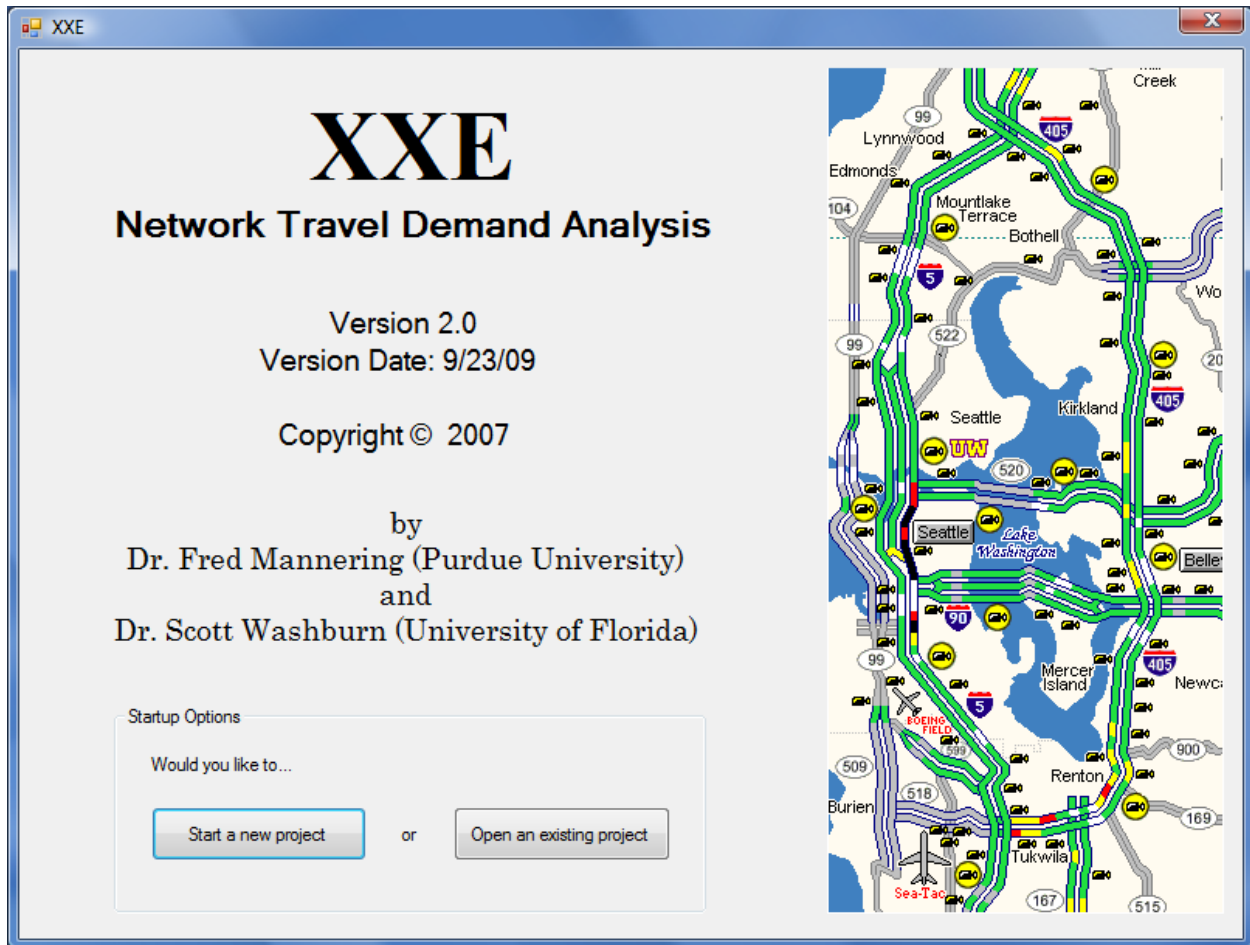# XXE

Version 2.0

Users Guide

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by

Fred L. Mannering

(Purdue University)

and

Scott S. Washburn

(University of Florida)

After starting the program, you will be presented with the 'splash' screen, as shown in Figure 1.

Figure 1. Splash screen

From this screen, you can select to start a new project or open an existing project. Once you start a new project or open an existing one, you will be presented with the 'project properties' screen, as shown in Figure 2.
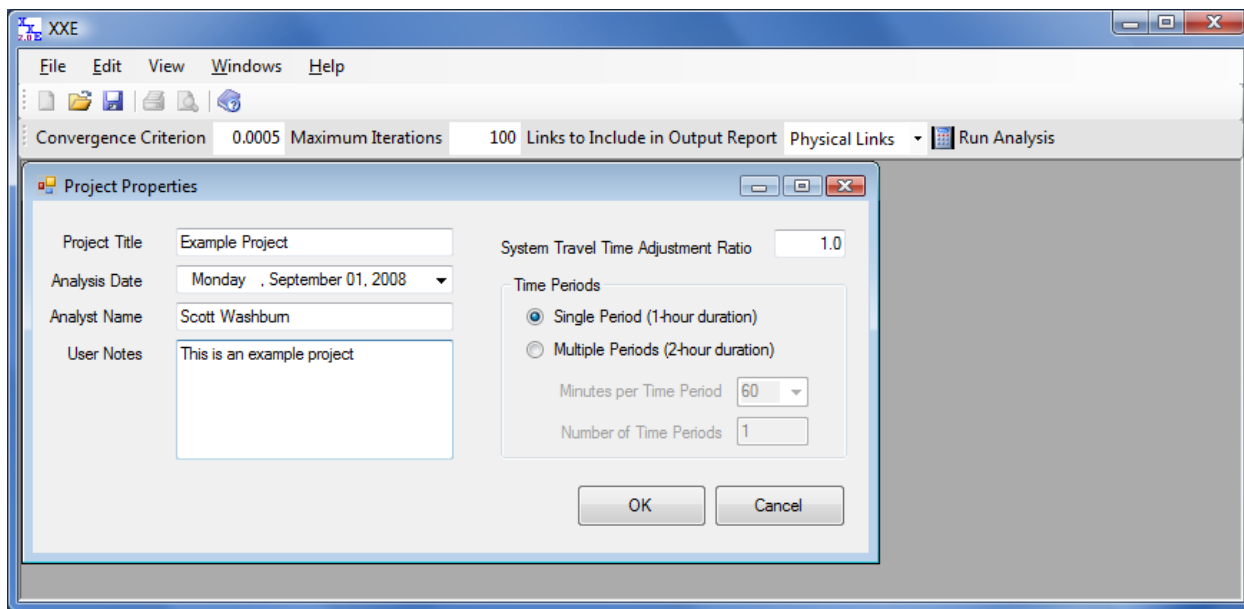
Figure 2. Project properties screen

On this screen, you specify basic project information, as well as specify a single-period or multiple-period analysis (the multiple-period feature is currently under development and further information on this option will be provided in a future program update).

To be able to perform a network analysis, two main sets of input data are necessary: node-link data and origin-destination data. The information needed for these data is described below.

Node-Link Data

The node-link data consists of origin nodes, destination nodes, the length (in miles) of the highway link connecting each origin and destination node, the capacity (in vehicles per hour) of each highway link, and the free-flow speed (in miles per hour) of each highway link. When entering the network information, it is essential that the nodes be numbered sequentially in the following order:

1. Origin nodes
2. Destination nodes
3. Network nodes

Consider the simple "horseshoe" network shown in Figure 3. This network consists of 3 traffic analysis zones (TAZs) and 6 physical links. For XXE to run a user equilibrium assignment on this network, the network must be coded as shown in Figure 4. Note that each TAZ has both an origin and destination node (as opposed to a single node). This numbering convention is needed for XXE. Thus, the number of the first network node will always be two times the number of TAZs plus 1. For the horseshoe network, this is 7 ($2 \times 3 + 1$). Also, an additional link is added from the destination node back to the physical network. A very low capacity is given to these additional links (such as 1 veh/h) and thus these links should have zero flow but they are needed for the optimization process in XXE to work.
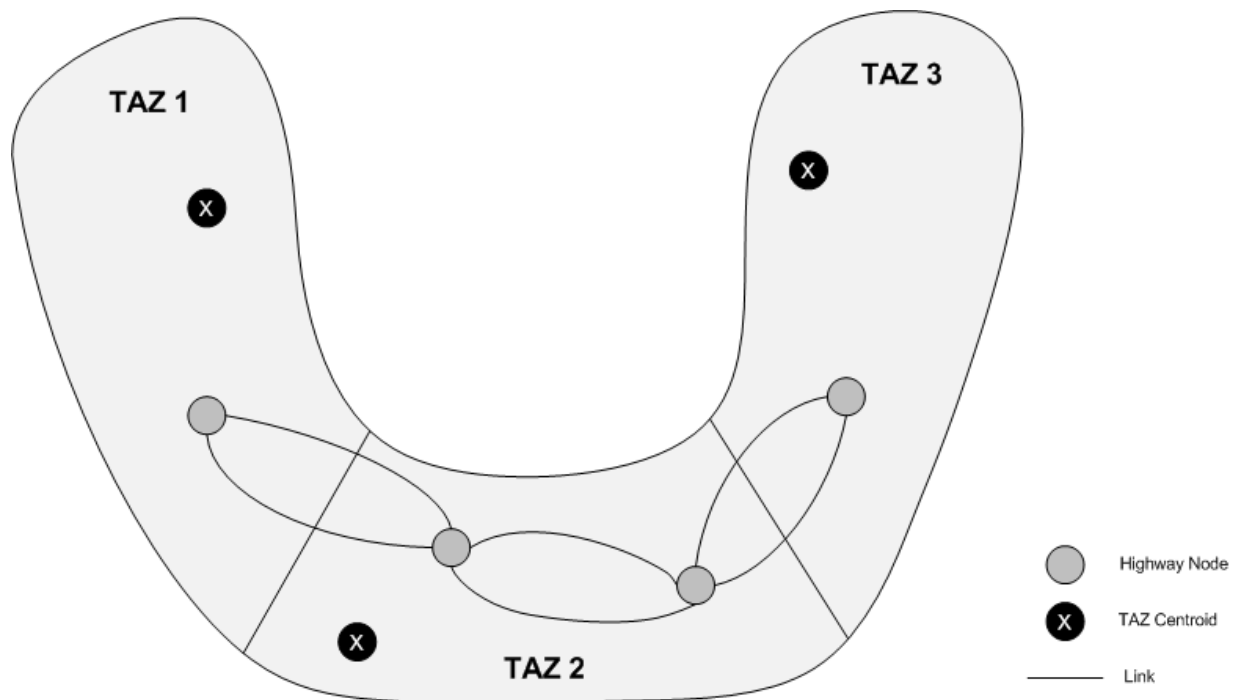
Figure 3. Example horseshoe network
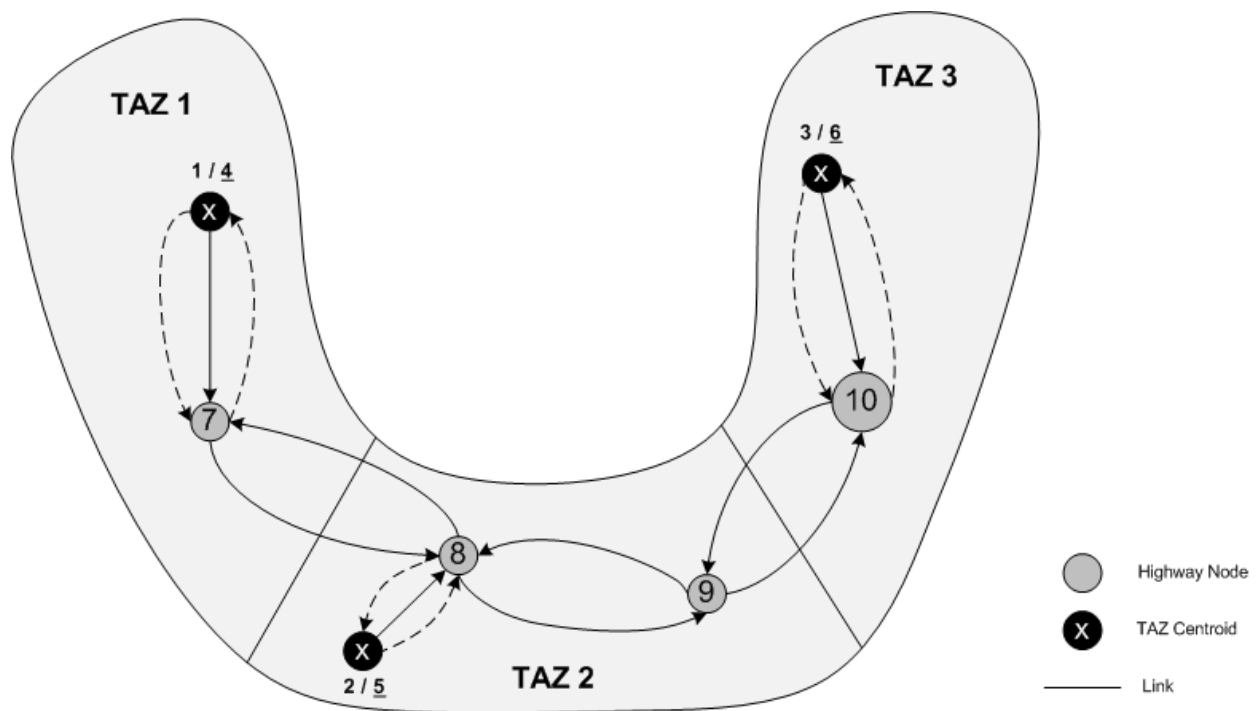
Figure 4. Node numbering for the horseshoe network, with nodes 1 to 3 being origin nodes, nodes 4 to 6 being destination nodes, and nodes 7 to 10 being network nodes.

While the length and capacity of the physical highway links can be determined by observation, the length and capacity of the links used to get travelers from the physical network to and from

the TAZs are a judgment call since these are intended to represent local street networks (also, note that TAZs may access the network at more than one network node, although this is not the case in the horseshoe network).

The node-link data are entered on the 'Node-Link' screen, which can be accessed from the 'View' menu. With the "from" node, the "to" node, the length of the highway link, the capacity of the highway link, and the free-flow speed, the link-node network description will look as shown in Figure 5 (note ordering of data).

Figure 5. Link-node network description for "horseshoe" network

As can be seen in Figure 5, data is entered into a grid, where each row represents a unique link, and each column represents one of the previously described data items for each link, except for the 'Description' column. This entry is not necessary to perform an analysis, but will assist you in reading and interpreting the results output.
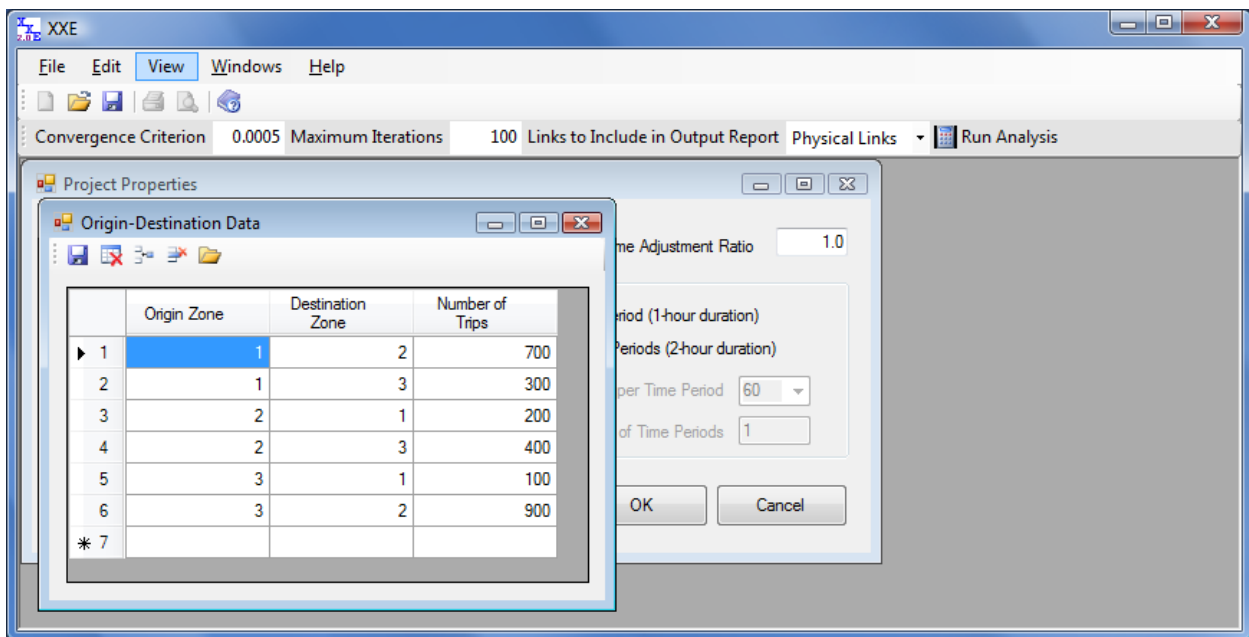
In the toolbar above the grid are icons that represent, in order, the following functions:

- Save the link data and close the form
- Discard link data changes and close the form
- Insert a row above the selected row
- Delete the selected row
- Load a 'NW.dat' file (an XXE Ver. 1.0 file)

Two other data items must be specified to complete the network node-link description. One item is the number of the first physical node. As previously mentioned, this will be two times the number of TAZs plus 1. For the horseshoe network, this is 7 ($2 \times 3 + 1$). The second item is the total number of nodes, including the origin and destination nodes. For the horseshoe network, this is 10. Note these data items are entered in the toolbar just above the node-link data grid.

Origin-Destination Data

The origin-destination data simply contain the number of vehicle trips during the hour being analyzed that travel to and from the various TAZs. For these data, only the TAZ numbers are used; thus, the node numbers used in the network data that included an origin and destination node for each TAZ are not used. For the horseshoe network shown in Figure 4, the origin-destination data will look as shown in Figure 6 (note ordering of data).

Figure 6. Origin-destination data for "horseshoe" network

As for the node-link data, the origin-destination data are entered into a grid, and in the toolbar above the grid are icons that represent, in order, the following functions:

- Save the OD data and close the form
- Discard OD data changes and close the form
- Insert a row above the selected row
- Delete the selected row
- Load a 'OD.dat' file (an XXE Ver. 1.0 file)

Once the link-node data and origin-destination data have been entered and saved, a user-equilibrium network traffic assignment can be run. This is accomplished through the use of the 'Analysis Toolbar', as described in the following section.

Analysis Toolbar

Once you are ready to make an analysis run, you need to specify values for the following three parameters:

1. Convergence criterion: this value is used as a stopping criterion for the user-equilibrium math program (default value is 0.0005)
2. Maximum number of iterations: this value is used to stop the program in case convergence is not reached (default value is 100)
3. Output report display option: Either the results for all links, or only the results for the physical links (default value), can be displayed in the analysis results report.

These values are entered into the analysis toolbar, as shown in Figure 7.
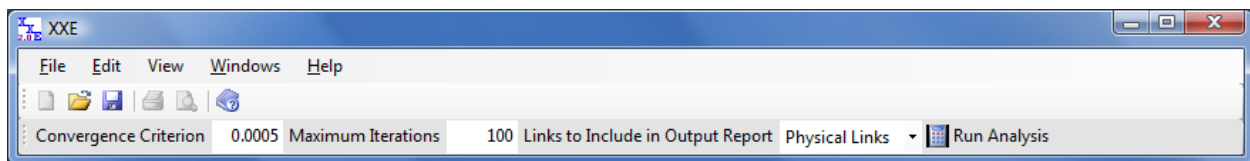

Figure 7. Analysis toolbar

Once these values have been set accordingly, press the 'Run Analysis' button (with the calculator icon) to start the analysis. Once done, "Analysis Complete" will be displayed next to the 'Run Analysis' button, and the results file will be automatically displayed (and it can also be accessed from the 'View' menu). The contents of this output file are described in the next section.

XXE Model Output

For the links that were chosen for display (either all, or physical only), the results output provides the traffic flow (veh/h), capacity (veh/h), volume/capacity ratio, and link identifiers (origin-destination nodes and description if included). In addition, the following overall network information is provided:

1. Number of iterations
2. Actual model convergence measure
3. Total travel time (summation across all physical links of link travel time $\times$ link flow)
4. Total VMT (summation across all physical links of link length $\times$ link flow)
5. Average congestion (the arithmetic average of all physical links' volume/capacity ratio)

The results output for the "horseshoe" network is shown in Figure 8.
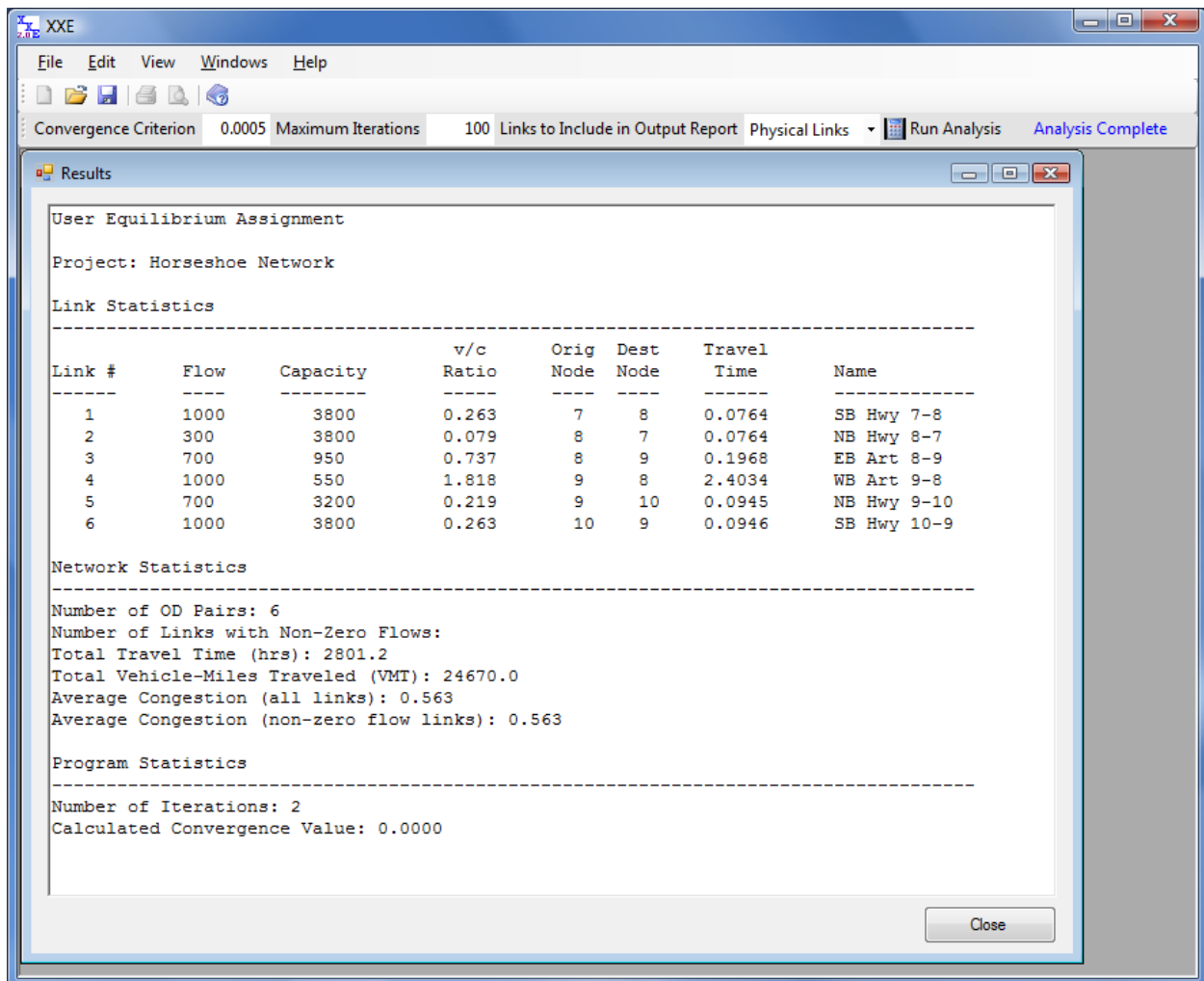
Figure 8. Analysis results for "horseshoe" network

Note that the output file is a simple text file, and is stored in the program installation folder. It can be loaded directly from that location into a text editor program (e.g., Notepad) and printed from that location, among other things.