# Introduction to Transportation Engineering

Summer 2016


YOU'LL NEVER
GET TO WORK
ON TIME
HAHA!!


ONE WAY
4NORTH TRNSFR PT


LEFT
SHOWARD LAKE RD

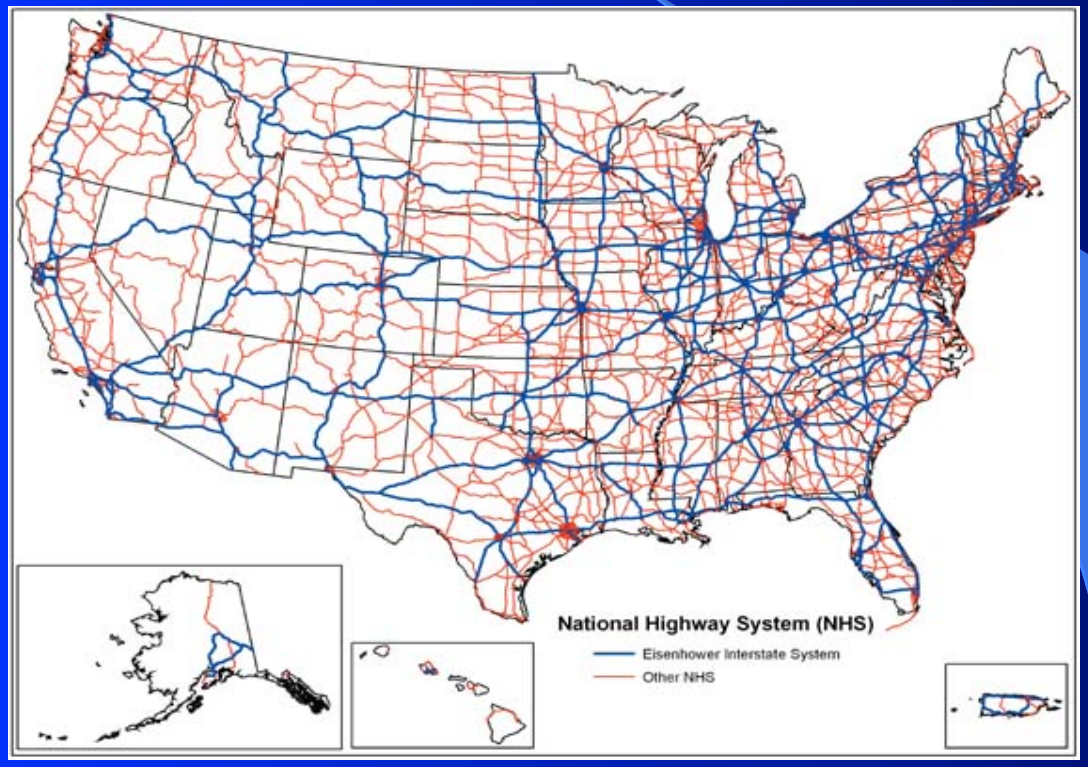
# Transportation History

- 1794, First toll road, the Lancaster Turnpike, PA
- 1807, Fulton tested a steam boat on Hudson River
- 1869, First transcontinental railroad
- 1903, First flight of Wright brothers
- 1956, Interstate highway system began
- 1969, Men landed on the moon and returned
- 1972, BART completed
- 1992, ITS
- 1998, Electric cars
- Now

high speed rail, driverless car, AHS, solar highway ……

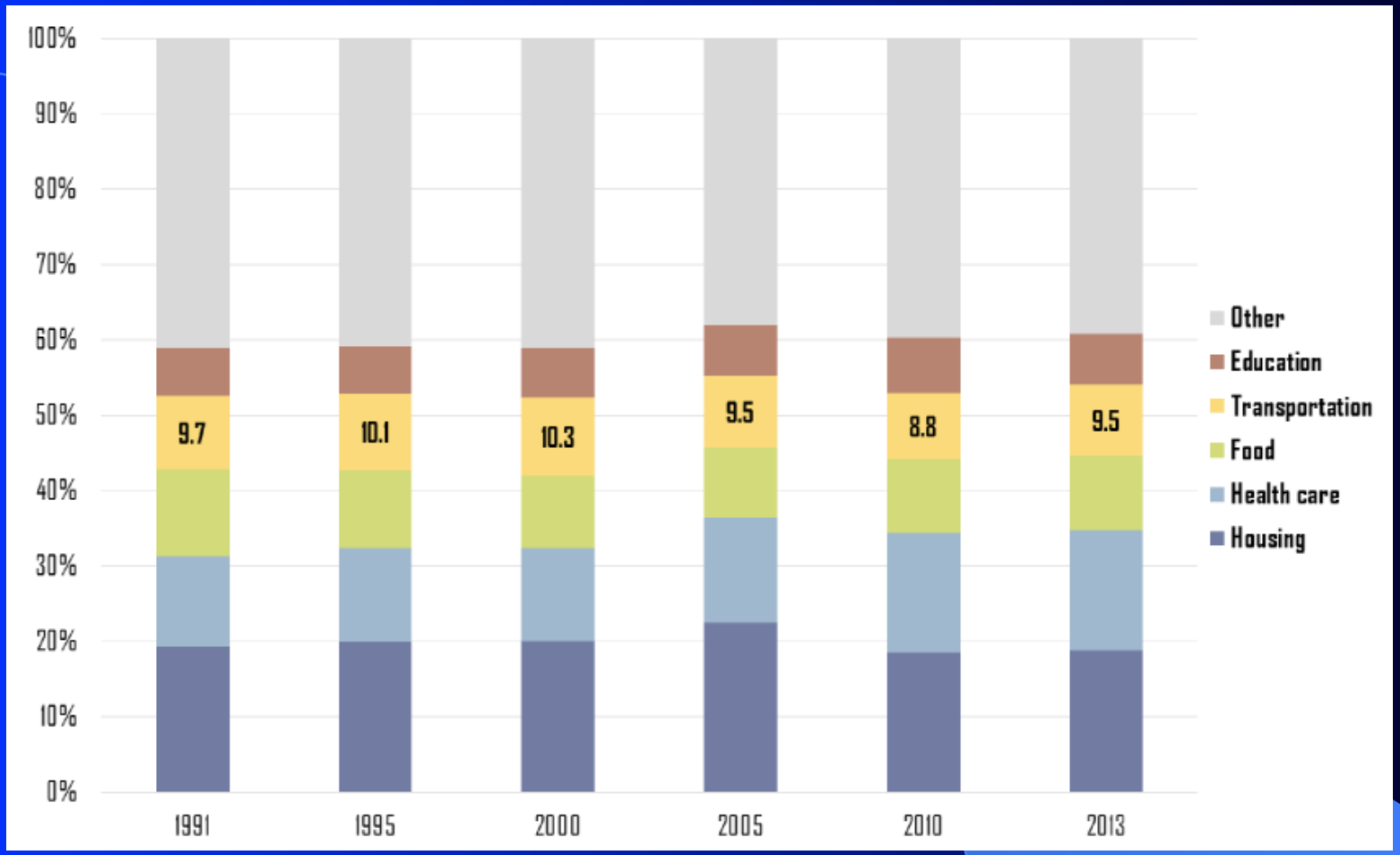
# Our Transportation System

- 4,000,000 miles of paved roadway
- 46,800 miles of interstate highways
- 140,300 miles of freight railroads
- 5,300 public use airports
- 26,000 miles of navigable channels
- 359,000 miles of oil and gas pipelines




Each person in USA travels an average of 12,000 miles/year

# Transportation is essential for a nation's development and growth




USA GDP
Source:
U.S. DOT

Transportation accounts for about 18% of household expenditure and employs over 10% of the workforce

# National Transportation Safety Statistics

- More than 40,000 deaths on the road per year
  - ~ 1 death on the road every 12 minutes (40% DUI)
  - ~ 1 injury every 11 seconds
  - ~ 1 reported crash every 5 seconds
  - ~ 4,000 fatalities in California
  - Leading cause of death for people ages 1 to 33 (40%)

- More Americans have been killed on U.S. highways than in all of the wars in which the nation has involved

# Traffic Congestion is a Headache

- 30~40% of major urban highways are congested

- Vehicle miles traveled increased by 39% from 1990 to 2013
  - New road mileage increased by only 4%
  - The population grew by 27%

- In 2013, traffic congestion costs Americans over $124 billion a year


# And, environmental and social impacts

- Land, energy and material consumptions
  - –The transportation sector makes up 28% of total U.S. energy use
- Noise
- Disturbance to natural beauty
- Environmental changes
- Air and water pollutions
  - ~ 70% of petroleum used in USA is for transportation
  - ~ 50% of CO emission and 30% of NO emission in USA come from highway vehicles
  - ~ 20% of total US population is living in areas that do not meet the health-based standards

# Current Infrastructure Conditions and Travel Trends

- ~30% of America's major roads are in poor or mediocre condition.
  - ✓ Roadway conditions are a significant factor in approximately one-third of traffic fatalities
- 25% of America's 601,396 bridges are structurally deficient or functionally obsolete
- Americans rely almost exclusively on motor vehicles for mobility
  - Travel in private vehicles accounts for ~90% of all person miles of travel
  - Air travel accounts for ~8%
  - Transit accounts for ~1%

What can we do to improve transportation safety and efficiency, and at the same time, reduce environmental and social impacts?

# Transportation Engineering - A Very Diverse Field

The application of technology and scientific principles to the planning, functional design, operations and management of facilities for any modes of transportation in order to provide safe, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods

# Highway Infrastructure Improvements

- Rehabilitation and reconstruction
- Remove or shield obstacles
- Add or improve medians
- Add lanes
- Widen lanes and shoulders
- Upgrade roads from two lanes to four lanes
- Improve road markings and tr signals

# Traffic Control Improvements

- One-way street
- Reversible street
- Ramp metering
- Signal coordination
- Parking restrictions
- Congestion pricing

# Travel Demand Management

- Telecommuting
- Short work week
- Variable work hours
- Carpooling
- Better transit system

# Sustainable Transportation

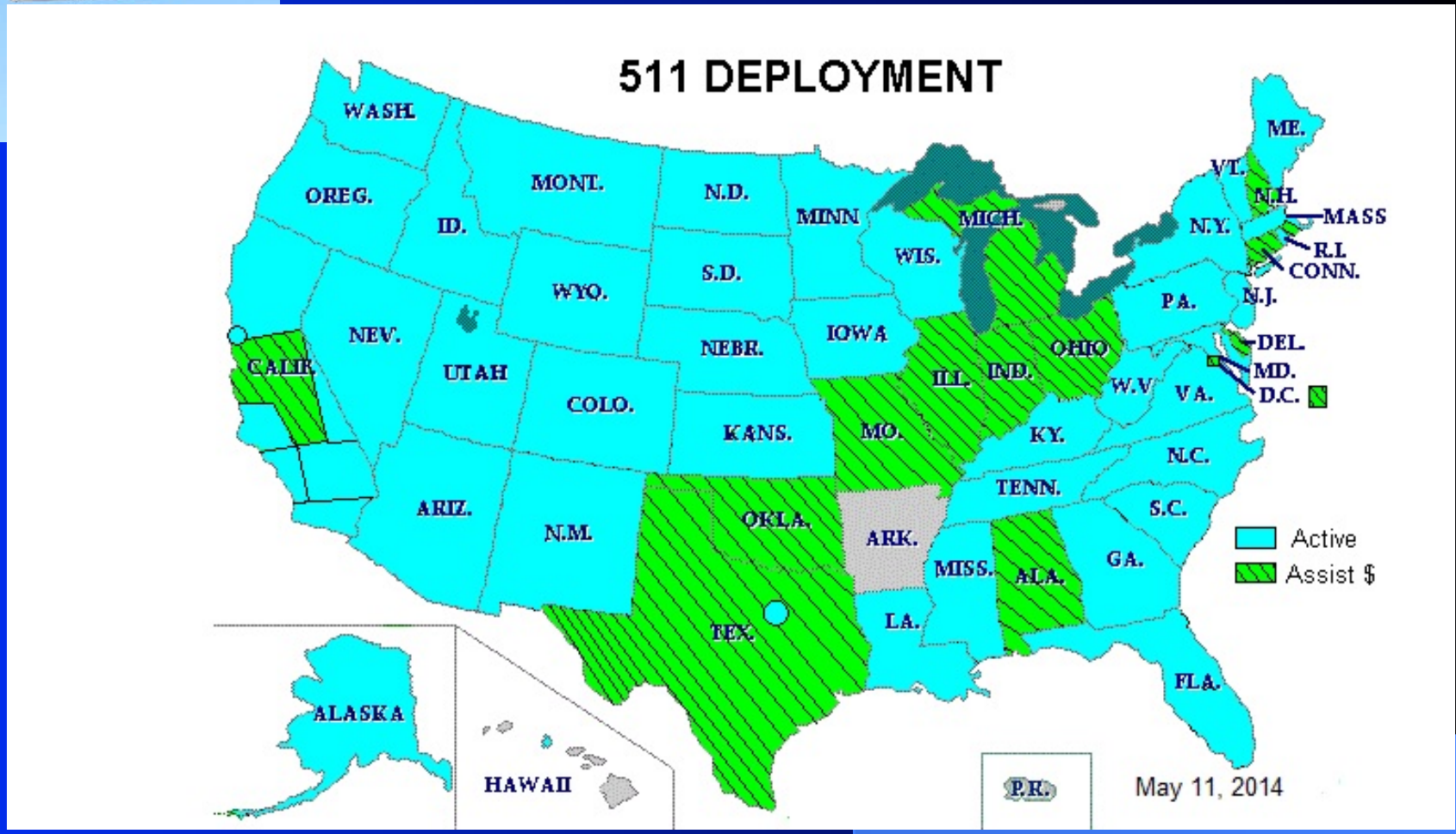
Satisfy present needs without compromising future generations' needs

- Green vehicles
- Public transportation
- Less car intensive lifestyle
  - Walkability
  - Bike lanes

# Intelligent Transportation Systems

ITS are the systems that utilize electronics, communications and information technology to improve the efficiency and safety of surface transportation


# National 511 Service



# Public Traffic Sites


http://www.dot.ca.gov

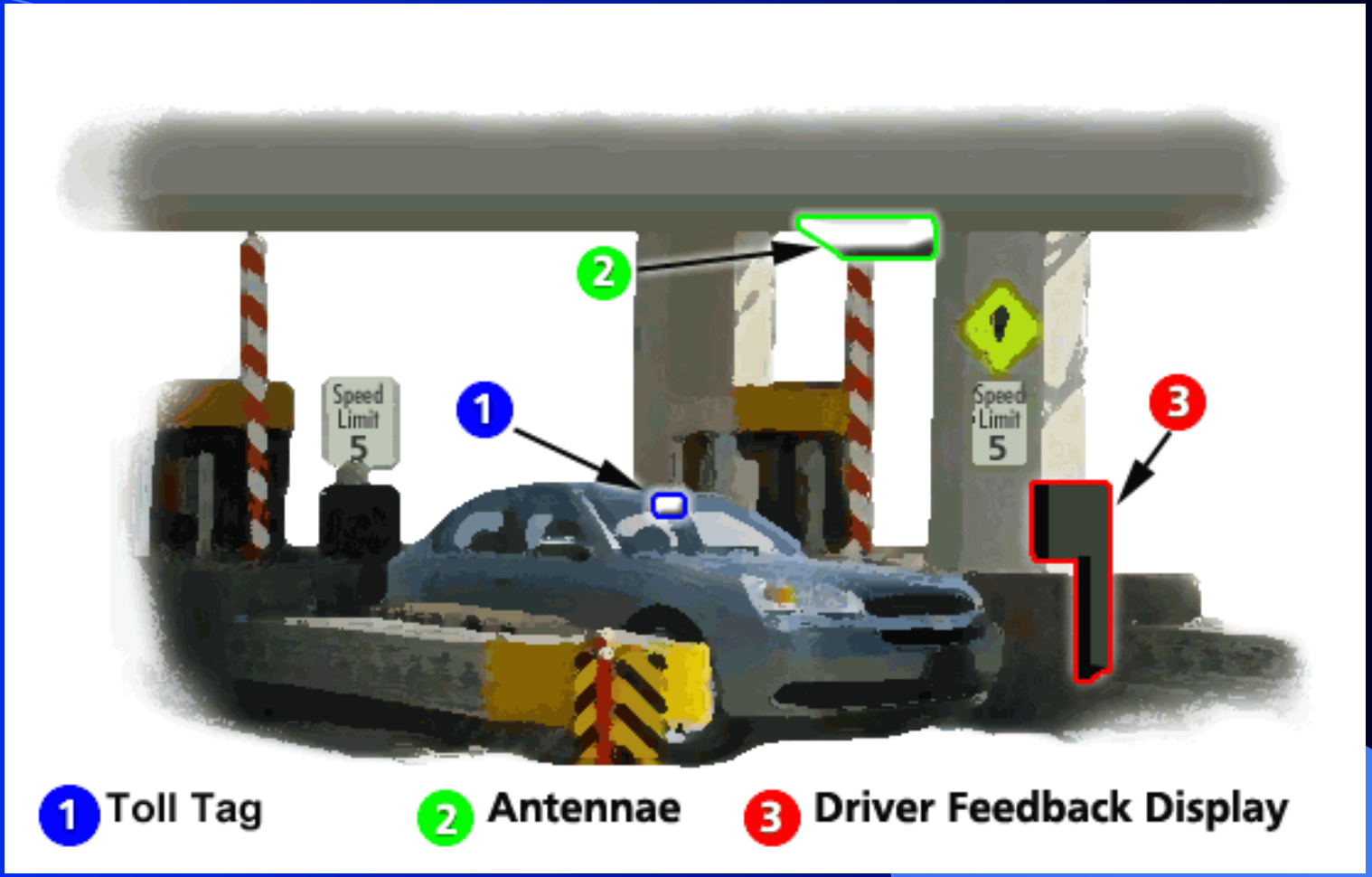
# En Route Driver Information

# En Route Driver Information

# En Route Transit Information

# Parking Systems Information

# Electronic Toll Collection



# Traffic Surveillance and Management

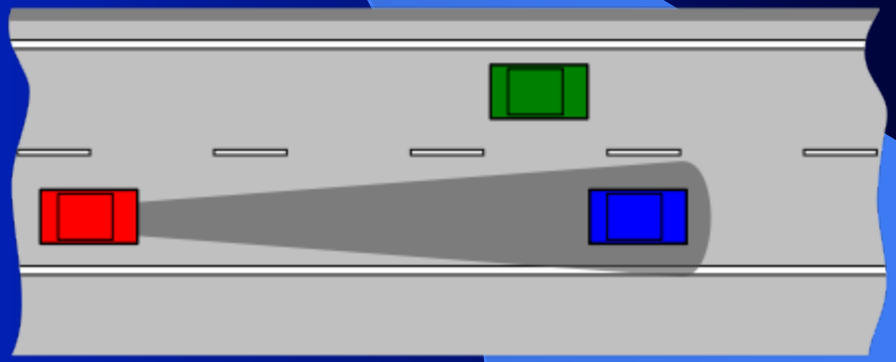
- Incident management
- Freeway ramp metering
- Signal control
- Traveler information
- Automatic vehicle identification

# Navigation Systems


- Dynamic Route Guidance
- Automatic Route Recalculation
- Crisp voice instructions
- Routing Options
- Detour and Avoid Roads

# Collision Avoidance Systems

- Issue warnings to the driver
- Modify the vehicle's operation as needed
- Make adjustment to safety devices such as airbags, seatbelts, suspensions, steering systems and brakes in anticipation of a collision



# Google Driverless Car

# Solar Roadways

https://www.youtube.com/watch?v=qlTA3rnpgzU

# However, sometimes, transportation people are not clear….

http://www.irrationalsigns.com/

# Designed by a Michigan grad…

# California Version

# Hope it's not too urgent…

# Welcome to Iowa….

# Decision making…


# Designed by a Minnesota grad…

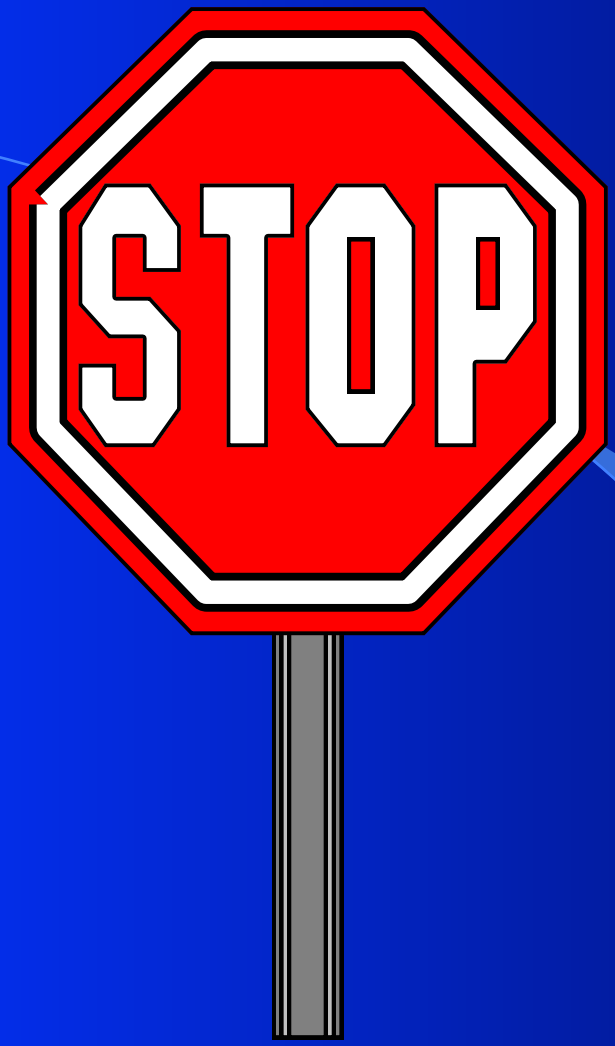
# Designed by another Minnesota grad….

# Welcome to Alabama…

# Cupertino, California

# Santa Clara, California

# I Want You In Transportation !




# Questions?