Hazardous Materials Routing Study Phase I

Establishing Hazardous Materials Truck Routes for Shipments through the Dallas-Fort Worth Area

October 1985

North Central Texas
Council of Governments

The North Central Texas Council of Governments

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The Council of Governments is an organization of, by, and for local governments. Its purpose is to strengthen both the individual and collective power of local governments - and to help them recognize regional opportunities, resolve regional problems, eliminate unnecessary duplication, and make joint regional decisions - as well as to develop the means to assist in the implementation of those decisions.

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Since 1974 NCTCOG has served as the Metropolitan Planning Organization (MPO) for transportation for the Dallas-Fort Worth area. NCTCOG's Department of Transportation and Energy is responsible for the regional planning process for all modes of transportation. The Department provides technical support and staff assistance to the Regional Transportation Council and its technical committees, which compose the MPO policy-making structure. In addition the Department provides technical assistance to the local governments of North Central Texas in planning, coordinating, and implementing transportation decisions.

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Funding to conduct this project was provided by the Texas State Department of Highways and Public Transportation in cooperation with the Federal Highway Administration as part of the Texas Traffic Safety Program.

October 1985

Executive Summary

The transportation of hazardous materials over streets and highways in the Dallas-Fort Worth area has become a significant transportation safety concern. Recent accidents involving vehicles transporting hazardous materials have resulted in extensive property damage, traffic congestion, serious injury, and loss of lives. The occurrence of these accidents heightened interest on the part of local officials to address this problem.

In response to these concerns the North Central Texas Council of Governments, working with local governments in the Dallas-Fort Worth area, established a set of regional hazardous materials truck routes. This study, completed in January of 1984, developed a regionwide routing system for hazardous materials truck shipments traveling through the metropolitan area.

This approach was based upon the guidelines established by the Federal Highway Administration for systematically analyzing alternative routes and selecting those with the least amount of risk.

This report summarizes the process followed to implement the FHWA risk assessment approach, the results of the analysis, and steps toward implementation of the selected routes.

Abstract

TITLE: Hazardous Materials Routing Study Phase I: Establishing Hazardous Materials Truck Routes for Shipments through the Dallas-Fort Worth Area

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SUBJECT: Summary of the technical analysis and process to establish hazardous materials truck routes for shipments traveling through the Dallas-Fort Worth metropolitan area.

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ABSTRACT: The transportation of hazardous materials over streets and highways in the Dallas-Fort Worth area has become a significant transportation safety concern. This report documents the first phase of a two-part study addressing hazardous materials truck routes in the Dallas-Fort Worth area. Based upon findings from this study, a regional hazardous materials truck routing system has been developed in cooperation with local governments and the State Department of Highways and Public Transportation for hazardous materials truck shipments through the Dallas-Fort Worth area. Results of the risk assessment study used to develop these routes are based upon the FHWA report, Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials.

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CHAPTER I

INTRODUCTION

The purpose of this study is to develop a system of regional hazardous materials truck routes for shipments through the Dallas-Fort Worth area. This plan was developed in response to the need identified by local, state, and federal officials for designing a regionwide routing system based upon the selection of the safest available routes coordinated among each of the various local jurisdictions.

Funding to conduct this analysis was provided by the Texas State Department of Highways and Public Transportation in cooperation with the Federal Highway Administration. This study was conducted by the North Central Texas Council of Governments, the Metropolitan Planning Organization for the Dallas-Fort Worth area.

Background

In 1978, in an effort to minimize the risk associated with hazardous materials being shipped through the city of Dallas, the Dallas City Council amended the city code to restrict shipments of hazardous materials through the city to designated routes. This code modification also prohibited hazardous materials carriers from using certain freeways and tunnels. The Dallas routing plan designated the outer freeway loop for hazardous materials being shipped through the area. In proximity to the Dallas CBD, the ordinance prohibits local hazardous materials vehicles from using the elevated or depressed portions of freeways and the underground delivery tunnel system. City of Dallas police and fire personnel began signing, monitoring, and enforcement of these routes in 1983.

The City of Fort Worth amended existing city codes also to specify routes for through shipments of hazardous materials in 1979 . The loop freeway system around the city was designated for through shipments. The routing plan has not yet been signed or implemented for enforcement.

Several studies related to the routing of hazardous materials have previously been completed by NCTCOG. A Rail Planning Program for North Central Texas was developed in 1980.(1) While this document primarily addressed rail transportation issues, a final recommendation of this report cited the need to address hazardous materials movements by truck in the North Central Texas region.

The Regional Industrial Waste Management Study, also completed in 1980, documented the significant levels of hazardous industrial waste materials which are being shipped via the trucking system in the Dallas-Fort Worth area.(2)

In the fall of 1982, NCTCOG directors held a series of meetings with local police, fire, emergency response, health, and transportation officials regarding all facets of hazardous materials. Local representatives expressed a strong interest in developing a regionwide program addressing hazardous materials issues, including transportation.

Following the meetings with local governments a regional hazardous materials task force comprised of local staff members (one member appointed from each of the ten largest cities) was created. The purpose of this group was to assist NCTCOG in the development and implementation of a work program addressing hazardous materials management. The work program dealt with three subject areas: (1) Hazardous Wastes Storage, Treatment, and Disposal; (2) Hazardous Materials Transportation; and (3) Emergency Response to Hazardous Materials Incidents.

Section 2 of this work program, "Hazardous Materials Transportation," outlined a two-phase approach to addressing hazardous materials truck routing. Phase 1 of the approach was aimed at establishing a regional system of hazardous materials truck routes for "through shipments" of hazardous materials. Through shipments being defined as those not having origin or destination points within the Dallas-Fort Worth area. Phase 2 of this approach is the development of local routes within each jurisdiction. The local routes would be designated to serve those shipments with terminal locations in each city.

In the development of the work plan for this study, local officials emphasized the immediate need to develop a regional through-routing system which would be coordinated across all local jurisdictions. City representatives indicated that once a regional routing system was established, the local routes analysis could be completed on a case-by-case basis working in cooperation with local staffs. The through-region routes could then also be utilized as access/egress routes to local routes developed by each city.

CHAPTER II

DEVELOPMENT OF AN ANALYSIS METHOD

The initial task of this study was to develop an analysis method for evaluating alternative hazardous materials truck routes for shipments through the Dallas-Fort Worth area. An approach for analyzing and selecting hazardous truck routes based upon a risk assessment methodology is outlined in the Federal Highway Publication, "Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials," (hereafter referred to as FHWA Guidelines).[3] This document provided the basic framework for evaluating alternative highway routes for hazardous materials truck shipments.

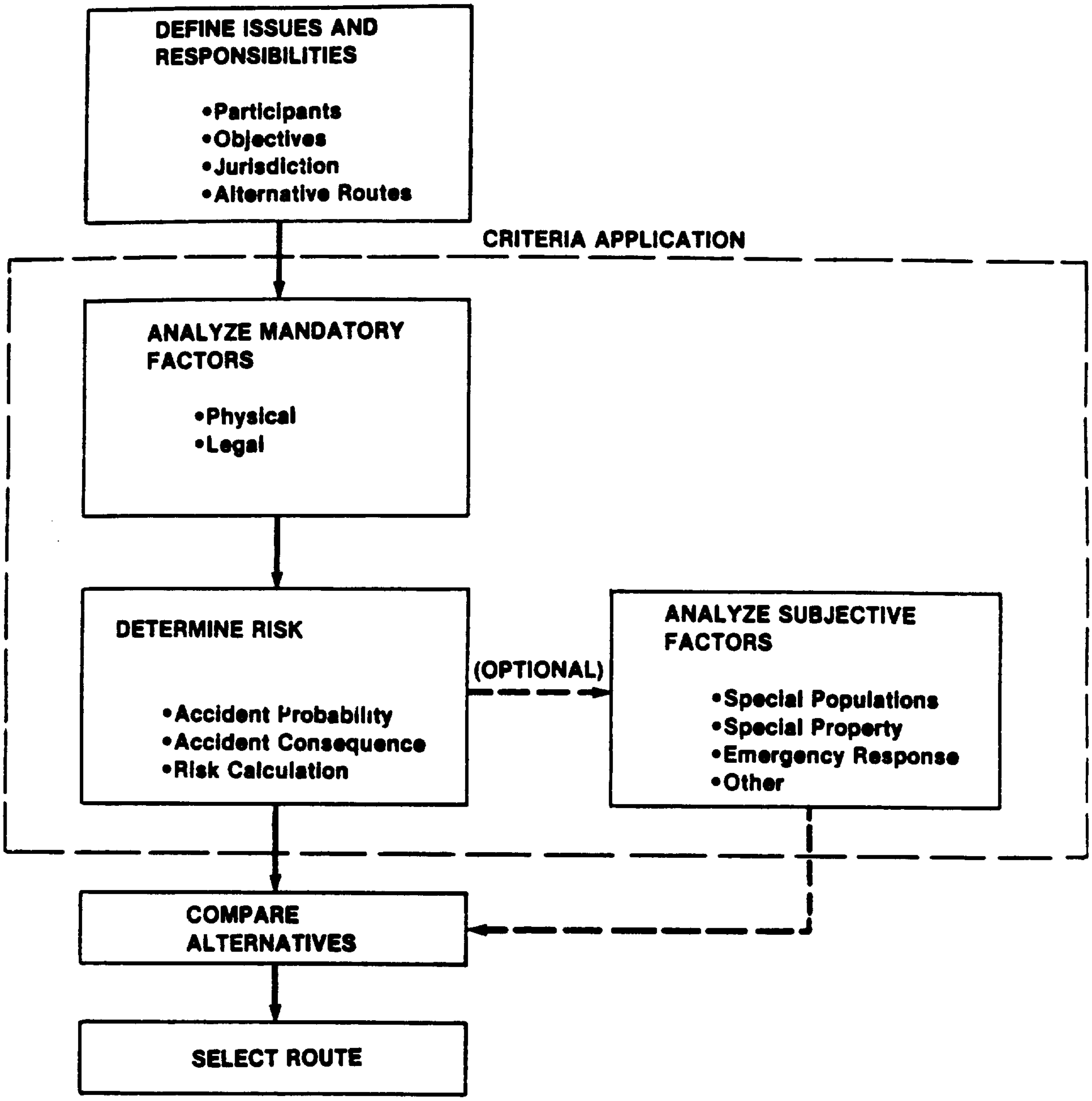
Figure 1 illustrates the hazardous materials routing method as outlined in the FHWA Guidelines. The first step in this procedure is to define study issues and responsibilities. These include the identification of participants, objectives, jurisdiction, and potential routes for the analysis. Each of these four areas were addressed in the development phase of this study along with the type of shipments to be considered and several planning assumptions.

Study Participants

NCTCOG was identified as the lead agency to conduct this analysis. Assistance was provided by the staffs of local cities in the region, the Texas State Department of Highways and Public Transportation (SDHPT) and the Federal Highway Administration (FHWA). In order to gain input from all levels of government and the trucking industry, a technical committee of 40 members was established to review the project at key points in the study. This committee was made up of local representatives from transportation planning and emergency response offices of major cities in the region, the SDHPT, the FHWA, the

FIGURE 1

FHWA HAZARDOUS MATERIALS ROUTING PROCEDURE



Source: FHWA-IP-80-15 Implementation Package Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials. U.S. Department of Transportation, Federal Highway Administration. Washington, D.C., November, 1980.

Dallas-Fort Worth Council of Safety Professionals, area trucking firms, trucking interest groups, and the previously established NCTCOG Hazardous Materials Task Force.

Objective

The objective of this study was to develop a system of regionally coordinated hazardous materials truck routes which would reduce the potential exposure of individuals to an accidental release of hazardous materials transported on public roadways through the Dallas-Fort Worth area.

Jurisdiction

The jurisdiction for this routing study was the Dallas-Fort Worth metropolitan area, which includes all of Dallas and Tarrant Counties and a small portion of the counties immediately adjacent to Dallas and Tarrant. This area corresponds to the Intensive Study Area (ISA), a geographic area designated by the Metropolitan Planning Organization and used for all regional transportation planning. Figure 2 is a map showing the 2,600 square mile study area boundary and major thoroughfare network.

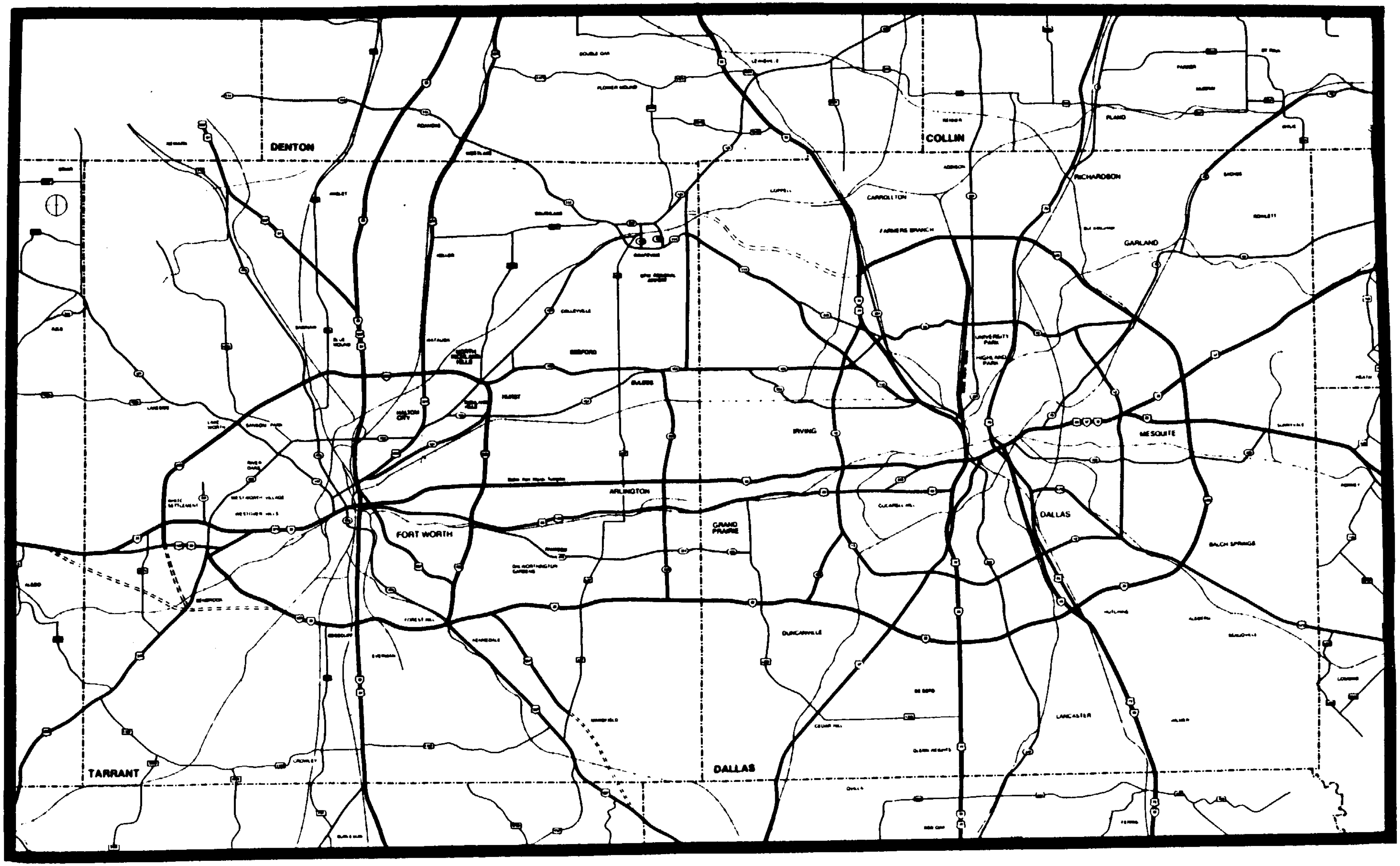
Planning Assumptions

Several assumptions were made with regard to the implementation of this risk assessment analysis. The first being that the designation of hazardous materials truck routes for shipments through the region was a regional issue and should be addressed from a regional perspective. In doing so, the recommendations of this study must serve to enhance the safety of the entire region and not that of a single interest group or community.

FIGURE 2

DALLAS-FORT WORTH REGION

HAZARDOUS MATERIALS ROUTING STUDY AREA



Secondly, this analysis assumed that an acceptable route or set of routes for all hazardous materials being transported in conformance with federal safety regulations could be designated through the region.

Finally, it was assumed that the risk assessment approach would identify those routes with the least amount of risk as defined by the FHWA Guidelines independent of information regarding the frequency, type, or volume of hazardous materials shipments traveling through the region.

Type of Shipment Considered

Clearly, various levels of risk can be associated with different quantities and types of shipments. However, in order to establish a uniform regional routing system, the decision was made that any vehicle transporting hazardous materials through the Dallas-Fort Worth area in sufficient quantity to require placarding as set forth by the U. S. DOT regulations would be subject to the through-region routes. This includes, but is not limited to, those shipments identified in Table 1 of the Code of Federal Regulations 49 Section 172.504. These are Class A Explosives, Class B Explosives, Poison A, Flammable Solid, and Radioactive Materials. Also included are all other hazardous materials found on Table 2 of CFR 49 Section 172.504 which requires placarding, including those materials transported in bulk-cargo tankers with a capacity of more than 110 gallons.

Alternative Routes

The identification of routes to be evaluated as alternatives in this analysis was completed in the initial phase of this study. Four criteria were established for designating this initial network:

1. All freeways (i.e., controlled access facilities) should be considered as potential through routes.
2. Potential through routes entering and exiting the metropolitan area should serve as direct paths to other major metropolitan areas or the interstate system and remain on controlled access facilities wherever possible.
3. Freeway-to-freeway travel movements, not served by direct ramp connections should be included.
4. Potential through routes should not include existing tollroad facilities and noncontiguous freeway facilities.

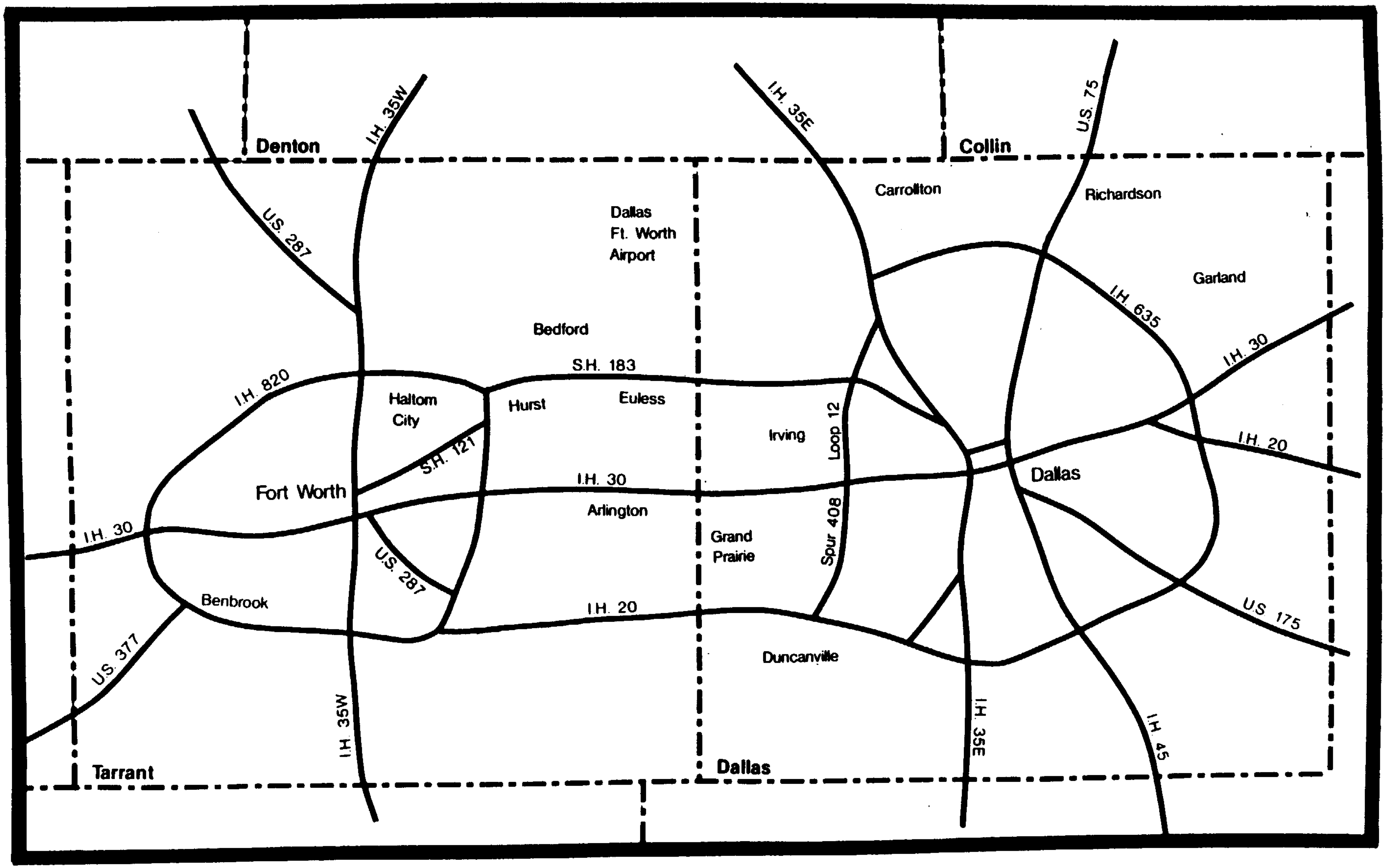
Figure 3 shows the network examined in this analysis.

Once the preliminary network was established, the criteria application phase as shown in Figure 1 began. An initial screening of the network was done to eliminate alternative routes based upon mandatory or nonreconcilable factors. These factors included any physical constraints such as weight limitations on bridges, height restrictions on overpasses, inadequate shoulders for breakdowns, and extensive construction. The majority of the network used for this study included interstate facilities or major freeway facilities built to interstate standards. None of the preliminary network was eliminated in the initial screening process based upon physical constraints.

Legal constraints such as regulations regarding bridges and tunnels were also reviewed for the network. While both the cities of Dallas and Fort Worth had established hazardous materials truck route ordinances as previously described, these regulations were not used to eliminate potential network alternatives. No other legal constraints were identified to eliminate any of the network.

FIGURE 3

PRELIMINARY HAZARDOUS MATERIALS NETWORK



CHAPTER III

RISK ASSESSMENT METHODOLOGY

Based upon FHWA Guidelines, the risk associated with hazardous materials shipments on a roadway segment may be calculated by estimating the probability of an accident occurring on that segment and the consequences of that accident should it occur. These two variables, accident probability and accident consequence, may then be combined to establish a total risk measure referred to as the "Population Risk." This numerical value is determined by multiplying the probability of an accident occurring by the potential consequence of that accident for each link segment in the network. By summing these link specific risk measures along each alternative route, a total risk value can be established for each route. The route with the lowest risk value may then be determined. The FHWA Guidelines suggest this value to be the primary criteria in the route selection process. The guidelines also note that these risk values are not particularly meaningful as absolute numbers; it is the relative difference in the risk values that are used to differentiate the routes. The following discussion summarizes the accident probability, consequence, and total risk calculations used in the risk assessment application to the Dallas-Fort Worth region.

Implementing the FHWA risk assessment method on a regional scale for the Dallas-Fort Worth area entailed the analysis of approximately 500 miles of freeways over a 2,600 square mile area. While the FHWA Guidelines provide the user with a set of worksheets for manually entering the data and performing the necessary calculations, it was determined at the outset of this study that manually performing this analysis on a regionwide scale would be extremely tedious and time consuming.

Additionally, much of the detailed freeway network and demographic information required to implement the FHWA risk assessment was in place and being used in the NCTCOG Multi-Modal Transportation Analysis Process (MTAP), a set of computer programs used for travel demand forecasting. Hence, in order to conduct this analysis on a more efficient basis and to reduce opportunities for human error in the detailed and repetitive calculations needed, the FHWA risk assessment approach was developed into a series of computer programs compatible with the regular travel demand modeling process.

Accident Probability

The probability of a hazardous materials accident is the likelihood or chance that a vehicle carrying hazardous materials will be involved in a roadway accident. The FHWA guidelines provide a formula for calculating accident rates for all vehicles operating on a freeway, based upon the facility type and average daily traffic. A constant value to adjust the all-vehicle accident probability to equal the accident probability of a vehicle transporting hazardous materials is also provided. These equations are recommended when data to derive local estimates are not available.

In this application to the Dallas-Fort Worth area, truck accident data was provided by the State Department of Highways and Public Transportation (SDHPT) for all the freeways in the region. The SDHPT data consisted of the total number of semi-tractor/trailer truck accidents for the years 1980, 1981, and 1982 summarized by one-half mile segments. For each study segment an annual total number of truck accidents was developed. This data was formulated into accident rates by combining the accident data with estimates of total annual traffic volume for the corresponding segment.

The accident rates are expressed as the total number of truck accidents per million vehicles (all vehicles). According to the FHWA Guidelines, the accident probability is determined by adjusting the accident rate to reflect the amount of exposure a vehicle experiences. Hence the accident rate for each segment was adjusted by the segment length to obtain an accident probability (accidents/vehicle mile) for each segment.

The accident probability formula is:

Probability of an Accident on Segment I = Annual Number of Truck Accidents$_I$/(Annual Number of Vehicles$_I$ * Link Length$_I$)

As illustrated in the following example, a freeway segment of .7 miles in length with an annual traffic estimate of 44,200,000 vehicles (130,000 vehicles per day x an annualization factor of 340), and twenty-six truck accidents per year has an accident rate of 0.5 accidents per million vehicles and a probability of 0.8 accidents per million vehicle miles.

R_I = (26 truck accidents/44,200,000 vehicles)

$R_I = .5 \times 10^{-6}$

P_I = 26 truck accidents/(44,200,000 vehicles x 0.7 miles)

$P_I = .8 \times 10^{-6}$ accidents/vehicle mile

P_I = .8 accidents per million vehicle miles

The accident probability values for each of the 2,800 link segments which determined the freeway network were then posted on the NCTCOG network link file for input into the risk calculation.

The FHWA Guidelines provide a factor to adjust all-vehicle accident probabilities to estimate the probability of a hazardous materials accident. This factor of 2.3×10^{-5} is based upon the national ratio of hazardous materials accidents to all-vehicle accidents for the years 1973 through 1978. This adjustment factor was not applied to the accident probabilities in the Dallas-Fort Worth study. Since the factor would have been applied uniformly across all potential routes, no additional detail would have been introduced to the study. In addition, no adjustment factor is provided by FHWA to adjust a truck accident rate. The purpose of using truck accident rates was to represent the relative risk of alternative routes based upon the historical frequency of all semi-tractor/trailer truck accidents.

Accident Consequence

According to FHWA Guidelines, the consequences of a hazardous materials accident/spill may be estimated for both exposure to population and property. For this application only exposure to population and employment were estimated in the consequence analysis. Data was not available on a regional scale to estimate potential property damage.

The potential impact area for a hazardous materials release will depend upon the class of hazardous material that is being considered. A review of available literature regarding hazardous materials impact areas and recommended evacuation distances revealed an impact range with a radius varying from one-quarter mile to over two miles depending on the material, severity of spill, and atmospheric conditions present at the time of the accident. Information regarding the types and quantities of hazardous materials being transported through the Dallas-Fort Worth region was not available. An analysis of annual wind direction and speed revealed significant seasonal variations. For these reasons a worst case exposure area was used for this analysis with an impact area radius of two miles. As recommended by the FHWA Guidelines, this distance was held constant throughout the study.

In order to estimate the potential consequences of a hazardous materials accident on the Dallas-Fort Worth freeway system a FORTRAN computer program was developed. The program, given the coordinates for each of the 2,800 link segments which made up the potential freeway routes, calculates the geographic impact area which falls within a two mile distance of each freeway segment. The program then determines the analysis zones which fall into a link impact area and sums the population and employment for those zones in the impact area of each link.

While the concept of estimating population and employment for each link segment is outlined in FHWA Guidelines, an important change was made in this risk assessment application regarding the calculation of the accident consequence.

In order to take into account the length of each link or route segment when estimating the impact area, the total population and the total employment found to be within an impact area of a link was multiplied by the length of the link segment. The resultant measures are expressed as population exposure miles and employment exposure miles. The use of this concept is similar to that used in calculating vehicle miles of travel in the accident probability equation in which the number of vehicles on a link are multiplied by the link length. The formula and computer program developed to calculate exposure miles was designed to estimate the value equally on link segments of varying length. This problem of analyzing alternative route segments which are of different length is not addressed in the FHWA Guidelines.

Once the total population exposure miles and total employment exposure miles were calculated for each link, the values were posted on the network file and used to estimate the total risk factor for each link segment.

<u>Risk Assessment Calculation</u>

The accident probability and the potential consequence measure for each link segment are multiplied together to produce a total risk factor. Summing across all network links produces a total risk value for each alternative route. In this study the total risk factor for each route segment was defined as:

$$\text{Total Risk}_I = \text{Accident Probability}_I \times \text{Sum of the Population and Employment Exposure Miles}_I$$

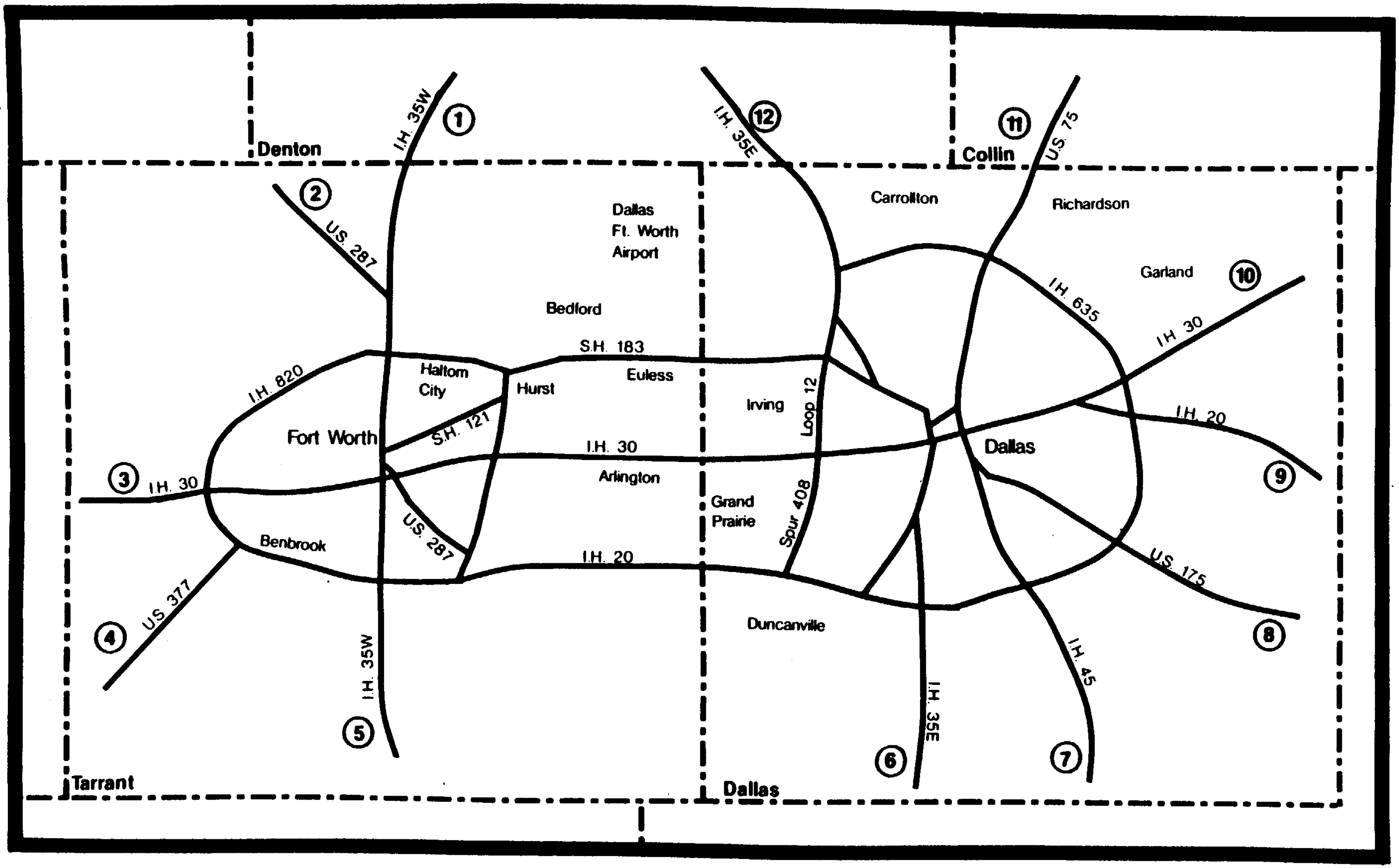
The total risk factor for each link segment was calculated in a computer program and posted on the network link file.

In order to identify those routes for hazardous materials shipments through the Dallas-Fort Worth area, a minimum risk path algorithm was developed. Twelve entry/exit points to the region were identified on interstate or state highways as shown in Figure 4. The freeway network designated as potential through routes was then read into a minimum risk path algorithm along with the accident probability, accident consequence, and total risk measure for each network link.

The minimum risk path algorithm was based upon using the NCTCOG-MTAP travel assignment program similar to the program UROAD used in FHWA/UMTA Urban Transportation Planning System (UTPS). This program is a path building program

FIGURE 4

FREEWAY NETWORK ENTRY/EXIT POINTS



Entry/Exit Point

based upon the minimum path impedance. When used for travel assignment the highway paths are selected based upon a combined minimum impedance of travel time, travel distance, and tolls.

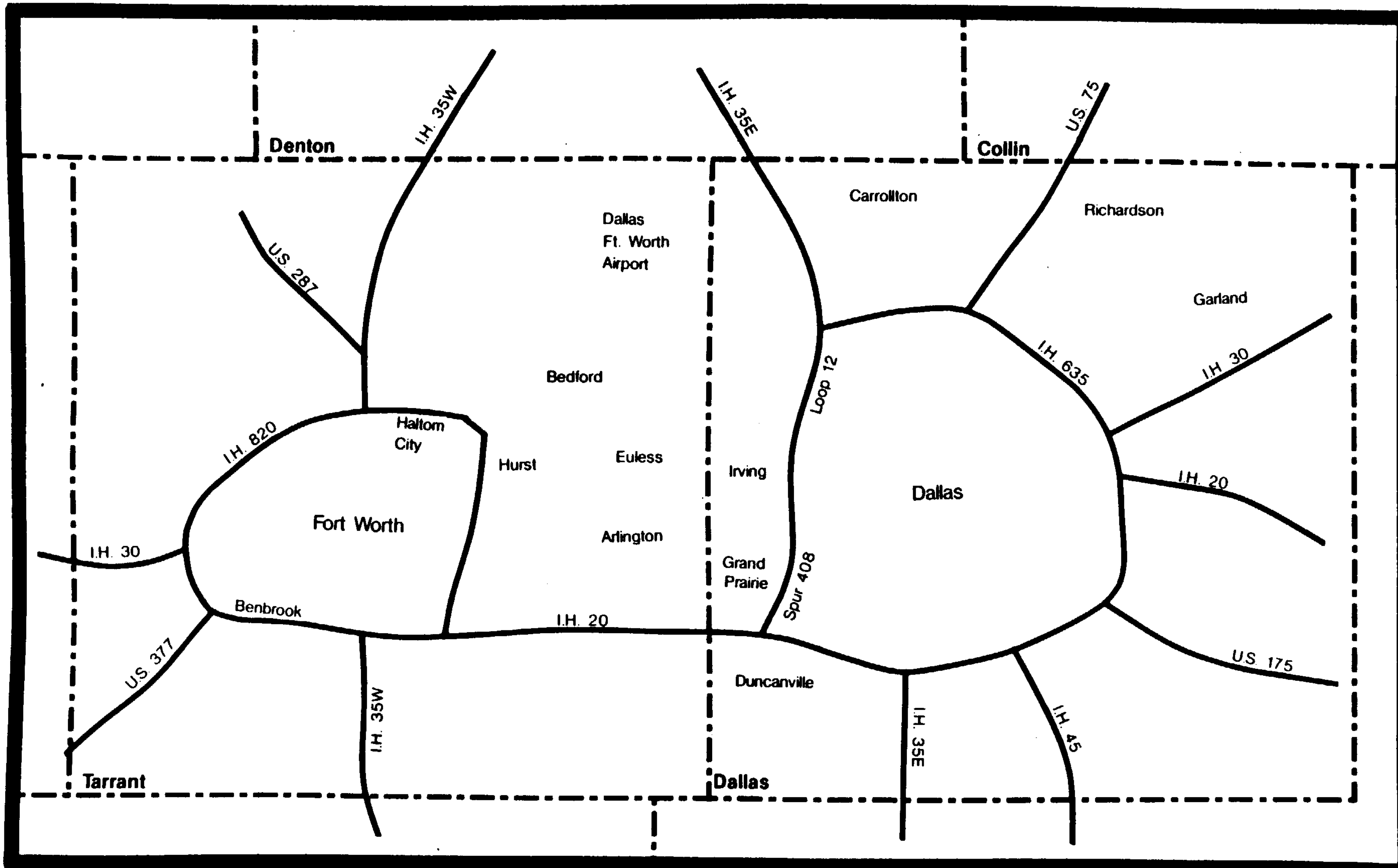
In order to use the path building approach to select the minimum risk routes, the time distance and toll impedance on each link used for travel assignment were replaced by the total risk factor for each link. The program then calculated the least risk paths from all entry/exit points to all entry/exit points based upon minimizing the total risk.

The routes which had the highest frequency of use when traveling between each of the twelve entry/exit paths would then represent the least risk paths. A significant concern of this approach was the possibility that a large variation of least risk paths would occur based on the origin entry/exit point and the destination entry/exit point. This would, in turn, make it difficult to establish a set of routes with any uniformity based upon this analysis.

The result of the minimum risk paths is shown in Figure 5. As shown, the minimum risk paths chosen were the outer-belt loops of I.H. 635, I.H. 35E, Loop 12, and Spur 408 in Dallas County, outer loop I.H. 820, I.H. 20 in Tarrant County, and I.H. 20 providing the east-west connection between loops. A summary of the frequency in which these routes were chosen revealed that out of the possible 132 paths selected from each of the 12 exit/entry points to all other entry/exit points, the routes shown in Figure 5 were chosen on 128 occurrences. In four instances, S.H. 183 between I.H. 35E and I.H. 820 was chosen.

FIGURE 5

MINIMUM RISK PATHS



In order to establish both the relative benefit of the least risk paths as opposed to not designating routes, and the potential amount of circuity a routing system would create for hazardous materials shipments as recommended by the FHWA Guidelines, a set of minimum distance routes were calculated.

The minimum distance routes, referred to as the Base Case analysis, were chosen as a means of measuring the impact of routes currently being used by trucks under no restrictions since data was not available regarding the relative frequency of hazardous materials shipments on specific freeways through the Dallas-Fort Worth region. Using the minimum distance routes as a comparison was based upon the assumption that hazardous materials carriers would elect to minimize their travel distance when traveling through the metropolitan area. In reality however, it is likely that shippers are more sensitive to travel time, traffic congestion, and safety as opposed to only minimizing travel distance. This would indicate a greater likelihood for hazardous materials shipments to use the interstate loops around Dallas and Fort Worth as shown in the least risks paths.

Figure 6 illustrates the minimum distance routes. As shown, the majority of the freeways are used when using the minimum distance routes between each entry and exit point. A summary of the risk assessment process comparing minimum risk routes to minimum travel distance routes is shown in Figure 7.

FIGURE 6
MINIMUM DISTANCE PATHS

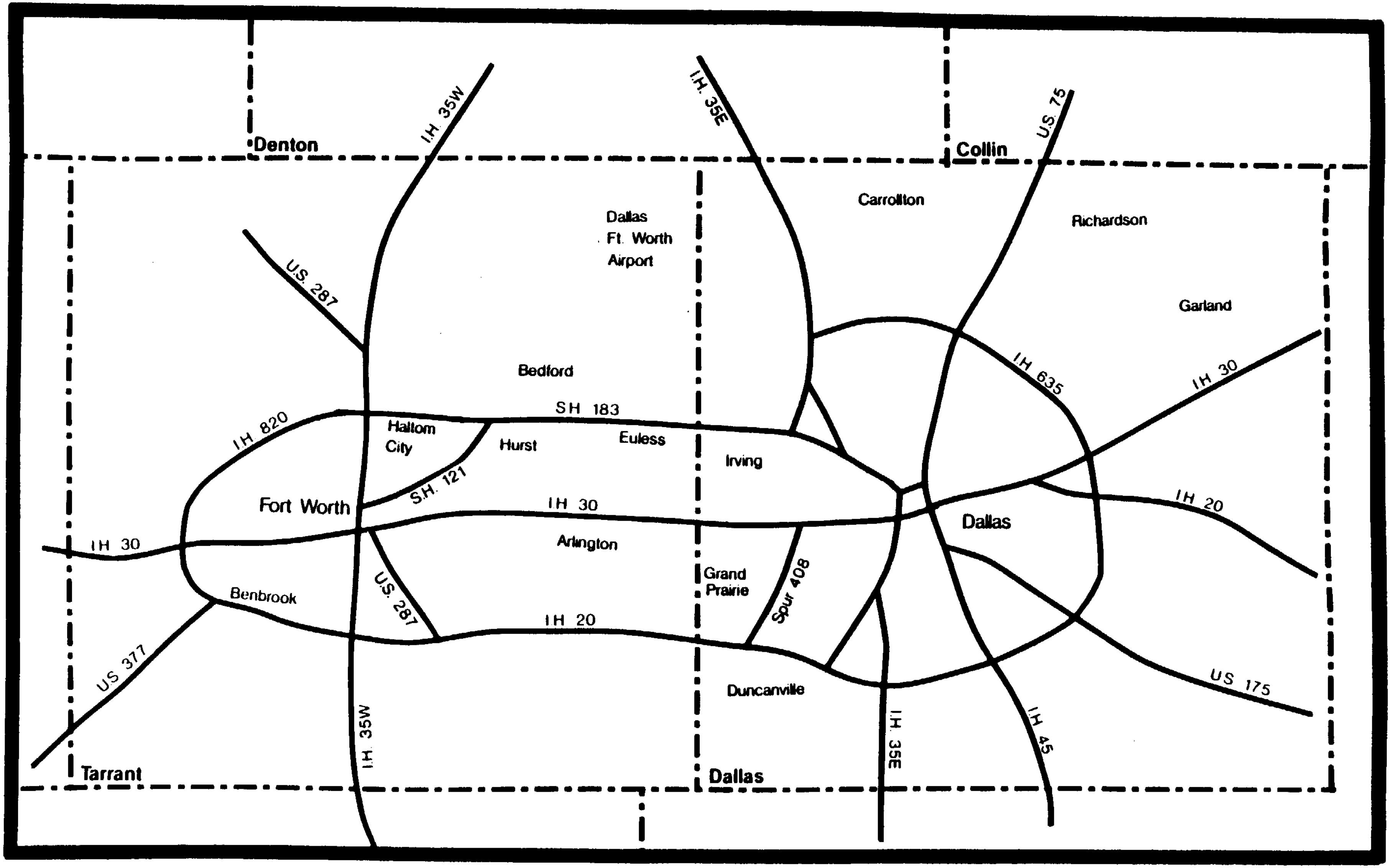
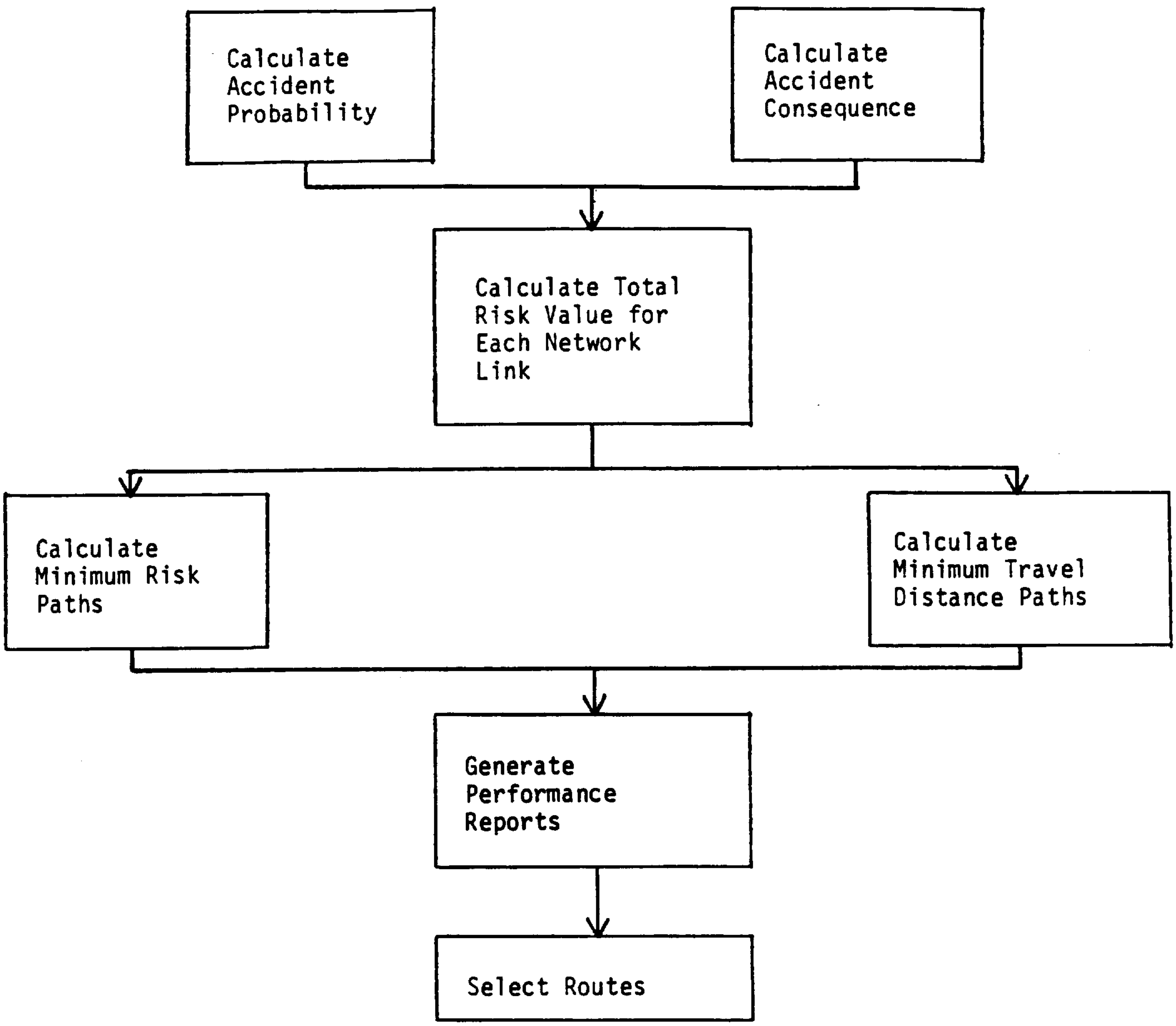


FIGURE 7

HAZARDOUS MATERIALS ROUTING RISK ASSESSMENT METHODOLOGY



CHAPTER IV

RESULTS OF RISK ASSESSMENT

Table 1 provides a summary of this risk assessment study comparing the results of the base case (minimum distance routes) and the minimum risk paths. As shown, the cummulative total risk of 42,884,000 experienced in the base case analysis is reduced by 62 percent when using the minimum risk routes.

A second means of measuring the benefit of the minimum risk routes was to sum the total population and employment exposed along the minimum risk routes versus the base case minimum distance paths as shown in Table 1. In the base case, over 72 percent of the region's population and over 86 percent of the region's employment fell into the two-mile exposure band along the minimum distance path. Implementing the minimum risk routes reduces the amount of population exposed by 47 percent and employment by over 80 percent.

The FHWA Guidelines recommend that a measure of circuity be estimated to represent a generalized measure of the added travel costs associated with selection of the minimum risk path.

Circuity is defined as the ratio of the minimum risk paths' length to length of minimum distance paths. For this application the sum of the minimum risk paths distance from each entry/exit point to all other entry/exit points was divided by the sum distance of the minimum distance paths. The result expressed in vehicle miles of travel shown in Table 1 indicates that utilization of minimum risk paths would increase circuity by 116 percent, meaning on the average shipments would be required to travel over twice as far. As was mentioned before, however, this assumes that truck shipments today are using the minimum

TABLE 1

SUMMARY OF RISK ASSESSMENT

Performance Measure	Base Case (Minimum Travel Distance)	Minimum Risk Routes	Percent Change
Total Risk	42,884,000	16,336,000	-61.9
Total Population Exposed	1,931,000	1,018,000	-47.3
Percent of Metropolitan Areas' Population Exposed	72%	38%	-47.3
Total Employment Exposed	1,197,000	231,000	-80.7
Percent of Metropolitan Areas' Employment Exposed	86%	17%	-80.7
Circuity (Vehicle Miles of Travel)	3,543	7,658	+116.1

distance paths as opposed to the more likely case of using outer-belt freeways to minimize travel time due to congestion effects, and to avoid the higher accident locations near the Dallas and Fort Worth central business districts.

The final measure considered in this analysis was to examine the ratio between the change in the total risk value (i.e., benefit) and the change in the amount of circuity (i.e., cost) added as a result of the minimum risk routes. The value as shown in Table 2 is greater than 1.0. This implies a positive benefit as a result of the minimum risk routes when the value of risk is assumed to be equal to that of circuity. Restating Table 2, the analysis showed that for a reduction of 2.625 units of risk, the additional amount of circuity or cost equaled 2.161.

The ideal measure for this comparison would be a cost/benefit analysis based upon dollar value. To do a cost/benefit analysis however, would require specific data regarding the frequency of hazardous materials shipments on each freeway facility. This information was not available for the study.

TABLE 2

COMPARISON OF RISK AND CIRCUITY CHANGES

Change in Total Risk*	2.625
Change in Circuity**	2.161
Benefit/Cost Ratio	1.21

* Total Risk of Minimum Distance Paths/Total Risk of Minimum Risk Paths

** Total Vehicle Miles of Travel of Minimum Risk Paths/Total Vehicle Miles of Travel of Minimum Distance Paths

CHAPTER V

SUBJECTIVE CRITERIA

As shown in Figure 1, the FHWA Guidelines provide for the optional application of subjective criteria to reflect those factors which are not quantified in the risk assessment. These factors may be applied to cases where no one single alternative is clearly superior to the others.

In this application to the Dallas-Fort Worth area, given the results of the risk assessment, there did not appear to be a need to examine subjective criteria in detail.

An initial exercise completed on the part of the technical review committee was to rate those criteria, many of which fell into the category of subjective factors, which they determined to be important in establishing hazardous material truck routes. Those rated highly, including exposure to population and employment, were emergency vehicle access, proximity to population with special evacuation needs, and proximity to municipal water supplies. Traffic congestion, proximity to environmentally sensitive areas, and exposure to special activity centers also were rated.

While no attempt was made to weigh or quantify these additional factors into the risk assessment, a number of overlay maps were used to examine the location of all fire stations, hospitals, schools, shopping centers, and water supply reservoirs in the region. The results of this process indicated that the majority of routes through the region fell into areas served by various municipal fire departments. Each of the alternative routes impacted numerous hospitals, schools, and activity centers.

At a regional level it was therefore determined that exposure to population and employment served as the appropriate measure for these factors. However, it was noted that should a set of regional routes be established, it will be essential for local municipalities to address the need for additional emergency response capabilities and risk prevention measures as each of these factors relate to recommended routes.

CHAPTER VI

PLAN ENDORSEMENT

In January of 1984 the results of the risk assessment study were presented to the review committee established for this study. The technical review committee supported the use of the minimum risk routes as the through-region routing plan. Clearly, the risk assessment analysis supported previous actions by the cities of Dallas and Fort Worth to establish the outer freeway loops as through routes for hazardous materials shipments. The designation of I.H. 20 connecting the two outer loops and serving as the major east/west corridor received support from the committee, not only because of its lower risk value but also due to lower traffic volumes and lack of congestion. No attempt was made to further evaluate the freeway segments outside of the interstate loops to the boundary of the study area as these segments are needed for access to the region.

At the outset of this study considerable concerns were recognized regarding the impact of designating the outer freeway loops on the suburban communities surrounding both the cities of Dallas and Fort Worth. All of the suburban communities who took part in the study review process agreed with study findings. Many of the suburban representatives commented that while they were concerned from an emergency response standpoint about the presence of the route through or adjacent to their community, they recognized that a route must be provided. Finally it was recognized that by designating the routes, we have reached a point of knowing where the shipments should be and can begin assessing emergency response capabilities and risk reduction measures needed along each route.

Following approval of the minimum risk routes by the technical committees the study results and proposed routing plan were presented to and approved by the NCTCOG Hazardous Materials Task Force, the NCTCOG Executive Board, and the Regional Transportation Council. Copies of NCTCOG Executive Board resolution and minutes of the February 7 RTC meeting supporting establishment of the Regional Routing Plan are provided in Appendix A.

The results of this study were submitted to the Texas State Department of Highways and Public Transportation and the Federal Highway Administration. Once their approval is received, implementation of the regional routing system by the local governments in cooperation with the SDHPT and FHWA is expected.

CHAPTER VII

CONCLUSION

The safe transport of hazardous materials requires a coordinated approach by all levels of government, local, state, and federal, as well as involvement on the part of shippers and transporters. In this application each of these parties were essential in formulating the risk assessment approach and developing a regionwide routing system.

This study provided a systematic means of comparing alternative routes for hazardous shipments through the Dallas-Fort Worth area and resulted in the selection of routes based upon minimizing the potential risk. The FHWA Guidelines provided the basic framework for completing this analysis with several modifications required for the local application.

A significant amount of effort is still needed to implement this routing plan. Implementation of this plan will require a uniform set of guidelines for signing and enforcement. NCTCOG recently completed a Hazardous Materials Emergency Response Directory which provides a summary of each local municipalitie's capabilities for responding to a hazardous materials incident. The individual cities and the region should examine the additional need for emergency response capabilities in light of the routing plan.[4]

Finally, the interaction brought about between the various levels of governments, the trucking industry, and project staff provided an open forum for discussion of many of the complicated yet related issues regarding hazardous materials transportation. Designating routes for hazardous materials shipments is only one means of reducing the potential risk. Clearly, programs involving vehicle inspection and maintenance, vehicle operator training and licensing, and upgraded emergency response capabilities should be pursued to reduce the risk and improve public safety.

APPENDIX A

ENDORSEMENT OF THE HAZARDOUS MATERIALS REGIONAL THROUGH-ROUTING PLAN

- Regional Transportation Council
- NCTCOG Executive Board

Regional
Transportation
Council
P.O. Box 5888 • Arlington, Texas 76005-5888

FROM: Gordon A. Shunk
Director of Transportation and Energy

DATE: January 31, 1984

TO: The Regional Transportation Council

SUBJECT: Hazardous Materials Truck Routing Plan

NCTCOG staff in cooperation with local, state and federal officials have recently completed an analysis of hazardous materials truck routes for the Dallas-Fort Worth metropolitan area. This work completes the first phase of a two-part study of hazardous materials transportation. Phase One identified regional truck routes for shipment of hazardous materials through the Dallas-Fort Worth area. Phase Two of this study will design a strategy for selecting local truck routes for hazardous materials shipments. This study was funded by the Federal Highway Administration.

In January 1984, NCTCOG staff presented the results of the Phase One through-routing analysis to representatives from area cities, the State Department of Highways and Public Transportation, the Federal Highway Administration, the Dallas-Fort Worth Safety Council, the Texas Motor Transport Association, and area trucking firms. The proposed routing plan has also received endorsement by the NCTCOG Hazardous Materials Task Force and the NCTCOG Executive Board.

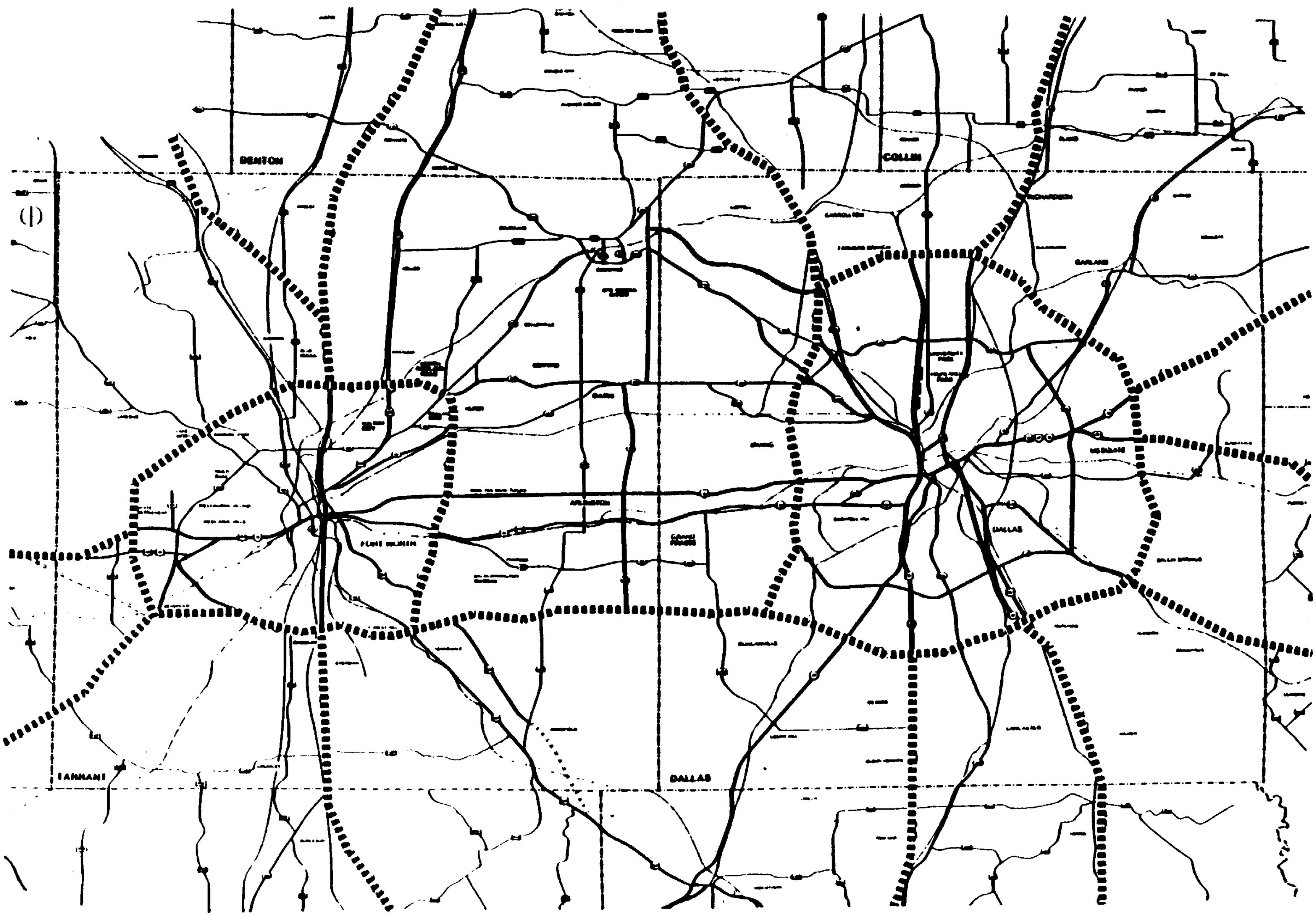
The routing analysis is based on investigation of the location of truck accidents over the past several years and calculations of the number of individuals (population and employment) who could potentially be exposed should an accident result in the release of a hazardous material.

The results of this analysis indicate that the outer Interstate loops, (I.H. 635 in Dallas and I.H. 820 in Fort Worth) and I.H. 20 between Dallas and Fort Worth are the routes through the region with the least amount of risk. Findings show that only about 38 percent of the region's population and about 17 percent of the area's employment would potentially be exposed if these routes are used. On the following page is a map showing the routes recommended in the Hazardous Materials Routing Plan which will be submitted to the Federal Highway Administration. Pending federal approval NCTCOG staff will begin working with local governments to develop a model ordinance for use in implementing this plan.

The Regional Transportation Council is requested to approve this through-routing plan shown on the attached map.

va
Attachment

HAZARDOUS MATERIALS TRUCK ROUTING PLAN



Extracted from the February 7, 1985 Meeting Minutes of the Regional Transportation Council.

ITEM 1

MINUTES

REGIONAL TRANSPORTATION COUNCIL
February 7, 1984

2. Approval of Hazardous Materials Truck Routing Plan. NCTCOG staff, in cooperation with local, state and federal officials, has completed an analysis of hazardous materials truck routes for the Dallas-Fort Worth area. Dan Kessler provided a summary of the risk assessment approach used in the analysis, described the resultant routing plan, and summarized the impact of the selected routes. The recommended routes, for through-shipments only, are the outer Interstate loops (I.H. 635 in Dallas and I.H. 820 in Fort Worth) and I.H. 20 between the two cities. If these routes are used, the percent of population exposed to hazardous materials shipments would decrease from 72% to 38%, and employment exposure would decrease from 86% to 17%. Local truck routes will be handled in the second analysis phase. Since nuclear materials are excluded from this plan, Mr. Skaggs asked to see the nuclear routes in this area. The plan has received endorsement from the NCTCOG Hazardous Materials Task Force and the NCTCOG Executive Board. Endorsement of the Hazardous Materials Truck Routing Plan as a component of the Regional Transportation Plan was unanimous; Olin Jaye (M); Leo Berman (S).

RESOLUTION ENDORSING HAZARDOUS MATERIALS
TRUCK ROUTING PLAN

WHEREAS, the North Central Texas Council of Governments is authorized by law to conduct such coordinating and technical studies as may be required to guide the unified development of the area, eliminate duplication, and promote economy and efficiency through areawide planning; and,

WHEREAS, the State Department of Highways and Public Transportation has provided funding to NCTCOG for the development of a regional truck routing plan for through movements of hazardous materials; and,

WHEREAS, NCTCOG staff has conducted this analysis in cooperation with local, state and federal representatives; and,

WHEREAS, the routes designated by the truck routing plan represent those routes with the least amount of risk for transporting hazardous materials through this region as defined by the study; and,

WHEREAS, final approval of this plan is needed by the Federal Highway Administration;

NOW, THEREFORE, BE IT HEREBY RESOLVED:

<u>Section 1.</u> That the NCTCOG Executive Board endorses the Hazardous Materials Routing Plan subject to approval by the Federal Highway Administration.

<u>Section 2.</u> That the NCTCOG Executive Board encourages local governments to adopt the plan and pursue the development of local ordinances for its implementation.

<u>Section 3.</u> That this motion shall be in effect immediately upon adoption.

Foster Parsell

Foster Parsell, President
North Central Texas Council of Governments
Councilmember, City of Hurst

I hereby certify that this resolution was adopted by the Executive Board of the North Central Texas Council of Governments on January 26, 1984.

Jerry D. Rucker

Jerry Rucker, Secretary-Treasurer
North Central Texas Council of Governments
Councilmember, City of Dallas

REFERENCES

1 North Central Texas Council of Governments. Rail Planning Program for the North Central Texas Region, Arlington, Texas, March 1980.

2 North Central Texas Council of Governments. Regional Industrial Waste Management Study, Arlington, Texas, December 1980.

3 U. S. Department of Transportation, Federal Highway Administration. Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials, FHWA-IP-80-15, Washington, D.C., November 1980.

4 North Central Texas Council of Governments. Hazardous Materials Emergency Response Directory of North Central Texas, Arlington, Texas, April 1985.

Acknowledgements

Financial support for this project was provided by the Texas State Department of Highways and Public Transportation in conjunction with the Federal Highway Administration of the U. S. Department of Transportation. The North Central Texas Council of Governments is appreciative to local, state, and federal government officials and representatives from the trucking industry for their guidance and support in this effort.

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