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Transportation Routing Analysis Geographic Information System (TRAGIS)

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Outline of Presentation

- ④ What is TRAGIS?
- ④ Accessing TRAGIS
- ④ TRAGIS Networks
- ④ TRAGIS features
- ④ Recent developments
- ④ Future directions



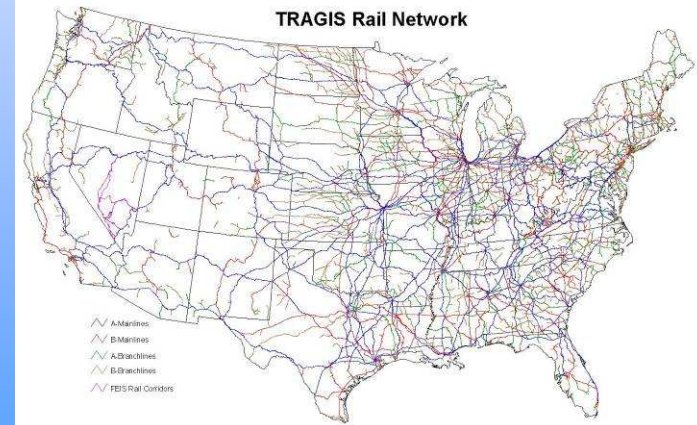
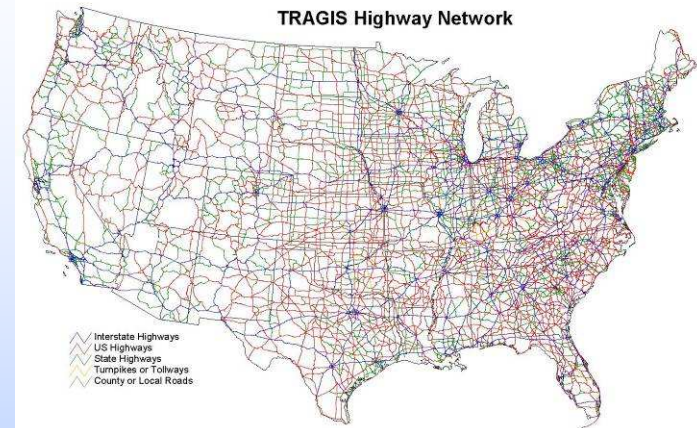
What is TRAGIS?

- ④ The Transportation Routing Analysis Geographic Information System (TRAGIS) model is a powerful routing and GIS analysis tool developed for DOE
- ④ The model has client-server architecture
 - WebTRAGIS – client software
 - TRAGIS server – web server at ORNL
- ④ 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?

- ④ WebTRAGIS software on user's PC is used to select routing parameters
- ④ Information is sent over the Internet to the TRAGIS routing engine on central server
- ④ Results are quickly returned to user's PC for display
- ④ Routing networks on central server minimizes updates and ensures that all users access the most recent database
- ④ 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

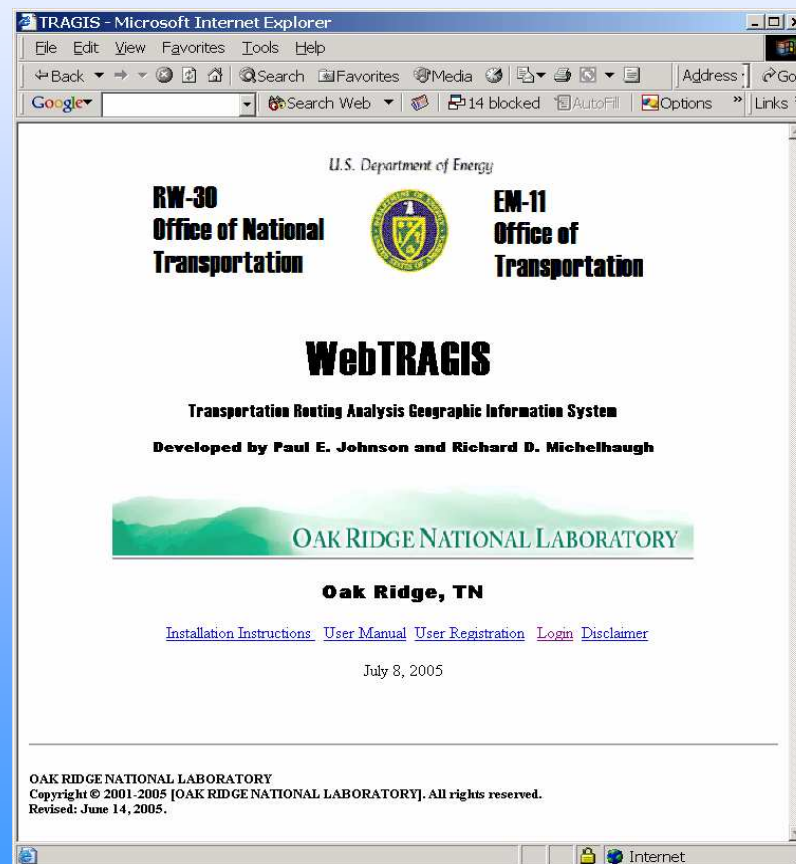
User login to download software

Installation instructions

User's manual

Home page address is:

<https://tragis.ornl.gov>





TRAGIS Access

- ④ All users need to register
- ④ Restrictions include
 - No commercial users
 - No foreign users
- ④ Access controlled through:
 - Username
 - Password
- ④ After approval, users can login to download software

WebTRAGIS Client Version: 4.6.1

U.S. Department of Energy

RW-30
Office of National
Transportation

EM-11
Office of
Transportation

Client Version: 4.6.1

Web-TRAGIS

TRANSPORTATION ROUTING ANALYSIS GEOGRAPHIC INFORMATION SYSTEM

UserName:

Password:

Start

This is a Federal computer system and is the property of the United States Government. It is for authorized use only. Users (authorized or unauthorized) have no explicit or implicit expectation of privacy. Any or all uses of this system and all files on this system may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to authorized site, Department of Energy, and law enforcement personnel, as well as authorized officials of other agencies, both domestic and foreign. By using this system, the user consents to such interception, monitoring, recording, copying, auditing, inspection, and disclosure at the discretion of authorized site or Department of Energy personnel. Unauthorized or improper use of this system may result in administrative disciplinary action and civil and criminal penalties. By continuing to use this system you indicate your awareness of and consent to these terms and conditions of use. LOG OFF IMMEDIATELY if you do not agree to the conditions stated in this warning.

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Help Client Software Parameters



TRAGIS User Base

- ④ Currently over 260 registered users
- ④ Federal Users
 - DOE
 - DOT
 - DOD
 - NRC
- ④ National Laboratories
- ④ Federal Contractors/Subcontractors
- ④ State Agencies



TRAGIS Highway Routing

- ④ Many commercial software packages and web applications are useful for planning trips
- ④ Such routing tools are not suitable for planning HRCQ shipments because of the need to meet USDOT routing regulations
- ④ Trucking firms may not select routes compliant with USDOT regulations for radioactive materials
- ④ Model also includes HazMat restrictions



What Makes TRAGIS Unique for Truck Routes?

- ④ TRAGIS calculates truck route to comply with USDOT HRCQ regulations (49 CFR 397.101)
- ④ 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)

The screenshot shows the WebTRAGIS Client interface with the following sections:

- Mode:** Radio buttons for Highway (selected), Railroad, Water, and Intermodal.
- Origin:** A table with columns for State and Node Name. The selected node is ORNL (U411064) in TN. A "Selected Node Number" field contains 471112136.
- Destination:** A table with columns for State and Node Name. The selected node is ARBONN (U411066) in IL. A "Selected Node Number" field contains 171105662.
- Route Type:** Radio buttons for Commercial, Quickest, Shortest, HRCQ, Other, Nevada, and WIPP.
- Buttons:** "Calculate Route", "Calculate Alternative Route", "Help", and "Client Software Parameters".
- Parameters:** "Alternative Route Penalty" (Link Penalty 1-100) set to 10, and "Date/Time Options" (Use Current Date and Use Current Time checked).



USDOT HRCQ Routing Requirements

- ④ Shortest distance from origin to preferred highway entrance
- ④ Minimize driving time on preferred network
 - Use Interstate bypasses/beltways around cities
- ④ Shortest distance from preferred highway exit to destination
- ④ 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

- ④ No single railroad provides service across the U.S.
– unlike highways where many trucking companies serve the entire country
- ④ Railroad corporations own their right-of-way – trucks operate over public highways
- ④ 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

- ④ TRAGIS calculates routes that reflect current rail shipping patterns
 - Based on traffic density
 - Includes consideration of interchange locations between rail companies
- ④ 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

- ④ Waterway network includes inland, coastal, and deep water channels
- ④ Nuclear sites with possible barge facilities are included in the network
- ④ Port facilities are in the network



Barge Route between Pittsburgh and New Orleans



- ④ Distance: 1,761.4 miles
- ④ Estimated travel time: approximately 15 days
- ④ Population within ½ mile either side of route: 401,700



TRAGIS Routing Features

- ④ Model provides ability to temporarily modify the routing network by blocking
 - Nodes
 - Links
 - States
 - Railroad companies
- ④ This feature is useful for analysis of
 - Infrastructure damage or repair
 - Temporary traffic delays
 - User determined alternative routing



TRAGIS Route Listing Features

- ④ Model generates a listing that provides a description of the route and summary information
- ④ Table of tribal lands and mileage through tribal lands is provided
- ④ 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

- ④ Map of route can be displayed by two methods
 - Quickest is straight line segments
 - Actual shape file of route takes a minute to process
- ④ Background data provided
 - Respective transportation network
 - Census urbanized areas
 - Native American tribal lands
- ④ User provided shape files can be added to map
- ④ Maps can be
 - Saved as ESRI shape files or as bitmap files
 - Printed

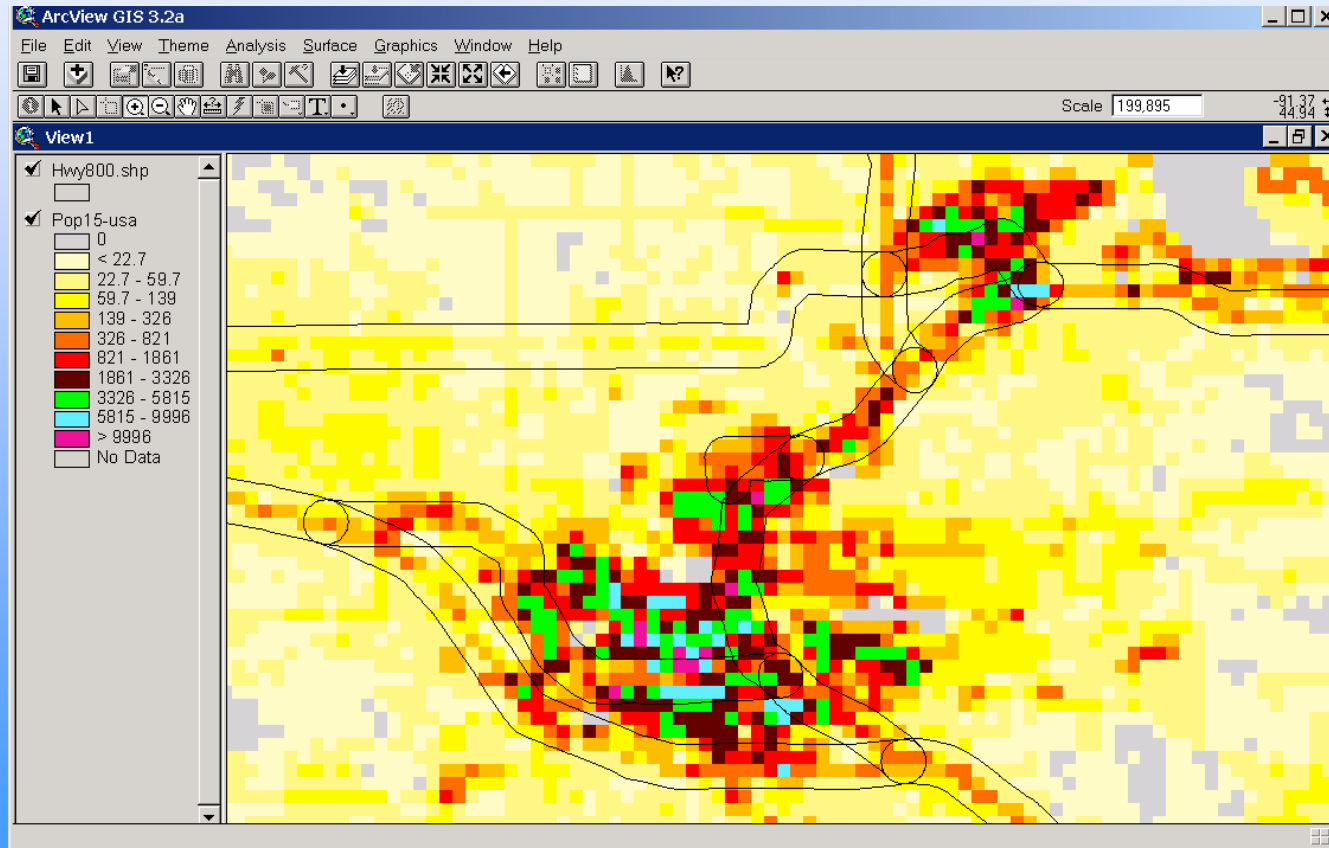


Population Data in TRAGIS

- ④ Based on LandScan USA Interim 15 arc-second (450 m) grid cell database
- ④ Uses 2000 Census data
- ④ 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

④ 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

④ 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