HEAVY LOAD VEHICLE ROUTING USING HIGHWAY NETWORK MODELS AND BRIDGE LOAD FORMULA

An interim report on

Study No. 2/10/5-91-1266

OVERWEIGHT PERMIT RULES BASED ON BRIDGE STRESSES

by

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July, 1993
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A demonstration software for the routing of vehicles and for the retrieval of BRINSAP information of bridges along a route is presented. The software is demonstrated for its potential application in evaluating a proposed Bridge Load Formula. The software is implemented using a network model of the On-system roads of TxDot's District 12. The model was created from digitized maps and by defining node and link attributes. The definition of the bridges on the links and the nodes was accomplished by a mapping procedure and was verified using TxDot's Road Inventory sheets. Due to insufficient span length information in BRINSAP, implementation of the Bridge Load Formula requires determination of individual span lengths of all bridges.

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**NOTE:** Volumes greater than 1000 L shall be shown in m³.

**NOTE:** Temperatures above 100°C shall be shown in °C.

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* Si is the symbol for the International System of Measurements
ABSTRACT

A demonstration software for the routing of vehicles and for the retrieval of BRINSAP information of bridges along a route is presented. The software is demonstrated for its potential application in evaluating a proposed Bridge Load Formula. The software is implemented using a network model of the On-system roads of Tx Dot’s District 12. The model was created from digitized maps and by defining node and link attributes. The definition of the bridges on the links and the nodes was accomplished by a mapping procedure and was verified using Tx Dot’s Road Inventory sheets. Due to insufficient span length information in BRINSAP, implementation of the Bridge Load Formula requires determination of individual span lengths of all bridges.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>INTRODUCTION, BACKGROUND AND OBJECTIVES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Background of Tx DOT Permitting Process</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Background of Bridge Formula</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Objectives</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Scope of the Research</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>ROUTING SOLUTION USING NETWORK MODELS AND BRINSAP</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Summary of Network Models</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Information Available to Create Network Models</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>2.2.1 BRINSAP</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>2.2.2 Digitized Maps</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2.2.3 Road Inventory Sheets</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2.2.4 Printed Maps of District 12</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Tasks Faced</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>DEVELOPMENT OF NETWORK MODEL</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Summary of Procedure</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Generation of Nodes and Node Attributes</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Generation of Link Attributes</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Bridges on Links and Nodes</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Divided Highways</td>
<td>15</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DESCRIPTION OF ROUTING SOFTWARE</td>
<td>17</td>
</tr>
<tr>
<td>4.0</td>
<td>Introduction</td>
<td>17</td>
</tr>
<tr>
<td>4.1</td>
<td>Use of BRG Program</td>
<td>17</td>
</tr>
<tr>
<td>4.2</td>
<td>Sample Route</td>
<td>19</td>
</tr>
<tr>
<td>4.3</td>
<td>Software Disclaimer</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>SUMMARY CONCLUSIONS AND RECOMMENDATIONS</td>
<td>21</td>
</tr>
<tr>
<td>5.0</td>
<td>Summary</td>
<td>21</td>
</tr>
<tr>
<td>5.1</td>
<td>Conclusions</td>
<td>22</td>
</tr>
<tr>
<td>5.2</td>
<td>Recommendations</td>
<td>22</td>
</tr>
</tbody>
</table>

REFERENCES | 23
APPENDIX -- LISTING OF BRG PROGRAM | 24
CHAPTER 1

INTRODUCTION, BACKGROUND AND OBJECTIVES

1.0 Introduction

A problem faced in U.S. highways is the constraint imposed on the transportation industry due to limitations of pavements, bridges and obstacles on the roads. These limitations typically constrain vehicles to minimum heights and widths, to minimum and maximum lengths (depending on the number of axles) and to a maximum allowable weight. On Texas roads, the maximum allowable weight, without a permit, is 80,000 lb. However, given current demands of industry, there are times when a truck must carry a load that exceeds the allowable. In this case, the individual responsible for the transport requests an overload permit.

1.1 Background of Tx DOT Permitting Process

The Central Permit Office (CPO) of the Tx Dot handles overload permit requests. Usually, if the load is slightly over the allowable, then the CPO grants the permit relatively fast. However, the CPO may dictate the route to follow. For unusually heavy vehicles, however, the trucker, when requesting a permit, must provide details of the equipment to be transported, the trailer to be used (number of axles, axle spacing, wheelbase, wheel gage, etc.), the origin and destiny, and the tentative route. The CPO then determines if the numbers of axles and tires are sufficient for not damaging the pavement. The information is then passed to the Division of Bridges and Structures for engineering evaluations of the bridges along the route. The bridge engineers evaluate each bridge on the proposed route and determine if it has sufficient strength to sustain the vehicle and its load. During the process, they identify all bridges to be crossed, retrieve the structural plans pertaining to critical bridges, and analyze them. The CPO will then approve or deny the permit.
requests based upon the capacity analyses performed. Furthermore, the CPO may require an alternate route, a maximum speed limit and/or a police escort.

The problems associated with the process of issuing overload permits for unusually heavy vehicles are as follows. First, the time it takes to process the permit requests is usually long. Second, the process requires a tremendous amount of engineering efforts. And third, permit fees are low when compared to the cost of issuing the permits.

1.2 Background of Bridge Formula

In an effort to ease the process of issuing overload permits, this project, conducted by the Texas Transportation Institute (TTI) and the University of Texas at El Paso (UTEP), was conducted. The overall objective was the development of a Bridge Load Formula and to demonstrate its application in the routing process of overload vehicles.

The formula was developed by the Texas Transportation Institute and its development is reported in Reference [1]. The proposed Bridge Load Formula is given by:

\[
G_W = \frac{1}{A + B*WB}
\]

where,

\[
A = 0.01884 \, e^{(-0.009715 \, L)}
\]

\[
B = 4.663 \times 10^{-5} - \frac{0.00832}{L} - \frac{0.004034}{L^2}
\]

L is the bridge span length in feet, WB is the wheelbase in feet if (WB < L), or WB
is the bridge span length in feet if \((WB > L)\), and \(GW\) is the group weight in kips. The group weight \(GW\) is the maximum allowable load of a group of axles. Since the proposed formula is a function of the span length(s) of the bridge and of the wheelbase of the vehicle, a route evaluation process would consist of identifying all bridges along a route, retrieving all span lengths and evaluating the formula for each span of each bridge. This would determine the allowable group weight corresponding to each bridge span. If the allowable group weight of a bridge is less than that of the actual vehicle, then an alternate route shall be considered bypassing the critical bridge or bridges. The work at U.T. El Paso consisted of investigating the implementation of such a formula by automating the identification of bridges along a given route, and the retrieval of bridge information from the Bridge Inventory, Inspection and Appraisal Program (BRINSAP) [2].

1.3 Objectives

The objective of this document is to report on the work accomplished at U.T. El Paso as part of this project. The work centered in the development of a demonstration software to evaluate the bridges along routes for the incoming overload vehicles. The software is based on highway network models to simulate paths of travel and on the BRINSAP data base. The network models were created using digitized maps obtained from the Division of Transportation Planning. These drawings do not have all the identifications and the locations of the bridges. These were made part of the network model by mapping the geographic bridge coordinates stored in BRINSAP onto the digitized map. Then, the bridge identifications were attributed to the links of the network model. Thus, once identifying all segments of roads along a route, the bridges are identified and the corresponding BRINSAP records accessed. However, there is no room for leaving bridges out of the network model. For this reasons, the bridge locations within the network model were verified manually using maps made available by District 12 and using Tx Dot Road Inventory sheets.
1.4 Scope of the Research

The network models developed in this project correspond to the On-system highways of District 12 of the Texas highway system. No street, city or county roads were incorporated in the network model.
CHAPTER 2

ROUTING SOLUTION USING
NETWORK MODELS AND BRINSAP

2.0 Introduction

Paths of travel are always determined using highway maps. If these maps had the exact location and identification labels of all bridges, then by a simple inspection, an individual can collect the identifications of all bridges to be crossed over. Then, each bridge file can be pulled out and the bridge information retrieved for evaluating and analyzing the bridge. A network model of the highway system and a data base file of updated bridge information can be used. First, a network model of a highway map can be created. This model may consist of nodes (simulating road intersections and/or interchanges) and links (simulating road segments between two intersections). Each node can have attributes such as the coordinates, the system and number of the highways being intersected, and others. Each link or road segment can have several attributes. These may include: route system, route highway number, length, control section numbers, number of bridges within the link, bridge identifications, bridge location, etc. Using a network model, all road segments (links) on a path of travel can be identified. Thus, if the bridge identifications are attributes of the road segments, then these are identified and the bridge characteristics can be extracted from the bridge data base. The Bridge Load Formula can then be evaluated to determine the adequacy of the bridge with respect to the overload.

2.1 Summary of Network Models

Network models are widely used for studying flow problems. They are used in areas such as electrical circuits, transportation, manufacturing processes, construction management, etc.. In this project, we were not interested in minimizing the path
length between two points but to use the models for bridge identification and information retrieval purposes.

Any highway map can be modeled as a network. This has at least a set of nodes, representing highway intersections or interchanges, and a set of links, representing road segments. Figure 1 depicts an schematic of a network model. We see that there are many paths of travel between any two points.

Attributes that can be assigned to nodes and links are many. The selection of the attributes is determined by the information available. Attributes such as planar or geographic coordinates, identifications of links connecting to nodes, bridges on the nodes and others can be assigned to the nodes. Likewise, attributes that can be assigned to the links, besides connection points, are system type (Interstate, US, State Highway, Farm Market Roads, etc.), highway number, length of road segment, identification numbers of bridges on the link, direction of travel, etc.

![Figure 1 Schematic of a Network](image-url)
The definition of the attributes also defines the scheme to follow for the route selection and for the bridge information retrieval. For route selection, intersection coordinates, information of the links connecting into the intersection, and the system type and highway number of the links, all can be used for selecting a route given a general path of travel. The general path of travel may consist of the principal routes and directions to be followed without specifying the individual road segments or links that are travelled. For example, a general path can be stipulated as: start at the intersection of IH-45 and FM 2553, go north on IH-45; take IH-10 west; take loop IH-610 north; and exit at the intersection of IH-610 and US-290. In this route, many intersections and road segments (links) are crossed. The identification of the segments can be accomplished by moving from node to node. At each node, the highways’ numbers of the links intersecting it can be used to decide which link to continue on. Using this process, a complete list of links and nodes to be travelled can be compiled. Then, the bridge identification attributes of the links and nodes in this list, thus identify the bridges to be crossed. Then the process of retrieving the bridge information from BRINSAP is almost automatic. This approach requires that bridge attributes be assigned.

2.2 Information Available to Create Network Models

The information available to the authors to create a Network model for bridge information retrieval was the following: 1) BRINSAP files, 2) digitized maps of District 12, 3) Road Inventory Sheets of District 12, and 4) printed maps of District 12 with the bridge labels on.

2.2.1 BRINSAP

BRINSAP is the Tx Dot’s program to implement the National Bridge Inspection Standards issued by the Federal Highway Administration [2]. BRINSAP is intended as a management tool rather than a data base of bridge details. It contains records of
each bridge up to 179 fields. The following BRINSAP records were found useful in this research for locating bridges and to evaluate the bridge formula: control road ID and section number, structure number, route system, features crossed, facilities carried over, location, latitude and longitude coordinates, design load, safe load capacity, structure length, loading type, span type, number of spans and maximum span length. The fields such as control section number, location, features crossed, and latitude and longitude coordinates are helpful to locate a bridge and to assign the bridge identification attributes to the links of network models.

It should be noted, however, that BRINSAP fails to provide the lengths of the individual spans of a bridge. Since the Bridge Load Formula requires the span length, BRINSAP can only be used to retrieve the span length of simple-span and two-span bridges.

2.2.2 Digitized Maps

Tx DOT has implemented the use of Intergraph software for all drawings and maps they publish. Digitized geographic maps of the Texas highways currently exist and are available through the Division of Transportation Planning. The electronic maps are available as quad sheets; each quad sheet covers 7.5 degrees in latitude by 7.5 degrees by longitude. These maps use Lambert planar projection coordinates. To cover the entire District 12 more that 70 quad sheets were required. These maps have excellent accuracy but may fail to completely provide all details of road names, highways numbers, bridge locations, etc. The maps include drawings elements indicating bridge locations, but we found that some bridges were not indicated.

2.2.3 Road Inventory Sheets

The Road Inventory Sheets (RI sheets) are Tx Dot’s way to maintain an official inventory of the Texas highways. These consist of straight line diagrams of control
sections showing bridge locations, roadway width, pavement type, etc. Initially, RI sheets were created by draftpersons and were continuously updated as changes occurred on the roads. However, the process of updating information and maintaining an accurate inventory was cumbersome and time consuming. The Division of Transportation Planning is now adopting digitized road inventory sheets. In any event, the use of RI sheets is a way to ensure that all bridges be included in a network model.

2.2.4 Printed Maps of District 12

The District 12 offices has in its possession printed maps which include the bridge locations and labels. This information had been compiled as a means of managing their own bridges. In particular, these maps were very helpful to verify the locations of bridges in the network. Most importantly, however, was a sorting of identifications of the bridges on all complicated elevated interchanges. It should be remembered that interchanges are considered as a single node. Thus, a node may have more than one bridge on it but not all the bridges will be crossed. The identifications of bridges on interchanges will be explained in a later section.

2.3 Tasks Faced

The challenges of this study primarily consisted in the manipulation of all the information required for the routing of vehicles and the retrieval of bridge identifications. Some of the tasks included: a) the creation of the network model by defining nodes and links and their corresponding attributes, b) the incorporation and accounting of all on-system bridges of District 12 into the network, c) modeling of interchanges and intersections, and d) the modeling of divided highways.

The creation of the network models was carried out semi-automatically using a CAD software and the geographic maps of the highways. First, all streets and city
and county roads were deleted from the maps, leaving only the on-system roads. For each intersection or interchange (or node) of the highway map a unique identification number was assigned. The same was also done for the links or segments of the roads between two nodes. The geographical attributes that were considered critical to assign, were the node coordinates and the segment length. The node coordinates were determined using a macro program within the CAD software. This program asked the user to click on an intersection. Upon this action, the planar coordinates of the point were retrieved, and the node was assigned a unique number. This information was then permanently stored in a file. The length of the segments was similarly obtained using a macro program in the CAD software. The rest of the attributes were later assigned manually.

The incorporation of Bridges on Network Model was also a challenging task because it required that all bridges be accounted for. First, the BRINSAP coordinates were used to map the location of the bridges on the digitized maps. However, the BRINSAP coordinates are listed using latitudes and longitudes (spherical). The coordinate system of the digitized maps was a planar projection system (rectangular). Thus a transformation from latitude-longitude coordinates to rectangular coordinates was conducted. The procedure was reported in reference [3]. When the rectangular coordinates of the bridge location were available, a macro was program written within the CAD software to plot a drawing element at the bridge location and to label the corresponding bridge. About 95% of the bridges were mapped on the correct locations. For the other 5% of bridges, BRINSAP contains incorrect geographic coordinates or no coordinates at all. It was very clear however that most of the errors were made in keying the BRINSAP coordinates. The descriptions of the bridge locations were used to correctly position the bridges. All on-system bridges included in the BRINSAP file of District 12 that was available to U.T. El Paso were located on the digitized map.
The modeling of interchanges and intersections was done using a mini data base for each intersection. This data base included all possible paths of travel through an interchange or intersection. Each path contained a list the bridges to cross. Thus, if a node is found to be crossed, the path of travel is examined more carefully. For example, if the path of travel if from north bound lane of IH-45 to the west bound lane of IH-610, a different bridge will be crossed as if the path of travel were from the North bound of IH-45 to the east bound of IH-610.

Frontage roads were not considered in the model because it required the detailed modeling of all freeway exits. This activity was judged important but was not performed due to lack of time.

Divided Highways were modeled with parallel links. One link was specified to only carry traffic in one direction only. The parallel link was assigned to carry the flow of traffic in the opposite directions. The corresponding bridges were then assigned matching the direction of the traffic flow.
CHAPTER 3

DEVELOPMENT OF NETWORK MODEL

3.0 Introduction

This chapter provides details of the methods used to develop the network model of District 12. It includes the procedure implemented to attribute parameters to nodes (intersections) and links (road segments), and the procedure to attribute bridges to the corresponding links and nodes.

3.1 Summary of Procedure

It was explained in the previous chapter that a node is defined as the intersection of two or more roads, and a link is the road segment between two intersection points. The nodes and links were both given unique numbers to identify them. DBase III plus package and Intergraph’s Microstation-PC software were used as tools for the generation of the data files of nodes and links.

3.2 Generation of Nodes and Node Attributes

The nodes of the network model have attributes as the planar coordinates, number of highways intersecting at the nodes, and the highway numbers which are intersecting etc. Microstation-PC software was used to generate the planar coordinates of the nodes. This software has a relational database interface. A macro program was written in Microstation-PC language to automatically generate the planar coordinates of nodes in a dBase III plus file by simply clicking at the node on the digitized map. This program first asked the user to input the node number for which he wants the planar coordinates. The program then asked the user to click at the node. When the user clicked, the microstation-PC retrieved the X and Y coordinates...
of that point. The user was then asked for the next node number and the procedure was repeated until all node coordinates were defined.

Another information attributed to the nodes was the intersecting highway details. This information was generated with a FORTRAN program which read the input from the link attributes, described in the next section, and outputs all the highways that are intersecting at each node.

3.3 Generation of Link Attributes

The links of the network model have attributes as the two connecting nodes, highway type and highway numbers on which that particular links exist, the length of the link, the number of bridges on the link and the bridge identification numbers etc. Microstation-PC was used to determine the length along each link. First, the digitized maps were modified in the following manner. The digitized maps only consisted of drawing elements and did not necessarily started or ended at an intersection point. The drawing elements were broken up if they overlapped over nodes, and the elements were joined if there were two or more elements between two nodes. The modifications were needed to have only one drawing element per link or between two nodes. This way, a macro command of the Microstation PC language was used to retrieve the length of the links. A macro program was then written to retrieve the link length, to define the link number, the starting and ending nodes, the highway type (IH, US, etc.) and the highway number. All this information was stored in a Dbase III file.

Using this data file of link attributes, the highways that intersect at a node can were determined as mentioned in section 3.2. This was done with a separate FORTRAN program. For each node, the program reads the data file of link attributes and determines all links that connect into each node.
3.4 Bridges on Links and Nodes

As already explained, the bridges were mapped onto the digitized maps using coordinates transformed from longitude and latitude coordinates of the BRINSAP records. Each bridge included in BRINSAP was then attributed to the corresponding link(s) or node on which it exists. The bridges which lay on intersections or interchanges were attributed to the nodes. Separate files containing the bridge identification numbers of the links and the nodes were created. However, the fact that several bridges are identified to pertain to a particular node, the following logic was required to correctly identify the actual bridges to be crossed.

Consider the interchange of IH 610 WEST and US 59 SOUTH depicted in Figure 2. This figure includes the identification of all eleven bridges in the interchange. The following observations can be noted. If travelling North on IH 610 through the interchange, only bridge 0271-17-104 will be crossed. Likewise, if travelling South on IH 610 through the interchange, only bridge 0271-17-103 will be crossed. Travelling US 59 west onto IH 610 North, bridges 0027-13-427 and 0027-13-179 will be crossed. From IH 610 heading South onto US 59 East, bridge 0271-17-110 will be crossed, and so on. It can be seen that the particular bridges to be crossed depend on the path of travel within the interchange. For this reason, a mini data base was created for each interchange that contained the path of travel within the interchange and the corresponding bridges that will be crossed. This was done for all complicated interchanges. Thus, if a node is found to be crossed, the path is closely examined to determine the actual bridges.
3.5 Divided Highways

Divided Highways were considered by defining parallel links. In other words, a link modeling a divided highway has identical connecting nodes. One link is assigned a direction of travel while the parallel link is assigned the opposite direction. Bridges on divided highways were also sorted and assigned to the link pertaining to the same sense of travel.
Figure 2. Details of IH 610 West and US 59 South Interchange.
CHAPTER 4

DESCRIPTION OF ROUTING SOFTWARE

4.0 Introduction

The material described in Chapters 2 and 3 summarized the activities, tasks and work accomplished for the implementation of a routing program that identifies bridges along a route. This chapter provides a brief description of the program. The program is intended to be used with a regular Texas Highway map without knowledge of the internal structure of the network model. The program was implemented using the network model of the On-System highways of Tx Dot District 12. Furthermore, due to the fact that the only span information BRINSAP includes is the major span length besides the total length of the structure, it is impossible to evaluate the proposed Bridge Load Formula for all bridges along a given route. For this reason, calculations of the allowable axle group weight for a given bridge using the formula were excluded from the program. It is the opinion of the authors that it should only be implemented when the span length information of all bridges be complete. This information however, may be available in the near future, since it may not be so difficult to obtain.

Appendix I shows a listing of the routing program BRG. This program was coded in Microsoft FORTRAN and executes in the PC environment. It requires a 80286 Personal Computer with math coprocessor and a minimum of 512 of free RAM memory.

4.1 Use of BRG program

The program is initiated by typing BRG and then the "Enter" key from the subdirectory that contains the executable files. First, the program will prompt you to enter a name for an output file. This file will be used to store the information on the
route of travel and of the bridges on the route. The user needs to specify if he wants a short or a long output. It is recommended that the short output option be always selected. You will now see a message displayed in the computer screen informing the user about valid entries for highway types. These entries are IH for Interstate highway, US for US highway, SH for State highway, FM for Farmer Market road, SPUR, BW for Beltway, PR for Park Road and TOLL for Toll roads. A highway is identified by first entering the highway type, and then the highway number.

The next part corresponds to the input of the origin and destination of travel. It should be pointed out that travel is only modeled from a node to another node. Thus, the input and origin and destination is specified by providing two intersecting roads of the node. Proceeding is the input of the route selection. This is entered by specifying the highway identifications to be travelled plus the directions (N, E, S or W). To finish specifying the route simply enter END. It should be noted that if the incorrect information is entered, the program will alert you of that. Upon a successful input of the route selection, the computer will summarize your route request. Please verify if this information is correct. The program will then proceed to read the network information of District 12. You will see that the network model consists of 502 nodes, 738 links and 1,929 bridges. The program will now proceed to identify all links and nodes on the requested route and will conclude by displaying messages such as the number of nodes and links to be crossed, link and node numbers to be crossed, the length of travel, the number of bridges along the route, and the bridge labels of all bridges to be crossed. The program will now access the BRINSAP file and output file will be created providing with some of the characteristics of the bridges.
4.2 Sample Route

Consider the scenario that an overload permit is requested to move a piece of machinery from Ellington Field to Cullen Blvd. near IH 610. By observing a normal Texas highway map, it can be seen that the closest on-system intersection to Ellington Field is that of SH 3 and FM 1959. That to Cullen Blvd is IH 610 and FM 865. A tentative route is FM 1959 South, IH 45 North and IH 610 West. When this information is entered, the following is part of the screen display.

NUMBER OF POTENTIAL BRIDGES TO BE CROSSED 31
LENGTH OF TRAVEL PATH (IN MILES) 14.985250
BRIDGE IDENTIFICATION NOS THAT ARE CROSSED:
   0271-16-361 0271-16-362 0271-16-364 0271-16-366
   0271-16-482 0271-16-483 0271-16-486 0271-16-489
   0271-16-493 0271-16-494 0271-16-495 0271-16-496
   0500-03-014 0500-03-015 0500-03-021 0500-03-022
   0500-03-023 0500-03-024 0500-03-025 0500-03-042
   0500-03-054 0500-03-061 0500-03-073 0500-03-090
   0500-03-091 0500-03-126 0500-03-208 0500-03-264

The information above includes the number of bridges to be crossed, the length of travel and the BRINSAP bridge labels. The length of the path is obtained by adding the individual length of all links.

This route and many other routes have been tested and have been verified by comparing the results to the bridges labels of the Printed Maps of District 12. So far all information seems to be working satisfactorily.
4.3 Software Disclaimer

Installation and official utilization of this software by personnel of Texas Department of Transportation may be prohibited by the Automated Division of Tx Dot. This software is only intended to demonstrate the route selection and bridge information retrieval process for a possible evaluation of the proposed Bridge Load Formula.
SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.0 Summary

This report has summarized the activities accomplished by U.T. El Paso under this joint project with the Texas Transportation Institute. The overall objective was the development of a Bridge Load Formula and to demonstrate its application in the routing process. The proposed formula was developed by the Texas Transportation and is reported in Reference [1]. Since the proposed formula is a function of the span length(s) of the bridge and of the wheelbase of the vehicle, a route evaluation process requires identifying bridges along a route and retrieving all span lengths. The work at U.T. El Paso consisted of investigating the implementation of the formula by automating the identification of bridges along a given route, and the retrieval of bridge BRINSAP.

This report also presented the development of a demonstration software to evaluate bridge along routes for incoming heavy load vehicles. The software is based on highway network models to simulate paths of travel and on the BRINSAP data base. A network model of Tx Dot District 12 was created using digitized maps. Bridge labels were made part of the network model by mapping the geographic bridge coordinates onto the maps. The software identifies all segments of travel along a route with their corresponding bridges. The calculations of the Bridge Load Formula were left out of the software because BRINSAP lacks sufficient information to determine the individual span lengths of multispan bridges. However, if this information were collected, then it would not be too much of a problem in implementing the formula.
5.1 Conclusions

This investigation has laid out a methodology for the routing of heavy load vehicles to minimize bridge stress based upon a Load Formula. It is concluded that an automated implementation of a bridge load formula to evaluate bridges along routes of heavy-load vehicles is practical. This implementation will require network models of our highways, an accurate accounting of all bridges and additional span information of all bridges. The routing software has demonstrated that savings could result if this or a similar software be implemented.

5.2 Recommendations

It is recommended that the Texas Department of Transportation consider upgrading the information stored in BRINSAP. It is suggested that the individual span lengths of all bridges be included. Another recommendation is the creation of a separate bridge details information system that would allow engineers the access to all bridge details electronically. If this were to exist, the evaluation of incoming vehicles could be done by an expert system performing automated analysis on the individual bridges. This way, uncertainties could be eliminated.
REFERENCES


2. Bridge Inventory, Inspection and Appraisal Program - Manual of Procedures, Texas Department of Transportation, Division of Safety and Maintenance Operation, September 1984, Austin, Texas.

3. R.A. Osegueda, et. al., Towards the Implementation of an Overload Permit Formula Using Network Models and BRINSAP
APPENDIX

LISTING OF BRG PROGRAM

This program was coded and compiled using Microsoft Fortran version 5.0. The program requires a math co-processor and a minimum of 512 KB of free RAM space. For an executable copy of this program, please contact the author at the address listed in the cover sheet. The authors are not responsible for any use of this software. It is only intended to be a demonstration software for possible implementation of the proposed Bridge Load Formula.

LISTING

```fortran
$debug
#include 'fgraph.f'
#include 'fgraph.fd'
record /rccoord/ curpos
INTEGER I,J,K,kode,node(600),link(1200),nci(1200,2),nn,nl,
& nb(1200),ibr(1100,50),idb(4000),nbatt,itemp,NLNOD(2000),
& NOD,LNUM(1110,50),LTRAVEL(100),NTRAVEL(100),NODE1,NODE2,
& nde(11100)
INTEGER ISTR(200,40),ln(20)
real x(600),y(600),x(1200),xxl,co,si
CHARACTER*1 DIR(100), ans,str1
character*4 str4
character*6 str6,CTSEC
character*9 CIDB1,cidb2,cidb3,cidb4
CHARACTER*3 CTSECSTR
CHARACTER A*S14
CHARACTER*4 HWTYPE(100),HWN0(100),NODHWN(600,3),nodhwt(600,3),
& lhwt(800,3),lhwn(800,3)
character*4 hwt1,hwn0,lhwt2,hwn02
CHARACTER COUNTY*3,CONT*4,SEC*2,MP*5,STNUM*3,RDES*1,RS*2,RN*4
CHARACTER RDIR*1,FCHOS*24,CRBR*1,FOVER*18,LC*25,VCLEAR*4
CHARACTER FCLASS*2,YB*4
CHARACTER LANON*2,LANUN*2,0LOAD*1,APW*3,0PST*1,1 TYPE*1
CHARACTER LOA0*3,TYSER*2
CHARACTER MSTYP*4,MJTP*4,MNSPAN*3,NMSPAN*3,NMNSPAN*3
CHARACTER TOTSPAN*4
CHARACTER HCLEAR*4,MXSPAN*4,STRLEN*6,RWIDE*4,DCKWID*4
CHARACTER DCKCOND*1,SRCOND*1
CHARACTER SCOND*1,OPRAT*3,IRATING*3,STREVA*1,SLCAP*1,DEFHD*1
integer STNODE,ENDNODE
integer*2 dummy2, row
integer*4 dummy4
character*12 nout
character*18 descnode
CHARACTER*4 C1,C4,C7,C10
CHARACTER*2 C2,C5,C8,C11
CHARACTER*3 C3,C6,C9,C12
dummy4 = setbkcolor(int4(10))
call clearscreen($gclearscreen)$
dummy4 = setbkcolor(int4(14))
dummy2 = settextcolor(int2(15))
call settextposition(int2(23),int2(1),curpos)
```

24
call outtext( ' ENTER the name of the output file: ')
READ( *, '(a12)') nout
OPEN(1, file = nout, status = 'new')
OPEN(2, FILE = 'd12k.txt', STATUS = 'OLD')
OPEN(3, FILE = 'd12hw.out', status = 'old')
open(4, file = 'd12kbrd.txt', status = 'old')
OPEN(6, file = 'kmuldef.txt', status = 'old')
OPEN(11, FILE = 'INTCHG.TXT', STATUS = 'OLD')
lpcode = 0
do while (lpcode.lt.1.or.lpcode.gt.2)
dummy4 = setbkcolor(int4(0))
call clearscreen ($gclearscreen)
dummy4 = setbkcolor(int4(1))
call outtext( ' BRIDGE INFORMATION OUTPUT FORMAT ')
call settextposition(int2(2),int2(30),curpos)
call outtext( ' (1) Short Output ')
call settextposition(int2(5),int2(30),curpos)
call outtext( ' Please enter your choice number: ')
read( *, *) ipcode
end do
C This part takes the input related to the route to be travelled
C
dummy4 = setbkcolor(int4(0))
call clearscreen ($gclearscreen)
dummy4 = setbkcolor(int4(1))
call outtext( ' BRIDGE AND ROUTE INFORMATION RETRIEVAL PROGRAM ')
call settextposition(int2(2),int2(15),curpos)
call outtext( ' This program requires you to enter a starting ')
call settextposition(int2(6),int2(15),curpos)
call outtext( ' node of origin, an ending node of destiny, and ')
call settextposition(int2(7),int2(15),curpos)
call outtext( ' the highway identifications and directions to ')
call settextposition(int2(8),int2(15),curpos)
call outtext( ' be followed. ')
call settextposition(int2(10),int2(15),curpos)
call outtext( ' To define the highway identifications you need ')
call settextposition(int2(11),int2(15),curpos)
call outtext( ' to specify highway type, and highway number. ')
call settextposition(int2(12),int2(15),curpos)
call outtext( ' Valid entries for the highway type consist of: ')
call settextposition(int2(13),int2(15),curpos)
call outtext( ' I Interstate highway ')
call settextposition(int2(14),int2(15),curpos)
call outtext( ' US US highway ')
call settextposition(int2(15),int2(15),curpos)
call outtext( ' SH State highway ')
call settextposition(int2(16),int2(15),curpos)
call outtext( ' FM Farm Market Road ')
call settextposition(int2(17),int2(15),curpos)
call outtext( ' SPUR Spur highway ')
call settextposition(int2(18),int2(15),curpos)
call outtext( ' BW Beltway ')
call settextposition(int2(19),int2(15),curpos)
call outtext( ' P Park Road ')
call settextposition(int2(20),int2(15),curpos)
call outtext( ' TOLL Toll Road ')
call settextposition(int2(22),int2(15),curpos)
call outtext( ' USE CAPITAL LETTERS ONLY ')
call settextposition(int2(24),int2(40),curpos)
This program requires you to enter a starting node of origin, an ending node of destiny, and the highway identifications and directions to be followed.

To define the highway identifications you need to specify highway type, and highway number.

Valid entries for the highway type consist of:
- Interstate highway
- US US highway
- SH State highway
- FM Farm Market Road
- SPUR Spur highway
- BW Beltway
- P Park Road
- TOLL Toll Road

54 continue

c
read node information
c
IF (KREAD.EQ.0) THEN
  k = 1
27  read(3,fmt = 26,end = 29) node(k),x(k),y(k),nadhwt(k,1),nadhwn(k,1),
  & nadhwt(k,2),nadhwn(k,2),nadhwt(k,3),nadhwn(k,3)
c  write(*,26) node(k),x(k),y(k),nadhwt(k,1),nadhwn(k,1),
  & nadhwt(k,2),nadhwn(k,2),nadhwt(k,3),nadhwn(k,3)
k = k+1
  goto 27
  goto 27
29  continue
REWIN(3)
26  format(i5,f16.5,f16.5,2x,a4,1x,A4,3x,a4,1x,A4,3x,a4,1x,A4)
nn = k-1
  KREAD = 1
END IF

C write(*,3) 'Enter the intersecting highwaytype1'
C read(*,3) hwtp1
C write(*,3) 'Enter the intersecting highwayno1'
C read(*,3) hwno1
C write(*,3) 'Enter the intersecting highwaytype2'
C read(*,3) hwtp2
C write(*,3) 'Enter the intersecting highwayno2'
C read(*,3) hwno2

101  j = 1
dummy4 = setbkcolor(int4(0))
call clearscreen(gclearscreen)
dummy4 = setbkcolor(int4(1))
call settextposition(3,int2(18)),curpos)
call outtext(' ENTER INTERSECTING HIGHWAYS FOR START POINT ')
call settextposition(6,int2(18)),curpos)
call outtext(' HW1_TYPE HW1_NO HW2_TYPE HW2_NO')
7  dummy4 = setbkcolor(int4(0))
col = j + 20
dummy4 = setbkcolor(int4(4))
call settextposition(B,int2(col)),curpos)
call outtext(' ')
call settextposition(B,int2(col)),curpos)
  kde = 0
read(*,3) HWTP1
if (hwtp1 .eq. 'IH') kode = 1
if (hwtp1 .eq. 'US') kode = 1
if (hwtp1 .eq. 'SH') kode = 1
if (hwtp1 .eq. 'FM') kode = 1
if (hwtp1 .eq. 'SPUR') kode = 1
if (hwtp1 .eq. 'BW') kode = 1
if (hwtp1 .eq. 'F') kode = 1
if (hwtp1 .eq. 'TOLL') kode = 1
if (kode.eq.0) then
goto 7
else
dummy4 = setbkcolor(int4(0))
call settextposition(8,int2(col),curpos)
call outtext(hwtp1)
end if
col = col + 9
dummy4 = setbkcolor(int4(4))
call settextposition(8,int2(col),curpos)
call outtext(' ')
call settextposition(8,int2(col),curpos)
read(*,3) hwno1
dummy4 = setbkcolor(int4(0))
call settextposition(8,int2(col),curpos)
call outtext(hwno1)
endif
dummy4 = setbkcolor(int4(0))
col = col + 18
dummy4 = setbkcolor(int4(4))
call settextposition(8,int2(col),curpos)
call outtext(' ')
call settextposition(8,int2(col),curpos)
kode = 0
read(*,3) HWTP2
if (hwtp2 .eq. 'IH') kode = 1
if (hwtp2 .eq. 'US') kode = 1
if (hwtp2 .eq. 'SH') kode = 1
if (hwtp2 .eq. 'FM') kode = 1
if (hwtp2 .eq. 'SPUR') kode = 1
if (hwtp2 .eq. 'BW') kode = 1
if (hwtp2 .eq. 'F') kode = 1
if (hwtp2 .eq. 'TOLL') kode = 1
if (kode.eq.0) then
goto 6
else
dummy4 = setbkcolor(int4(0))
call settextposition(8,int2(col),curpos)
call outtext(hwtp2)
end if
col = col + 10
dummy4 = setbkcolor(int4(4))
call settextposition(8,int2(col),curpos)
call outtext(' ')
call settextposition(8,int2(col),curpos)
read(*,3) hwno2
dummy4 = setbkcolor(int4(0))
call settextposition(8,int2(col),curpos)
call outtext(hwno2)
endif
i = 1
j = 0
72 if (hwtp1.eq.nodhwt(i,1).and.hwno1.eq.nodhwn(i,1)) then
if (hwtp2.eq.nodhwt(i,2).and.hwno2.eq.nodhwn(i,2)) .or.
+ (hwtp2.eq.nodhwt(i,3).and.hwno2.eq.nodhwn(i,3)) then
    j = j + 1
    in(i) = node(i)
end if
endif
i=i+1
if(i.le.nn) goto 72

i = 1
73 if (hwtp1.eq.nodhw(i,2).and.hwno1.eq.nodhwn(i,2)) then
if (hwtp2.eq.nodhw(i,1).and.hwno2.eq.nodhwn(i,1)) or.
+ (hwtp2.eq.nodhw(i,3).and.hwno2.eq.nodhwn(i,3)) then
    j=j+1
    in(i) = node[i]
endif
endif
i=i+1
if(i.le.nn) goto 73

74 if (hwtp1.eq.nodhw(i,3).and.hwno1.eq.nodhwn(i,3)) then
if (hwtp2.eq.nodhw(i,2).and.hwno2.eq.nodhwn(i,2)) or.
+ (hwtp2.eq.nodhw(i,1).and.hwno2.eq.nodhwn(i,1)) then
    j=j+1
    in(i) = node[i]
endif
endif
i=i+1
if(i.le.nn) goto 74

if(j.gt.1) then
dummy4 = setbkcolor(int4(1))
call clearscreen
call settextposition(int2(3),int2(14),curpos)
call outtext("There are ")
call settextposition(int2(3),int2(26),curpos)
call outtext("nodes which intersects the ")
call settextposition(int2(4),int2(14),curpos)
call outtext("given highways. These are ")
irow = 5
do 999 k = 1,j
   write(str4(/(i4)') in(k)
irow = irow + 1
   rewind(3)
1010 read(3,fmt=1026,end=1029) intnode,descnode
   if(intnode.ne.in(k)) goto 1010
1029 continue
Rewind(3)
1026 format(i5,69x,a16)
call settextposition(int2(irow),int2(14),curpos)
call outtext(str4)
call settextposition(int2(irow),int2(19),curpos)
call outtext(descnode)
999 continue
irow = irow + 2
1001 call settextposition(int2(irow),int2(19),curpos)
call outtext("Please Enter your Choice number ")
dummy4 = setbkcolor(int4(4))
call settextposition(int2(irow),int2(52),curpos)
call outtext(" ")
dummy4 = setbkcolor(int4(1))
call settextposition(int2(irow),int2(52),curpos)
read(*,*) stnode
kode = 0
do 1002 k = 1,j
If (stnode.eq.in(k)) then
    kode = 1
end if

1002 continue
1003 if (kode.eq.0) goto 1001

c write(*,*)'There are',j,'nodes which intersect the given
c + highways'
c write(*,*)'Enter the correct node no of these nodes'
c write(*,*) (in(k),k=1,j)
c read(*,*) stnode
end if
if(j.eq.0) then
dummy4 = setbkcolor(int4(0))
call clearsreen(gclearscreen)
dummy4 = setbkcolor(int4(4))
call settextposition(int2(4),int2(16),curpos)
call outtext('')
call settextposition(int2(5),int2(16),curpos)
call outtext(' ')
call settextposition(int2(6),int2(16),curpos)
call outtext('ERROR')
call settextposition(int2(7),int2(16),curpos)
call outtext('NO NODE WHICH INTERSECTS THESE HIGHWAYS')
call settextposition(int2(8),int2(16),curpos)
call outtext('PRESS ANY KEY TO REINPUT THE NODE DATA')
call settextposition(int2(9),int2(16),curpos)
call outtext('')
read(*,*)
goto 101
c write(*,*)'No node which intersects the highways'
end if
if(j.eq.1) then
dummy4 = setbkcolor(int4(1))
call settextposition(int2(10),int2(16),curpos)
call outtext('The node which intersects the given highways')
call settextposition(int2(11),int2(16),curpos)
call outtext('is : ')
call settextposition(int2(11),int2(22),curpos)
call outtext(str4)
c write(*,*)'The node intersects the given highways is',in(j)
c stnode = in(j)
end if
read(*,*)

ans = '
c stnode = 0
c do while (stnode.lt.1.or.stnode.gt.233)
c dummy4 = setbkcolor(int4(0))
c call clearsreen(gclearscreen)
c dummy4 = setbkcolor(int4(4))
c call settextposition(int2(2),INT2(15),curpos)
c call outtext('Please input STARTING NODE number: ')
c dummy4 = setbkcolor(int4(9))
c call settextposition(int2(2),INT2(52),curpos)
c call outtext('')
c dummy4 = setbkcolor(int4(0))
c call settextposition(int2(2),INT2(52),curpos)
c read(*,*) stnode
C

201  j = 1
    dummy4 = setbkcolor(int4(0))
    call clearscreend(3)
    dummy4 = setbkcolor(int4(1))
    call settextposition(3,INT2(18),curpos)
    call outtext(' ENTER INTERSECTING HIGHWAYS FOR END POINT ')!
    call settextposition(6,INT2(18),curpos)
    call outtext(' HW1_TYPE HW1_NO HW2_TYPE HW2_NO')!
  777  dummy4 = setbkcolor(int4(0))
      col = j + 20
      dummy4 = setbkcolor(int4(1))
      call settextposition(8,int2(col),curpos)
      call outtext(' )
      call settextposition(8,int2(col),curpos)
      kode = 0
      read(*,3) hwtp1
      if (hwtp1 .eq. 'H') kode = 1
      if (hwtp1 .eq. 'US') kode = 1
      if (hwtp1 .eq. 'SH') kode = 1
      if (hwtp1 .eq. 'FM') kode = 1
      if (hwtp1 .eq. 'SPUR') kode = 1
      if (hwtp1 .eq. 'BW') kode = 1
      if (hwtp1 .eq. 'TOLL') kode = 1
      if (kode .eq. 0) then
        goto 777
      else
        dummy4 = setbkcolor(int4(0))
        call settextposition(8,int2(col),curpos)
        call outtext(hwtp1)
        end if
      end if
      col = col + 9
      dummy4 = setbkcolor(int4(1))
      call settextposition(8,int2(col),curpos)
      call outtext(' )
      call settextposition(8,int2(col),curpos)
      read(*,3) hwno1
      dummy4 = setbkcolor(int4(0))
      call settextposition(8,int2(col),curpos)
      call outtext(hwno1)
  666  dummy4 = setbkcolor(int4(0))
      col = col + 18
      dummy4 = setbkcolor(int4(1))
      call settextposition(8,int2(col),curpos)
      call outtext(' )

call settextposition(8,int2(col),curpos)
kode = 0
read(*,3) HWTP2
if (hwtp2 .eq. 'IH') kode = 1
if (hwtp2 .eq. 'US') kode = 1
if (hwtp2 .eq. 'SP') kode = 1
if (hwtp2 .eq. 'FM') kode = 1
if (hwtp2 .eq. 'SH') kode = 1
if (hwtp2 .eq. 'BP') kode = 1
if (kode.eq.0) then
    goto 666
else
    dummy4 = setbkcolor(int4(0))
call settextposition(8,int2(col),curpos)
call outtext (hwtp2)
end if

col=col+10
dummy4 = setbkcolor(int4(4))
call settextposition(8,int2(col),curpos)
call outtext ("l")
call settextposition(8,int2(col),curpos)
call outtext(hwno2)

i=1
j=0
722   if (hwtp1.eq.nodhw(i,1).and.hwno1.eq.nodhwn(i,1)) then
       if (hwtp2.eq.nodhw(i,2).and.hwno2.eq.nodhwn(i,2)) then
           in(i) = node(i)
       endif
       endif
       i=i+1
   if(i.le.nn) goto 722

i=1
733   if (hwtp1.eq.nodhw(i,2).and.hwno1.eq.nodhwn(i,2)) then
       if (hwtp2.eq.nodhw(i,1).and.hwno2.eq.nodhwn(i,1)) then
           in(i) = node(i)
       endif
       endif
       i=i+1
   if(i.le.nn) goto 733

i=1
744   if (hwtp1.eq.nodhw(i,3).and.hwno1.eq.nodhwn(i,3)) then
       if (hwtp2.eq.nodhw(i,2).and.hwno2.eq.nodhwn(i,2)) then
           in(i) = node(i)
       endif
       endif
       i=i+1
   if(i.le.nn) goto 744
endif
dummy4 = setbkcolor(int4(1))
call settextposition(int2(3),int2(14),curpos)
call outtext(' There are ')  
call settextposition(int2(3),int2(26),curpos)  
call outtext(str4)  
call settextposition(int2(3),int2(31),curpos)  
call outtext(' nodes which intersects the ')  
call settextposition(int2(4),int2(14),curpos)  
call outtext(' given highways. These are ')  
irow = 5  
do 995 k = 1,j  
write(str4,'(i4)') in(k)  
rewind(3)
1030  read(3,fmt = 1026,end = 1039) intnode,descnode  
if(intnode.ne.in(k)) goto 1030  
1039 continue  
REWIND(3)
995 continue
irow = irow + 2  
1004 call settextposition(int2(irow),int2(19),curpos)  
call outtext(str4)  
call settextposition(int2(irow),int2(19),curpos)  
call outtext(descnode)  
kode = 0  
do 1005 k = 1,j  
if (endnode.eq.in(k)) then  
kode = 1  
endif  
1006 continue  
1006 if (kode.eq.0) goto 1004

c write(‘*’,'X’ There are,’i,’nodes which intersects the given
+c + highways’

c write(‘*’,’X’ Enter the correct node no of these nodes’

c write(‘*’,’X’ in(k),k = 1,j)

c read(*,’X’ endnode

endif

if(j.eq.0) then  
dummy4 = setbkcolor(int4(0))  
call clearscreen(103)  
dummy4 = setbkcolor(int4(4))

call settextposition(int2(6),int2(16),curpos)  
call outtext(’’

call settextposition(int2(5),int2(16),curpos)  
call outtext(’’

call settextposition(int2(4),int2(16),curpos)  
call outtext(’’

call settextposition(int2(3),int2(16),curpos)  
call outtext(’’

call settextposition(int2(2),int2(16),curpos)  
call outtext(’’

call settextposition(int2(1),int2(16),curpos)  
call outtext(’’

call settextposition(int2(7),int2(16),curpos)  
call outtext(’’

call settextposition(int2(6),int2(16),curpos)  
call outtext(’’

call settextposition(int2(5),int2(16),curpos)  
call outtext(’’

call settextposition(int2(4),int2(16),curpos)  
call outtext(’’

call settextposition(int2(3),int2(16),curpos)  
call outtext(’’

call settextposition(int2(2),int2(16),curpos)  
call outtext(’’

call settextposition(int2(1),int2(16),curpos)  
call outtext(’’

ERROR ‘

call settextposition(int2(7),int2(16),curpos)  
call outtext(’’

NO NODE WHICH INTERSECTS THESE HIGHWAYS ‘

call settextposition(int2(8),int2(16),curpos)  
call outtext(’’

call settextposition(int2(9),int2(16),curpos)  
call outtext(’’

call settextposition(int2(10),int2(16),curpos)  
call outtext(’’

PRESS ANY KEY TO REINPUT THE NODE DATA ‘

call settextposition(int2(11),int2(16),curpos)  
call outtext(’’

32
call outtext('No node which intersects the highways')
endif

if(j.eq.1) then
    call settextposition(int2(10),int2(16),curpos)
    call outtext('The node which intersects the given highways')
    call settextposition(int2(11),int2(16),curpos)
    call outtext('is: ')
    write(str4,'1i41'1 in(j)
end node = in(j)
end if
write('•••• Illegal entry ••')
must be greater than 0 and ••
Press ENTER to continue •'
endif
c end do

7 write('•••• Enter ENDING NODE number')
c READ(5,*) ENDNODE
c if (ENDNODE.lt.1.or.ENDNODE.gt.233) then
    write('***** Illegal entry -- must be greater than 0')
c call settextposition(int2(16),int2(16),curpos)
    call outtext('and less than 234')
c call settextposition(int2(21),int2(29),curpos)
    call outtext('Press ENTER to continue')
c read('••••
c

J = 1
dummy4 = setbcolor(int4(0))
call clearscreen($gclearscreen)
dummy4 = setbcolor(int4(1))
call settextposition(2,int2(26),curpos)
call outtext('ENTER ROUTE INFORMATION ')
call outtext(‘SEGMENT HWY_TYPE HWY_NO DIRECTION ’)

8 dummy4 = setbcolor(int4(0))
row = j + 5

call settextposition(row, INT2(22), curpos)
write(str1, 'H1')
call outtext(str1)
dummy4 = setbcolor(int4(4))
call settextposition(row, INT2(32), curpos)
call outtext(‘ ’)
call settextposition(row, INT2(32), curpos)
c call outtext(‘ Enter HIGHWAY TYPE (I,US,SH,FM,...) OR END’)
kode = 0
read(*,31 HWTyp(j))
format (a4)

3 if (HWTyp(j) .eq. ’END’) GO TO 25
if (hwtyp(j) .eq. ’I’) kode = 1
if (hwtyp(j) .eq. ’US’) kode = 1
if (hwtyp(j) .eq. ’SH’) kode = 1
if (hwtyp(j) .eq. ’FM’) kode = 1
if (hwtyp(j) .eq. ’SPUR’) kode = 1
if (hwtyp(j) .eq. ’BW’) kode = 1
if (hwtyp(j) .eq. ’P’) kode = 1
if (hwtyp(j) .eq. ’TOLL’) kode = 1
if (kode.eq.0) then
dummy4 = setbcolor(int4(4))
call settextposition(INT2(16), INT2(15), curpos)
call outtext(‘ -------- illegal entry -------- ’)
call settextposition(row, INT2(20), INT2(22), curpos)
call outtext(‘Press ENTER to continue ’)
cread(‘*’, *)
go to 8
else
dummy4 = setbcolor(int4(0))
call settextposition(row, INT2(32), curpos)
call outtext(hwtyp(j))
end if
dummy4 = setbcolor(int4(4))
call settextposition(row, INT2(43), curpos)
call outtext(‘ ’)
call settextposition(row, INT2(43), curpos)
call outtext(hwno(j))
9 continue
dummy4 = setbcolor(int4(4))
call settextposition(row, INT2(55), curpos)
c call outtext(‘ Enter direction to follow (E,W,N OR S) ’)
call outtext(‘ ’)
call settextposition(row, INT2(55), curpos)
kode = 0
read(*,21 DIR(j))
format(a1)

2 if(dir(j).eq. ’E’) kode = 1
if(dir(j).eq. ’W’) kode = 1
if(dir(j).eq. ’N’) kode = 1
if(dir(j).eq. ’S’) kode = 1
if (kode.eq.0) then
dummy4 = setbcolor(int4(4))
call settextposition(INT2(16), INT2(15), curpos)
call outtext(‘ -------- illegal entry -------- ’)
call settextposition(INT2(20), INT2(22), curpos)
call outtext(‘Press ENTER to continue ’)
cread(‘*’, *)
go to 9
else

\textbf{dummy4 = setbkcolor(int4(0))}
\textbf{call settextposition(row,Int2(55),curpos)}
\textbf{call outtext(dir(j))}
\textbf{end if}

\textbf{J = J + 1}
\textbf{GOTO B}

25 \textbf{CONTINUE}
\textbf{dummy4 = setbkcolor(int4(0))}
\textbf{call clearscren($gclearscreen$)}

\textbf{NSEG = J - 1}

\textbf{****}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call clearscren($gclearscreen$)}
\textbf{write(str4,'(41)' nseg}
\textbf{WRITE(*,30) nseg}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(3),int2(14),curpos)}
\textbf{call outtext(' You have selected to travel over')}\textbf{')}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(3),int2(48),curpos)}
\textbf{call outtext(str4)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(3),int2(53),curpos)}
\textbf{call outtext(' segment(a) ')}
\textbf{write(str4,'(41)' snode}
\textbf{call settextposition(int2(5),int2(14),curpos)}
\textbf{call outtext(' beginning at node ')}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(5),int2(33),curpos)}
\textbf{call outtext(str4)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(5),int2(40),curpos)}
\textbf{write(str4,'(41)'that intersects highways ')}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(6),int2(15),curpos)}
\textbf{call outtext(' that intersects highways ')}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(6),int2(43),curpos)}
\textbf{call outtext(str4)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(6),int2(32),curpos)}
\textbf{write(str4,'(41)' ending at node ')}
\textbf{write(str4,'(41)' nodhwt(stnode,1)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(6),int2(39),curpos)}
\textbf{call outtext(str4)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(7),int2(21),curpos)}
\textbf{call outtext(str4)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(7),int2(33),curpos)}
\textbf{call outtext(str4)}
\textbf{dummy4 = setbkcolor(int4(11))}
\textbf{call settextposition(int2(7),int2(40),curpos)}
\textbf{call outtext('that intersects highways ')}
\textbf{write(str4,'(41)' nodhwt(endnode,1)}
dummy4 = setbkcolor(int4(1))
call settextposition(int2(9),int2(15),curpos)
call outtext(str4)
write(str4,'(a4)')nodhwn(endnode,1)
call settextposition(int2(9),int2(19),curpos)
call outtext(str4)
write(str4,'(a4)')nodhwn(endnode,2)
call settextposition(int2(9),int2(28),curpos)
call outtext(str4)
write(str4,'(a4)')nodhwn(endnode,3)
call settextposition(int2(9),int2(32),curpos)
call outtext(str4)
write(str4,'(a4)')nodhwn(endnode,4)
call settextposition(int2(9),int2(39),curpos)
call outtext(str4)
write(str4,'(a4)')nodhwn(endnode,5)
call settextposition(int2(9),int2(43),curpos)
call outtext(str4)
dummy4 = setbkcolor(int4(11))
call settextposition(int2(11),int2(14),curpos)
call outtext(' following: ')
row=12
do 35 i=1,nseg
dummy4 = setbkcolor(int4(11))
write(str4,'(a4)') hwtyp(i)
call settextposition(int2(row),int2(15),curpos)
call outtext(str4)
write(str4,'(a4)') hwno(i)
call settextposition(int2(row),int2(21),curpos)
call outtext(str4)
write(str4,'(a4)') dir(i)
call settextposition(int2(row),int2(28),curpos)
call outtext(str4)
row=row+1
35 continue
dummy4 = setbkcolor(int4(0))
 WRITE(1,30) nseg
 c 30 format (5x, 'You have selected to travel over ',/3, ' segments')
c write(*,31) stnode
c write(1,31) stnode
 c 31 format (5x,'beginning at node ',/4, ' that intersects highways')
c write(*,32) nodhwn(stnode,1),nodhwn(stnode,1),nodhwn(stnode,2),
c & nodhwn(stnode,2),nodhwn(stnode,3),nodhwn(stnode,3)
c write(1,32) nodhwn(stnode,1),nodhwn(stnode,1),nodhwn(stnode,2),
c & nodhwn(stnode,2),nodhwn(stnode,3),nodhwn(stnode,3)
c 32 format (10x,3(a4,1x,A4,3x))
c write(*,33) endnode
c write(1,33) endnode
c 33 format (5x,'ending at node ',/4, ' that intersects highways')
c write(*,34) nodhwn(endnode,1),nodhwn(endnode,1),nodhwn(endnode,2),
c & nodhwn(endnode,2),nodhwn(endnode,3),nodhwn(endnode,3)
c write(*,34)
c write(1,34) nodhwn(endnode,1),nodhwn(endnode,1),nodhwn(endnode,2),
c & nodhwn(endnode,2),nodhwn(endnode,3),nodhwn(endnode,3)
c write(1,34)
c 34 format(/5x,'following:',/1)
c do 35 i=1,nseg
c write(*,35) hwtyp(i),hwno(i),dir(i)
c write(1,35) hwtyp(i),hwno(i),dir(i)
c 36 format(10x,a4,1x,A4, " direction ",/1)
c continue
 cENSIONS======================================================
do while (ans.ne.'Y'.and. ans.ne.'N')
dummy4 = setbkcolor(int4(0))
call settextposition(int2(24),int2(20),curpos)
call outtext(' Is this correct (Y/N) ? '

dummy4 = setbkcolor(int4(4))
call settextposition(int2(24),int2(47),curpos)
call outtext('"

call settextposition(int2(24),int2(47),curpos)
read(*,57) ans

57 FORMAT (A11)
end do
C pause ' hit <enter> to continue'
dummy4 = setbkcolor(int4(0))
if(ans.eq.'N') goto 64

dummy4 = setbkcolor(int4(0))
call clearscreen(fgclearscreen)
dummy4 = setbkcolor(int4(1))
call settextposition(int2(12),int2(31),curpos)
call outtext(' Please Wait .... ')

C C
C C

read link data

k = 1
40 read(2,fmt = 41,end = 42) link(k),nc(k),nc(k),xl(k),x(k),
& (lhwtk(i),lhwkn(i),i = 1,1)
ndef(k) = 1
xl(k) = x(k)/5280.
C C
C write(*,41) link(k),nc(k),nc(k),xl(k),ndef(k),
C C
& (lhwtk(i),lhwkn(i),i = 1,ndef(k))
k = k + 1
goto 40
42 continue
41 format(3(i5),f16.3,i3,3(1x,e4,1x,e4))
rl = k - 1
C C
C read bridge attributes of links
C
do 45 i = 1,1100
read(4,50) jj, nb(i),(ibr(i,j),j = 1,nb(i))
C C
C write(*,50) jj, nb(i),(ibr(i,j),j = 1,nb(i))
45 continue
50 format(5(i5),i7,5x,50(i10))
K = 0
DO 55 I = 1,1100
DO 55 J = 1,nb(i)
k = k + 1
idb(K) = ibr(i,j)
55 continue
C nbatt = k
C WRITE(1,*) ' NBATT = ',NBATT
C DO 56 I = 1,NBATT
C 56 write(1,*) idb(i)

I = 1
283 READ(11,282,END = 285) LK1,LK2,NOSTR,(ISTR(I,J),J = 1,NOSTR)
282 FORMAT(4(i4,i12,25(i10))
DO 62 J = 1,NOSTR
k = k + 1
idb(K) = ISTR(I,J)
62 continue
C NB2 = NB2 + NOSTR
I = I + 1
GOTO 283
285 REWIND 11

nbatt = k
C
c sort
c
do 60 i = 1,nbatt
do 70 j = 1,nbatt
if (idb(j).lt. idb(i)) then
    write(*,'(i1)') j
    itemp = idb(i)
    idb(i) = idb(j)
    idb(j) = itemp
end if
70 continue
60 continue
c WRITE(1,*) 'BEFORE ELIMINATION'
c do 75 i = 1,nbatt
c write(*,'(i1)') idb(i)
c 75 continue
IF(NBATT.EQ.0) GOTO 83
k = 1
kk = 2
77 if (idb(kk).gt.idb(k)) then
    k = k + 1
    idb(k) = idb(kk)
else
    kk = kk + 1
end if
if (kk.le.nbatt) goto 77
nb2 = k
c WRITE(1,*) 'AFTER ELIMINATION'
c do 76 i = 1,nb2
c write(*,'(i1)') idb(i)
c 76 continue
83 dummy4 = setbkcolor(int4(0))
call clearscreent($gclearscreen)
dummy4 = setbkcolor(int4(1))
call settextposition(int2(4),int2(23),curpos)
call outtext('HARRIS COUNTY NETWORK INFORMATION')
c WRITE(*,*)'Number of nodes',nn
c WRITE(*,*)'Number of links',nl
c WRITE(*,*)'Number of total bridge attributes',nbatt
c WRITE(*,*)'Number of total bridges',nb2
38
WRITE(1,*) 'HOUSTON DISTRICT NETWORK INFORMATION'
WRITE(1,*) '***************************************
WRITE(1,*) 'Number of nodes ',nn
WRITE(1,*) 'Number of links ',nl
C WRITE(1,*) 'Number of total bridge attributes',nbatt
WRITE(1,*) 'Total number of bridges ',nb2
pause 
C pause 'Hit <ENTER> to continue'
C DETERMINE NUMBER OF LINKS CONNECTING TO NODE
DO 90 I = 1, NL
DO 95 J=1,2
NOD = NC(I,J)
NLNOD(NOD) = NLNOD(NOD) + 1
K = NLNOD(NOD)
NUMINOD(K) = 1
C WRITE(*,*) I
95 CONTINUE
90 CONTINUE
C OPEN (7,FILE = 'LLL.DAT',STATUS = 'NEW')
C DO 100 I=1,NN
C WRITE(7,**), NLNOD(I),I,NUMI(I,J),J=1,NLNOD(I)
C100 CONTINUE
C BEGIN THE ROUTE SELECTION OF THE ROUTE
C ISEG = 1
K = 0

NUMBER = NLNOD(STNODE)
NOD = STNODE
C ************

150 KODE = 0
kode2 = 0
NUMBER = NLNOD(NOD)
DO 105 I=1, NUMBER
IF(KODE.NE.0) GOTO 105
LN = NUMI(NOD,I)
IF (K.GT.0) THEN
IF (LN.EQ.LTRAVEL(K)) GOTO 105
END IF
C WRITE(*,*) 'LN ISEG', LN,ISEG
C + + + + + + + + + + +
 n = ndef(ln)
iflag = 0
do j = 1, n
IF (HWTPY(ISEG),eq.LHWT(LN,j)) then
IF (HNWNO(ISEG),eq.LHWN(LN,j)) iflag = 1
end if
end do
if (iflag.eq.0) goto 105
C at this point the link ln in on the path of travel
C defined on the current segment [iseg]
IF (NC(LN,1).EQ.NOD) THEN
NODE1 = NC(LN,1)
NODE2 = NC(LN,2)
END IF
IF (NC(ILN,2).EQ.NOD) THEN
   NODE1 = NC(ILN,2)
   NODE2 = NC(ILN,1)
END IF
XXX = SQRT((X(NODE2)-X(NODE1))**2 + (Y(NODE2)-Y(NODE1))**2)
CO = (X(NODE2)-X(NODE1))/XXX
SI = (Y(NODE2)-Y(NODE1))/XXX
IF (DIR(ISEG).EQ.'E') THEN
   IF (CO.GT.0.) KODE = 1
   END IF
IF (DIR(ISEG).EQ.'W') THEN
   IF (CO.LT.0.) KODE = 1
   END IF
IF (DIR(ISEG).EQ.'N') THEN
   IF (SI.GT.0.) KODE = 1
   END IF
IF (DIR(ISEG).EQ.'S') THEN
   IF (SI.LT.0.) KODE = 1
   END IF
IF KODE IS 1 THE LINK IN ALSO HAS THE SAME DIRECTION
IF KODE IS NOT FOUND
KODE2 = 1
105 CONTINUE
IF (KODE.EQ.0 .AND. KODE2.NE.0) THEN
IF (HWTYPE(ISEG+1).EQ.HWTYPE(ISEG) .AND. 
& HWNO(ISEG+1).EQ.HWNO(ISEG)) THEN
   ISEG = ISEG + 1
   GOTO 150
END IF
ENDIF
IF (KODE.EQ.1) THEN
   K = K + 1
   LTRAVEL(K) = LN
   NTRAVEL(K) = NOD
   NOD = NODE2
   WRITE(*, '(', ') ', 'LTRAVEL', LTRAVEL(K)
   WRITE(*, '(', ') ', 'NTRAVEL', NTRAVEL(K)
   WRITE(*, '(', ') ', 'NEXT NODE', NOD
   NOD = NODE2
ENDIF
IF (NOD.EQ.ENDNODE) GOTO 200
C CHECK TO SEE IF YOU NEED TO SWITCH SEGMENTS
C
NUMBER = NLNOD(NOD)
DO 103 I = 1,NUMBER
   LN = LNUM(NOD,I)
   IF (LN.EQ.LTRAVEL(K)) GOTO 103
IF (NOD.EQ.NC(ILN,1)) THEN
   N1 = NC(ILN,1)
   N2 = NC(ILN,2)
   ELSE
   N1 = NC(ILN,2)
   N2 = NC(ILN,1)
   END IF
   XXL = SQRT((X(N2) - X(N1))**2 + (Y(N2) - Y(N1))**2)
   CO = (X(N2) - X(N1))/XXL
   SI = (Y(N2) - Y(N1))/XXL
   WRITE('(', ') ', 'CO', CO,'SI', SI
C ++ +++++ ++++++++ ++++++++ + ++
n = ndef(n)
   iflag = 0
   DO J = 1,n
IF (HWTYPISEG + 1).EQ.LHWTLN(JJ) THEN
  IF (HWNOLLSEG + 1).EQ.LHWN(LN(JJ)) IFLAG = 1
  END IF
END DO
IF (IFLAG.EQ.1) THEN
  IF (HWTYPISEG + 1).EQ.HWTPYISEG(JJ) AND.
     HWNOLLSEG + 1).EQ.HWNOL(JJ) THEN
    IF (DIRISEG + 1).EQ.'N' THEN
      IF (ABS(S(I)).GT.ABS(CO).AND.S.I.GT.0.) KODE = 2
      END IF
    IF (DIRISEG + 1).EQ.'S' THEN
      IF (ABS(S(I)).LT.ABS(CO).AND.S.I.LT.0.) KODE = 2
      END IF
    IF (DIRISEG + 1).EQ.'E' THEN
      IF (ABS(S(I)).GT.ABS(CO).AND.CO.LT.0.) KODE = 2
      END IF
    IF (DIRISEG + 1).EQ.'W' THEN
      IF (ABS(S(I)).LT.ABS(CO).AND.CO.GT.0.) KODE = 2
      END IF
    ELSE
      KODE = 2
    END IF
  END IF
  IF (KODE.EQ.1) GOTO 150
  IF (KODE.EQ.2) THEN
    WRITE(*, *) hwtypiseg, hwnollseg, diriseg, ltravek
    GOTO 150
  END IF
END IF
103 CONTINUE
END IF
IF (KODE.EQ.1) GOTO 150
IF (KODE.EQ.2) THEN
  WRITE(*,*) * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(*,'(A10,':') TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE')
  WRITE(*,*) 'DEFINITION'
  WRITE(*,*) '••••••••••••••••••••••••••••••••••••••••••••••••-
  call settextposition(int2(7),int2(16),curpos)
  call outtext(' TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  call settextposition(int2(8),int2(16),curpos)
  call outtext(' DEFINITION')
  call settextposition(int2(9),int2(16),curpos)
  call outtext(' Program is Exiting')
  call settextposition(int2(10),int2(16),curpos)
  call outtext('')
  WAITE(1,' * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(1,*) ' ERROR'
  WRITE(1,*}
  ••••••••••••••••••••••••••••••••••••••••••••••••
  C WRITE(*,*) * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(*,'(A10,':') TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  WRITE(*,*) 'DEFINITION'
  WRITE(*,*) '••••••••••••••••••••••••••••••••••••••••••••••••-
  call settextposition(int2(7),int2(16),curpos)
  call outtext(' TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  call settextposition(int2(8),int2(16),curpos)
  call outtext(' DEFINITION')
  call settextposition(int2(9),int2(16),curpos)
  call outtext(' Program is Exiting')
  call settextposition(int2(10),int2(16),curpos)
  call outtext('')
  WAITE(1,' * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(1,*) ' ERROR'
  WRITE(1,*}
  ••••••••••••••••••••••••••••••••••••••••••••••••
  C WRITE(*,*) * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(*,'(A10,':') TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  WRITE(*,*) 'DEFINITION'
  WRITE(*,*) '••••••••••••••••••••••••••••••••••••••••••••••••-
  call settextposition(int2(7),int2(16),curpos)
  call outtext(' TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  call settextposition(int2(8),int2(16),curpos)
  call outtext(' DEFINITION')
  call settextposition(int2(9),int2(16),curpos)
  call outtext(' Program is Exiting')
  call settextposition(int2(10),int2(16),curpos)
  call outtext('')
  WAITE(1,' * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(1,*) ' ERROR'
  WRITE(1,*}
  ••••••••••••••••••••••••••••••••••••••••••••••••
  C WRITE(*,*) * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(*,'(A10,':') TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  WRITE(*,*) 'DEFINITION'
  WRITE(*,*) '••••••••••••••••••••••••••••••••••••••••••••••••-
  call settextposition(int2(7),int2(16),curpos)
  call outtext(' TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF DESTINY, CHECK YOUR INPUT FOR THE ROUTE'
  call settextposition(int2(8),int2(16),curpos)
  call outtext(' DEFINITION')
  call settextposition(int2(9),int2(16),curpos)
  call outtext(' Program is Exiting')
  call settextposition(int2(10),int2(16),curpos)
  call outtext('')
  WAITE(1,' * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  WRITE(1,*) ' ERROR'
  WRITE(1,*}
  ••••••••••••••••••••••••••••••••••••••••••••••••
C WRITE(*,*) 'TRAVEL ROUTE FAILED TO CONVERGE TO ITS POINT OF'
WRITE(*,*) 'DESTINY, CHECK YOUR INPUT FOR THE ROUTE' 
WRITE(*,*) 'DEFINITION'
WRITE(*,*)
C PAUSE ' '
GOTO 5001
END IF

200 CONTINUE
NLINKS = K
NNODES = K+1
NTRAVEL(NNODES) = NC

WRITE(*,*)' LINKS TO BE TRAVELLED'
WRITE(*,*)' LINKS TO BE TRAVELLED
WRITE(*,180) (LTRAVEL(I),I=1,NLINKS)
dummy4 = setbkcolor(int4(0))
call clearscreen($gclearscreen)
dummy4 = setbkcolor(int4(1))
call aettextposition(int2(4),int2(16),curpos)
call outtext(' LINKS TO BE TRAVELLED' )
call aettextposition(int2(5),int2(16),curpos)
call outtext(' LINKS TO BE TRAVELLED')
call aettextposition(int2(6),int2(16),curpos)
call outtext('')
row = 2
col = 16
j = 0
call aettextposition(int2(row),int2(16),curpos)
call outtext('')
do i = 1,nlinks
write(str6,'(16)')ltravel(i)
call aettextposition(int2(row),int2(col),curpos)
call outtext(str61)
col = col + 6
j = j + 1
if(j.eq.8) then
row = row + 1
col = 16
j = 0
call aettextposition(int2(row),int2(16),curpos)
call outtext('')
endif
denido

WRITE(*,*) ' LINKS TO BE TRAVELLED'
WRITE(*,*) ' LINKS TO BE TRAVELLED'
WRITE(*,180) (LTRAVEL(I),I=1,NLINKS)
180 FORMAT(8(16))
c WRITE(*,*) ''

XXL = 0.0
DO 288 I=1,NLINKS
XXL = XXL + XL(LTRAVEL(I))
288 CONTINUE

c c loop to check for the two-way traffic links

42
do 250 i = 1, NLINKS
   in = ltravel(i)
   node1 = ncol(in, 1)
   node2 = ncol(in, 2)
   if (node1.eq.ntravel(i + 1) .and. node2.eq.ntravel(i)) then
      read(6, 225, end = 245) lk1, lk2
      if (lk1.eq.ltravel(i)) then
         ltravel(i) = lk2
      endif
   end if
end if
rewind 6
245 rewind 6
250 continue
225 format (i5,i5)
WRITE(*,180) (LTRAVEL(I), I = 1, NLINKS)
c 180 FORMAT(B10)
col = 16
j = 0
call setextposition(int2(row),int2(16),curpos)
call outtext('')
do i = 1,nnodes
   write(str6,'(i6)') ntrav(i)
call setextposition(int2(row),int2(16),curpos)
call outtext(str6)
col = col + 6
j = j + 1
if(j.eq.16) then
   row = row + 1
   col = 16
   j = 0
   call setextposition(int2(row),int2(16),curpos)
call outtext('')
endif
ddono

WRITE(1,* ' ')
WRITE(1,* ' NODES TO BE CROSSED' )
WRITE(1,* ' **********
WRITE(1,180) (NTRAVEL(I),I = 1,NNODES)
CONTINUE

K = 0
DO 255 I = 1,NLINKS
   LN = LTRAVEL(I)
   DO 255 J = 1, nb(LN)
      k = k + 1
      idb(K) = ibr(LN,J)
   255 continue
   nbatt = k

DO 291 I = 1,NLINKS-1
   LN1 = LTRAVEL(I)
   LN2 = LTRAVEL(I+1)
   293 READ(11,292,END = 295) LK1,LK2,NOSTR,ISTR(I,J),J = 1,NOSTR
   292 FORMAT(I4,14,12,25(I10))
   IF(LK1.EQ.LN1 .AND. LK2.EQ.LN2) THEN
      NB2 = NB2 + NOSTR
      DO 294 J = 1,NOSTR
         K = K + 1
         IDB(K) = ISTR(I,J)
      294 continue
   ENDIF
GOTO 293
295 REWIND 11
291 CONTINUE

NBATT = K

WRITE(*,'(i4,2x,14,12,25(f15.1))') LN1,LN2,LK1,LK2,NOSTR,ISTR(I,J)
C WRITE(*,'(i4,2x,14,12,25(f15.1))') LN1,LN2,LK1,LK2,NOSTR,ISTR(I,J)
C WRITE(*,'(i4,2x,14,12,25(f15.1))') LN1,LN2,LK1,LK2
C
C 294 CONTINUE
ENDIF
GOTO 293
295 REWIND 11
291 CONTINUE

NBATT = K

C sort
C
do 260 I = 1,nbatt
   DO 270 J = I,nbatt
      IF(idb(J).lt.idb(I)) then
         WRITE(*,'(i4,2x,14,12,25(f15.1))') idb(I)
         idb(I) = idb(J)
         idb(J) = temp
      endif
   270 continue
C 260 continue
end if
270 continue
280 continue

C WRITE(1,*) 'NBATT=',NBATT
C do 75 i=1,nbatt
C write(1,*) idb(i)
C 75 continue

k = 1
kk = 2
277 if (idb(kk) .gt. idb(kk)) then
  k = k + 1
  idb(k) = idb(kk)
else
  kk = kk + 1
end if
if (kk.le.nbatt) goto 277
nb2 = k

******************************************************************************

C converting integer to character

open(20, file = 'junk.txt', status = 'unknown')
do 2050 i=1,nb2
2000 format(1x,i9)
  if (idb(i) .gt. 99999999) then
    write(20,2000) idb(i)
    goto 2050
  endif
  if (idb(i) .lt. 99999999) then
    write(20,2010) idb(i)
    goto 2050
  endif
2010 format(1x,'O',i7)
  endwhile
2050 continue

******************************************************************************

C WRITE(1,*) 'NUMBER OF POTENTIAL BRIDGES TO BE CROSSED', NB2
C WRITE(1,*) 'LENGTH OF TRAVEL PATH (IN MILES)',XXL
WRITE(1,*) 'NUMBER OF POTENTIAL BRIDGES TO BE CROSSED', NB2
WRITE(1,*) 'LENGTH OF TRAVEL PATH (IN MILES)',XXL
WRITE(1,*) 'BRIDGE IDENTIFICATION NOS THAT ARE CROSSED :'
row = row + 2
call settextposition(int2(row),int2(16),curpos)
call outtext(' NUMBER OF POTENTIAL BRIDGES TO BE CROSSED')
write(str6,'(i16)') nb2
call settextposition(int2(row),int2(60),curpos)
call outtext(str6)
row = row + 1
call settextposition(int2(row),int2(16),curpos)
call outtext(' LENGTH OF TRAVEL PATH IN MILES')
write(str10,'(f10.4)') XXL
call settextposition(int2(row),int2(38),curpos)
call outtext(str10)
row = row + 1
col = 16
j = 0
call setextposition(int2(row),int2(16),curpos)
call outtext(""
WRITE(*,180) (IDB(I),I=1,NB2)
rewind 20
1800 read(20,1900,end = 1995) c1,C2,cm
read(20,1900,end = 1995) c4,c5,c6
read(20,1900,end = 1995) c7,c8,c9
read(20,1900,end = 1995) c10,c11,c12
1800 format(1x,a4,A2,A3)
WRITE(1,185) c1,C2,C3,C4,C5,C6,C7,C8,C9,c10,c11,c12
185 FORMAT(10x,A4,",",A2,",",A3,"")
call setextposition(int2(row),int2(16),curpos)
call outtext(c1)
call setextposition(int2(row),int2(20),curpos)
call outtext("-"
call setextposition(int2(row),int2(21),curpos)
call outtext(c2)
call setextposition(int2(row),int2(23),curpos)
call outtext("-"
call setextposition(int2(row),int2(24),curpos)
call outtext(c3)
call setextposition(int2(row),int2(28),curpos)
call outtext(c4)
call setextposition(int2(row),int2(32),curpos)
call outtext("-"
call setextposition(int2(row),int2(33),curpos)
call outtext(c5)
call setextposition(int2(row),int2(35),curpos)
call outtext("-"
call setextposition(int2(row),int2(36),curpos)
call outtext(c6)
call setextposition(int2(row),int2(40),curpos)
call outtext(c7)
call setextposition(int2(row),int2(44),curpos)
call outtext("-"
call setextposition(int2(row),int2(45),curpos)
call outtext(c8)
call setextposition(int2(row),int2(47),curpos)
call outtext("-"
call setextposition(int2(row),int2(48),curpos)
call outtext(c9)
call setextposition(int2(row),int2(52),curpos)
call outtext(c10)
call setextposition(int2(row),int2(56),curpos)
call outtext("-"
call setextposition(int2(row),int2(57),curpos)
call outtext(c11)
call setextposition(int2(row),int2(59),curpos)
call outtext("-"
call setextposition(int2(row),int2(60),curpos)
call outtext(c12)
call setextposition(int2(row),int2(28),curpos)
call outtext(c1b2)
call setextposition(int2(row),int2(40),curpos)
call outtext(c1b3)
call setextposition(int2(row),int2(52),curpos)
call outtext(c1b4)
row = row + 1
call setextposition(int2(row),int2(16),curpos)
call outtext(""
if(row.eq.24) then
row = 4
OPENING BRINSAP DATA FILE

OPEN(10,FILE = 'C:\BRINSAP\D12SORT.TXT', STATUS = 'OLD')

OPEN(10,FILE = 'DIST12.TXT', STATUS = 'OLD')

K = 1

KK = 1

C

REWIND 20

READ(20,2100,END = 5000) CTSEC,CTSECSTR

2100 FORMAT(1X,A6,A3)

400 CONTINUE

READ(10,FMT = 340,END = 4900) A

340 FORMAT(A514)

IF (A(7:12).EQ. CTSEC .AND. A(18:20).EQ. CTSECSTR ) THEN

GOTO 500
ELSE

GOTO 400

ENDIF
C DECODE AND PRINT
C

500 COUNTY = A(4:6)
  CONT = A(7:10)
  SEC = A(11:12)
  MP = A(13:17)
C
STNUM = A(18:20)
  RDES = A(28:28)
RS = A(30:31)
  RN = A(32:35)
  RDIR = A(36:36)
  FCROS = A(53:76)
  CRBR = A(77:77)
  FOVER = A(91:108)
  LC = A(109:133)
  VCLEAR = A(134:137)
  FCLASS = A(171:172)
  YB = A(173:176)
  LANON = A(177:178)
  LANUN = A(179:180)
  DLOAD = A(189:189)
  APW = A(190:192)
  OPST = A(210:210)
  LTYP = A(211:211)
  LOAD = A(212:214)
  TYSER = A(215:216)
  MSTYP = A(217:220)
  MJTYP = A(221:224)
  MNTYP = A(225:228)
  NMSPAN = A(241:243)
  NMJSPAN = A(244:246)
  NMNSPAN = A(247:249)
  TOTSPAN = A(250:253)
  HCLEAR = A(254:257)
  MXSPAN = A(258:261)
  STRLEN = A(262:267)
  RWIDE = A(274:277)
  DCKWID = A(278:281)
  DCKCOND = A(303:306)
  SPRCOND = A(304:304)
  SBCOND = A(305:305)
  OPRAT = A(308:310)
  !RATING = A(312:314)
  STREVA = A(315:315)
  SLCAP = A(316:318)
  DEFHD = A(408:408)

if(ipcode.eq.1 .or. ipcode.eq.2) then
c  write(*,600) COUNTY,STNUM,RS,RN,RDIR
  WRITE(*,601) FCROS,FOVER,LC
  WRITE(*,602) LANON,DLOAD,OPST,LTYP,LOAD,MSTYP
  WRITE(*,603) NMSPAN,TOTSPAN,MXSPAN,STRLEN,RWIDE
  WRITE(*,604) OPRAT,IRATING,DEFHD
write(1,600) COUNTY,STNUM,RS,RN,RDIR
WRITE(1,601) FCROS,FOVER,LC
WRITE(1,602) LANON,DLOAD,OPST,LTYP,LOAD,MSTYP
WRITE(1,603) NMSPAN,TOTSPAN,MXSPAN,STRLEN,RWIDE
WRITE(1,604) OPRAT,IRATING,DEFHD

600 FORMAT ['IX,60(' .. ',1X,'CNTY ',A3,' STR NO. ',A3,' R. S. ',A2,
& ' R No. ',A4,' R. DIR ',A1]
601 FORMAT ['IX,' FEATURE CROSSSED ---- ',A24,/, &
1X,' FAC. CARRIED OVER -- ',A18/, &
1X,' LOCATION OF BR. ---- ',A25)
602 FORMAT ['IX,' No. LANES ',A2,' DESIGN LOAD ',A1,' OP. STAT. ', &
A1',/,' LOAD TYPE ',A4,' MAIN SPAN TYPE ',
& A4)
603 FORMAT (1X, 'No. MAIN SPANS ',A3,' TOTAL No. SPANS ',A4,
& ' MAX. SPAN LGTH ',A4,’/1X,’ STRUC. LENGTH ',A6,
& ' ROAD WIDTH ', A4)
604 FORMAT (1X, ' RATINGS **** OPERATION ', A3,' INVENTORY ',A3,
& '/1X, ' DEFENSE HWY DESIGN ', A1)
GOTO 390
ENDIF

4900 REWIND 10
GOTO 390
5000 CONTINUE

    dummy4 = setbkcolor(int4(0))
    call clearscreent$cclearscreen

5001 end