The future of transportation … and how we’ll pay for it

A Day With Northwestern – 40th Anniversary Seminar Day

Joseph L. Schofer
Department of Civil & Environmental Engineering

April 18, 2009

What a great transportation system!
But it's got a few problems

- Congestion & capacity
- Energy/environment/climate change
- Failing infrastructure
- Finance – we're out of money!

(1) Chicago congestion trends

- Annual hrs. delay per peak traveler
- Annual cost per peak traveler
- Travel time index

Hours

Dollars per Year


1.31 1.34 1.34 1.35 1.35 1.34 1.35 1.41 1.43 1.44 1.47

0 5 10 15 20 25 30 35 40 45 50

$0 $100 $200 $300 $400 $500 $600 $700 $800 $900 $1,000
Bad day on the Stevenson I-55
Dan Ryan to Harlem (9.15 miles) Thursday 03-12-2009

Current Average Normal range

http://www.eia.doe.gov/emeu/aer/pecss_diagram.html

(2) U.S. Primary Energy Consumption by Source and Sector, 2007
(Quadrillion Btu)

Quadrillion Btus 10^15

Petroleum (8.4)
Natural Gas (23.6)
Coal (22.8)
Renewable Energy (6.8)
Nuclear Electric Power (8.4)

Transportation 29.0
Industrial 21.4
Residential and Commercial 10.6
Electric Power 40.6

Note: Source: Energy Information Administration, Annual Energy Review 2007, Tables 1.1, 2.1a, 2.1f, and 10.3.

http://www.eia.doe.gov/emeu/aer/pecss_diagram.html
Energy consumption & travel

- Auto dependence
- Location & land use
- Fleet mix & use
- Family factors
  - e.g., walking to school: 1969: 41%  2001: 13%

"This may be your last chance to acquire a superpowered, economical, hyper-fuel-efficient gas guzzler. Don't blow it!"
International auto efficiency standards
U.S. at the Bottom – and it matters

http://www.interacademycouncil.net/CMS/Reports/11840/11914/11924.aspx
U.S. monthly vehicle miles traveled

Price does matter!

(3) Failing infrastructure
The Ron Popeil mentality

- 12% bridges structurally deficient – key load bearing components in poor or worse condition
- 13.5% of bridges functionally obsolete – for carrying current traffic
- Set it and forget it!
Costs of failing infrastructure

• Operating costs (fuel)
• Delay – travel time
  – Reduced speed
  – Rerouting
• Increased repair cost

But well-maintained infrastructure can last a long time!

(4) Money is a problem!

• Highways aren’t free
• Motor fuel taxes (1925)
  – Convenient, popular
  – Use-based - equitable
  – Federal 1930s, all states by 1940
  – Interstate Highways
  – Trust fund - “lock box”
  – Federal + Illinois:
    • 18.4 + 19¢/gal: ~2¢/mile
• Taxes haven’t kept up with costs

$8 billion supplement to HTF voted in 2008
How did this happen?

- Fixed ¢ per gallon
- Slowdown in travel
- Ethanol tax breaks
- Rising fuel economy
  - 10.5 mpg (1970)
  - 22.5 mpg (2000)
  - 35 mpg (2020)
- Construction costs rising faster than CPI
  - Global competition
- Tax increases rare (1993 federal)
  - require legislation

No new taxes!

What to do about it?
Coping with rising costs & flat revenues

- Other taxes
  - Local option sales, real estate taxes
- Raise, index taxes
- Bonds & borrowing?
- Toll the roads
- Privatize the roads
  - Existing, New
- Congestion pricing

Which will raise the smallest stink??
Charging to drive into London

- £8 daily fee Winter ’03
- £123m directed to enhance (bus) transit (’06/’07)
- Congestion down 25%, volumes down 21% (70,000 fewer vehs/day)
- 43% increase in cycling in priced zone
- No significant impacts on London businesses
- Exemptions/discounts: residents, taxis

Objectives:
- Congestion
- Environment
- Safety
- Energy

Goodbye flat tax; welcome to user fees

Paying the Fee in London

By midnight on the day of travel (£8 daily charge): You can pay before or after the journey on the day of travel.

By midnight the following charging day (£10 charge): You can only pay this charge via the website or the call centre. If you travel on a Friday you have until midnight on the following Monday to pay.

Important note: If you fail to pay the charge by midnight on the following charging day you will be issued with a Penalty Charge Notice.

How to pay:
- Online
- By SMS
- By phone
- At a shop
- At a self-service machine
- By post

The points:
- Demand management
- Revenue generation
Use-based (congestion) pricing
SR 91 Orange County, California

- Private franchise
- Toll financed express lanes (4/12)
- Added capacity
  - Demand management
    - By signaling true costs
    - Motivates behavior changes
    - 60 vs 20 mph

Technology barriers are gone, but political barriers remain!

Why not do road pricing it?

Privacy
Equity
Technology

Costs

Revenue
Efficiency
Demand management
Equity

Benefits

We're watching you
Tapped, Tricked and Taxed
The Toll Tax

Object now @ www.manchester toll tax.com
Privatization – What’s the big deal?

- Using other people’s money
- Recent infrastructure leases
  - Chicago Skyway: $1.83 B 99 yrs
  - Indiana Toll Road: $3.85 B 75 yrs
  - Midway Airport: $2.52 B 99 yrs
  - Chicago parking meters $1.1 B 75 yrs
- The devil is in the contract
  - Valuing the asset
    - Predicting demand, revenue, costs
  - Monitoring & assuring condition & performance
  - Controlling prices
  - Managing uncertainty

Future vehicle technology

- There will be (different) cars...
- Propulsion & fuels
  - Efficient ICEs
    - Engines, drive trains
    - Fuels
    - Materials – weight reduction
  - Hybrids, plug-ins
    - Regenerative braking
    - Trucks & buses, too
- Electrics
  - MOBs – fuel cells
  - SOBs – pure electrics
The future is electric

The future of transit
Can we share a ride?

• Neither panacea nor dead horse
• Cost-effectiveness?
  – Market share
    • Coverage, service quality
  – Controlling costs
    • Existing ROW
• Light, lively & flexible
  – Modal integration
    • Bikes, cars, buses, trains
  – Land use access
  – Off board, electronic fares
  – Real time management
    • Traveler information
    • Connection protection

Bus rapid transit
Barriers to successful transit

• Market density (for collective travel)
• High capital costs
• Sustained operating funding

Managing the road network
congestion, emissions, safety

• Real time network management - ITS
  – Distributed sensors
    • Ramp metering
    • Real-time information
  – Incident management
    • 25% of congestion
• Vehicle-infrastructure integration
  – Traffic and collision avoidance, enforcement
• Real time tracking
  – Management, incident detection, tolling
Location, location, location
Reorganizing our activities in space

- Low density, sprawled development is trouble
  - Long trip distances
  - Autos are required
  - Transit can’t compete
  - Kids forget how to walk
- Can we provide alternatives?
  - Transit oriented development
    - Moderate density
    - Mixed land uses
  - Non-motorized travel
- How to do it?
  - Creative designs
  - Incentives: policies, taxes
  - Rules & restrictions
  - **Must be regional, long term**
Intercity travel
How about high speed rail?

- How fast is high speed
  - Grade crossings
  - R-O-W
- Are we ready?
  - Competition: air, auto
  - Capital cost
  - Operating costs
  - Sustainability
- Market size?
- Sustainability?

Sustainable infrastructure
New materials, designs & management strategies
What we can expect

• The auto lives… and changes
  – New propulsion, energy sources & storage, IT
• Transit won’t alone work: must restructure land use
  – Markets will help … but must repair social services
  – Soft transit works best
• Sooner rather than later, we’ll pay as we drive, for energy, insurance, roads

Get ready for tomorrow!

Questions, discussion, debate?