

Transport Planning for Low Carbon Mobility in Secondary Cities: The Case of Chiang Mai

Professor Douglas Webster

School of Geographical Sciences &
Urban Planning

Arizona State University

Connective Cities Workshop –
CHIANG MAI - JULY 12 2017

Basic Principles

- ***Transportation networks normally dominant shaper of Urban Form***
- Accessibility should be goal, not mobility
 - Accessibility: “ability of people to reach & take part in activities normal for that society”
 - Mobility: “average distance traveled in city per capita”
- “Everyone” agrees land use & transportation planning must be integrated: In reality: Separate land use planning & transportation planning / engineering bureaucracies distort urban form efficiency
 - Disconnect in aligning FARs, Zoning, Public Investment, etc.

Socio-economic Costs of Congestion

- Human time
 - Economic + social (family stress) costs
- GDP Loss
 - As high as 20% of potential GCP
- Discourages dense business centers: face-to-face innovation transactions



Environmental / Human Costs of Motorization

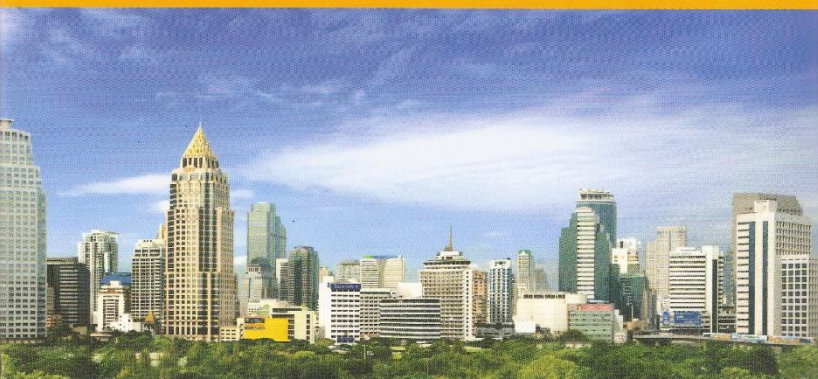
- Energy
 - Electric trains most energy efficient
- Conventional Pollution
 - E.g., Nano particulates
- GREEN HOUSE gases
 - E.g., CO₂
- Health: China 750K Premature Deaths / Year
- Leading cause of Death & Injury
 - Thailand >25K deaths per year (WHO)
 - 3rd Highest Per Capita in World
 - Especially among young (motorcycles)
 - 2 Wheel Deaths: 75% (Cyclists 2%)



Bangkok Metropolitan Administration

Action Plan on Global Warming Mitigation 2007 - 2012

Executive Summary



	Year 2007	Year 2012	
Sector	Current GHG Emission (CO ₂ equivalent - million tons)	Future GHG Emission Under Business as Usual Scenario (CO ₂ equivalent - million tons)	Future GHG Emission Under BMA Action Plan Implementation (CO ₂ equivalent - million tons)
Transportation	21.18	25.30	19.77
Biofuels Energy (<i>reduced GHG</i>)			(-0.61)
Electricity	14.86	16	13.75
Waste / Wastewater	1.13	1.13	0.95
Waste Recycle (<i>reduced GHG</i>)			(-0.28)
Others (<i>estimate 15% of total GHG emission from other sectors</i>)	5.58	6.36	6.36
Green Area (<i>reduced GHG</i>)	(-0.10)	(-0.10)	(-1.00)
Total	42.65	48.69	38.94

Carbon Reduction

- Electric trains best, followed by bicycling, walking, electric motorbikes
- Individual Petrol Vehicles & 2-Cycle Motorcycles Problematic
- But Technological Change will dramatically reduce Petrol Vehicles: Thailand: BOI: HEVs, PHEVs, EVs
 - Volvo
- Carbon Reduction: Product of
 - 1. Mode Share
 - 2. Mode Technology / Vehicle Utilization Rate
 - 3. Kilometers Travelled related to Urban Form / Distribution of Activities, Density / Variation, Compactness, Nodality
 - 4. Consumer Travel Preferences

Secondary Cities Challenges

- Lack diversified economies – vulnerable
- If Tourist Cities: Peaking problems (seasonal visitors, second homes); public services overwhelmed
- Inefficient land use:
 - Lower densities
 - Lack of Nodes & Clearly Defined Axis
- Traffic congestion: car dependent & poor public transit systems
 - Lack but need appropriate rapid transit
 - Lack but need improved road systems, e.g., overpasses, direct arterials
- Urban expansion: Leap-frogging & fast falling densities
- Prematurely apply metropolitan urban form concepts: e.g., Satellite towns
- Lack of: (i) Individual attention (tendency to generalize group); (ii) Bargaining power with national govt, (iii) Access to best practice expertise

Mass Transit Trajectory

- Heavy Rail not suitable for secondary cities
- Bus Rapid Transit (BRT) can be initial step (Curitiba, Bogota, Jakarta, Kunming): 1/5 or less cost per km of LRT
 - Bogota BRT system reduced 1-way commute times from 70-42 minutes
 - BRT: \$5-10 million USD per km
- Can upgrade to Light Rail (LRT)

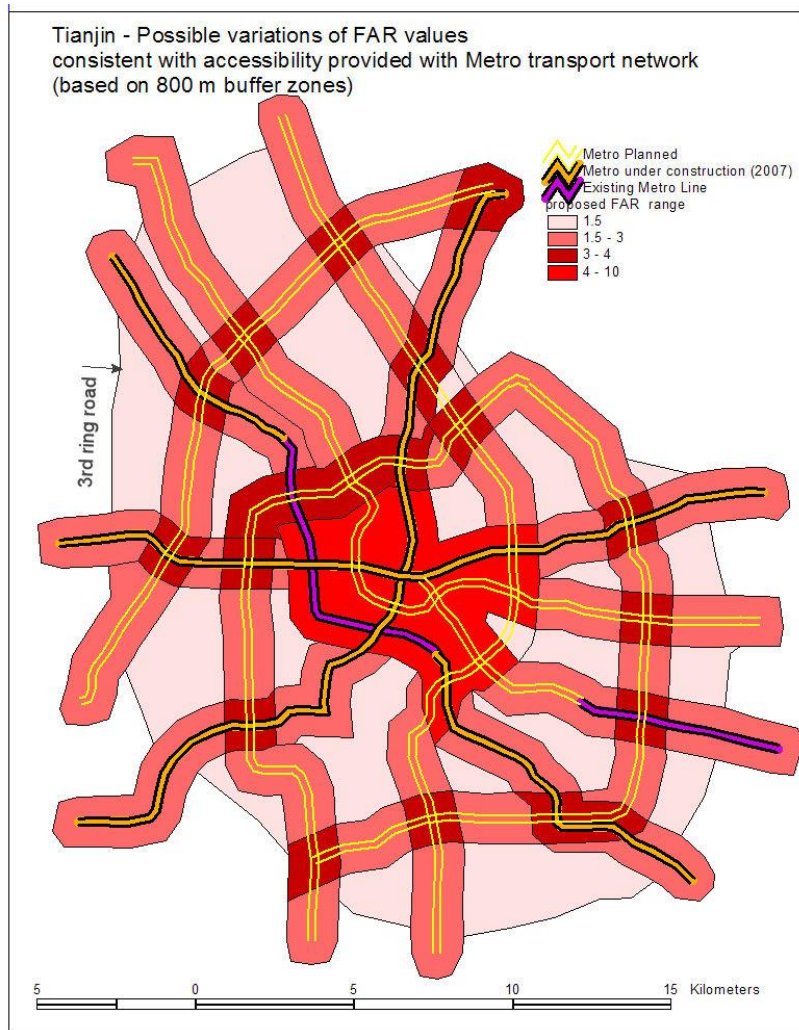


Bogota

Transport Development Principles

- Support Smart Growth: Density & Nodality managed well
- Aim for Necklace Structure (Corridors/Nodes) With Grid & Green Corridor Infill, e.g., Copenhagen Finger Plan
- Target balanced inter-modal transportation systems: Road, Rail / BRT, Feeder Bus, Cycling, Walking: Avoid auto dependency
- Use technologies appropriate to level of economic development

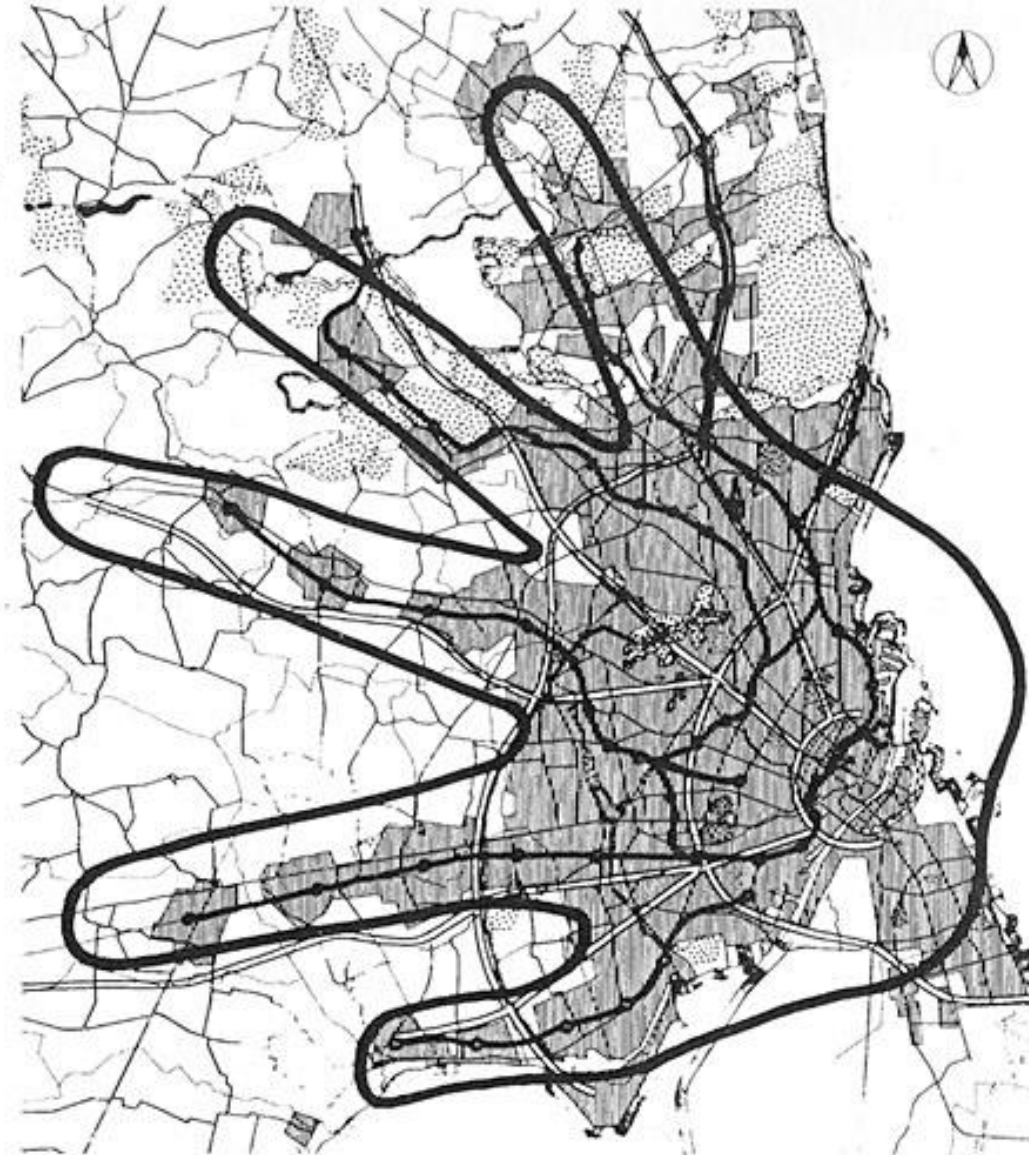
Nodality and FAR Potential: Tianjin, China



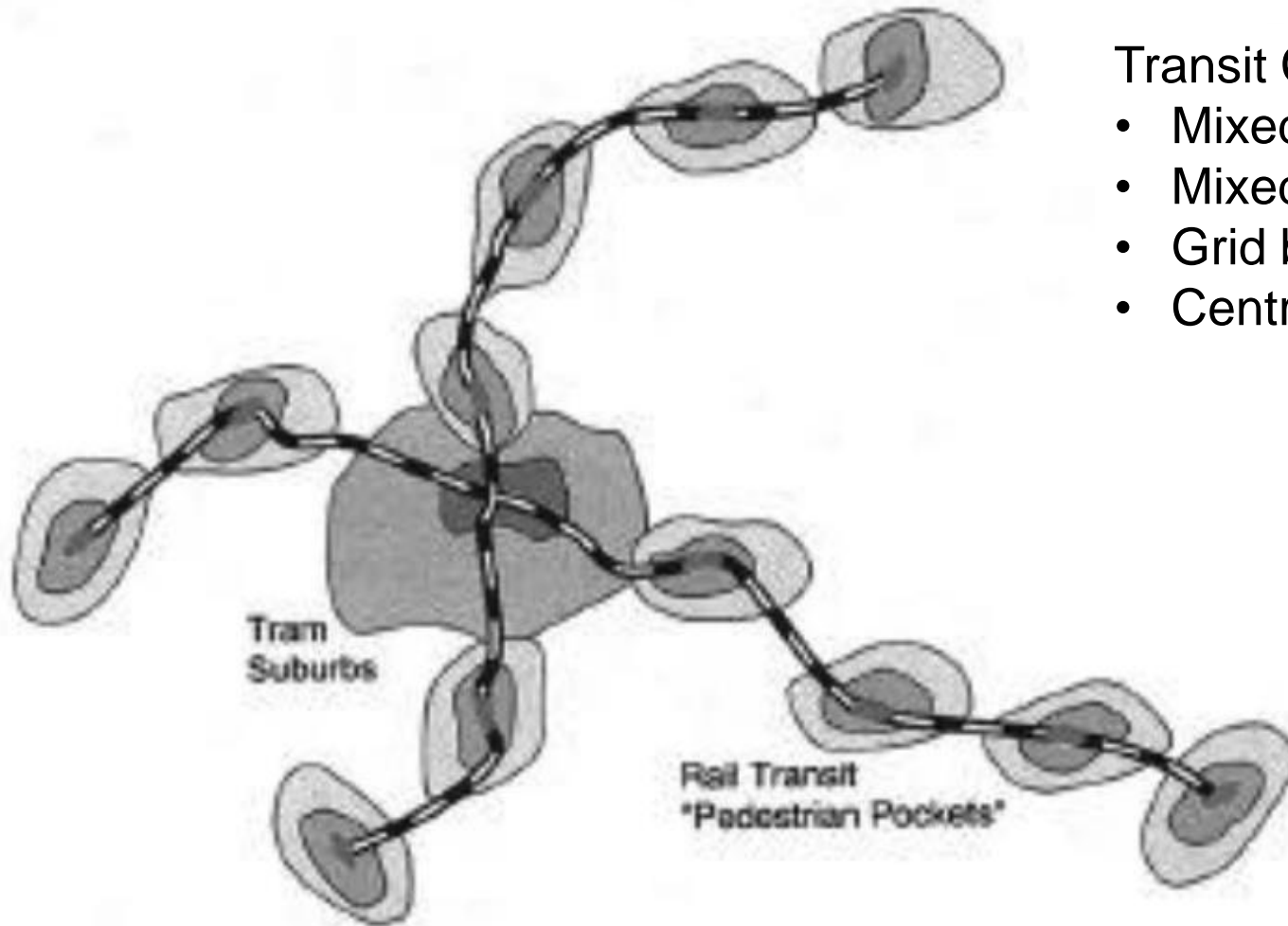
Nodality

- Justifies transportation investment
- Lowers unit infrastructure costs
- Creates Vital innovation / leisure environments
- Saves human time
- Saves energy
- Enables accessible affordable housing

Copenhagen Finger Plan



Necklace Form



Transit City

- Mixed Density
- Mixed Use
- Grid based
- Centralized

Taking Action

- Fuel Quality: National
- Fuel & Vehicle Taxes: National
- Congestion pricing / management
 - Zones: e.g., Singapore
 - Can be low tech
- Attempt smart growth
 - Density, Nodes / Corridors, Limit Leap-Frogging

Taking Action: Roads

- Proper management: Maximize Effectiveness of Current Road System
 - Traffic management: computer control of signals, electronic signage (congestion, parking)
 - Enforce Parking Regulations; Do not underprice
 - Relatively inexpensive for low income cities
- Cost effective hard infrastructure
 - Overpasses (aesthetic issues), combined with:
 - Super arterials

Road Overpass: Naples, FL



Source: MCM

Taking Action: Roads (con't)

- Cost effective capacity: Do not design for fast flows at peak
- 24 hour road usage: Incentives to truck deliveries at night – timed entry ban
- Do not under price parking

Explore New Systems / Technologies

- CONSIDERABLE FLUX: Transport Planning Very Difficult
 - New Propulsion Systems: Source of Electricity, Carbon in Manufacturing
 - Autonomous Vehicles: Communal Vs Private
- Electric vehicles / carts in high density areas
 - “Orbit” Systems
- Para-transit (Vans, Jeepneys): Fastest growing form of transport in world
 - Manila: EV Jeepneys
- Driverless Vehicles, e.g., buses (in operation in Helsinki)
- Electric Motorcycles as Feeders?

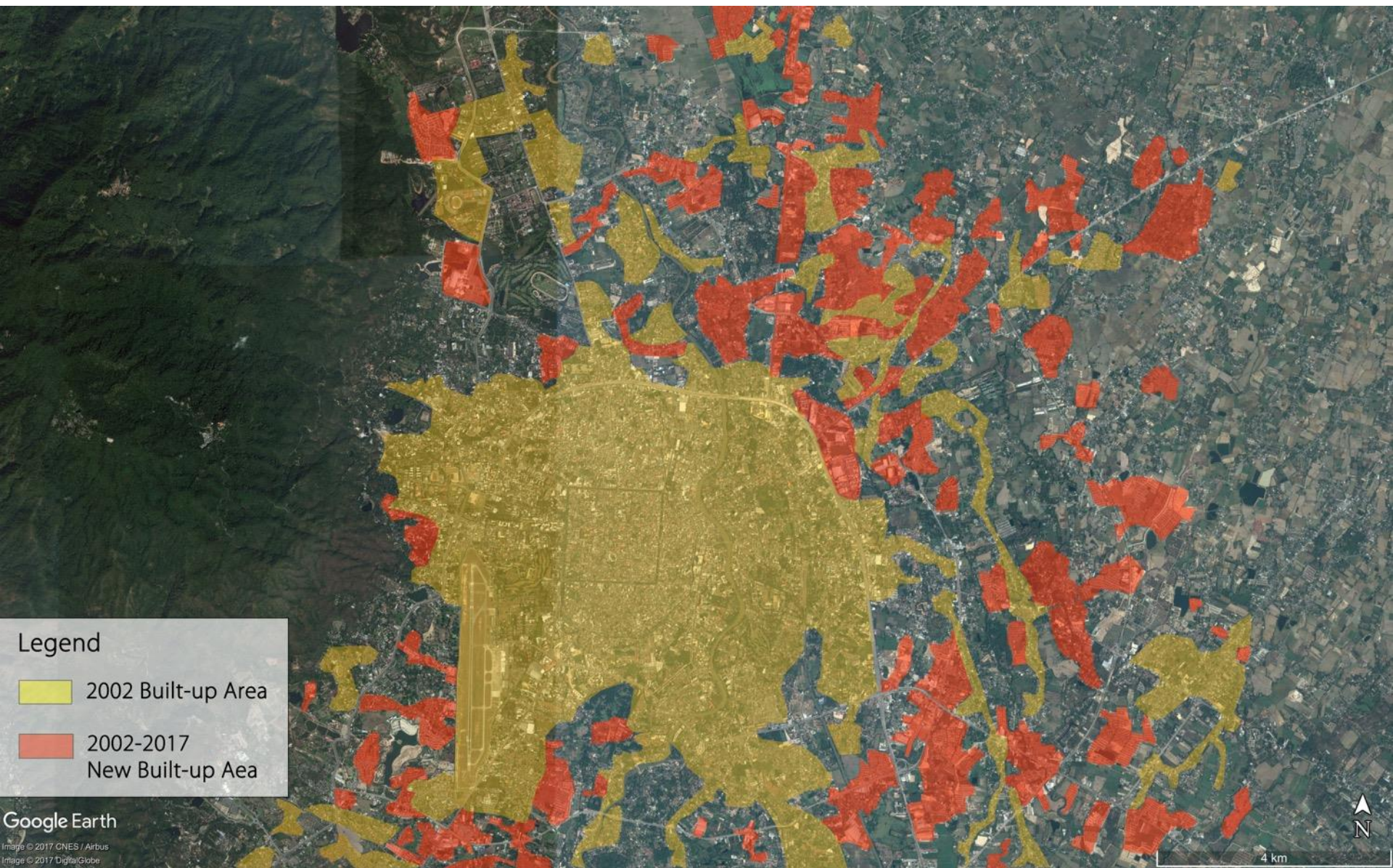
Driverless Buses in Helsinki



Source: Wonder Discovery

Achieving Balanced Systems

- Incentivize appropriate modal mixes
 - Transit, walking, biking to work: 14% US; 56% Europe; 80% Wealthy Asian cities
- Investment mix
 - By utilizing Innovative Finance (BOT, BOO, etc.) + appropriate borrowing long term benefits can be pursued
 - Long time horizon: Road & MT Systems last centuries



Chiang Mai Built-up Area



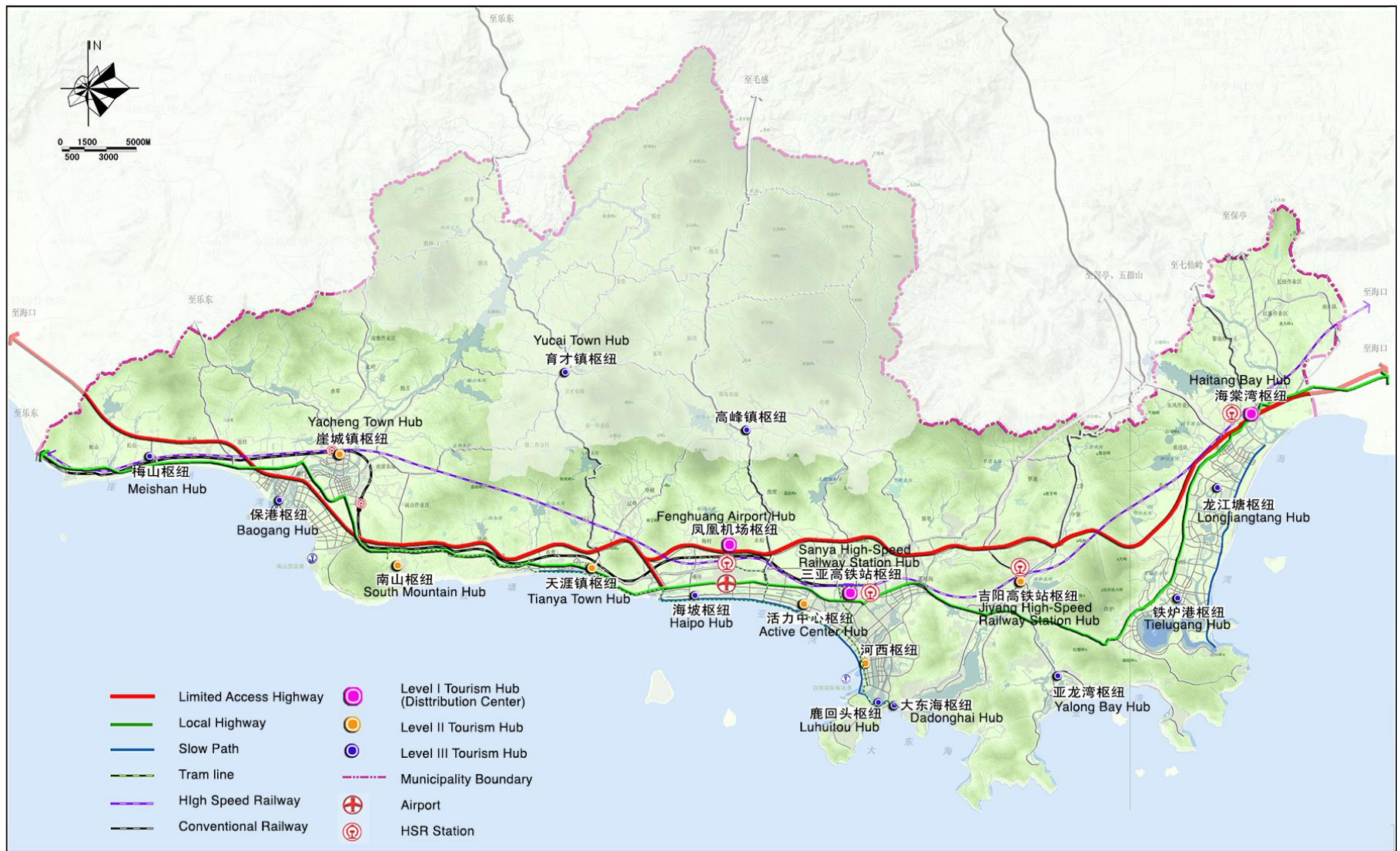
Chiang Mai Element Map

Chiang Mai Challenges

- Large Fluctuations in Demand: Tourism
- Very slow population growth makes reshaping urban form more difficult
- Natural & Historical Barriers
- Unclear Spatial Development: Low-Density Leapfrogging
- Lack of Strong Axes & Nodes Make Feasibility of Rapid Transit Difficult
- Difficult Pedestrian Environments
- Congested Core Difficult to Retrofit for Different Modes, e.g., NMT
- Ring Road Emphasis Encouraged Sprawl

Chiang Mai: Going Forward

- Encourage Urban Form Conducive to BRT on a Few Radials (Super Arterials)
- E Buses Operating Orbit Routes
- Electric Motorcycle Taxis as Feeders?
- Close Selected Roads at Peak Season
- Improve Pedestrian Environments
- Cycling: Poor Record in Thailand: BKK has failed since 90s: Climate, Culture
 - Pun Pun Bike in BKK: Down to 300 Users
 - Considerable Recreational Potential
- Petrol Motorbike Ban?: Hanoi



Coastally Oriented Transportation Corridor

High speed rail system just opened: potential to reshape urban form
 Current airport vastly operating vastly over capacity: new site will impact urban form



HSR on Sanya Edge