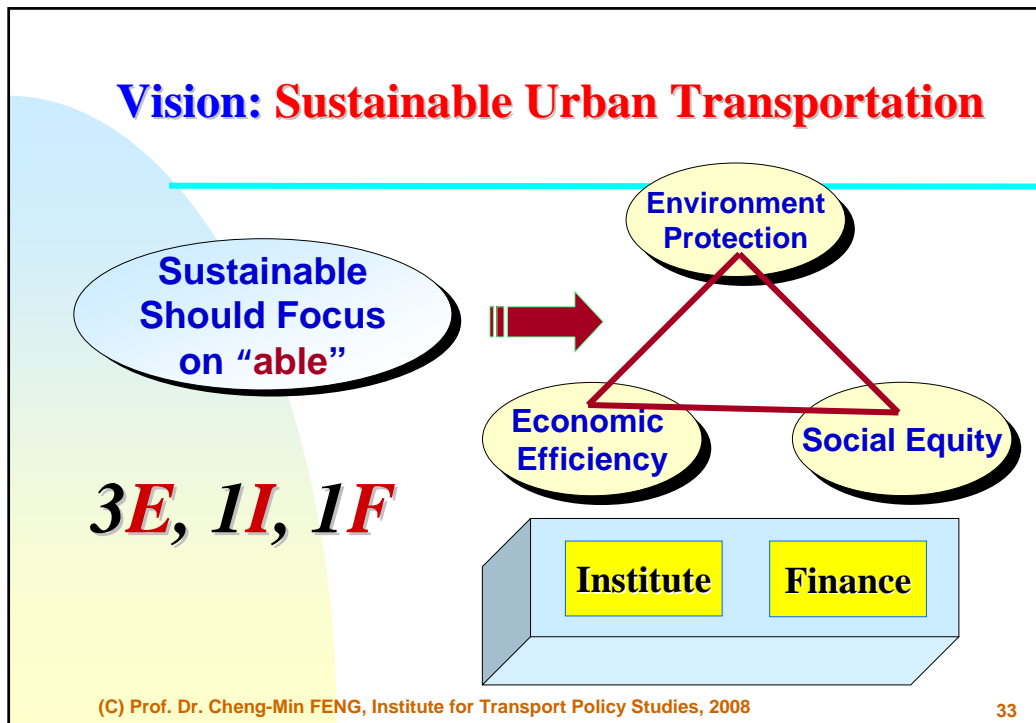
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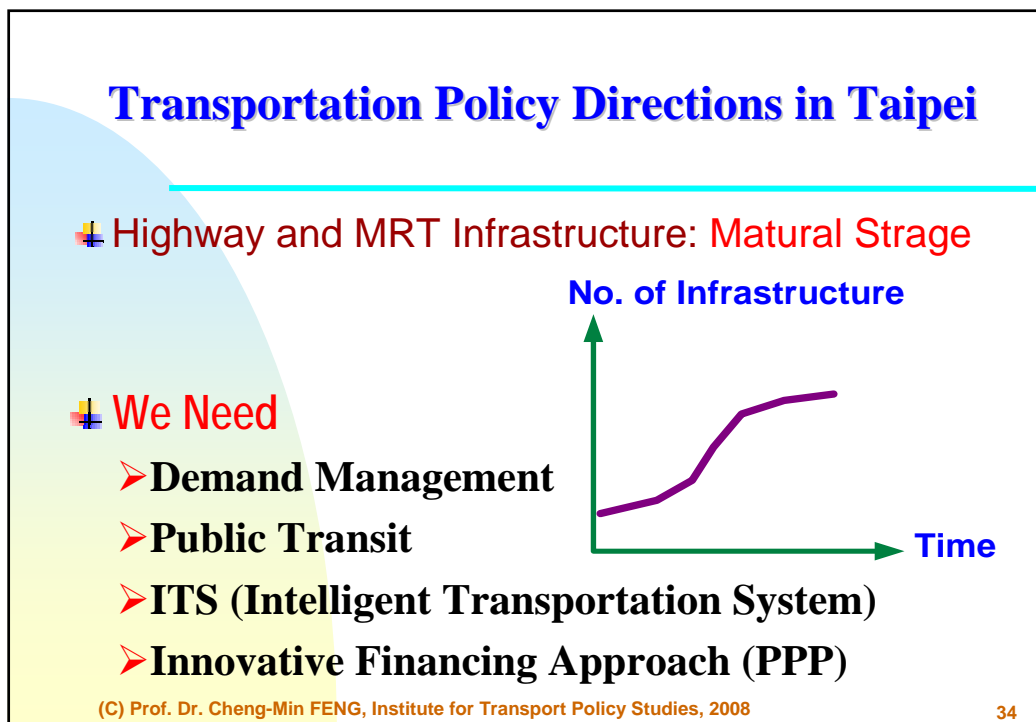
Urban Transportation Policy



Do the Right Thing!

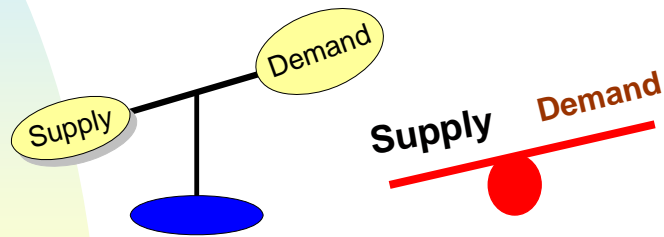


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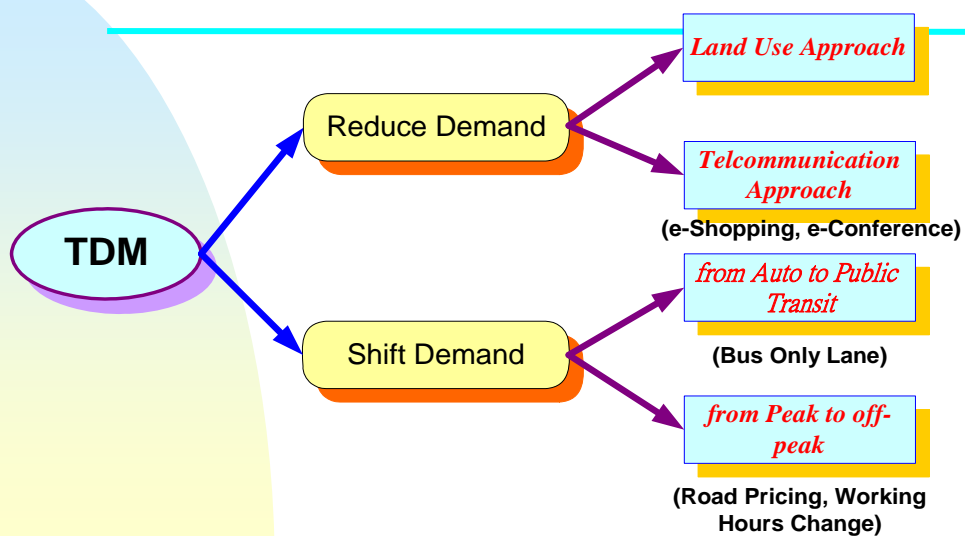
Focus on Transportation Demand Management



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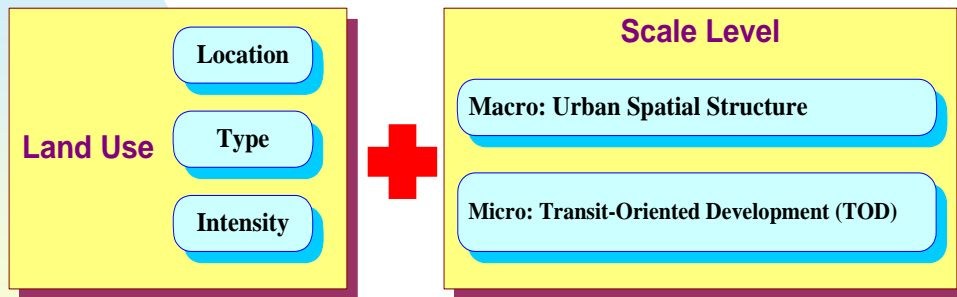
Transportation Demand Management (TDM)



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Land Use Approach

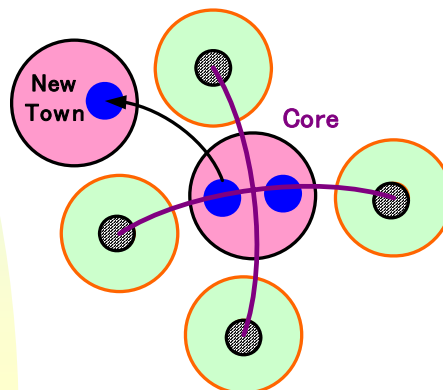


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Macro Level: Urban Spatial Structure

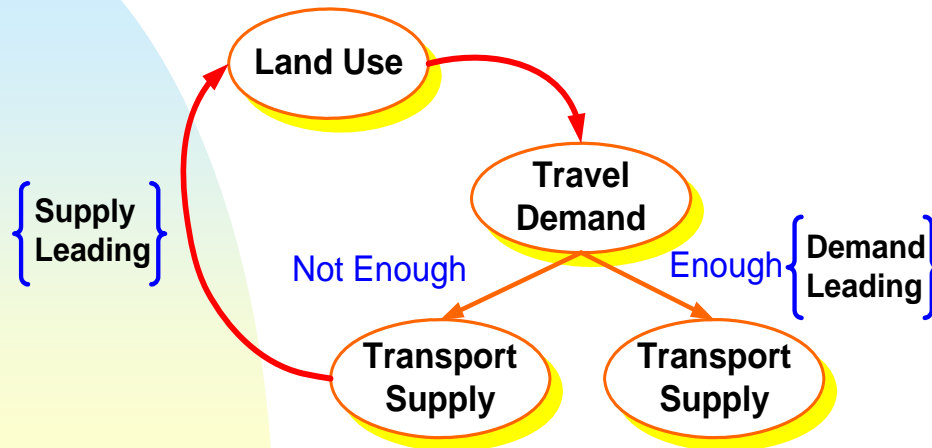
- ✚ Demand Leading vs. Supply Leading
- ◆ New Town can be seen as a new center.



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Supply Leading vs. Demand Leading



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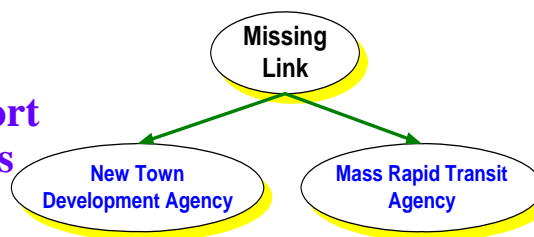
Barriers for Taihai New Town Development in Taipei Metropolis

Two Barriers:

◆ Resource Barrier

☞ Government Support on Infrastructures (MRT)

◆ Institutional Barrier

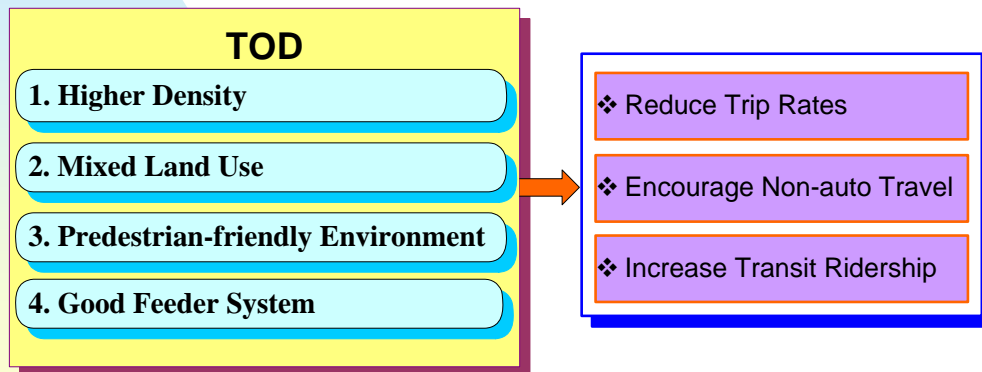


If barriers can be reduced, commuting trips will be reduced and commuting by public transit will be increased.

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Micro Level: TOD



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Transit-Oriented Development

- ✚ Integrated Transfer Center for Intercity Bus, City Bus, MRT and HSR
- ✚ Higher Density and Mixed Land Use Development at or nearby Transfer Center
- ✚ Pedestrian Friendly Sidewalk System
- ✚ BOT Approach



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The Lessons from Taipei MRT's TOD Development

- ✚ to establish a clear public policy and guideline
- ✚ to consolidate public responsibility in one agency
- ✚ to analyze the real estate market
- ✚ to place a right timing
- ✚ to get qualified staff
- ✚ to define the role and responsibility of parties,
- ✚ to do the impact study
- ✚ to identify the terms of cost and benefit

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Promote Public Transit



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Promote Public Transit and Intermodal System

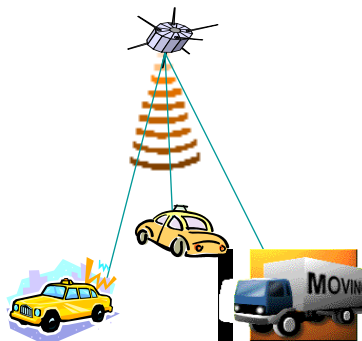
- ✚ Integration between Modes
 - ◆ Integration among MRT, Intercity Bus and City Bus
- ✚ Integration between Transportation and Land Use (Transit-Oriented Development, TOD)
 - ◆ Joint Development (Public-Private Partnership)



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Use Intelligent Transportation System



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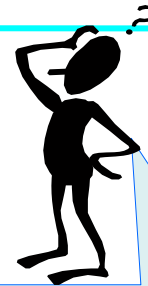
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Make Use of Existing Facilities

Don't Forget the Old Ones

● ITS
● TSM

The Present Problem is Not
“Insufficient Problem” but “Existing
Usage and Space Allocation Problem”



Introduce ITS or
Build New Roads

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Usage of Intelligent Technology

**Priority of ITS
Development**

😊 APTS
😊 ATMS
😊 ATIS



Public Information

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Lessons for ITS

What are the Information Needs?

- ✚ APTS (Advanced Public Transport System)
 - ◆ Real Time Bus Information (e-Bus Service)
- ✚ ATIS (Advanced Travel Information System)
 - ◆ Parking Guidance Information System
 - ◆ E-Travel Information



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Encourage Public Private Partnership



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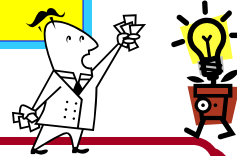
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Encourage Private Participation

Private Investment and Participation



- ✚ More Efficiency and Creativity
- ✚ More Community Participation



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Alternative way to Finance Infrastructure - BOT Approach

- ✚ **B**: Build, Private Sector, Finance, Design
- ✚ **O**: Operate, Maintenance, Manage
- ✚ **T**: Transfer, Termination, Asset, Government, Certain Period



Enact a New Law to Promote BOT

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Why Take BOT Approach?

- ✚ The Government Reduces the Heavy Up-front Financial Burden
- ✚ The Government Completes Infrastructure Projects by Private Sectors with Little Government Involvement
- ✚ BOT Arrangement Opens Up Opportunities for Foreign as well as Local Contractors and Developers
- ✚ BOT Arrangement Provides Opportunities of Employment with Higher Flexibility and Efficiency

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Types of BOT

		Construction	
		Public	Private
Operation	Public	—	BT (Build-Transfer)
	Private	OT (Operate-Transfer)	BOT

Others: BOO (Build-Operate-Own)
BTO (Build-Transfer-Operate)

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When to use BOT?

- Transparent Policies and Stable Political Environment
- Economically Feasible and Financially Viable

		Economic	
Finance		NPV>0	NPV<0
	NPV>0	P	x
	NPV<0	G、P	x

NPV: Net Present Value

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Issues of BOT

- Concession Period
- Fare Adjustment
- Payment of Royalties
- Land Acquisition and Rent
- Termination Payment and Transfer
- Bidding and Reviewing Process
- Government Role

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Pay Attention to Life Cycle and Maintenance

Higher Cost, If No Maintenance



- **Repair and Maintain Old Roads and Bridges**
- **Using Pricing to Decrease Pavement Damages from Heavy Vehicles**

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Core Value is on People-oriented Transport

**People First,
Vehicle Second**



- **Considerate Pedestrian Signal**
- **Protection of Pedestrian Traffic Rights**
- **Pedestrian Friendly Facility**



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Future Prospects



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Urban Transit Reform Project - Social Reason

- ✚ Low Platform Buses are Required in New Bus Routes Application and New Buses Purchase
- ✚ Small Buses are Promoted in Remote Areas



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Public Bicycle Rent Project

- Environment Reason (1)

- ✚ Objective: Encourage People to use Non-motorized Mode to Reduce Pollution, Energy and Congestion

- ✚ Build-Operate-Transfer (BOT) Approach

Gov.	Private
<ul style="list-style-type: none"> ➢ Set Up 10 Bike Rent Sites, 500 Meters between Two Sites ➢ Set Up Bike Network 	<ul style="list-style-type: none"> ■ Buy 500 Bikes ■ 5 Years of Concession Period (2008-) ■ Gov. Pay the 1st Year's Operation Cost ■ Private Bike Operators Pay Operation Cost (from 2nd Year) ■ Obtain the Operation Right of Advertisement on Public Facilities ■ Bike Operator is Selected from Bidding Process

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Public Bike Rent Project

- Environment Reason (2)

- ✚ Special Design of Bike and Bike Station
- ✚ Location of Bike Station: Park, MRT Station, School, Open Space
- ✚ Users Rent Bike at Station A and Return at Station B
- ✚ Automatic Fee Collection through Cash, Membership Card, Smart Card and Credit Card
- ✚ Rent Fee is Determined by Gov.

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Public Bike Rent Project

- Environment Reason (3)



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Public Bike Rent Project

- Environment Reason (4)

- ✚ Expenditure in 2008: NT\$12.5 Million
- ✚ Expected Bike Usage: 2.6% (2007) will Increase to 5% (2010)
- ✚ Expected Reduction of Air Pollution

Unit: ton/year			
NO ₂	CO	THC	NMHO
66.78	24.48	135.50	2.48

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Public Bike Rent Project

- Paris Example (Vélib) (1)

- ✚ 10 years BOT (JC Decaux, Advertisement Company) Start in July, 2007
- ✚ 10,468 Bikes, 750 Bike Stations (1st Year)
- ✚ 100,000 Members, 10 Times/Bike, Day
- ✚ Rent Fee:

0-0.5 hr	Free (80%)
0.5 hr-1 hr	Euro \$1
1-1.5 hr	Euro \$2
1.5 hr-	Euro \$4

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Public Bike Rent Project

- Paris Example (Vélib) (2)



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On Street Parking Management (PM) - **Efficiency Reason**

- ✚ Outsourcing PM to Private Company
- ✚ Using PDA to Record and Issue Parking Ticket
- ✚ Charging Motorcyclist Parking Fee of \$20/time in Some Districts

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Red/Green Traffic Signal Countdown Display- **Efficiency Reason**

- ✚ Implement Demonstration of Red/Green Traffic Signal Countdown Display



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Red/Green Traffic Signal Countdown Display- Efficiency Reason



Red is Better!

	Green	Red
Change Rate of Accidents	+100%	-50%

Start-up Delay Analysis (Red)

Before Installation	1.5 Months After Installation	3.0 Months After Installation	4.5 Months After Installation
3.74 Sec.	4.62 Sec.	4.45 Sec.	3.24 Sec.

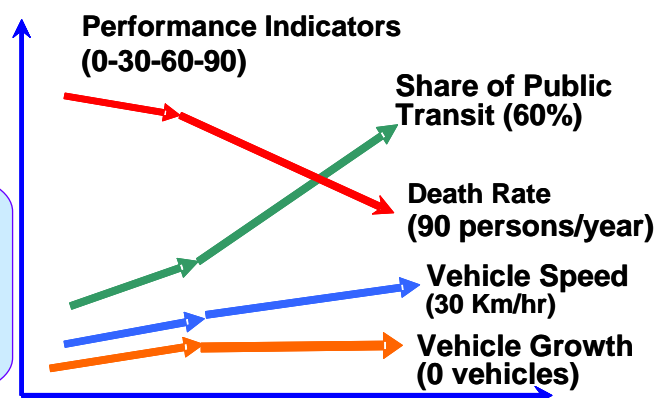
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Connect Budget with Sustainable Transportation Indicators

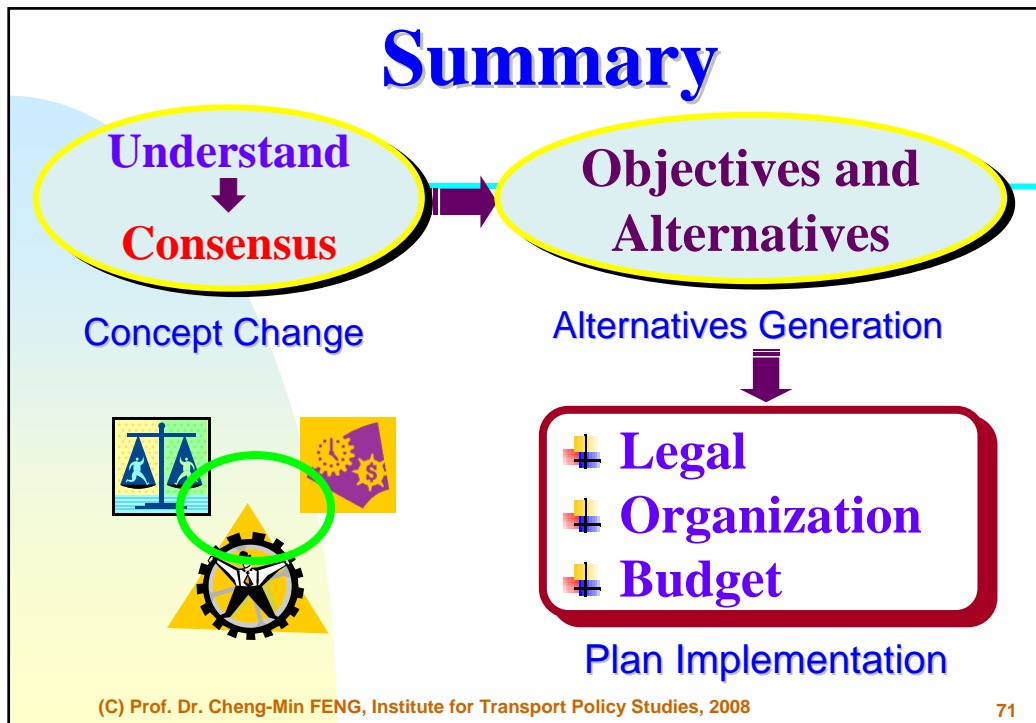


Mayor's Commitment is Important!

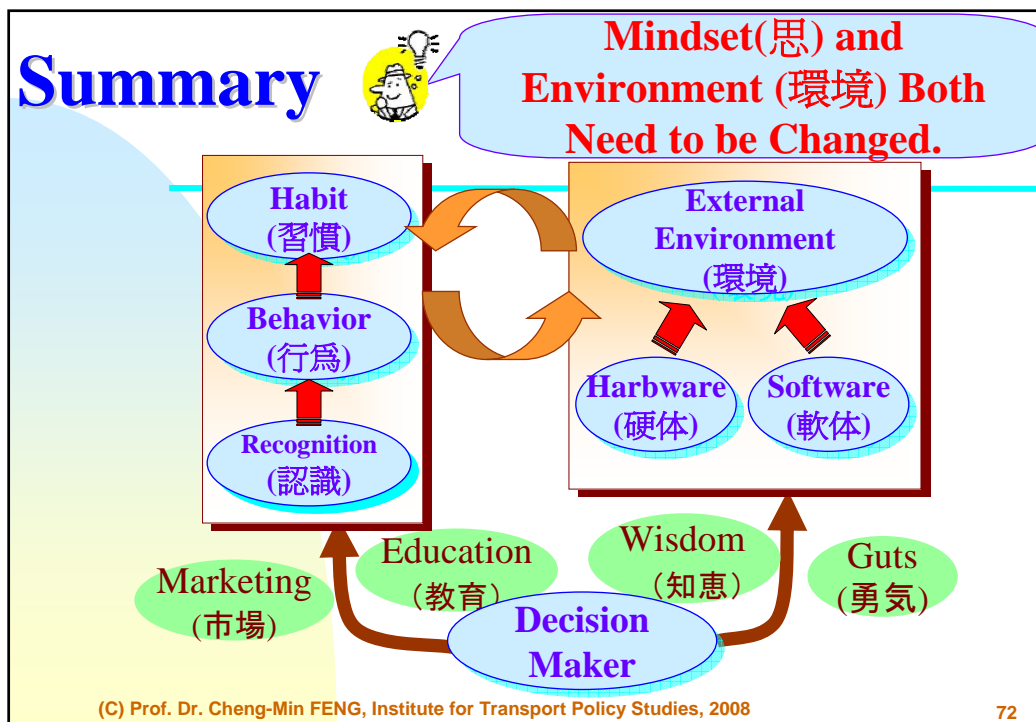


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*The End.
Thank You Very Much*