U.S. Transportation System

- After housing (31%), households spend most in transportation (18%)
- 88% person-miles by pvt veh
- 2.5% public transportation
- 9.5% air, school bus, walking/biking, etc.
- 25% Rev ton-miles of freight-hwy
- 32% Railway
- 28% Water

Annual VMT/capita
- USA 8,600
- Japan 3,300
- Germany 4,050
- Mexico 360

Auto/capita
- USA 0.6
- Japan 0.3
- Germany 0.5
While road mileage increased 2.6% since 1973, number of vehs increased 54%, VMT 75%.

While VMT increased by 75%, gallons of motor fuel used for vehs decreased by 39%.

Highway Capital Exp 1.73 cents/vmt
- 66% increase since 1970

3.9 million miles of roads
- 20.5% state
- 74.9% local
- 4.6% fed
- 58% paved
- 42% unpaved

VMT
- 1 trillion ($10^{12}$) rural
- 1.5 trillion urban
- 2.5 trillion total

IS 23%, local 13%
Increasing congestion-% Peak-hr under congestion 78%
- 41% (1975)
Safety
- 40,000 traffic fatalities
- 44% alcohol related
- 10% IS

IS mileage 45,749
NHS 110,342

About $90 billion revenue
- 38% local
- 61% state
- 1.6% fed

Trust funds & Fed Transpo Funding

Transportation Development Process
National, Regional, State, & Local
Areas:
- System Planning
- Corridor or Location Planning
- Design
- Construction
- Operation
- Maintenance
System Planning

- Continuous Process
- Involves:
  - Goals and Objectives
  - Inventory
  - Analysis and Forecast
  - Alternatives
  - Evaluation and Selection

Actors (stakeholders) are:
- Federal and State Agencies
- Local Governments
- Transit Operators and Other Transpo Providers
- Citizen Groups
- Special Interest Groups

Corridor or Location Planning

- 3-5 years
- Consists of an individual portion of the system plan along a corridor (project).
- Involves:
  - Evaluation of Existing Facility
  - Social, Econ. & Env. Data
  - Definition of Alternate Corridors
  - Informal Meetings
- Study of Corridors
  - Draft EI Report
- Location Hearings
- Final Report and EIS
  - Approval

Design

- 2-5 years
- Context Sensitive
- Consists of detailed construction plans, acquisition of property, and letting the project to contract

Involves:
- Design Study & Review
- Design Hearing
- Final Design
- Approval
- Detailed Plans, Specs, and Estimates
- Relocation and ROW Acquisition Plan
- Processing of Contract Documents
- Advertising for Bids and Letting the Contract
- **Construction**: 2-5 years
- **Operation**: continuous
- **Maintenance**: continuous
- Information is returned to the planning phase to assist in improving the system for the future.
- **Performance Evaluation** on a periodic basis with respect to stated goals and objectives.

**ISTEA of 1991**
- Management Systems
- LCCA
- Multimodal Transportation Planning
- AQ Considerations (CAAA of 1990)

**TEA 21**
- Performance Based Planning
- Sustainability
- Technology
Transportation Decision-Making

- Decision—Selecting a course of action in committing resources—purposeful choice of one from several alternatives
- An evaluation process must have a clear definition of goals and objectives

Objective—specific statement; outgrowth of a goal
- Criteria—operational definitions attached to objectives
- Standard—fixed objectives (lowest or highest level of performance; cut-off point)

Example

- Societal goal—equal opportunity
  - Objective—to improve public transportation accessibility for the residents
  - Criterion—measures, tests, or indicates; eg. to minimize walking time to public transportation access points
  - Standard—a standard for public transportation accessibility
    - Bus routes must be within 2 blocks of all residential areas
Evaluation Process

- To clarify issues of choice
- To fully inform decision-makers
- To achieve community agreement
- Form and sophistication of the process depend on:
  - Decision-maker
  - Decision-involved
  - Alternative courses of actions involved

Evaluation serves two functions:
- Sifting and sorting
- Defining new alternatives

Evaluation can be defined as the relative and absolute assessment of the worthwhileness of a particular course of action or planned expenditure

How does one measure worthwhileness?
- What units of measure?
- Worthwhile for whom?
  - Agency
    - Operating Agency
    - Donor Agency
  - User
  - Non-User
- Who is impacted?
  - Socio-economic groups

- What is the boundary?
  - Corridor
  - Local Community
  - Region
  - State

- What is the time frame?
  - Short range
  - Long term

- Efficiency: evaluation of the relative value of the return from an alternative with respect to the required investment—getting one’s money’s worth

- Effectiveness: evaluation of the degree to which an alternative is expected to accomplish the tasks—just how well it attains the objectives specified

- Equity: both geographical and social equity in the distribution of costs and benefits related to an alternative
Evaluation Techniques

- Engineering-Economic Approach
  - Priceable items
  - Annual cost
  - B/C
  - PW
  - ROR
  - Economic efficiency of investment

- Cost-Effectiveness Approach
  - Priceable as well as intangible factors
  - All costs and consequences
  - Tradeoffs or compromises

Optimal vs. Good Choices

- Optimality Requirements
  - All feasible solutions known
  - All consequences known
  - Optimality precisely defined

- Decision-making tends to be “satisficing,” if not optimal. Truly optimal solutions are not attainable.
Community Goals and Objectives

- Mobility Enhancement
- Congestion Relief
- Environmental Improvement
- Economic Efficiency
- Financial Viability
- Center vs. Suburban Concerns
- Improved Accessibility

Measures of Effectiveness

- Economic Value
  - e.g. jobs within 30 minutes
- Mobility
  - e.g. vehicle hours of delay reduced
- Environmental Quality
  - e.g. tons of hydrocarbons removed
- Monetary Measures
  - e.g. net present value

- Economic Development
- Overall and Distributional Measures
- Non-Monetary Measures
- Qualitative Measures
Levels of Analysis

- Regional/Corridor/Project
  - Possibly Different Methodology
  - Possibly Different Emphasis on MOE

Conceptual Framework for Evaluation

**Key Inputs**
- Goals and Objectives
- Concerns of Decision-Makers and Others
- Legal and Administrative

**Evaluation**
- Overall Merit of Alternatives
- Equity (Incidence of Impacts)
- Financial Feasibility
- Legal and Administrative Feasibility
- Sensitivity of Findings to Uncertainties and Value-Based Assumptions
- Adequacy of the Range of Alternatives and Impacts Studied

Principles of Good Practice

- Cognizance of Decision Sequence
- Concerns and Valuations of Decision-Makers and Others
- Qualitative As Well As Quantitative
- Uncertainties and Value-Based Assumptions Should Be Well Recognized
- All Key Impacts
Legal And Administrative Requirements

- Local Ordinances
- State Statutes
- Federal Program Requirements
- Environment
- Safety
- Equity
- Access

Public Involvement is:

- Inclusive of all affected parties
- Proactive
- Early and continuing

Evaluation Work Plan

- Step 1: Identify concerns to be addressed by evaluation
  - Purpose and Need of the Effort
  - Alternatives
  - Impacts
  - Relationship to legal and administrative requirements
  - Different decisionmakers/interests and their key concerns
  - Preferences of key interests and valuation implied
Step 2: Determine Information Needs to Address Concerns
- Set of impact measures
- Relationship of measures to goals
- Level of detail for each measure
- Formats for summarizing impacts

Step 3: Assumptions and Analysis Procedures
- Relative Importance of Impacts
- Current knowledge about measures
- Procedures for Reducing Uncertainty
- Possible sensitivity tests
- Making trade-offs

Travel Forecasting & Evaluation
- Coordination with Estimating Impacts
- Level of Aggregation
- System Sensitivity
  - Variability in Population/Employment Forecasts
  - Value of Time
  - Fuel Prices
  - Parking Costs
  - Peak Spreading
  - Induced Travel
  - Equilibration
  - Operating Policies (e.g., fares, HOV-2, HOV-3)
Principles for Developing Alternatives

- Responsiveness to Goals and Problems
- Range of Alternatives/Trade-Offs
- Open and Documented Development

Responsiveness to Goals and Problems

- Recognize Overlap Between Markets and Models
- Mix of Models
- Recognize Physical Characteristics
- Respond to the Context and Values

Range of Alternatives

- No-Build (NEPA)
- TSM (MIS Requirements)
- TDM/Pricing
- All Reasonable Modes
- Address Different Goals and Objectives
- Anticipate Preferred Alternative
- Fall Back Alternative
- Manageable Number
Process of Alternative Development

- Definition of Components
- Stages in Development
- Open and Documented Process