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A REGIONAL ANALYSIS OF THE EFFECTS OF HIGHWAY DEVELOPMENT ON TOURISM IN THE TEXAS GULF COAST

by

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and
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Research Report 1106
Research Study Number 2-10-87-1106

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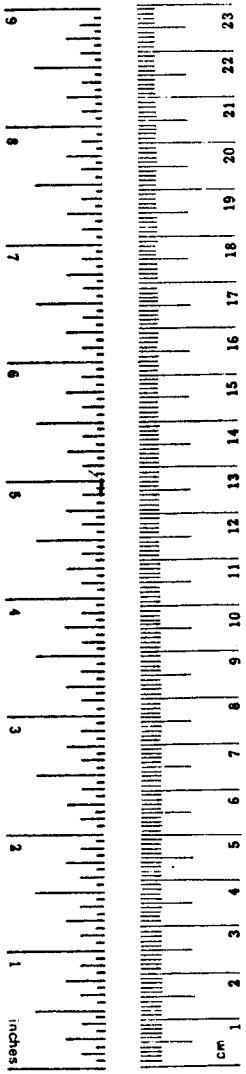
College Station, TX 77843

November, 1988

METRIC CONVERSION FACTORS

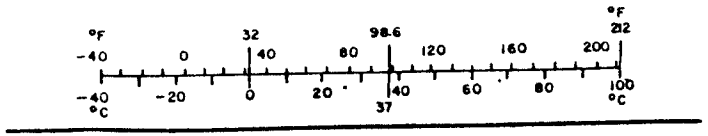
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



Abstract

This report describes the pattern of tourism/recreational travel in the area of the Texas Gulf Coast. An examination is made of the tourism resources that are available along the Texas Gulf Coast. The patterns of highway development in the region are examined. The effectiveness of the highway network in meeting the demands of the tourism industry is evaluated.

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I. Introduction

Tourism in Texas represents a $17.3 billion industry that is second only to the oil and gas industry in the State. Specifically, travel expenditures increased 7.8 percent or $1.26 billion from 1985 to 1986. This figure is significantly greater than the 0.9 percent increase in gross state product for the same year (Smith and Echeverri-Carroll, 1986). Clearly the recreation/tourism industry has a strong presence in the Texas economy, and there is a need for state agencies to implement planning policies that will encourage further growth in this economic sector. The purpose of this research report is to examine the relationship between highway development and tourism activity.

The goal of the research is to isolate the effect of the highway network on economic development, specifically on the development of the tourism industry along the Texas Gulf Coast. To accomplish this goal, four objectives must be achieved:

1. To describe the patterns of tourism/recreational travel in the area of the Texas Gulf coast.
2. To examine the tourism resources that are available along the Texas Gulf Coast.
3. To examine the patterns of highway development in the Gulf Coast region.
4. To evaluate the effectiveness of the highway network in meeting the demands of the tourism industry.

The findings of each objective provide the building blocks to achieve the goal of this research.

This report is divided into six sections. First, a brief review of literature will be presented in Section II. The review includes the current status of research in both the transportation and tourism research disciplines. Section III describes the patterns of tourism travel in the area of the Texas Gulf Coast. Aspects of tourism/recreational travel are discussed within the context of travel expenditures and the patterns of origins and destinations. Section IV provides a description of the tourism resources of the Texas Gulf Coast. Tourism resources will include both natural resources, such as, seashores and wetland fishing areas, and those that are man-made, such as amusement parks, hotels, and campgrounds. Section V focuses on the transportation network, specifically, the highway network that serves the Texas Gulf Coast. The issue of accessibility of the region to tourism

travel is also examined. The concluding Section presents a brief discussion of some policy implications that are relevant to both tourism and transportation planners.

II. Literature Review

This research draws upon two disciplines: namely, the economic transportation and tourism planning fields of study. The connection between the two disciplines is easily understood. Transportation economists study, analyze, and forecast economic effects of a transportation segment or network. Tourism planners study the impact of the tourism industry on the regional economy. Transportation is a recognized input to the tourism industry, and the tourism industry is one that is continually responding to changes and innovations in the transportation sector. Therefore, the linkage between highway development and tourism activity is one that is acknowledged by researchers in both fields. There is, however, little research published that attempts to evaluate the magnitude on strength of this relationship. For example, the transportation literature does not particularly address the key role that investments in transportation infrastructure play in promoting tourism or economic development, in general. The same is true for the tourism planning literature. There is little research that specifically demonstrates how transportation investments will change the patterns of tourism. This review will identify the research that has emphasized the presence of a relationship between transportation and economic activity with special attention to tourism economic activity.

Within the context of the economic transportation literature, the role of highway development on economic growth is mostly examined as it relates to the concept of accessibility. The tie between highway development and accessibility is well documented. Briggs (1981) demonstrates, using regression analysis, that the location of interstate highways has a positive effect on economic growth through population migration and employment change. Siccardi (1986) documents the legislative history of Federal attempts to stimulate growth through transportation improvements. Siccardi concludes that economic growth is promoted by increasing accessibility to meet specific objectives, such as improving access to airports, hospitals and other community service functions. Additionally he points out that population receives beneficial growth effects from highway improvements, and this will, in fact, become a positive stimulus to prosperity.

The effect of highway development on improved accessibility also has a positive impact on property values. Miller (1971) elaborates on the concept of accessibility and the resulting appreciation of property. He states that the relative location of a piece of property

is a key factor in enhancing property values. Using time series and regression techniques, Langley (1981) and Palmquist (1982) demonstrate how proximity to major thoroughfares increases adjoining property values. Specifically, Palmquist predicts a 15 to 17 percent increase in property values resulting from being directly accessible to a highway segment.

The difficulties in defining the monetary benefits of highway investments are expressed by Stanley and Nash (1977). They use cost benefit analysis to assess the impact of transportation projects. The authors conclude that this technique is of value; however, it cannot be used solely for predictions since it is difficult to appraise the monetary values of the external forces that result from highway improvements (the costs) and affect economic growth (the benefits). Gamble and Davinroy (1978) discuss some of the externalities that result from highway investments and construction. Included in their report are the environmental effects (the effects on the biotic components of the environment, pavement preservation, etc.), the social effects related to highway development (changes in community patterns, the socio-demographic makeup of a community), and the economic effects (changes in the employment structure, journey to work patterns, etc.). Gamble and Davinroy present an extensive review of literature that encompasses these issues in transportation development.

Dye (1980) develops a model to estimate economic growth as measured by the growth in personal income, growth in employment, and growth in value-added by manufacturing. The independent variables used to predict economic growth were classified into eight categories that include measures of taxing, spending, redistribution, warmth and sunshine, historical development, unionization, size, and other confounding factors. Dye identified several correlates to economic growth that are transportation related. It is demonstrated that state spending is more instrumental in explaining the variance in economic growth than is state taxing. Specifically, he concludes that state spending on capital infrastructure, including highways, is more effective in stimulating economic growth than other kinds of state expenditures or tax incentives.

There are two recent empirical studies that evaluate the relationship between highway investments and economic development. Stephanedes and Eagle (1986, 1987) demonstrate the existence of such a relationship, specifically, how highway construction expenditures affect employment. They followed a two-stage methodology involving both cross-sectional and longitudinal data. In the first stage, cross-sectional data consisting of

manufacturing employment, retail sales, retail employment, and family income were tested against highway expenditures. Then, a time series analysis was used to test if changes in one series (highway expenditures) statistically precedes changes in another series (employment levels). Their findings suggest that there were significant increases in employment for the 2-3 years following highway improvements; however, by the tenth year, employment was back to its initial level. Stephanedes and Eagle fail to consider the dynamic forces that promote economic growth through the more long term effects of multipliers. The authors do, however, present a concise and easily applied methodology to estimate the degree of employment growth that can be expected from highway investments.

Reports and articles in the transportation literature that reflect the research needs of this study, that is, how highway investments and development specifically affect the tourism/recreational industries, are scant. Unger (1967) used gravity models to translate recreation participation rates into expected traffic volumes. He did not, however, address the issues of accessibility, or the increased economic development that would result from this traffic flow. Yu and Farzad (1979) studied the problem of accessibility to a recreational area outside of Salt Lake City, Utah. Although the authors considered the issue of accessibility, the more dynamic economic relationship involving the economic benefits that would accrue to a tourist community from the improved accessibility was not analyzed.

The tourism planning literature concentrates on estimating the volume and behavior of the tourism market. However the term "tourism" is poorly defined. Mill and Morrison (1985) recognize the fact that there is no universally accepted definition of tourism. They acknowledge a link between tourism, travel, recreation, and leisure. It is clear, however, that these concepts do not belong exclusively to the study of tourism. For example, all travel is not tourism, nor all recreation activity is tourism, nor is all leisure time. For this reason the overall effect of tourism on the economy is difficult to measure. However, the generation of tourism dollars is a politically attractive goal because the outcome of tourism spending is felt by many businesses and organizations. The economic benefits of tourism activity to economically depressed areas are well documented (Elkan, 1975; Hills and Lundgren, 1977; Stock, 1977; Pearce, 1981; Gunn, 1988).

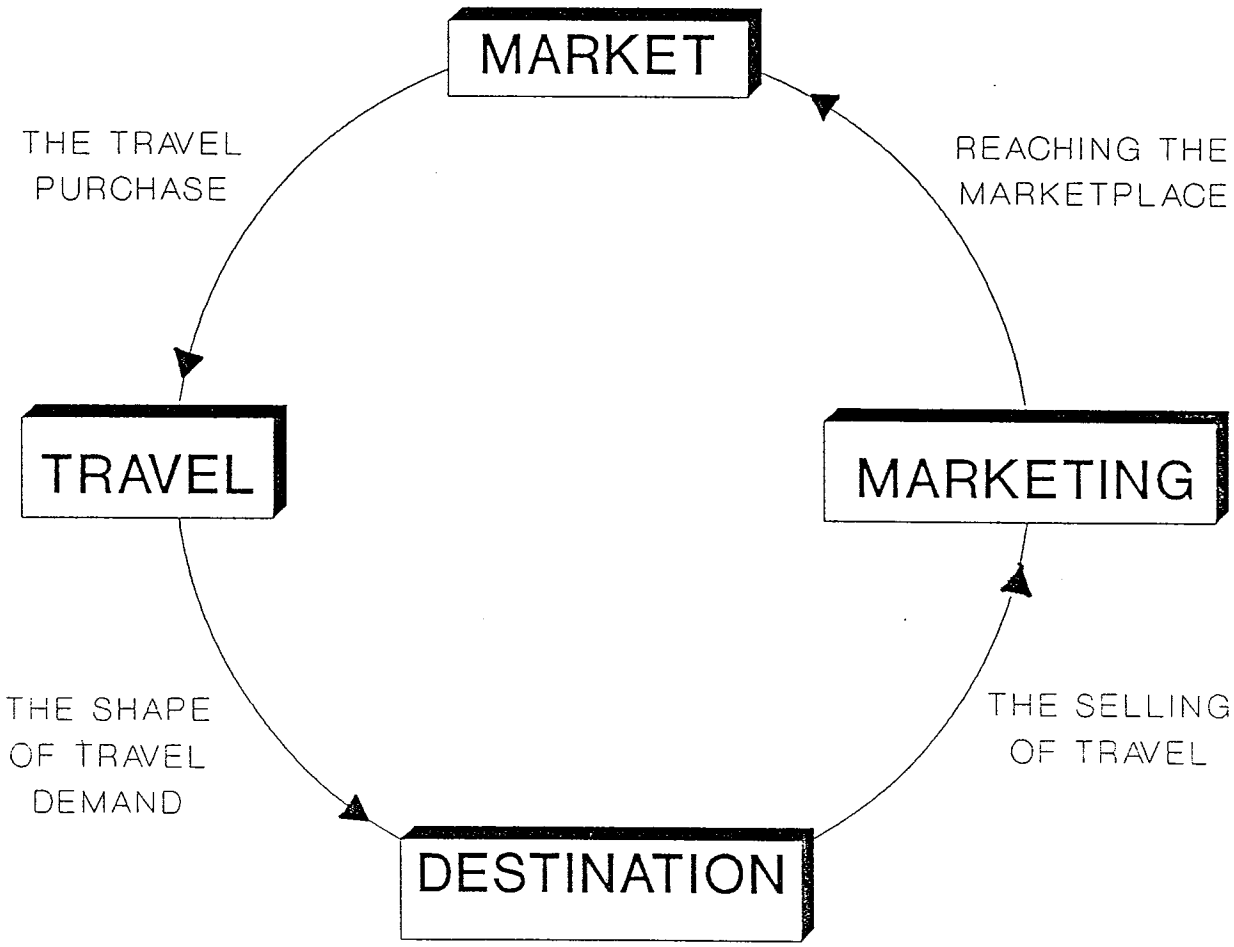
Much of the literature concentrates on the entire tourism planning process as it relates to the local, domestic, and international economic communities (Pearce, 1981; Mill and Morrison, 1985; Murphy, 1985; Gunn, 1988). Mill and Morrison identify the underlying

processes that are fundamental to the existence of tourism. Figure 1 summarizes the "Tourism System" from which to model and understand the processes of tourism activity. The model is comprised of four components: Market; Travel; Destination; Marketing. This model is a useful tool for examining one or all aspects of tourism. The first section of the "Tourism System" focus on the market segment for tourism activity. To describe the market for travel, it is necessary to study the individual's travel purchase behavior and the factors that influence an individual to purchase travel. Once an individual chooses to travel, he must decide where, when, and how to go.

There are several trends in the tourism industry that shape the nature of travel demand. The third segment of the model describes the Destination; the product mix of attractions and services. To obtain the continual benefits from tourism, the people at the destination must establish a policy to plan and develop tourism resources for the long-term benefit of the destination. Finally the destination area, through the process of marketing, encourages continued tourism activity. The process of marketing involves the development of a promotional plan that will reach the general market and influence potential travel. The significance of the transportation sector to tourism planning is acknowledged by this model. The travel segment of the model provides the framework from which to examine the relative importance of alternative modes of transportation in the decision making process of choosing a destination.

The historical importance of transportation to the tourism industry is outlined by Gunn (1988). He provides a historical background of how transportation innovations changed patterns of tourism activity. For example, steamship travel along the coasts and river systems of the United States dominated tourist transportation for a relatively brief period during the 1800's. In response to this mode of transportation, many luxury resort hotels opened on the shores of the Great Lakes and other port cities. Improvements in rail travel brought about the demise of steamboats, and a new set of tourism destinations became accessible for tourist travel. Rail was able to accommodate a greater number of travellers and the market for tourism increased substantially. The railways frequently developed resort hotels that were served by their lines. Also, during this period, the development of the streetcar or electric trolley stimulated the development of the nearby lakes to resorts.

FIGURE 1.
THE TOURISM SYSTEM



The advent of personal ownership of the automobile precipitated the demise of the train, and the great rail resorts in the United States. The automobile encouraged a more random pattern of travel to new destinations and stimulated the development of new automobile oriented facilities and services along highways and roads. Of major significance was the development of the nationwide interstate highway network which made automobile travel faster and safer.

The current innovation to transportation is the airline industry. It is unlikely that jet travel will supercede automobile travel; yet the airline industry has experienced phenomenal growth. The general trend of decreasing air fares has made air travel more affordable and simultaneously made it accessible to a larger set of international travel destinations.

The historical evolution of tourism is recognized to be directly linked to both transportation and regional development. (Mill and Morrison, 1985; Murphy, 1985; Gunn, 1988). The highway system reflects transportation linkages that are influenced by a large array of factors--none of which include tourism promoting criteria--such as primary access to tourism resources, attractions, or scenery. This can be considered a weakness of transportation planning; yet tourism planners fail to demonstrate the advantages of promoting and investing in alternative routes that are beneficial to tourism (Gunn, 1988).

Gunn identifies the transportation needs of tourists as:

1. Tourists require movement from home to destinations and within destinations;
2. Tourists seek pleasurable travel; in many circumstances the travel and its associated amenities are a large portion of the "attractiveness" of a destination; and
3. Tourists pursue several personal travel conditions, such as comfort, convenience, safety, dependability, price, and speed.

Gunn and others identify both the historical and current importance of the role of transportation in tourism development; yet more intensive research on the exact contribution of the transportation sector to tourism activity is not well addressed by the literature. This report will identify the role of transportation on tourism, independent of the other contributing factors. To begin this analysis, the following section addresses the current state of tourism activity along the Texas Gulf Coast. Section III will analyze the attraction component of tourism, and Section V will summarize the characteristics of the highway network. The concluding Section VI will provide an analysis of the independent effects of transportation.

III. Patterns of Tourism Activity

The tourism industry contributes a significant amount of revenues to the Texas State economy. During 1986, a little over $17 billion was spent on transportation lodging, food, entertainment, recreation, and incidentals by visitors in Texas. The largest portion of these expenditures was directed for transportation, specifically $6.2 billion on auto transportation. During that year, travel and tourism generated 294,000 jobs throughout the State. The majority of these jobs (45.2 percent) were absorbed by food related businesses such as restaurants and drinking places. (Texas Tourist Development Agency, 1988). The importance of the tourism industry to the State is evident. However, not all Texas communities benefit equally from this revenue generating industry. Section III of this report summarizes the spatial characteristics of the tourism industry, focusing primarily at tourism activity in the counties along the Texas Gulf Coast. The patterns of tourism activity will be examined from two perspectives: (1) by the distribution of expenditures; and (2) by patterns of origins and destinations.

Tourism in general is an urban phenomenon. In Texas 64 percent of all tourism revenues are directed toward the major cities of Houston, Dallas, Ft. Worth, and San Antonio. Figure 2 illustrates the distribution of tourist dollars in the State. The $1.3 billion for the Gulf Coast is underestimated by $3.9 billion that are attributed to Houston and thus fall into the urban category. Overall, the Texas Gulf Coast (including Harris County) accounts for 30 percent or $5.2 billion dollars of travel expenditures.

To study tourism activity along the Texas Gulf Coast, 21 counties were selected for analysis. Table 1 identifies these counties and lists the amount of travel expenditures that they generated. Harris County represents the area attracting the greatest amount of tourism dollars. The urban centers of Beaumont, Brownsville, Corpus Christi, and Galveston also capture a sizeable portion of the tourism expenditures of the region. These counties act as seed areas or provide a stimulus for growth of the tourism industry.

FIGURE 2.
TEXAS TRAVEL EXPENDITURES
1986

(000's)

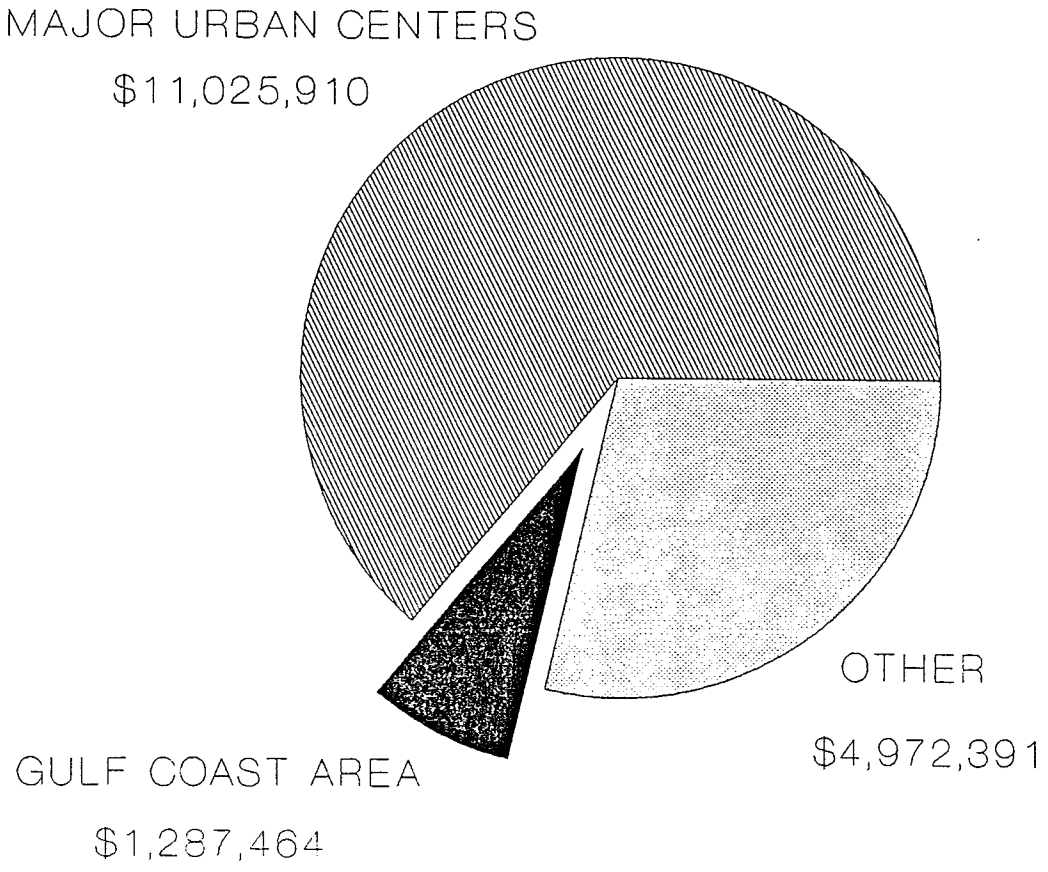
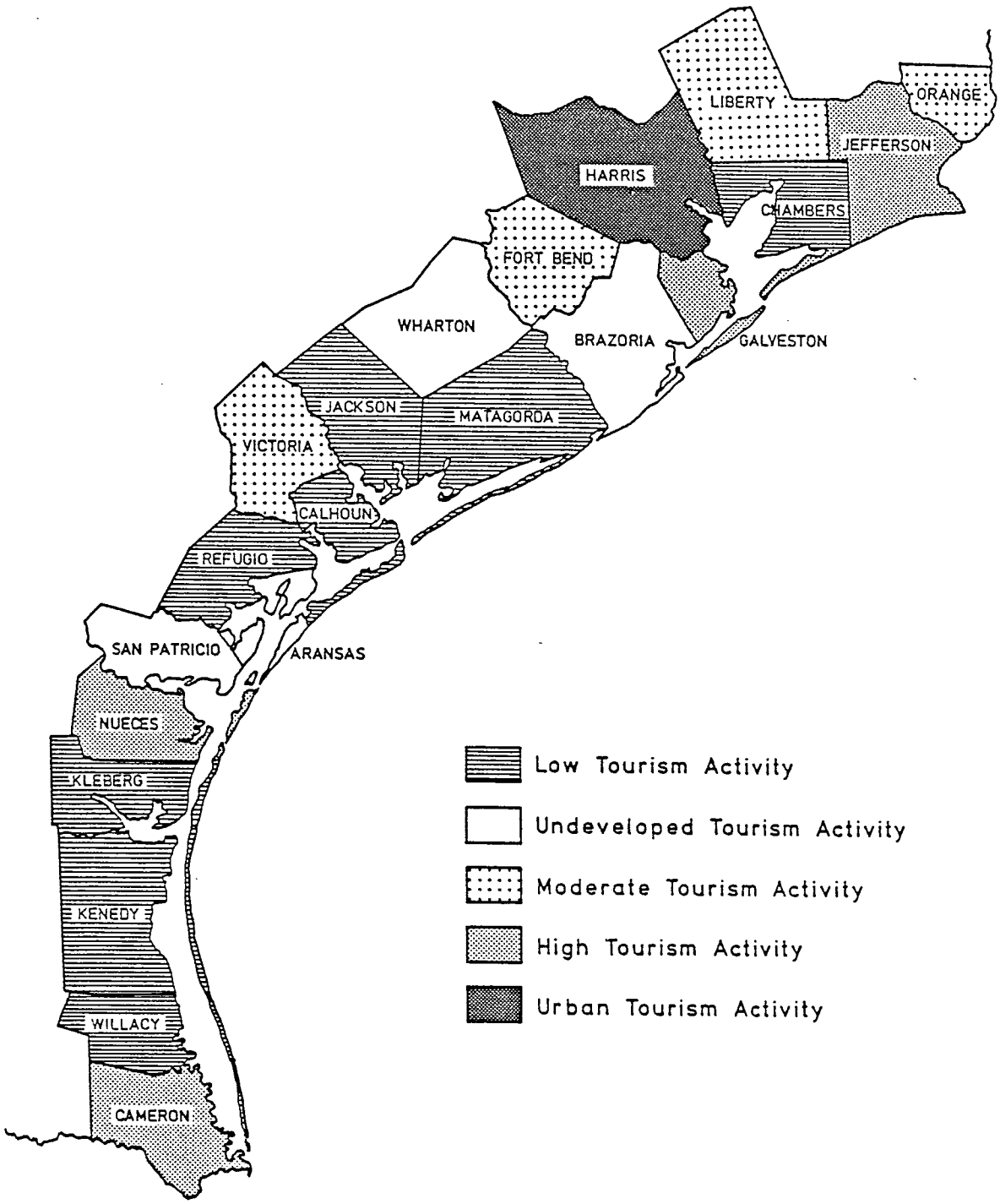


Table 1. Travel Expenditures and Travel Generated Employment for Counties on the Texas Gulf Coast (1986)

COUNTY	Travel Expenditures (000's)	Travel Generated Employment (JOBS)
ARANSAS	25154	677
BRAZORIA	29635	465
CALHOUN	1100	991
CAMERON	2445074	778
CHAMBERS	9885	76
FORTBEND	53113	38
GALVESTON	245196	3823
HARRIS	3954310	69804
JACKSON	7394	60
JEFFERSON	200907	3041
KENEDY	185	5
KLEBERG	12185	112
MATAGORDA	10079	95
NUECES	255492	4199
ORANGE	38912	294
REFUGIO	6962	53
SAN PATRICIO	24966	191
VICTORIA	46421	439
WHARTON	22202	151
WILLACY	5309	41

Tourism expenditures can be translated into a measure of tourism activity. Figure 3 describes the spatial patterns of tourism activity along the Gulf Coast within the context of 5 categories. A category of tourism activity represents those counties that have similar shares of tourism expenditures. Harris County captures the highest amount of tourism activity and is categorized independently under the heading of Urban Tourism Activity. The 4 smaller SMSA's (Beaumont, Brownsville, Corpus Christi, and Galveston) are represented by the High Tourism Activity category. Each of these counties has at least $200 million in expenditures. Four counties, not directly accessible to the Gulf Coast, are represented by the moderate category. The relatively high level of expenditures, fluctuating around $40 million, is perhaps explained by the counties' proximity to the urban centers. These dollars

FIGURE 3. TOURISM ACTIVITY



may represent secondary spending from trips to Harris and Jefferson counties. The level of activity in Victoria County is an exception to this hypothesis. Counties falling in the Undeveloped Tourism Activity category (from 20-25 million dollars in expenditures) especially San Patricio, Aransas, and Brazoria counties, are counties adjacent to areas with relatively high activity. Yet these counties do not share similar levels of activity. The smallest amount of tourism expenditures are represented by counties in the Low Tourism Activity classification. These counties have minimal tourism expenditures that range from $85,000 to $12 million. It is clear that the higher levels of tourism activity concentrate around the urban areas.

Spatial patterns of tourism expenditures provide information about the geographic characteristics of economic benefits. The expenditure data are valuable for making policy recommendations to encourage tourism activity. To better understand the nature of the expenditures, it is also important to examine the patterns of origins and destinations of the recreational trips. Trip origin/destination data collected for the Water Development Board was used to illustrate these spatial patterns. This data includes the response of a little over 5000 Texans who stated they visited the Texas Gulf Coast for recreational pursuits during 1986.

Table 2 summarizes the patterns of trip destinations. These figures coincided with the pattern of tourism expenditures. The number of trips to Harris County, however, is greatly understated due to the nature of the questionnaire. Respondents were asked if they had taken a trip to the Gulf Coast during 1986. Houston, or Harris county, is not considered by most Texans, as part of the Texas Gulf Coast. In fact, the respondents who acknowledged their trip to Harris County as part of the Texas Coast were from counties farthest away from the Coast. The four counties that include the SMSA's of Beaumont, Brownsville, Corpus Christi, and Galveston are the most often cited destinations.

Table 2. Counties of Destination for Travellers to the Texas Gulf Coast (1986)

Destination	No. of Visitors	Percent of Total
ARANSAS	230	4.43%
BRAZORIA	304	5.84%
CALHOUN	124	2.38%
CAMERON	624	11.99%
CHAMBERS	44	.84%
FORT BEND	3	.05%
GALVESTON	2000	38.44%
HARRIS	188	3.61%
JACKSON	2	.05%
JEFFERSON	116	2.23%
KENEDY	0	.01%
KLEBERG	25	.49%
MATAGORDA	1472	.83%
NUECES	1184	22.77%
ORANGE	9	.18%
REFUGIO	18	.35%
SAN PATRICIO	130	2.49%
VICTORIA	2	.05%
WHARTON	4	.07%
WILLACY	48	.91%

The pattern of visitor origins provides some useful insights to the spatial behavior of tourism on the Texas Gulf Coast. The counties of origin that represent more than 1 percent of the total trips are listed in Table 3. The majority of recreational trips to the Gulf coast originate in Harris County. As would be expected, the 3 largest SMSA's account for almost 50 percent of the trips to the Gulf. Another significant characteristic is that, excluding those trips originating from the top 3 SMSA's, a large proportion of trips originate from those counties closest to the Texas Gulf Coast. This characteristic can best be explained by distance decay phenomena and the patterns described by General Interaction Models - the Gravity Model. The concepts of spatial interaction and the friction of distance are brought together in the gravity model. Gravity models explain interaction as a function of the size of the two centers (the origin and the destination) and indirectly related to the intervening

distance (Berry, 1967). The gravity model is a useful tool for explaining the spatial distribution of trips to the Texas Gulf Coast and the effect of the friction of distance on recreation travel.

Table 3. Counties of Origin for Travellers to the Texas Gulf Coast

ORIGIN COUNTY	NUMBER OF TRAVELLERS	PERCENT OF TOTAL
BEXAR	399	7.67%
BRAZORIA	124	2.38%
CAMERON	127	2.45%
DALLAS	327	6.28%
FORT BEND	75	1.45%
GALVESTON	159	3.06%
HARRIS	1,459	28.05%
HIDALGO	127	2.45%
JEFFERSON	164	3.15%
MATAGORDA	57	1.09%
NUECES	197	3.78%
TARRANT	152	2.91%
TRAVIS	189	3.63%
VICTORIA	52	1.01%
TOTAL	3,608	69.37%

This section of the report provided an explanation to the nature of tourism activity along the Texas Gulf Coast. In summary, it is clear that the urban areas attract the greatest amount of travellers. An important segment of these travellers live in counties adjacent to the Gulf Coast area. Section IV of the report will summarize the tourism attractions and the resources to the tourism industry on the Texas Gulf Coast.

IV. Texas Gulf Coast Tourism Resources

The tourism industry, like all industry, relies upon the availability of resources. In this case, the resources are the attractions to tourist travel. These resources are comprised of both natural and man-made attractions as well as the businesses that form the support infrastructure for the existence of the attractions. This section will focus on the tourism resources of the 21 coastal counties examined in Section III. A methodology has been designed to categorize the 21 counties according to the extent of resources that are present. The findings of this analysis is used to describe a spatial characterization of tourism attractions along the Gulf Coast.

Information on two types of tourism resources was collected. Resources were classified as either natural attractions or tertiary industry attractions. A list of all the variables used as indicators of resources are listed in Table 4.

Table 4. Tourism Resources of the Texas Gulf Coast

1) Fresh water reservoirs
2) Salt water reservoirs
3) Miles of Gulf frontage
4) Total surface acres of salt water bays
5) Total surface acres of fresh water bays
6) Miles of permanently floatable fresh water rivers
7) Miles of seasonable floatable fresh water rivers
8) Total acres of recreation land
9) Total acres of developed recreation land
10) Total number of state parks
11) Total number of federal parks
12) Total number of local parks
13) Total number of commercial parks
14) County population
15) Number of establishments for auto dealers and service stations (SIC 55)
16) Number of establishments for eating and drinking places (SIC 58)
17) Number of establishments for eating places (SIC 5812)
18) Number of establishments for hotels and other lodging places (SIC 70)
19) Number of establishments for amusements and recreational areas (SIC 79)
20) Total number of establishments serving the tourism industry

Items 1 through 13 of Table 4 represent variables that are indicators of the wealth of natural attractions in each county. Items 14 through 20 represent indicators of the urban infrastructure that supports the tourism industry. For example, the number of

establishments under each standard Industrial Code (SIC) listed are representative of the tertiary industries that support the natural attractions, such as a state park or a fresh water reservoir. The population variable acts as a surrogate for all the urban infrastructure that supports the tourism industry in urban areas. The analysis of tourism patterns previously in Section III identified a greater amount of urban tourism activity, and one would expect that the support for that activity is directly proportional to the size of the population.

Factor Analysis

A two-stage methodology was designed to reveal the spatial characteristics of the tourism resources. Factor analysis was used to eliminate the natural multicollinearity that exists in data of this nature. This technique reduces the original data into a fewer number of factors that represent a linear combination of the original variables (Hair et al., 1979). The result is a smaller set of composite dimensions or factors. This analysis produced 5 significant factors that explain 97 percent of the variance of all 20 variables.

Each factor consists of factor loadings which represent the correlation between the original variables and the linear combinations of the variables. Table 5 presents the factor loadings for each of the items listed in Table 4. A high factor loading indicates that the factor is a good surrogate for that original variable. Additionally, the factor analysis produces five factor scores that correspond to each factor for each observation. The factor score represents the composite values from all the variables that load high with that particular factor. The new values (factor scores) are statistically independent and thus can be used for further statistical analysis.

Table 5. Rotated Factor Pattern

Variable Item	Factor 1 Natural Resources	2 Urban Resources	3 Reservoirs	4 Recreation Land	5 State Parks
1	-0.181	-0.026	**-0.911**	-0.321	-0.072
2	-0.247	0.015	**0.824**	-0.373	-0.328
3	**0.948**	0.140	0.089	0.251	-0.098
4	**0.671**	0.054	-0.051	**0.643**	0.293
5	**0.944**	0.123	-0.182	-0.186	0.089
6	**0.932**	0.133	-0.026	-0.185	0.128
7	**0.937**	0.122	0.050	0.209	0.136
8	0.263	0.007	0.078	**0.956**	0.015
9	**0.973**	0.143	0.002	0.160	-0.066
10	0.425	0.080	-0.139	0.101	**0.883**
11	**0.926**	0.195	0.045	-0.059	0.189
12	**0.879**	0.184	0.036	0.172	0.255
13	**0.792**	0.170	-0.024	0.344	0.258
14	0.155	**0.986**	0.011	0.013	0.028
15	0.142	**0.988**	0.022	0.015	0.024
16	0.138	**0.989**	0.009	0.022	0.031
17	0.143	**0.988**	0.008	0.022	0.035
18	0.093	**0.985**	-0.005	0.018	0.012
19	0.159	**0.985**	-0.004	0.014	0.036
20	0.140	**0.989**	0.010	0.020	0.031

Factor 1 is characterized by high loadings for items 3, 4, 5, 6, 7, 9, 11, 12, and 13. This dimension best captures the water resources variables and is thus a good indicator of the natural resources of tourism. This new composite dimension is a good surrogate for all the variables that describe the water resources or attractions available in each county.

Factor 2 is a dimension composed of the population variable (item 14) and all the tourism related business variables (items 15-20). This factor represents the urban element of the tourism industry. As one would expect, there are more tourist-related businesses in the urban area; and therefore the "population" variable would be highly correlated with the "business" variables. Factor 2 represents the "urban" characteristics of the 21 sample counties.

Factors 3, 4, and 5 collectively account for 23.6 percent of the variance of the original variables, a relatively small proportion of the total variance. Each represents basically

one variable. Factor 3 is related to the presence of salt water reservoirs. Item 8, the total acres of recreation land, is highly correlated to Factor 4. This dimension also has some correlation with item 4, the total acres of salt water bays. Factor 4 represents the recreation potential that exists for each county. Finally, Factor 5 represents the State Park variable.

Cluster Analysis

The five factor scores produced by this technique were then used for further statistical analysis that required a non-multicollinearity assumption. To achieve the objective of identifying profiles of counties according to the tourism resources that are present, a statistically valid classification method was used. Cluster analysis is a classification technique that can be used to display and summarize data by describing the natural clusters that are known to exist within the dataset (Anderberg 1973). For this analysis, a clustering routine was used to categorize the 21 counties into meaningful groupings that manifest similar characteristics for the 5 factor dimensions described above. The factor scores produced by the factor analysis for each county were the input to this cluster analysis.

A seven-cluster solution was found to best describe the spatial patterns of tourism resources. Table 6a lists the counties that are grouped by each cluster and Table 6b identifies the means of the factor scores for each cluster.

Table 6a. Cluster Pattern

1	2	3	4	5	6	7
Brazoria	Harris	Jefferson	Wharton	Cameron	Calhoun	Aransas
Chambers		Orange		Willacy	Jackson	Kenedy
Fort Bend					Victoria	Kleberg
Galveston						Nueces
Liberty						Refugio
Matagorda						San Patricio

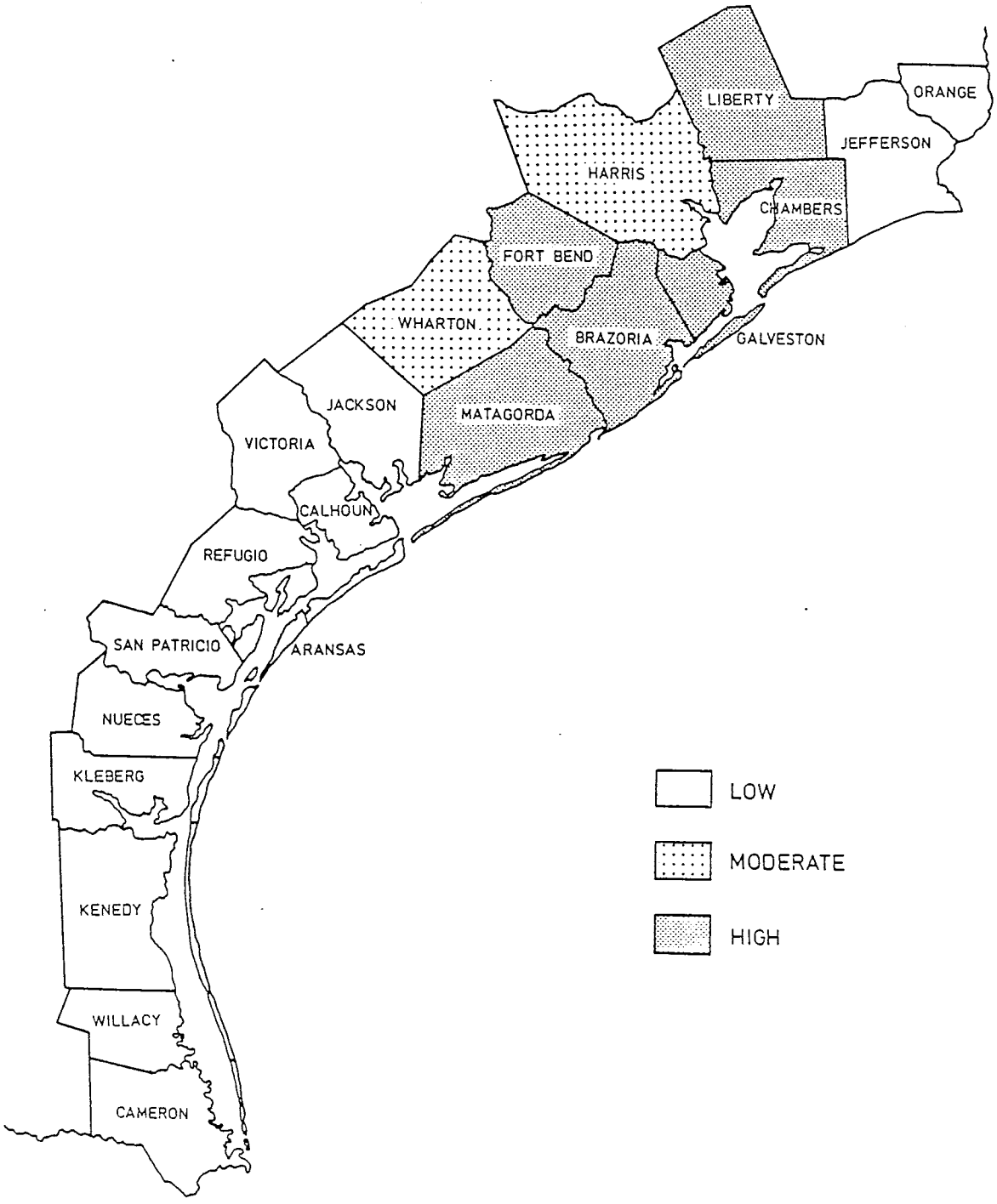
Table 6b. Cluster Means

Cluster	Factor 1 Natural Resources	Factor 2 Urban Resources	Factor 3 Reservoirs	Factor 4 Recreation Land	Factor 5 State Parks
1	1.37	-0.40	0.10	-0.09	0.40
2	0.61	4.24	-0.07	0.16	0.25
3	-0.74	0.04	2.48	-1.12	-0.99
4	0.91	-0.41	-0.46	0.51	-2.61
5	-0.59	0.03	-1.85	-1.15	-1.46
6	-0.89	-0.20	-0.45	-1.16	1.40
7	-0.74	-0.16	0.01	1.32	0.11

Cluster 1 is characterized by high scores for Factors 1 and 5, the water resources and State park variables. These counties are relatively rich in the natural resources or tourism, yet poor in the man-made support infrastructure and total recreation land acres. Cluster 2 describes the unique characteristics of Harris County. This county has the highest degree of "urbaness", although it does not have a particularly high level of natural resources development. Jefferson and Orange counties comprise Cluster 3. These counties are the only ones with salt water reservoirs and are most likely distinguished from the other counties on that basis. Wharton County is grouped independently by Cluster 4, due to its relatively high abundance of tourism natural resources and low urban resources. Cameron and Willacy Counties are grouped on the basis of Factor 3, which is based on the high occurrence of fresh water resources. Also these counties have a moderately high level of urban support. Cluster 6 is rich in the number of state parks but has the least amount of the tourism natural resources. The counties comprising Cluster 7 are rich in the amount of undeveloped recreation land acres, and have minimum amounts of the natural resources explained by Factor 1. Factor 2, the "urban" factor, has a moderate presence in these counties.

The above cluster pattern is based on all five factors. Each cluster has varying degrees of strength on each aspect of all the resources to tourism. If the clustering algorithm was based solely on the water resources (Factor 1), three groupings can be identified. Figure 4 illustrates the spatial distribution of the water resources. Those counties categorized as "high" are those grouped together by Cluster 1 in the above analysis. The counties located

FIGURE 4. WATER RESOURCES ALONG THE TEXAS GULF COAST



along the lower portion of the Gulf Coast have very low values of Factor 1; however, as illustrated in Figure 5, they have a much higher acreage of recreation land acres. A cluster analysis based solely on the "urban" resources (Factor 2) produces the spatial pattern illustrated in Figure 6. Harris County dominates the landscape and is grouped independently of all the other counties. The "moderate" category is comprised of counties that have the second tier of urban centers in the region.

It is clear that the spatial distribution of the natural resources do not match the distribution of the urban resources. The importance of one resource over another has not yet been determined. More tourism expenditures are directed at the urban centers; yet, the role of the natural resources cannot be discounted.

The procedures discussed in this section provide a useful method of analysis to develop functional classification of counties. These profiles can assist planners for developing policies that best target the needs of each type of county. The following section will deal with the issue of accessibility as measured by the extensiveness of the highway network. A clustering technique will be applied to transportation data to yield the spatial pattern of accessibility.

FIGURE 5. RECREATION LAND ACRES ALONG THE TEXAS GULF COAST

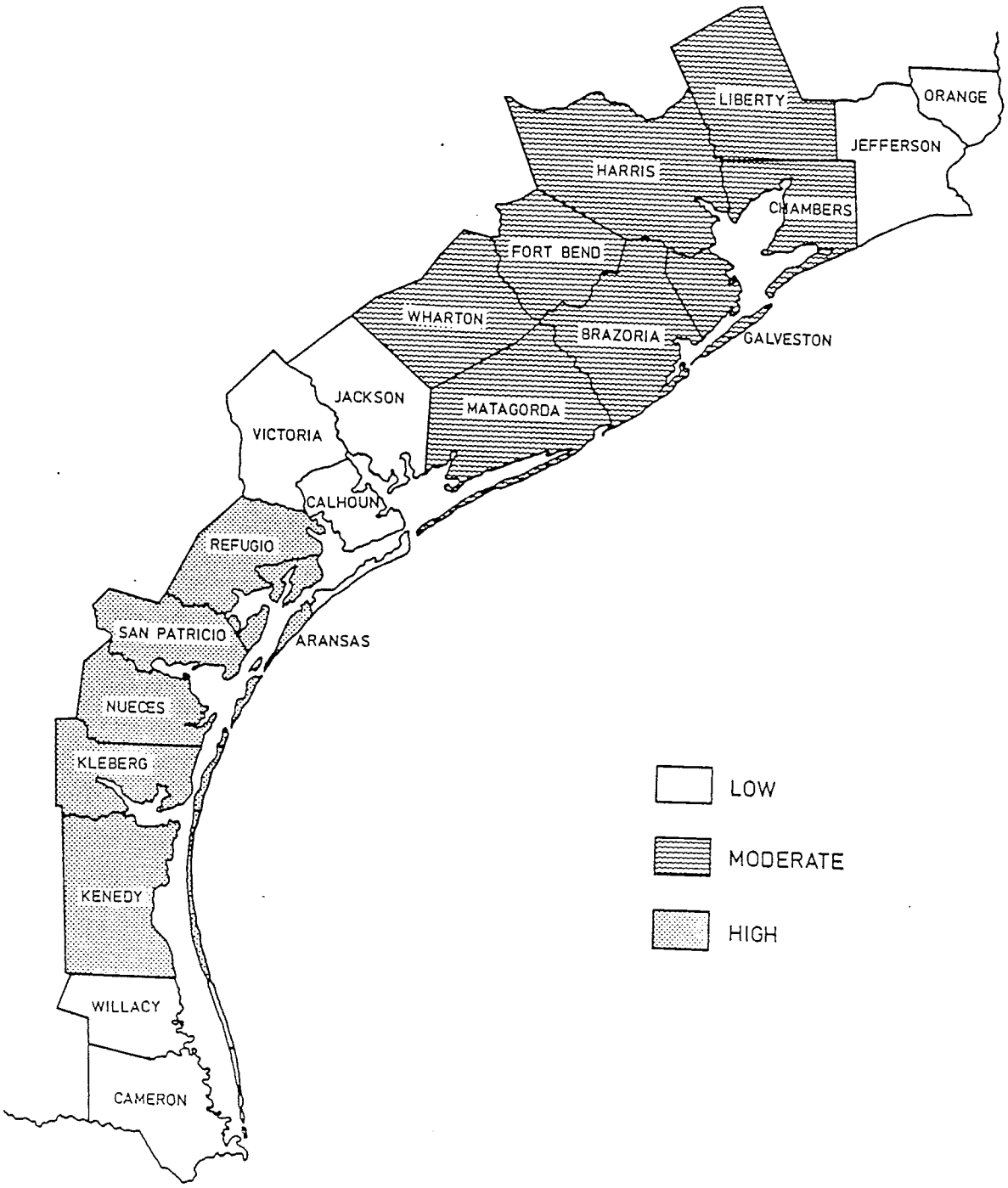
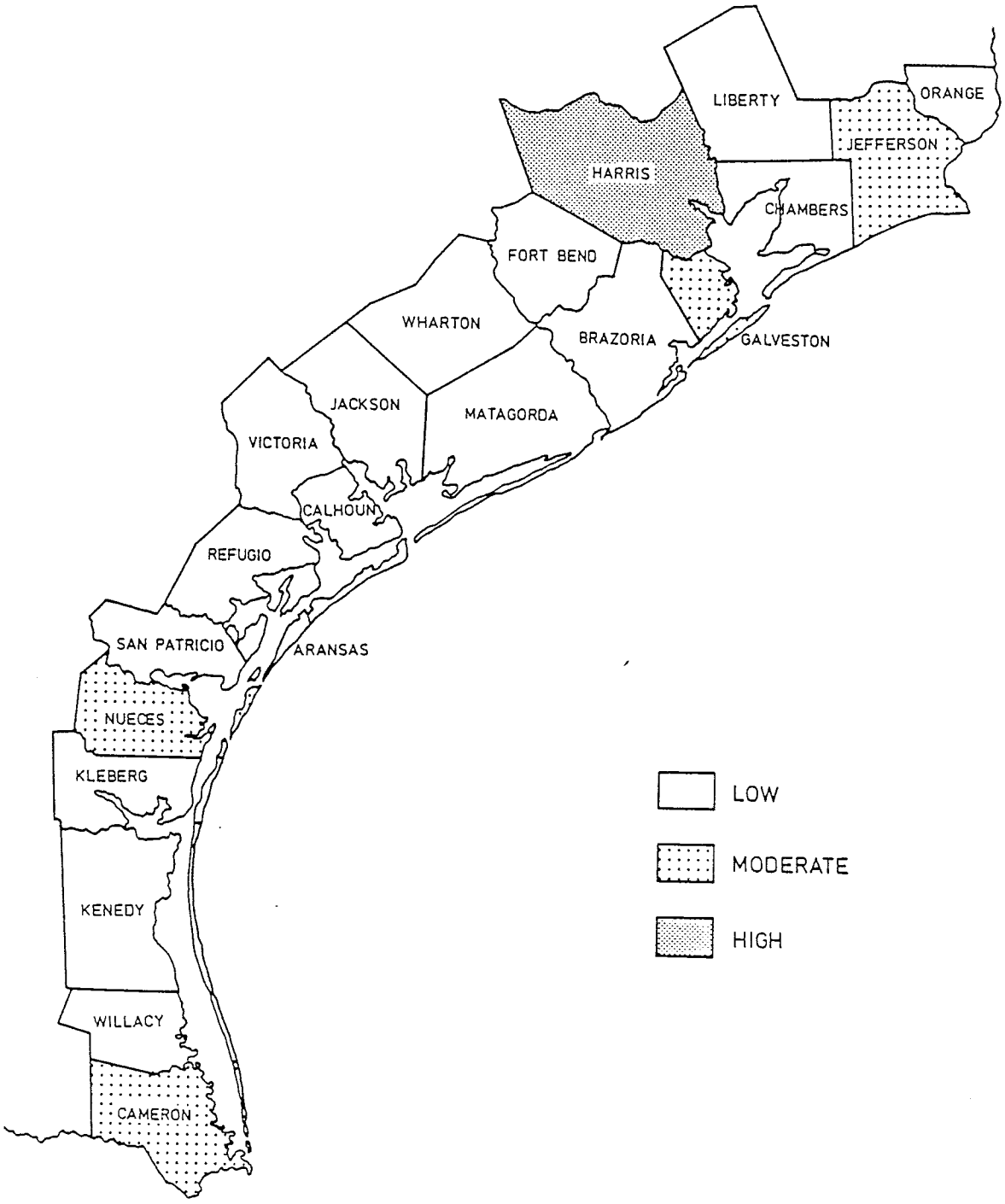


FIGURE 6. URBAN RESOURCES ALONG THE TEXAS GULF COAST



V. Transportation and Accessibility

The previous section categorized counties according to their Tourism resources. The counties were classified by those that are "natural" and those that are "urban." The transportation network could also be considered a resource to the tourism industry. The literature concurs that the transportation infrastructure is an integral component to the success of the tourism industry. To isolate the importance of the highway network, its spatial characteristics must first be examined independently.

Two types of highway information were collected to be used as surrogates or indicators of accessibility. Total highway miles per county provided an indication of the overall extent of highway coverage. These figures, however, do not consider the extent of infrastructure development with regard to the intensity of coverage. Therefore, overall highway miles per square acre of the county was used as a secondary indicator of accessibility.

A cluster analysis was conducted to identify the "best" explained classification of Gulf Coast counties. A three-cluster solution was found to be most appropriate. Figure 7 illustrates the spatial characteristics of this application of cluster analysis. On the basis of overall highway miles, four counties, Brazoria, Cameron, Harris, and Nueces, were ranked "high" in overall coverage. The same approach was applied to the highway miles per square acre data. The three-cluster solution produced slightly different results. The most accessible counties using this criteria are: Cameron, Galveston, Nueces, and Orange. Figure 8 depicts this spatial pattern. Comparing the two measures of accessibility, it is clear that counties that have a relatively high degree of resources and tourism activity also manifest appropriate levels of accessibility.

This analysis has briefly outlined both the intensiveness and extensiveness of the highway network along the Texas Gulf Coast. The previous sections of the report have described and analyzed the patterns of tourism activity, the resources supporting the tourism industry, and the highway infrastructure that services the tourism destinations. The following section will present a methodology that will evaluate the importance of these aspects as they affect the pattern of tourism expenditures.

FIGURE 7. LEVELS OF ACCESSIBILITY

(HIGHWAY MILES)

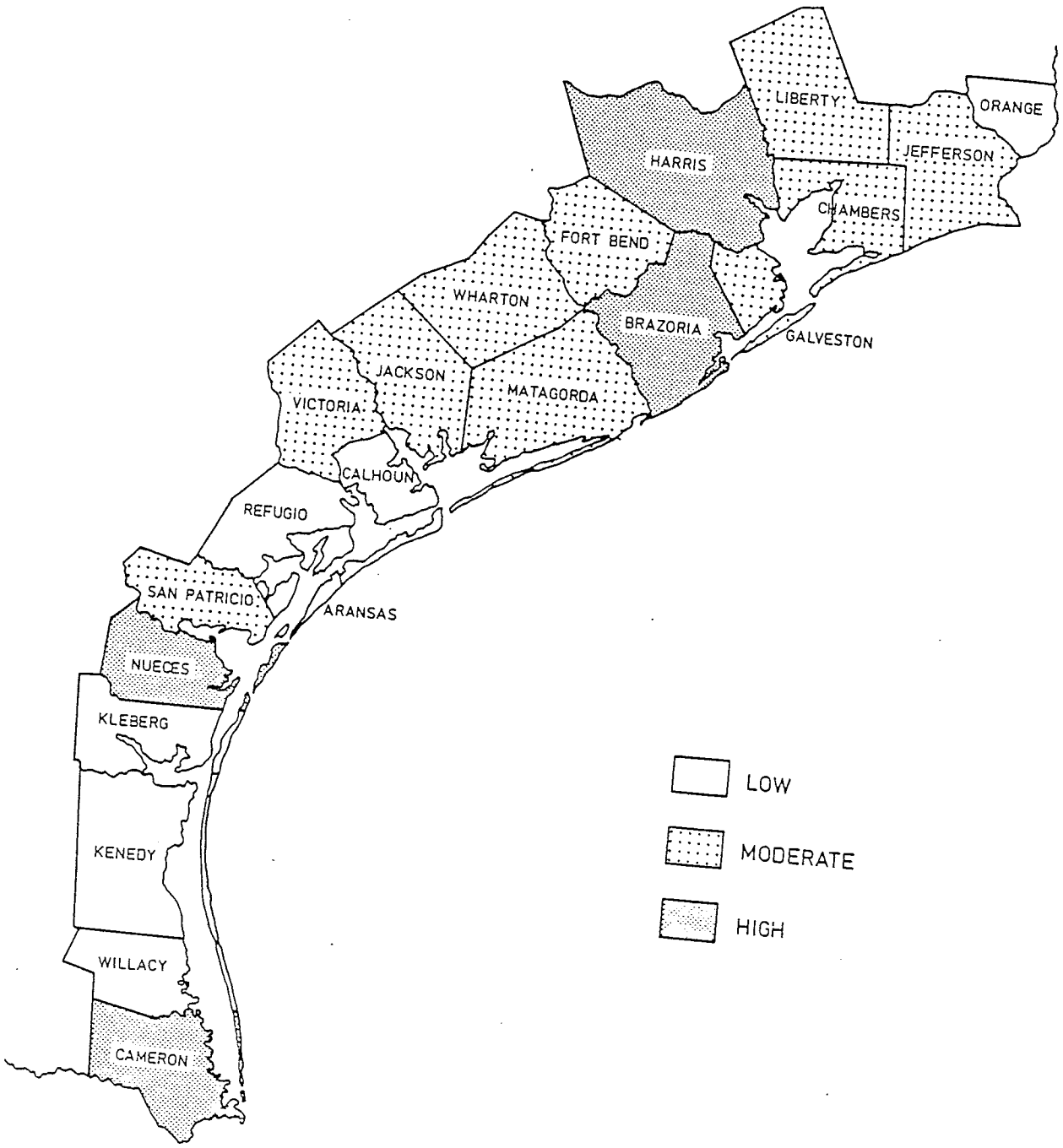
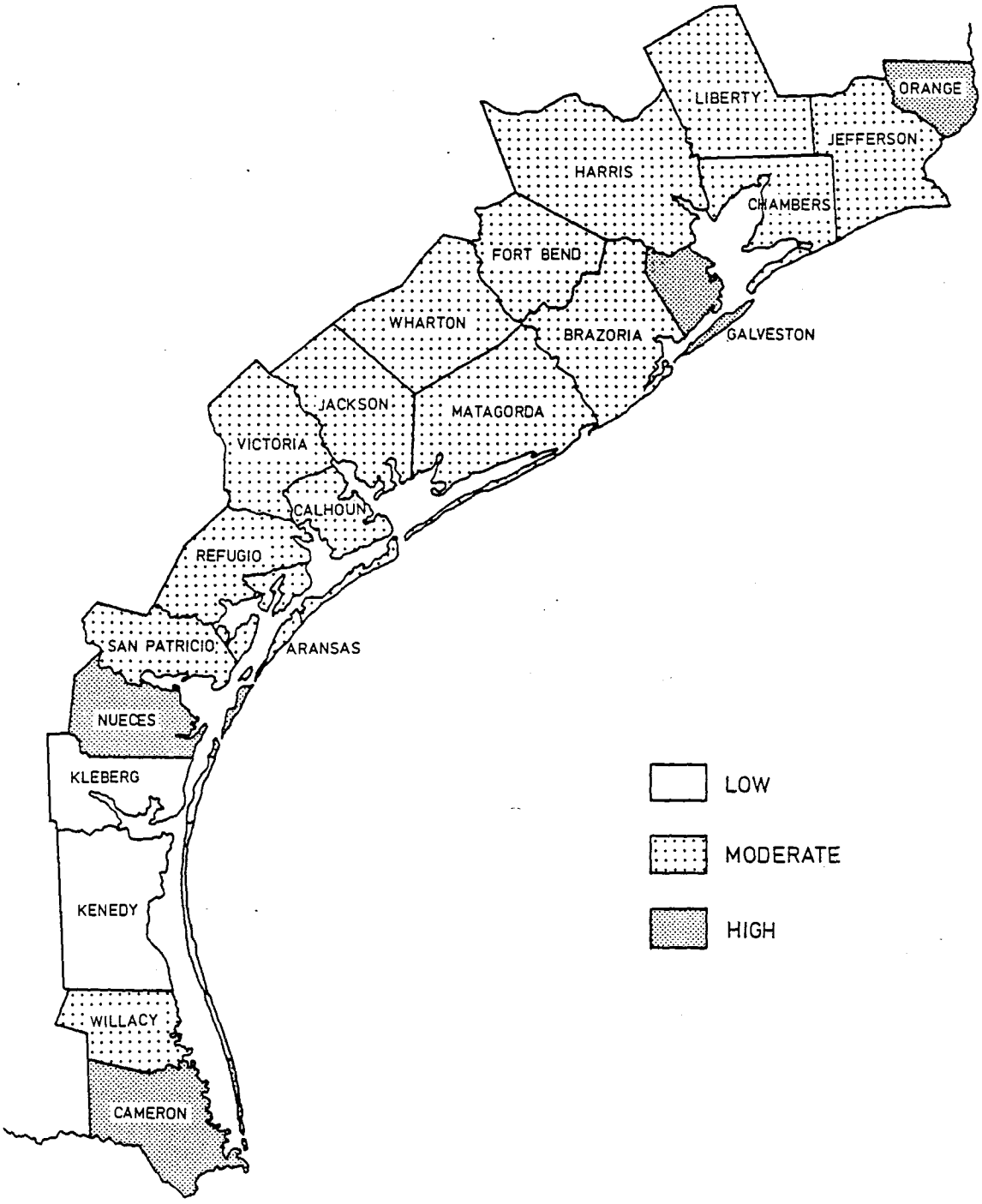


FIGURE 8. LEVELS OF ACCESSIBILITY

(HIGHWAY MILES PER SQUARE ACRE)



VI. The Effects of Transportation and Tourism Resources on Tourism Expenditures

The previous sections of this report analyzed the three aspects of tourism expenditures independently. Section III identified the patterns of tourism activity, Section IV developed profiles of counties according to their affluence of tourism resources, and Section V identified the level of the highway infrastructure present in each county. This section will address the question of how and to what extent do the effects of transportation and presence of tourism resources influence the variation of tourism expenditures in counties along the Gulf Coast.

For this analysis, a three-step process was followed to identify and evaluate the relative contribution of the transportation sector and tourism resources towards explaining the dependent variable, tourism expenditures. The first step of this procedure identifies the parameters that can be used to explain travel expenditures. Step 2 focuses on the relative contribution of each of the independent variables for predicting the variance of the dependent variable, tourism expenditures. Finally, the analysis of Step 3 further evaluates the effects of the variables on a population segmented data set.

The data for this analysis are those reported in the previous part of the report. The dependent variable is the tourism expenditure data described in Section III. The independent variables include the factor scores from the factor analysis performed in Section IV and the overall highway miles used for the analysis in Section V.

Regression Analysis

A step-wise regression model was calibrated to identify the significant independent variables that can be used to explain variation in tourism expenditures. The six independent variables included in this analysis are: 1) Factor 1, the natural resources to tourism, 2) Factor 2 the urban resources to tourism, 3) Factor 3, the presence of fresh/salt water reservoirs, 4) Factor 4, acres of recreational land, 5) Factor 5, the presence of state parks, and 6) overall highway miles. The results of the analysis identified two independent variables--Urban resources (Factor 2) and overall highway miles--to be significant in evaluating the variance of the dependent variable, tourism expenditures. Factor 1, representing the natural resource characteristics of the county, did not significantly contribute to tourism spending. To further evaluate the parameters of the step-wise model, a multiple regression model was fitted to the data. Table 7 lists the parameters of the

model. The degree to which the independent variables explain the variation of tourism revenue is estimated by the R^2 coefficient. The R^2 value of .695 means that the independent variables explain almost 70 percent of the variance of tourism dollars.

Table 7. Multiple Regression Analysis

Dependent Variable: Tourism $
Multiple R: .834 Squared Multiple R: .695

Independent Variable	Coefficient	Standardized Coefficient	T
Constant	0.133	0.00	0.053
Factor 2	0.814	0.410	2.892
Highway Miles	1.834	0.581	4.098

Path Analysis

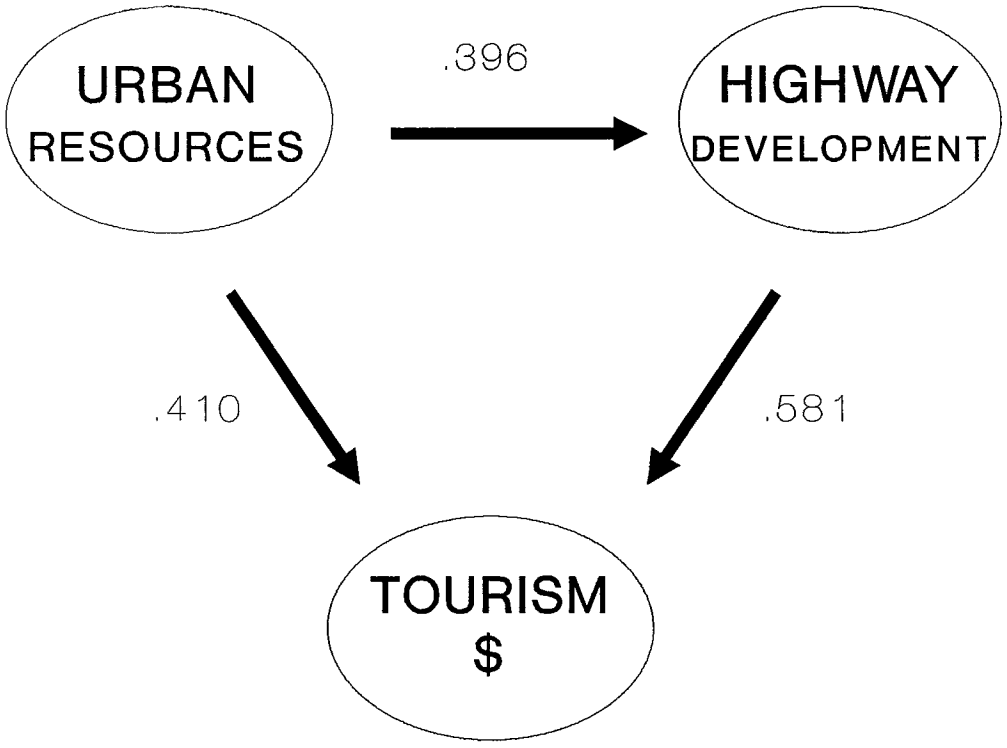
The regression analysis identifies the variables that are significant to the explanation of tourism expenditures. To further evaluate the relative importance of each of the independent variables on tourism dollars, the partial effects coefficients are examined using a technique referred to as path analysis. Dye (1976, 1977) suggests the use of "effects coefficients" derived from path analysis is the appropriate method for assessing the relative importance of the independent variables in explaining the dependent variable.

This analysis depends on the interpretation of standardized beta coefficients yielded by the regression model. The interrelationships between the two independent and dependent variables is best described by Figure 9. This analysis is based on the hypothesis that the urban resources are linked both directly and indirectly with tourism spending.

The direct relationship between the population related variable, the highway development variable, and tourism expenditures is described by the general linear model summarized previously in Table 7. There is, however, an intuitive underlying hypothesis that the population variables are also indirectly related to tourism dollars by providing the framework for the State's highway system. The Effects Coefficients incorporate both the direct and indirect relationships when evaluating the relative effects of the two independent

FIGURE 9.

PATHS AND PATH COEFFICIENTS FOR THE TOTAL ANALYSIS



$E_{HIGHWAYS} = .58$

$E_{URBAN\ RESOURCES} = .41 + (.396 \times .581) = .64$

variables. For this particular model, the Effect Coefficient for highway miles on tourism expenditures is .581 and for the population related variable is .64. These coefficients suggest that the influence on tourism dollars by the highway network is a substantial portion of the total effects.

Segmented Analysis

Research suggests that the relationship described above might vary substantially depending upon the level of urban development within a particular county, i.e., Houston and Corpus Christi. For the third step of the analysis, the data were segmented into two sub samples based upon the population of the respective counties. A similar analysis (Steps 1 and 2) was repeated for each of the subsamples. It is expected that in the non-urban areas, the natural resources and highway development would be significant. Whereas in the urban areas, which are all well linked to the highway system, it is hypothesized that the urban resources (Factor 2) would be dominant.

For the results for the non-urban areas, it appears that the highway system is the significant variable for explaining tourism expenditures. All other resources do not contribute to the explanation of the dependent variable. In the urban areas, as expected, only the urban resource variable proved significant. Tables 8a and 8b present the results of the respective models.

Table 8a. Multiple Regression Analysis for Non-Urban Counties

Dependent Variable: Tourism $
Multiple R: .666 Squared Multiple R: .443

Independent Variable	Coefficient	Standardized Coefficient	T
Constant	1.068	0.000	0.713
Factor 2	1.924	0.247	0.334
Highway Miles	1.667	0.724	3.956

Table 8b. Multiple Regression Analysis for Urban Counties

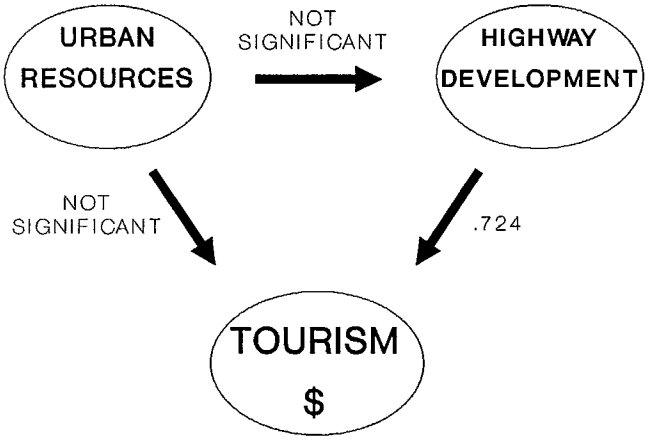
Dependent Variable: Tourism $
Multiple R: .834 Squared Multiple R: .695

Independent Variable	Coefficient	Standardized Coefficient	T
Constant	18.265	0.000	2.133
Factor 2	1.018	1.071	3.397
Highway Miles	-1.091	-0.239	-0.760

These results reveal that in the rural areas the nature of the transportation network alone can describe the variation of the tourism expenditures. However, the strength of this relationship is weaker than it is for the overall analysis. Conversely, the contributing criterion for explaining tourism dollars in urban centers is strictly Factor 2, the urban resources. The strength of this relationship is reflected by the relatively high R^2. Figures 10a and 10b graphically depict these relationships.

The three steps of analysis outlined in this section provide a useful methodology for determining the importance of the highway network on the pattern of tourism expenditures. The significance of highway development is established in the first step. The findings presented in Step 2 reveal that the relative strength of the independent effect of highway development is almost equal to the independent effect of urban resources. A further refinement of the model is described in Step 3 where the analysis is repeated for non-urban and urban counties. These findings show that transportation has a considerably greater effect on tourism expenditures in non-urban areas than it does in urban areas. In urban areas, however, the effect is clouded by the high correlation that exists between urban and transportation development.

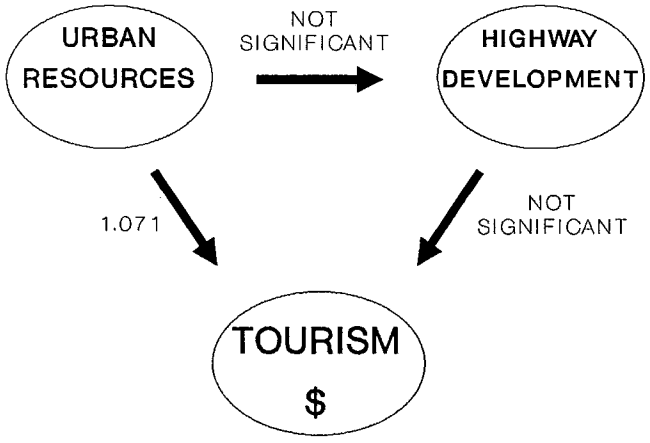
FIGURE 10a. PATHS AND PATH COEFFICIENTS FOR NON-URBAN AREAS



$E_{MILES} = .724$

$E_{URBAN\ RESOURCES} =$ NOT SIGNIFICANT

FIGURE 10b. PATHS AND PATH COEFFICIENTS FOR URBAN AREAS



$E_{MILES} =$ NOT SIGNIFICANT

$E_{URBAN\ RESOURCES} = 1.071$

VII. Conclusions

This report presents an analysis of the characteristics of tourism activity for the 21 counties along the Texas Gulf Coast. Three aspects of the tourism industry were evaluated and analyzed. The patterns and flows of tourism dollars were examined in Section III. The resources of tourism were presented and summarized in Section IV. A measure of accessibility or highway development was described in Section V. And the interrelationship existing between the three elements of tourism were then evaluated in Section VI. From this analysis, several key characteristics are evident:

- Tourism is an urban phenomenon.
- There are two important types of tourism resources: 1) natural/ water resources, 2) urban infrastructure resources.
- There are three salient functional resource-based classification of counties: 1) the urban centers, 2) the non-urban counties that are rich in recreational land acres, natural resources, and have some urban infrastructural support; and 3) those counties that have a relatively high level of natural resources, but minimal recreation land acres.
- Two indicators are significant in describing the variation of tourism generation: 1) the urban tourism resource variables; and 2) accessibility as measured by highway miles.
- The natural resources do not contribute to the explanation of tourism activity. This phenomenon may be explained by two untested hypotheses: 1) the spatial distribution of water resources is fundamentally isotropic, in that all of the sample counties are accessible to the resource; and/or 2) this analysis specifically examines Gulf Coast tourism, and therefore the existence of water resources is a given assumption for all trips.
- The influence of highway development on tourism generation is more significant in the non-urban areas.

This research provides State planners and policy makers with some critical information for the second largest industry in the State. If it is the State's goal to encourage tourism activity away from the urban centers, then the findings of this report suggest the State invest in the rural highway infrastructure. However the trend of "urban"

tourism activity cannot be ignored. Highway dollars directed to recreational areas near the urban centers of Beaumont, Brownsville, Corpus Christi, and Galveston would also see high returns on investment.

Generally the tools presented here can be used to evaluate and measure the effects of highway development on any industry. Path analysis can reveal the independent effects of highway investments on specific sectors of employment, property values, etc.

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