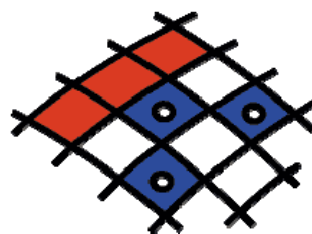
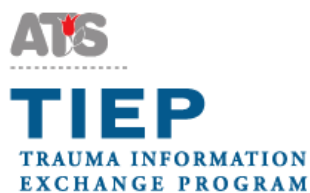


Mapping Tool to Assess Timely Access to Trauma Centers



Documentation

Introduction

The difference between life and death for severely injured people often depends on the amount of time it takes to get them to a trauma center. This website can be used as a decision-support tool for trauma systems planning and evaluation. Maps and tables of existing level I and II trauma center and ambulance coverage for the Continental United States, each of the 50 states, and the District of Columbia can be created.

What follows is an introduction to this unique mapping tool. It includes a general approach to using the tool, some technical documentation and frequently asked questions.

Getting Started (How to build a map)

In order to make the most of this tool, users should begin by determining the specific question they wish to answer. Are you interested in knowing more about the locations of trauma centers or are you interested in learning more about geographic areas that are “covered” (or “uncovered”)? Is your focus on a national, state or local level? Are you interested in one set of data points in relation to another or considered on their own? Once you are ready proceed with creating a map or access tables to answer your particular question, follow these general steps:

- Go to the level of geographic detail you need – For national maps, you may begin from the main starting page. For inquiries of state or more local level, click on the state of interest and zoom in or out as needed to display the geographic scale you want.
- Consider how the issue of trauma center access (coverage) affects what you’d like to view – If you wish to display coverage areas, choose the response time and transport method that best suits your needs.
- Consider the data layers to display on your map – the mapping tool includes several types of data that may be plotted on the display map in the form of points, lines, and areas. These data may be directly related to trauma system resources (e.g. hospitals and helipads), local infrastructure (e.g. roads) or geographic characteristics (e.g. elevation).
- Update the map – If necessary, update the map image to reflect your most recent choices of items to display.

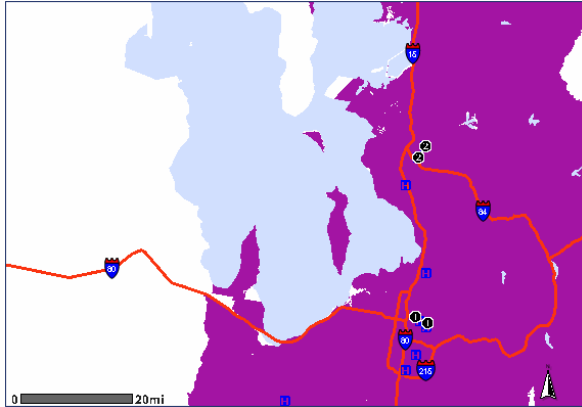
Documentation (Tool Features and Data Layers)

Provided below is a working document which provides information regarding the features and controls associated with the mapping tool as well as an explanation of the data layers available through the system. This information is organized into the following six areas of interest:

- Primary Output / Results
- National vs. State Level Analysis
- Measures of Trauma Center Access Parameters
- Displaying Point, Line and Area Features
- Map View Manipulation
- Navigation and Support

Primary Output / Results

MAP (VIEWABLE) AREA



Shown: All pages

Use: Displays the map resulting from the geographic area, trauma center access parameters, and map layers selected.

Note: A scale (in miles) and compass are provided along the bottom of the map image.

POINT FEATURE SELECTION

Location Details

Type: Trauma Center Level 1
Name: JOHNS HOPKINS HOSPITAL
City: BALTIMORE
State: MD
Beds: 844

Type: Base Helipad
Name: CA0181
City: Napa
State: CA
of Helos:

Shown: Results (pop up) pages only

Use: Displays basic characteristics of a selected trauma center, hospital, or helipad point feature.

Includes information on name, city, and state. For hospitals (and trauma centers), the trauma care level is included as is the number of beds when available. If known, helipad details also include the number of helicopters located at the base.

COVERAGE CALCULATIONS

Level I/II Trauma Center Coverage	% Popn	% Land
Existing System:	84.7%	10.2%

Shown: All pages

Use: Displays the percentage of the population that can access a level I or level II trauma center given the selected response time and transport method. Also displays the percentage of land mass where this access is possible given the selected response time and transport method.

Note: The denominator for total population or land mass used in these calculations is either for the United States as a whole (when viewing a national map) or for the state selected (when viewing any map below the national level).

National vs. State Level Analysis

STATE SELECTION FUNCTIONS

Continental US	Alaska	Hawaii
----------------	--------	--------

Shown: National view only

Use: Display a map of either the 48 contiguous states at the national level (Continental US), or Alaska/Hawaii alone.

Hint: When viewing a map of the continental US, states may also be selected by clicking on them with your mouse.

Shown: All pages

Use: Display a map of the selected state

Measures of Trauma Center Access Parameters

USE OF NEIGHBORING STATES

 Include Neighboring States

Shown: State (and finer detail) pages only

Use: Include level I/II trauma centers from neighboring states in calculating population and land area access.

Note: When this box is checked, it effectively removes state borders when evaluating trauma center access (i.e. additional population and land area may be "covered" by trauma centers or ambulances in another state). The map will refresh immediate when checking or unchecking this box.

Hint: When the "neighboring states" option is checked, both the coverage calculations and the map display are updated, but these are still presented from the perspective of the selected state (to look at coverage from a multi-state perspective, one must use the national view). Unchecking this box shades out the surrounding states to better distinguish them from the state of interest.

DATA YEAR

Select Year:

Shown: All pages

Use: Display maps using trauma center, helipad, and geographic data for the selected year [currently inactive].

Note: Currently, data can only be accessed for calendar year 2005. The system will be updated in the near future to include additional years.

RESPONSE TIME

Select Response Time:

60 Minutes

Shown: All pages

Use: Selects the time standard used to calculate population and land area access to level I/II trauma centers.

Note: Currently available choices include "45 minutes" and "60 minutes."

TRANSPORT METHOD

Select Transport Method:

Helicopter or Ambulance

Shown: All pages

Use: Selects the transportation method used to calculate population and land area access to level I/II trauma centers.

Note: Currently available choices include "Helicopter or Ambulance," "Helicopter," "Ambulance," and "None."

Hint: To create a map that does not display the trauma center access "coverage" areas, select "None" and this will turn off this feature.

Displaying Point, Line and Area Features

MAP LAYERS

Map Layers

- Major Cities
- States
- Interstates

Shown: National view only

Use: Display point and area elements on a national map by checking the box associated with a feature. Available layers include:

- Major Cities (point feature) – Major cities based on population
- States (line feature) – State borders
- Interstates (line feature) – Interstate highways

Hint: When multiple layers are selected, they are applied to the background map in the order they appear in the menu – layers at the top of the menu are overlaid on those that appear below it.

Map Layers

- Trauma Centers
- Hospitals
- Helipad
- States
- Counties
- Zip Codes
- Interstates
- Other Roads
- Cities
- Elevation
- Population Density
- Urban Areas

Shown: State (and finer detail) pages only

Use: Display point and area elements on a state or finer detail map by checking the box associated with a feature. Available layers include:

- Trauma Centers (point feature) – Level I/II/III trauma
- Hospitals (point feature) – Acute care hospitals
- Helipad (point feature) – Aeromedical depots, i.e. the on-duty resting location for medical helicopters
- States (line feature) – State borders
- Counties (line feature) – County borders
- Zip Codes (line feature) – Zip code borders
- Interstates (line feature) – Interstate highways only
- Other Roads (line feature) – Interstate highways, state highways, major roads, primary and some secondary roads
- Cities (point feature) – Various cities used to provide points of reference
- Elevation (area feature) – Texture tool to show elevation based on relative height above sea level
- Population Density (area feature) – Shading tool to highlight areas of varying population density based on number of people per square mile
- Urban Areas (area feature) – Shading tool to highlight areas of varying "urbanicity" based on census block characteristics.

Hint: When multiple layers are selected, they are applied to the background map in the order they appear in the menu – layers at the

top of the menu are overlaid on those that appear below it. When selecting a particular state, all of these features (with the exception of "Other Roads") will display for the entire viewing area of the map.

REFRESH MAP / RECALCULATE PERCENTAGES

Update Map

Shown: State (and finer detail) pages only

Use: Refresh map to now include current selection of map layers.

Tip: The current map view may be changed immediately or refreshed (without use of this button) by manipulating the following parameters:

- "Include Neighboring States"
- "Select Response Time"
- "Select Transport Method"

or using the following controls:

- "Maps Home" button
- Any state selection control
- Toolbar buttons "full extent," "zoom in," "zoom out," and "re-center"

Map View Manipulation

TOOLBAR



Shown: State (and finer detail) pages only

Use: Manipulate the overall display area of the map, select certain point features, or measure distances between points in the viewable area. Clicking a button on the toolbar highlights that button (in a darker shade of blue) and enables that function for use with your mouse. Available buttons include:

- Full extent – Immediately returns map to the original view associated with the selected state.
- Zoom in – When enabled, clicking any point in the viewable area zooms in on and re-centers the map around the point chosen. Alternatively, one can accomplish the same result by clicking in the viewing area and dragging a box (hold mouse button until box is drawn to desired size, then release) on the area to be zoomed in on and re-centered around.
- Zoom out – Functions in the same manner as the zoom in button, but zooms the image out.
- Re-center – When enabled, clicking a single point in the viewing area will re-center the image around the point chosen while maintaining the current zoom level. Alternatively, the image can be dragged within the viewing area while holding down the mouse button to accomplish the same

task.

- Select – When enabled, this button will provide details of trauma center, hospital, and helipad point features in a pop up window.
- Measure – When enabled, the distance (“as the crow flies,” in miles) can be calculated between two points in the viewable map area by clicking on the initial point and dragging a line to the second point of interest.

Note: Using the toolbar buttons, in and of themselves, will affect neither the access parameters chosen nor the selected map layers. The features displayed will remain the same unless they are specifically changed through other means.

Hint: Even if the “Trauma Center” layer is not on, selecting a hospital (from the “Hospital” layer) that is a trauma center will still be noted in the resulting pop up window. Although there is little to look at in such fine detail given the current available layers, the viewing area can show detail as fine as approximately 0.01 mi (H) by 0.015 mi (W) when using the zoom function.

Navigation and Support

OVERALL NAVIGATION



Shown: All pages

Use: Return to the ATS home page (www.amtrauma.org)



Shown: All pages

Use: Return to the start page (national view)



Shown: Results (pop up) pages only

Use: Close the current pop up (results) window.

LEGEND



Shown: All pages

Use: Denotes geographic areas where access to a level I/II trauma center is possible given the selected response time and transport method.

SUPPORT FUNCTIONS

Print Map
Support

Shown: All pages

Use: “Print Map” creates a printer-friendly version of the map displayed and includes a key indicating your selected parameters and layers. This printer-friendly map is created in a pop up window. “Support” contains this support document.

Frequently Asked Questions:

1. Why isn't my level I/II/III trauma center shown here?

The National Inventory of Trauma Centers was formed in 2002 and has been updated quarterly since October 2003 by the American Trauma Society's Trauma Information Exchange Program (TIEP). Trauma centers included in our database have always included those hospitals designated by a state or regional authority or verified by the American College of Surgeons (ACS). It is important to recognize that the mapping application displays data as a snapshot in time. As part of our initial release of this tool, we are using data from 2005 and there are bound to be newer trauma centers (using the definition above) that were not included in the data set used here. This is likely to be the case for centers located in the several states that recently began to designate trauma centers or those centers with new or recently upgraded (e.g. from level 3 to level 2) programs.

2. Where are the level IV/V trauma centers?

To be certain, TIEP recognizes the importance of the numerous centers designated or verified at levels 4 through 5 as part of the larger system of care in many areas of the country. The reason for not currently displaying these centers in the initial release of this mapping tool is based on an appreciation that the resources, personnel, and processes (e.g. higher transfer rates of patients to level I/II centers) are distinct and often quite different from many level I/II/III trauma centers.

3. I'm noticing a gap in "coverage" around a level III trauma center.

The preliminary analyses performed in the development of this tool which indicated that access to trauma centers did not significantly increase in most areas when including level III centers. Further, these hospitals often have different characteristics in terms of resources and personnel from their level I/II counterparts. Given these reasons, the focus on access to trauma care has been limited to level I/II centers for the initial release of this tool. It should be noted that measures of access to level III centers will be added to future versions of the application.

4. How do I save a copy of the map I just created?

Since it is dynamically generated, the image you see does not exist in a format suitable for saving. Click "Print map." This creates a static image which you can now right click and save. Options for file format include PNG and BMP for most browsers.

5. I'm having trouble distinguishing between various features or colors on my map.

It is always a challenge to incorporate many features on a map. In fact, too many features often take away from the overall clarity and intended message of a map. The color palette here was selected by professional cartographers because it tested best for its overall ability to work well with the many point and area features, fonts, symbols, and design scheme chosen. While the tool is able to present a good quality map in most circumstances, there will be limited instances where clarity is sacrificed, potentially based on the layers you've chosen to display. The best course of action here may be to revisit the original focus of the map you wish to create and choose only the most important (fewer) layers to display accordingly. Unfortunately, the only way for the end user to manipulate color palettes is to use image editing software to modify a saved map image.

6. I'm looking at a national map with the "Major Cities" layer turned on but I'm not seeing some of the country's biggest cities.

Major cities are defined by the software used to build the mapping application as those of a certain size based on population and the cities displayed here have met this criterion. The problem here is one how to display so many labels for these cities, particularly in the densest areas of the country where very populous cities may be quite close to each other. The mapping tool, understanding it would be impossible to display every point in this layer, adjusts and picks which to display based on how many it can reasonably display in the map area. This logic also applies to cities at a state or finer detail level.

References upon which this website is based

Carr BG, Caplan JM, Pryor JP, Branas CC. A meta-analysis of prehospital care times for trauma. *Prehospital Emergency Care*. 2006;10(2):198-206.

Branas CC, MacKenzie EJ, Williams JC, Schwab CW, Teter HM, Flanigan MC, Blatt AJ, ReVelle CS. Access to trauma centers in the United States. *Journal of the American Medical Association* 2005;293(21):2626-2633.

Flanigan M, Blatt A, Lombardo L, Mancuso D, Miller M, Wiles D, Pirson H, Hwang J, Thill JC, Majka K. Assessment of air medical coverage using the Atlas and Database of Air Medical Services and correlations with reduced highway fatality rates. *Air Medical Journal* 2005;24(4):151-63.

Branas CC. No time to spare: improving access to trauma care. *Leonard Davis Institute of Health Economics Issue Brief*. 2005 Sep;11(1):1-4.

Branas CC, MacKenzie EJ, Williams JC, Schwab CW. Access to trauma centers -- reply. *Journal of the American Medical Association* 2005; 294(14): 1759-1760.

MacKenzie EJ, Hoyt DB, Sacra JC, Jurkovich GJ, Carlini AR, Teitelbaum SD, Teter H Jr. National inventory of hospital trauma centers. *Journal of the American Medical Association* 2003; 289(12):1515-22.

Branas CC, ReVelle CS. An iterative switching heuristic to locate hospitals and helicopters. *Socio-Economic Planning Sciences* 2001; 35(1): 11-30.

Branas CC, ReVelle CS, Mackenzie EJ. To the rescue: optimally locating trauma hospitals and helicopters. *Leonard Davis Institute of Health Economics Issue Brief* 2000;6(1):1-4.

Branas CC, MacKenzie EJ, ReVelle CS. A trauma resource allocation model for ambulances and hospitals. *Health Services Research* 2000; 35(3):489-507.

Branas CC, ReVelle C. TRAMAH to the Rescue. *Operations Research/Management Science Today* 1999; 26(3):38-40. (<http://www.lionhrtpub.com/orms/orms-6-99/tramah.html>)