



Presents:

Sustainable Transportation Systems: Approaches & Challenges

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Why is Transportation Important?

☐ Why is transportation so important?

- Economic growth
- National security
- Access to medical services
- Maintaining social life

☐ Some statistics:

- 17.5% of U.S. GDP
- 10% of the US work force
- Each person travels on average one hour/day



Transportation Systems

- ❑ In the U.S., transportation accounts for
 - 28% of energy consumption
 - 67 percent of petroleum consumption
- ❑ About 57% of the U.S. population lives in areas that fail to meet federal clean air standards
- ❑ Highway congestion costs:
 - Roughly \$65 billion per year
 - Uses 2.3 billion gallons of gasoline
- ❑ Highway Crashes



Transportation Engineering Profession

- ❑ Provide for the movement of people and goods in a fashion that is:
 - Safe
 - Economical
 - Comfortable
 - Convenient
 - Rapid
 - Environmentally compatible





Transportation Strategies for Sustainable Development

- ☐ Vehicle/Fuel Technological Change
 - Improved efficiency of existing vehicles
 - Alternative Vehicles
 - Alternative Fuels
- ☐ Road/Vehicle Operations Improvements
 - Conventional Improvements
 - Intelligent Transportation Systems
 - Improved Logistics and Fleet Management
- ☐ Demand Management
 - Modal Substitutions
 - Telecommunications Substitutions
 - Pricing Incentives/Disincentives
 - Land use-transportation strategies



Alternative Fuels

- ☐ Different Options:
 - Bio-diesel
 - Electricity
 - Ethanol
 - Hydrogen



Bio-diesel

- ☐ Renewable fuel from vegetable oils, animal fats, or recycled restaurant greases
- ☐ Blends of 20% bio-diesel with 80% petroleum diesel (B20) can generally be used in unmodified diesel engines
- ☐ Can also be used in its pure form (B100), but it requires engine modifications, and may not be suitable for wintertime use.



Ethanol

- ☐ Alcohol-based alternative fuel produced by fermenting and distilling starch crops, including corn, barley, and wheat.
- ☐ Ethanol is most commonly used to increase octane and improve the emissions quality of gasoline.
- ☐ All gasoline vehicles are capable of operating on gasoline/ethanol blends with up to 10% ethanol.





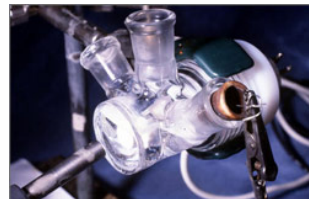
Electricity

- ❑ Electric Vehicles (EVs) store electricity in an energy storage device such as a battery.
- ❑ EV batteries have a limited storage capacity and their electricity must be replenished by plugging the vehicle into an electrical source.
- ❑ Hybrid Electric Vehicles (HEV) and Plug-in Hybrid Electric Vehicles (PHEV)



Hydrogen

- ❑ Hydrogen can be used in an internal combustion engine vehicles as pure hydrogen mixed with natural gas.
- ❑ Fuel Cell Technology:
 - Hydrogen and oxygen from air fed into a proton exchange membrane (PEM) fuel cell "stack" can produce enough electricity to power an electric automobile.





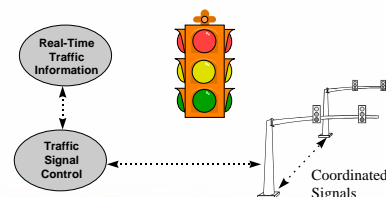
Challenges

- ☐ Existing Infrastructure
- ☐ Transition Time Horizon
- ☐ Unknown impacts



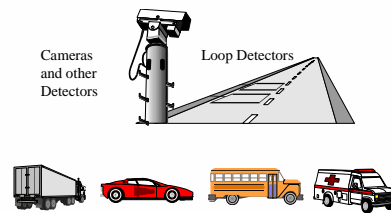
Road/Vehicle Operations Improvements

- ☐ Traditional Approaches:
 - Bottleneck identification
 - Optimal and adaptive signal timing
 - Alternative means of traffic control (e.g. roundabouts)



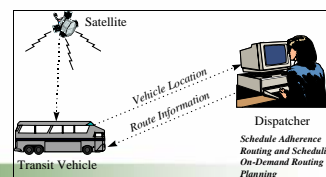
Intelligent Transportation Systems (ITS)

- ❑ ITS applies advanced technologies to make transportation systems safer, more efficient, more reliable and more environmentally-friendly, without necessarily having to physically alter existing infrastructure.
- ❑ ITS cuts across disciplines (transportation, engineering, communications, computer science, finance, electronic commerce and automobile manufacturing,...etc.).



ITS Applications

- ❑ **Real-time management & control of transportation networks**
 - Optimize network utilization
 - Avoid breakdowns
 - Real-time information about travel conditions and options
 - Improve air quality
- ❑ **Intelligent Vehicle-infrastructure systems**
 - Vehicles communicate with the infrastructure and among themselves
 - Automated Highways
- ❑ **Advanced Public Transportation Systems**
 - Encourage transit usage
 - Personalized and flexible systems





The Promise of ITS

- ☐ Improving travel without harming the environment
- ☐ Increasing transportation system efficiency
- ☐ Boosting productivity
- ☐ Improving safety



Demand Management

- ☐ Three different types of actions:
 - Reducing the demand
 - Shifting the demand
 - Repackaging the demand

Influencing Demand

❑ Reduce:

- Shorter work weeks
- Shorter trip length through effective landuse-transportation planning
- More people to work at home

❑ Shift:

- Staggered and flex working hours

❑ Repackage;

- Carpooling and transit use

Transportation-Land Use Modeling

❑ Transportation planning moving toward activity-based, micro-simulation approaches

❑ Land-Use Modeling

- UrbanSim uses an agent-based modeling approach

