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The perceptions of business owners and managers of the impacts of the rural highway bypass

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INTRODUCTION

What happens to a rural community when it is bypassed by a highway that once went through the main street in town? What are retail merchants' thoughts concerning the impact of the bypass? Has the highway bypass brought them business? Has it taken business away? Would they favor a highway bypass the second time around?

This thesis discusses the rural highway bypass and the impact it has on the rural community. Many community leaders are concerned when the Iowa Department of Transportation announces plans to construct a highway bypass around their town. The leaders view the bypass as a threat to their economy. Some retail merchants believe they will lose customers and are often strongly opposed to the proposed bypass.

Prior to construction of a rural highway bypass, business owners and managers anticipate economic impacts that may or may not happen. This study explores attitudes of the business owners after the bypasses have been completed. Several statistical methods have been used to compare and test the relationships of merchants' attitudes toward the bypass with their location and type of business.

The purpose of the rural highway bypasses has been to "meet the demands made by the modern automobile and to

satisfy the desire for time savings by the motorists. Many of Iowa's highways had to be reconstructed or relocated to provide safe, convenient, and economical transportation systems" (Iowa Highway Commission 1966, 1). Eleven communities from various parts of Iowa were examined. All communities were rural.

The results of the survey have been coded and compiled as frequencies and crosstabulations to examine the relationship between various attitudes concerning the effects of the bypass. An empirical model has been developed to test the hypothesis that the rural highway bypass will produce impacts that affect the perceptions of business owners and managers. These perceptions of the impact will vary depending on the type of business and its location.

The questionnaire was designed to elicit the thoughts of retail merchants concerning the economic impact of the bypass. They were asked about the effect of the bypass on such things as: traffic noise and volume, accident rates, parking problems, the shopping environment, the number of customers and overall quality of life.

The businesses responding to the survey were separated into eleven major business categories. This variable was later reclassified into three business categories. The location variable was handled in a similar manner. Four locations were examined.

The theoretical and historical background of the highway bypass, as well as the literature review of this topic, will be discussed in the next chapter. The use of bypasses in the interstate highway system will be examined to determine the role it has played in the development of the rural highway bypass system. Safety and efficiency have become the main factors in the success of the bypass highway.

The highway system in Iowa has been an important link to the economic development of this state over the course of many years. Iowa has been an agricultural state from its conception and consequently the roads have been built to move commodities from the farm to nearby markets. The literature review will discuss the importance of the rural highway bypass to the farm sector as well as the impact of the bypass on the communities it serves.

Methodology will describe the methods used to study the bypass impact in each of the eleven communities. The analysis of the data collected will be discussed in the analysis. The analysis will include the development of the questionnaire.

The conclusion will have comments on the role of the rural highway bypass as an important economic link in the transportation system in Iowa. The bypass is important to retail merchants, commerce, farming, and the traveling public, as well as to economic development.

LITERATURE REVIEW

The transportation network in Iowa had its beginnings with the Ordinance of 1785. The ordinance provided funds to survey the unsettled land of the Louisiana Territory. The survey was a system of one mile grids which led to the rectangular county roadways found in Iowa today.

Before the turn of the century, county roads were used for hauling. The roads were very muddy when it rained and full of ruts when they were dry. A horse pulling a wagon would find it difficult to haul farm products to town for marketing (Office of Project Planning 1988).

The road problem grew worse as the automobile became popular. The clay soil in much of Iowa brought automobile traffic to a stand-still on rainy days. Iowa citizens carried picket signs in the 1920s to protest the terrible road conditions. The signs read, "Get Iowa Out of the Mud."

"The State of Iowa used matching federal funds, made available with the passage of the Federal Road Act of 1916, to make improvements to rural highways" (Office of Project Planning 1988, 3). Farmers could move their products to market on graveled or hard surfaced roads. They could travel longer distances with greater efficiency.

"By 1950 about 50 percent of the local rural roads were improved with all-weather gravel or paved surfaces" (Baumel

et al. 1989, 1). As the number of farms decreased, the size of the farms increased. The larger farms meant larger and heavier equipment was traveling over roadways not built to support the weight. As a result, many arterial roads were paved in the 1950s and 1960s to improve the farm-to-market transportation system.

Iowa's economy depends on its rural transportation system. "Improved transportation has generally been regarded as one of the more important forces underlying the American agricultural revolution" (Office of Research and Development 1964, 124). The rural highway bypass system in Iowa has been implemented to further improve the farm-to-market roads.

History of the Bypass

> With the development of the inter-city travel, it soon became apparent that travel through urban areas would have to be given consideration along with the travel to and from urban areas. This consideration led to the urban bypass, a provision in highway location whereby the traveler may get to the opposite side of the urban area without going through it, or at least not through the central business district (Office of Project Planning 1991, 1).

The success of the urban bypass has led to experiments with a rural bypass.

The history of the rural highway bypass begins with the interstate highway. The Federal-Aid Highway Act of 1956 was the beginning of the Interstate Highway System in the United States. It was "one of the most important transportation

laws ever passed regarding transportation" (Wright and Ashford 1989, 48).

This system connects all major cities of the United States with controlled access freeways constructed to approved modern design standards. The interstate highway system provides high levels of service for drivers using the system (Wright and Ashford 1989). People traveling on the interstate highway can drive for miles without interruption.

The rural highway bypass provides similar comforts and conveniences as the interstate. These highways can move goods from factories to consumers more quickly and efficiently (Iowa Department of Transportation 1991). The system is safer than two lane highways or multilane highways without controlled access. Some safety features include: continuous wide shoulders, wide medians, at least two wide lanes in each direction and limited access to other streets, roads or highways.

Many highway bypasses constructed in Iowa during the 1980s were four lane. The specifications for construction of these rural highways are less rigorous than those of an interstate highway. For example, the roadways and shoulders are not as wide as an interstate (Wright and Ashford 1989).

Although construction standards on the rural highway bypass do not meet those of the interstate highway, they do have limited access and offer many of the same safety advantages as the interstate. Many obstacles that confront a

motorist have been removed by the construction of the highway bypass. Some obstacles include traffic lights, pedestrian crossings, curb-side parking, cross-traffic and driveways.

Transportation Investment

Regardless of whether a rural highway bypass is two or four lanes, it improves the farm-to-market transportation system in Iowa. Iowa's economy depends on good roads. "Improved transportation is generally an important force underlying the American agricultural revolution" (Office of Research and Development 1964, 10).

"Road investment in highway bypass construction normally produces benefits for road users in the form of reduced journey times, in vehicle operating costs, and an improvement in safety" (Andersen et al. 1993, 1). The Iowa Highway Commission found the highway bypass brought safety improvements, especially in the central business districts. Parking and traffic patterns improved when through traffic moved to the bypass (Iowa Highway Commission 1964, 1996).

Investment in safer and more efficient roadways also has a direct and indirect impact on local and regional economies. A transportation investment will provide consumers and merchants with economic ties to the outside world. The investment will benefit firms, households, and local and state governments (Huddleston and Pangotra 1990).

Some firms will be directly influenced by the transportation investment and will experience economic growth. These same firms may take profits away from other businesses, who then may experience decline (Huddleston and Pangotra 1990). Transportation investment is not always a positive experience for all firms and households. The Iowa Highway Commission attempted to measure the bypass effect on businesses.

Iowa Highway Commission Study

During the 1960s, the Iowa Highway Commission conducted several studies of the economic impact of the highway bypass on rural communities. The bypass, in these reports, was generally a two lane roadway that moved from "downtown" to the city limits. Some of these highways had controlled access.

The Traffic and Highway Planning Department of the Iowa Highway Commission used raw taxable retail sales data to measure the economic impact of the bypass. The data were collected four years "before" construction of the bypass and two years "after." The six years included the construction period.

One of the impact studies conducted by the Iowa Highway Commission involved Chariton, Iowa. This community was bypassed by U.S. Highway 34. The highway opened to traffic on October 17, 1961. Retail sales data was collected for six

years beginning in July of 1957. The "before" data includes the time from July, 1957 to the opening date. The "after" data begins with the opening of the bypass to July 1963.

The highway bypass construction period in the above studies was two to three years. When comparing the experimental data to that of the control group, those years of construction added bias to the statistics used to measure the data. One problem with this data, for example, is that it will have an overestimated sample mean. This mean would not represent an approximation of the population mean (Hollander and Wolfe 1973).

The goal of these studies was to measure the economic impact of the highway bypass. The data indicate that bypass effects might be directly connected to the construction years. Effects noted in the Stuart, Iowa, project were especially apparent in the cafe and service station businesses. There were sharp increases in retail sales of gasoline and prepared food midway through the construction period (Iowa Highway Commission 1964, 9).

Eleven communities, bypassed in the late 1950s and early 1960s, were selected for the impact studies. Each study was carried out over a six year period that included the construction year. Planners of the Iowa Highway Commission conducted the analysis. The general conclusions were as follows:

1. The communities are not necessarily dependent on the traveling public.
2. Service stations, restaurants and motels suffered more loss than other business types.

Each of these impact studies made comparisons between retail sales categories in one town and an appropriate control group. The control groups were generally economic areas, other cities or counties. The studies involved several communities, however, there were no comparisons made between communities (Iowa Highway Commission 1962, 1963, 1964, 1965, 1966).

The Iowa Highway Commission study used retail sales data to examine the impact of the bypass on the merchants in various communities. The study compared several types of businesses to determine the impact of the bypass. The findings show restaurants, service stations and motels experienced the most negative impacts. This thesis will examine the merchants' perceptions of the bypass impact and its effect on their businesses.

This thesis examines the impact of the bypass on eleven communities different from those of the Iowa Highway Commission studies. The towns examined in the thesis were bypassed during the 1980s. Each town was compared to the other ten. It is possible that certain towns are affected more than others. Location, relative to the bypass, is one factor that can have an important influence on the community.

Location

The location of a highway affects firms and households in many different ways. For example, home owners will not want a major highway close to their home. It would be dirty and noisy, and introduce safety problems for the residents. The safety issue can be especially great for residents with children.

Businesses, on the other hand, will often compete to be near a highway because it brings more customers. Gas stations, motels and restaurants generally prosper in such locations. Other firms, however, will prefer the quieter atmosphere of a central business district. These might include men's and women's clothing stores, gift shops, book stores and appliance stores.

Location Study

A 1972 study conducted by the Texas State Department of Highways used a written survey to find a business's preferred location. The survey involved 175 Houston business persons, out of a possible 1,710. Manufacturers, wholesalers, retailers and service establishments in a planned freeway corridor in Houston, Texas, admit they would prefer to be along the freeway or within two or three blocks of it. The survey also provided the following results:

135 Favored the proposed freeway;

21 Opposed it;

19 Had no opinion.

(Texas A&M University 1972, 160). The merchants who owned businesses along the planned freeway corridor overwhelmingly supported freeway construction.

Every business person in a community searches for the perfect location. The Andersen bypass study looked at the location of a business relative to the bypass. Some types of business experienced losses because of their location, while others were unaffected by the relocation of the old highway. Location is an important factor to the profit and viability of a business.

Location will be an issue in this thesis as well. The merchants' perceptions of the bypass impact will be examined as it relates to the location of their business. The Andersen study divides the State of Texas into six regions and found that the bypass impact had different effects on the various locations. This thesis divides eleven communities into four different locations to determine if the bypass impact will vary.

Retail Sales Study

The viability of a business can be examined using retail sales tax data. A study directed by Daniel M.Otto (1992) uses taxable retail sales data from fourteen types of retail

businesses. The data for the Otto study involved the same eleven bypassed cities as those in this thesis. The result produced "pull" factors calculated for the fourteen retail sales categories.

The "pull" factor accounts for the population and income of a community and state. It is:

> the ratio of trade area capture to municipal population and measures the community's drawing power. Trade area capture allows a community to measure the extent to which it attracts nonresidents (tourists and nonlocal shoppers). Trade area capture represents annual retail sales by business category, state population, county and state per capita income.

$$\text{Pull Factor} = \frac{\text{Trade Area Capture}}{\text{Municipal Population}}$$

(Shaffer 1989, 153).

Although "pull" factors are calculated from retail data, they are relative scores that can be used to make comparisons over different years. Raw retail sales data in current dollars can be converted into "pull" factors. The raw data does not account for price inflation, population changes or changes in the economy. "The current dollar sales were converted to pull factors in the Wal-Mart study to provide a more equitable comparison when analyzing the trends for towns in a state." (Stone 1989, 2).

The pull factors, derived from the raw retail sales data, compare cities with a highway bypass to those without. "Without a control group, there is no way to tell how much of the general effect in the experimental group was true cause

and how much was extraneous effect" (Bailey, 1978, quoted in Isserman and Merrifield, 1982, 44). The Otto study used two control groups to explain the general effect of the bypass impact to raise the assurance to a true cause. One group was "paired cities" and included two towns of similar size, economic, social and political make-up but without bypasses. The other "control" group included all towns in Iowa of similar size.

The Otto study used retail sales data as did the Iowa Highway Commission study. However, the Otto study used pull factors to reduce the influence of outside economic factors. This thesis will use primary data collected by a survey instrument to measure the merchants' perceptions of the bypass impact to determine whether the findings discussed in the previous studies are similar.

Survey Method

The survey method was used to gather data for this thesis. "The survey constitutes a method of data collection that utilizes interview or questionnaire techniques for recording the verbal behavior of respondents" (Phillips 1971, 125). It is an appropriate measure of the attitudes and beliefs of the business owners or managers.

The before/after and with/without data collection methods allow for more accurate statistical measurements because the experimental group is compared to a control

group. "There will be less influence from outside sources with the control groups" (Phillips 1971, 111). These data collection methods cannot, however, measure the attitudes and beliefs of the merchants to the bypass impact.

A survey records the views of the respondent. It "constitutes an effective tool for getting a cause-and-effect relationship" (Phillips 1971, 125). One problem with the survey method is its inability to distinguish between a person's perception and the reality of the situation. At the same time, a survey can reveal a great deal about the individual who responds.

Van Houten and Hatry (1987) discuss the survey as a form of citizen participation:

> The citizen survey is a means of collecting data and opinions representing the experiences and opinions of all citizens and, where appropriate, of specific population groups within the community. Survey data can provide valuable information about citizen attitudes toward changes under consideration before such changes are submitted to those in authority (Van Houten and Hatry 1987, 1).

The bypass survey allowed the business owners or managers in the eleven bypassed communities an opportunity to express their thoughts about the highway bypass. These merchants have had indirect input in the planning process of future highway bypass projects simply by returning the questionnaire.

This study attempts to explain the bypass impact using procedures described above. Some merchants see the bypass as

a detriment to their business. The type of business they operate can play a role in the growth or decline of that business with the advent of the bypass. The merchants noticed reductions in traffic, dirt and noise after the bypass opened.

METHODOLOGY

Retail merchants work hard to attract customers. They often strongly oppose an announced bypass because they view it as a threat to their businesses. Merchants believe the highway bypass causes potential customers to avoid their central business district. As a result, other merchants might be indirectly affected. Then they all believe the results of the avoidance is a decrease in retail sales.

The rural highway bypass produced an impact for the community. The perceptions of the bypass impact can be very different depending what type of business the person owns. Past research provides evidence that highway oriented businesses experience loss of sales after the opening of a highway bypass (Iowa Highway Commission 1962, 1963, 1964, 1965, 1966).

The location of a business relative to the bypass is also an important consideration. Location is very important to highway oriented businesses. Often their sales depend on the traveling public and when a major highway is moved to the outskirts of the town, the business experiences lost sales.

This research evaluated the retail merchants' perceptions of a number of highway bypass related issues. It may be easier for the merchants to adjust to the impact if

they realize there are many positive effects or, at least, no negative changes.

Sample Description

For this study, data was collected from eleven pre-selected communities in Iowa (see Appendix One for maps of the bypassed communities). The criteria included communities with highway bypasses constructed since the late 1970s. Table 1 contains a list of the bypassed cities.

Table 1.--Population Data for the 11 Bypassed Communities

Town	County	City Population	County Population
Center Point	Linn	1,693	168,767
DeWitt	Clinton	4,514	51,040
Dyersville	Dubuque	3,703	86,403
Elkader	Clayton	1,510	19,054
Evansdale	Black Hawk	4,638	123,798
Independence	Buchanan	5,972	20,844
Jesup	Buchanan	2,121	20,844
Manchester	Delaware	5,137	18,035
McGregor	Clayton	797	19,054
Walker	Linn	673	168,767
Webster City	Hamilton	7,894	16,071

Source: Willis Goudy and Sandra Charvat Burke, Iowa Counties: Selected Population Trends, Vital Statistics, and Socioeconomic Data. 1992 Edition, October 1992, p 6-7.

The newly relocated U.S. Highway 20 bypasses Dyersville, Evansdale, Independence, Jesup, Manchester and Webster City. This highway runs west-east across Iowa. It is a four lane highway with controlled access from Dubuque to Fort Dodge and is one of the most heavily traveled roads in Iowa.

Interstate 380 from Cedar Rapids to Waterloo is the highway that bypasses Walker and Center Point. U.S. Highway 30 and U.S. Highway 61 bypass DeWitt. This is also a four lane highway with controlled access. The Iowa Highway 13 bypass of Elkader and the U.S. Highway 18 bypass of McGregor brought relief from heavy traffic congestion in their central business districts.

Description of Business Categories

Iowa Taxable Retail Sales records divide Iowa businesses using two and three digit Standard Industrial Codes. This study uses nine two-digit codes and two three-digit codes. The service stations and motels are a subset of service, therefore, they are the three digit codes. The eleven business types are described in the following text, beginning with the general merchandise category.

General merchandise includes merchants who sell both durable and nondurable consumer goods. This category includes such things as: clothing stores, shoe stores, variety stores, department stores, drug stores, farm machinery stores, hardware stores, bookstores, sporting good

stores and household appliance stores. This category covers a very wide range of goods. The largest number of surveys were from the general merchandisers.

The **service category** includes anyone who offers a service. These merchants might provide automobile service, refrigerator service, air conditioner service, painting, wallpaper hanging, car washes, lawn care, flowers, movie theaters, photography and undertaking. This group also consists of many retail merchants; therefore, the response in this category was also large.

The **building materials** group includes any merchant who sells goods used to build a house, barn, pole building, or metal bin. Persons in the construction business are included in the building materials category because they provide a building service to their customers. These merchants might be electrical contractors, plumbing contractors, home builders or cabinet makers.

Owners or managers in the **food** group sell food products. This category consists of grocery stores, meat lockers, bakeries, dairies, candy stores and vegetable markets. The merchants at a farmer's market selling edible items are also included here.

The **apparel** group includes stores that make a profit selling only clothing for men, women or children. This does not include apparel sold at department or discount stores. It includes only individual firms selling apparel.

The **home furnishing** category includes the sale of furniture items. The group includes any merchant who sells goods and services to customers decorating the inside of a room or a whole building. Furniture stores and carpet and drapery shops also belong in the home furnishings group.

Anyone who sells automobiles or automobile parts is a part of the **motor vehicle** category. This can include an automobile dealer, tire store, auto parts store or muffler shop. These merchants make their profits primarily on automobile sales or parts.

The **eat and drink** group is a combination of two retail sales categories. The eat group includes cafes, restaurants, lunch rooms and snack bars. The drink group consists of taverns, over-the-counter liquor stores, beverage stores and tobacco stores.

Service stations and **motels** are a subset of the service category. Restaurants, taverns, service stations, motels and hotels are service groups but they are also considered highway oriented businesses. They are examined as subcategories because this study is interested in how these particular merchants feel about the impact of the bypass since it affects them more directly.

Miscellaneous includes almost anything that does not fit in another category. For example, this group has utility companies, auction barns, hatcheries and grain elevators.

The eleven categories previously described were collapsed to form three groups. These three groups are treated as dummy variables in a Probit regression to determine their impact on the dependent variable. The model will be explained more fully in another section of this methodology. The next section describes the questionnaire and explains the type of business question as it relates to the whole survey.

Questionnaire

This thesis used the survey to examine the merchants' perceptions of the impact of the bypass on their businesses (see Appendix Two for a copy of the Human Subjects Review). In January of 1992, the Iowa State University Human Subjects Committee approved the survey instrument that was mailed to the retail merchants.

The questionnaires were mailed to 1,438 merchants in the eleven bypassed communities. There was a 29 percent return rate after the first mailing; the post card reminder brought another 7 percent response. Approximately 1 percent of the surveys were discarded because they were incomplete. Table 2 describes the survey response distribution by community.

The survey, which can be found in Appendix Three, was designed to measure the attitudes of the retail merchants on bypass related issues. Part I begins with thirteen fixed

Table 2. Survey Distribution by City

City	Response to Survey			
	Number Sent	Number Returned	Percent Returned	Percent of Sample
Center Point	150	17	11	3.4
DeWitt	166	61	37	12.2
Dyersville	153	55	36	11.0
Elkader	100	47	47	9.4
Evansdale	102	31	30	6.2
Independence	176	78	44	15.6
Jesup	70	21	30	4.2
Manchester	177	57	32	11.4
McGregor	59	29	49	5.8
Walker	29	14	48	2.8
Webster City	256	90	35	18.0
Total	1,438	500		100.0

alternatives that address the impact of the highway bypass on the quality of life in their community. The "fixed alternatives question limits the respondent to a choice among specific alternatives" (Phillips 1971, 138). The alternative responses in these 13 questions included "better", "no change," or "worse".

Four of the questions in section one of the survey were not used in this analysis. Question B is an open-ended question and proved to be too difficult to code on the computer. Questions C and D were often unanswered. Judging from the responses, people did not know the answers to these two questions.

Question E concerned informational signs along the highway bypass. Informational signs tell motorists how to

reach towns, important places such as airports and hospitals, and historic places. Some of these signs are for advertising. It was an important issue to the merchants, judged by their responses to this question and the open-ended question, F, in this section.

The smaller the town, the more concerned the merchants were about the lack of signs. The further the town from the highway bypass, the more concerned they were also. They would like to see more signs directing travelers to their town and their businesses. However, change may be difficult because the State of Iowa has very strict policies covering this issue for aesthetical reasons.

Part two of the questionnaire asked merchants to describe their businesses. Question A divided the primary types of business into eleven categories. Almost all responses were in retail trade, number nine, and services, number eleven. When compared with other variables in crosstabulations, the other nine categories had more than 20 percent of the cell frequencies with values less than five. The Chi-square tests in these cases were over-valued and, consequently, were not accurate.

The data for the Chi-square test were set into a contingency table with two categories, for example, highway noise(i) by type of business(j). This table was used "to obtain the expected frequency for the cell i. To find the frequency, simply multiply the cell probability of occurrence

by the total sample size" (Daniel 1990, 182). If more than 20 percent of the expected cell frequencies were five or less, the Chi-square results are overestimated and thus appear significant when in fact they may not be (Cochran 1954).

When type of business was used as a category in a crosstabulation, there were many empty cells of the sort described above. The Chi-square results were often too large. The decision was made to recode this question. The completed surveys aided in the sort of the original eleven groups into eleven new groups. The goal was to equalize the responses as much as possible and to make the response understandable.

Of the eleven choices offered on the survey, most merchants marked only retail sales and services. These two categories were broken down into more specific groups. The specific groups became the eleven categories noted above. These are groups designated by the Iowa Retail Sales Codes. Since this thesis is part of a larger study, continuity was essential. Table 3 shows both the original and the final list of business categories.

Question B of part two asked owners or managers when present management assumed control of the businesses. Question D of the same section asked when the business was established at its present location. The inclusion of these two questions might tell us if the merchants' thoughts about

Table 3. Categories used in Type of Business

Original List	Final List
1. Cafe/Restaurant	General Merchandise
2. Tavern/Beverage/Tobacco	Construction/Materials
3. Truck Stop	Food
4. Service Station	Apparel
5. Construction/Materials	Home Furnishings
6. Manufacturing	Eat and Drink
7. Transportation	Services
8. Wholesale Trade	Motor Vehicles
9. Retail Trade	Service Stations
10. Finance/Insurance	Motel/Hotel
11. Services	Miscellaneous

the bypass have changed over time.

Question C asked for the location of each business. The location of the business was an important aspect of this paper. One objective concerns the location of the business relative to the owner's or manager's perceptions of the bypass impact. This question gave the responder four choices of location:

(1) In the central business district;

(2) On the old highway but not in the central business district;

(3) Near the bypass;

(4) At another location.

Question E had three parts. One asked the respondents to describe the effect of the bypass on their businesses. Another asked the merchants if they would favor the bypass project given the same scenario. The third part of question

E asked owners or managers if the highway bypass caused an increase or decrease in their business.

Part three of the survey was an opened-ended question. Merchants were asked to make any comments that would be helpful to the study. The comments written in this section will be discussed in the analysis.

Statistical Methods

A Probit model evaluated the relationship between the independent variables and the dependent variable using maximum-likelihood to estimate the model parameters. Maximum likelihood estimators have the properties of consistency, efficiency and asymptotic normality, and these assumptions carry over to the Probit estimates.

The Probit results were compared to ordinary least squares (OLS), but OLS was not a desirable estimate because it was inefficient when a binary dependent variable was used. For example, the standard errors of the OLS parameter estimates were large when compared to the Probit estimates. The assumption of normality, without the requirement of a large sample size, can not be made with categorical data, as was used in this thesis. In fact,

> the expected value of the dependent variable is interpreted as a conditional probability. The predicted values based on the estimated model may not fall in the unit interval, making interpretation difficult (Judge et al. 1982, 528).

When ordinary least squares is compared "on the basis of goodness of fit (R^2), Probit would clearly dominate. The R^2 statistic calculated for the probit model measures the portion of the variation in the underlying scale explained by the model and is thus roughly comparable to its linear regression counterpart" (Pindyck and Rubinfeld 1991, 275).

When a parameter estimate is asymptotically consistent, efficient or normal, it means that as the sample size approaches infinity, the parameter estimates get closer and closer to the unknown population parameter. "In addition, all parameter estimators in Probit are known to be (asymptotically) normal, so that the analog of the regression t-test can be applied" (Pindyck and Rubinfeld 1991, 281). The asymptotically normal assumption allows the researcher to use the Student t-test on parameter estimates.

When a model is efficient, there is not another parameter estimate that is closer to the parameter value. Let the value of the population parameter, Beta (if it is known) be equal to .5. Let the parameter estimate, Beta Hat, be equal to .4999. If there is not a model with a Beta Hat closer to Beta, the Beta Hat is asymptotically efficient.

A model is consistent when, as the sample number approaches infinity, Beta Hat approaches the population parameter, Beta. In other words, the larger the sample size, the more consistent the estimate of Beta. The Probit model is both consistent and efficient.

One dependent variable was the for/against variable and was described by merchants as being either for or against the highway bypass.

The second dependent variable was the merchants' perceptions on business activity. The third dependent variable was the overall impact of the bypass on the community. These are binary choice variables and the empirical approximation can be written as:

FRi = 0 if the merchant is against the highway bypass,

FRi = 1 if the merchant is in favor of the bypass

where FRi is the i'th merchant's decision to favor the bypass or oppose it. They might also perceive that business activity increased or stayed the same or that it had decreased. Another perception, as in model three, says the bypass impact has an effect on the community or it does not.

The dependent variables are probabilities which can range in value from zero to one as described above. This calls for the use of a cumulative probability function represented as follows:

$$Pi = F[A + B(Xi)] = F(Zi)$$

> The probit probability model is associated with the cumulative normal probability function. Observations on Zi are not available. Instead we have data that distinguish only whether individual observations are in one category (high values of Zi) or a second category (low values of Zi). Probit analysis solves the problem of how to obtain estimates for the parameters A and B while at the same time obtaining information about the underlying index Z (Pindyck and Rubinfeld 1991, 254).

The Xi in the model represents the characteristics used by the merchants to describe their beliefs about the affects of the highway bypass on their town or business. Some of these Xis are qualitative variables related to perceptions that merchants have concerning the quality of life in their communities and others involve beliefs concerning the bypass.

There are three basic models to be analyzed for each of three dependent variables. Model one is considered the full model. This model was reduced from an experimental one that included all variables possible for development from the survey instrument. Model two is the reduced model with variables having very low Student t-test scores removed. The variables removed include: noise, freight delivery, official accident rate and began management.

Model three is a regression that includes only variables that are not qualitative in nature. It was developed to test the results of the quantitative variables separate from the qualitative ones. The model was built to test the use of data measured on an interval scale, rather than a nominal scale, to find meaningful results that were different from the other two models. In general, the results were often similar in all three models.

The estimate of the coefficient, B, yields information about the qualitative variables only.

> Estimated coefficients do not indicate the increase in the probability of the event occurring, given a one unit increase in the corresponding independent variable.

> Rather, the coefficients reflect the effect of a change in an independent variable on F-1(Pi). The amount of the increase in probability depends on the original probability and thus on the initial values of all the independent variables and their coefficients (Judge et al. 1982, 522).

The quantitative variables gave more usable information in the form of elasticities of the means. The categorical data are based on a nominal scale, therefore, the statements to be made about the variables are limited. The nominal scale is the weakest of the measurement scales. See Table 4 for descriptions of the dependent and independent variables used in the above model. Table 5 on page thirty-four lists the means and standard deviations of independent variables.

The explanatory variables are included in the list of variables and explain quality of life issues, bypass impact issues, demographic information, and break downs of type of business and location. The quality of life responses are items that describe a community as a more pleasant place to live and work. They include such things as traffic noise and volume, shopping environment, number of customers and the ease of freight delivery.

The bypass impact variable relates how the merchant thought about the bypass and whether or not it has had an affect on the success or failure of his business. The defining information included distances from the bypass and from urban centers, opening year of the bypass and county per capita income. The concern over the signs is a policy issue

Table 4. Definition of Variables

Independent Variables	Definition
Noise	Categorical data for traffic noise where -1 = Worse, 0 = No Change, 1 = Better
Traffic Volume	Categorical data for traffic volume, description same as noise
Accident Rate	Categorical data for accident rate, description same as noise
Shopping Environment	Categorical data for shopping environment, description same as noise
Customers	Categorical data for number of customers, description same as noise
Freight Delivery	Categorical data for ease of delivery of freight, description same as noise
Quality of Life	Categorical data to measure quality of life, description same as noise
Merchant's Perception	Categorical data to measure perception were -1 = Significant Decrease, 0 = No Change, 1 = Significant Increase in Business
County Seat	0 = No, not county seat, 1 = Yes, county seat
Income	County income figures from 1990 Census
Bypass Year	Year city was bypassed by highway
Accident Rate	Official state accident rates in % change
Distance	Distance from center of town to bypass highway
Urban Distance	Distance from bypass town to nearest town of over 40,000 population

Table 4. (continued)

Sign Issue	Adequacy of signs on bypass
Bypass Impact	Categorical data with 0 = Bypass caused increase or decrease in business, 1 = Bypass did not cause this
Began Management	Year present management took control of the business
Began Business	Year business began
Highway Businesses	Dummy variable equal to 1 if business is highway oriented
Services	Dummy variable equal to 1 if business is service oriented
Old Highway, Not CBD	Dummy variable equal to 1 if business is located on the Old highway but not in the CBD
Near Bypass	Dummy variable equal to 1 if business is located near the Bypass
Other Location	Dummy variable equal to 1 if business is located at another place in town

that groups can use to improve advertising services available to them. Access signs were also important to merchants in a community.

The types of business categories were broken down from eleven groups to three: general merchandise, services, and highway oriented businesses. The highway businesses included service stations, restaurants, taverns, motels and hotels. These categories were condensed to provide manageable

Table 5. Means and Standard Deviations of Independent Variables

Variable	Mean	Standard Deviation
Noise	.602	.538
Traffic Volume	.452	.759
Perceived Accident Rate	.398	.549
Shopping Environment	-.030	.674
Customers	-.157	.660
Freight Delivery	.259	.466
Quality of Life	.361	.634
County Seat	.536	.500
Income	16434.000	1485.700
Bypass Year	85.133	3.393
Official Accident Rate	28.178	30.558
Distance	1.307	.295
Urban Distance	30.807	13.925
Sign Issue	.596	.824
Bypass Impact	.235	.425
Began Management	77.380	11.693
Began Business	70.904	18.778
Highway Businesses	.170	.376
Service Businesses	.314	.465
Old Highway, Not CBD	.200	.400
Near Bypass	.154	.361
Other Location	.239	.427

groups with similar behaviors. The general merchandise category was the base group for this set of dummy variables.

Dummy variables were also created for the location variable. The base category was the central business district. The other dummy variables for location include: on the old highway but not in the central business district, near the bypass and other locations in town.

The methods described in this chapter were used in the analysis of the highway bypass data. Each method provided an important link in describing the overall effect of the bypass

on the merchants in the eleven Iowa communities. Their perceptions were an important part of this thesis.

ANALYSIS

The rural highway bypass will produce an impact on the community bypassed. Business owners and managers' perceptions of the impact will vary. The merchants' views are influenced by many factors but this thesis will concentrate analysis on two areas: (1) the type of business they operate and (2) its location. These areas will be examined using the data gathered from the survey sent to merchants in each bypassed community.

Frequency and Crosstabulation Results

The merchants were asked to respond to thirteen questions concerning the overall quality of life in their community since the opening of the bypass. They overwhelmingly believed that quality of life is better or had not changed since construction of the bypass (see Appendix Four for frequency charts and Appendix Five for crosstabulations).

The highway bypass removed through traffic from many downtown areas to the newer highway. For this reason, the shopping environment in these communities is safer, quieter, and more peaceful with less traffic on the city streets. The surroundings are more pleasant for merchants and especially for customers.

The business people agree, by a two to one margin, that there has been a reduction in highway noise on city streets since the bypass opened. They also believed, by a ratio of five to one, that there had been a significant reduction in truck traffic along the old highway. The reduction in car and truck traffic can account for most of the reduction in highway noise.

Traffic Reduction

The town of McGregor had many traffic problems, including noise and heavy truck traffic, until the community was bypassed by U.S. Highway 18. The old highway ran down the main street of McGregor. It was the major thoroughfare to the bridge over the Mississippi River at Marquette. McGregor has a large grain operation that loads corn and soybeans on barges and rail cars for movement south.

Travelers attracted by the beautiful fall leaves and harvest time bring so many extra cars and trucks to town that traffic is often slowed to a crawl. In summer, McGregor is busy with tourists. Although the town is generally opposed to the bypass, it seems the removal of the excess traffic has reduced traffic noise and congestion. It has become a quiet community, a perfect place for the tourist, all year long. The grain trucks are still there in the fall but there is little traffic congestion now.

Shopping Environment

Reduced traffic led most business people to believe there is a general improvement in the shopping environment in their communities. This pleasant environment invites customers to visit their retail merchants. It is easier and safer for customers to drive into the town, park a car and cross the streets.

DeWitt has a shopping environment that invites customers to its downtown. It is a good example of the positive effects that can occur when heavy traffic is moved to a highway bypass. In this case, the town has been bypassed by two highways, U.S. 61 and 30. The central business district is a clean and quiet place to shop.

Traffic Volume

A reduction in traffic volume reduces noise levels. According to the survey responses of the eleven communities, 60 percent of the merchants saw a decrease in traffic volume. This improves the shopping environment because it is easier for shoppers to drive around town.

Independence had problems with the quantities of cars and trucks on U.S. Highway 20 and Iowa Highway 150 running through its central business district. The Highway 20 bypass has reduced some of the traffic volume but Highway 150 presents the community with problems of its own. This is a busy north-south highway and makes a very tight 90 degree

turn in the middle of the central business district. It is a difficult turn for large trucks. A number of survey respondents suggested a bypass for Highway 150 as well as Highway 20.

Merchants in bypassed communities thought the dirt and dust problem had been reduced with the decrease in traffic volume. They believed the number of customers visiting their places of business had not changed with the opening of the bypass. Most merchants (43 percent) believed it took less time for customers to get from the bypass to their business. There were also improvements in the shopping environment of the communities involved with the survey.

Favor Bypass

One of the survey questions asked retail merchants "If they knew then (when the bypass opened) what they know now, would they still favor the bypass?" The number of people who favored the bypass was three times greater than the number opposed. According to some of the written comments, a few merchants were even excited about the highway bypass.

Several merchants in Elkader, Manchester and Independence were enthusiastic about the bypass and the changes it had made to their downtown areas. In fact, they commented that they would like to see the construction of a bypass of the other major highway in their communities.

For example, a few Elkader business people wanted Iowa

Highway 56 to bypass their town. Some Manchester merchants want Iowa Highway 13 moved to the edge of town. And as mentioned previously, some Independence merchants want Iowa Highway 150 moved out of the downtown.

Impact on Business

Another question asked retail merchants to describe the impact on their businesses since the bypass opened. Most (53 percent) of the merchants responding to the question thought the bypass had no significant impact. According to the written comments, many merchants believed most of the business decrease they experienced was a result of an economic downturn. One merchant wrote that it was necessary to change the business to fit the new economic situation.

In general, the majority of merchants agreed that the quality of life in their towns had improved since the highway bypass opened. Traffic noise, traffic volume and truck traffic had decreased in the downtown areas. This led to a more pleasant shopping environment for merchants and customers.

Most believed the impact of the bypass had no effect on the success or failure of their businesses. This led the business people to conclude that quality of life had not changed or was better than before. In general, merchants thought that locating the bypass on the edges of their

communities was an improvement to the business environment in other parts of town.

Location

The majority of businesses (41 percent) were located in the central business district of the community. There were 20 percent of the businesses along the old highway but not in the central business district, 15 percent near the highway bypass and 24 percent at other locations around town. The six location crosstabulations are all statistically significant using a Chi-square test with six degrees of freedom. The crosstabulations in Table 6 compare the four locations with the three responses available to merchants in the quality of life variables of part one in the survey instrument.

Location of a business is an important aspect of its

Table 6. Chi-Square Values of Location Variables

Crosstabulation	Chi Square (Critical)[a]	Chi Square (Calculated)
Location by Noise	12.6	16.504
Location by Traffic Volume	12.6	21.103
Location by Shopping Envir.	12.6	24.432
Location by Quality of Life	12.6	15.540
Location by Customers	12.6	55.622

[a] Chi-square with 6 degrees of freedom and .05 significance level.

survival. The removal of a major highway through a town has an impact on the retail merchants, depending on where they are located. When location was compared by crosstabulation to traffic noise and volume, merchants in all four locations thought these problems were better with the opening of the bypass. Traffic volume had decreased markedly in this area and with it came a definite reduction in traffic noise.

The majority of merchants (43 percent) in all locations thought the shopping environment was better or that there had been no changes since the bypass opened. Most business people saw no change in quality of life for their community. The one exception is the businesses in other locations; these people thought the quality of life was better since the bypass.

The response, however, to numbers of customers in the four locations was mixed. Although, most merchants in the central business districts thought they had lost customers because of the bypass, nearly as many business people saw no change in the number of customers.

McGregor merchants, for example, believed they have lost customers in their central business district because of the highway bypass. This town's marketing strategy is to attract tourists and they do it very well. Now they might work to attract more tourists because traffic is less congested.

More merchants on the old highway and not in the central business district saw no change in the number of customers

they served. Those near the bypass believed there were more customers since the bypass opened, and those in other locations overwhelmingly believed the numbers of customers had not changed.

Business Categories

The results discussed previously used survey data to examine the location issue. This section compares business categories to the quality of life factors using the survey data. The larger Otto study used retail sales data to make similar comparisons.

The larger study used overall retail sales categories broken into types of business. The study was conducted using secondary data in the form of pull factors. The retail sales data of the Otto study was compared to control groups of like-size cities in Iowa as well as to paired cities that were similar in make-up to the bypassed city but are without a bypass.

The pull factors were calculated for the various types of business. The pull factor scores for the bypass cities in the auto, furniture, miscellaneous and wholesale categories show these businesses have lost customers compared to the same categories in paired cities in Iowa. The bypass communities fared will in the apparel, building supplies and general merchandise areas. When pull factors of the bypass town were compared to those of the control group; auto sales,

eating and drinking establishments, services, wholesaling and miscellaneous sales lost customers. Customers increased in the apparel and general merchandise areas.

This thesis found that most merchants believed that the number of customers shopping at their places of business had not changed since the opening of the bypass. However, merchants in the food group, eat and drink group, service stations and motels thought they had lost customers since the bypass opened. When the pull factor data is compared to the survey data concerning loss of customers, the only area of agreement is in the eat and drink business.

The business categories have also been compared to the quality of life data from the survey. As previously mentioned, noise was one of the variables examined. Merchants in all eleven types of businesses agreed that the traffic noise problem was better since the opening of the bypass. They also agreed that truck traffic had been reduced.

Most business persons thought there had been no change in the number of their customers. Merchants in four types of businesses, however, believed they had lost customers after the opening of the bypass. The businesses include: the food group, eat and drink establishments, service stations, and motels. The number of customers to these four types of business will vary depending on where their place of business is located. Merchants near the bypass will likely have more

customers, but those on the old highway may experience a reduction.

Merchants in all eleven communities agreed that the opening of the bypass had no effect on the success or failure of their businesses. They were also in favor of the highway bypass. The merchants in McGregor were the only exception. It is a small community that relies on summer and fall tourism. They thought the bypass has taken away some of this traffic.

The number of customers were also broken down by city. Merchants in McGregor, Walker and DeWitt thought they had lost customers because of the bypass. Business persons in remaining communities saw no change in the number of customers. McGregor and Walker are towns of fewer than 800 people. Both towns are also several miles from the bypass. This might account for the negative response.

When examined by type of business, most of the merchants who responded to the survey were in favor of the bypass and believed the numbers of customers had not changed. Merchants in the following types of businesses, however, thought they had experienced reduced numbers of customers: the food group, eat and drink group, motels and service stations. It appears that perceptions do vary with the type of business.

Regression Model

The maximum-likelihood Probit estimates of three different dependent variables are discussed in this analysis. The Probit results were estimated using SHAZAM (White 1990). Three variations of a basic model for each dependent variable explains attitudes toward the bypasses. These are presented in Table 7.

The parameter estimates are presented along with their standard errors and elasticities. The last column in Table 7 is the conditional probability of each independent, qualitative variable. "We can interpret the probability, Pi, resulting from the Probit model as an estimate of the conditional probability" that a merchant will favor the bypass, given the merchant's attitude about traffic volume is Xi (Pindyck and Rubinfeld 1991, 257).

The equation for the conditional probability is as follows:

$$A + B(Xi) = Zi$$

where A represents the constant term of the regression and B represents to estimate of the coefficient. The Xi represents the characteristics used by the merchants to describe the effects of the bypass impacts. The overall mean for the coefficients of the characteristics was used for Xi. When the A and B terms are standardized and Zi is determined, the conditional probability of the Zi can be obtained from the Standard Normal table.

Table 7. Coefficients, Elasticities and Conditional Probabilities for Three Dependent Variables

Dependent Variable: Part 7A For/Against Bypass

Variable	Model 1	Model 2	Model 3	Conditional Probability
Noise	.202			.567
	(.510)			
Traffic Volume	1.206***	1.103***		.958
	(.302)	(.273)		
Perceived Accident Rate	-.299	-.138		.394
	(.600)	(.515)		
Shopping Environment	.276	.180		.480
	(.378)	(.354)		
Customers	.761*	.757		.378
	(.507)	(.405)		
Freight Delivery	.394			.536
	(.635)			
Quality of Life	-.038	.019		.484
	(.403)	(.348)		
For/Against Bypass				
Business Perception				
County Seat	1.654***	1.407***	.617**	.858
	(.775)	(.590)	(.365)	
Bypass Year	.068	.034	-.035	
	(.099)	(.072)	(.046)	
	[.276]	[.188]	[-.654]	
Official Accident Rate	.005			
	(.013)			
	[.006]			
Distance to Bypass	-.844	-.875	-.890**	
	(.981)	(.795)	(.490)	
	[-.053]	[-.747]	[-.258]	
Urban Distance	-.055***	-.049***	-.023**	
	(.205)	(.018)	(.011)	
	[-.081]	[-.985]	[-.156]	
Sign Issue	-.495***	-.416***		.063
	(.203)	(.185)		
Bypass Impact	-1.518***	-1.332***		.242
	(.572)	(.500)		
Began Management	-.039**			
	(.024)			
	[.000]			
Began Business	.032***	.020**	.012**	
	(.013)	(.010)	(.007)	
	[.000]	[.094]	[.192]	
Highway Business	.038	-.161	-.171	.476
	(.547)	(.504)	(.334)	
Service Business	-.828*	-.700	-.238	.298
	(.567)	(.509)	(.315)	
Old Highway, Not CBD	-.503	-.278	-.131	.397
	(.549)	(.500)	(.311)	
Near Bypass	.617	.766	.677**	.520
	(.748)	(.722)	(.445)	
Other Location	.056	.138	1.013**	.476
	(.716)	(.678)	(.498)	
Constant	-.801	-.104	4.603	
	(10.900)	(6.450)	(4.170)	
Loglikelihood Ratio Test	98.696	94.725	34.200	
Chi-Square	32.671 {21 df}	27.587 {17 df}	18.307 {10 df}	
Chow R^2	.659	.623	.225	

Note: Standard errors and elasticities corresponding to the estimated coefficients are reported in parenthesis and brackets, respectively. *, **, *** indicates significant at .1, .05, and .01, respectively.

Part 7B. Perception on Business Activity				Part 7C. Overall Bypass Impact on Community			
Model 1	Model 2	Model 3	Conditional Probability	Model 1	Model 2	Model 3	Conditional Probability
-.804			.005	.073			.221
(.761)				(.302)			
1.332***	1.070***		.201	.088	.081		.227
(.548)	(.401)			(.245)	(.231)		
-.949	-.564		.011	-.730***	-.451**		.035
(1.10)	(.752)			(.324)	(.282)		
.893*	.542*		.024	.206	.169		.174
(.680)	(.472)			(.264)	(.244)		
1.507**	1.458***		.012	-.407*	-.193		.242
(.754)	(.572)			(.295)	(.270)		
.571			.034	.901***			.855
(1.24)				(.376)			
.840*	.713*		.071	.243	.300*		.284
(.641)	(.462)			(.257)	(.239)		
				-1.625***	-1.423***		.000
				(.506)	(.466)		
				-.523**	-.497*		.203
				(.308)	(.305)		
2.234**	1.835***	.663**	.169	.657	.436	-.081	.390
(1.22)	(.812)	(.372)		(.557)	(.400)	(.323)	
.334**	.244***	.054		.072	.054	.039	
(.166)	(.101)	(.048)		(.074)	(.056)	(.045)	
[.024]	[.130]	[1.07]		[9.769]	[7.077]	[4.657]	
.004				.004			
(.017)				(.007)			
[.000]				[.195]			
.580	.753	-.237		1.212**	1.118**	1.066***	
(.999)	(.868)	(.441)		(.633)	(.555)	(.457)	
[.000]	[.006]	[.072]		[2.538]	[2.243]	[1.950]	
-.017	-.150	-.007		-.018*	-.016	.002	
(.031)	(.024)	(.010)		(.015)	(.014)	(.010)	
[-.001]	[-.003]	[-.049]		[-.887]	[.000]	[.089]	
.396	.223		.054	-.695*	-.607**		.054
(.713)	(.584)			(.351)	(.327)		
-2.614***	-2.214***		.003				
(.805)	(.687)						
.039				.003			
(.038)				(.016)			
[.003]				[.213]			
.021	.028**	.012**		-.004	-.005	-.013**	
(.019)	(.016)	(.006)		(.010)	(.008)	(.006)	
[.001]	[.012]	[.199]		[-.494]	[.000]	[-1.267]	
.046	.396	-.035	.027	.563*	.445*	.191	.251
(.811)	(.641)	(.321)		(.388)	(.346)	(.287)	
2.628**	1.819**	.670**	.092	-.371	-.505*	-.363*	.115
(1.34)	(.929)	(.337)		(.405)	(.375)	(.293)	
-.449	-.567	.031	.020	-.027	-.075	.113	.169
(.847)	(.709)	(.318)		(.425)	(.400)	(.304)	
3.097**	2.602**	1.100**	.047	1.182***	1.157***	.488*	.302
(1.802)	(1.438)	(.510)		(.442)	(.408)	(.323)	
-1.196*	-.834	.480*	.012	.102	.172	-.448	.203
(.924)	(.778)	(.378)		(.457)	(.440)	(.378)	
34.492	-22.094	-4.665		-5.117	-5.664	-4.612	
(17.770)	(8.980)	(4.403)		(8.420)	(5.219)	(4.110)	
114.566	111.423	25.536		14.566	111.423	25.536	
32.671	27.587	18.307		32.671	27.587	18.307	
{21 df}	{17 df}	{10 df}		21 df}	{17 df}	{10 df}	
.764	.741	.149		.764	.741	.149	

"When we look at the conditional probability of individual coefficients, what matters is their relative magnitude, not their absolute size" (Pindyck and Rubinfeld 1991, 257). The magnitude of the conditional probability indicates which variable contributes the most to the regression, which is second, third and so forth. The probabilities listed in Table 7 were calculated using model one of each dependent variable. The conditional probability for all quantitative variables used in this thesis were calculated to be zero and were not recorded in Table 7.

The elasticities are recorded for the quantitative variables only. Probit does not give the standard one unit change in a qualitative variable relative to the dependent variable that is normal for an elasticity. Therefore, the elasticity of qualitative variables under Probit can not be interpreted with accuracy.

Chow R^2 measures the variation in the dependent variable which is explained by the regression equation (Pindyck and Rubinfeld 1991, 77).

$$\text{Chow } R^2 = 1 - \frac{s^2\ (B\hat{})}{s^2\ (B-)}$$

where B- is a vector of zeros except for the coefficients of the dummy variables. $B\hat{}$ is the estimated parameter for B. The s^2 is an estimate of the variance of the regression

model (Chow 1983, Chap. 8). The Chow R^2 for model one is .6593, for model two is .7637 and for model three is .4208.

The first dependent variable is for/against the bypass (see Part 7A of Table 7), the second is the perceptions of impacts on business activity (see Part 7B of Table 7) and the third is the overall bypass impact on the community (see Part 7C of Table 7). The nine models listed in Table 7 are all significant at the .05 level using Chi-square tests.

The for/against variable attempts to use the independent variables to determine if merchants are in favor of the bypass or opposed. The variable that describes perceptions of impacts on business activity uses the independent variables to show whether a merchant thought the business had increased or experienced no change, or if a business had decreased. The last dependent variable describes the merchants' beliefs about the overall impact of the bypass on the community and shows that merchants believed the bypass had an effect or that other impacts had effects on their businesses.

Location

The rural highway bypass produces impacts that affect the perceptions of business owners and managers. These perceptions will vary depending on the type of business and its location. The effects of location on the dependent variables will be examined first.

The location variable was used to create four dummy variables. As discussed earlier, business locations are classified as falling into one of four categories: the central business district, along the old highway but not in the central business district, near the bypass, and at another location. The location dummy variables are compared to the base category, central business district.

The dummy variable that represents locations near a bypass is significant at the .05 level in the three models of the perception dependent variable (Part 7B) and at the .01 level in two models of the bypass impact variable (Part 7C), relative to businesses in the central business district. With all other variables held constant, the differences of the near bypass variables in the perceived bypass impact model (Part 7C) and the perceived changes in business activity model (Part 7 B), are larger than the service variable when compared to the changes in central business district.

Merchants who were near the bypass believed the bypass had not caused a significant impact on their communities. When these same merchants were asked about their perceptions of business activity, they felt there had been an increase in business activity or that there had been no change.

Merchants on the old highway but not in the central business district tended to be against the bypass. They thought their businesses had declined since the bypass and

believed the bypass caused a downturn in their business activities. Merchants at other locations relative to the central business district, believed their business activity had declined. This variable was significant at the .10 level in Part 7B and at the .05 level in Part 7A.

The magnitude of the conditional probabilities of the location dummy variable, near the bypass, is greater in the models of all three dependent variables than the other two location variables. This variable is more important as a predictor of the dependent variables than the other two dummy variables concerned with location.

The large number of merchants nearest the bypass are likely to favor the bypass compared to those in the central business district. The results are understandable when compared to the other two locations. The businesses near the bypass are generally newer service stations, fast food restaurants and motels built since the announcement of the highway location.

Another location variable to be considered is the distance of the central business district from the bypass. In the bypass impact models (Part 7C), this variable is significant at the .05 and .01 levels. The merchants' responses reflect concern with accessibility to the bypass. The further they were from the bypass, the more likely they were to believe the bypass had a negative impact on their business activity.

The models of the perception variable (Part 7B) show that as the distance increases there is a very slight increase or no change in business activity. When the distance variable is regressed on the for/against dependent variable, the merchants are against the bypass. For example, the towns of Jesup and Walker are at least two miles from the highway bypass. Jesup merchants believed there had not been a change in the number of customers coming to shop in their community. However, Walker merchants thought the bypass had caused customers to go to urban centers to shop.

The variable, "urban center" describes a city that is closest to a bypass town and has a population greater than 45,000. The urban center has a larger population and a greater variety of stores for shopping. This represents the "pull" of an urban center and reflects the ease of using the bypass and hence, the negative attitudes. It is another important location variable and represents the distance between the urban center and the bypassed community.

Two models of the for/against variable indicate that the more distance there is between the bypass community and the urban center, the more likely it is that the merchant will oppose the bypass. This variable is significant at the .01 level. When the urban center is closer to the bypassed community, it may be that the town acquires business as a result of the larger urban center.

Several community leaders in some of the bypassed towns, however, said the bypass made it easier for people to drive to larger urban centers and spend the day shopping. The merchants might also be more apt to hear about the one day shopping trip thus causing them concern. See Table 8 for the urban centers and their distances.

According to the above results, the merchants perceptions vary with the location of their businesses. This

Table 8. Urban Centers

Bypass City	Urban Center	Distance (miles)
Center Point	Cedar Rapids	10
DeWitt	Davenport	15
Dyersville	Dubuque	25
Elkader	Dubuque	56
Evansdale	Waterloo	6
Independence	Waterloo	24
Jesup	Waterloo	15
McGregor	Dubuque	49
Manchester	Waterloo	42
Walker	Cedar Rapids	16
Webster City	Ames	43

is true for the four locations around the community as well as the merchants' distance from the bypass and from a larger urban center.

Type of Business

In addition to location, the hypothesis of this thesis concerns the perceptions of business owners and managers and

the impact of the bypass on their firms. The effect of the bypass will vary by type of business. As mentioned earlier, the frequency patterns indicated that there is an effect. The Probit regression, with other factors held constant, will test the consistency of the pattern.

Three types of businesses were described as dummy variables in the three models. They are as follows: general merchandise, highway oriented businesses, and service businesses. When compared to the general merchandise category, the service category is significant at the .05 level in the models of the perception variable (Part 7B). The comparison of these dummy variables assume all other variables in the models were held constant.

Merchants in the service businesses thought their business activities had not changed or had improved since the opening of the bypass. The merchants also believed the bypass did not have an overall impact on the community. These observations assume that the variable, general merchandise, is held constant and did not have an increase or decrease in their businesses activities relative to the service business variable.

The service merchants tend to be more oriented toward the local trade center. Their operations would be strong at the local level because of the demand for special skills. They may not think the bypass impact has the same effect on them as the merchants in the central business district.

Service businesses require good customer relations to stay in operation. In addition, it requires a very steady stream of repeat customers. Once good customer contact is established, they need not be so concerned with the impact of the bypass.

The merchants in highway businesses, in the for/against dependent variable, tended to favor the bypass in model one when compared to those in the central business district. They also believed their business activities had increased or remained unchanged. In the models of the bypass impact variable (Part 7C), these same merchants thought the bypass had had a negative impact on their community. The variable in two models was significant at the .10 level.

The highway oriented businesses along the old highways, when compared to the general merchandise businesses, believed they had experienced the negative effects from the bypass. Service stations, restaurants and motels often depend on motorists for their business. When the highway bypass is opened, new highway businesses are established along the roadway. The business persons along the old route are often forced to change their services to continue in business.

In general, the impact from the bypass has been positive. The merchants' perceptions did vary depending on the types of businesses they operated. The merchants in highway oriented businesses tended to be the most positive about the bypass and those in the central business districts tended to be more negative.

Information Signs

Even though merchants thought the current signs directing people to their community were inadequate, they favored the bypass. This variable is significant at the .01 level in two models of the for/against variable (Part 7A). Of all written comments on the survey instrument, the sign issue was the most controversial and most frequently discussed.

A few merchants were upset because there was not a sign on the bypass to even direct people to their town. Of those towns that had signs, it had taken some time to persuade the Iowa Department of Transportation to install signs along the bypass. Some wanted signs to direct people to downtown areas that were difficult to find.

Several merchants wanted signs to direct people to historic or noteworthy places. Some of these requests came from Dyersville merchants wanting to draw tourists to their "Field of Dreams" and their National Farm Toy Museum.

A merchant from Manchester suggested signs for highway oriented businesses that were "cut-off from highway traffic" when the bypass opened. Many wanted advertising signs placed along the bypass. However, the regulations for road signs along Iowa's highways are very specific.

Chapter 306C of the Code of Iowa, 1987 says,

> No advertising device shall be erected or maintained within any adjacent area as defined in section 306C.10, or on the right of way of any primary

> highway (Iowa Congress 1987, 2285). An adjacent area means an area which is contiguous to and within six hundred sixty feet of the nearest edge of the right of way of any interstate, freeway primary, or primary highway. (Iowa Congress 1987, 2284).

There are some exceptions to the above code. Three of these exceptions will be discussed using the Department of Transportation Administrative Code. Chapter 118 describes the rules and regulations for logo signing.

> This chapter pertains to official signs that are located within the right-of-way of interstate and freeway primary highways and that give specific information of interest to the traveling public. The department shall control the erection and maintenance of these signs in accord with this chapter (Iowa Department of Transportation 1987, 1).

These signs are for private company logos that advertise gas, food, lodging or camping. Merchants near the bypass would be most interested in this type of advertising. There is a charge for making the sign plus a yearly cost of maintaining it.

There is a Tourist Oriented Directional Sign. The Iowa Department of Transportation describes the sign this way:

> Tourist-oriented directional signing is official signing that is located within the right-of-way of a primary highway and that gives specific information regarding activities or sites of significant interest to the traveling public (Iowa Department of Transportation 1989, 1).

These signs direct tourists to something of significant interest. All signs in this category must be approved by the Iowa Tourism Signing Commission.

The Private Directional Signing is the last of the legal signs that will be discussed. The Iowa Department of Transportation describes Private Directional Signing as follows:

> They are signs containing directional information about public places owned or operated by federal, state or local governments or their agencies; publicly or privately owned natural phenomena or historical, cultural, scientific, educational or religious sites; or publicly or privately owned areas of natural scenic beauty or naturally suited for outdoor recreation. This definition includes sites set aside as refuges for the preservation of species on the federal or state endangered species list. Private directional signs pertain only to signs erected on private property (Iowa Department of Transportation 1987, 1).

The only road signs available to most merchants is the logo signing mentioned above. Also, a logo sign may be installed for advertising purposes along primary highways. These are often used by rural businesses and are paid for by the merchants. Communities may have their town name on a sign along a highway bypass. But Brooks Glasnapp, of the Advertising Control Section in the Iowa Department of Transportation, says it takes at least six months to put the signs in place.

Merchants were concerned that customers might not be able to locate their town or their places of business. Being able to have a properly placed sign was important to them. Some thought there no signs at all, and others believed there were not enough signs.

Quality of Life

The final variables to be discussed are the quality of life issues. A number of these variables are significant and have important ranks in conditional probabilities. Traffic volume is ranked number one in magnitude among the conditional probabilities in the regression models of the for/against and the perception variables and is significant at the .01 level in four of the nine models.

Merchants strongly believed traffic volume had decreased since the opening of the bypass. The results of the models of the for/against variable (Part 7A) and the perception variable (Part 7B) show strong support for the bypass. Merchants who thought there was a reduction in traffic also thought there was no change or that there was an increase in their businesses activity. Merchants who thought there was a reduction in traffic volume after the opening of the bypass also thought the bypass was very important to the quality of life in their communities.

Merchants tended to favor the bypass as the number of customers increased. They believed that their business activity had increased or at least did not change. In model one of the bypass impact variable (Part 7C), they thought customer numbers were not effected by the overall impact of the bypass on their community. Models in Part 7A and 7C are significant at the .10 level and models in Part 7B, at the

.05 level. Overall, merchants seemed to be pleased with the number of customers visiting their places of business.

Merchants who believed there had been an improvement in their shopping environments also favored the bypass and thought their business activity had improved or had not changed since the bypass. This variable is significant at the .10 level in models of the perception variable in Part 7B. In models of the bypass impact variable of Part 7C, however, the merchants thought the bypass had an effect on their communities. In general, merchants thought there had been an improvement in the shopping environment since the bypass opened.

The merchants thought the overall quality of life had improved as business activity grew. This variable is significant at the .10 level in models of the perception variable in Part 7B. The other two models show overall quality of life in more negative connotations.

Merchants appear to believe that the quality of life in their communities has not changed due to the impact of the bypass. They seem to think that moving the highway away from the downtown areas has made improvements for them and for their customers.

Accident Rate

The official accident rates were taken from traffic records at the Iowa Department of Transportation. The

information was collected for an eight year period. The eight years included data for four years before the bypass opened and four years after. The Iowa Department of Transportation does traffic counts and the accident rates yearly.

They count primary highways on even years, and highways and streets in communities in the odd years. However, they do not always count every highway and street in these two years. As a consequence, this variable has missing data. The findings may not be accurate.

Merchants believe the number of accidents have decreased since the opening of the bypass. The official accident rate, however, indicates a slight increase in the number of accidents over an eight year period. The difference between perceived accident rates and official rates may be due to several factors.

Merchants' perceptions of fewer accidents may stem from their strong feelings of reductions in traffic volume. There may be more accidents but fewer personal injuries and less damage so the accidents are not as noticeable. More frequent accidents may be occurring at new locations. For example, a high accident intersection may be further away from the merchant than it had been in the past. As a result, accidents are not seen as often.

Other Variables

The "began business" variable asked when the business began operation. The variable that describes the year a business began operation is significant at the .01 level in the basic model and at the .05 level in the other two models of the for/against variable (Part 7A). The longer a business has been in operation, the more likely the merchant will favor the bypass.

According to the perception models (Part 7B), the longer merchants have been in operation, the more they believe their business activity has increased or has not changed since the bypass opening. And similarly, the models of the bypass impact variable (Part 7C) show merchants do not blame the bypass for any downturn in business.

As mentioned earlier, the longer a business is in operation, the more likely it is that it will have repeat business and loyal customers. Therefore, these establishments are less concerned about losing business because of the bypass. On the other hand, newer businesses must build up repeat business and will be more concerned about possible loss of customers.

When the opening year of the bypass was considered, merchants believed that their business activity had changed little or has increased since the opening of the bypass. In addition, the models of the for/against variable (Part 7A) show that the longer the bypass highway has been open, the

more likely merchants are to favor the bypass. The bypass year is significant at the .05 level in two models of the perception variable (Part 7B). Overall, it seems that merchants learn to accept the bypass over time.

Merchants in a town that is a county seat are likely to be in favor of the bypass. They also believe business activity has not changed or has increased since the bypass opened. The county seat variable is significant at the .01 level in models of Part 7A and at the .05 level in models of Part 7B. This variable ranks second in magnitude among conditional probabilities. This variable has a significant effect on the dependent variables.

County seat towns probably draw customers from more rural areas. They serve as urban centers for these surrounding towns. Rebeckah Swanson, the executive manager of the Manchester Area Chamber of Commerce, described Manchester as this type of urban center. It is the largest community in the immediate area and it offers goods and services not available in the small rural towns. Manchester is also the county seat of Delaware County, so county residents must visit Manchester when they have business at the county courthouse.

The perceptions of the merchants vary with the length of time they have been in business. The longer they were in business, the easier it was for them to adjust to the bypass impact. Their perceptions also seem to vary by county seat

town. Merchants in towns that are county seats appear to be more optimistic about their business outlook.

According to the for/against dependent variable, merchants tend to favor the bypass if they are in a county seat town. They also favor the bypass when they believe the traffic volume and noise levels have decreased. The belief that the shopping environment has improved and that freight delivery is easier also shows merchants favoring the bypass. As the number of years in business and the years since the opening of the bypass increase, merchants tend to favor the bypass. Merchants tend to be opposed to the bypass as the urban distance grows longer.

The merchants in the service businesses, according to model one, are opposed to the bypass. The highway businesses favor the bypass with the general merchandisers falling in between. The merchants from old highway locations are the most often opposed to the bypass. Those at other locations and near the bypass are in favor of the bypass. Overall, the merchants favored the bypass.

When merchants thought there had been an improvement in traffic volume, in the shopping environment and in the quality of life, they perceived their business activity to have increased or stayed the same. They believed the number of customers had increased along with business activity, especially if they were in a county seat town. As urban distance increased, merchants believed their business

activity had decreased. They thought the impact of the bypass did not cause a decrease in business.

The service and highway merchants thought they had experienced an increase or no change in business activity since the bypass opened. Merchants near the bypass believed the bypass has increased business. Those on the old highway and at other locations thought they experienced a decrease in business. Most merchants thought the bypass impact had either increased their business activity or, at least, had not changed it.

Merchants thought the decrease in noise and traffic volume, the improvement in the shopping environment and quality of life were all due to the overall impact of the bypass on the community. They believed the decrease in the perceived accident rates, the increase in customers and the increase or decrease of their business activity were a result of factors other than the bypass impact. When merchants favored the bypass, they thought factors other than the bypass were involved. They believed the distance to the bypass was a factor in the increase or decrease of their business.

The merchants in highway businesses thought the increase or decrease in business was due to the impact of the bypass. The service merchants thought the changes were caused by other factors. General merchandisers fall between highway and service businesses. Merchants in locations near the

bypass and in other locations thought the changes were caused by the bypass impact. Those along the old highway believed other factors were involved. The increase or decrease in business activity seems to favor the bypass. Most merchants do not believe the bypass impact was a detriment to their community.

The Probit model results provide information on factors that influence a merchant's attitudes toward the bypass. These attitudes indicate a tendency to favor the bypass. The majority of these business people believe the bypass has been a positive force in the growth of their community. Both location and type of business variables present evidence favoring the bypass.

RECOMMENDATIONS AND CONCLUSION

The rural highway bypass is an important component of the transportation system for business people in Iowa. To farmers, the highway means more efficient transport of commodities to nearby markets. To retail merchants, it means timely delivery of goods. To the merchants, it also means customers. The economy of Iowa depends on safe and efficient roadways.

This thesis has attempted to determine if the rural highway bypass would produce impacts that affect perceptions of business persons that vary depending on the type of business they operate and on its location. Overall, the merchants who responded to the bypass survey were in favor of the bypass. According to the crosstabulations, merchants in all four locations thought the traffic volume and noise had decreased. They thought the shopping environment and accessibility of suppliers and delivery trucks to their places of businesses had not changed since the opening of the bypass.

Merchants at other locations thought the quality of life had improved, while those in the central business district, on the old highway and near the bypass believed it had not changed. Business persons in the central business district thought they had lost customers, those near the bypass gained

customers and those along the old highway and at other locations believed there had been no change.

When location is used as a variable in a Probit regression, controlling for other variables, the results are more varied. Merchants nearest the bypass favored the bypass, thought their business activity had increased and that the impacts from the bypass had brought about the changes. Merchants from other locations were opposed to the bypass and believed their business activity had decreased since the bypass. The merchants' perceptions of the bypass impact may be affected by the location of their businesses.

The findings also indicate that the further merchants are from the bypass, the more likely they are to be opposed to the bypass. In follow-up interviews, many merchants said they believed that urban communities near the bypassed towns drew customers away from their businesses. The community's proximity to urban centers was a concern for many merchants in the bypassed towns.

Merchants' responses also varied according to type of businesses. The crosstabulations show merchants in all types of business agreed that there were reductions in noise levels, traffic volume and truck traffic since the bypass was opened. Merchants in grocery stores, restaurants, taverns, service stations and motels, however, thought they had lost customers after the opening of the bypass. The merchants in the other seven types of business thought there had been no

change. Business persons in all eleven types of business were in favor of the bypass.

On evaluation of the Probit regression, merchants in the service businesses were opposed to the bypass and those in highway businesses favored it, when compared to the those in the general merchandise category. Compared to the general merchandisers, merchants in service and highway businesses thought activity had not changed or had improved with the opening of the bypass. Highway merchants thought the increase or decrease in business was due to the impact of the bypass. Service merchants thought the change was caused by other factors. The findings show that the perceptions that merchants have toward the bypass impact does depend on the type of business they operate.

The regressions also show that the longer merchants were in business, the more they tend to favor the bypass. With time, most business persons seem to have made the necessary adjustments to account for the bypass impact. Once again, the impact levels off and it becomes business as usual for these merchants.

Communities adjusted differently to the impact of the bypass. Kermit Doolittle, a Webster City merchant, said, "The bypass effect was not immediate." Merchants were delighted to see the excess traffic moved to the highway bypass, but opposition to the bypass developed after its opening.

Kay Hagen, the executive director for the Chamber of Commerce in Webster City, said the town has a Main Street Project that has been in effect for two years. The project has made progress in developing a unique central business district and hope to attract customers who may shop in larger urban centers.

How merchants view the impact of the bypass depends on their distance from the bypass. It has been pointed out that the distance of the community from the bypass is important, as is the community's distance from a larger urban center.

This thesis lends itself to several areas for further study. One study might compare the merchants' perceptions concerning accident rates and the official rates. Extra work would need to be done to obtain accurate official rates. It would be interesting to know why merchants believe the rates have decreased when in fact, in most cases, they have increased.

An examination of merchants' perceptions could be another area for further study. Friends, business groups, society, the economy and many other influences led merchants to answer the survey as they did. Their answers on the survey may be different at another time.

Another interesting area of study might be the examination of patterns of response by communities in relation to central place theory. A regional effect brings customers to a city based on the distance that a customer is

willing to travel. There is a point at which the customer will find it more advantageous to travel to another city.

The merchants who completed the survey instruments were participants in a large rural highway bypass study. They were often very anxious to express their views. They were very concerned about informative signs and advertising access to their community. However, they did not seem to realize that there was little they could do to erect the type of advertising signs they felt they needed.

If merchants had been involved in the bypass process earlier, they would be more likely to understand it. For example, they might have had important input on the routing and location of the interchanges leading to their communities. The information collected from these citizens could be used in the future to alleviate concerns of other merchants who face the prospect of a highway bypass.

A challenge to the merchants might encourage the necessary adjustments. They could begin to plan as a group what they might do to offset problem areas. The area near the bypass could be zoned commercial, and the town might promote the central business district. This would not only help the community remain stable but it might also bring the people together.

Rural highway bypasses are being used as a cost effective means of improving traffic flow. Also, the overall impact of the bypass on the community retail sector appears

to be minimal. A transfer among individuals appears to be occurring in these communities where certain businesses along the old highway close and others open along the new bypass. The merchants who are able to adjust to the impact, will more likely favor the bypass over time.

Other studies have indicated that merchants may have an a priori negative attitude toward bypasses that change to a more positive one with the passage of time. Merchants anticipate a proposed bypass may have a very negative impact on the business community. With time and the necessary adjustments, as this study indicates, most merchants believe the bypass is a benefit to them and to their communities. Overtime, the business community appears to be able to make adjustments so eventually support for the bypass develops.

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APPENDIX 1

MAPS OF BYPASSED COMMUNITIES

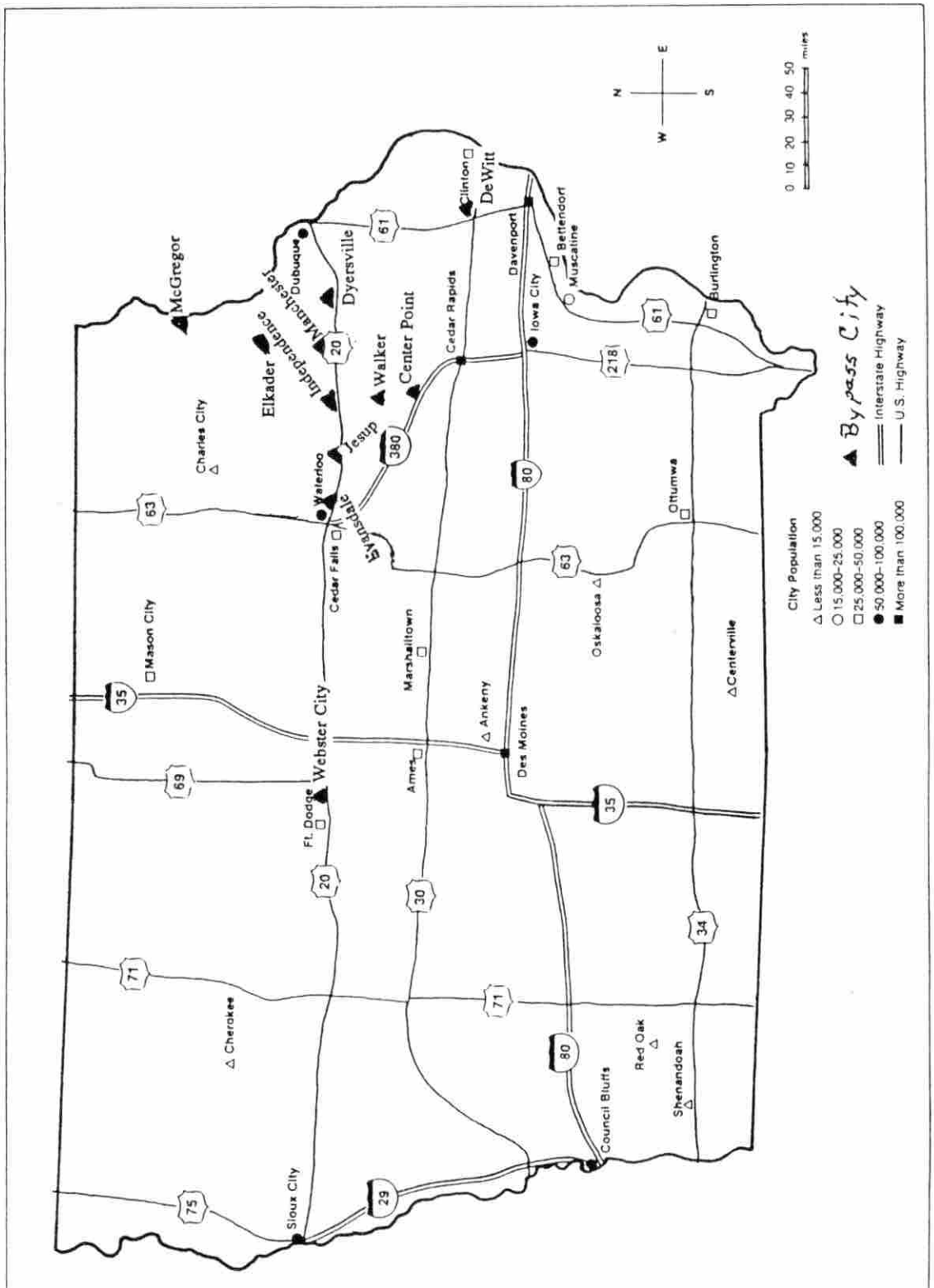


Figure 1. Eleven bypassed communities shown on a map of the State of Iowa.

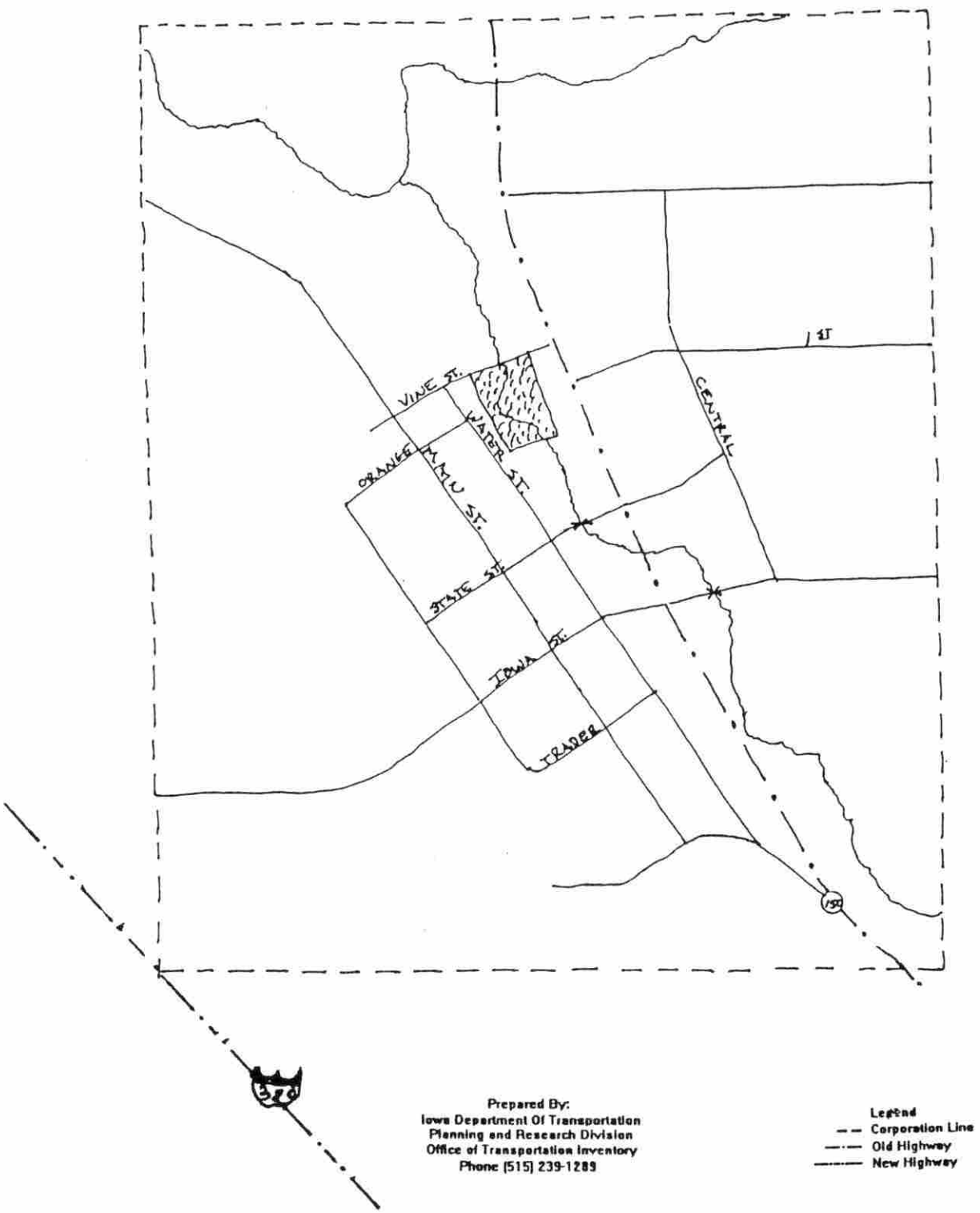


Figure 2. Center Point.

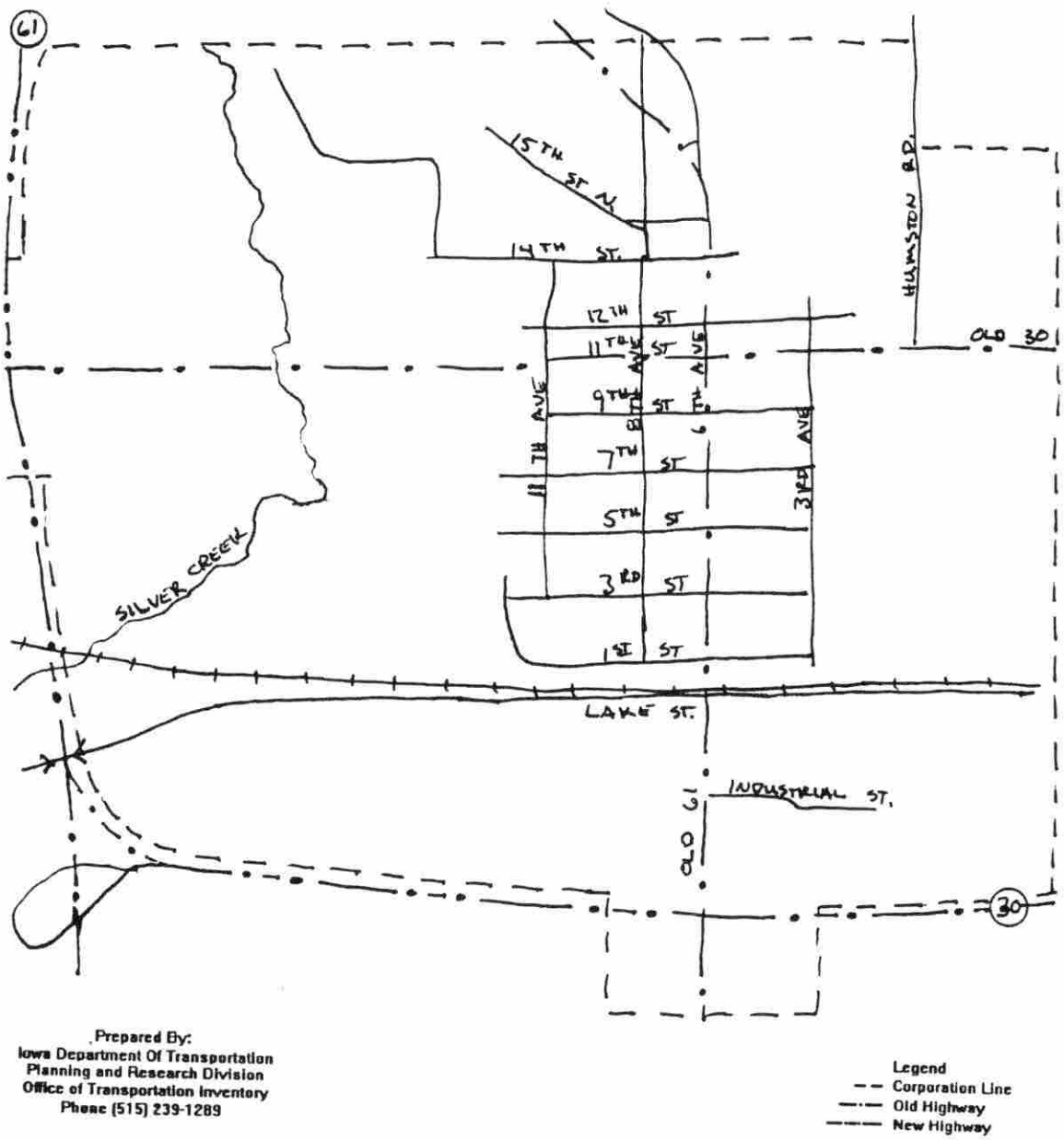


Figure 3. DeWitt.

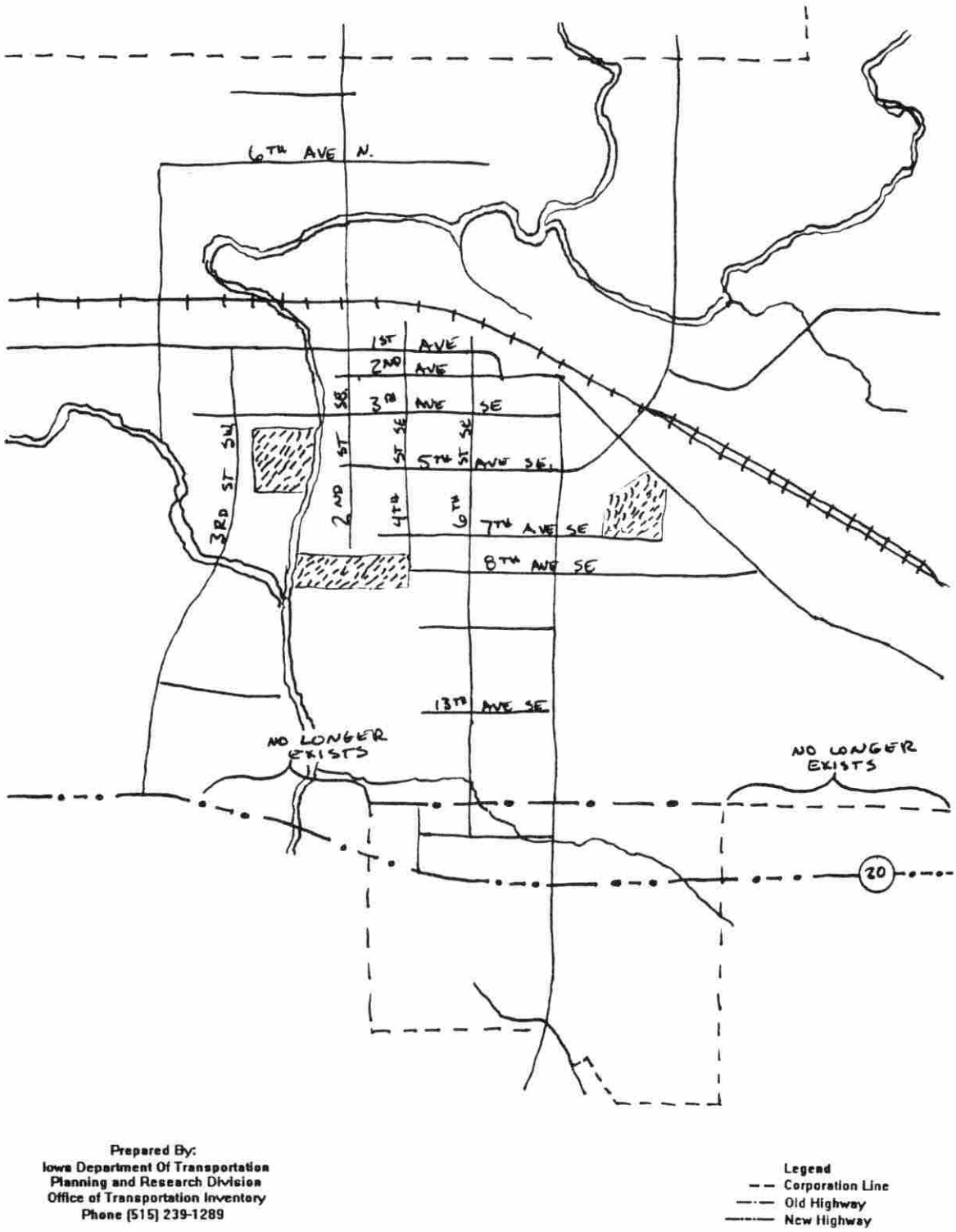


Figure 4. Dyersville.

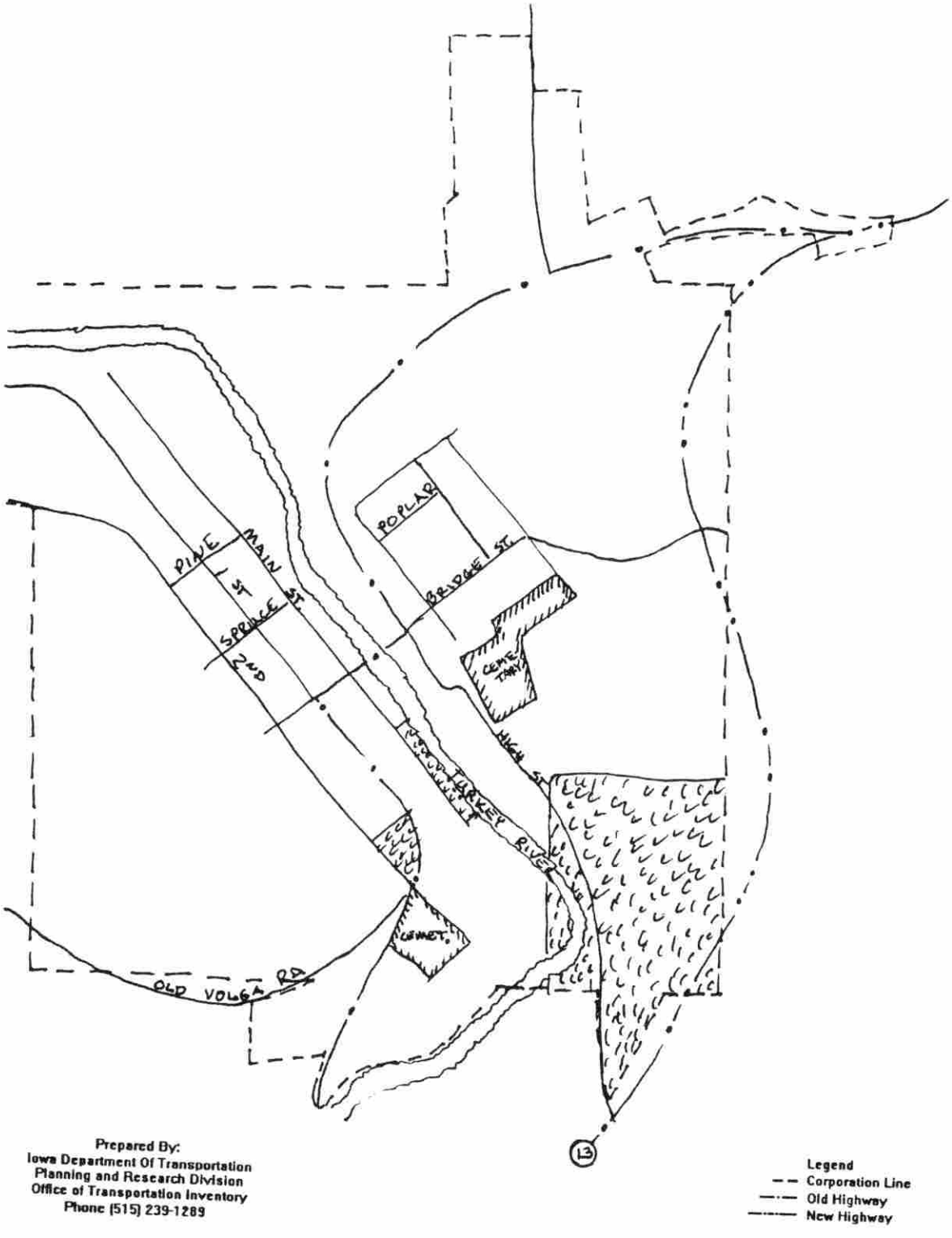


Figure 5. Elkader.

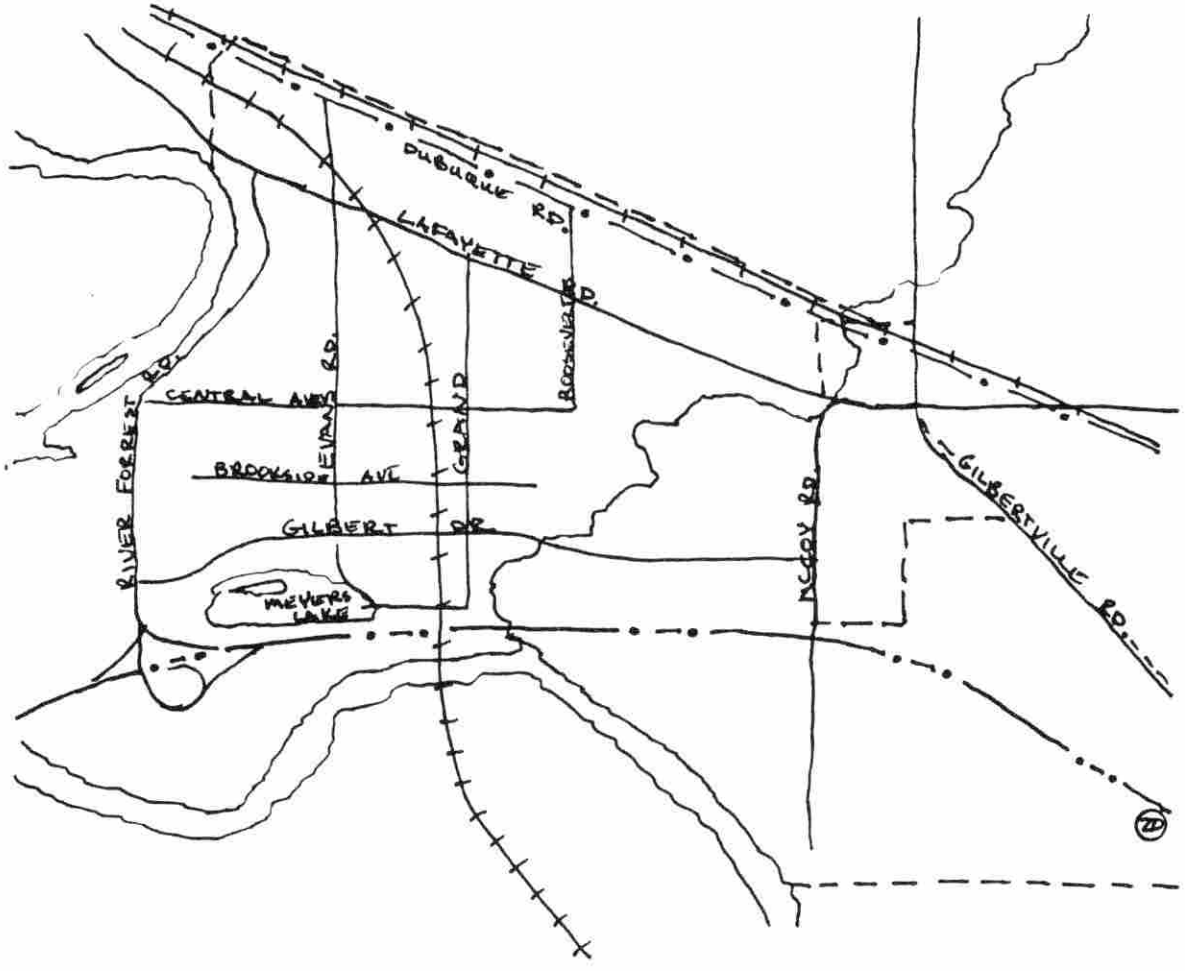


Figure 6. Evansdale.

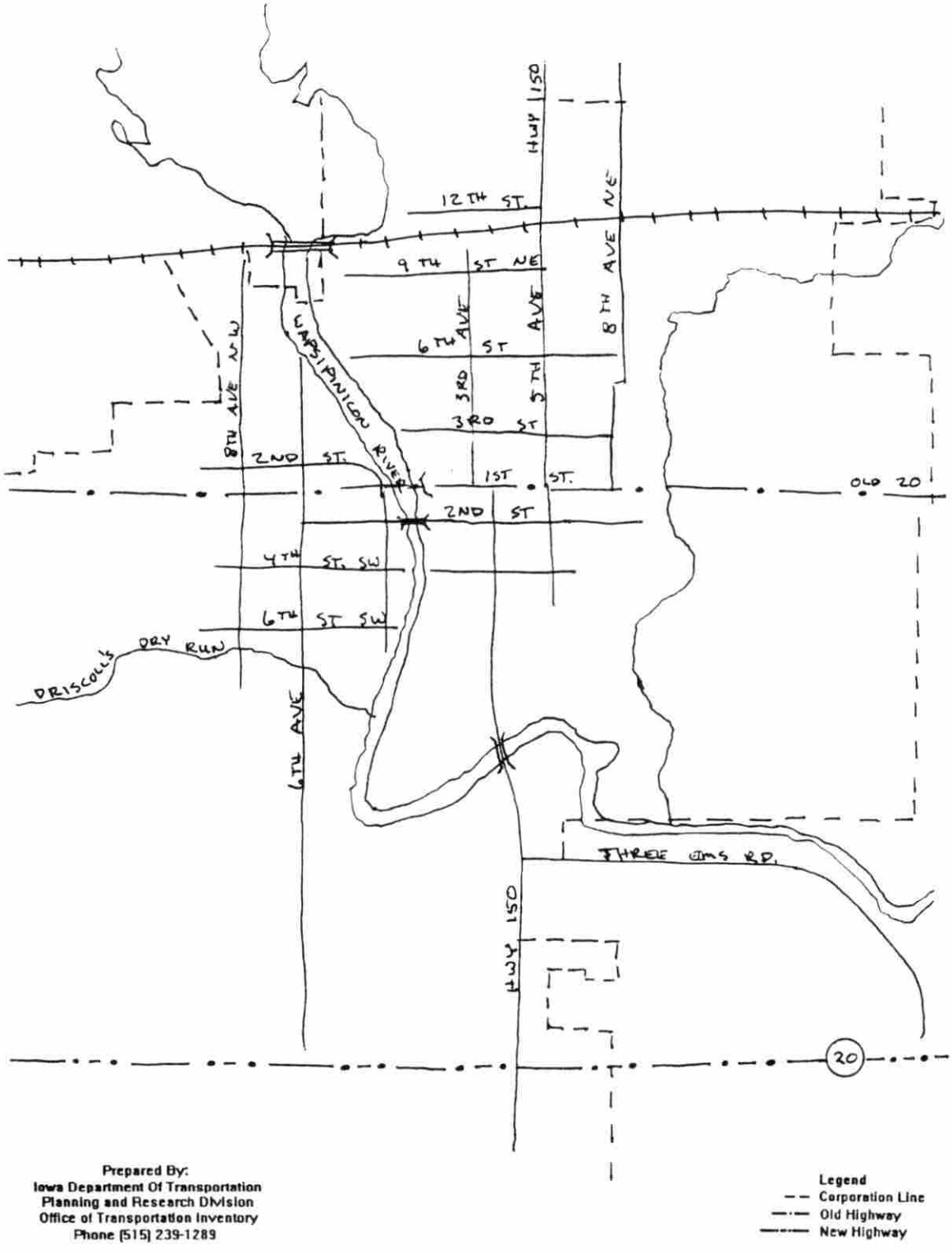
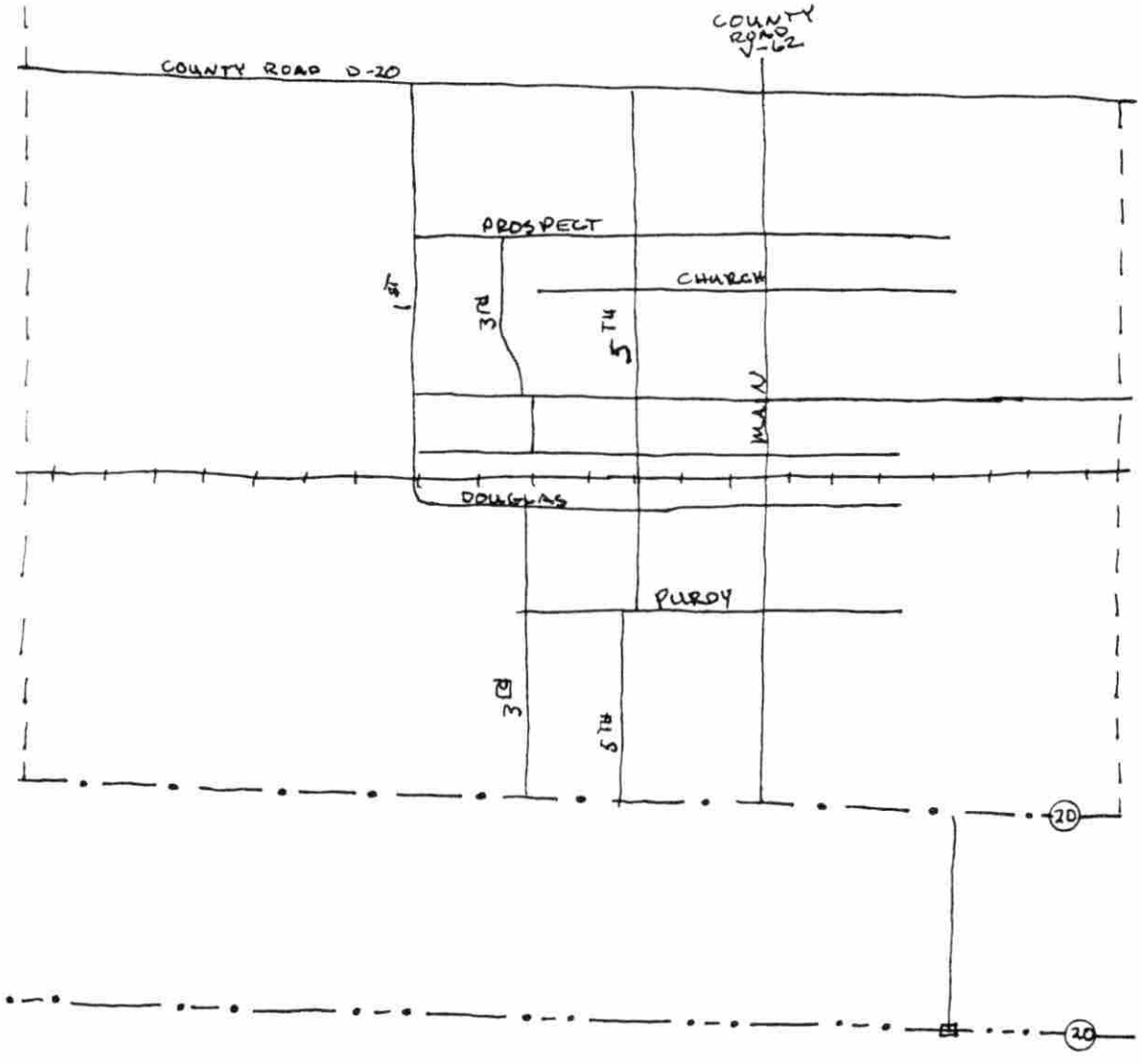


Figure 7. Independence.



Prepared By:
Iowa Department Of Transportation
Planning and Research Division
Office of Transportation Inventory
Phone (515) 239-1289

Legend
Corporation Line
Old Highway
New Highway

Figure 8. Jesup.

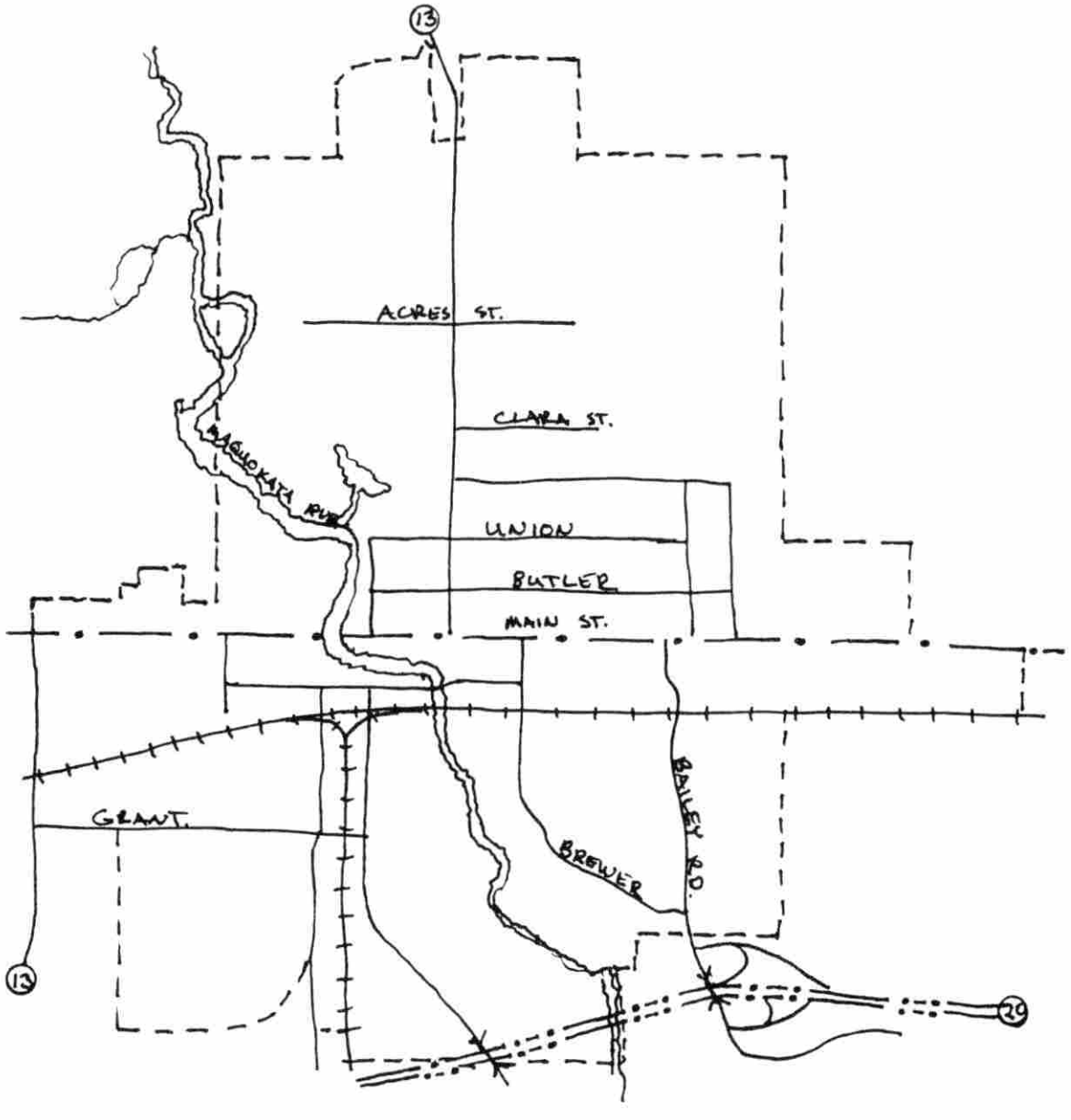


Figure 9. Manchester.

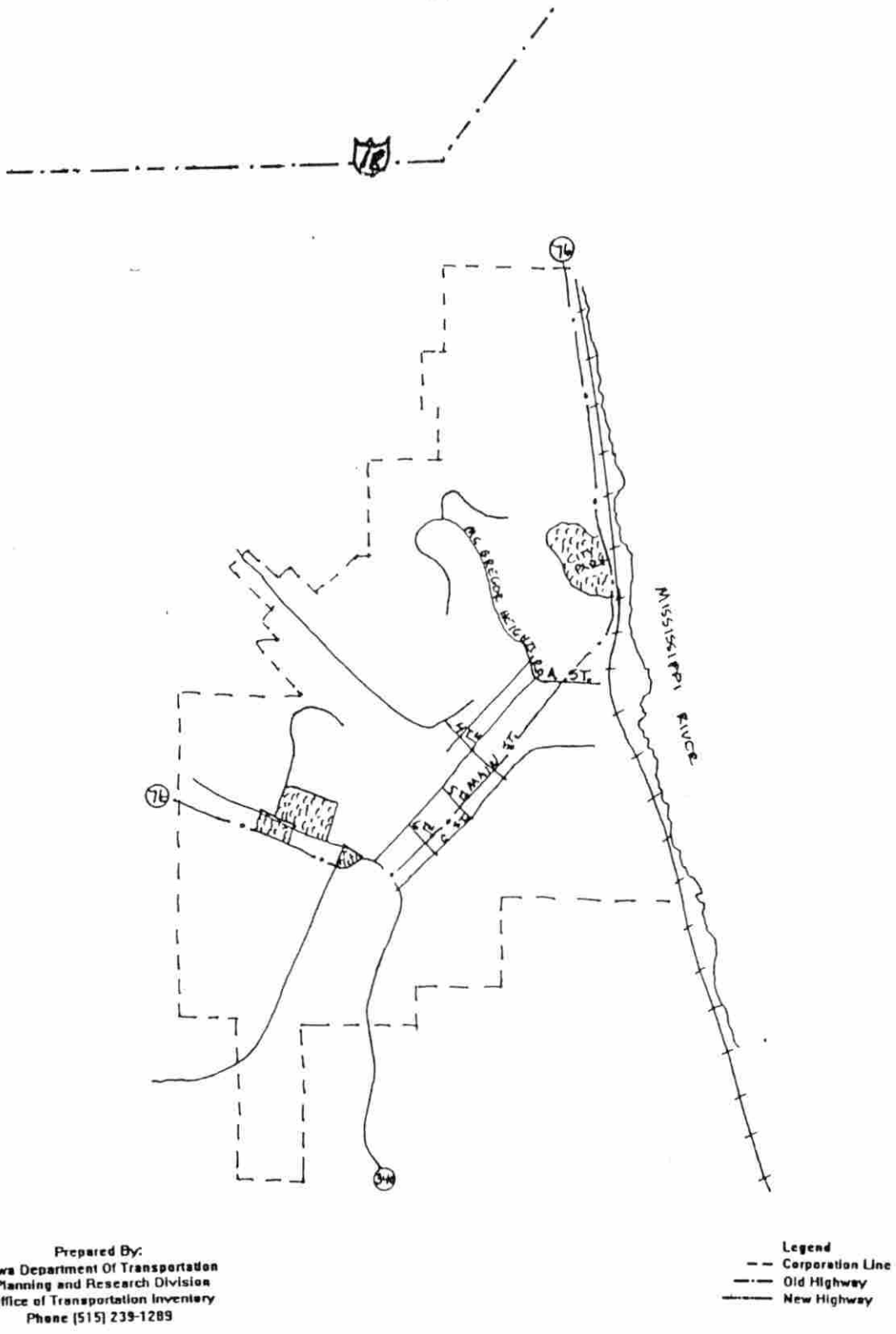


Figure 10. McGregor.

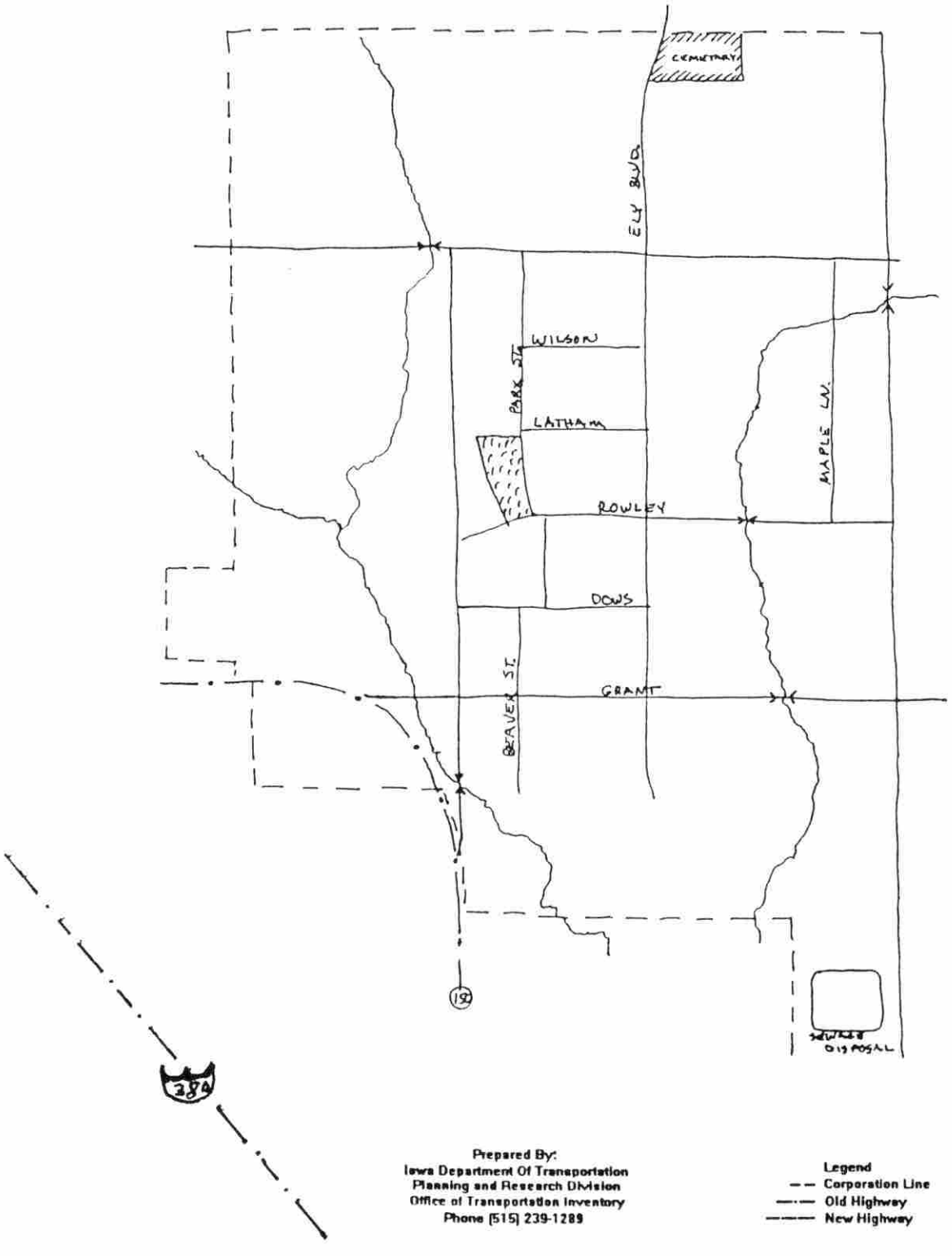


Figure 11. Walker.

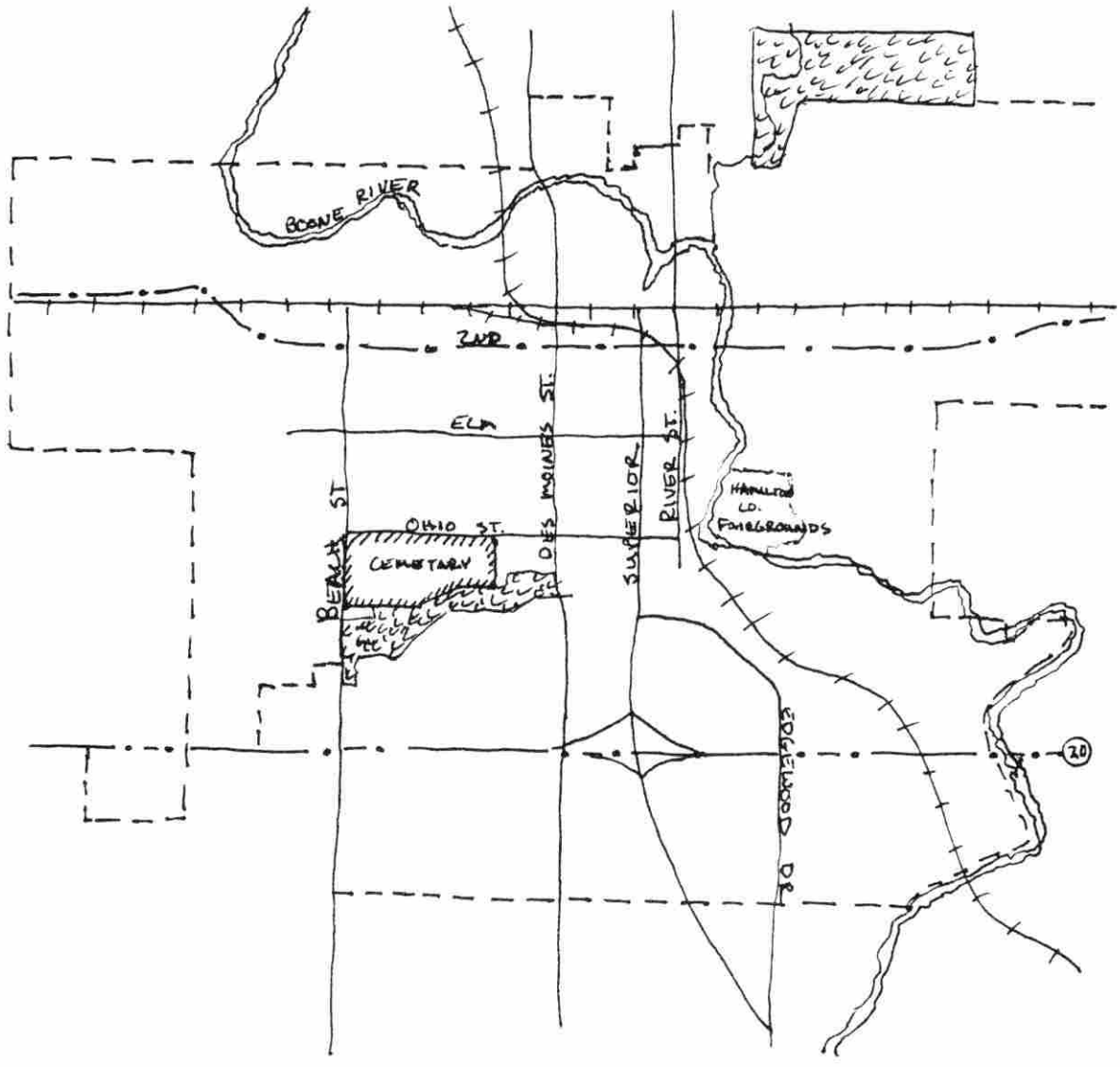


Figure 12. Webster City.

APPENDIX 2

INFORMATION FOR REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS

Information for Review of Research Involving Human Subjects
Iowa State University
(Please type and use the attached instructions for completing this form)

1. Title of Project THE ECONOMIC IMPACT OF NON-INTERSTATE BYPASSES IN RURAL AREAS

2. I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review. I agree to request renewal of approval for any project continuing more than one year.

Daniel M. Otto — 1/6/92 — Daniel Otto
Typed Name of Principal Investigator — Date — Signature of Principal Investigator

Economics — 560B Heady Hall — 294-6147
Department — Campus Address — Campus Telephone

3. Signatures of other investigators

	Date	Relationship to Principal Investigator
Connie J. Anderson	1/6/92	Research Assistant

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4. Principal Investigator(s) (check all that apply)
☒ Faculty ☐ Staff ☒ Graduate Student ☐ Undergraduate Student

5. Project (check all that apply)
☒ Research ☒ Thesis or dissertation ☐ Class project ☐ Independent Study (490, 590, Honors project)

6. Number of subjects (complete all that apply)
☒ # Adults, non-students About 600 ☐ # ISU student ☐ # minors under 14 ☐ # minors 14 - 17 ☐ other (explain)

7. Brief description of proposed research involving human subjects: (See instructions, Item 7. Use an additional page if needed.)

The Economics Department is involved with the Iowa Department of Transportation in a project to evaluate the effects of a Highway Bypass on several rural communities in Iowa. Retail sales data has been collected to determine changes in sales in the 11 communities as a result of the bypass. This survey has been developed to measure the business person's attitudes toward changes that have come about as a result of the bypass. This study will be used to help in planning improvements to the rural transportation services.

(Please do not send research, thesis, or dissertation proposals.)

8. Informed Consent:
☐ Signed informed consent will be obtained. (Attach a copy of your form.)
☐ Modified informed consent will be obtained. (See instructions, item 8.)
☒ Not applicable to this project.

Figure 13. Information for review of research involving human subjects. Page 1.

9. Confidentiality of Data: Describe below the methods to be used to ensure the confidentiality of data obtained. (See instructions, item 9.)

An identifier code will be used to identify the city from which the survey instrument is returned. It will also be used to to send follow-up letters to those business persons not responding to the questionnaire. The coding system will be destroyed when this process is complete.

10. What risks or discomfort will be part of the study? Will subjects in the research be placed at risk or incur discomfort? Describe any risks to the subjects and precautions that will be taken to minimize them. (The concept of risk goes beyond physical risk and includes risks to subjects' dignity and self-respect as well as psychological or emotional risk. See instructions, item 10.)

There is little or no risk to the subjects involved with this survey. We are not asking the businesses to reveal any information that would normally be held in strict confidence.

11. CHECK ALL of the following that apply to your research:

- ☐ A. Medical clearance necessary before subjects can participate
- ☐ B. Samples (Blood, tissue, etc.) from subjects
- ☐ C. Administration of substances (foods, drugs, etc.) to subjects
- ☐ D. Physical exercise or conditioning for subjects
- ☐ E. Deception of subjects
- ☐ F. Subjects under 14 years of age and/or ☐ Subjects 14 - 17 years of age
- ☐ G. Subjects in institutions (nursing homes, prisons, etc.)
- ☐ H. Research must be approved by another institution or agency (Attach letters of approval)

If you checked any of the items in 11, please complete the following in the space below (include any attachments):

Items A - D Describe the procedures and note the safety precautions being taken.

Item E Describe how subjects will be deceived; justify the deception; indicate the debriefing procedure, including the timing and information to be presented to subjects.

Item F For subjects under the age of 14, indicate how informed consent from parents or legally authorized representatives as well as from subjects will be obtained.

Items G & H Specify the agency or institution that must approve the project. If subjects in any outside agency or institution are involved, approval must be obtained prior to beginning the research, and the letter of approval should be filed.

Figure 14. Information for review of research involving human subjects. Page 2.

Last Name of Principal Investigator Otto

Checklist for Attachments and Time Schedule

The following are attached (please check):

12. ☒ Letter or written statement to subjects indicating clearly:
    a) purpose of the research
    b) the use of any identifier codes (names, #'s), how they will be used, and when they will be removed (see item 17)
    c) an estimate of time needed for participation in the research and the place
    d) if applicable, location of the research activity
    e) how you will ensure confidentiality
    f) in a longitudinal study, note when and how you will contact subjects later
    g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. ☐ Consent form (if applicable)

14. ☐ Letter of approval for research from cooperating organizations or institutions (if applicable)

15. ☒ Data-gathering instruments

16. Anticipated dates for contact with subjects:

First Contact	Last Contact
January 13, 1992	March 15, 1992
Month / Day / Year	Month / Day / Year

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:

February 28, 1992
Month / Day / Year

18. Signature of Departmental Executive Officer | Date | Department or Administrative Unit

James R. Stoker | 1-6-92 | Economics

19. Decision of the University Human Subjects Review Committee:

___ Project Approved ___ Project Not Approved ___ No Action Required

Patricia M. Keith
Name of Committee Chairperson | Date | Signature of Committee Chairperson

SC:1/90

Figure 15. Information for review of research involving human subjects. Page 3.

APPENDIX 3

COVER LETTER AND SURVEY INSTRUMENT

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

University Extension

Department of Economics
500 Heady Hall
Ames, Iowa 50011-1070
515 294-3000
FAX 515 294-0221

January 21, 1992

Dear Respondent:

The Economics Department at Iowa State University is involved with the Iowa Department of Transportation in a project to evaluate the effects of a Highway Bypass on several rural communities in Iowa. Your Walker Business Community has been selected to assist with this evaluation. Your completion of this questionnaire will help us assess the effects of the Highway Bypass on Walker.

We would like you to take about 10 minutes to answer the questions contained in the enclosed questionnaire. When you have completed the questionnaire, seal it in the addressed, postage paid envelope and drop it in the mail.

The information obtained through this survey will be kept confidential and will be displayed as group data only. The code number you see on this questionnaire will be used to identify each city involved with the survey and to write follow-up letters to non-responders. The coding system will be destroyed when this process is complete.

Your response to the questions is very important for the success of the survey. For the results to be truly representative of the businesses in Walker, it is necessary that all of the businesses complete the questionnaire.

If you have any questions about the survey, please call Daniel Otto at (515) 294-3000.

Thank you for taking the time to complete our survey.

Daniel M. Otto
Principal Investigator
Economics Department
Iowa State University

Connie J. Anderson
Research Assistant

Figure 16. Cover letter.

I. Records indicate that Interstate 380 from Waterloo to Cedar Rapids was opened to traffic in 1984. The construction of Interstate 380 caused Walker to be bypassed.

A. What impact, if any, has the Highway Bypass had on the following? (Circle one number for each response)

	Better	No Change	Worse
Highway noise	1	2	3
Traffic volume	1	2	3
Dirt and dust	1	2	3
Accident rates	1	2	3
Truck traffic	1	2	3
Parking problems	1	2	3
Shopping environment	1	2	3
Customers	1	2	3
Suppliers	1	2	3
Freight delivery problems	1	2	3
Travel time for persons coming to/leaving your place of business	1	2	3
Overall costs of doing business	1	2	3
Overall quality of life	1	2	3

Other_____

B. What types of businesses were most adversely affected by the Highway Bypass?

_____

C. Have new businesses developed along the Bypass that have diverted business away from you?

1. YES
2. NO

D. Were restrictions placed along the Bypass to prevent or reduce new commercial development with direct access to the Bypass route?

1. YES
2. NO →

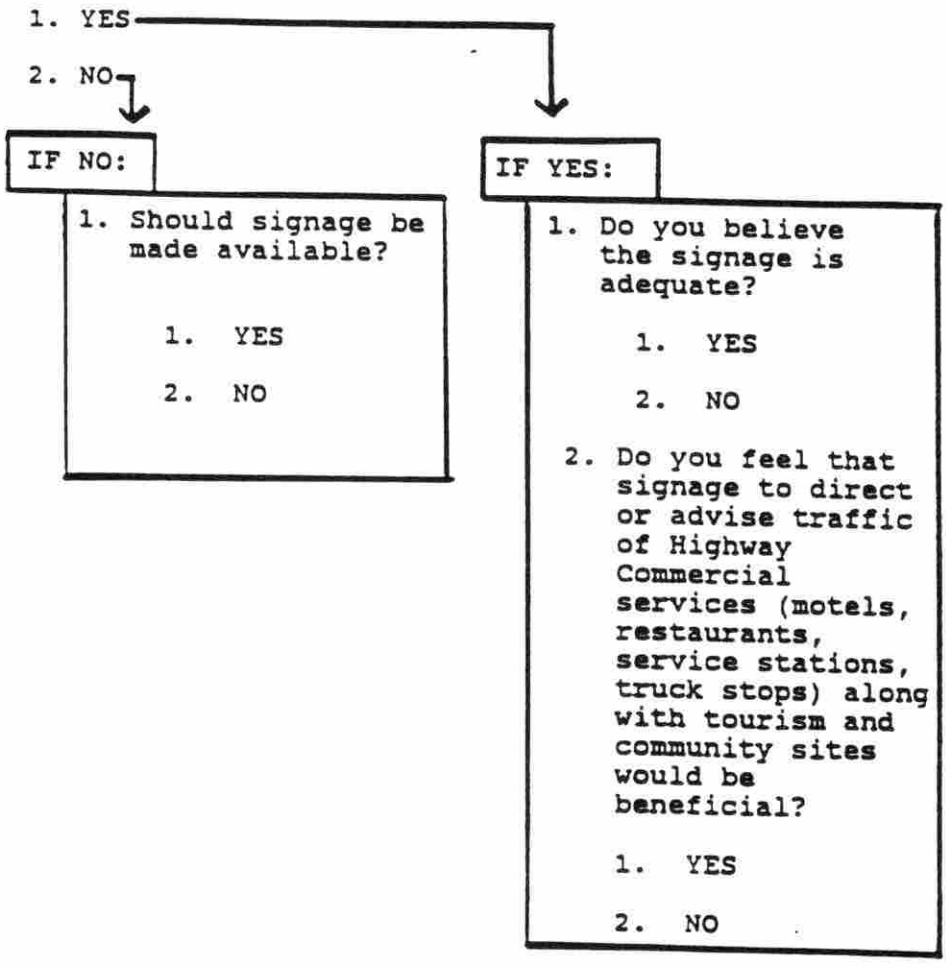
IF NO: Would you be in favor of such restrictions?

1. YES
2. NO

Figure 17. Survey. Page 1.

E. Regarding informational signs along the Bypass route:

1. Was "signage" placed along the Bypass route to advise and direct traffic to Highway Commercial type business?



F. What, if any, changes would you make concerning the current signage along the Bypass route?

_____

_____

Figure 18. Survey. Page 2.

II. Please describe your business by answering these questions.

A. Primary type of business? (Circle one number only)

1. Cafe/Restaurant
2. Tavern/Beverage/Tobacco Store
3. Truck stop
4. Service Station
5. Construction/Building Materials
6. Manufacturing
7. Transportation/Utilities
8. Wholesale Trade
9. Retail Trade (Other than those listed above)
10. Finance/Insurance/Real Estate
11. Services (Other than those listed above)

B. In what year did present management assume control of this business?

__ __ __ __ (YEAR)

C. Where is this business located in relation to the Bypass? (Circle one number only)

1. In the Central Business District
2. On the old highway but not in the Central Business District
3. Near the Bypass
4. At another location

D. In what year was this business established at its present location?

__ __ __ __ (YEAR)

E. For businesses starting operation before the bypass:

1. What has happened to this business since the opening of the Bypass? (Circle one number only)

   1. Significant increase
   2. Significant decrease
   3. No significant effect

2. If you knew then what you know now, would you be in favor of a Bypass?

   1. YES
   2. NO

Figure 19. Survey. Page 3.

3. If this business has increased or decreased since the opening of the bypass, do you feel this change is due to the Bypass?

   1. YES

   2. NO

4. Rate factors that may have had an effect on this business. (Circle one number for each response.)

	No Effect				Major Effect
Other businesses close to or along the Bypass.....	1	2	3	4	5
Shopping mall(s) in your community.....	1	2	3	4	5
Shopping mall(s) in another community.....	1	2	3	4	5
State of the economy.....	1	2	3	4	5

III. Please use this space to make any comments that you believe would be helpful to this study.

Figure 20. Survey. Page 4.

APPENDIX 4

FREQUENCY RESULTS FROM BYPASS SURVEY

Table 9. Frequencies of Merchants' Perceptions of the Bypass Impact.

Variable	Percent Responding		
	Better	No Change	Worse
Highway Noise	65	31	4
Traffic Volume	62	18	20
Number of Accidents	46	50	4
Truck Traffic	74	16	10
Shopping Environment	24	47	29
Number of Customers	17	47	35
Delivery Problems	25	73	2
Truck Traffic	74	16	10
Quality of Life	45	47	8

	Increase	No Effect	Decrease
Impact on Business	11	67	22

	Yes	No
In Favor of the Bypass	79	21

APPENDIX 5

CROSSTABULATION RESULTS FROM BYPASS SURVEY

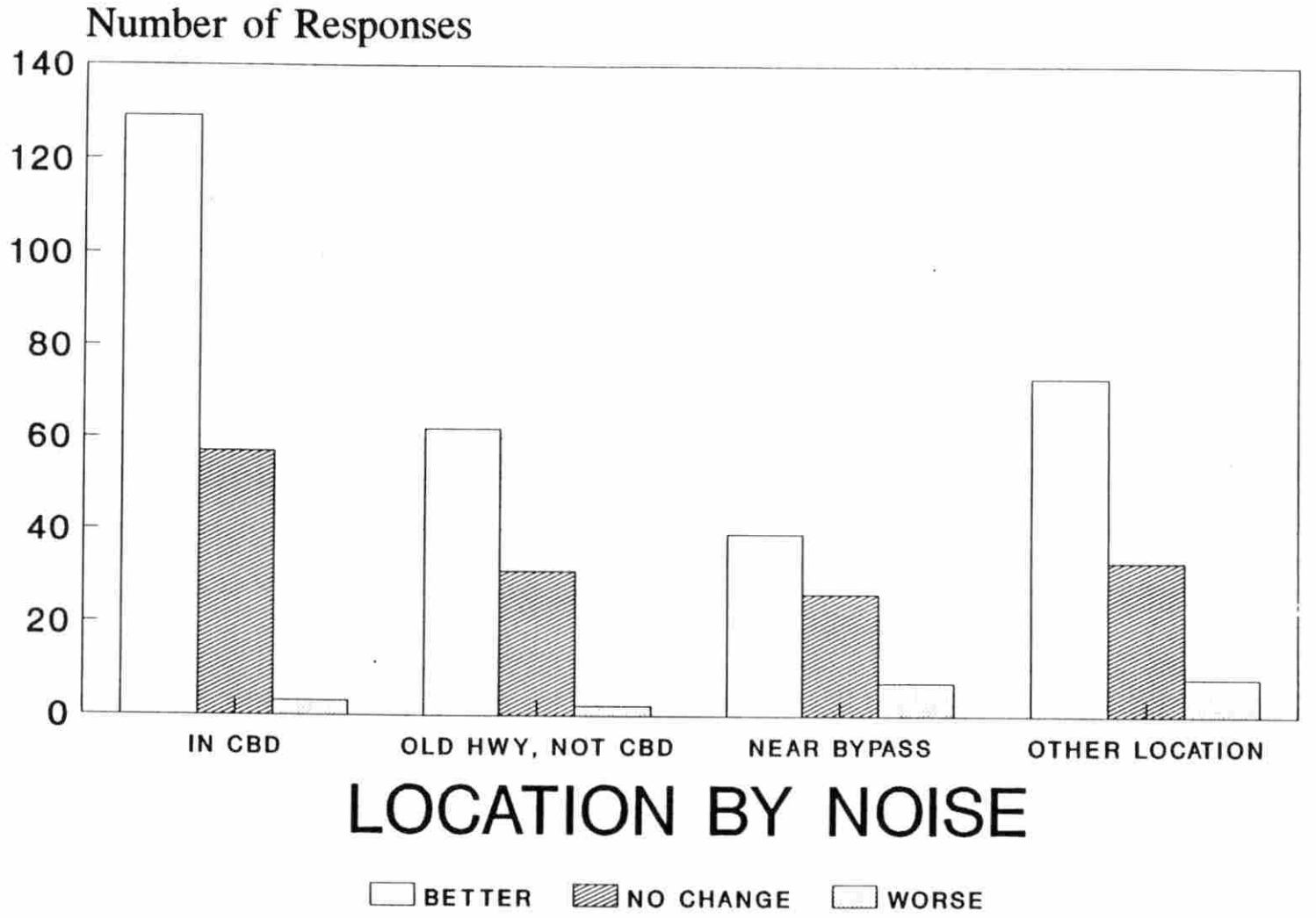


Figure 21. Merchants' perceptions of traffic noise from four locations in the community.

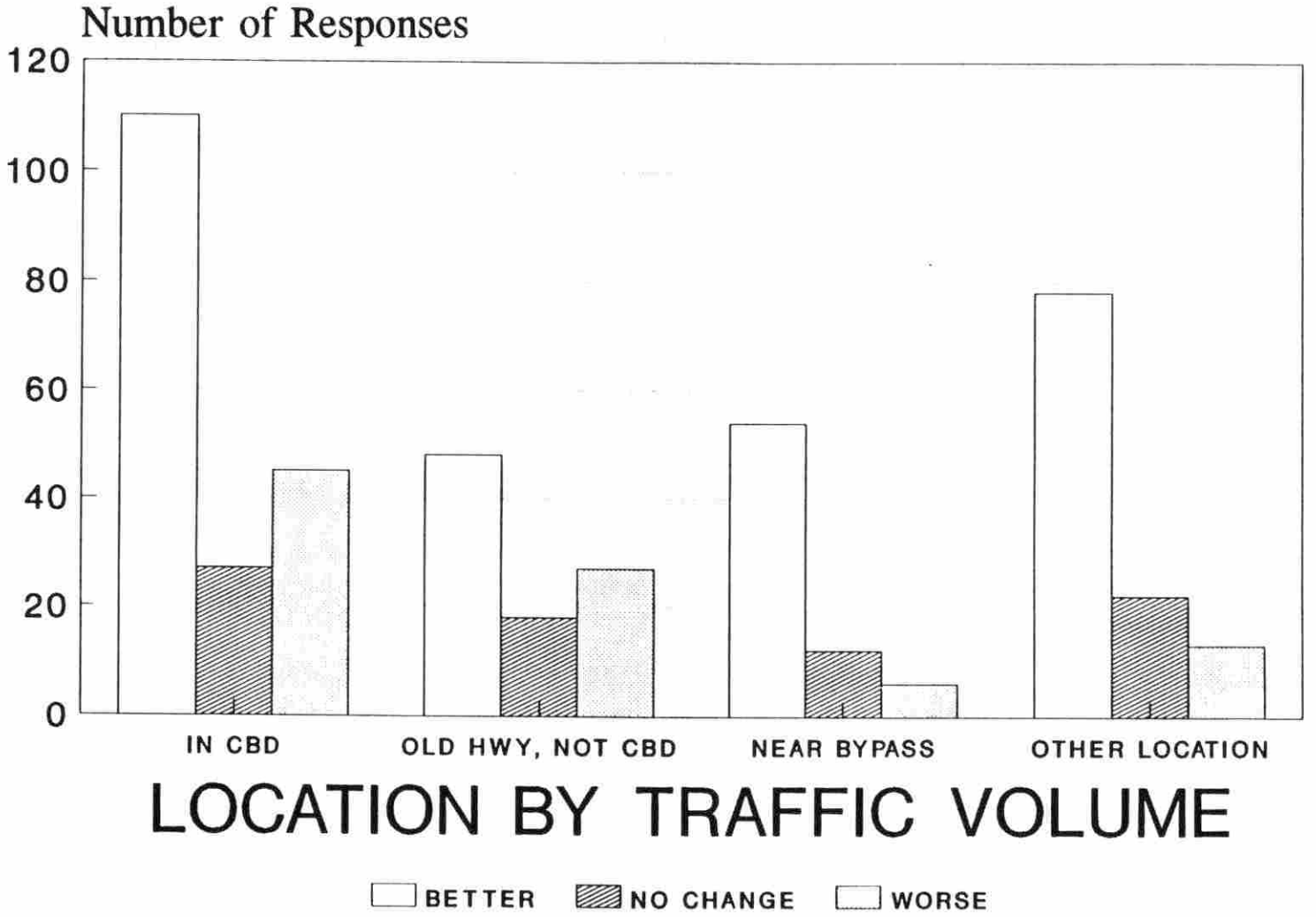


Figure 22. Merchants' perceptions of traffic volume from four locations in the community.

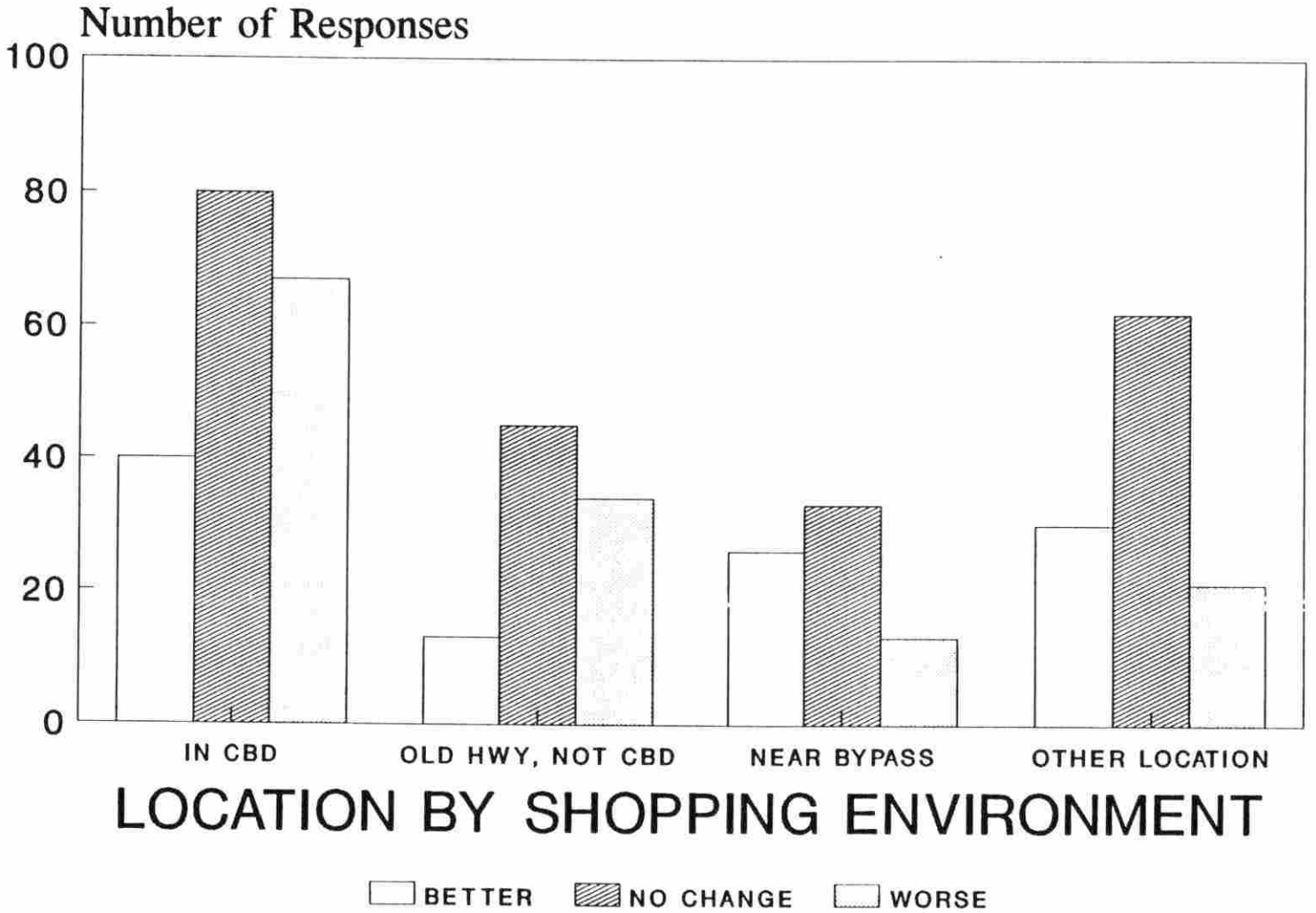


Figure 23. Merchants' perceptions of the shopping environment in their community from four locations.

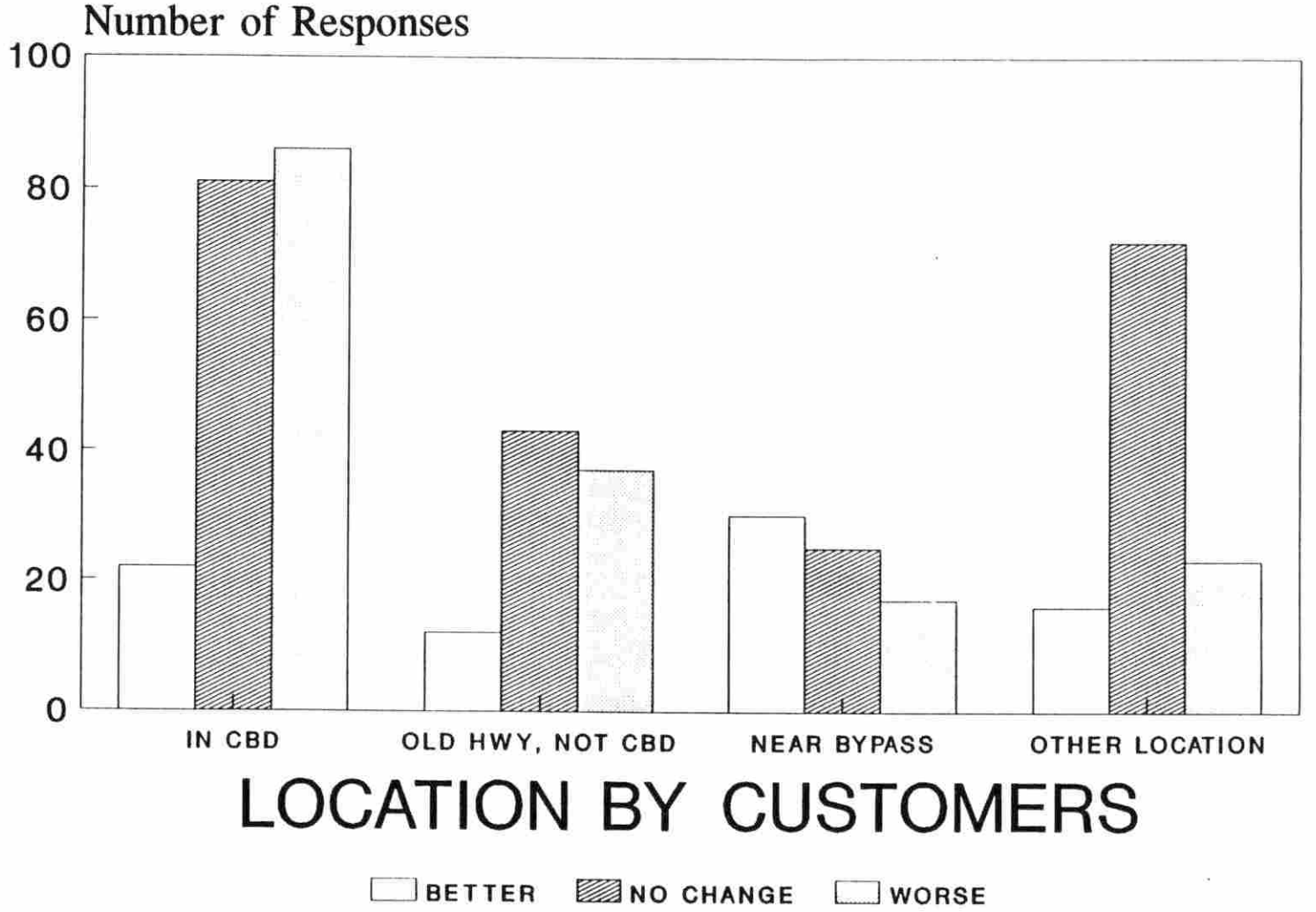


Figure 24. Merchants' perceptions of numbers of customers from four locations in the community.

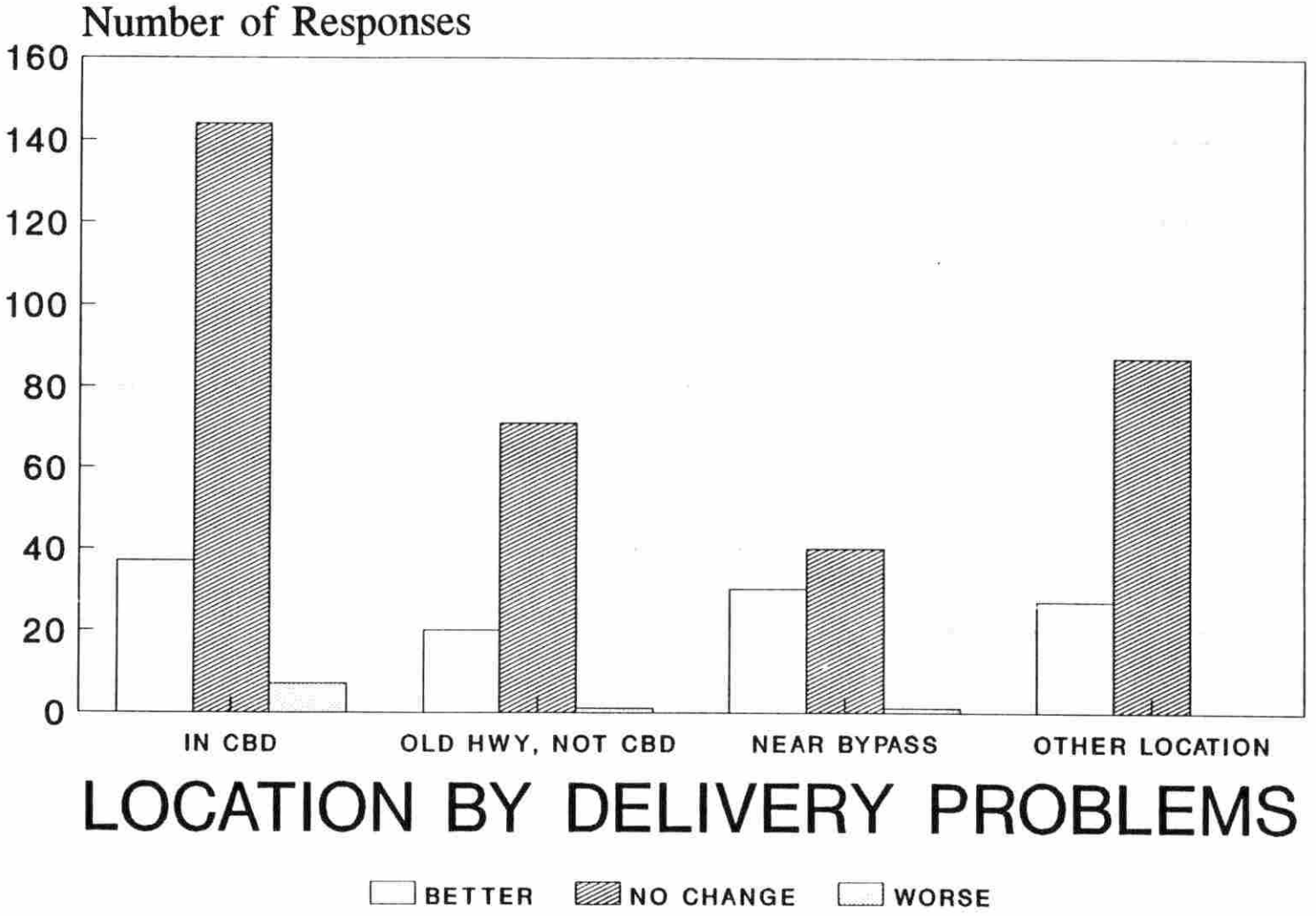


Figure 25. Merchants' perceptions of delivery problems from four locations in the community.

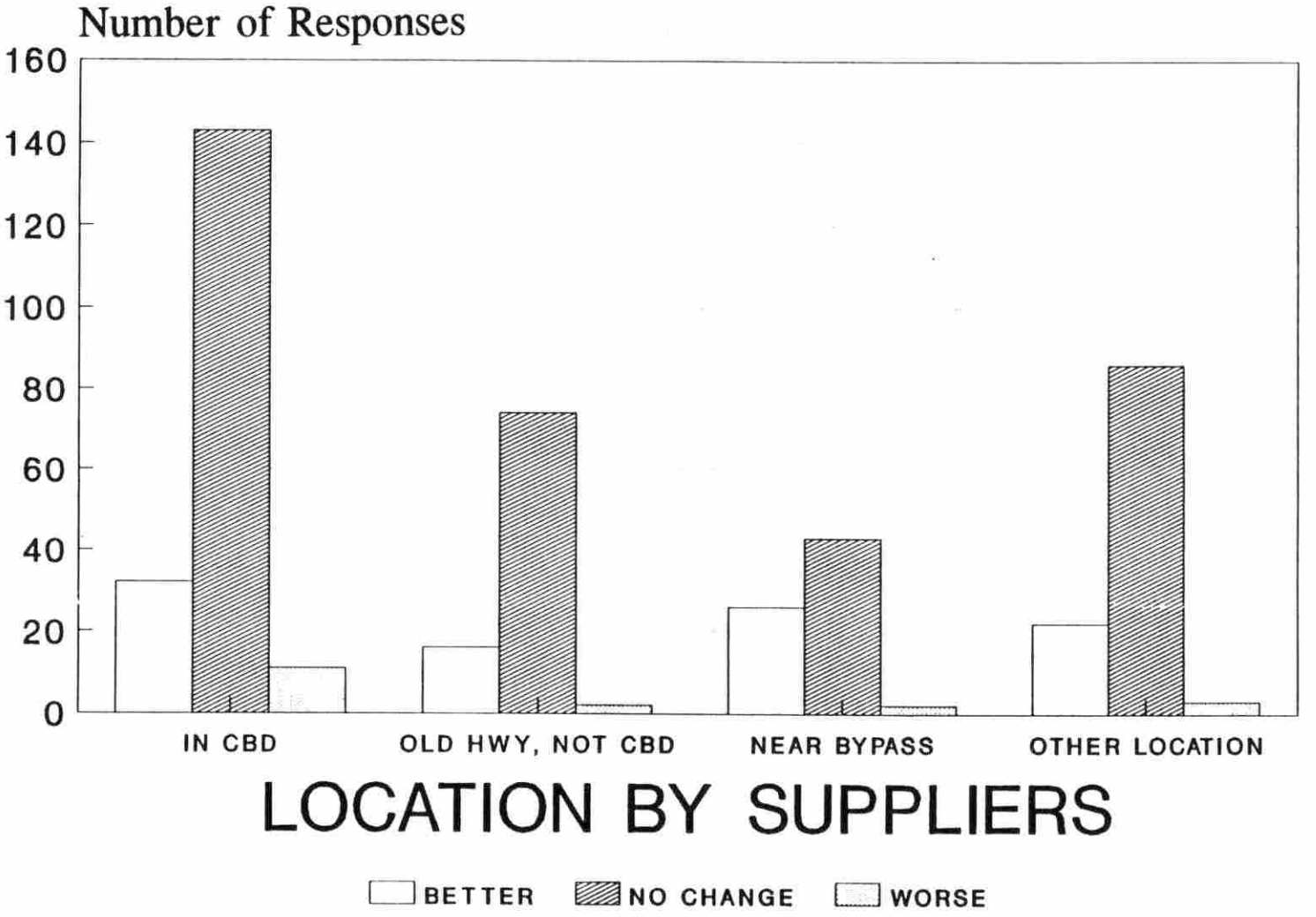


Figure 26. Merchants' perceptions of suppliers ability to reach their stores from four locations in the community.

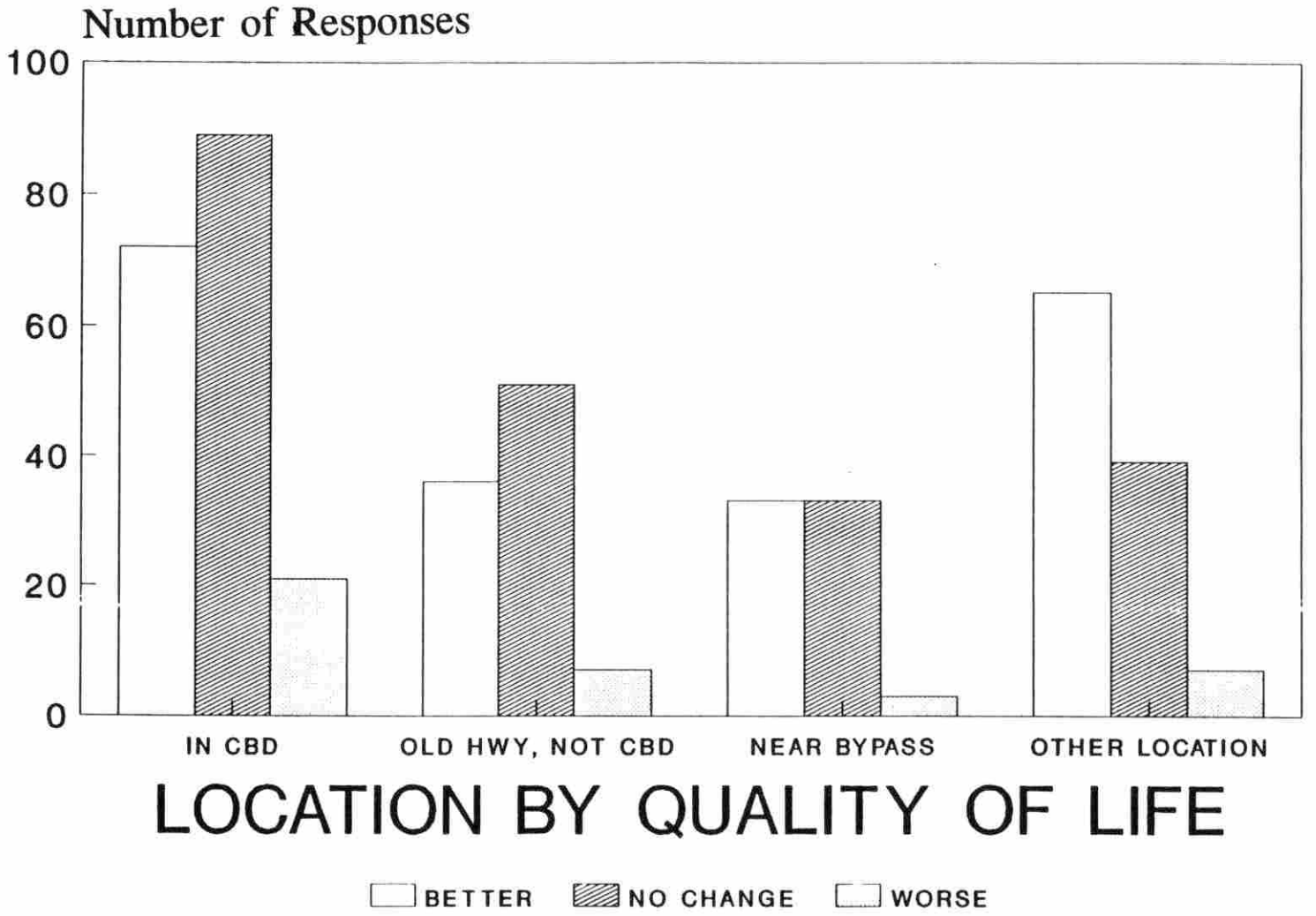


Figure 27. Merchants' perception of the quality of life in their community from four locations.

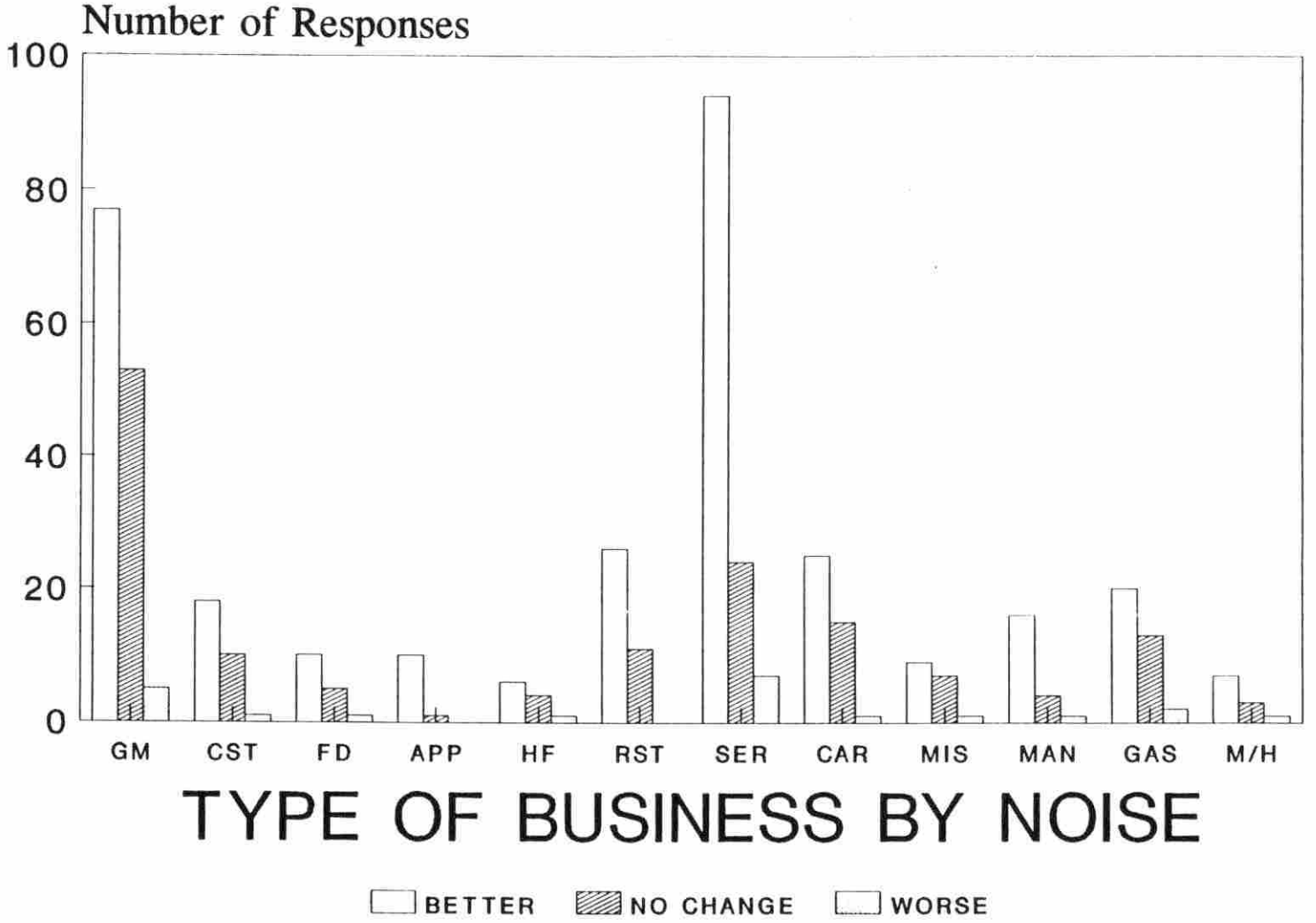


Figure 28. Merchants' perceptions of traffic noise according to the type of business they operate.

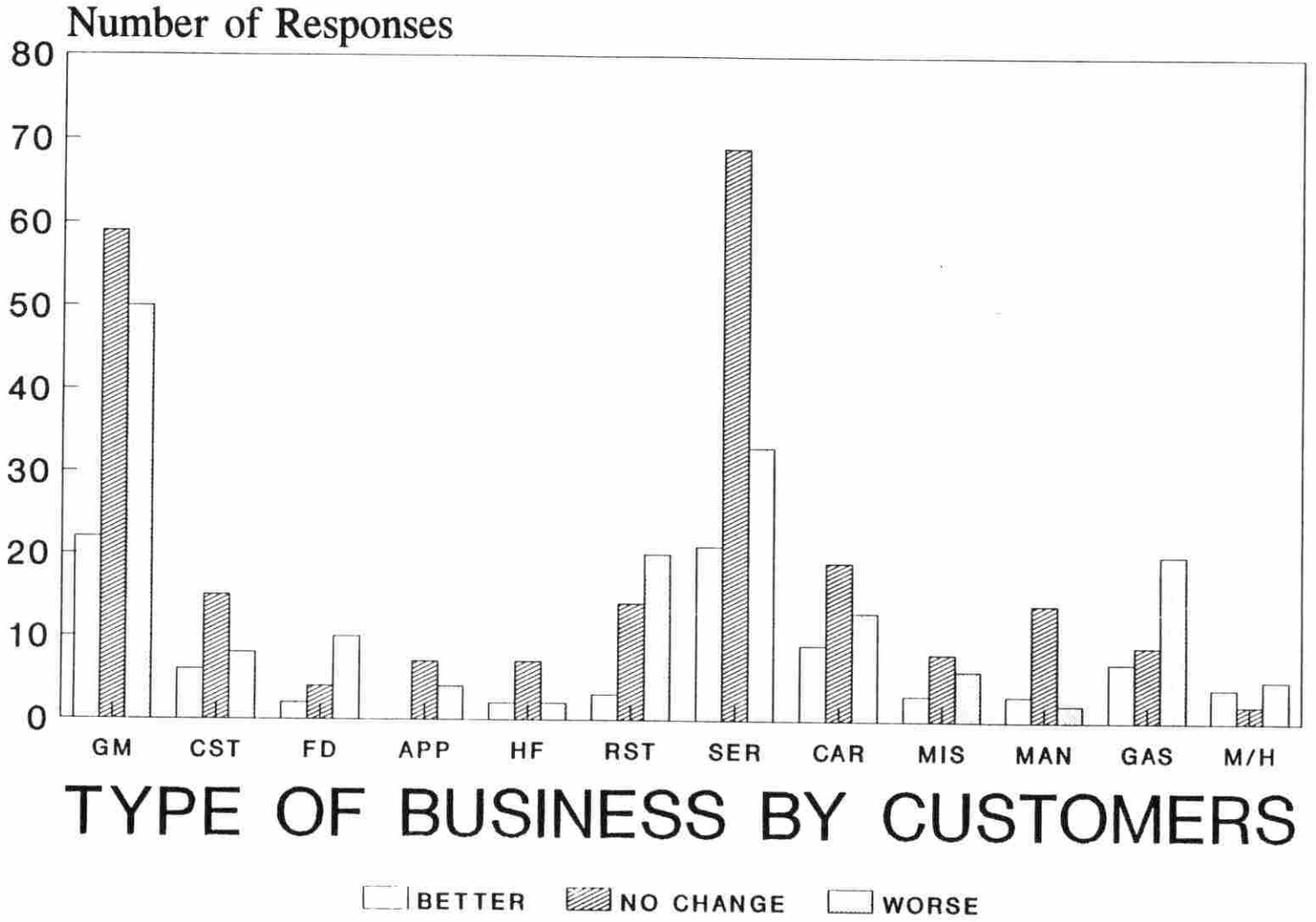


Figure 29. Merchants' perceptions of the number of customers according to the type of business they operate.

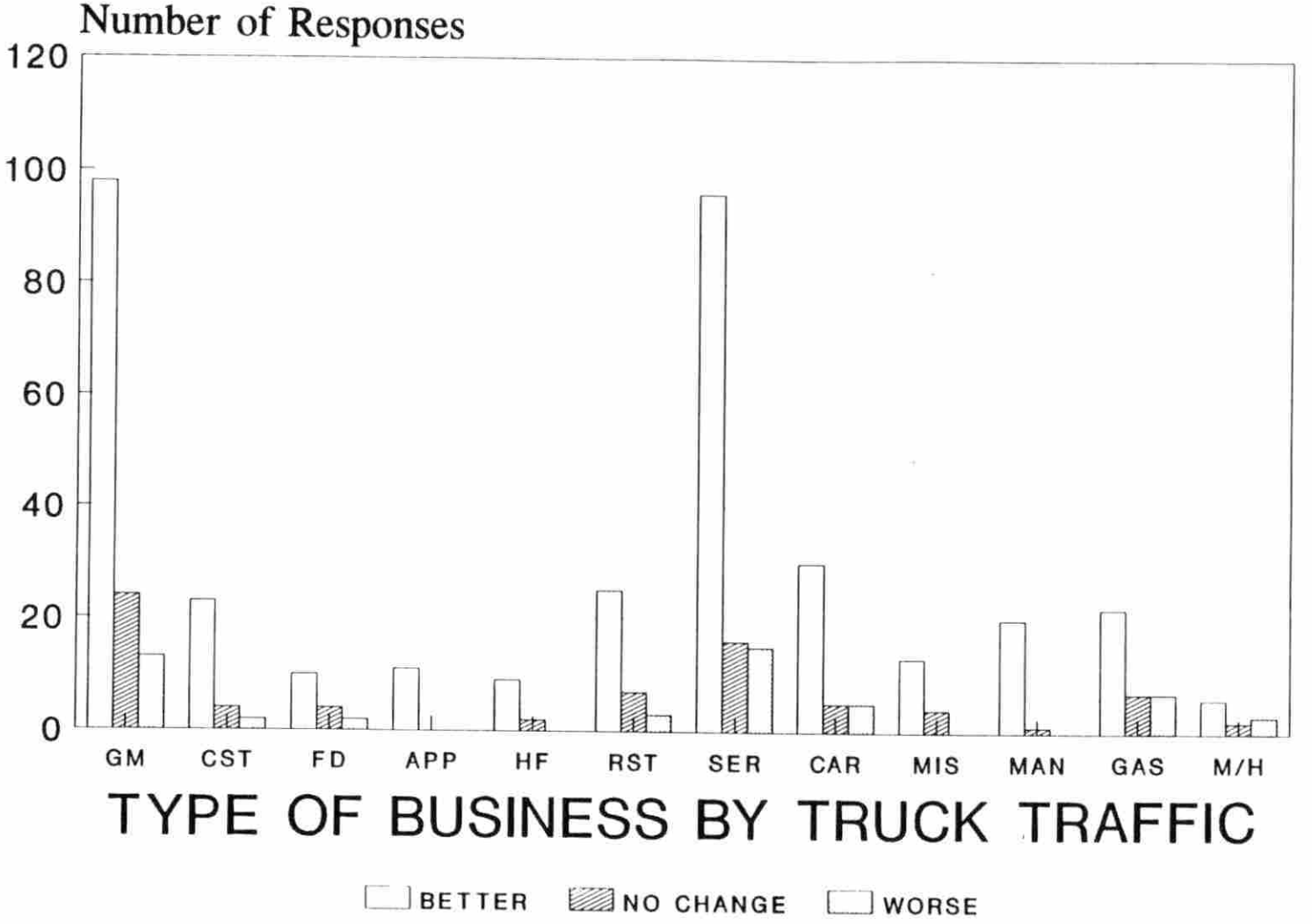


Figure 30. Merchants' perceptions of truck traffic according to the type of business they operate.

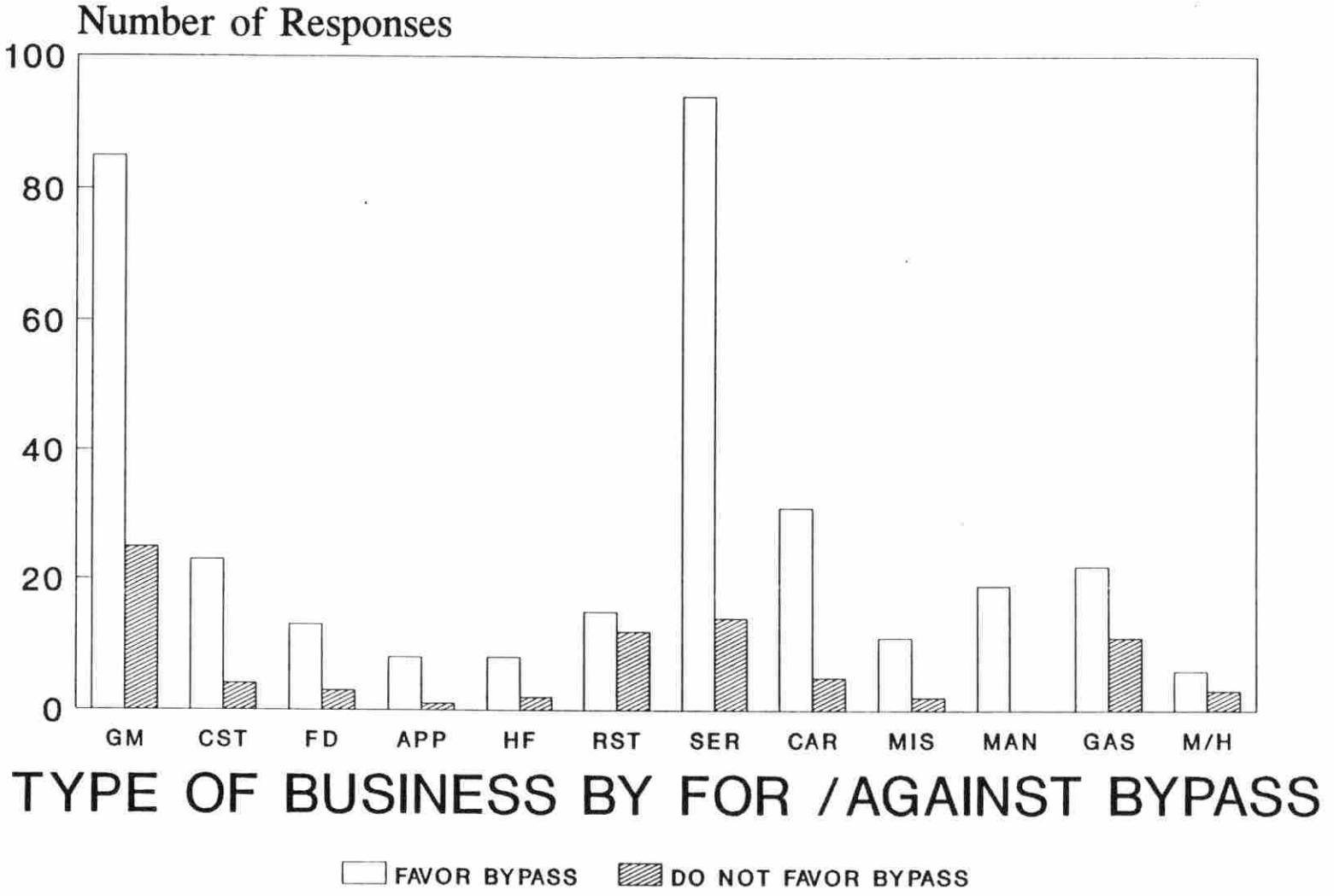


Figure 31. Merchants in favor of or opposed to the bypass according to the type of business they operate.

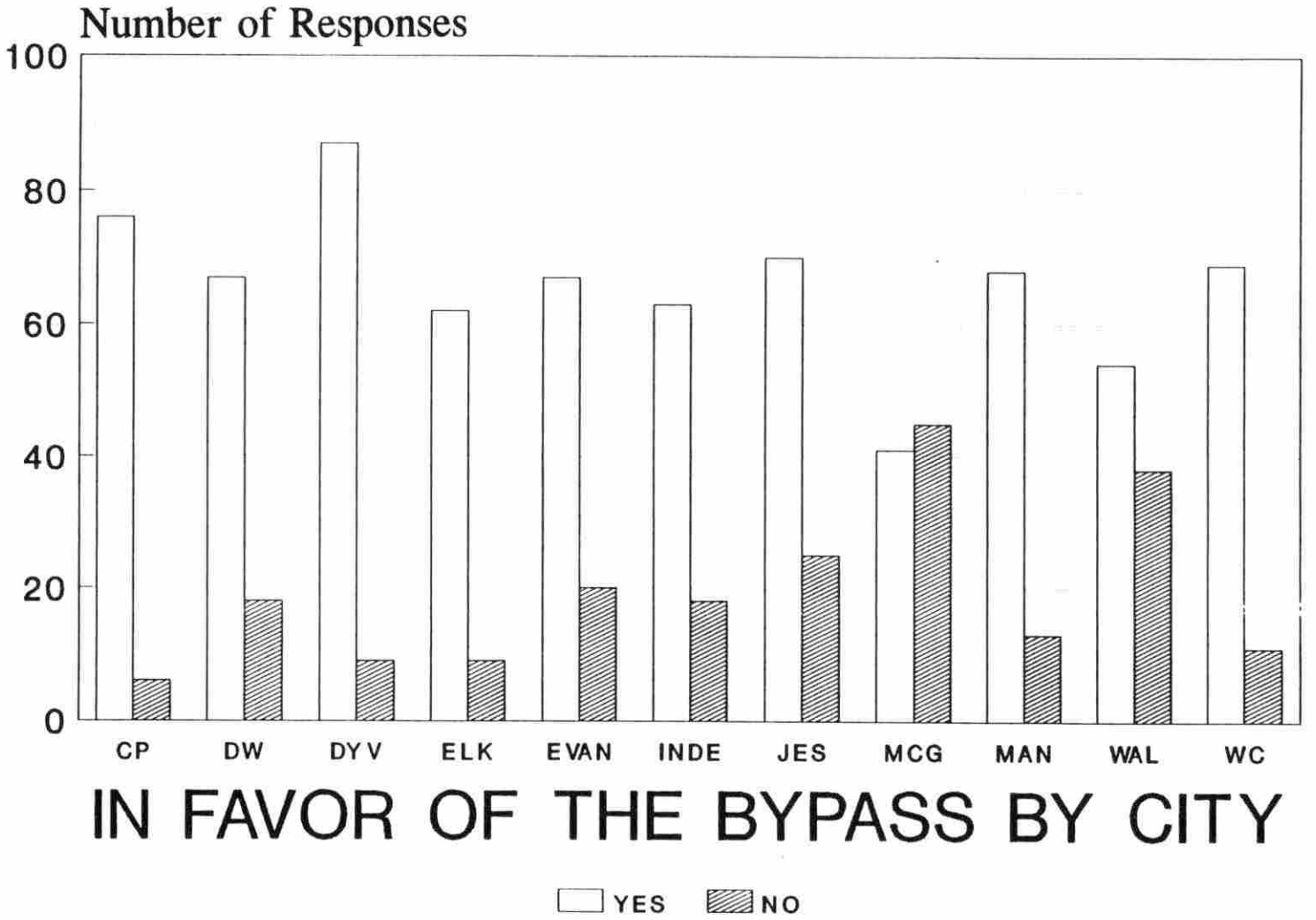


Figure 32. Merchants in favor of or opposed to the bypass according to their bypassed city.

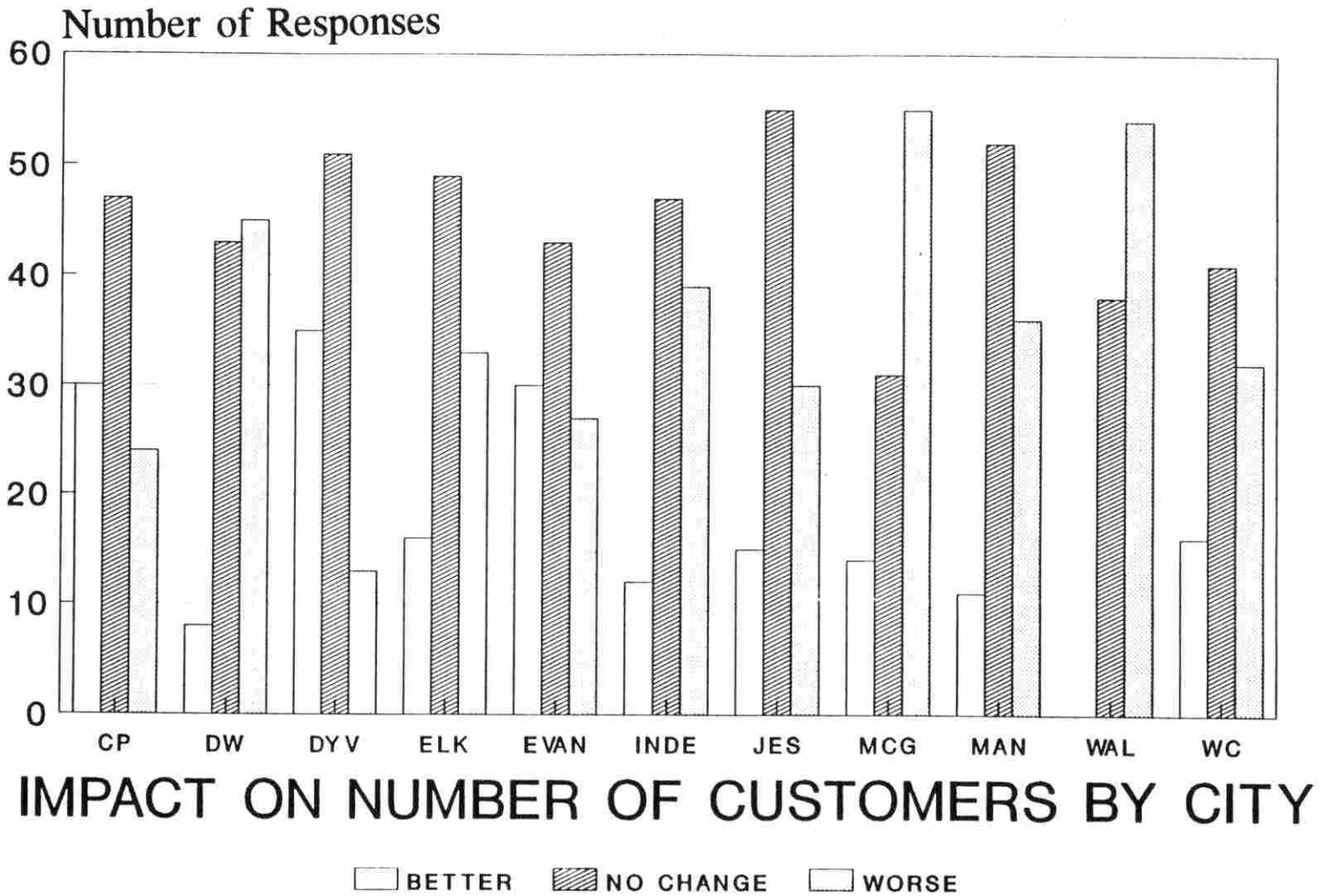


Figure 33. Merchants' perceptions of number of customers by their bypassed city.

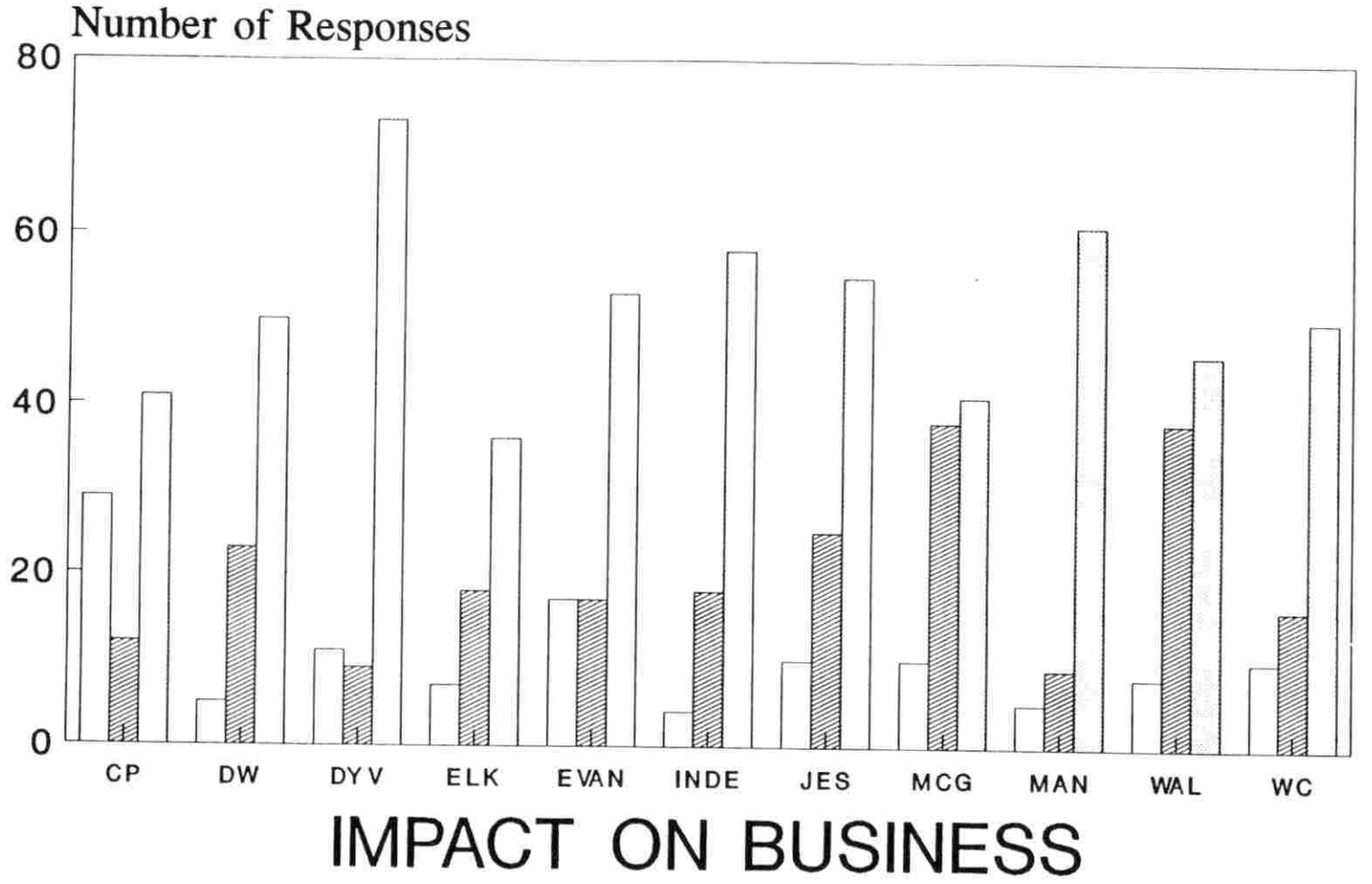


Figure 34. Merchants' perceptions of the effect of the bypass impact on their business activity according to bypassed city.