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16. Abstract This manual was developed as part of a project funded by the Texas Department of Transportation (TxDOT) to implement methods of improving transportation planning techniques and is based on research conducted in a previous project to examine methods of improving transportation planning techniques. Within these research projects, the need to develop a set of simplified procedures for developing the input data for travel demand forecasting that can be used by small area Metropolitan Planning Organizations (MPOs) was identified. Many MPOs under 200,000 in population do not have the staff or financial resources necessary to develop the variables using traditional models or methods. A step-by-step process was developed to guide small MPOs in the development of the base year and forecast year population, employment, household and income data needed to run TRIPCALS, the trip generation model used by TxDOT in preparing the travel demand forecasts. Data sources as well as a recommended growth allocation process are included.					
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**PROCEDURES FOR ESTIMATING DEMOGRAPHIC
DATA FOR TRIPCAL5**

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IMPLEMENTATION STATEMENT

The process presented in this report is intended for use by urban areas with populations of 200,000 persons or less. It is designed to be performed by the MPO or city staff and to require little or no assistance from outside agencies.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the Texas Department of Transportation. This report does not constitute a standard, specification or regulation. Additionally, this report is not intended for construction, bidding, or permit purposes. George B. Dresser, Ph.D., was the Principal Investigator for the project.

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SUMMARY

For most urban areas within Texas, travel demand forecasts are prepared by the Transportation Planning and Programming Division of the Texas Department of Transportation (TxDOT) using the Texas Travel Demand Package. The Texas Package consists of three mainframe computer models for trip generation, trip distribution, and traffic assignment. Trip generation, the first step in this process, develops estimates of the number of trip ends for each of the specified trip purposes that will be made in an area for a typical day. These estimates are computed based on different socioeconomic characteristics of the households or the activities located within each traffic analysis zone. Within the Texas Package, trip generation is performed by TRIPCAL5, a flexible trip generation program which can estimate trip productions and attractions for up to ten trip purposes and 9,999 traffic survey zones.

The programs within TRIPCAL5 are designed to use the socioeconomic data normally used in trip generation. The trip production models use estimates of the number of households stratified by household size, household income, and auto ownership for each zone. Trip attraction models employ estimates of each zone's employment stratified by employment type and area type. These data requirements represent the most detailed level anticipated for use in TRIPCAL5. Options are available in the program which require less detailed data (2). The specific data elements that are recommended be developed for running TRIPCAL5 for each traffic analysis zone include population, number of households, median household income, and number of employees in the basic, service, and retail categories.

This report provides guidelines on procedures to develop the base year and forecast year data necessary for producing reasonable estimates of future travel within small urban areas in Texas. The procedures outlined within this report were developed taking into consideration the number and experience level of staff at small MPOs across the state. Included are procedures for estimating base year population, employment and median household income, procedures for projecting population, employment and median household income for a specified forecast year, as well as a process for allocating the forecast year population and employment to traffic analysis zones.

I. INTRODUCTION

Travel demand modeling typically involves a four-step process that includes trip generation, trip distribution, mode split, and assignment. This process produces estimates of travel for existing and proposed transportation facilities and modes. For most urban areas within Texas, travel demand forecasts are prepared by the Transportation Planning and Programming Division of the Texas Department of Transportation (TxDOT) using the Texas Travel Demand Package. The Texas Package consists of three mainframe computer models for trip generation, trip distribution, and traffic assignment (see Figure 1) (1). A mode choice model is currently under development.

Trip generation, the first step in this process, develops estimates of the number of trip ends for each of the specified trip purposes that will be made in an area for a typical day. These estimates are computed based on different socioeconomic characteristics of the households or the activities located within each traffic analysis zone. Within the Texas Package, trip generation is performed by TRIPCAL5, a flexible trip generation program which can estimate trip productions and attractions for multiple trip purposes.

This manual presents recommended procedures for developing the population, employment, household, and income data that are needed to run TRIPCAL5. It was developed for Metropolitan Planning Organizations (MPOs) of small and medium sized urban areas in Texas (generally 50,000 to 200,000 in population) which have limited staff and experience; this manual provides a step-by-step guide to preparing the data needed to forecast future travel using the Texas Travel Demand Package.

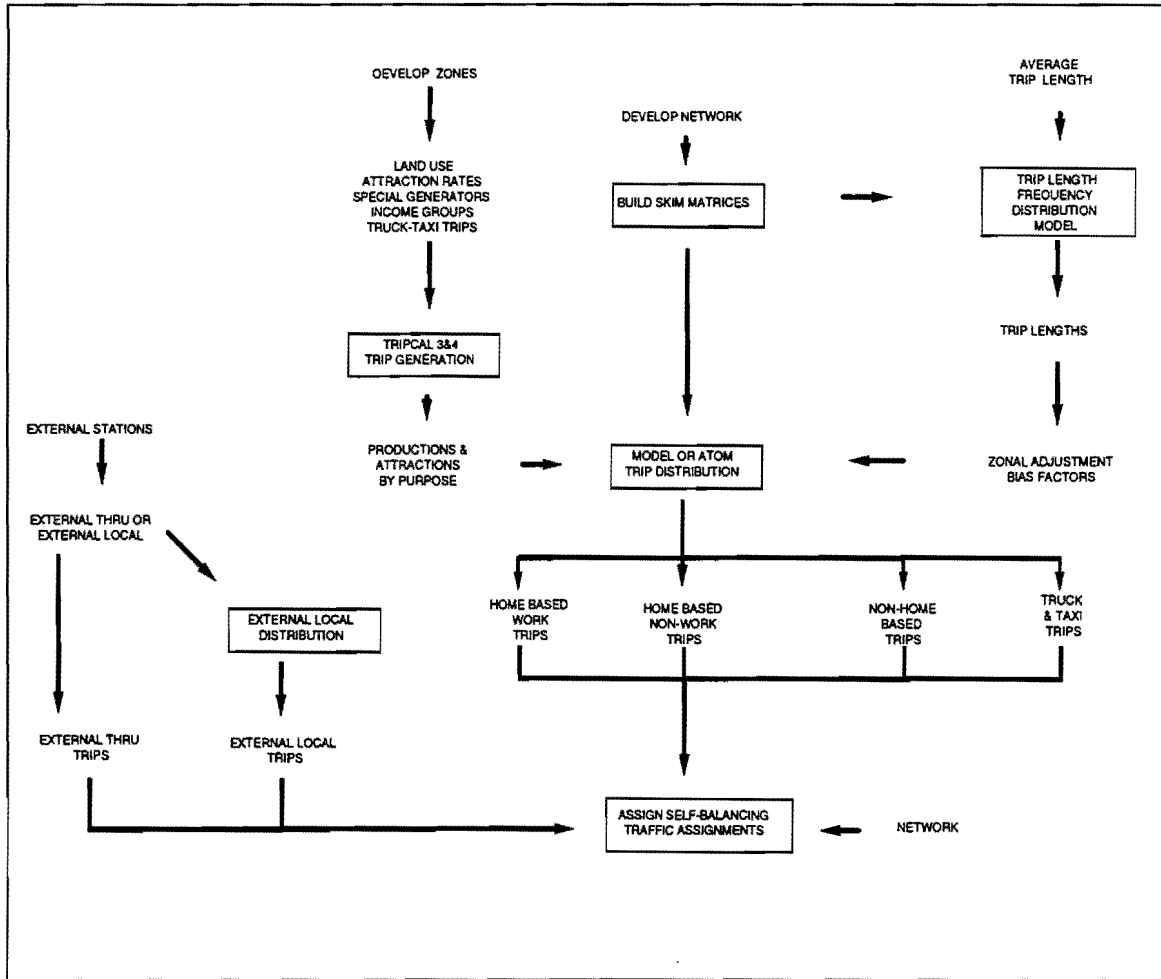


Figure 1. Texas Travel Demand Package Process (1)

II. REVIEW OF TRIP GENERATION DATA REQUIREMENTS

The demand for transportation is created by the separation and intensity of urban activities. Inventories and forecasts of land use, population, and employment provide information on the existing and anticipated future location of households, businesses, and other activities. These data include the intensity of activity in an area such as the number of households, number of employees, and data relative to income levels and household size. This information is used as input into the trip generation phase of travel demand forecasting.

The transportation planning process relies heavily on regional computer travel demand forecasting performed by TxDOT for each urbanized area (except Houston and Dallas-Fort Worth) within the state using the Texas Travel Demand Package. The output of these forecasts is used to develop the information needed to evaluate the effects that known and projected changes in population, employment, land use, and other socioeconomic conditions may have on the travel demand on the urban area's major roadway and transit systems. The travel forecasts output prepared for system planning is used by TxDOT, the MPOs, and local governments to develop and/or update the transportation plan, to program projects for additional study, and to rank transportation improvements in order of priority in the Transportation Improvement Program. Thus, the information developed in a system forecast ultimately guides the expenditure of state, local, and federal transportation funds.

Regional forecast accuracy depends on the accuracy of the various data used in calibrating the models, the validation process, and the forecasts of urban activity (population, dwelling units, employment, land use, etc.) used as input to the models. Variances in the actual individual household trip-making characteristics from those developed from the travel survey; variances between the base-year traffic counts and actual average weekday link traffic; and, miscalculation or unforeseen changes in the predicted population, employment, income, or land use of an area can all impact the accuracy of the travel demand forecast. Much of the congestion being experienced in major Texas cities is the result of the unforeseen, and thus, not forecast, growth in population and employment. Underestimating the growth of these cities has resulted in increased user costs in terms of delay; increased maintenance costs; increased construction and reconstruction costs due to right-of-way and traffic maintenance costs; increased social costs due to air quality degradation; and, noise, energy and overall quality of life impacts. Conversely, forecasts that predict too much growth or the wrong location for growth may result in the inefficient use of scarce funding.

TRIPCAL5 DATA REQUIREMENTS

TRIPCAL5 is a multifunctional program which estimates trip productions and attractions for up to ten trip purposes and 9,999 traffic survey zones. This program includes features which allow for user-specified data or default models for the disaggregation of data at the zone level. Program options include trip production models, trip attraction models, disaggregation models, multiple trip purposes, and user-selected data inputs.

Three trip production models are included in TRIPCAL5:

- A two-way cross-classification model which allows trip rates stratified for up to six categories for each independent variable.
- A three-way cross-classification model which allows trip rates to be stratified for up to six categories for two of the independent variables and up to four categories for the third independent variable.
- A linear regression model with up to six independent variables.

The recommended trip production model is a two-way cross-classification model with person trips (or auto-driver trips) per household cross-classified by up to six row categories and up to six column categories. Although the program is developed to allow the user to input any independent variables for the cross-classification model, the recommended independent variables are median household income and household size.

Five models are available to estimate trip attractions:

- A two-way cross-classification model may be selected and attraction trip rates stratified for up to six categories for each independent variable.
- A three-way cross-classification model with trip rate stratified for up to six categories for two of the independent variables and up to four categories of the third independent variable.
- A cross-classification/regression model with trip rates stratified for up to 24 generation areas by households and employment type.
- A linear regression model with up to six independent variable.
- A two-tier regression model with six independent variables.

The regression type cross-classification model is recommended for trip attraction for each trip purpose stratified for up to 24 generation areas. The recommended independent variables are employment and households, and the trip rates are developed from a workplace survey.

The programs within TRIPCAL5 are designed to use the socioeconomic data normally used in trip generation. The trip production models use estimates of the number of households stratified by household size, household income, and auto ownership for each zone. Trip attraction models employ estimates of each zone's employment stratified by employment type and area type. These data requirements represent the most detailed level anticipated for use in TRIPCAL5. Options are available in the program which require less detailed data(2). The specific data elements that are recommended to be developed for running TRIPCAL5 for each traffic serial zone include population, number of households, median household income, and number of employees in the basic, service, and retail categories. This report provides guidelines on procedures to develop the base year and forecast year data necessary for producing reasonable estimates of future travel within small urban areas in Texas. The procedures outlined within this report were developed taking into consideration the number and experience level of staff at small MPOs across the state.

HOW TO USE THIS MANUAL

The first section of this guide, Data Sources, presents a brief description of the data sources recommended for use in the procedure for developing the inputs for TRIPCAL5. Where possible, suggestions on how to obtain each of the data sources are included. The section, Process for Data Development, includes an overview of the major steps involved and helpful suggestions for getting started, followed by a step-by-step description of the recommended methods for developing the base year and forecast year data. Finally, the third section provides information on the recommended process for allocating the projected population and employment growth to the traffic analysis zone level. For additional information on using Delphi for growth allocation, see the referenced source.

III. DATA SOURCES

This section presents a discussion of the recommended sources of data for use in preparing the travel demand inputs. The sources are organized according to the suggested use (base year or forecast year) and type of data available. A general description of the data, the source, and how to obtain the information is included.

POPULATION DATA

The U.S. *1990 Census Transportation Planning Package (CTPP)* provides 1990 data at the traffic analysis zone level for population, number of households, number of employees in the basic, retail and service categories, and 1989 data for median income. These data can be used to develop the base year information needed to validate the travel demand models for each urban area. A software program is needed to put the CTPP information into a readable format.

CTPP data are available through a number of sources:

- TxDOT has purchased the CTPP for all urban areas within the state.
- CDs and/or tapes of the data are also available from the Bureau of Transportation Statistics (BTS). A software program to format the CTPP is available from BTS.

The *State Data Center* (409-845-5115) located at Texas A&M University is responsible for producing the official state estimates and forecasts of population. Population estimates are prepared for cities and counties annually for the previous year (i.e., 1994 estimates of population are available in 1995) using symptomatic indicators such as school enrollment, water connections, telephone connections, and new home construction and demolitions collected each year from the cities, counties and school districts. These estimates are checked using a cohort survival technique. The estimates are for total population with no stratification.

The State Data Center at Texas A&M also produces population projections for counties every other year in 5-year increments for approximately 40 years beyond the current year. Three different scenarios of future population representing a baseline and high and low growth are prepared. Projections are made using cohort survival with special populations such as prisons and universities taken into account. Projections are stratified by age, sex, and race/ethnicity. The fertility, mortality, and migration rates for each county are also available.

The *Texas State Comptroller's Office* provides population projections for counties by total population and by the race categories of white, black, hispanic and other. Data are available in one-year increments for years 1990 through 2030. Data can be obtained via the electronic bulletin board and/or the Internet (see Base Year Employment Data).

EMPLOYMENT DATA

The *Texas State Comptroller's Office* makes available recent past and current employment totals for Metropolitan Statistical Areas (MSAs) and the state's ten designated economic regions (a description of the counties included within each MSA and within each of the ten regions is found in Appendix A). The data are available in totals and subtotals by the major industrial sectors of manufacturing, mining, construction, transportation/ communication/ utilities, trade, finance/insurance/real estate, services and government. These figures are annualized employment figures based on monthly estimates for MSAs and quarterly surveys for the economic regions. Current year totals are annualized based on monthly data available. All figures are originally reported from the Texas Employment Commission. The data may be obtained by calling the Comptroller's electronic bulletin board (1-800-227-8392) or through the Internet at <http://www.window.state.tx.us> and through Telnet at window.texas.gov. Files may be downloaded directly from these sources (3).

The U.S. Bureau of Census publishes annual employment figures in *County Business Patterns*. It is prepared using administrative reports and supplementary surveys and is available from the Department of Commerce, Bureau of the Census.

The *Texas Almanac* publishes historic basic, service, and retail employment for Texas Counties. These figures are from the Texas Employment Commission.

The *Bureau of Economic Analysis*, U.S. Department of Commerce, produces projections of employment and income for the United States for 40 years into the future using population projections developed by the Census Bureau and the gross national product (GNP). Projections are allocated to states and to MSAs within each state. These projections are updated every 5 years.

IV. PROCESS FOR DATA DEVELOPMENT

The overall process for developing the data needed as inputs to TRIPCALS generally includes three basic steps:

1. Preparation of base year estimates of population, number of households, average household size, median household income and employment at the urban area, district and zone levels.
2. Preparation of 10-year and 20-year future projections of population, number of households, household size, median household income and employment for the urban area.
3. Allocation of the forecast year area projections to the district and zone levels.

Recommended procedures for developing the input data for the base year and forecast years and for allocating the forecast data to the zone level are discussed in later sections of the report.

DEFINITIONS

In order to ensure understanding of the data needed and the suggested data development process, a number of the terms used throughout this guide are defined for clarity and convenience:

Population - Total population is the total number of persons living either within a specified geographic area such as the county, the urban area, or traffic analysis zone.

Household - In general, *household* refers to persons living in a single dwelling unit. Thus, the number of households would be the number of occupied dwelling units, including houses, individual apartments, and/or duplex units and mobile homes.

Average Household Size - The average number of persons living in a single dwelling unit within a specified geographic region.

Traffic Analysis Zone (also called Traffic Survey Zone or Traffic Serial Zone) - Geographic units that correspond to census tracts or block groups and are used in travel demand modeling.

District or Sector - A geographic area comprised of a group of traffic analysis zones. For most urban areas these districts have been defined for previous forecasts.

Urban area - That area determined by agreement between the MPO and the Governor as the urban area within which the transportation planning process must be performed.

SIC Code - The standard industrial classification code representing the specific types of industrial sectors used in economic and employment forecasts. Table 1 provides the SIC code ranges by industry, industry group, and basic, retail, and service categories.

**Table 1
SIC Codes by Industry and Industry Group**

SIC Range	Industry	Industry Group	Basic/Retail/Service
1-999	Agriculture	Not Used	Not Used
1000-1499	Mining	Manufacturing/Mining	Basic
1500-1799	Construction	Construction	Basic
2000-3999	Manufacturing	Manufacturing/Mining	Basic
4000-4999	TCPU	WTCPU	Basic
5000-5199	Wholesale Trade	WTCPU	Basic
5200-5999	Retail Trade		Retail
6000-6799	FIRE	FIRE/Services	Service
7000-8199	Services	FIRE/Services	Service
8200-8299	Educational Services	Government/Education	Service
8300-8999	Services	FIRE/Services	Service
9000-9799	Government	Government/Education	Service

Special Generators - Land use activities that are considered to be unique and are handled individually in the modeling process. Special generators typically include colleges and universities, military bases, hospitals, amusement parks, airports, regional shopping centers, and other unique activities identified for a particular area.

Median Household Income - The income amount at which 50 percent of the households within a specified geographic area are above and 50 percent of the households are below.

GETTING STARTED

Prior to initiating the data development process several tasks should be completed that will facilitate the data preparation. First, each urban area should work with the Transportation Planning and Programming Division of TxDOT to establish the base year and the 10- and 20-year future forecast years for the model run. Generally, the base year will be either the current, previous or next calendar year. Forecast years may be exactly ten and 20 years beyond the base year or may represent selected years slightly more or less than ten and 20 years in the future.

Base maps of the urban area traffic analysis zones and districts or sectors (districts are geographic areas that represent aggregations of traffic analysis zones) should be prepared as well as a zone/district equivalence table. This table provides a list the zones that are included within each district. Additionally, it is recommended that each district be divided into smaller geographic units, called areas in this manual. Areas should be defined based on similarities between zones with regard to natural geographic boundaries, county and city boundaries, and zone population and employment characteristics.

These areas will be used in the process for allocating projected population and employment and should consist of aggregations of a smaller number of traffic analysis zones within each district. For example, an urban area with 230 traffic analysis zones might be divided into six districts. Each of the six districts would then be subdivided into possibly five to six smaller areas.

The 1990 CTPP population, number of households, median household income, and basic, service, and retail employment data by traffic analysis zone for the urban area should be acquired. Sources for these data are given in the previous section. If CDs or tapes of the data are obtained, the CTPP information will have to be formatted with a computer software program in order to have the data in a readable form. Historic census data on population, number of households, median income, workers per household, and employment for the urban area from 1970 and 1980 should also be obtained, if possible. There will be differences in the type, definition, and level of reporting between census years; but adjustments can be made in order to compare the data.

Other data such as current land use maps and records of building permits, demolitions, zoning changes, and variances for the years 1990 through the current year should be assembled. These data should be collected and reviewed for the entire urban area, and the traffic analysis zone in which the activity occurred should be identified. Additionally, information on development and growth within the county(s) but outside the urban area should be obtain.

Other data and information that should be collected initially include estimates of county and city population for the base or most recent year from the State Data Center; estimates of employment for the county from County Business Patterns or other outside source for the base or most recent year; historic census data from 1960, 1970, and 1980 for the urban area, county and city(s) on average household size; and the consumer price index (CPI) for the base or most recent year.

PREPARATION OF BASE YEAR DATA

A number of ways exist in which an urban area may develop estimates of the base year data for the travel demand forecasting process. Some areas may have established a process for monitoring and maintaining the data needed on a regular basis while others may have developed their own methodologies for the preparation of these data. This discussion presents a step-by-step guide that may be used by small to medium sized urban area MPOs (generally under 200,000 population) to develop the base year data. Methods to estimate changes to the data at the zone level are included.

The 1990 U.S. Census Transportation Planning Package (CTPP) provides population, household, median household income, and employment data by traffic survey zone for each urban area. This information represents the most complete source of data available at the traffic analysis zone level and is recommended for use in developing the base year inputs needed to validate the area travel demand forecasting model.

In order to update the census data to the base year, an estimate of the changes in population, number of households, median household income, and employment must be made. Several agencies provide annual estimates of either population or employment as discussed in an earlier section of the manual. Recommendations for updating each of the data inputs from the 1990

CTPP to the base year are presented in the sections below.

Developing Base Year Population Estimates

- Step 1. Prepare a table of the 1990 CTPP total population for the county and urban area and for individual traffic analysis zone. This can be done in either a computer spreadsheet format or manually.
- Step 2. Obtain the county population estimate for either the base year or the year closest to the base year from the State Data Center. If the year of the estimate is not the selected base year, it will be necessary to adjust that estimate to the base year using an average annual growth rate and professional judgment. For example, if the base year is 1995 and the most recent population estimate available is for 1994, the 1994 estimate will need to be adjusted to 1995.

To make this adjustment using the average annual growth rate, first determine the average annual rate of growth between the 1990 census population and the population estimate obtained for the year closest to the base year in the following fashion:

$$\frac{(P2 - P1)/P1}{N2 - N1} = \text{Average Annual Growth Rate}$$

Where:

- P1 = 1990 county population
P2 = county population for most recent estimate
N1 = 1990
N2 = year of most recent estimate

Once the average annual growth rate has been determined, local knowledge of the area should be used to assess whether conditions affecting the growth of the area, such as general economic trends and the loss or addition of major employers, have remained unchanged or whether the growth rate may account for unusual events. Because the State Data Center uses various symptomatic indicators obtained from local agencies to prepare estimates of population, it is likely that the average annual growth as developed will already account for specific local conditions as well as regional and national trends.

Next the growth rate is applied to the most recent estimate of population by multiplying the population estimate by average annual growth rate. For example, if the growth rate is determined to be 0.0215, the population estimate would be multiplied by 1.0215 to make the adjustment. This must be done for each year from 1990 to the base year.

- Step 3. Develop a ratio of the 1990 urban area population to the 1990 county population and apply to the base year county population estimate (developed in Step 2) to

prepare the base year total population estimate for the urban area. To develop the 1990 ratio, divide the 1990 urban area population by the 1990 county population.

Once this ratio has been developed the data and information gathered relative to growth and development within the county but outside of the urban area boundaries versus the growth and development within the urban area should be used to determine if this ratio is applicable without adjustment. This can be done by using county records of plats filed.

Next take the base year county population estimate from Step 2 and multiply it by this ratio to determine the base year total population within the urban area.

Step 4. Determine the numerical difference between the 1990 total population of the urban area and the base year total population of the urban area. This difference represents the population that needs to be allocated at the zone level.

In allocating base year estimates it is recommended that the staff of the MPO use professional judgment and local area knowledge in conjunction with the data collected with regard to building permits, zoning, known developments, and demolitions to identify areas of growth and decline within the urban area. Prior to starting the data development process it was recommended that the staff gather the aforementioned data and determine the zone location for those data. Based on this information as well as local knowledge the numerical difference between the 1990 and base year population should be allocated among the traffic analysis zones within the area.

One simple method for making an initial allocation is to determine the number of new dwelling units using building permit data and/or field observation, that have been built within each traffic analysis zone. Then, using the average household size for the urban area (developed from the 1990 census data by dividing the total number of households within the urban area by the total urban area population), allocate the additional population to that zone by multiplying the number of new dwelling units by the average household size. This method may result in allocating too much or too little growth in population and thus requires that the total population allocated be checked against the total numerical change in population.

In addition to allocating the numerical change between 1990 and the base year, data regarding demolitions or local knowledge should be used to determine areas which may have experienced a decrease in population. If such areas are identified, an estimate of the decrease in population in such zones should be made and this population reallocated to other zones accordingly based on local knowledge and zone characteristics.

Developing Base Year Estimates of Number of Households

- Step 1. Determine the average household size for each traffic analysis zone, using the 1990 CTPP data, by dividing the number of households within a zone by the population within that zone.
- Step 2. Determine the number of households within each zone for the base year by dividing the base year population of each zone by the average household size within that zone as determined in Step 1.

Developing Base Year Estimates of Median Household Income

- Step 1. Determine the Consumer Price Index (CPI) for 1989 (the year of the census data) and the CPI for the base year. The CPI must use 1967 as a base year for use in TRIPCAL5. The base year for the CPI has been changed to 1982-1984. As a result, currently published CPI numbers must be converted to 1967 equivalents. To do this, divide the 1989 CPI (at 6 months) by 0.334 to get the 1967 equivalent.

Subtract the 1989 CPI from the base year CPI and divide the difference by the 1989 CPI. This will give the percentage increase between 1989 and the base year.
- Step 2. Multiply the median household income in each zone from the CTPP by the percentage increase in the CPI to determine the increase in the median income. Add this increase to the 1989 median household income for each zone to produce the base year median income.

Developing Base Year Estimates of Employment

- Step 1. Develop a total employment for each employment category (basic, service, and retail) for the urban area and for the county using the 1990 CTPP data for basic, service, and retail employment. Develop a ratio of the 1990 urban area employment to the 1990 county employment by basic, retail, and service categories. This is done by dividing the urban area employment for each category by the county employment for each category.

Once these ratios have been developed the data and information gathered relative to growth and development within the county but outside the urban area boundaries versus the growth and development within the urban area should be used to determine if this ratio is applicable without adjustment.
- Step 2. Obtain base year estimates of county employment by major industrial sectors from the State Comptroller's Office or other selected data source. Add together the employment from the appropriate industrial groups to get the total basic, service, and retail employment for the base year (see Table 1). Apply the ratio for each employment category as developed in Step 1 to the base year county employment in each category to estimate the total employment by category for the urban area.
- Step 3. Determine the numerical difference between the 1990 urban area employment and

the base year employment for each employment category. This represents the differences in the basic, service, and retail employment that must be allocated to traffic serial zones.

Step 4. Use professional judgment and local area knowledge in conjunction with the data collected with regard to building permits, zoning, known developments, and demolitions to identify areas of employment growth and decline within the urban area.

Another method that may be used to assist in allocating employment among traffic analysis zones is to develop a ratio of 1990 employment to 1990 population for each traffic analysis zone and apply that ratio to the base year population of each zone. This is done by dividing the 1990 total zone employment by the 1990 total population. The results of this calculation is then multiplied by the base year population to determine an estimate of the total base year employment within a zone.

Developing Base Year Special Generator Information

As defined in a previous section, special generators are land use activities that are considered to be unique and are handled individually in the modeling process. Special generators typically include colleges and universities, military bases, hospitals, amusement parks, airports and regional shopping centers. Specific data are required for each special generator according to the type of land use activity. Table 2 lists the data required for each special generator. Only those data fields applicable for a specific special generator are required. Optional data that may be provided for high schools include the number of high school students that drive to school and the number of students who have jobs off-campus.

For areas which have conducted a recent travel survey, this information will have been collected for the year of the travel survey and should be available from TxDOT. For other areas these data must be collected and/or updated for the base year by requesting the specific information required from each individual special generator.

**Table 2
Special Generator Information**

DATA ITEM	DESCRIPTION
Employment Type	The type of employment at the special generator: basic, service, or retail
Zone Number	Traffic analysis zone where the special generator is located
Name	Name of special generator
Hours of Operation	Number of hours in operation during a normal weekday
Total Employment	Total number of persons (full and part time) employed at the special generator
On Base Military	If special generator is a military base, the total number of military personnel living on base
Off Base Military	If special generator is a military base, the number of military personnel living off base
On Base Civilians	If special generator is a military base, the number of civilian employees who live and work on base
Off Base Civilians	If special generator is a military base, the number of civilian employees who live off base and work on base
Number of Shifts	The number of work shifts at the special generator
Employees per Shift	Number of employees per work shift
Student Enrollment	If special generator is a school, the total number of students enrolled in the school
Living On-Campus	If special generator is a school, the total number of students living on campus
Hospital Beds	If special generator is a hospital, the total number of hospital beds in the hospital
Number of Flights	If special generator is an airport, the number of flights per day served at the airport
Airline Passengers	If special generator is an airport, the number of deplaning passengers per day

PREPARATION OF FORECAST YEAR DATA

Numerous techniques are available to project population: number of households, median household income, and employment for input into the travel demand forecasting models. Many of these methodologies are time consuming and require knowledge and experience not usually available within the staff of small to medium sized MPOs. This section of the manual describes suggested methods to project the socioeconomic inputs required by TRIPCAL5 given the limited staff time and experience. For most inputs the use of data from outside sources is recommended; although for several inputs, alternative ways to develop the data in-house are described.

Projecting Population Data

Step 1. Obtain the county population projections prepared by the State Data Center. As discussed in the section on data sources, these projections are made every other year and provide projections of population in five year increments for approximately 30 years beyond the current year. As a result, it is possible that the population projections available may not correspond exactly to the 10- and 20-year transportation planning forecast years. If the projection years are different from the selected forecast years, it will be necessary to adjust the projection to the planning forecast year using an average annual growth rate and professional judgment. For example, assume the base year is 1995 and the planning forecast years are 2005 and 2015. If the most recent population projection was performed in 1994, projections would be available for 2004 and 2014. Thus, the 2004 and 2014 population projections will need to be adjusted to 2005 and 2015.

To make this adjustment using the average annual growth rate, first determine the average annual rate of growth between the base year population as developed in the previous section and the projection year closest to the 10-year planning forecast year. This is done using the calculation below. The average annual growth rate between the 10- and 20-year planning forecast period should also be developed. Using the example cited above, that would mean that the average annual growth rate between the 2004 and 2014 population projections would be determined:

$$\frac{(P2 - P1)/P1}{N2 - N1} = \text{Average Annual Growth Rate}$$

Where:

- P1 = base year county population
- P2 = county population for future year closest to the forecast year
- N1 = base year
- N2 = year of population projection

Once the average annual growth rate has been determined, local knowledge of the area should be used to assess the reasonableness of the growth rate. Because the State Data Center uses a cohort survival technique and considers special populations such as prisons and universities within each area as well as other indicators to make population projections, it is likely that the average annual growth as developed will account for state, regional, and local trends.

Next the appropriate growth rate is applied to the population projection closest to the planning forecast year by multiplying the population projection by average annual growth rate. For example, if the growth rate between the base year and 2004 is determined to be 0.0215, the 2004 population projection would be

multiplied by 1.0215 to make the adjustment to 2005. The growth rate for the 10- to 20-year projection period should also be applied to the 2014 projection to determine the 2005 population.

Step 2. Use the ratio of the urban area population to the county population that was developed for determining the base year population (see Step 3 under Developing Base Year Population), either with or without adjustment to determine the projected population for the urban area from the county population projection. Local area knowledge and professional judgment should be used in conjunction with any available historical data to determine if past and/or current trends indicate that the county population outside of the urban area would represent a greater proportion of the total county population than that in 1990 or the base year.

Once the ratio has been reviewed and adjusted as necessary, apply the ratio to the county population for the 10- and 20-year planning forecast years to develop the urban area total population projection for those years.

Step 3. Present population projections for the 10- and 20-year planning period to the appropriate MPO committees and boards for adoption by the MPO structure as well as the major city(s) within the MPO area.

Step 4. Allocate the total urban area population to the district level. A growth allocation process using the Delphi technique is the recommended procedure for making the allocation of population to the districts. A detailed description of the proposed procedure for making this allocation is given in the next section of this report.

Step 5. Following completion of the Delphi process to allocate the projected population to the district level, the 10- and 20-year population projections must be allocated to traffic analysis zones. Given the large number of traffic analysis zones it is recommended that allocation of population to the zone level be performed by the MPO staff. The procedure for allocating growth to the zone level is also included in the section on the growth allocation process.

Cohort Survival Technique

If an urban area would prefer to perform their own population projections for the 10- and 20-year planning forecast years, it is recommended that the cohort survival technique be used. This procedure independently projects the three components of population change, births, deaths, and migration. The basic equation used in this technique is given below (4):

$$P_{x+t} = P_x + B_{x+t} - D_{x+t} + M_{x+t}$$

Where:

P_{x+t} = population projected at some future date t years beyond year x

P_x = population at the base year

B_{x+t} = number of births that occur during the interval t

- D_{x+t} = number of deaths that occur during the interval t
- M_{x+t} = amount of net migration that takes place during interval t

The general steps involved in the cohort survival technique include:

- Adjusting the baseline population cohorts for the correct time periods and spatial references.
- Adjusting rates of migration, fertility and mortality.
- Surviving the baseline population to the end of the projection period.
- Adding or subtract migrants from the baseline population.
- Computing births and adding births to initial cohorts of the baseline population.
- Summing cohorts as desired to obtain total population.
- Adjusting the sum of populations for subareas to population totals for the larger area.

When developing population projections using this method, the staff should be aware that certain special populations such as universities, military bases, and prisons need to be handled separately. Techniques to handle these special populations are available. Additionally, certain assumptions must be made with regard to the use of current migration rates and fertility rates to project population at some future date. When developing population projections using this method, review of historic trends with regard to fertility should be made; and anticipated future economic conditions should be analyzed to determine if migration rates will remain relatively constant. Projected mortality rates should be available from a life survival table (4, 5, and 6).

For a complete description on how to use this technique, it is suggested that the reader follow the procedure described in references 4 and 6.

Projecting the Number of Households

- Step 1. Analyze historic data on average household size from the 1960, 1970, and 1980 census and the average household size from the 1990 CTPP to identify what changes have occurred to the average household size within the area and what the past and current trends are with regard to household size. This may be done using simple extrapolation based on the average annual change in household size for the period for which data are available. This may be accomplished by using the following calculation:

$$H_{t_2} = H_{t_1} [t (1 + r)]$$

Where:

- H_{t_2} = average household size for the projection date (t_2)
- H_{t_1} = average household size for the base year (t_1)
- r = rate of growth per unit of time (t)
- t = time period between the base year (t_1) and the projection date (t_2)

Professional judgment is needed to determine if past and/or present trends will continue. If the data indicate that the average household size has been decreasing, care should be exercised to ensure that the projected household size is reasonable.

- Step 2. Determine the number of households for the 10- and 20-year planning forecast years, by taking the projected population for each of the forecast years and dividing by the projected average household size for each year, respectively.
- Step 3. Determine the number of households for each traffic analysis zone, by dividing projected population for each zone for the planning forecast years by the projected average household size for each of the forecast years, respectively. The number of households within each zone should then be summed, and the total compared to the projected total number of households for each planning year as determined in Step 2. Using professional judgment the number of households within the traffic analysis zones should be adjusted so that the sum equals the total number of households projected for the urban area in Step 2.

Projecting Employment

- Step 1. Develop a ratio of the base year population to the base year employment by service, retail, and basic categories. This is accomplished by dividing the total number of employees in each of the three SIC groups by the total base year population for the urban area.
- Step 2. Develop the employment projections for the 10- and 20-year planning forecast years by taking the total projected population for each of those years and multiplying it by each of the three ratios developed in Step 1. This will provide an estimate of the number of employees in each of the SIC groups for the two forecast years.
- Step 3. As a method to check the reasonableness of the employment projections, collect the recent historical employment data from the State Comptroller's Office as well as historic employment data from the Texas Almanac or other source. Develop the average annual growth rate in employment for the time period for which data are available. A separate growth rate should be calculated for each of the three SIC

groups.

Apply the appropriate average annual growth rate to the base year estimates of basic, service, and retail using the following calculation.

$$E_{t_2} = E_{t_1} [t (1 + r)]$$

Where:

E_{t_2}	=	number of employees in the selected SIC group for the projection date (t_2)
E_{t_1}	=	number of employees in the selected SIC group for the base year (t_1)
r	=	rate of growth per unit of time (t)
t	=	time period between the base year (t_1) and the projection date (t_2)

- Step 4. Compare the estimates of employees by industry groups as developed in Step 2 with those developed in Step 3. Professional judgement is needed to determine the “best” projection of employment. Particular care should be used when applying the ratio of population to employment to base employment due to the weak relationship between population growth and growth in basic employment.
- Step 5. As with the population projections, present the employment projections for the 10- and 20-year planning period to the appropriate MPO committees and boards and adopted by the MPO structure as well as the major city(s) within the MPO area.
- Step 6. Allocate the total urban area employment for each industry group to the district level. A growth allocation process using the Delphi technique is the recommended procedure for making this allocation to the districts. A detailed description of the proposed procedure for making this allocation is given in the next section of this report.
- Step 7. Following completion of the Delphi process to allocate the estimates of future employment to the district level, allocate the 10- and 20-year population projections to traffic analysis zones. It is recommended that allocation of employment to the zone level be performed by the MPO staff. The procedure for allocating growth to the zone level is also included in the section on the growth allocation process.

Projecting Median Household Income

Step 1. Obtain historic data on median household income and median family income from the 1970, 1980, and 1990 census for the county as a whole and by census tract. Note that pre-1980 census data provide median family income but not median household income. The 1980 and 1990 census data report both median family and median household income. If 1970 data are to be used in the trend analyses, median family income will need to be converted to median household income.

To make this conversion, first develop a ratio of median family income (1970) to median household income for the data found in the 1980 and 1990 censuses. A countywide ratio and individual census tract ratios should be developed for both census years. To obtain these ratios, divide the median household income by the median family income.

Next, analyze the resulting ratios for 1980 and 1990 to identify any significant difference between the ratios. If there is a significant difference (in the range of $\pm 5\%$) some adjustment may be necessary before the ratio is applied to the 1970 data. Professional judgment and local knowledge should be used to determine if the 1980 or 1990 ratio, or if an average of the two ratios would be best.

Take the ratios developed and multiply the 1970 median family income for the county and for the individual census tracts by the appropriate ratio. This will result in converting median family income to median household income for use in further analyses.

Step 2. Obtain the Consumer Price Index (CPI) developed by the Department of Labor for the years 1970, 1980, and 1990. The CPI will be used to convert the median household income developed in Step 1 to constant dollars. This conversion can be made to any of the three census years (1970, 1980, or 1990) because the purpose of this step is to determine the changes to real income that have occurred over time. For this example, the conversion will be made to 1990 dollars.

First, convert the 1970, 1980, and 1990 CPI figures to 1967 equivalents as described under Step 1 for developing base year estimates of median income. Determine the percentage change between the 1970 CPI and the 1990 CPI and the percentage change between the 1980 CPI and the 1990 CPI. To do this, subtract the 1970 CPI from the 1990 CPI and divide the result by the 1970 CPI. Perform the same calculation with the 1980 and 1990 CPI figures. Next, add 1 (one) to the result of each calculation. Then multiply the percentage change between the 1970 and 1990 CPI by the 1970 median household income for the county and each census tract. Also, multiply the percentage change between the 1980 and 1990 CPI by the 1980 median household income for the county and each census tract. This will result in converting the 1970 and 1980 median household income data to 1990 constant dollars.

Step 3. Analyze results of Step 2 to determine the trend with regard to change in median household income between 1970 and 1980, between 1980 and 1990 and between 1970 and 1990. To do this, develop the percentage change between the median

household income for the periods of 1970 to 1980, 1980 to 1990 and the overall change between 1970 and 1990. This should be performed for the county median household income as well as for each census tract.

Local area knowledge concerning past and present economic activity in the area should be used to assess whether the past trend in income growth (or decline) is likely to continue or if upward or downward adjustments are needed. This assessment should be made for at the county level and for each of the census tracts. As an example, it may be that an unusually low growth in the county median income experienced during one of the decades represented unusual economic circumstances such as a military base closure; or at the census tract level, an area that was undeveloped 10 and 20 years ago would likely show a sharp increase in median income that, once development slowed, would in future years be more in line with the growth in income experienced in previously developed census tracts with similar characteristics. Additionally, some adjustment may be necessary for census tracts that have been split over the time period used.

Step 4. Determine the average annual rate of growth in median household income for the historic period used for the county and for each census tract. In this case, the average annual rate of growth would be developed for the period of 1970 - 1980, 1980 - 1990, and 1970 to 1990. Based on the assessment of historic trends made in Step 3, adjust the average annual growth rate according to anticipated future conditions.

Step 5. Determine the appropriate rate of growth for each traffic analysis zone by referring to the urban area's census tract/traffic analysis zone table of equals. Apply the appropriate growth rate to the base year median household income for the county and for each traffic analysis zone. To accomplish this the following calculation may be used to project the median household income for each zone for the 10- and 20-year planning forecasts:

$$I_2 = I_1 [t (1 + r)]$$

Where: I_2 = median household income for the projection date (t_2)
 I_1 = median household income for the base year (t_1)
 r = rate of growth per unit of time (t)
 t = time period between the base year (t_1) and the projection date (t_2)

Projecting Special Generator Data

The specific data required for each type of special generator as shown in Table 2 must be projected for the 10- and 20-year forecast periods. The best method to do this is to request the information from each special generator at the time the base year data are being collected. In some cases there may be not anticipated change for the special generator because there are no plans for expansion. For example, a university may anticipate an increased enrollment for the forecast years; but if the school does not anticipate the construction of additional on-campus housing, the data for the number of students living on-campus may be expected to be the same as for the base year.

V. GROWTH ALLOCATION PROCESS

The allocation of the growth in population and employment is an important part of preparing the input data for travel demand forecasting. Even if all the data input variables are projected with no errors, the estimation of travel and the development of the transportation plan based on that estimate have been shown to be very sensitive to the allocation of the data to traffic analysis zones (7).

The Delphi process is a set of inquiry techniques designed to solicit and collate the opinions of a group of individuals in an iterative process to arrive at the most reliable consensus possible. These techniques can be tailored to fit almost any set of circumstances and applications. As part of previous research for TxDOT, the Delphi process was modified to provide a qualitative measure of an area's growth at the district and area level (as defined previously, an area is a geographic sub-unit of a district). The results of the growth allocation process at the area level are carried forward for use in allocating growth to the traffic analysis zone level. The allocation process described in this manual is based on the results of that study (8).

DELPHI PROCESS PREPARATION

Figure 2 illustrates the major steps to be performed in allocating growth to the zone level using this technique. There are four basic parts to the preparation process: selecting panel members, aggregating traffic analysis zones, preparing the information packets and scheduling meeting times and locations. Each of these are further described below.

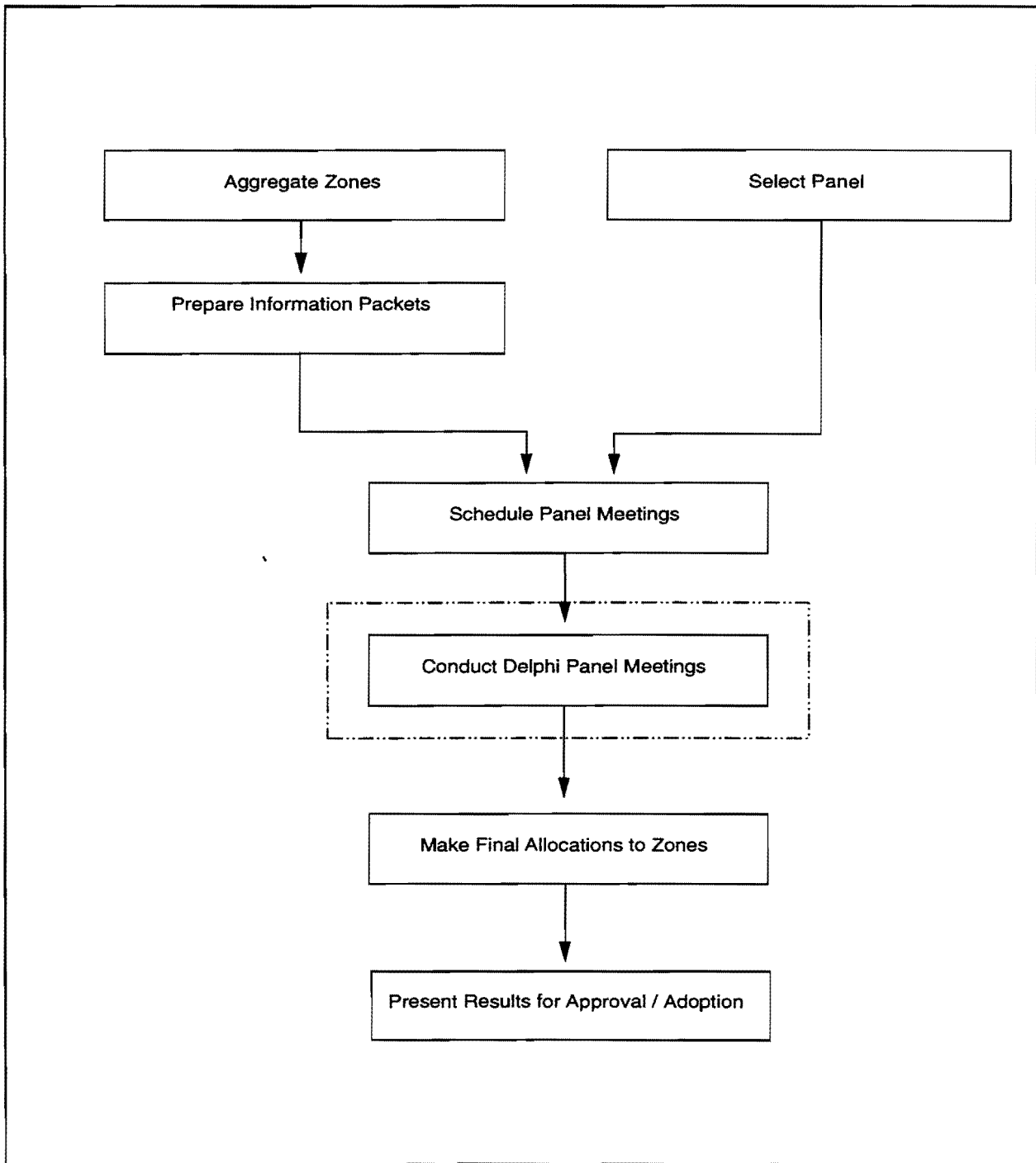


Figure 2. Flowchart of Overall Delphi Process Procedure (8)

Panel Selection

It is recommended that a panel of approximately 45 to 50 individuals be used for this process. The group should include persons in specific disciplines and/or serving in key positions and committees as well as local citizens. As a guideline, representation from the following areas is recommended:

- Engineers
- Planners
- Developers (commercial and residential)
- Employers (basic, retail, and service)
- Bankers
- School officials
- Real estate brokers
- Elected officials (city and county)
- MPO members
- Interested citizens

It is suggested that an initial list that includes about 50 percent more individuals than are needed be prepared, because not all of those asked will be willing or able to serve. Each potential panel member should be contacted to explain the process and the time involved and to invite them to participate.

Aggregation of Traffic Analysis Zones

As part of the data preparation process (see Getting Started) traffic analysis zones should be grouped into districts and areas.

Preparation of Information Packets

Panel members need current and historical information on population, employment, and land use as well as information on projected population and employment. Recommendations for the selection and presentation of these data are highlighted below:

1. A table showing the 1980 census population, 1990 census population and net change and percentage change for each district and the total MPO area.
2. A map showing the percentage change from 1980 to 1990 in each district.
3. A table showing 1990 population and base year population (if different from 1990) and net change and percentage change by traffic analysis zone.
4. A line graph of historical population for the county and for the major city(s) within the MPO area. Historical data for at least 40 years should be included.
5. Historical basic, service, and retail employment figures for the county and Metropolitan Statistical Area (MSA). The Texas Almanac provides historic employment figures from the Texas Employment Commission.
6. Maps of the urban area for each of the employment categories indicating the location and

concentration of base year employment.

7. A table showing 1990 and base year (if different from 1990) basic, service, and retail employment and net change and percentage change by traffic analysis zone.
8. A table showing base year population, employment (by category), number of households, median household income, and undeveloped acreage by district.
9. A table showing the base year and the 10- and 20-year projections of population and the net change and percentage change by district.
10. A table showing the base year and the 10- and 20-year projections of employment for each category and the net change and percentage change by district.
11. A table showing the acreage of different land uses and undeveloped land for the base year and the future land uses by acreage for each district.
12. A table showing current zoning requirements by district.
13. A table showing current zoning by district.
14. Base year and future land use maps. Individual overlays of the district, area, and traffic analysis zone boundaries should be made for these maps. (These graphics should be made available during the meetings).

Schedule

Prior to contacting the individual potential panel members, a schedule should be set for the meetings. It is recommended that meetings be held weekly at a set time. The process is anticipated to require between eight and ten weeks depending on the number of rounds required to reach a consensus.

Develop Questionnaires

The next step in the process is to develop the questionnaires for use in allocating the population and employment. Four rounds of questionnaires that were developed and used in a pilot project in Longview, Texas, are provided in Appendix B. The questionnaires are divided into two groups: two questionnaires regarding growth in each of the districts and two questionnaires regarding growth at the area level. Additional rounds of questionnaires may be required in order to reach a consensus on allocating growth. The process used with each questionnaire is presented in the next section on the Delphi methodology.

DELPHI METHODOLOGY

The overall growth allocation process using Delphi is illustrated in Figure 3. The process consists of an introductory meeting, four to eight meetings to exchange information, and an evaluation meeting. Beginning after the first round of questionnaires, feedback regarding the responses and results should be provided to members of the panel. Once a general consensus is reached at each allocation level the process advances to the next level and is repeated.

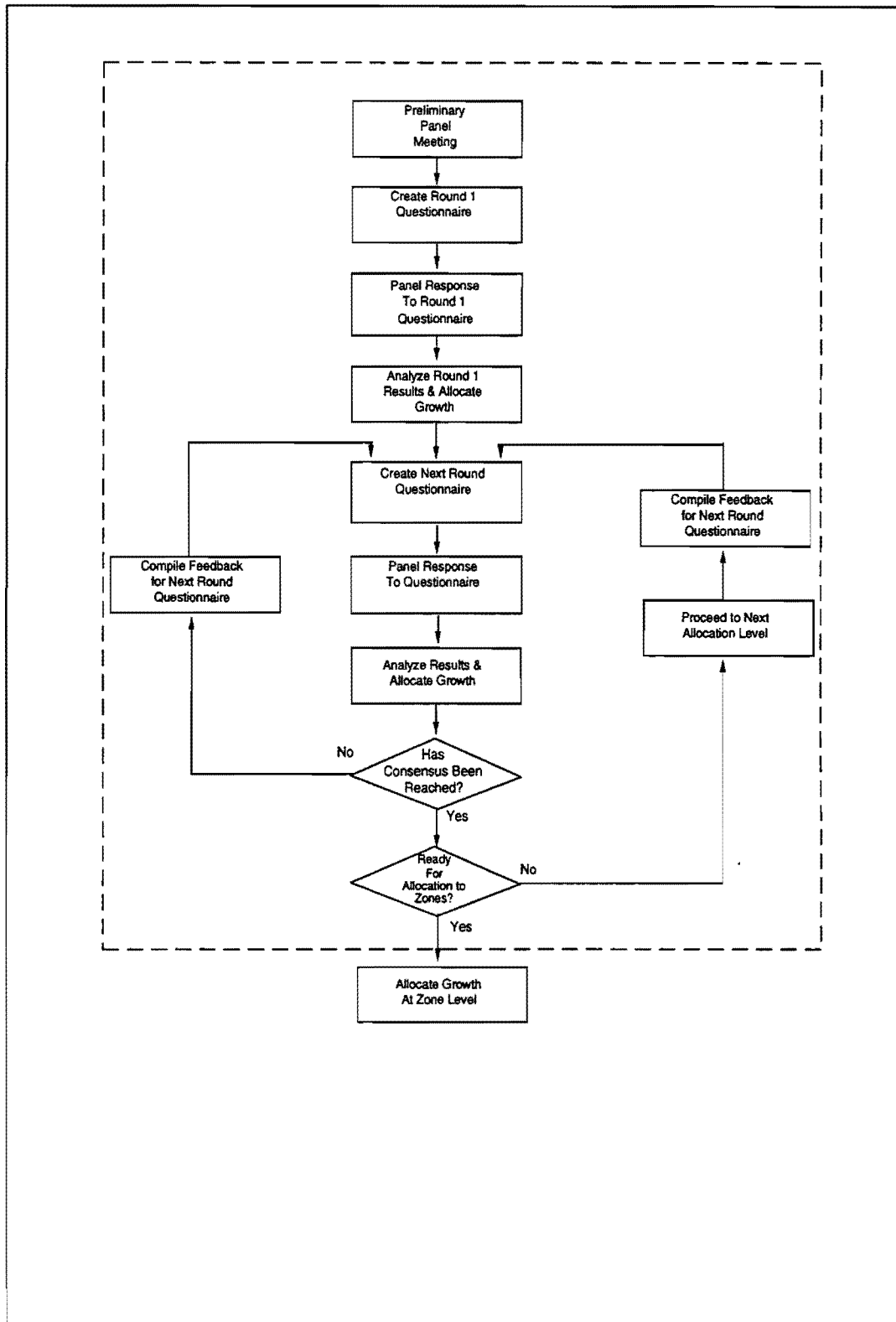


Figure 3. Flowchart of Delphi Process Methodology (8)

Orientation Meeting

The purpose of the orientation meeting is to acquaint the panel members with the overall Delphi process, and to distribute the information packets. An overview of the proposed schedule, process, and questionnaires should be the focus of this meeting. Additionally, each panel member should be assigned a random number to be used throughout the process to assure anonymity of the responses provided.

Allocation of Growth at the District Level

This section describes the use of two rounds of generally the same questionnaire to reach a consensus on allocating population and employment growth to the district level. In some areas additional rounds of the same questionnaire may be required to reach a consensus. The process described would be continued if any additional rounds are required.

Round 1 Questionnaire and Analysis

The Round 1 questionnaire (see Appendix B) is divided into seven basic sections: a self-evaluation, a rating of factors that influence growth, a growth potential ranking for each district, population growth potential for each district, basic employment growth potential for each district, retail employment growth potential for each district, and service employment growth potential for each district. The purpose of including the first three sections is to prepare the panel members for participation in the process. The other sections are the actual first step questionnaires for allocating growth to the district level.

The self-evaluation asks panel members to indicate their familiarity with the urban area using the following scale:

- (1) Unfamiliar
- (2) Slightly familiar
- (3) Generally familiar
- (4) Very familiar
- (5) Expert or Actively Studying

Additionally, panel members are asked to rate the importance of 13 factors which might influence growth in one or all of the districts and to rate their familiarity with the 13 factors using the same scale listed above. The intent of asking panel members for the self-evaluation and to rate the 13 factors is to gather information on their perceptions of what influences growth and to get them to think about which factors actually affect the growth potential of a district or area rather than giving a "gut" response. The self-evaluation and questions regarding factors that affect growth should be completed prior to the section of the questionnaire relative to growth allocation.

The high, low, median, and mean responses for these portions of the process should be calculated and the information provided to panel members. However, these responses are not used directly in the method described for evaluating responses for allocating growth.

Four of the sections of the initial questionnaire require the panel members to rate the potential for the types of growth (population and basic, service, and retail employment) for each of the districts using the following scale:

- 1) 10% or Greater Decrease
- 0) Stable (No Change)
- 1) 10% Increase
- 2) 25% Increase
- 3) 50% or Greater Increase

The responses to these four sections are used directly in the methodology for evaluating the panel responses and allocating growth between the districts.

In the last part of the questionnaire, panel members are asked to rate their familiarity with each type of growth in that district and to rank the districts in order of priority, with a ranking of 1 being the least likely to grow. The purpose of this ranking is to ask for the same basic information regarding growth potential in a different format to provide a means of verifying that members are interpreting the questions correctly. As with the first portions of the questionnaire, responses are not used in the direct calculation for allocating growth.

Questionnaires are distributed at the meeting. Panel members should be free to ask questions and given as much time as needed to complete each questionnaire.

The following process is a recommended method to determine the projected growth distribution at the district level after the first questionnaire.

Population Distribution:

- Step 1. Calculate the mean and median responses given by the panelists, and average the two resulting values to reduce the influence of extreme responses.

$$\frac{(\text{Mean of panel responses}) + (\text{Median of panel responses})}{2} = \% \text{ Growth of district}$$

2

- Step 2. Decrease or increase the population for the base year for each district by the percentage obtained in Step 1.

$$(\text{Base year district population}) * (1 + (\% \text{ Growth of district})) = \text{Unscaled projected district population}$$

- Step 3. Sum the calculated populations for each of the districts to obtain an unscaled projected population.

$$\sum \text{Unscaled projected district populations} = \text{Total calculated population projection}$$

- Step 4. Calculate the net change between the calculated population projection (from Step 2) and the base year population for each of the districts and the total from Step 3.

$$(\text{Calculated district population}) - (\text{Base year district population}) = \text{Net change of district population}$$

$$(\text{Calculated total population}) - (\text{Base year total population}) = \text{Net change}$$

- Step 5. Calculate the net change between the total projected population (from population projections) and the base year total population.

$$(\text{Total projected population}) - (\text{Total base year population}) = \text{Net change from base year to forecast year}$$

- Step 6. Use the net change between the calculated population projection and the base year population (from Step 4) and the net change between the total projected population and the base year population (from Step 5) to scale the populations for each district using the following calculation.

$$\frac{(\text{Net change of district pop.})}{(\text{Net change of calculated pop.})} * (\text{Net change of projected pop.}) = \text{Scaled change of district pop.}$$

- Step 7. Calculate the total population in each district by adding the scaled change in district population to the base year district population.

$$\text{Base year population} + \text{Scaled change of district pop.} = \text{Projected district population}$$

Step 8. Calculate the percentage growth of each district using the following equation.

$$\frac{(\text{Scaled district pop.}) - (\text{Base year district pop.})}{(\text{Base year district pop.})} * 100 = \% \text{Growth}$$

Employment Distribution:

The following calculations are performed for each category of employment (basic, service, and retail).

Step 1. Calculate the mean and median responses given by the panelists and average the two resulting values to reduce the influence of extreme responses.

$$\frac{(\text{Mean of panel responses}) + (\text{Median of panel responses})}{2} = \% \text{ Growth of district}$$

Step 2. Decrease or increase the employment for the base year for each district by the percentage obtained in Step 1.

$$(\text{Base year district employment}) * (1 + (\% \text{ Growth of district})) = \text{Unscaled projected district employment}$$

Step 3. Sum the calculated employment for each of the districts to obtain an unscaled projected employment.

$$\sum \text{Unscaled projected district employment} = \text{Total calculated employment projection}$$

Step 4. Calculate the net change between the calculated employment projection (from Step 2) and the base year employment for each of the districts and the total from Step 3.

$$(\text{Calculated district employment}) - (\text{Base year district employment}) = \text{Net change of district employment}$$

$$(\text{Calculated total employment}) - (\text{Base year total employment}) = \text{Net change}$$

- Step 5. Calculate the net change between the total projected employment (from employment projections) and the base year total employment.

$$(\text{Total projected employment}) - (\text{Total base year employment}) = \text{Net change from base year to forecast year}$$

- Step 6. Use the net change between the calculated employment projection and the base year employment (from Step 4) and the net change between the total projected employment and the base year employment (from Step 5) to scale the employment for each district using the following calculation.

$$\frac{(\text{Net change of district emp.}) * (\text{Net change of projected emp.})}{(\text{Net change of calculated emp.})} = \text{Scaled change of district emp.}$$

- Step 7. Calculate the total employment in each district by adding the scaled change in district employment to the base year district employment.

$$\text{Base year employment} + \text{Scaled change of district emp.} = \text{Projected district employment}$$

- Step 8. Calculate the percentage growth of each district using the following equation:

$$\frac{(\text{Scaled district emp.}) - (\text{Base year district emp.})}{(\text{Base year district emp.})} * 100 = \% \text{Growth}$$

Round 2 Questionnaire and Analysis

The Round 2 questionnaire is essentially the same as the questionnaire used in the first round, although the questions dealing with the factors influencing growth and the district rankings are not a part of the second round.

At the Round 2 meeting, a summary of the results from the first round questionnaire should be provided to the panel. It is suggested that this summary include panel high and low responses, the median and mode of the panel responses, and the quantitative allocations and growth distributions over the forecast period based on the calculations performed for the responses from Round 1. Each panel member should also receive a copy of his/her individual responses from the first questionnaire.

During the Round 2 questionnaire, panel members should be allowed to change their previous responses (that is, if they wish to change a response from that given in the Round 1 questionnaire) and to make any additional comments.

Following completion of the second round questionnaire the eight-step process described under Round 1 should be used to produce the population and employment growth allocation results.

Determination of a Consensus

After completion of the Round 2 questionnaire, the results from Round 1 and Round 2 may be evaluated to determine if a general consensus has been reached regarding the allocation of growth to the district level. This may be accomplished using a statistical test for the comparison of two means to determine if the mean panel responses from the two questionnaires are statistically different. This is accomplished by performing the following calculation for each of the four parts of the questionnaires relative to the growth potential for each district.

$$t = \frac{\bar{X}_i - \bar{X}_j}{\sqrt{\frac{\sigma_i^2}{n_i} + \frac{\sigma_j^2}{n_j}}}$$

- Where:
- X_i = mean response from Round 1
 - X_j = mean response from Round 2
 - σ_i = variance of responses from Round 1
 - σ_j = variance of responses from Round 2
 - n_i = number of responses from Round 1
 - n_j = number of responses from Round 2

A table for the distribution of t is given in Appendix C and can be used to determine if the means are significantly different. If the results indicate that the panel responses from the two questionnaires are statistically the same at a confidence level of 98 percent or greater, and panel members are comfortable with the allocation, then the process of allocating growth to the area level may be started. If the results indicate that the responses are not statistically the same, then an additional round of the questionnaire should be performed.

Revisions to the District Level Allocations

Even when the test indicates that the responses from the questionnaires are statistically the same, panel members may be given the opportunity to disagree with the results of the growth allocation to the district level; and further adjustments should be made. A sample questionnaire has been provided to accomplish this (see the second series of questionnaires in Round 2 Questionnaires, Appendix B).

Where a panel member indicates that a district should receive a higher or lower allocation of growth, they are also asked to indicate which other district should be adjusted in the opposite direction. Then that individual panel member's previous responses (from Round 2) for the affected districts are adjusted by one rating level in the appropriate direction, the district allocations from the previous round recalculated (using the eight-step process), and the revised allocations carried forward for use in allocating growth to the area level.

Allocation of Growth at the Area Level

Two rounds of questionnaires are suggested for use in allocating growth to the area level (see Round 3 and Round 4 questionnaires in Appendix B). For this level of allocation it is helpful to include a small urban area map highlighting the appropriate district and areas on each questionnaire form. As with the process used to allocate growth to the district level, more than two rounds of questionnaires may be required to reach a consensus on allocating growth to the area.

Following completion of the Round 3 questionnaire, the eight-step analysis is completed for each area. The mean, median, high, and low responses from the panel members should be calculated and included for reference on the Round 4 questionnaire as well as the number of undeveloped acres within each area (see Round 4 questionnaires in Appendix B). Additionally, the resulting population and employment allocation for each area from Round 3 should be provided in the information distributed with the Round 4 questionnaire.

Upon completion of Round 4, the statistical test may be used to determine if a general consensus has been reached regarding the allocation of growth between the areas. This is accomplished using the same calculations described in the previous section. If the comparison does not yield a result that indicates the responses are statistically the same, additional rounds of this questionnaire should be completed.

Allocation of Growth at the Zone Level

Due to the large number of traffic analysis zones within even small urban areas, the allocation of growth to the zone level using the Delphi process would be too lengthy and tedious. As a result, the allocation from the area level to the zone level should be accomplished by the MPO staff.

The staff should utilize data on the amount of available land, future land use plans and densities, and potential for redevelopment of vacant and existing non-conforming uses within each zone to make an initial determination as to whether the population and employment growth

allocated to each area within an area can be absorbed by traffic analysis zones within that area. This should be done for each area in the initial step. If the zones within a area can absorb the growth allocated, no adjustments to that area will be necessary. If, however, it is determined that the zones cannot absorb the growth allocated within the area, surrounding areas within the district should be considered to determine if the excess growth could be shifted to those areas. In the event that the areas within a district cannot accommodate all of the growth allocated to that district, the areas adjacent to that district in the adjacent districts should be considered as targets for the excess growth.

VI. FORMATTING DATA FOR TRIP GENERATION

The base year and forecast year trip generation data prepared for use in forecasting travel should be submitted to TxDOT in an ASCII file. A separate file should be prepared for each year of data (i.e., base year, 10-year forecast year and 20-year forecast year). The following format should be used. All numbers should be right justified, and no decimals or dollar signs should be used.

DATA	COLUMNS
Zone Number	4 - 8
Zone Size in Acres	9 - 15
Total Population	16 - 22
Total Households	23 - 29
Median HH Income	37 - 43
Total Employment	44 - 50
Basic Employment	51 - 57
Retail Employment	58 - 64
Service Employment	65 - 71
Comments	72 - 120

There is no specified format for submittal of the special generator data.

REFERENCES

1. Williams, Tom A. and George B. Dresser. Summary Documentation for the Texas Travel Demand Package. Research Report 1375-1, Texas Department of Transportation, December 1992.
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3. From State of Texas Comptroller's Electronic Bulletin Board. July, 1995.
4. Murdock, Steve H. A Primer on Basic Demographic Methods for Small Area Analysis. Department of Rural Sociology, Texas A & M University. December 1981.
5. Murdock, Steve H. and David R. Ellis. Applied Demography. Westview Press, Boulder, Colorado, 1991.
6. Murdock, Steve H., Rita R. Hamm, Sean-Shong Hwang, and Kenneth Backman. Population Projections: A Review of Basic Principles, Practices, and Methods. Department of Rural Sociology, Texas A&M University. In cooperation with the Texas State Data Center and the Texas Advisory Commission on Intergovernmental Relations. April 1987.
7. Hamburg, John R., George T. Lathrop, and Edward J. Kaiser. Forecasting Inputs to Transportation Planning. NCHRP Report 266. Transportation Research Board. December 1983.
8. Gamble, Arthur F., David F. Pearson, and George B. Dresser. Growth Allocation by the Delphi Process. Research Report 1235-12. Texas Transportation Institute, Texas A&M University, College Station, Texas. February 1993.

APPENDIX A
TEXAS REGIONS AND MSAs

Following are the counties that make up Texas' MSAs. In all cases, the counties listed below are entirely contained within the MSA.

MSA	COUNTIES INCLUDED:
Abilene	Taylor
Amarillo	Potter, Randall
Austin	Hays, Travis, Williamson
Beaumont-Port Arthur	Hardin, Jefferson, Orange
Brazoria	Brazoria
Brownsville-Harlingen	Cameron
Bryan-College Station	Brazos
Corpus Christi	Nueces, San Patricio
Dallas	Collin, Dallas, Denton, Ellis, Kaufman, Rockwall
El Paso	El Paso
Fort Worth-Arlington	Johnson, Parker, Tarrant
Galveston-Texas City	Galveston
Houston	Chambers, Fort Bend, Harris, Liberty, Montgomery, Waller
Killeen-Temple	Bell, Coryell
Laredo	Webb
Longview-Marshall	Gregg, Harrison
Lubbock	Lubbock
McAllen-Edinburg-Mission	Hidalgo
Odessa-Midland	Ector, Midland
San Angelo	Tom Green
San Antonio	Bexar, Comal, Guadalupe
Sherman-Denison	Grayson
Texarkana	Bowie
Tyler	Smith
Victoria	Victoria
Waco	McLennan
Wichita Falls	Wichita

The following counties make up the ten regions of Texas. In all cases, the counties listed below are entirely contained within the region.

REGION	COUNTIES INCLUDED:
Region 90: High Plains	Armstrong, Bailey, Briscoe, Carson, Castro, Childress, Cochran, Collingsworth, Crosby, Dallam, Deaf Smith, Dickens, Donley, Floyd, Garza, Gray, Hale, Hall, Hansford, Hartley, Hemphill, Hockley, Hutchinson, King, Lamb, Lipscomb, Lubbock, Lynn, Moore, Motley, Ochiltrie, Oldham, Parmer, Potter, Randall, Roberts, Sherman, Swisher, Terry, Wheeler, Yoakum
Region 91: Northwest Texas	Archer, Baylor, Brown, Callahan, Clay, Coleman, Comanche, Cottle, Eastland, Fisher, Foard, Hardeman, Haskell, Jack, Jones, Kent, Knox, Mitchell, Montague, Nolan, Runnels, Scurry, Shackelford, Stephens, Stonewall, Taylor, Throckmorton, Wichita, Wilbarger, Young
Region 92: Metroplex	Collin, Cooke, Dallas, Denton, Ellis, Erath, Fannin, Grayson, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, Wise
Region 93: Upper East Texas	Anderson, Bowie, Camp, Cass, Cherokee, Delta, Franklin, Gregg, Harrison, Henderson, Hopkins, Lamar, Marion, Morris, Panola, Plains, Red River, Rusk, Smith, Titus, Upshur, Van Zandt, Wood
Region 94: Southeast Texas	Angelina, Hardin, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Polk, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Tyler
Region 95: Gulf Coast	Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, Wharton
Region 96: Central Texas	Bastrop, Bell, Blanco, Bosque, Brazos, Burleson, Burnet, Caldwell, Coryell, Falls, Fayette, Freestone, Grimes, Hamilton, Hays, Hill, Lampasas, Lee, Leon, Limestone, Llano, Madison, McLennan, Milam, Mills, Robertson, San Saba, Travis, Washington, Williamson
Region 97: South Texas	Aransas, Atascosa, Bandera, Bee, Bexar, Brooks, Calhoun, Cameron, Comal, Dewitt, Dimmitt, Duval, Edwards, Frio, Gillespie, Goliad, Gonzales, Guadalupe, Hidalgo, Jackson, Jim Hogg, Jim Wells, Karnes, Kendall, Kenedy, Kerr,

Kinney, Kleberg, LaSalle, Lavaca, Oak, Maverick, McMullen, Medina, Nueces, Real, Refugio, San Patricio, Starr, Uvalde, Val Verde, Victoria, Webb, Willacy, Wilson, Zapata, Zavala

Region 98: West Texas

Andrews, Borden, Coke, Concho, Crane, Crockett, Dawson, Ector, Gaines, Glasscock, Howard, Irion, Kimble, Loving, Martin, Mason, McCulloch, Menard, Midland, Pecos, Reagan, Reeves, Schleicher, Sterling, Sutton, Terrell, Tom Green, Upton, Ward, Winkler

Region 99: Upper Rio Grande

Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, Presidio

APPENDIX B
DELPHI PROCESS QUESTIONNAIRES

BIOGRAPHICAL BACKGROUND INFORMATION

The following background information is only for the use of the Texas Transportation Institute and will be used to group panelists with similar backgrounds in order to aid in evaluating the results of the Delphi. In instances where comments made by a panelist are being provided to the rest of the panel for information purposes, the panelist will be referenced by a number and only the most general background information will be provided. For example, background information might be given for panelist number four as "an engineer with 10-20 years of experience in planning". Every possible precaution will be taken to maintain the anonymity of the commenting panelist.

This information is entirely voluntary and you may choose not to answer certain questions or choose not to answer any of the questions without affecting your participation on the panel. However, any information which you can provide will be appreciated.

Name _____

Age _____

Sex (circle) M F

Number of years living in the Longview area? _____

Occupation? _____

Number of years of experience in that occupation? _____

Number of years working in the Longview area? _____

Home address _____

Home phone _____

Business address _____

Business phone _____

Longview Area Delphi Survey
Round 1 Questionnaire
June 15, 1992

SELF EVALUATION

Indicate with an **X** the one phrase which comes closest to expressing your familiarity with current development trends in the urban area.

Scale For Self-Evaluation

- (1) Unfamiliar
- (2) Slightly Familiar
- (3) Generally Familiar
- (4) Very Familiar
- (5) Expert or Actively Studying

The rating scale (1 to 5) will also be used in the following questions to allow you to indicate your familiarity with more specific issues present in the area.

FACTORS AFFECTING POPULATION GROWTH

This section of the questionnaire pertains to factors which may affect population growth in one or more of the study area districts or the study area as a whole. Using the rating scale below, rate the importance of the following factors. Also, indicate your familiarity with the factors using the familiarity scale. If there are other factors which you feel will have an influence on growth, please list them in the space provided on the next page.

Rating Scale for Factors Affecting Future Growth

- 0 Little or No Importance
- 1 Minor Importance
- 2 Considerable Importance
- 3 Very Great Importance

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

Factor Affecting Population Growth	Importance Scale 0 to 3	Familiarity with Factor 1 to 5	Districts Affected							Comments	
			All	1	2	3	4	5	6		
1) Improvements made to the local transportation system											
2) Availability of developable land											
3) New industry											
4) Availability of water											
5) Availability of utilities											
6) Schools											
7) Property taxes											
8) Subdivision ordinances/Zoning											
9) Accessibility to and availability of retail/service oriented businesses											
10) Construction of new roads to serve undeveloped areas											
11) Available housing											
12) Housing cost											
13) Neighborhood integrity											

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Other Factors Affecting Population Growth (any district)	Comments

POPULATION GROWTH POTENTIAL OF DISTRICTS

Using the information provided and your personal knowledge and experience, please indicate what you consider to be the population growth potential of each of the six districts by placing the appropriate number from the rating scale in the spaces provided. Also indicate your familiarity with the individual districts using the familiarity scale, and make comments regarding any of the districts which might provide information which could be helpful to the rest of the panel. Related information is provided on pages 1, 4, 5, and 7-15 in the information packet.

Rating Scale for Population Growth Potential of Districts

- 1 10% or Greater Decrease
- 0 Stable (No Change in Population)
- 1 10% Increase
- 2 25% Increase
- 3 50% or Greater Increase

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

District	Population Growth Potential Scale -1 to 3	Familiarity with District Scale 1 to 5	Comments
1			
2			
3			
4			
5			
6			

ORDERING OF DISTRICTS BY POPULATION GROWTH POTENTIAL

Using a scale of 1 to 6 (1 indicates the least likely to grow and 6 indicates most likely to grow) indicate the order of the districts according to population growth potential. Assign only one district for each of the scale values in the table.

Scale	District	Comments
1 (least likely to grow)		
2		
3		
4		
5		
6 (most likely to grow)		

DISTRIBUTION OF POPULATION GROWTH OVER PROJECTION TIME PERIOD

In this section of the questionnaire you are asked to make a judgement regarding what level of growth activity will occur during each of the population projection time periods. Place the number which most accurately describes your response in the appropriate space for each district and time period.

Responses

- 1 Decrease in Population
- 0 No Growth
- 1 Slight Growth
- 2 Moderate Growth
- 3 Considerable Growth

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)			Comments
	1990-2000	2000-2010	2010-2015	
1				
2				
3				
4				
5				
6				

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FACTORS AFFECTING BASIC EMPLOYMENT GROWTH

This section of the questionnaire pertains to factors which may affect basic employment growth in one or more of the study area districts or the study area as a whole. Using the rating scale below, rate the importance of the following factors. Also, indicate your familiarity with the factors using the familiarity scale. If there are other factors which you feel will have an influence on growth, please list them in the space provided on the next page.

Rating Scale for Factors Affecting Future Growth

- 0 Little or No Importance
- 1 Minor Importance
- 2 Considerable Importance
- 3 Very Great Importance

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

Factor Affecting Basic Employment Growth	Importance Scale 0 to 3	Familiarity with Factor 1 to 5	Districts Affected							Comments
			All	1	2	3	4	5	6	
1) Improvements made to the local transportation system										
2) Availability of developable land										
3) New industry										
4) Availability of water										
5) Availability of utilities										
6) Schools										
7) Property taxes										
8) Subdivision ordinances/Zoning										
9) Accessibility to and availability of Population and support businesses										
10) Construction of new roads to serve undeveloped areas										
11) Available housing										
12) Housing cost										
13) Neighborhood integrity										

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Other Factors Affecting Basic Employment Growth (any district)	Comments

BASIC EMPLOYMENT GROWTH POTENTIAL OF DISTRICTS

Using the information provided and your personal knowledge and experience, please indicate what you consider to be the basic employment growth potential of each of the six districts by placing the appropriate number from the rating scale in the spaces provided. Also indicate your familiarity with the individual districts using the familiarity scale, and make comments regarding any of the districts which might provide information which could be helpful to the rest of the panel. Related information is provided on pages 1, 4, 5, 7, and 16-20 in the information packet.

Rating Scale for Basic Employment Growth Potential of Districts

- 1 10% or Greater Decrease
- 0 Stable (No Change in Basic Employment)
- 1 10% Increase
- 2 25% Increase
- 3 50% or Greater Increase

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

District	Basic Employment Growth Potential Scale -1 to 3	Familiarity with District Scale 1 to 5	Comments
1			
2			
3			
4			
5			
6			

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ORDERING OF DISTRICTS BY BASIC EMPLOYMENT GROWTH POTENTIAL

Using a scale of 1 to 6 (1 indicates the least likely to grow and 6 indicates most likely to grow) indicate the order of the districts according to basic employment growth potential. Assign only one district for each of the scale values in the table.

Scale	District	Comments
1 (least likely to grow)		
2		
3		
4		
5		
6 (most likely to grow)		

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DISTRIBUTION OF BASIC EMPLOYMENT GROWTH OVER PROJECTION TIME PERIOD

In this section of the questionnaire you are asked to make a judgement regarding what level of growth activity will occur during each of the basic employment projection time periods. Place the number which most accurately describes your response in the appropriate space for each district and time period.

Responses

- 1 Decrease in Basic Employment
- 0 No Growth
- 1 Slight Growth
- 2 Moderate Growth
- 3 Considerable Growth

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)			Comments
	1990-2000	2000-2010	2010-2015	
1				
2				
3				
4				
5				
6				

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FACTORS AFFECTING RETAIL EMPLOYMENT GROWTH

This section of the questionnaire pertains to factors which may affect retail employment growth in one or more of the study area districts or the study area as a whole. Using the rating scale below, rate the importance of the following factors. Also, indicate your familiarity with the factors using the familiarity scale. If there are other factors which you feel will have an influence on growth, please list them in the space provided on the next page.

Rating Scale for Factors Affecting Future Growth

- 0 Little or No Importance
- 1 Minor Importance
- 2 Considerable Importance
- 3 Very Great Importance

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

Factor Affecting Retail Employment Growth	Importance Scale 0 to 3	Familiarity with Factor 1 to 5	Districts Affected								Comments
			All	1	2	3	4	5	6		
1) Improvements made to the local transportation system											
2) Availability of developable land											
3) New industry											
4) Availability of water											
5) Availability of utilities											
6) Schools											
7) Property taxes											
8) Subdivision ordinances/Zoning											
9) Accessibility to and availability of Population and support businesses											
10) Construction of new roads to serve undeveloped areas											
11) Available housing											
12) Housing cost											
13) Neighborhood integrity											

RETAIL EMPLOYMENT GROWTH POTENTIAL OF DISTRICTS

Other Factors Affecting Retail Employment Growth (any district)	Comments

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ORDERING OF DISTRICTS BY RETAIL EMPLOYMENT GROWTH POTENTIAL

Using a scale of 1 to 6 (1 indicates the least likely to grow and 6 indicates most likely to grow) indicate the order of the districts according to retail employment growth potential. Assign only one district for each of the scale values in the table.

Scale	District	Comments
1 (least likely to grow)		
2		
3		
4		
5		
6 (most likely to grow)		

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DISTRIBUTION OF RETAIL EMPLOYMENT GROWTH OVER PROJECTION TIME PERIOD

In this section of the questionnaire you are asked to make a judgement regarding what level of growth activity will occur during each of the retail employment projection time periods. Place the number which most accurately describes your response in the appropriate space for each district and time period.

Responses

- 1 Decrease in Retail Employment
- 0 No Growth
- 1 Slight Growth
- 2 Moderate Growth
- 3 Considerable Growth

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)			Comments
	1990-2000	2000-2010	2010-2015	
1				
2				
3				
4				
5				
6				

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FACTORS AFFECTING SERVICE EMPLOYMENT GROWTH

This section of the questionnaire pertains to factors which may affect service employment growth in one or more of the study area districts or the study area as a whole. Using the rating scale below, rate the importance of the following factors. Also, indicate your familiarity with the factors using the familiarity scale. If there are other factors which you feel will have an influence on growth, please list them in the space provided on the next page.

Rating Scale for Factors Affecting Future Growth

- 0 Little or No Importance
- 1 Minor Importance
- 2 Considerable Importance
- 3 Very Great Importance

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

Factor Affecting Service Employment Growth	Importance Scale 0 to 3	Familiarity with Factor 1 to 5	Districts Affected							Comments
			All	1	2	3	4	5	6	
1) Improvements made to the local transportation system										
2) Availability of developable land										
3) New industry										
4) Availability of water										
5) Availability of utilities										
6) Schools										
7) Property taxes										
8) Subdivision ordinances/Zoning										
9) Accessibility to and availability of Population and support businesses										
10) Construction of new roads to serve undeveloped areas										
11) Available housing										
12) Housing cost										
13) Neighborhood integrity										

Other Factors Affecting Service Employment Growth (any district)	Comments

SERVICE EMPLOYMENT GROWTH POTENTIAL OF DISTRICTS

Using the information provided and your personal knowledge and experience, please indicate what you consider to be the service employment growth potential of each of the six districts by placing the appropriate number from the rating scale in the spaces provided. Also indicate your familiarity with the individual districts using the familiarity scale, and make comments regarding any of the districts which might provide information which could be helpful to the rest of the panel. Related information is provided on pages 1, 4, 5, 7, 16-19, and 22 in the information packet.

Rating Scale for Service Employment Growth Potential of Districts

- 1 10% or Greater Decrease
- 0 Stable (No Change in Service Employment)
- 1 10% Increase
- 2 25% Increase
- 3 50% or Greater Increase

Familiarity Scale

- 1 Unfamiliar
- 2 Slightly Familiar
- 3 Generally Familiar
- 4 Very Familiar
- 5 Expert or Actively Studying

District	Service Employment Growth Potential Scale -1 to 3	Familiarity with District Scale 1 to 5	Comments
1			
2			
3			
4			
5			
6			

ORDERING OF DISTRICTS BY SERVICE EMPLOYMENT GROWTH POTENTIAL

Using a scale of 1 to 6 (1 indicates the least likely to grow and 6 indicates most likely to grow) indicate the order of the districts according to service employment growth potential. Assign only one district for each of the scale values in the table.

Scale	District	Comments
1 (least likely to grow)		
2		
3		
4		
5		
6 (most likely to grow)		

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DISTRIBUTION OF SERVICE EMPLOYMENT GROWTH OVER PROJECTION TIME PERIOD

In this section of the questionnaire you are asked to make a judgement regarding what level of growth activity will occur during each of the service employment projection time periods. Place the number which most accurately describes your response in the appropriate space for each district and time period.

Responses

- 1 Decrease in Service Employment
- 0 No Growth
- 1 Slight Growth
- 2 Moderate Growth
- 3 Considerable Growth

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)			Comments
	1990-2000	2000-2010	2010-2015	
1				
2				
3				
4				
5				
6				

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Longview Area Delphi Survey
Round 2 Questionnaire
June 23, 1992

GROWTH POTENTIAL OF DISTRICTS

Using the information provided from Round 1, your previous responses, and the responses of the panel as a whole, please re-evaluate the growth potential of each of the six districts for Population, Basic Employment, Retail Employment, and Service Employment. If you do not wish to change your previous response, please enter your previous response in the "Current Response" column.

Rating Scale for Population Growth Potential of Districts

- 1 10% or Greater Decrease
- 0 Stable (No Change in Population)
- 1 10% Increase
- 2 25% Increase
- 3 50% or Greater Increase

POPULATION GROWTH POTENTIAL

District	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response	Comments
1			1.19	0	1	3	
2			1.32	0.4	1	3	
3			0.32	-1	0	3	
4			1.21	-1	1	3	
5			1.52	-1	1.75	3	
6			-0.34	-1	0	1	

BASIC EMPLOYMENT GROWTH POTENTIAL

District	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response	Comments
1			0.88	0	1	3	
2			1.53	0	1	3	
3			1.29	0	1	3	
4			0.76	-1	1	3	
5			1.06	-1	1	3	
6			-0.06	-1	1	1	

RETAIL EMPLOYMENT GROWTH POTENTIAL

District	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response	Comments
1			0.71	0	1	2	
2			0.71	0	1	2	
3			0.29	-1	0	1	
4			1.44	0	2	2	
5			2.21	1	2	3	
6			0.18	-1	0	2	

SERVICE EMPLOYMENT GROWTH POTENTIAL

District	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response	Comments
1			0.76	0	1	2	
2			0.94	0	1	2	
3			0.53	0	0	2	
4			1.65	0	2	3	
5			1.88	0	2	3	
6			0.47	-1	1	2	

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DISTRIBUTION OF GROWTH OVER PROJECTION TIME PERIOD

Using the information provided from Round 1, your previous responses, and the responses of the panel as a whole, please re-evaluate the level of growth activity over the projection time periods for each of the six districts for Population, Basic Employment, Retail Employment, and Service Employment. If you do not wish to change your previous response, please enter your previous response in the "Current Response" column.

Responses

- 1 Decrease in Population**
- 0 No Growth**
- 1 Slight Growth**
- 2 Moderate Growth**
- 3 Considerable Growth**

POPULATION GROWTH

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)																	
	1990-2000						2000-2010						2010-2015					
	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response
1			1.41	1	1	3			1.76	1	2	3			1.47	0	2	2
2			1.41	1	1	3			1.71	1	2	3			1.47	0	1	3
3			0.71	-1	1	2			0.88	-1	1	3			0.88	-1	1	3
4			1.65	0	2	3			1.24	0	1	2			0.82	0	1	3
5			2.06	1	2	3			1.71	1	2	3			1.44	0	1	3
6			-0.29	-1	0	1			-0.18	-1	0	1			0.06	-1	0	1

BASIC EMPLOYMENT GROWTH

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)																	
	1990-2000						2000-2010						2010-2015					
	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response
1			1.06	0	1	3			1.24	0	1	3			1.06	0	1	3
2			1.44	1	1	2			1.69	1	2	3			1.44	1	1	3
3			1.13	0	1	2			1.56	0	2	3			1.31	0	1	3
4			0.81	0	1	2			0.75	0	1	2			0.63	0	0	2
5			1.44	0	1	3			1.38	0	1	3			1.06	0	1	2
6			-0.19	-1	0	1			0	-1	0	1			0.13	-1	0	1

RETAIL EMPLOYMENT GROWTH

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)																	
	1990-2000						2000-2010						2010-2015					
	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response
1			1	0	1	2			1.18	0	1	2			1.12	0	1	2
2			1	0	1	2			1.30	0	1	3			1.24	0	1	3
3			0.47	-1	1	1			0.53	-1	1	1			0.59	-1	1	2
4			1.65	0	2	2			1.53	0	2	3			1.29	0	1	2
5			2.41	1	2	3			2.06	1	2	3			1.71	1	2	3
6			0.12	-1	0	1			0.29	-1	0	1			0.41	-1	0	1

SERVICE EMPLOYMENT GROWTH

District	Level of Growth During Indicated Time Period -- Scale (-1 to 3)																	
	1990-2000						2000-2010						2010-2015					
	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response	Your Current Response	Your Previous Response	Group Avg.	Lowest Response	Group Median	Highest Response
1			0.71	0	1	2			0.88	0	1	2			0.82	0	1	2
2			0.88	0	1	2			1.12	0	1	2			1.06	0	1	3
3			0.59	-1	1	2			0.47	-1	1	1			0.41	-1	0	1
4			1.47	0	1	3			1.41	0	2	2			1.24	0	1	2
5			2	0	2	3			1.71	0	2	3			1.35	0	1	2
6			0.35	-1	0	2			0.65	-1	1	2			0.53	-1	1	2

POTENTIAL FOR CHANGES WITHIN ZONES

The next six pages relate to the potential for change within each district's zones. Evaluate the growth potential for each zone for Population, Basic Employment, Retail Employment, and Service Employment. Place an X in the appropriate box in cases where you feel the zone DOES NOT have any significant potential for change.

For example: if you feel that Zone 25 has potential for population and service employment to change but does not have any significant potential for basic or retail employment to change (i.e., stable), you would mark Zone 25 as shown.

Zone	Pop.	Basic	Retail	Service
24				
25		X	X	
26				

DISTRICT 1 ZONES

Zone	Pop.	Basic	Retail	Service
105				
120				
121				
122				
123				
124				
125				
126				
144				
145				
146				
147				
148				
149				

Zone	Pop.	Basic	Retail	Service
150				
151				
152				
153				
154				
155				
162				
163				
164				
165				
166				
167				
168				
169				

Zone	Pop.	Basic	Retail	Service
170				
171				
172				
191				
192				
193				
194				
195				
196				

Zone #	Comments

82

DISTRICT 2 ZONES

Zone	Pop.	Basic	Retail	Service
42				
43				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
57				
60				

Zone	Pop.	Basic	Retail	Service
195				
196				
197				
199				
200				
201				
202				
203				
204				
205				
215				
216				
217				
218				

Zone	Pop.	Basic	Retail	Service
219				
220				
221				

Zone #	Comments

DISTRICT 3 ZONES

Zone	Pop.	Basic	Retail	Service
56				
57				
58				
70				
71				
72				
73				
80				
81				
82				
83				
84				
85				
87				
89				

Zone	Pop.	Basic	Retail	Service
90				
92				
93				
94				
95				
96				
97				
98				
99				
100				
101				
102				
103				
104				
106				

Zone	Pop.	Basic	Retail	Service
107				
108				
109				
110				
111				
112				
113				
114				
115				
116				
117				
118				
119				
129				
130				

Zone #	Comments

84

DISTRICT 4 ZONES

Zone	Pop.	Basic	Retail	Service
30				
127				
128				
131				
1132				
133				
134				
135				
136				
137				
138				
139				
140				
141				
142				

Zone	Pop.	Basic	Retail	Service
143				
156				
157				
158				
159				
160				
161				

Zone	Pop.	Basic	Retail	Service

Zone #	Comments

DISTRICT 5 ZONES

Zone	Pop.	Basic	Retail	Service
173				
174				
175				
176				
177				
178				
179				
180				
181				
182				
183				
184				
185				
186				
187				

Zone	Pop.	Basic	Retail	Service
188				
189				
190				
191				
197				
198				
199				
204				
205				
206				
207				
208				
209				
210				
212				

Zone	Pop.	Basic	Retail	Service
213				
214				
215				
217				

Zone #	Comments

DISTRICT 6 ZONES

Zone	Pop.	Basic	Retail	Service
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				

Zone	Pop.	Basic	Retail	Service
22				
23				
24				
25				
26				
27				
28				
29				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				

Zone	Pop.	Basic	Retail	Service
44				
45				
46				
59				
60				
61				
62				
63				
64				
65				
66				
67				
68				
69				
74				
75				
76				
77				
78				
79				
88				

DISTRICT 6 ZONES

Zone #	Comments

Longview Area Delphi Survey
Round 3 Questionnaire
July 9, 1992

ALLOCATION OF GROWTH

Based the panel responses from Round 2, growth allocations have been calculated for each of the districts for Population, Basic Employment, Retail Employment, and Service Employment. The following tables show the actual 1990 distributions as a percent of the total and the high and low estimates for 2015 as a percent of the total. Using the information packets provided, indicate whether or not you feel the allocations are reasonable. If you feel that the allocations are reasonable place an X in the "Agree" column. If your feel that the allocation should be higher or lower place an X in the appropriate column. Notice that if you respond that a district should have a lower allocation there must be a district which should have a higher allocation and vice versa.

Population

District	1990	2015		Agree	Disagree	
		Low	High		Should be Lower	Should be Higher
1	13.7	13.9	14.0			
2	7.8	8.2	8.2			
3	11.3	9.8	9.5			
4	31.0	31.9	32.1			
5	17.2	20.7	21.4			
6	19.0	15.5	14.8			

Basic Employment

District	1990	2015		Agree	Disagree	
		Low	High		Should be Lower	Should be Higher
1	9.5	9.3	9.0			
2	10.4	11.7	13.3			
3	51.6	53.1	55.0			
4	5.3	5.1	5.0			
5	4.9	4.9	4.9			
6	18.3	15.9	12.8			

Retail Employment

District	1990	2015		Agree	Disagree	
		Low	High		Should be Lower	Should be Higher
1	4.2	4.0	3.4			
2	3.5	3.3	3.0			
3	10.2	9.4	7.1			
4	32.1	33.2	36.1			
5	29.7	31.7	37.0			
6	20.3	18.4	13.4			

Service Employment

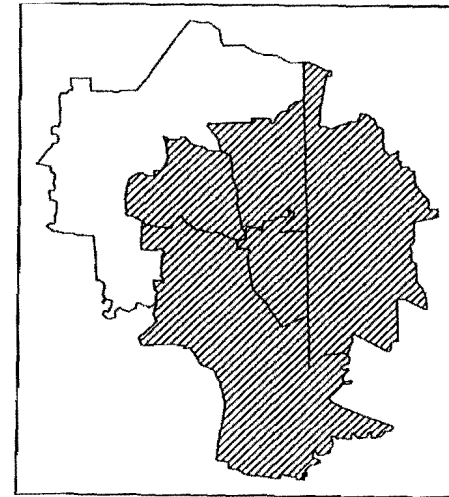
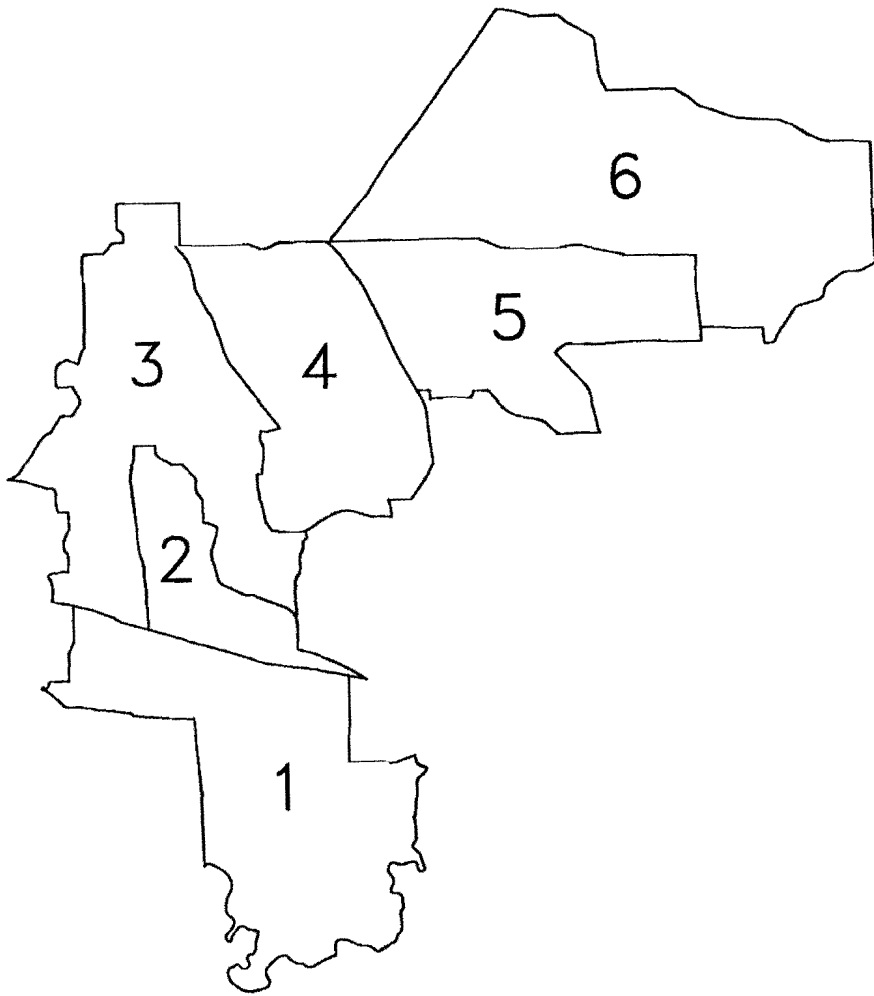
District	1990	2015		Agree	Disagree	
		Low	High		Should be Lower	Should be Higher
1	8.7	8.2	7.6			
2	1.9	1.9	1.7			
3	9.1	7.7	6.0			
4	18.0	20.3	23.3			
5	21.6	24.8	28.9			
6	40.7	37.1	32.5			

GROWTH POTENTIAL OF AREAS

Using the panel responses from Round 2, the zones within each district have been grouped into areas. Please evaluate the growth potential of each area within the districts for Population, Basic Employment, Retail Employment, and Service Employment.

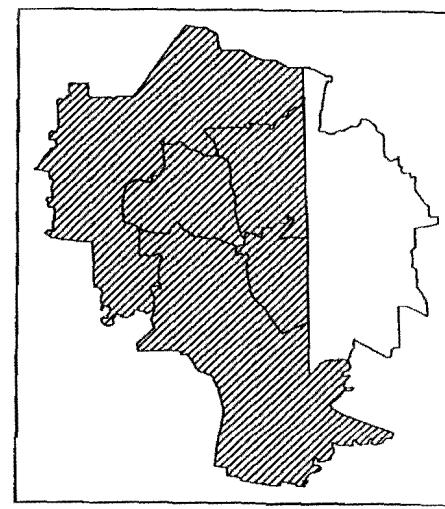
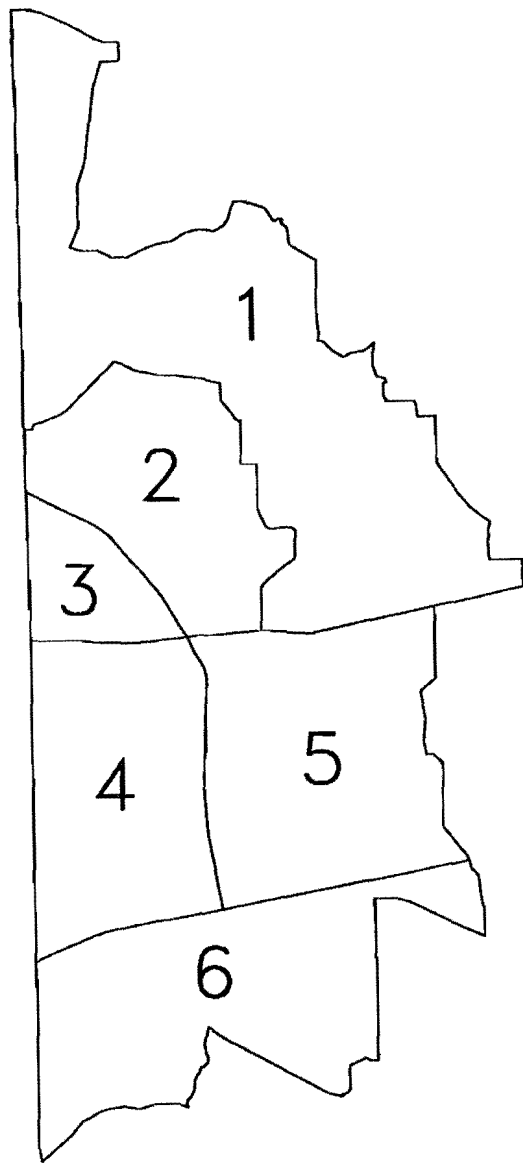
Rating Scale for Growth Potential of Areas

- 1 10% or Greater Decrease
- 0 Stable (No Change)
- 1 10% Increase
- 2 25% Increase
- 3 50% or Greater Increase



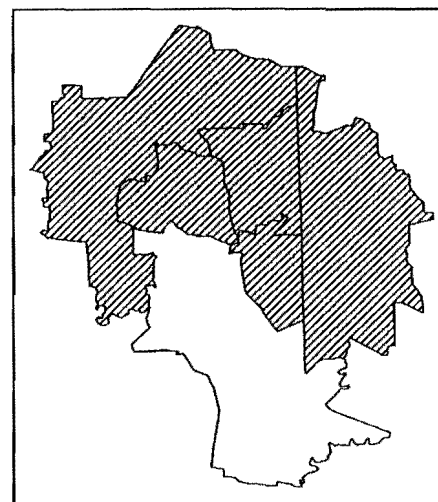
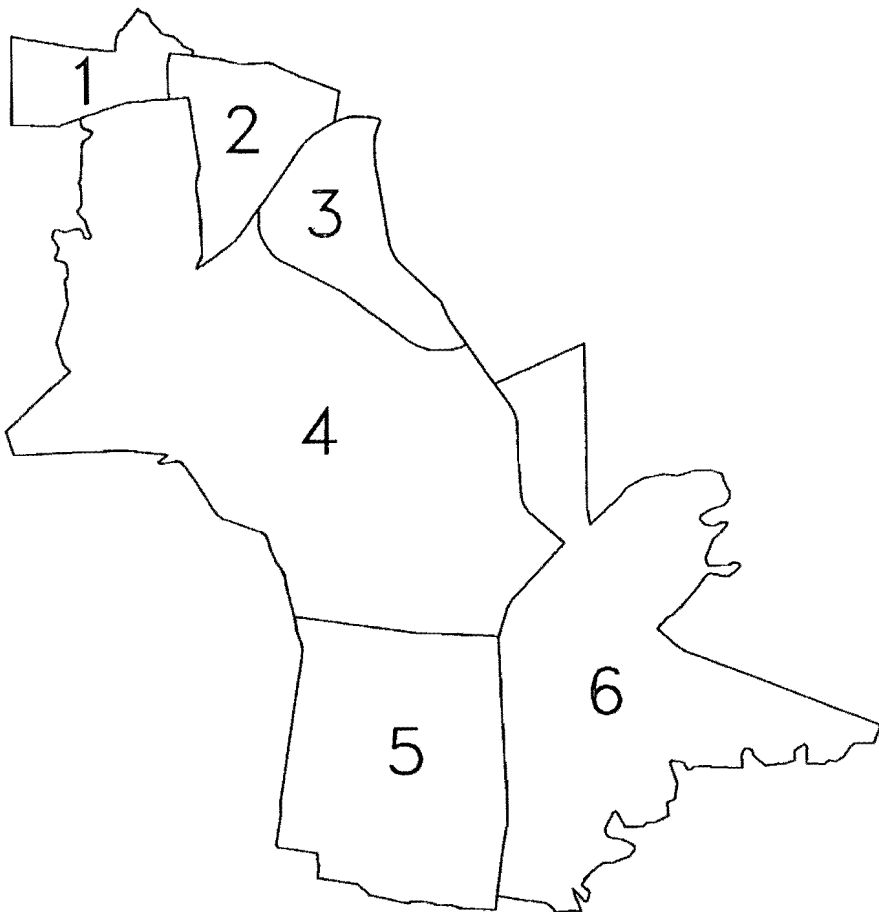
DISTRICT 1

Area	Population	Basic Employment	Retail Employment	Service Employment
1				
2				
3				
4				
5				
6				



DISTRICT 2

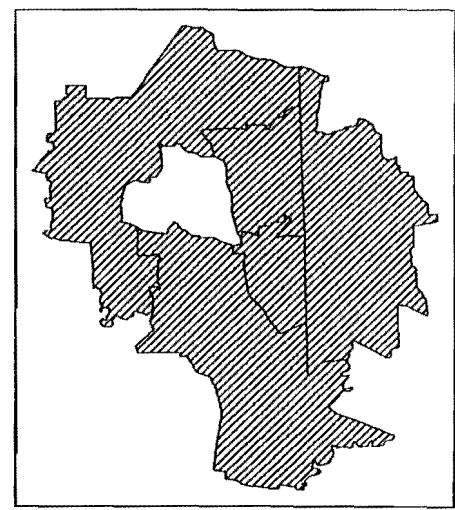
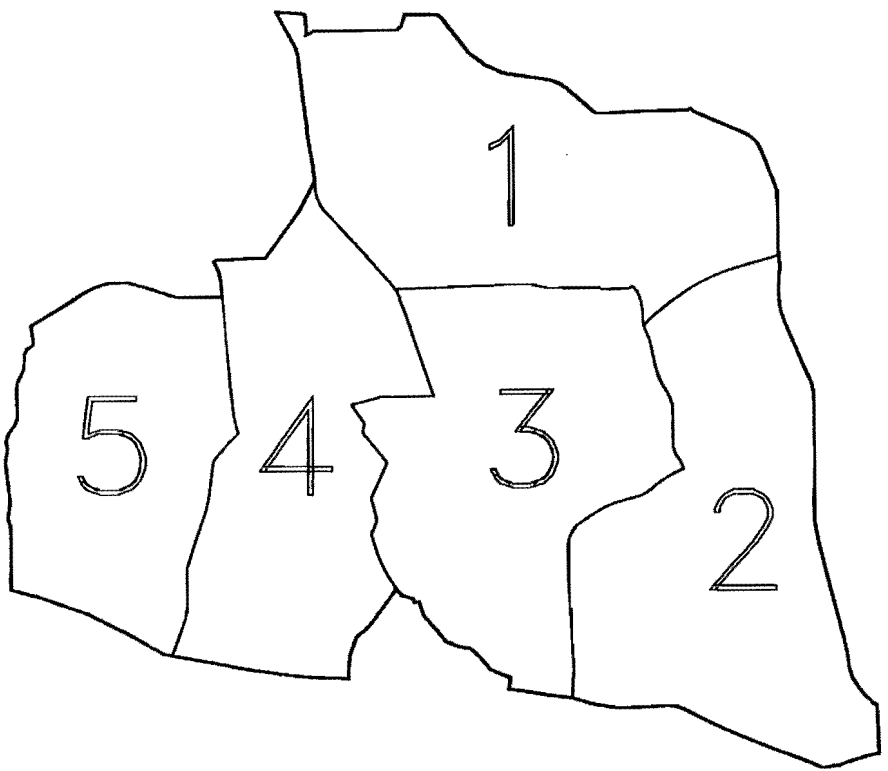
Area	Population	Basic Employment	Retail Employment	Service Employment
1				
2				
3				
4				
5				
6				



DISTRICT 3

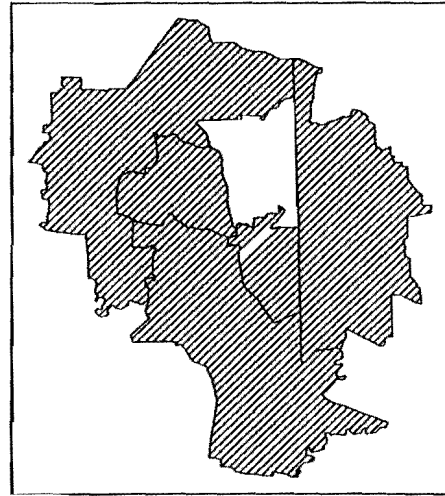
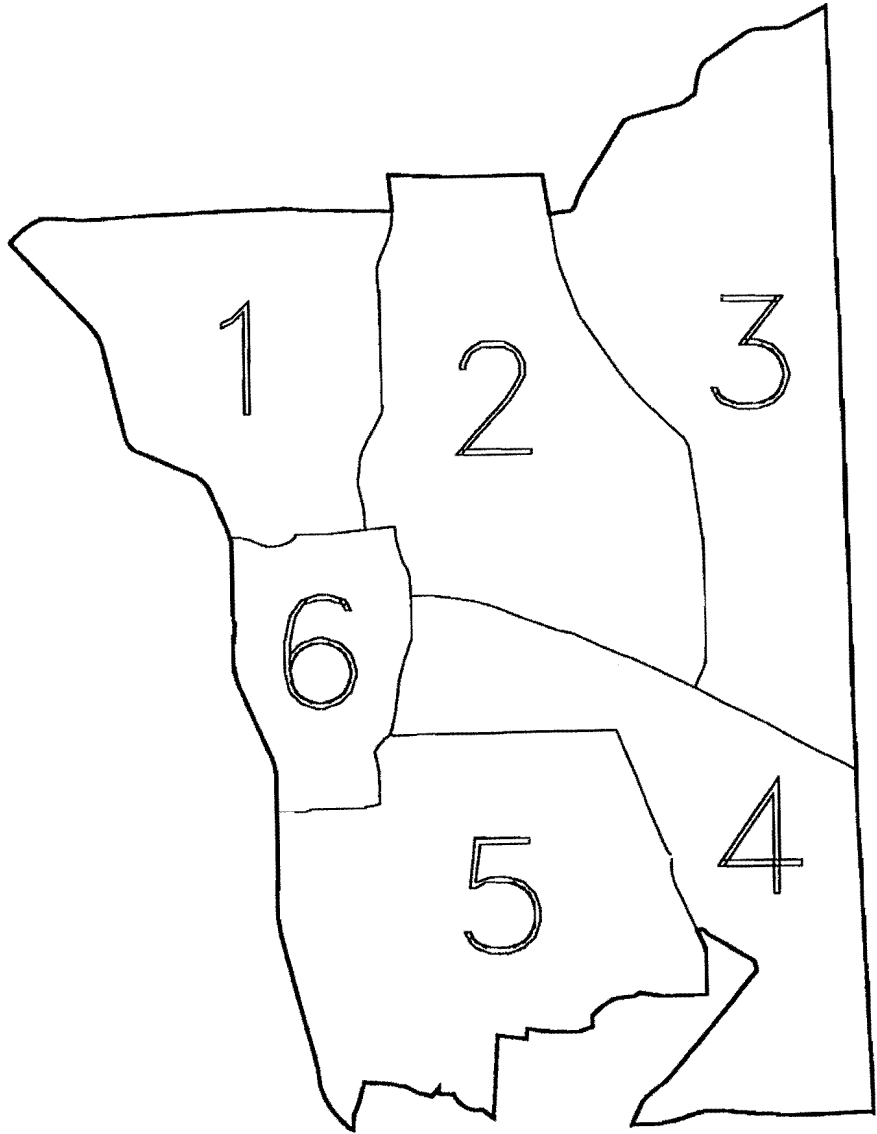
Area	Population	Basic Employment	Retail Employment	Service Employment
1				
2				
3				
4				
5				
6				

07



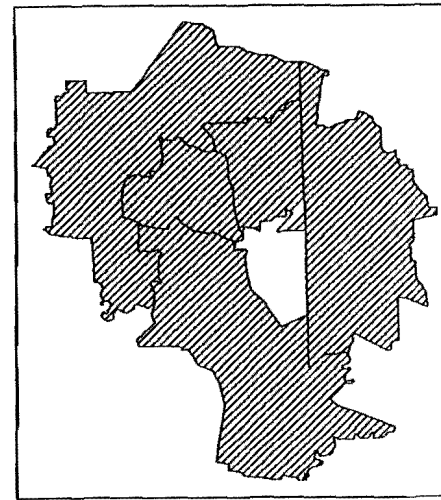
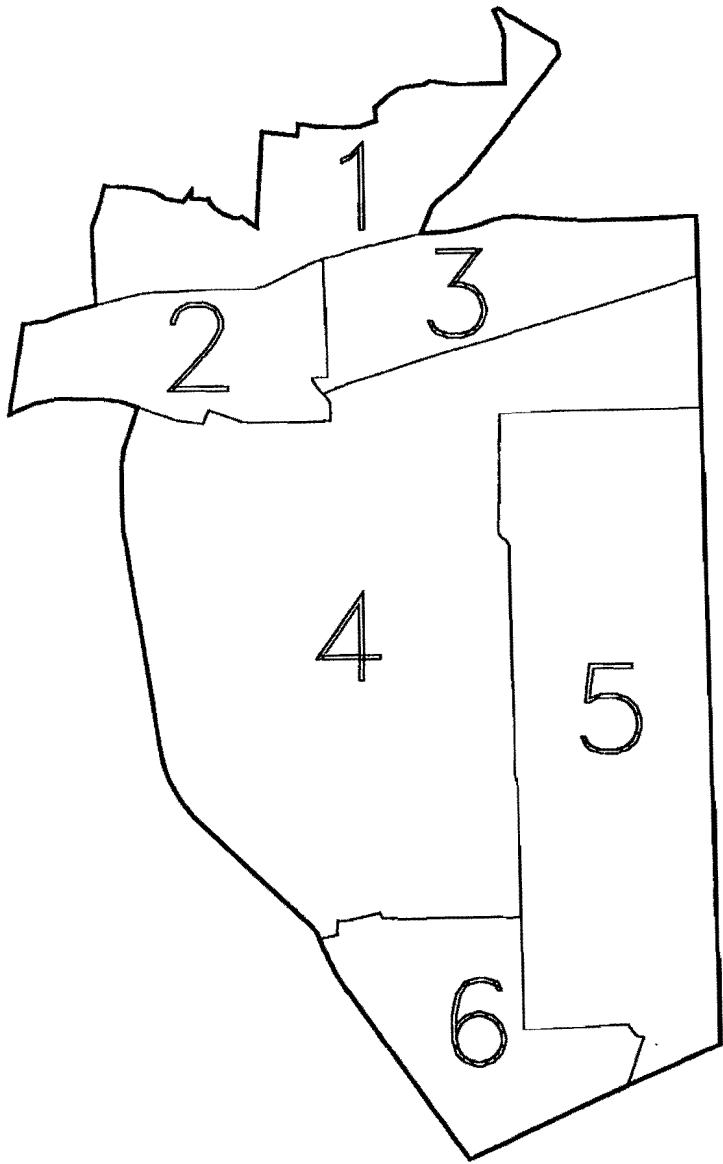
DISTRICT 4

Area	Population	Basic Employment	Retail Employment	Service Employment
1				
2				
3				
4				
5				



DISTRICT 5

Area	Population	Basic Employment	Retail Employment	Service Employment
1				
2				
3				
4				
5				
6				



DISTRICT 6

Area	Population	Basic Employment	Retail Employment	Service Employment
1				
2				
3				
4				
5				
6				

Longview Area Delphi Survey

Round 4 Questionnaire

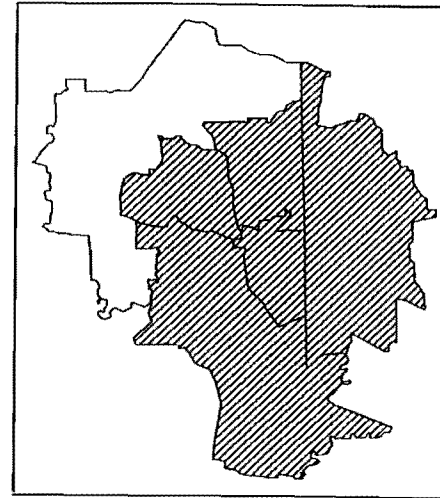
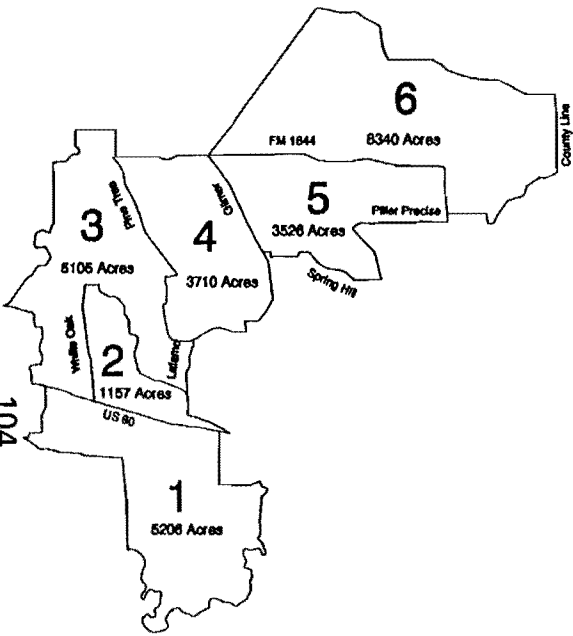
July 21, 1992

GROWTH POTENTIAL OF AREAS

Using the information provided from Round 3, your previous responses, and the responses of the panel as a whole, please re-evaluate the growth potential of the areas within each of the six districts for Population, Basic Employment, Retail Employment, and Service Employment. The acreage shown in the areas of each district map represents the undeveloped acreage within each area. If you do not wish to change your previous response, leave the "Current Response" column blank.

Rating Scale for Growth Potential of Areas

- 1 10% or Greater Decrease
- 0 Stable (No Change)
- 1 10% Increase
- 2 25% Increase
- 3 50% or Greater Increase



DISTRICT 1

POPULATION

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.11	-1	0	1
2			0.33	0	0	1
3			0.67	0	1	2
4			1	0	1	2
5			1.33	0	1	3
6			1	0	1	3

BASIC EMPLOYMENT

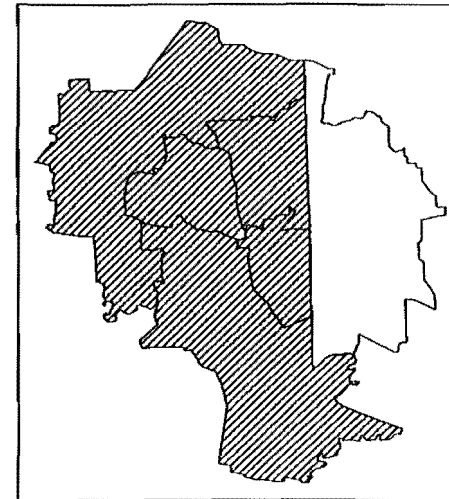
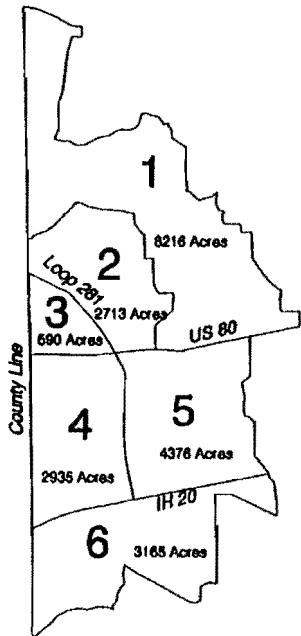
Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.44	-1	1	1
2			0.22	0	0	1
3			0.44	-1	0	2
4			0.44	0	0	2
5			0.44	0	0	2
6			0.44	0	0	2

RETAIL EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.11	-1	0	1
2			0.11	-1	0	1
3			0.22	-1	0	1
4			1	0	1	2
5			0.33	-1	0	2
6			0.22	-1	0	2

SERVICE EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0	-1	0	1
2			0.22	-1	0	1
3			0.22	-1	0	1
4			0.78	0	1	2
5			0.22	-1	0	2
6			0.22	-1	0	2



DISTRICT 2

POPULATION

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.78	0	1	2
2			0.67	0	1	2
3			0.22	0	0	1
4			-0.11	-1	0	1
5			0.44	0	0	1
6			0	-1	0	1

BASIC EMPLOYMENT

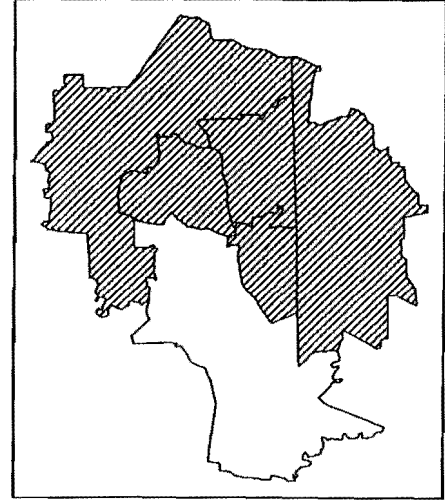
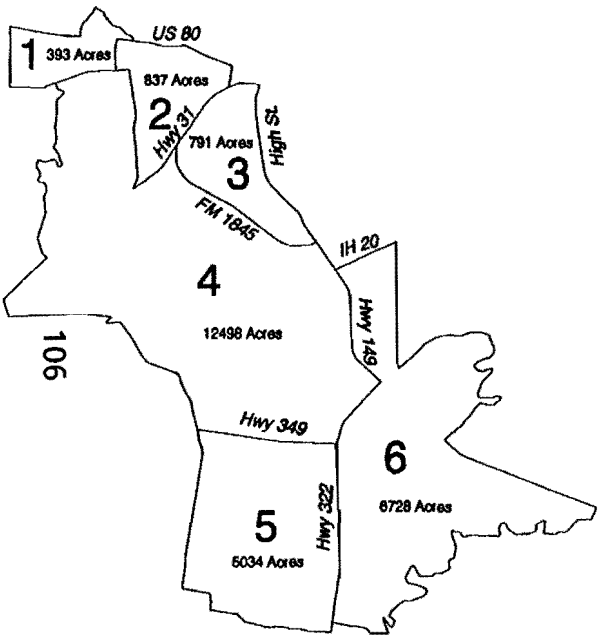
Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.44	0	0	1
2			0.44	0	0	1
3			0.11	0	0	1
4			0.44	0	0	2
5			0.78	0	1	2
6			0.89	0	1	2

RETAIL EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.33	0	0	1
2			0.78	0	1	3
3			0.78	0	1	2
4			0.33	0	0	1
5			0.22	0	0	1
6			0	0	0	0

SERVICE EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.33	0	0	1
2			0.56	0	0	2
3			0.67	0	0	2
4			0.11	0	0	1
5			0.44	0	0	2
6			0.22	0	0	1



DISTRICT 3

POPULATION

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			-0.22	-1	0	0
2			-0.11	-1	0	1
3			-0.22	-1	0	0
4			-0.11	-1	0	0
5			0.56	-1	1	1
6			0.33	-1	0	1

BASIC EMPLOYMENT

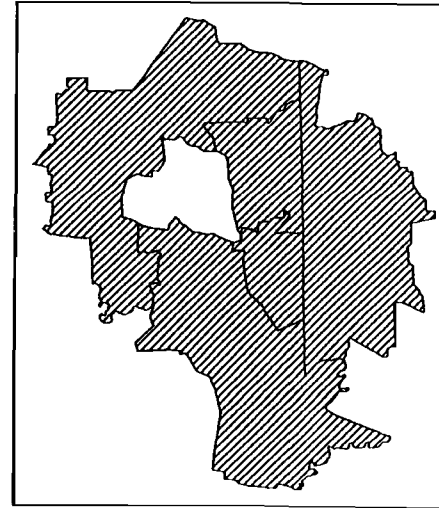
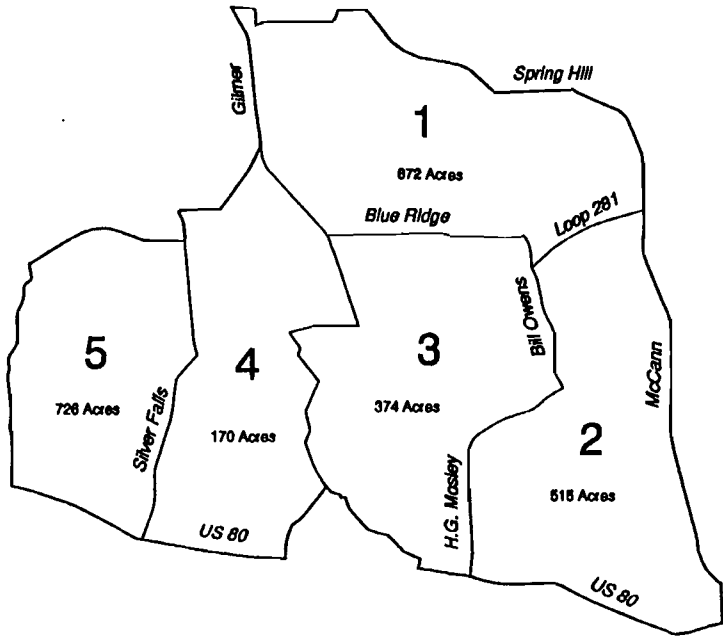
Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.11	0	0	1
2			0.56	0	1	1
3			0.33	0	0	1
4			0.67	0	1	1
5			0.56	0	1	1
6			1	0	1	3

RETAIL EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.33	0	0	1
2			0.33	0	0	1
3			0	-1	0	1
4			0	0	0	0
5			0	-1	0	1
6			0	0	0	0

SERVICE EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.22	0	0	1
2			0.11	0	0	1
3			0.22	-1	0	1
4			0	0	0	0
5			-0.11	-1	0	0
6			0.22	0	0	2



DISTRICT 4

POPULATION

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			1.22	0	1	2
2			0.56	0	0	2
3			0.78	0	1	2
4			0.44	0	0	1
5			0.56	0	0	2

BASIC EMPLOYMENT

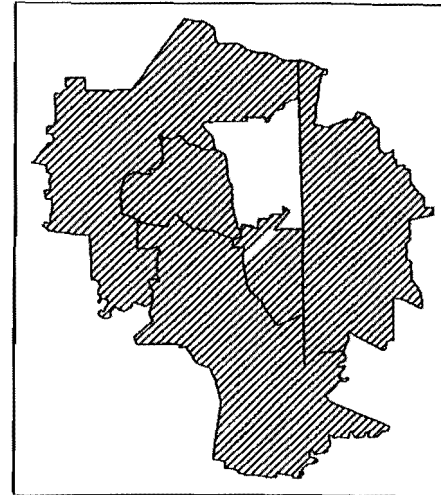
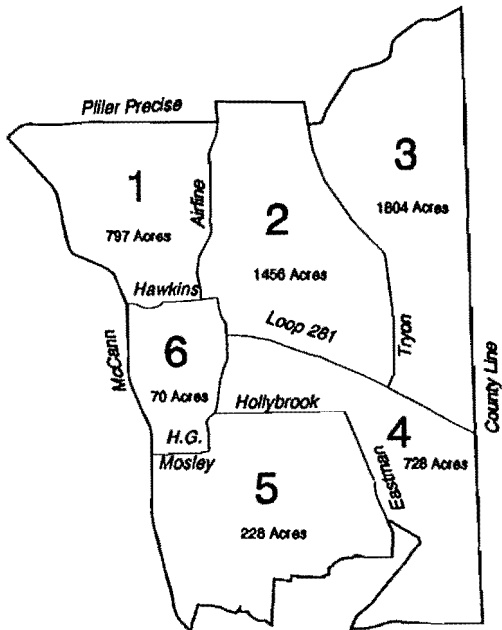
Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.11	0	0	1
2			0.22	0	0	1
3			0.11	0	0	1
4			0	-1	0	1
5			0	0	0	0

RETAIL EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.44	0	0	1
2			0.556	0	1	1
3			0.67	0	1	2
4			0.33	0	0	1
5			0.11	0	0	1

SERVICE EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.44	0	0	1
2			0.67	0	1	1
3			0.89	0	1	2
4			0.22	0	0	1
5			0.11	0	0	1



DISTRICT 5

POPULATION

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			1.33	0	1	3
2			1.78	1	2	3
3			1.11	0	1	3
4			0.67	0	1	1
5			0.33	0	0	1
6			0.22	0	0	1

BASIC EMPLOYMENT

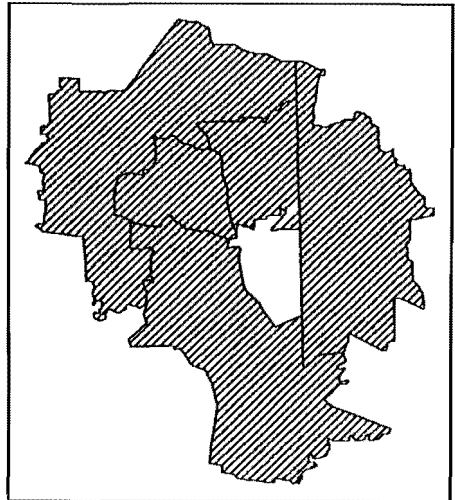
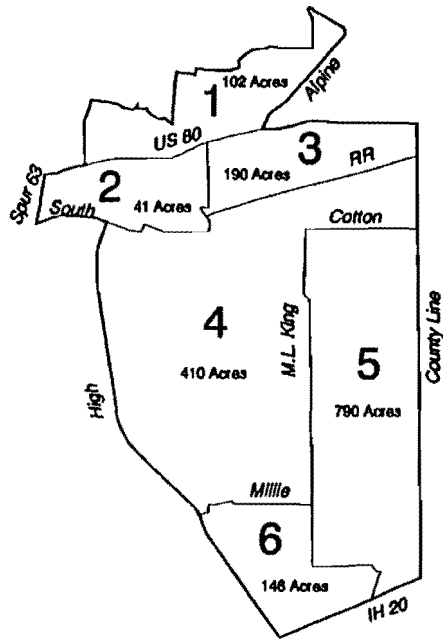
Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.44	0	0	1
2			0.44	0	0	2
3			0.44	0	0	1
4			0.33	0	0	2
5			0.33	0	0	2
6			0	0	0	0

RETAIL EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.56	0	0	2
2			1.56	0	2	3
3			0.56	0	0	2
4			1.11	0	1	3
5			0.22	0	0	1
6			0.78	0	1	2

SERVICE EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.56	0	1	1
2			1.11	0	1	2
3			0.33	0	0	2
4			0.78	0	1	2
5			0.33	0	0	1
6			0.44	0	0	1



DISTRICT 6

POPULATION

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			-0.22	-1	0	0
2			-0.33	-1	0	0
3			-0.33	-1	0	0
4			-0.56	-1	-1	0
5			-0.11	-1	0	0
6			-0.22	-1	0	0

BASIC EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0.11	0	0	1
2			0	-1	0	1
3			0	-1	0	1
4			-0.22	-1	0	0
5			0.22	-1	0	1
6			0	-1	0	1

RETAIL EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0	-1	0	1
2			-0.22	-1	0	1
3			0.11	-1	0	1
4			-0.22	-1	0	0
5			0.11	-1	0	1
6			0.11	0	0	1

SERVICE EMPLOYMENT

Area	Your Current Response Scale -1 to 3	Your Previous Response	Group Average	Lowest Response	Group Median	Highest Response
1			0	0	0	0
2			0.56	0	1	1
3			0.33	0	0	1
4			-0.33	-1	0	0
5			0	-1	0	1
6			0.11	-1	0	1

Longview Area Delphi Survey
Round 5 Questionnaire
July 30, 1992

EVALUATION OF DELPHI PROCESS

Your help in evaluating the Delphi process is an important step in developing the process for use in other areas. Please answer the following questions and provide comments where applicable. Circle the number which most accurately expresses your response to the statement. Thank you for your participation and cooperation in this process.

Rating Scale:

- 3 Strongly Disagree
- 2 Disagree
- 1 Somewhat Disagree
- +1 Somewhat Agree
- +2 Agree
- +3 Strongly Agree

	Disagree			Agree		
	-3	-2	-1	+1	+2	+3
The Delphi process is effective in obtaining, combining, and displaying the opinions of informed people so that their judgments can be used by city planners.						

Comments: _____

The participation of Longview area citizens on a Delphi panel has been an effective method of communicating information to city planners.	-3	-2	-1	+1	+2	+3
---	----	----	----	----	----	----

Comments: _____

Disagree Agree

The presentation of information and results from the previous round at the beginning of each meeting was helpful in completing the questionnaire for that meeting.

-3 -2 -1 +1 +2 +3

Comments: _____

The open discussion at the beginning of each meeting was helpful in bringing out issues which might have been overlooked by some panel members who might not have been familiar with a specific area or event influencing growth in an area.

-3 -2 -1 +1 +2 +3

Comments: _____

Having the panel's average, median, high, and low responses from the previous round to compare to my previous answers was helpful in evaluating my responses during Round 2 and Round 4 of the process.

-3 -2 -1 +1 +2 +3

Comments: _____

Disagree Agree

The format used for Round 1 and Round 2 -3 -2 -1 +1 +2 +3
questionnaires using only tables was the better of the
two formats.

Comments: _____

The format used for Round 3 and Round 4 -3 -2 -1 +1 +2 +3
questionnaires showing the map of the district and
areas was the better of the two formats.

Comments: _____

The allocations calculated using the panel responses -3 -2 -1 +1 +2 +3
are an accurate reflection of the panel's opinions.

Comments: _____

It would have been helpful to have been able to fill -3 -2 -1 +1 +2 +3
out the questionnaires at home and return them by
mail rather than during the meeting.

Comments: _____

	Disagree			Agree		
	-3	-2	-1	+1	+2	+3
I felt more comfortable dealing with numbers (estimated population, estimated employment, and undeveloped acres), rather than percentages, when evaluating the growth potential of a district or area.	-3	-2	-1	+1	+2	+3

Comments: _____

I felt more comfortable dealing with percentages (percent of total estimated population, percent of total estimated employment, and percent change), rather than numbers, when evaluating the growth potential of a district or area.	-3	-2	-1	+1	+2	+3
---	----	----	----	----	----	----

Comments: _____

Some form of compensation for the time spent participating in the process would have been appropriate.	-3	-2	-1	+1	+2	+3
--	----	----	----	----	----	----

Comments: _____

	Disagree			Agree		
January through May would have been the most convenient months for me to participate in the process.	-3	-2	-1	+1	+2	+3
June through August would have been the most convenient months for me to participate in the process.	-3	-2	-1	+1	+2	+3
September through December would have been the most convenient months for me to participate in the process.	-3	-2	-1	+1	+2	+3

Comments: _____

Mornings would have been the best time of day for me to attend meetings.	-3	-2	-1	+1	+2	+3
Afternoons would have been the best time of day for me to attend meetings.	-3	-2	-1	+1	+2	+3
Evenings would have been the best time of day for me to attend meetings.	-3	-2	-1	+1	+2	+3

Comments: _____

I would be willing participate in a similar Delphi process in the future.

Yes

No

Comments: _____

The following space is provided for comments on the final district and area allocations or any other comments which you feel might be helpful in improving the Delphi panel process.

APPENDIX C DISTRIBUTION OF *t*

df	Level of significance for one-tailed test					
	.01	.05	.025	.01	.005	.0005
	Level of significance for two-tailed test					
	.20	.10	.05	.02	.01	.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

SOURCE: This Table is abridged from Table III of R.A. Fisher and F. Yates, *Statistical Tables for Biological, Agricultural, and Medical Research* (1948 ed.), published by Oliver & Boyd, Ltd., Edinburgh and London, by permission of the authors and publishers.

