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Transportation Routing Analysis Geographic Information System (TRAGIS)

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Outline of Presentation

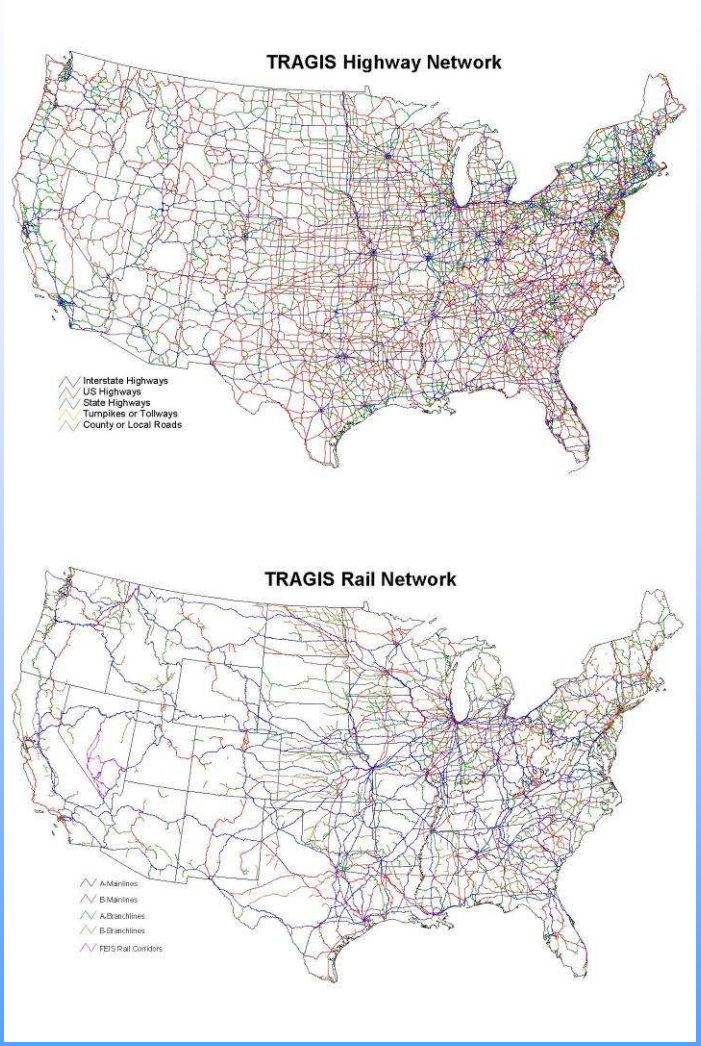
- What is TRAGIS?
- Accessing TRAGIS
- TRAGIS Networks
- TRAGIS features
- Recent developments
- Future directions

What is TRAGIS?

- The Transportation Routing Analysis Geographic Information System (TRAGIS) model is a powerful routing and GIS analysis tool developed for DOE
- The model has client-server architecture
  - WebTRAGIS – client software
  - TRAGIS server – web server at ORNL
- Replaced the legacy HIGHWAY and INTERLINE models over 6 years ago

TRAGIS Model

- Includes routings networks for
  - Rail
  - Truck
  - Barge
- Model provides population information for risk assessment
- Used to identify legally compliant routes

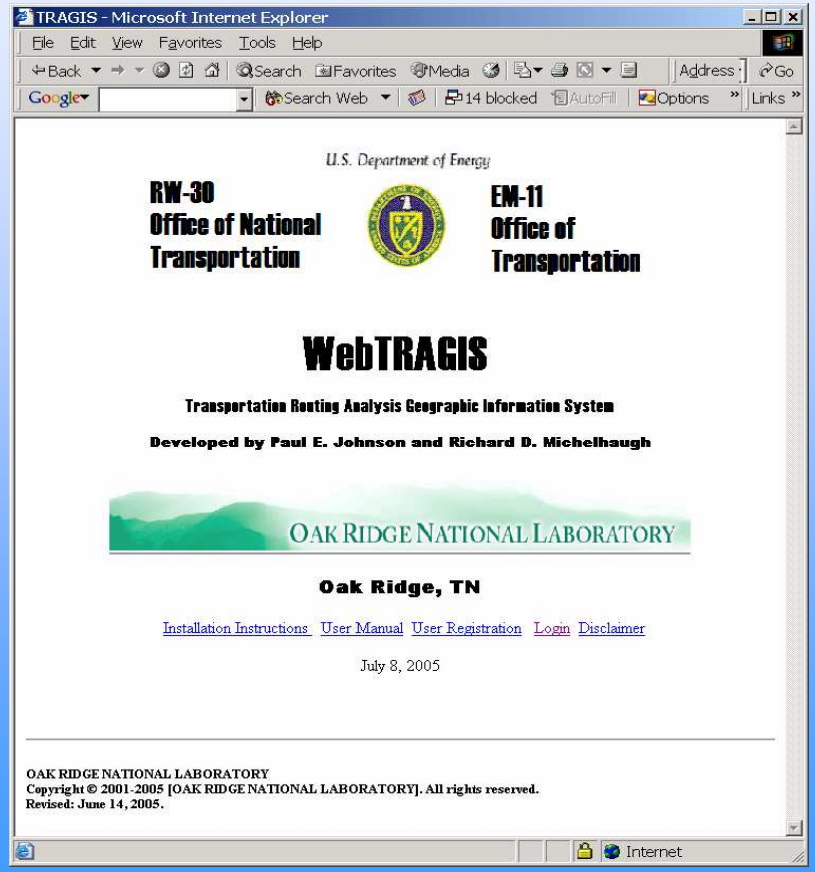


How does TRAGIS work?

- WebTRAGIS software on user's PC is used to select routing parameters
- Information is sent over the Internet to the TRAGIS routing engine on central server
- Results are quickly returned to user's PC for display
- Routing networks on central server minimizes updates and ensures that all users access the most recent database
- Model operates in two modes
  - Interactive, one route at a time
  - Batch, multiple routes

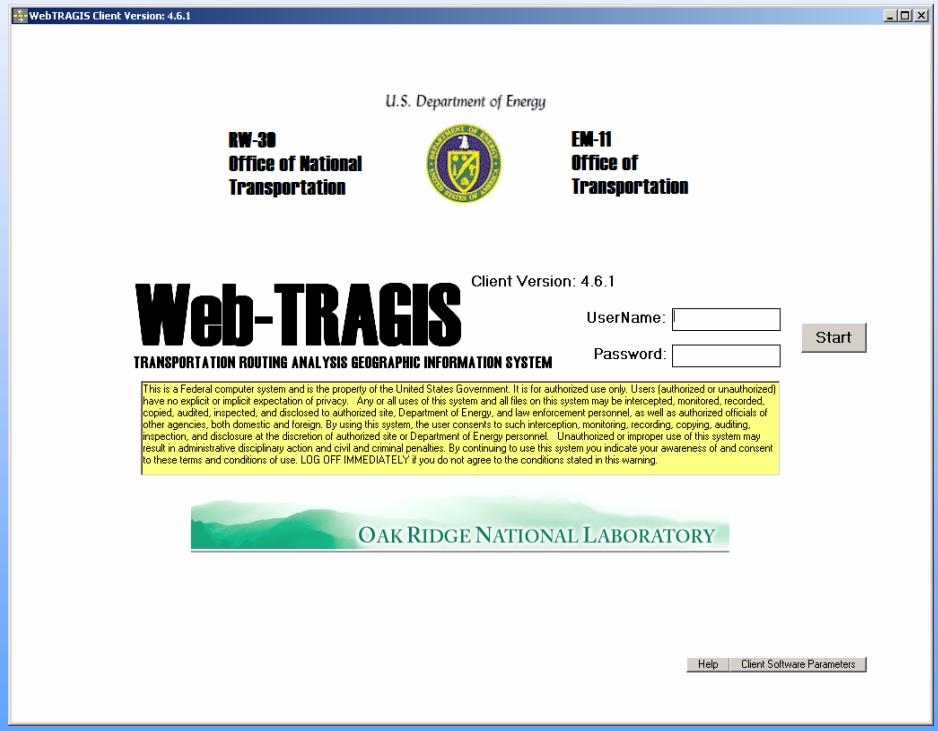
TRAGIS web site

- TRAGIS home page has links for:
  - User registration
  - User login to download software
  - Installation instructions
  - User's manual
- Home page address is: https://tragis.ornl.gov



TRAGIS Access

- All users need to register
- Restrictions include
  - No commercial users
  - No foreign users
- Access controlled through:
  - Username
  - Password
- After approval, users can login to download software



TRAGIS User Base

- Currently over 260 registered users
- Federal Users
  - DOE
  - DOT
  - DOD
  - NRC
- National Laboratories
- Federal Contractors/Subcontractors
- State Agencies

TRAGIS Highway Routing

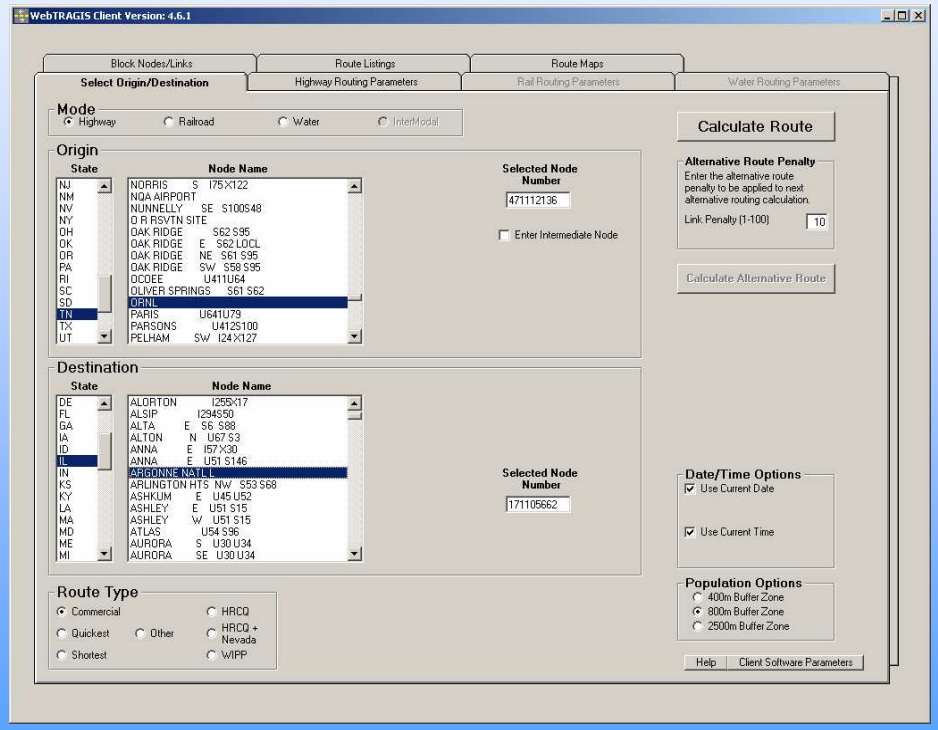
- Many commercial software packages and web applications are useful for planning trips
- Such routing tools are not suitable for planning HRCQ shipments because of the need to meet USDOT routing regulations
- Trucking firms may not select routes compliant with USDOT regulations for radioactive materials
- Model also includes HazMat restrictions

What Makes TRAGIS Unique for Truck Routes?

- TRAGIS calculates truck route to comply with USDOT HRCQ regulations (49 CFR 397.101)
- Highway network is:
  - 1:100,000-scale database
  - Frequently revised to maintain up-to-date information
  - Includes all nuclear sites (commercial reactors, research reactors, DOE sites)

TRAGIS Highway Route Types

- Standard
  - Quickest (minimize driving time)
  - Shortest (minimize driving distance)
  - Commercial (70/30 split between time/distance)
  - Other (user defined ratio)
- Special
  - HRCQ (follows USDOT regulations)
  - HRCQ with Nevada access roads (to match Yucca Mountain FEIS analysis)
  - WIPP (NM designated routes)



USDOT HRCQ Routing Requirements

- Shortest distance from origin to preferred highway entrance
- Minimize driving time on preferred network
  - Use Interstate bypasses/beltways around cities
- Shortest distance from preferred highway exit to destination
- States can designate preferred routes in addition or in lieu of Interstate highways

HRCQ Route between New York City and Los Angeles

- Estimated travel time: 49 hours, 50 minutes
- Distance: 2,953.8 miles
- Population within ½ mile either side of route: 1,496,672

Rail Routing is Different than Truck

- No single railroad provides service across the U.S. – unlike highways where many trucking companies serve the entire country
- Railroad corporations own their right-of-way – trucks operate over public highways
- Four major U.S., two Canadian, and over 600 regional and short line railroads in the country
  - In the east: CSXT & NS
  - In the west: BNSF & UP
  - In central US: CN & CP

TRAGIS Rail Routing

- TRAGIS calculates routes that reflect current rail shipping patterns
  - Based on traffic density
  - Includes consideration of interchange locations between rail companies
- Rail network is:
  - 1:100,000-scale database
  - Developed for DPO-MA at Dahlgren NSWC
  - Includes rail lines to nuclear sites with rail access
    - Rail corridors evaluated in FEIS to Yucca Mountain included
  - Frequently updated to reflect current ownership, trackage rights, and attribute information

Rail Route between New York City and Los Angeles

- Distance: 3,126.2 miles
- Estimated travel time: approximately 130 hours
- Railroads: CSX Transportation, Indiana Harbor Belt, BNSF
- Population within ½ mile either side of route: 1,710,639

TRAGIS Barge Routing

- Waterway network includes inland, coastal, and deep water channels
- Nuclear sites with possible barge facilities are included in the network
- Port facilities are in the network

Barge Route between Pittsburgh and New Orleans

- Distance: 1,761.4 miles
- Estimated travel time: approximately 15 days
- Population within ½ mile either side of route: 401,700

TRAGIS Routing Features

- Model provides ability to temporarily modify the routing network by blocking
  - Nodes
  - Links
  - States
  - Railroad companies
- This feature is useful for analysis of
  - Infrastructure damage or repair
  - Temporary traffic delays
  - User determined alternative routing

TRAGIS Route Listing Features

- Model generates a listing that provides a description of the route and summary information
- Table of tribal lands and mileage through tribal lands is provided
- Population information provided as:
  - Table of population density by state
  - Summary information for input to RADTRAN model
  - Population count for three buffer widths either side of the entire route and by state
    - 400 m
    - 800 m
    - 2500 m

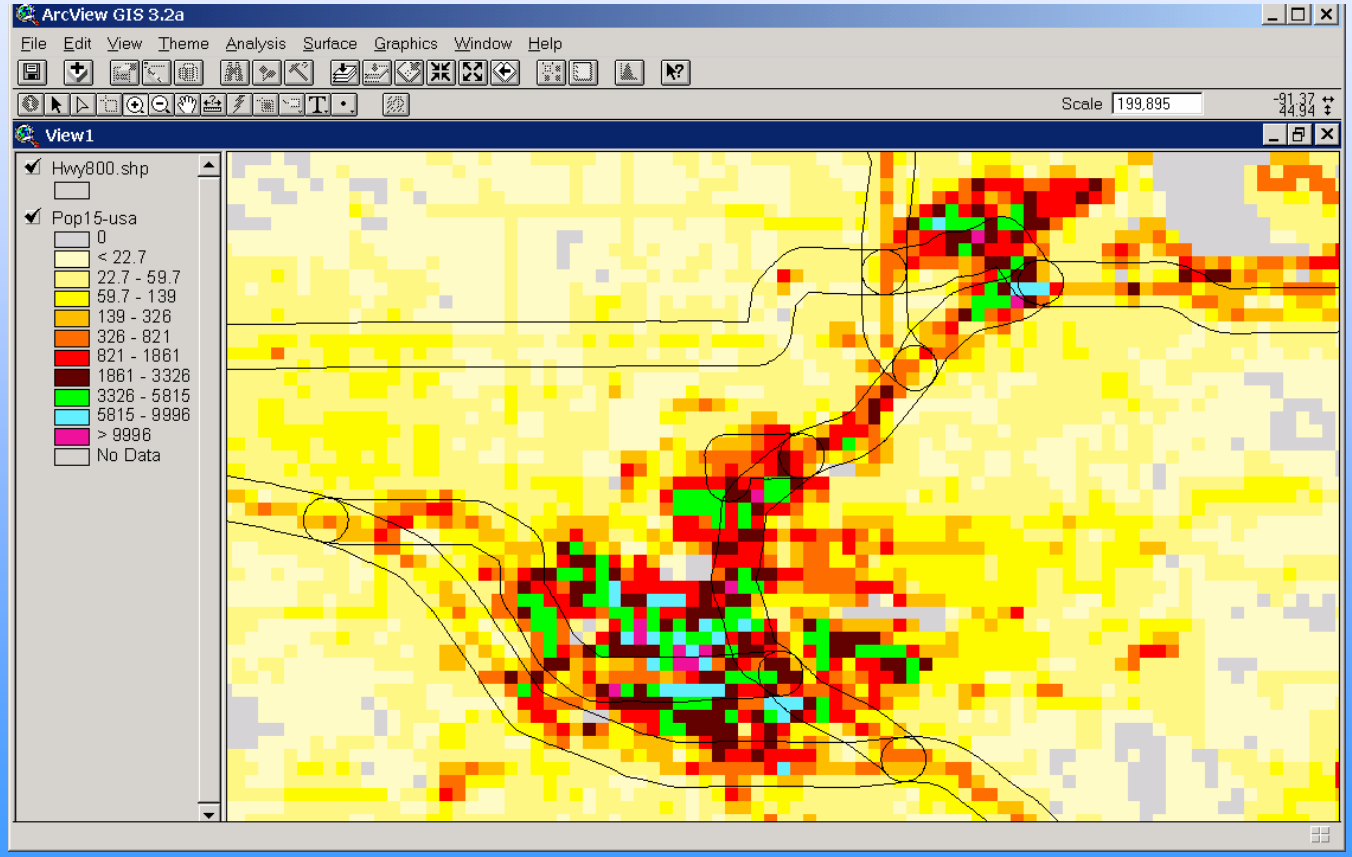
TRAGIS Mapping Features

- Map of route can be displayed by two methods
  - Quickest is straight line segments
  - Actual shape file of route takes a minute to process
- Background data provided
  - Respective transportation network
  - Census urbanized areas
  - Native American tribal lands
- User provided shape files can be added to map
- Maps can be
  - Saved as ESRI shape files or as bitmap files
  - Printed

Population Data in TRAGIS

- Based on LandScan USA Interim 15 arc-second (450 m) grid cell database
- Uses 2000 Census data
- LandScan model distributes population based on factors such as
  - Census geographic areas
  - Proximity to roads
  - Land use data
  - Slope of land surface

Example of population data and buffer



Recent Developments

- Federal Railroad Administration project to enhance TRAGIS
  - Adding a capability to intersect FRA point files to routes
    - Inspection data
    - Accident locations
    - Grade crossing locations
  - Improve GIS capabilities
    - Enhanced selection by attributes
    - Feature selection by area
    - Additional projections

Additional Enhancements Underway

- Work is underway to add intermodal capability to the model
  - Truck/Rail
  - Rail/Water
  - Truck/Water

Conclusion

- TRAGIS provides
  - Up-to-date transportation networks for routing analysis
  - Easy access via the Internet
  - Detailed population data adjacent to the transportation networks
  - Integrated visualization capabilities