I. Strategic Planning for Sustainable Metropolitan Transport and Alternatives Analysis

*Introduction to Public Transport Planning and Reform*
Strategic Metropolitan Transport Planning

• Serves strategic decision making for metropolitan transport by providing needed decision support information

• Long term time horizon (20+ years)

• Focuses on
  – Major investment needs/priorities
  – Strategic (long-term, regional) operating and management policies
Why Strategic Planning for Metropolitan Transport?

• Transport problems growing in magnitude and complexity and related to other strategic issues:
  – Land use
  – Climate change, energy, local air quality
  – Safety, security, health
  – Economic competitiveness

• Transport too often implemented and operated in pieces with too little holistic decision support information
Strategic Planning is Key to Dealing with Growing Challenges

How?

• Improves *decision making* by providing essential information
• Improves *coordination* of all transport and related policies and investments
• Helps achieve *consensus*
  – Transparency
  – Involvement
• Helps make *best use* of scarce resources
Strategic Investments

• Roadway capacity additions
  – New links
  – Significant widenings

• Strategic links
  – Bridges
  – Tunnels

• Mass Rapid Transit
  – Bus Rapid Transit (BRT)
  – Light Rail Transit (LRT, Trams)
  – Rapid Rail Transit (RRT, Metros)
  – Suburban rail
Strategic Operating and Management Policies

- Institutional/organizational reform
- Public transport fare policies and integration
- Highway pricing e.g., gasoline taxes, tolls, congestion pricing
Effective Strategic Metropolitan Transport Planning

- Comprehensive
- Continuous
- Cooperative
- Connected
- Championed
- Communicated
Comprehensive

• Covers *entire metropolitan area*
  – Goes beyond administrative and political boundaries

• Addresses transport *and related quality of life issues*
  – e.g., land use, climate change, local air quality, energy consumption, social/economic development.

• Performed *multi-modally*
  – *All* surface modes considered *simultaneously*
  – Transport Plan done for integrated transport system
    • Not for each mode separately
Continuous

• Ongoing *monitoring* of system travel demand, performance and condition
  – See what is working and what is not

• *Updates* on a regular basis
  – Plans
  – Planning data
  – Planning tools
Cooperative

• All public agencies at all levels of government (municipal, province/state, central government) with a direct stake in the transport system actively participate
  • Transport (implementation, operations, regulation)
  • Land use planning
  • Environmental
  • Social

• Private transport providers
Process is Legally Connected to Decisions that Matter

• Implementing/operating authorities must follow formally adopted metropolitan, multi-modal plans, programs, policies

• Plans, programs impact spending:
  – Capital projects are consistent with adopted/approved long range plans
  – Annual programs reflect adopted priorities for implementing plan
Championed

- The person (people) ultimately governing the planning process
  - Must be a strong, public champion for it
    - Vision, goals and objective
    - Projects and finance
    - System operations and management
  - Should have legal authority to make decisions regarding funding and strategies impacting operations
Communicated (Transparent)

- Two-way information flow, from beginning
- Facilitates participation by all stakeholders
  - Government
  - Private sector
  - Civil Society
  - Public at large
- Builds trust, support and momentum
- Variety of approaches
Starting Point? A Vision

- A vision of the metropolis in the future (20+ years) including transport and related sectors
- Projects may be outputs, not inputs, if not already committed

- “Vision: Two line, 40 Km Metro, 5km monorail and three ring roads by 2020”
Conversation Between Alice (in Wonderland) and the Cheshire Cat*

Alice: “Would you tell me, please, which way I ought to go from here?”

Cat: “That depends a good deal on where you want to get to.”

Alice: “I don't much care where.”

Cat: “Then it doesn't matter which way you go!”

*Lewis Carroll
Metropolitan Vision
What Should the Metropolitan Area Look Like in 20 Years?

• Vision covers transport and related quality of life issues
• Transport perspective goes beyond congestion considerations:
  – Safety
  – Access as well as mobility
• Vision must be realistic and reasonably consistent with financial and other potential resources
What Kind of Future?
Quality of Life
Important Part of Vision

- Social development and equity
- Economic development
- Local and global environment
- Land-use
  - Open space
Integrate Land Use Considerations in Transport Strategic Planning

- Induce
- Land Use
- Transport
- Serve
Integrate Land Use Considerations in Transport Strategic Planning

• Visual illustration of future
• Macro scale, 10,000 meter emphasis
• Address geographic balance among activities
• Basic sight-plan themes
• Address two-way relationships among transport and distribution of activities across metropolis and land-use character
### Strategic Metropolitan Transport and Land Use Alternatives

<table>
<thead>
<tr>
<th>Transport</th>
<th>Land Use</th>
<th>Land Use</th>
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<tbody>
<tr>
<td></td>
<td>Continue current trend</td>
<td>Create new medium density mixed use nodes, strengthen Central Business District (CBD)</td>
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<tr>
<td>Emphasis exclusively Non-Motorized Transport (NMT), Public Transport / Rapid Transit</td>
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<td>Mixed modes</td>
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<td>Road emphasis</td>
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? Consistent Land Use/Transport Strategy
Goals, Objectives, Criteria Linked to Vision

- **Vision**: Safe, secure, sustainable city with equitable services, economic opportunity

- **Transport system goal**: Clean, safe, secure, affordable access/mobility for all

- **Objective**: Everyone with reasonable access to employment

- **Criterion**: 75% of jobs within 45 minutes of all residents
Analysis: Do Not Mix Symptoms and Causes

Symptom: Congestion

Possible causes

• Demand / Public Transport supply mismatch
• Unaffordable Public Transport fares
• Poor pedestrian environment
• Poor roadway design
• Poor management

Moscow
Poor Public Transport System
Poor Pedestrian Environment
Poor Roadway Design
Demand Growing Faster than Supply; Changing Land Use Patterns

Figure 3. Change of Population Distribution in Beijing

Figure 1. Comparison of Car/Light Truck Ownership in U.S., China, Korea, Japan, and West Germany

- United States 1910-2003
- China 1987-2003
- Korea 1970-2002
- Japan 1965-2000
- W. Germany 1960-1995

GDP/Capita, 1990 USD (PPP)
Important Strategic Transport Concerns Beyond “Congestion”

- Health
  - Safety
  - Local air quality
- Energy, climate Change
- Logistics
- Economic, social development
- Sustaining existing system
Consider the Right Alternatives

• Begin with current, expected “no major change”
• Be *multi-modal*:
  – In public transport studies, consider transit-supportive highway improvements, and vice-versa
• Do not be afraid to leave major capacity enhancements specified without mode and design details,
  – e.g., “rapid transit,” “major highway”
• Include land use, strategic systems management, operations policies
• Money matters
  – Life cycle cost
  – Financial sustainability and risks
Parking Management
Road Improvements
Local transit
Traffic Management
Rapid Transit
Enforcement

Integration
Integration is Important in Alternatives Development

Examples

• Public transport with roadway improvements
• Metro/LRT/BRT with local transit
• Public Transport and roadway investment with improved operations and management
Do Not Distort Analysis to Favor Pre-determined Solutions!!

- Biased assumptions
  - e.g., fares, capacity standards
- Non-competitive alternatives
  - “Straw-men”
- Under-estimated costs
- Inflated benefits
- Ignored risk
Strive for Open Decision-Making

• Make decision information available to the general public in a timely fashion
• Have a communications program involving all stakeholders from the onset of planning
• Inform decision makers of stakeholder concerns before decisions are made
• Ensure stakeholder concerns are taken into account
Progression of Analyses & Studies

• Long-range, metropolitan strategic plans often do not include project details
  – e.g., mode, precise alignment, design concepts,

• Plans may only identify need for new roadway, rapid transit in specific corridors or sub-areas

• *In many situations, subsequent, focused corridor or sub-area studies (e.g., alternatives analyses) provide the requisite detail to make decision on mode and design concept*
Urban Transport Planning and Project Development Process

Metropolitan Strategic Transport Planning

- Detailed Corridor Alternative Analyses/Project Identification Studies
- Design

Detailed Management, Operations Studies

Construction/Operation
Why Alternatives Analysis (AA)?

- At the conclusion of metropolitan long range strategic planning:
  - Corridors have been identified as a top investment priorities
  - Investment alternatives have been pre-screened
  - However, accurate information (e.g., costs, environmental impacts) is not available to select a precise mode and design concept
    - Strategic planning covers entire metropolis, all corridors
    - Strategic planning considers all potential alternatives
    - Strategic planning has a distant planning horizon
  - There is significant uncertainty in critical criteria
    - Costs, benefits
    - Environmental, social impacts
    - Affordability
Why Alternatives Analysis (AA)?

• AA provides the better information needed to make an educated, supportable decision
  – Detailed look at fewer, pre-screened alternatives
  – Focused geographically
  – Shorter (i.e., fifteen year) time horizon
What is an Alternatives Analysis?

A process for finding the most desirable alternative for geographic area that:

– Solves transport and related problems
– Is cost-effective
– Is affordable
Alternatives Analysis Analogy
Meeting a Family’s Transport Needs

1. What are our transport needs?
2. How much money do we have to spend?
3. What are our options?
   - Continue to use public transport (“Do nothing”)
   - Buy a vehicle
4. How do the private vehicle options compare
   - Costs?
   - Size and features?
   - Repair record?
   - Comfort, aesthetics?
5. Opinion of spouse, spouse’s brother?
6. Decision
What Alternatives Analysis is Not!

- A Feasibility Study where:
  - A single, pre-determined solution is evaluated for;
    - Physical and operational “feasibility”
    - Absolute economic return
  - Other, potentially more cost-effective and desirable options are ignored
Establish Goals and Objectives; Transportation, Quality of Life

Evaluate Current Problems, Future Challenges

Identify Investment Alternatives

Evaluate Alternatives

Decision on Mode and General Alignment

Go!
Alternatives Analysis Guidelines

1. Make sure that everyone understands process from start
2. Understand the problems needing solution
3. Establish goals, objectives and evaluation criteria
4. Identify and collect the information needed for proper analysis and decision-making
5. Consider the right alternatives
6. Develop complete, objective and reliable information
7. “Make the case” for the selected alternative
Make Sure That Everyone Understands Process From Start

- Alternatives Analysis, not feasibility study
- Clarify “big decision” to be made at conclusion of Alternatives Analysis
  - Type of transport investment
    - e.g., metro, Bus Rapid Transit, Light Rail Transit, roadway
  - General alignment
  - Related management and operations strategies
Understand the Problems Needing Solution, in Detail

• Analyze current and expected future “no project” conditions in detail

• Identify underlying causes, not just symptoms
  – e.g., congestion and air pollution are symptoms, not causes

• Make sure everyone, decision makers and the public understand the issues
Symptom: Traffic Congestion
Possible Cause of Congestion
Land Use

• Poor land use, site planning
  – Widely scattered, single-purpose developments
  – Site planning not pedestrian or public transport “friendly”
  – Site planning forces auto dependency
10,000 Meter View
View on the Ground: Pune, India
No Possibility of Walking to Anything; Difficult to Serve with PT
Demand Side Changes Possible Cause of Congestion

• Explosive population, income and motorization growth

• Changing demographics
  – Declining household sizes (grown children moving to own residences)
  – Younger/older population

• Changing origin-to-destination patterns
  – Less core-focused
Changing Public Transport Demand Patterns Accra, Ghana

Links with Bus and Tro-tro volumes >250 vph in 2013 AM Peak
Supply Side Changes
Possible Cause of Congestion

• Public transport system
  – On-street, poorly regulated competition
  – Route structure not consistent with travel needs
  – Insufficient capacity in major corridors

• Non-Motorized Transport
  – Declining space dedicated
  – Right-of-Way (ROW) encroachment

• Roads
  – Poor design/condition /connectivity
  – Ineffective parking /traffic management
  – Poor enforcement of traffic rules
Inefficient Traffic, Public Transport Operations
Inefficient Traffic, Public Transport Operations
Poor Roadway Design

Ring Road 3 Beijing
Incomplete Arterial Grid

Manila
Poor/No Secondary Street Network
Right-of-Way (ROW) Encroachment
Inefficient, Ineffective General Traffic Management
Local Emissions
Poor Pedestrian Environment
Pedestrian and Bicycle Safety
Motor Vehicle Safety
Public Transport Safety
Sustaining the Existing System
Establish Goals, Objectives and Evaluation Criteria

• Cost-effectiveness
• Affordability
• Related non-transport issues
Cost-Effectiveness Criteria

- Combine
  - Total equivalent annual costs (capital, operating, maintenance)
  - Effectiveness measure or measures
    - e.g., travel time savings, public transport trips, person km of travel

- Calculated as changes from “no project” or base case
Typical Cost Effectiveness Criteria

- Cost per person Km of travel
- Cost per Public Transport Trip
- Benefit/Cost ratio
- Net present value
- Implicit cost of travel time savings
  - Used by U.S. Department of Transportation for major Public Transport projects
Affordability as a Criterion

• Should not be limited to initial capital cost of alternatives
• Should also include
  – Ongoing operation/maintenance
  – Costs associated with rest of transport system
    • Especially “background” local bus system needed for alternative to produce benefits
  – Recapitalization
Non-Transport Criteria

• Environmental, local and global

• Social

• Land and economic development effects

• Health, safety
Simplicity is a Virtue!

• Decision makers and citizens must understand the criteria

• Criteria must be “scalable,” capable of being related to something from everyday life

  e.g.,
  – Cost/Public Transport trip compared to cost of a car or taxi trip,
  – Cost per hour of travel time savings compared to wage rates
Identify and Collect Needed Information, Build Tools

- Current and future conditions
- Analysis tools
  - Ridership
  - Costs
  - Impacts
  - Accessibility, travel times
Current and Future Conditions

• Data describing current situation
  – Population
  – Land use
  – Demand
  – System supply & performance
    • e.g., travel times, capacity utilization
  – Finance
    • e.g., profitability, available funding

• Forecast data on future growth
  – Population
  – Land use
Data to Support Tool Development and Application

- Forecasts needed for evaluation criteria
- Tools needed to show differences among alternatives in criteria such as:
  - Travel demand
  - Network performance analysis
    - e.g., capacity utilization, travel times, transfers
  - Environmental impact assessment
    - e.g., local/global air, noise emissions
  - Costs
    - e.g., implementation, operating, maintenance, recapitalization
  - Financial resources
5 Consider the Right Alternatives

• Recognize that there is more than:
  – One rapid transit mode
    Not just metros/Light Rail Transit!!
  – One type of road capacity addition
    Not just expressways, freeways, flyovers!!

• Keep in mind system integration is critical
  – Rapid transit/local bus
  – Expressway/arterial street

• Consider integrated PT priority/traffic management as an alternative
  – Comprehensive package of “low-cost” improvements
Packaged Roadway/Public Transport Investments

Mexico City Metro, Expressway

Barcelona LRT, Arterial

Beijing BRT, Expressway
Guidelines for Developing Good Alternatives

• Make each alternative competitive
  – Develop each alternative based on an analysis of the current market for travel
  – Refine each alternative so it is operationally “feasible” and reasonable, physically, financially

• Establish constant policy setting, but identify policy options (e.g., tolls, traffic management, fares) to be tested
Is More Highway Capacity Necessary?
Is Metro Enough?

Bangkok

Manila
Rapid Transit Alternatives

- Bus Rapid Transit (BRT)
- Light Rail Transit (LRT)
- Metro
Common Rapid Transit Features

- **Objective:** High Capacity, performance, quality
- **Physical Characteristics**
  - Dedicated running ways, best fully grade-separated
  - Distinct stations with shelter, security, amenities
  - High capacity, easy boarding/alighting vehicles with good internal circulation
  - Supportive Intelligent Transportation Systems (ITS) applications
  - Unique branding
Common Rapid Transit Features

- Service, Operational Characteristics
  - All day, high frequency service
  - Medium stop spacing minimum (0.5-2 km)
  - Simple route structure
  - Off-board fare collection
  - Tight dispatching, supervision
BRT Elements
Bus Rapid Transit (BRT)

• Flexible, integrated package combining LRT, Bus features
  – May be at grade and/or have at grade intersections
  – Can be fully grade-separated

• Vehicles
  – Rubber tired, steerable 12-25 meters long
    • Norm is clean diesel or CNG but can be hybrid or fully electric

• Stations
  – Platforms can be low or high, depending on passenger volumes and design constraints
BRT Characteristics

• Revenue speeds
  – Key Factors: Station spacing, operating environment
  – Range: 15-50 km/h

• Maximum capacity
  – Key Factors: Level of grade separation/ dedication and operating environment
  – Range
    • 11,000 Passengers/hour single lane, at grade intersections
    • 20,000 Passengers/hour fully-grade separated (Istanbul)
    • 35,000 Passengers/hour, at grade two lanes/direction (Bogota)

• Total implementation costs for a line
  – Key Factors: Design and local cost environment
  – Range: US$ 5M – $25M/km
Light Rail Transit (LRT)

- Flexible combination of tram and metro
  - May be at grade and/or have at grade intersections
  - Can be fully grade separated

- Vehicles
  - Steel wheeled, high capacity vehicles up to 40 meters long
    - Norm is electric but can be Internal Combustion (IC) propulsion
    - Can be trained up to limits dictated by block lengths in at-grade sections

- Stations
  - Platforms can be low or high, depending on passenger volumes and design constraints
LRT Characteristics

- **Revenue speeds**
  - Key Factors: Station spacing, operating environment
  - Range: 15-50 km/h

- **Maximum capacity**
  - Key Factors: Level of grade separation/ dedication and operating environment
  - Range:
    - 11,000 Passengers/hour Tramways
    - 30,000 Passengers/hour Fully-grade separated

- **Total implementation costs for a line**
  - Key Factors: Design and local cost environment
  - Range: US$15M – $60M/km
Metro

• Highest capacity, highest performance rapid transit system

• Key is *fully grade-separated, dedicated running way and stations, no grade crossings*
  – Can be elevated, in subway, or surface

• Can be automated or manually driven, with “fail-safe” signal system
Metros

• Vehicles
  – Up to 23 meters long
  – Electric propulsion system, “third rail” or overhead contact system

• Stations
  – Spacing longest of Rail Transport modes >0.75 km
  – Usually high platform stations

• Service
  – Frequencies up to 40 trains per hour
  – Service plans with more than one service on a running way or stopping at a station rare in modern systems
Metro Characteristics

• Revenue speeds
  – Key Factor: Station spacing
  – Range: 30-60 km/hour

• Maximum capacity
  – Key Factors: Passing at stations and operating environment
  – Range: Up to 75,000 Passengers / hour

• Total implementation costs for a line
  – Key Factors: Design and local cost environment
  – US$40M – US$200M/km
Transit System Mode Comparison

Source: Montassar DRAIEF - SYSTRA
Operating Costs including Depreciation (US$/Seat-KM)

Source: Montassar DRAIEF - SYSTRA
Develop Complete, Objective and Reliable Information

- Be transparent
  - Fully disclose an honest, objective assessment of benefits, costs, impacts and risks

- Address risks
  - Sensitivity analyses (what happens if everything goes wrong)
  - Independent “reasonability” assessment of costs and benefits can build credibility
Forecasting Cautions

• Ridership forecasts
  – Avoid compound optimism
    e.g., Population, employment forecasts, walking distances, transfer penalties, speeds, capacities, fares and other user fees

• All cost forecasts
  – Apply different contingency factors to costs by project component, type of construction, and level of engineering
    • Conceptual planning factors higher than preliminary engineering ones
    • Tunneling factors much higher than for surface construction
“Make the Case”
for the Selected Alternative

• Tell a clear, coherent and concise story:
  – Problem(s) addressed
  – Relative effectiveness and costs of each alternative in addressing the problem(s)
  – Why the selected alternative is best
Summary

• Multi-modal strategic planning
  – Addresses strategic issues/concerns, both transport and transport-related
  – Used to set strategic priorities

• Alternatives Analysis follows
  – Not a feasibility study

• Outlined the AA process

• Discussed AA guidelines

• Described key characteristics of rapid transit modes