Final Report

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GIS for Evaluating Socioeconomic Data of Small Communities in Oklahoma

Oklahoma Department of Transportation Project Agreement #2149

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16. ABSTRACT

This document summarizes the overall tasks, functionality, and limitations related to the delivered product of this project. Specifically, we present a Geographic Information Systems (GIS)-based database and analysis package for evaluating socioeconomic data of small towns along US 70 in southeastern Oklahoma. This package should aid ODOT in its efforts to make equitable bypass decisions by providing a platform in which pertinent social and economic data can be queried, summarized, and presented for each town that ODOT is considering bypassing.

We have constructed a database for all ten towns along US 70 between the Arkansas state line and Ardmore. The primary bypass candidates of Boswell, Durant, Kingston, Oakland-Madill, Soper, and Valliant are modeled as well as Bokchito, Hugo, Idabel, and Ft. Towson. For each town, current statistics are available on business counts, selected socioeconomic census variables, sale tax collections and rates, and (where available) traffic count totals. Also, projections of business count changes as a result of a new bypass are predicted and presented.

This document serves as an executive summary, and thus does not contain the full detail of every aspect of this project but rather the main points and highlights. Fuller detail is presented as part of the training documentation that was distributed during the training phase of this project.

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The contents of this document were produced at Oklahoma State University by the authors for the express purpose of reporting to the Oklahoma Department of Transportation's Research Division the activities and outcomes of Project Agreement #2149, which was in effect from January 1, 1999 to December 31, 2000.

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OVERVIEW

This document summarizes the overall tasks, functionality, and limitations related to the delivered product of this project. Specifically, we present a Geographic Information Systems (GIS)-based database and analysis package for evaluating socioeconomic data of small towns along US 70 in southeastern Oklahoma. This package should aid ODOT in its efforts to make equitable bypass decisions by providing a platform in which pertinent social and economic data can be queried, summarized, and presented for each town that ODOT is considering bypassing.

While the original Request for Proposals indicated that there were six towns along US 70 under bypass consideration, we have constructed a database for all ten towns along this route between the Arkansas state line and Ardmore. This was done for the sake of completeness as well as the fact that the Executive Summary of the US 70 Feasibility Study (performed by the Benham Group for ODOT) indicated that potential bypass routes had been studied for nearly every town along the route. Thus, we felt it would be useful to ODOT to be able to evaluate the impacts in any of the towns. The primary bypass candidates of Boswell, Durant, Kingston, Oakland-Madill, Soper, and Valliant are modeled as well as Bokchito, Hugo, Idabel[1], and Ft. Towson.

This document serves as an executive summary, and thus does not contain the full detail of every aspect of this project but rather the main points and highlights. Fuller detail is presented as part of the training documentation that was distributed during the training phase of this project.

This document is organized as follows. After a brief **Introduction**, the next section, **Data Sources, Uses, and Limitations**, details the five main data sets that are included in this project: 1) block group level socioeconomic data; 2) current business patterns along the existing highway routes and projected changes; 3) town sales tax collection amounts; 4) traffic counts in selected locations; and 5) various GIS-related data sets that round out the project. The third section, **Overview of Bypass Impacts**, describes the impacts and results of the two data sources on which detailed data bypass impacts analysis was possible: 1) present and future business patterns, and 2) sales tax collections. That section provides an overview, based on our experience and interpretation of the analyses that were conducted, of the overall impacts that bypasses may have on the targeted towns and cities along US 70. The final section, **Conclusion**, summarizes the overall project.

INTRODUCTION

The purpose of this report is to provide an overview of the various data sets and their incorporation into a GIS framework that provides ODOT with a tool for analyzing the potential economic impacts of highway bypasses along US 70 in southeastern Oklahoma. Since each data set comprises a discrete area of analysis, the next section is divided into five sub-sections that correspond to each of the five main data types given earlier. For the purpose of consistency, each of the five data description sub-sections below follows the same general format by including:

- Characteristics of the data set:
  - The primary data sources that were used.
  - The rationale for the data that were used.
  - Data sources that were either rejected or unavailable.
- Data limitations that were inherent and how (or whether) they could be resolved.
- Primary functionality of each data component within the GIS framework.

DATA SOURCES, USES, AND LIMITATIONS

Block Group Level Socioeconomic Data

Socioeconomic data at the block group level are used to provide an indication of the present socioeconomic conditions along any existing or proposed highway route through the affected towns. The original source of this data is the US Census Bureau. Census block groups are among the smallest geographic units used in compiling the decennial US Census. The decennial census has always reported population by state and county and, in the latter half of the 20th century, added the concepts of the census tract, the block group (or enumeration district), and the census block to its spatial breakdown of the larger geographic units. The census tract is defined as a small, homogeneous area with an average population of 4,000 persons. The census block, normally used only in urbanized areas, is an actual physical block or other spatial unit within the census tract, with an average population of approximately 100 persons. The census block group combines several blocks to comprise approximately 1,000 persons, on average, and normally represents a residential subdivision or other reasonable geographic entity. Although the actual populations of these spatial units can vary widely, the general rules for average populations for these units tend to be maintained.

We felt that it was important to reach the smallest level of geographic detail possible to more accurately reflect the possible changes and trends that might be resulting from highway bypasses. Since most of the towns ODOT is considering for a bypass are extremely small (three of the six towns have less than 1,000 persons and only Durant exceeds 4,000), any larger geographic area (such as zip codes or census tracts) would more than likely include the entire town, the current route, and any proposed route, rendering geographic analysis useless other than as a broad representation of the overall conditions in the entire town.

One primary limitation of the block group data was that, like other predominantly rural states, Oklahoma population census data at the block group level were not reported until 1990, except for Tulsa and Oklahoma Counties. This situation provides little historical data on which to base

analyses of socioeconomic changes resulting from bypasses. Furthermore, as these data at best would have been collected every ten years (during the decennial censuses), it is unlikely that any pair of censuses (as a before-and-after analysis) would have sufficiently captured significant social or economic reorganization resulting from a bypass.

As a result, these data will inform ODOT of the existing socioeconomic conditions along the various routes. These data will allow researchers to determine the potential impacts of bypass construction in terms of numbers of residents, income levels, and employment statistics. Various private companies as well as the Census Bureau itself publish estimates that are based on the most recent census (1990) and a small amount of sampling. We have included the most recent Census update to obtain the aforementioned socioeconomic indicators. The GIS database thus contains data for all block groups in Oklahoma for 1999. The variable definitions used by the Census Bureau, at least in terms of the variables we obtained from the 1999 update[2], are quite standard. Hence, when the 2000 Census results are published in 2001, it should be possible to replace the current 1999 estimates with direct 2000 census statistics for the included variables. Part of the training documentation for this project will include instructions for extracting the necessary block groups and variables from a CD-ROM or the Census Bureau web site and inserting them into the GIS database.

The block group socioeconomic indicators represent the most powerful application of GIS in this project. Through a process we created during the project that draws upon existing algorithms, a very simple point-and-click interface allows the bypass analyst to select block groups and their associated data for any route through the town. The approach to analyzing the impacts of highway bypasses on small towns and cities developed for this project involves using ArcView GIS to determine the impacted zones within the urban area. ArcView is a desktop GIS that allows the trained user to develop spatial and aspatial queries of socioeconomic data sets, to aggregate spatially referenced data, and to display visually the results of these operations, all tasks useful for this project.

The methodology for determining the impacted area of a bypassed city involves several steps. First, the path for either an older, to-be-bypassed route or a proposed new route is selected. Using the predefined functions developed for this project, the user "traces" over the old or proposed route with the cursor, and ArcView creates an impact buffer around the selected street or proposed highway at a distance defined by the user (the default setting is 1 mile). In the second stage of buffering, ArcView selects all impacted streets and side street segments intersected by the initial buffer and creates a second buffer around all these segments. During the third and final phase of the buffering and selection process, ArcView chooses all block groups that intersect the buffer from the second stage.

After completing this process for either existing or proposed (bypass) routes, ArcView passes the tabular data relating to the selected block groups for the outlined routes to a spreadsheet for analysis or for direct computation of summary measures along the routes. By identifying impacted zones in this manner, the user can select and analyze the potentially impacted areas and the data relating to these areas more accurately. By allowing the user to choose the buffer distance, wider or narrower impacts corridors can be selected depending on how widely the analyst believes the current or proposed route will impact the town.

Present and Future Business Patterns

The analysis of existing and future business patterns in the affected towns is another crucial area of analysis. In terms of determining which subset of towns to bypass, understanding what businesses exist along the current route and the possible shifts that might occur with a bypass will provide another layer of information upon which bypass decisions can be made.

Our exploration of data pertaining to businesses led us quickly to the most difficult data limitation we had to overcome. For the most part, the towns along US 70 in southeastern Oklahoma are extremely small; as mentioned earlier, of the six primary bypass candidates three are smaller than 1,000 persons and two others are smaller than 4,000. The Economic Censuses that are conducted every five years (in years ending in 2 and 7) simply do not concern themselves with political entities this small. As a result, only places that meet the US definition of urban (2,500 persons) are reported. Of the six primary bypass candidates, only Durant and Madill have published data in the Economic Censuses. While all businesses are required to answer questionnaires and submit them to the Census Bureau, the Bureau does not deem it cost-effective to publish results to such a small scale and hence only places larger than 2,500 persons are published. Partly this is due to disclosure considerations; the Census Bureau will not publish business or personal information if there are so few entities in the geographic area that it would be easy to determine an individual's characteristics.

A second limitation is that the data that are published are not tied to any geographic location other than the political boundaries of the town or city. Since most bypasses will remain within the city limits (or will be quickly annexed to the city), these data would not provide any way to differentiate between businesses on the current route, on the bypass route, or elsewhere in the city.

Finally, in 1997 the Census Bureau changed the Standard Industrial Classification (SIC) codes that have been in use for decades to a new system called North American Industry Classification System, or NAICS. Many NAICS codes are similar to SIC codes, but there are also numerous differences and in general the industry definitions have been modified to the extent that "Where changes are significant, it will not be possible to construct time series that include data for points both before and after 1997."[3]

Because of the extreme importance of these types of data, we deviated from our initial desire to rely entirely on secondary, published data sources and went into the field in 2000 to collect business data directly. We visited every town along US 70 from Madill to Idabel, and tabulated the types of businesses along the highway through town as well as the bypasses around Hugo, Durant, and Idabel (which has actually been bypassed twice, north and south). These visits allowed us to tabulate the existing status of the highway route through all of these towns, as well as observe the businesses that have sprouted along the bypasses. In order to broaden our database of bypass impacts, we also visited eleven other towns and cities of varying size that had already been bypassed, as mentioned in the original Request for Proposals that generated this research project. The purpose of visiting already-bypassed towns was to obtain business tallies in order to observe, with the benefit of hindsight, what sorts of changes appeared to have happened in bypassed towns. These eleven towns, in combination with the three towns along US 70 that have also already been bypassed, provided us with a set of 14 towns and cities upon which to base our impacts projections.

Exploratory data analysis, in conjunction with research literature on highway bypasses, led us to subdivide the data set and our analysis into three levels: places smaller than 2,500 persons (henceforth "Small" towns), places between 2,500 and 7,500 persons ("Medium" towns), and places larger than 7,500 persons ("Large" towns). The general business characteristics led us to these divisions as large natural breaks indicated notable differences between Small, Medium, and Large towns. Furthermore, there were large population gaps across the 2,500 and 7,500 population break points, providing further justification for dividing the data set in these locations. This division provided us with five Small, five Medium, and four Large towns to use as reference points for the analysis of past bypass business impacts. The trends and distribution of activities in these fourteen towns and three categories provides the basis of estimating future bypass impacts along US 70. The estimation process involved applying the current distribution (i.e. percentage) of business activities in already bypassed towns (both along the old route and the new bypass route) to the distribution of activities in proposed bypass towns to develop projections in each size category (Small, Medium, Large).

We also relied on the bypass literature to develop categories of businesses depending on their degree of dependence on pass-by traffic. The first category of businesses was **traffic dependent** and included restaurants, gas/convenience stores, hotels, and car washes. Several subdivisions were used, including original use, re-habitation of buildings by similar or dissimilar uses, and vacancy. The second category of businesses was **traffic related** and included car dealerships, auto parts stores, the activities of the downtown business district, other free-standing businesses along the old and bypass routes, and banks. For the downtown district as well as other free-standing buildings a subdivision of retail, personal/professional services, and vacant was used (excluding the retail functions tabulated in the traffic dependent category). The final category was **non traffic related** and included other economic activities such as factories, extractive activities (i.e. sand pits and mines), and anything else that could not be conclusively placed in any other category.

We elected to use our own reference numbering system for these types of activities instead of the NAICS codes used by the Census Bureau because: 1) there is no likelihood of ever obtaining census data (due to publication and disclosure limitations) for any of the target towns except Durant and Madill; 2) it would have been very difficult to identify the precise NAICS code for every activity based on external observation alone; and 3) NAICS codes often lump seemingly dissimilar activities that would have muddled our analysis of traffic dependent and traffic related activities. Hence, in the data that come out of the GIS during the buffering and selection process outlined earlier, our own consecutive number system is used and is explained in the training documentation.

For the towns under bypass consideration along US 70, these data are referenced to the current route through town. Then, when a town is analyzed by the buffering and selection process mentioned earlier, current business patterns as well as projections of future patterns five years or greater after the bypass are selected. These can either be displayed directly in ArcView or be sent to a spreadsheet for further manipulation and analysis. Since Idabel has actually been bypassed twice, it is hard to imagine that another bypass will ever be built, so there is not a set of projections for Idabel but instead a simple reporting of existing activities along the old and both bypass routes. Although Hugo also has a southern bypass, the database does contain projections in the event another bypass were to be built (presumably around the north side of town) as well as reporting current business tabulations along the existing route through town and the existing bypass route.

Sales Tax Collections

Sales tax data were used as another avenue of analyzing economic changes in bypassed towns as a way of making projections for the impacts of future bypass. These data were collected directly from the Oklahoma Tax Commission (OTC) from their archived records. Initially we sought to use 4-digit SIC classifications to disaggregate various retail functions, but the data were very spotty and virtually non-existent for the Medium and Small towns. Thus, we had to limit our analysis to overall city sales tax collections for each year.

Because of inflation and varying tax rates in the towns, for the purposes of analysis all tax revenues were reduced to 1% sales tax values for one month in 1998 dollars. Hence, for a town with a 3% town tax rate, the annual tax collections would have been divided by 3 (to reach a standard 1% tax rate) and also divided by 12 (to reach a standard one month). Finally, an inflationary adjustment figure was used to inflate a given year's values to 1998 dollars. These calculations were performed to ensure that any tax rate changes from year to year were not due to inflation or to new (usually higher) tax rates going into effect. The rationale for reducing tax collections to one month equivalents is that in some towns a new tax rate went into effect in the middle of a calendar year; thus, adjustments were made to account for the different tax rate before and after the rate change, again to avoid finding a "trend" in tax revenue changes that was due to a simple rate increase (or decrease) as opposed to reflecting real changes in the economy of a town.

Since these tax collection figures are spatial only in the sense that they represent aggregate collections within a specific areal unit (the town boundaries), there is no explicit spatial dimension to the data. When a town is selected for bypass analysis in ArcView, a data window appears that provides the 1998 tax collections for the entire year, the current tax rate, and the single month tax collection (comparable to the numbers used in the analysis that produced Table 2, discussed in the Overview of Bypass Impacts section) for informational purposes.

Traffic Counts

We initially anticipated a greater role of traffic count data provided by ODOT, both for an analysis of changes in traffic patterns along the old route after a bypass opened, as well as to try to match traffic change trends to business or tax collection trends. However, due to the limitations of business patterns and disaggregated tax collections data describe earlier, in combination with the paucity of traffic count data, this data area has been reduced to one of informational purposes only.

When the route selection process is performed in ArcView and the old route is traced on the screen with the cursor, any traffic count stations for which data exist along that route will pop up in a data window with the option of sending the data to a spreadsheet. Again, however, there were severe limitations in the data, specifically: 1) traffic count stations were only occasionally located along either the new route or the bypass route in bypassed towns; 2) data were not always collected every year; and 3) the locations could not always be precisely determined because the station numbers were noted on maps that were often very poor copies, one county had no maps and therefore we had no way to determine the stations' locations, and most of the target towns had no traffic counts anyway. Hence, with so many holes in the data and no realistic way of analyzing any aggregate trends, the traffic count data are simply part of the database and, when present, pop up in a window.

Ancillary Data Sets

Various other easily obtained and integrated data types are present in the GIS database. These data include the National Highway Planning Network (NHPN), county and state borders, railroads, and large and small urban area designations as defined by the US Department of Transportation through the Bureau of Transportation Statistics (BTS). These data have been assembled for Oklahoma from the National Transportation Atlas Database (NTAD) for 1999, and from the Transportation Research Center at The University of Tennessee, the subcontractor for the NTAD.

In addition, digital ortho-photo quarter quadrangles (DOQQs) for the counties along US 70 in southeast Oklahoma are included to provide the user with the ability to see data on the ground as of the photo dates (mid-1990s). These images were obtained from the Oklahoma Conservation Commission, and represent the latest available DOQQs from an official state agency.

These features will inform the analyst of physical barriers or topographical features that would make locating a new bypass impractical or impossible, as well as permitting informational and attractive mapping of the route at various scales. The inclusion of these data adds very little in the way of cost or computer speed, but could conceivably be useful in myriad ways that are presently unanticipated.

OVERVIEW OF BYPASS IMPACTS

The anticipated economic changes that would occur in the targeted towns vary greatly, depending primarily on town size. This concept makes sense and was reinforced during our on-site data collection activities and ultimately led to the Small, Medium, and Large town divisions given earlier. As a town's size increases, the percentage of traffic that will be diverted onto the bypass route should shrink. It seems unlikely that very many drivers will choose to go through a Soper or Bokchito when a higher-speed route exists around it – the traffic on US 70 in the Small towns should be dominated by passers-through. Large and Medium towns, on the other hand, are destinations and much of the traffic on US 70 is coming into or out of these towns for shopping or business purposes. As the larger towns in this part of the state, they serve as central places for people to obtain goods and services from the surrounding hinterlands that are not available in the Small towns. This concept of fewer and more widely-spaced large central places serving a group of more numerous but smaller places was first formalized by the German economist Walter Christaller, and his Central Place Theory[4] on this topic seems to be strongly reflected in the actual landscape of southeastern Oklahoma.

The Small towns (fewer than 2,500 people) all appear to be declining. This is symptomatic of American society today, as in much of the world – urbanization is drawing ever more people away from smaller places towards larger ones with the lure of better job opportunities, more leisure and recreational activities, and a (supposedly) better lifestyle. Southeastern Oklahoma appears to be hard hit by this phenomenon, due to its relative inaccessibility. Interstates 30, 35 and 40 demarcate a roughly triangular region that is somewhat under served by highways. This is partially due to the hilly terrain, but also again due to the nature of urban systems as outlined by Christaller. With Dallas, Oklahoma City, and Little Rock forming the points of the triangle and Ardmore, McAlester, Sherman, and Fort Smith further ringing the region, the population base is too small to support another large town in the region. Hence, this area will probably continue to see declining rural populations, even if many of the migrants simply relocate to larger towns like Ada, Durant, and Idabel within the region.

Present and Future Business Patterns

The Small towns showed evidence of stronger business and retail activities in the past, but their current vacancy rates combined with the relatively low-level activities still present (auto repair shops, antique stores, video stores, etc., all occupying buildings that were obviously built for other purposes earlier this century) indicate these towns are slowly dying already. In all likelihood, more elderly populations still inhabit these towns and frequent the businesses that remain. As this generation gradually dies off, the primary customer base will also disappear and Bokchito, Boswell, Ft. Towson, Kingston, Soper, and Valliant will probably continue to decline. Bypassing these towns may speed the process up somewhat, but only slightly. Not too many of these towns have retail establishments that would appeal to the traffic passing through, so the diversion around town should not have much of an impact. The existing conditions in these towns are responsible for the decay, and a bypass will only slightly speed this process along.

Table 1 shows some clear trends and allows comparisons to be made concerning current business patterns in the ten towns along US 70 under study.

TABLE 1
Population and business characteristics along US 70

Town	1998 Popula-tion	Size	Number of Non-Vacant Establishment	Persons per Non-Vacant Establishment	Current Vacancy %	Projected Vacancy %
Soper	294	S	9	32.7	40	47
Ft. Towson	546	S	19	28.7	14	26
Bokchito	572	S	22	26.0	31	36
Boswell	622	S	26	23.9	30	34
Valliant	924	S	32	28.9	27	33
Kingston	1,433	S	60	23.9	10	16
Madill	3,934	M	96	41.0	13	18
Hugo	5,974	M	116	51.5	10	15
Idabel	7,278	M	153	47.6	22	n/a
Durant	13,187	L	181	72.9	10	13

S = smaller than 2,500 persons; M = 2,500 to 7,500 persons; L = larger than 7,500 persons
Note: no further bypass of Idabel seems likely, hence no projection of future vacancy rates

Population data source: US Census Bureau. All other data collected by the authors.

Setting aside Kingston for the moment as something of a cross-over between Small and Medium towns, the numbers of active businesses in Small towns along the current US 70 route only range from 9 (in Soper) to 32 (in Valliant). Without discounting the importance of these businesses to the communities and their role as the livelihood for dozens of people in these towns, these are relatively small numbers of activities that will be impacted by a bypass. Ft. Towson notwithstanding, the vacancy rates are quite high (27 to 40%) and the loss of just a few stores due to a bypass will noticeably raise the vacancy rates even higher.

The population to business ratio is quite distinct, ranging from 23 to 33 persons per active (non-vacant) establishment in the Small towns, 41 to 51 persons per business in the Medium towns, and about 73 persons per establishment in the lone Large town. In this statistic at least, Kingston fits within its Small town designation. These numbers clearly indicate that the Small towns depend on US 70 and are clustered along it, while the Large and even Medium towns have far more people per business and these people are more spread out away from (and off of) US 70. With such a narrow margin of available customers per business, further erosion of what passer-by traffic does stop in the Small towns will likely damage traffic-dependent businesses like restaurants and gas stations.

Within the ten target towns 1,000 persons actually appears to be a strong cut-off for vacancy rates; those towns smaller than 1,000 (again excepting Ft. Towson) all have vacancy rates over 25% while the towns larger than 1,000 persons all have vacancy rates below 22%. If Idabel is set aside, the vacancy rates are all in the low teens in Medium towns. Idabel's higher vacancy rate is probably due, in part, to the fact that this is the only town in this study to have been bypassed twice.

The Medium towns will likely be the most critical to evaluate. Madill and Hugo are quite a bit larger than the Small towns, but are still centered and focused along US 70. Overall the primary impact will likely be a redistribution of businesses from the old route to the new, as opposed to the Small towns where we expect a die-off along US 70 but very little new business along the bypass. While the Medium towns overall may not experience a net loss or gain of jobs or tax revenues, the downtown businesses would be hurt and this is reflected in the anticipated vacancy rate increase of 5%.

Large towns should be the least impacted by bypasses. The Large towns that have already been bypassed in Oklahoma that we studied (Ada, Durant, McAlester, and Okmulgee) all showed strong economies and fewer of the negative impacts along the old highway routes as a result of having been bypassed. Durant is the only Large town under consideration for a future bypass, this time along an east-west axis. The narrowness and congestion of US 70 through town, its enviable position as a closer node through which travel to Dallas is facilitated for areas to its east, and the presence of Southeastern Oklahoma State University, all combine to make a bypass seem like a positive change in the town. While vacancy rates along US 70 are anticipated to rise slightly (from 10 to 13%), the town may actually experience a renaissance along the old route as the heavy east-west traffic is redirected. While the original route of US 70 through Ada may not possess the most aesthetically pleasing buildings, that stretch of street is very vibrant with most original buildings having been re-occupied and rehabilitated. Durant has (to our sensibilities) an even less appealing appearance through town along US 70, and the removal of large volumes of pass-through traffic could lead to a push to beautify and "reclaim" the downtown for local citizens and pedestrians again. Ironically, this might even occur as a strategy against losing large numbers of businesses to a bypass.

Another manner of analyzing and summarizing the business conditions involves documenting some larger trends that are worth noting. Among the traffic dependent variables, restaurants remain firmly located in town along the old route except in Large towns, at which point larger numbers of bypass restaurants appear. The vacancy rate of gas/convenience stores along the old route through towns steadily decreases as town size increases, and as town size increases so does the percentage of service stations on the bypasses. There were no hotels in any of the studied Small towns; in the Medium and Large towns, hotels along the old route are predominantly locally-operated and owned while the vast majority of hotels along the bypass routes are operated by national chains. Lastly, we observed no car washes along any of the bypasses; these functions are strictly located in town along the old route.

Among the traffic related categories, car sales never appeared in Small towns. In Medium towns, all car sales were still in town along the old route, but for Large towns 80% of all the new car dealerships were located along the bypasses and the original in-town locations had clearly been converted to used car sales, either by the same dealer or as independent sales.

The downtown businesses have clearly taken the brunt of the economic damage from bypasses, especially in the Small towns. The store vacancy rate was 45% in Small towns, while it was only around 20% in the Medium and Large town categories. Furthermore, in Small towns there was an almost even distribution of retail and service providers in the non-vacant buildings, at 28% each (the three percentages add to 101% due to rounding in the spreadsheet calculations). In the Medium and Large towns, approximately 55% of the non-vacant businesses were retail oriented while the remaining 25% were personal/professional services. These two tallies plus the 20% vacancy rate account for 100% of the downtown activities.

Similarly, the non-downtown activities along the old route were hit hard in the Small towns, with about 31% being retail, 31% being services, and 38% being vacant. However, in the Medium and Large towns the vacancy rates were only 12-13% and retail functions again accounted for over half the total activities. Thus, in Small towns vacancy rates are two to three time larger for traffic related businesses than in Medium and Large towns, and retail functions are generally equal in quantity to service functions (medical, dental, legal, real estate, etc.) in Small towns. The Medium and Large towns generally still have over half of all traffic related activities concentrated in retail functions.

Finally, in what may or may not be a quirk of the fourteen studied towns, no banks are located along bypasses in any size town. So far, at least for these fourteen towns (some of whose bypasses were built in the 1960s), banks remain in town along the original routes.

Sales Tax Collections

Complementing the preceding discussion is an overview of sales tax collections. While these data are merely aggregates of the overall retail business collections of the towns under study, they represented our best source of year-by-year data, allowing us to analyze trends in the overall health of each town vis-à-vis its sales tax collections. Though other factors could certainly come into play, we felt that some information would be gained by analyzing tax collection changes before and after bypasses and maintained our time window at five years after a bypass as the farthest reasonable projection period. A further breakdown by business category (such as SIC codes) would have been even more useful, but these data were only available for Durant and Madill among the target towns in the original

Request for Proposals. Furthermore, as six of our ten target towns were in the Small category, and no disaggregated data were available for any of the other towns that size in Oklahoma that have already been bypassed, no analysis was possible. Thus, the 1998 data are simply given for informational purposes for Durant, Hugo, Idabel, and Madill when those towns are selected.

Table 2 summarizes the annual sales tax collection changes in already-bypassed towns in Oklahoma.

TABLE 2
Annual changes in tax collections, as a % of previous year's collections

Size	BP-4	BP-3	BP-2	BP-1	BP	BP+1	BP+2	BP+3	BP+4	BP+5
Small	-4.3	+4.4	+3.8	-1.0	+0.5	+2.9	+1.3	+3.7	-8.3	0.0
Medium	n/a	n/a	+8.7	+7.5	+10.1	-1.9	+9.5	+3.8	+4.2	-0.9
Large	+0.7	+1.3	+2.9	+1.7	+1.1	+4.4	+3.2	+4.4	+2.4	+2.0

BP-4 is four years before the bypass opened.
BP is the year the bypass opened.
BP+3 is three years after the bypass opened.

Source: Oklahoma Tax Commission

Under the BP-3 column (three years before the bypass), for example, the overall sales tax collections in Small towns were 4.4% higher than the previous year, BP-4 (four years before the bypass). In a similar fashion, the difference between each year's tax collections is expressed as a percentage change from the previous year's tax collections. Again, all tax collections were standardized to one month at 1% in 1998 dollars, removing all rate change (mid-year or not) and inflationary influences. Our sample was wider for this analysis due to the ease of collecting data for all previously bypassed towns in Oklahoma, and only OTC's dates of collection limited our analysis. Thus, there were four Small, four Medium, and nine Large towns in this analysis. There were insufficient data five and four years before bypasses in the Medium towns to calculate rates of change.

Generally, larger towns as a group did not experience regular annual declines in tax collections either before or after bypasses opened, and only Cushing, Tahlequah, and Okmulgee of the nine Large towns had frequent negative years. It is notable that in Large towns collection increases tended to be twice as large in the first three years after a bypass opened compared to pre-bypass annual growth, then collections settled back to previous annual increase levels in the fourth year after a bypass.

Medium towns showed much more robust growth of tax collections, and, after a collective small dip in the first year after a bypass, typically rebounded to pre-bypass annual growth rates. Small towns, after exhibiting very little impact of bypasses in the first few years, appear to have suffered more severely beyond the fourth year after a bypass. It is worth noting that while the Small and Medium town trends are based on only four towns each, this represented the entire set of bypassed towns in Oklahoma for which sales tax collections could be obtained.

CONCLUSION

Overall, the delivered GIS database/program package provides several avenues of comparative analysis in determining the impacts of highway bypasses along US 70. Projections of changes in businesses along the current route form a significant portion of the output, as these directly bear on the overall health of the town and the likely consequences of building bypasses around them. These projections are based on existing conditions in towns that have already been bypassed, and are grouped into size categories to allow differential effects in different sized towns.

The GIS package also allows selection of detailed socioeconomic data at the block group level. This selection process allows an examination of the overall population, employment, and economic characteristics of the areas through which US 70 currently passes as well as along new, proposed bypasses. Due to the particular nature of Oklahoma's census data, namely the lack of pre-1990 block group statistics, these data provide a snapshot of the current (i.e. 1998) socioeconomic conditions. However, this should still prove extremely useful in analyzing how many people will be impacted by a bypass, their per capita incomes, etc. as another means of comparing bypass alternatives.

Other non-spatial data are included that provide further indications of the economic setting of the towns under study, even though the data are referenced only to the entire town and are not published with geographic coordinates or addresses. Aggregate sales tax data as well as disaggregate data for some of the larger towns are available, plus some historical evidence of how tax collections fluctuated before and after bypasses (Table 2). Traffic count data proved to be more difficult to use because of the spotty nature of the data and our inability to match many of the traffic counts to geographical locations. What traffic count stations could be reliably placed on US 70 routes were incorporated into the GIS, but are not common enough to provide any analysis or predictions.

Finally, the power of GIS is its ability to integrate all types of spatial data into a comprehensive framework for analysis and display. In addition to the main data types summarized above, aerial photos of the region are available as background to provide an actual evaluation of the current land uses (especially in locations around town where bypasses have been proposed), the highway and rail networks can be displayed, and urban (for the larger towns) and county boundaries can also be displayed for reference. All these layers can be turned on or off as the analyst desires, providing a high level of flexibility in the selection, analysis, and presentation of the various data layers in the GIS database. Furthermore, by using a popular, powerful, and flexible GIS package like ArcView as the database management platform, ODOT personnel could add other data layers in the future that are of interest to both the economic and engineering aspects of proposing bypasses, paving the way for an extended use of this modeling framework and possibly expanding it to other locations in the state.

This project presented many challenges in its execution. Ultimately, the availability of data in the very small towns that ODOT wishes to study is very limited due to cost and disclosure issues. In the absence of governmentally collected data that would have made our task easier and somewhat more standardized (in terms of business definitions, for example), we strove to supplement what meager data there were with field-collected data using consistent techniques and redundant data-checking methods to ensure the quality of our field data. These aspects made the project a significant learning experience for us and probably for ODOT as well. We appreciate the opportunity to have worked with ODOT and hope that this has been a mutually beneficial endeavor.

NOTES

1. Idabel has actually been bypassed both to the south of the original US 70 route (in 1972) and since 1997 on the north side. The US 70 Feasibility Study done by the Benham Group in 1997 indicates a proposed northern bypass route. However, when we visited Idabel we discovered that the north bypass was complete and we drove its length.

2. These variables are: total population, total number of households, average household size, median age, total number of owner-occupied housing units, total number of renter-occupied housing units, average household income, per capita income, and total number of employed persons.

3. US Census Bureau, 1997 Economic Census, "Introduction to the Economic Census," page 1.

4. Christaller W. *Central places in southern Germany*. 1966. Baskin CW, translator. Englewood Cliffs (NJ): Prentice-Hall. Translation of: *Die zentralen Orte in Süddeutschland*. 1933. Jena: Fischer.