Access Management Awareness Program
Phase II Report

Sponsored by the Project Development Division
of the Iowa Department of Transportation
and the Iowa Highway Research Board
Iowa DOT Project TR-402
CTRE Management Project 97-1

December 1997

Center for Transportation
Research and Education

Iowa State University

Iowa Department of Transportation

Access Management Awareness Program
Phase II Report

Prepared for
Access Management Task Force
Iowa Department of Transportation

Prepared by
Center for Transportation Research and Education
Iowa State University
Iowa State University Research Park
2625 North Loop Drive, Suite 2100
Ames, IA 50010-8615
Telephone: 515-294-8103
Fax: 515-294-0467
http://www.ctre.iastate.edu
CTRE Management Project 97-1

Principal Investigator
Tom Maze

Project Manager
David Plazak

Sponsored by the Project Development Division
of the Iowa Department of Transportation
and the Iowa Highway Research Board
Iowa DOT Project TR-402

The preparation of this report was financed in part
through funds provided by the Iowa Department of Transportation
through its research management agreement with the
Center for Transportation Research and Education.

December 1997

Table of Contents:
Access Management Awareness Program Phase II Report

List of Figures:
Access Management Awareness Program Phase II Report

List of Tables:
Access Management Awareness Program Phase II Report

Abstract:
Access Management Awareness Program Phase II Report

Because of rising levels of traffic congestion and rising costs for new road construction, transportation officials are increasingly interested in access management techniques and projects. Access management is the process of carefully managing the dual role that arterial highways, roads, and streets play in serving through traffic and providing access to property and land development. Providing inappropriate or excessive access to property along arterial roadways can lead to increases in traffic accidents, delays, and congestion. When property access is managed carefully, potential conflict points are reduced. This in turn leads to enhanced safety and improved roadway operations.

The Iowa Access Management Awareness Program Phase II report presents the results of a number of detailed Iowa access management case studies. Case studies were selected to provide a cross-section of locations and community sizes in Iowa as well as a variety of project types. Generally, access management projects completed during the mid-1990s were chosen as case studies. Projects ranging from driveway consolidation to full raised medians were analyzed on a before and after basis in terms of traffic safety, traffic operations, and adjacent business vitality. Sources of information used for the case study analysis included: road project files; traffic accident records; state sales tax records; and personal interviews of business owners, business customers, and local officials.

The case study results from Iowa essentially confirm results of previous access management research from around the nation. Recent access in Iowa had significant, positive impacts in terms of traffic safety. The average reduction of annual accidents and accident rates on improved roadways was approximately 40 percent. Improvements in access management also led to significantly better roadway operations for most case studies. Although a small number of individual businesses do report sales losses and/or customer complaints once projects have been completed, access management projects in Iowa have not had an adverse impact on the majority of businesses located along them. In fact, some access management projects in Iowa seem to have contributed to an improved business environment along the corridors that have been improved.

The results from the Iowa case studies presented in this report will be used to develop access management education materials for Iowa transportation professionals and other audiences interested in the impacts of access management.

I. Phase II Summary

A. Introduction

According to the Federal Highway Administration:

> "Access Management is the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity, and speed. It attempts to balance the need to provide good mobility for through traffic with the requirements for reasonable access to adjacent land uses."

One of the most difficult problems in roadway administration and design today is balancing the dual function that many roads have: serving through traffic and providing access to property. Providing inappropriate or excessive access to property on arterial roadways can lead to increases in accidents, delays, and congestion. Access management involves carefully planning direct access from property to roadways. By doing this, potential conflict points are reduced. Conflict points lead to the opportunity for accidents to occur.

1. Background and Summary

Because of rising levels of congestion and rising costs for new road construction, transportation officials at the state and local levels are increasingly interested in access management techniques and projects. The extensive literature on access management indicates that access management projects often have significant benefits in terms of both traffic safety and operations. The literature also indicates, although less conclusively, that carefully designed access management projects do not usually negatively impact local businesses. However, many of the studies cited in the literature are usually from states that are considerably more urbanized than Iowa, such as Florida, Colorado, and New York.

The case studies from Iowa presented in this report confirm and expand upon the findings communicated in the extensive North American access management literature. Recent access management projects in the state of Iowa have had significant, positive impacts in terms of traffic safety and improved functioning of roadways. Although some individual businesses do report sales losses and/or customer complaints once projects have been completed, **access management projects in Iowa have not had an adverse impact on the great majority of businesses located along them. In fact, some of the projects seem to have contributed to an improved business environment along the corridors that have been improved.**

The case study corridors in Iowa have outperformed their communities in terms of retail sales and in terms of survival of businesses. Motorists who use the roadways overwhelmingly support the access management projects. The majority of local business owners and managers whose businesses are located along them also support them. Finally, public officials are also highly supportive of the access management projects completed in their communities.

2. Common Types of Access Management Projects

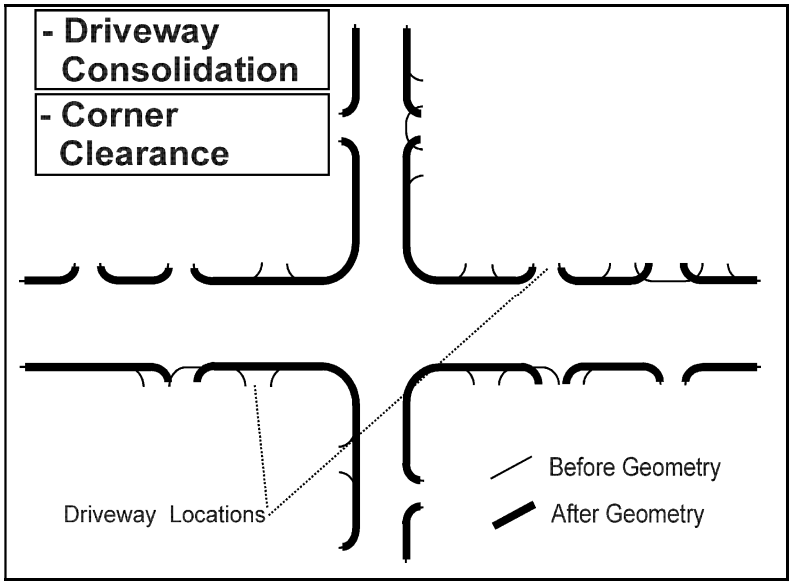
Access management projects are all designed to do one thing: reduce conflict points associated with traffic turning into or leaving land developments. Six types of treatments or projects are the most commonly used in the state of Iowa (see Figures 1-5).

These six treatments are:

- Driveway consolidation. These are the simplest access management projects. They are designed to limit the number of driveways per mile along a road and provide adequate spacing between driveways. This reduces conflicts associated with both left and right turns.

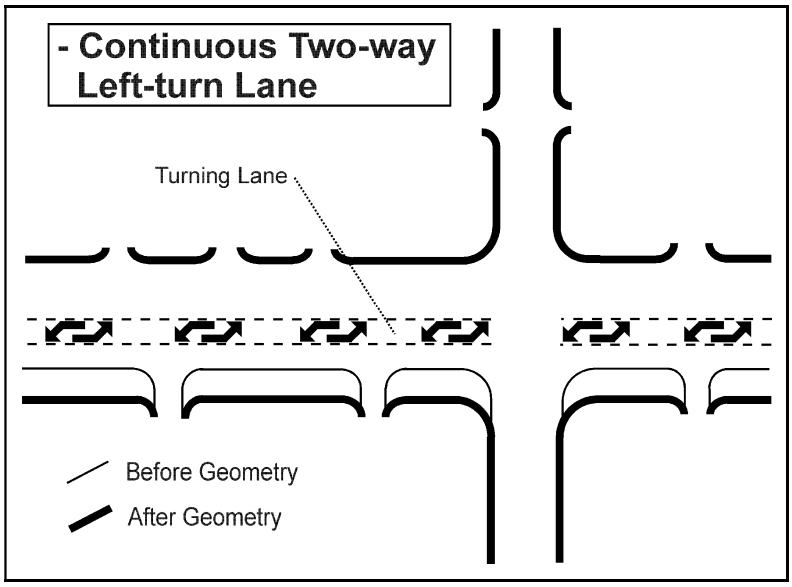
- Corner clearance. Corner clearance involves keeping or moving driveway entrances away from intersections. Sometimes driveways are moved from main streets to side streets to clear corners. Corner clearance eliminates conflict points that can cause rear-end collisions.

Figure 1: Driveway Treatments



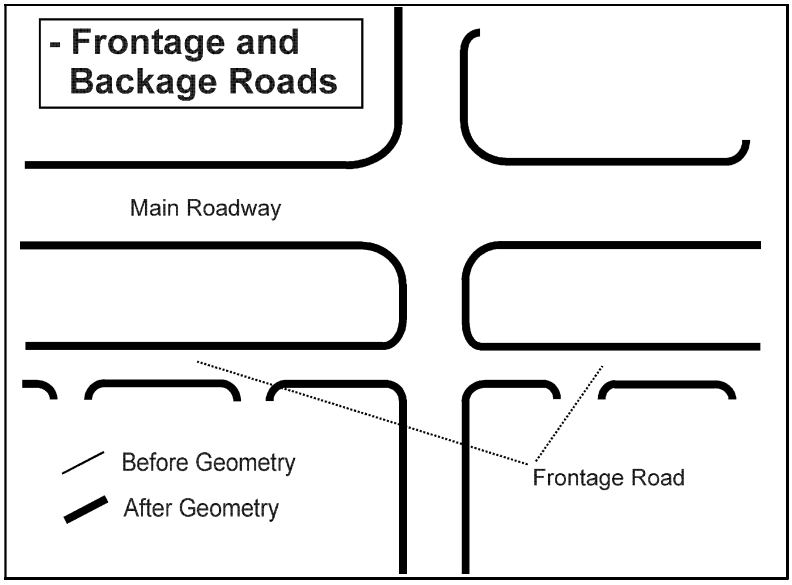
- Continuous two-way left-turn lane. These projects provide an additional dedicated turning lane in the center of a three or five lane street to separate left-turning traffic from through traffic. These turn lanes can be used in situations where moderate levels of traffic exist.

Figure 2: Continuous Two-way Left-turn Lanes



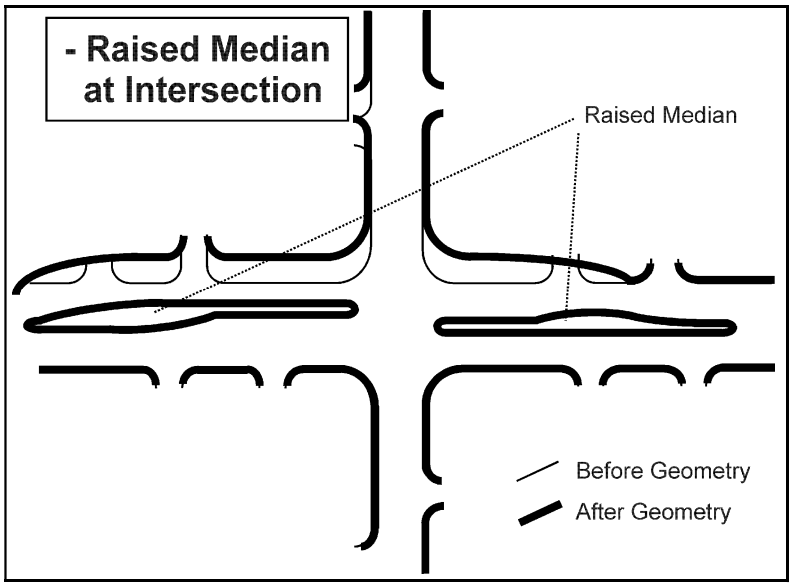
- Frontage and backage roads (alternative access ways). Frontage and backage roads provide alternative roadways off the main traveled roadway so as to separate turning and through traffic completely.

Figure 3: Alternate Access Treatments



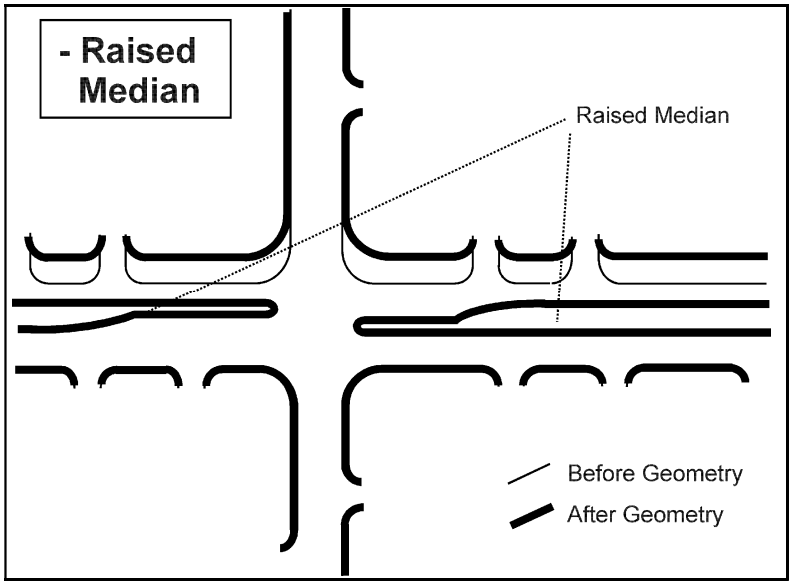
- Raised medians at intersections. These projects provide for limited installation of barriers near intersections in the center of multilane roadways. These prevent some turning movements near intersections. Such projects are very common in Iowa.

Figure 4: Raised Median at Intersection



- Full raised medians. Medians are barriers in the center of a major street that prevent both left turns and cross traffic. These projects eliminate a considerable number of conflict points and are most often used in situations where traffic volumes are high. They are usually the most controversial kind of access management project.

Figure 5: Full Raised Median Treatment

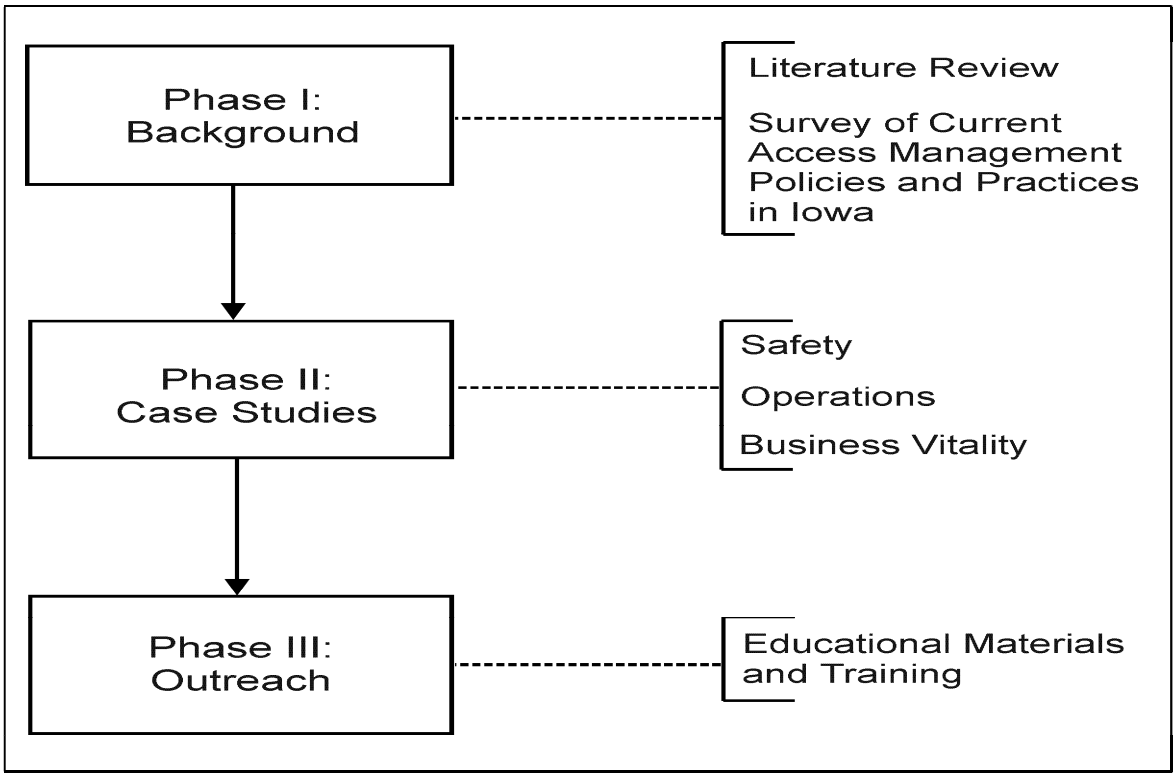


Access management treatments are often used in combination with each other and along with other roadway improvements such as improved signalization or installation of turning lanes or bays.

B. Iowa Access Management Research and Awareness Project

The Access Management Task Force worked cooperatively with the Safety Management System, the Iowa DOT, and the Center for Transportation Research and Education to develop a work plan that would both research and provide education and outreach activities on access management. The result was a three-phase effort spanning a total of 18 months (see Figure 6).

Figure 6: Project Overview



The three phases include the following:

- Phase I of the effort, completed in fall 1996, involved preliminary research on access management, including a review of existing literature and a survey of current access management practices in Iowa.

- Phase II of the effort, presented in this report, involved detailed research into the safety and traffic flow impacts of specific access management case studies in Iowa. The effect of controlling access on local businesses was also evaluated for selected case studies. This business vitality study is one the first of its kind ever conducted in the United States and Canada.

- Phase III, to be initiated in late 1997, will involve the development and distribution of access management educational materials based on the research results from Phases I and II. The key audiences for these materials will include local government officials, businesspersons, chambers of commerce, land use planners, real estate developers, and transportation professionals. Media to be used for education and training materials include print, multimedia, video, the Internet, and a statewide conference on access management.

1. Iowa Access Management Task Force

In 1996, the Iowa Department of Transportation (Iowa DOT) established an Access Management Task Force as part of its Safety Management System (SMS) development process. The Task Force has representation from the Iowa DOT, the Federal Highway Administration, local government, and the private sector.

The Safety Management System encompasses many activities, including accident location data improvement, work zone safety, sign vandalism prevention, speed limit change analysis, safety training and education, railroad grade crossing safety, and animal-related accident prevention. One of the highest priority projects initiated by the SMS involves research and outreach on access management.

2. Research Team

The team for the project represented a close collaboration by researchers from three universities in Iowa. The project was managed by the Center for Transportation Research and Education (CTRE) at Iowa State University. The Department of Marketing in the School of Business at the University of Northern Iowa undertook a major survey research effort during Phase II. The University of Iowa's Public Policy Institute provided support during Phase I in terms of studying current access management practices in Iowa. The Department of Economics at Iowa State University provided assistance in measuring impacts on local businesses.

3. Case Study Selection Process

The Iowa Access Management Research and Awareness Project has relied heavily on a case study approach for research data. Nominations for Iowa access management case studies were sought through direct mailings to local and state transportation officials throughout Iowa. In addition, a nomination form was made available on the Center for Transportation Research and Education's World Wide Web site and through its technology transfer newsletter. Over 50 locations in Iowa were nominated as potential case studies via direct submissions or the web page (http://www.ctre.iastate.edu/access).

The Access Management Task Force based on its selection of case studies on two main criteria: (1) types of access management issues and solutions illustrated and (2) geographic diversity. The task force wished to study a variety of issues and solutions as well as a variety of locations and city sizes around Iowa.

4. Case Study Types

The Access Management Task Force identified four types of cases to be studied in Iowa (see Figure 7). These types of case studies include:

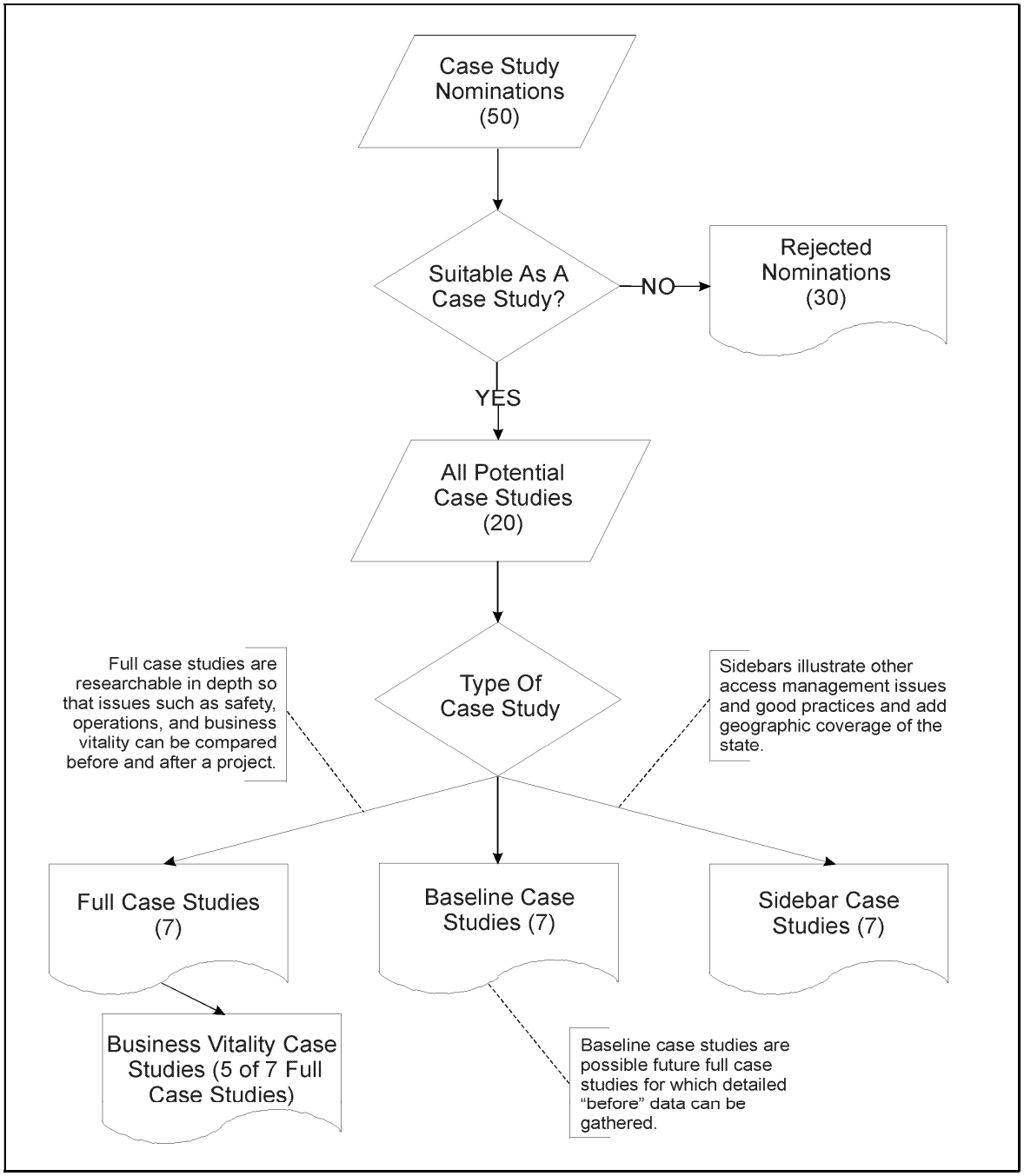
- Full Case Studies. Seven case studies were selected by the Task Force to receive intensive study in terms of safety and traffic operations. For the most part, these cases involved improvements made during the mid-1990s. Improvement types varied from driveway consolidation to full installation of medians.

- Business Vitality Case Studies. Five of the seven full case study locations were selected to receive intensive study in terms of the impacts of access management projects. These were all projects completed in the past decade so that business owners and motorists would be able to make detailed before and after comparisons.

- Sidebar Case Studies. Eleven additional case studies were selected to be studied in less detail. These eleven locations illustrate either good access management practices or current access management issues. The purpose of the sidebar cases was to provide additional coverage in terms of both issues analyzed and geography.

- Baseline Case Studies. Two other locations, in Coralville and Council Bluffs, were selected for data gathering so that future "before and after" comparisons could be easily made. These are case studies for which improvements are either pending or in progress.

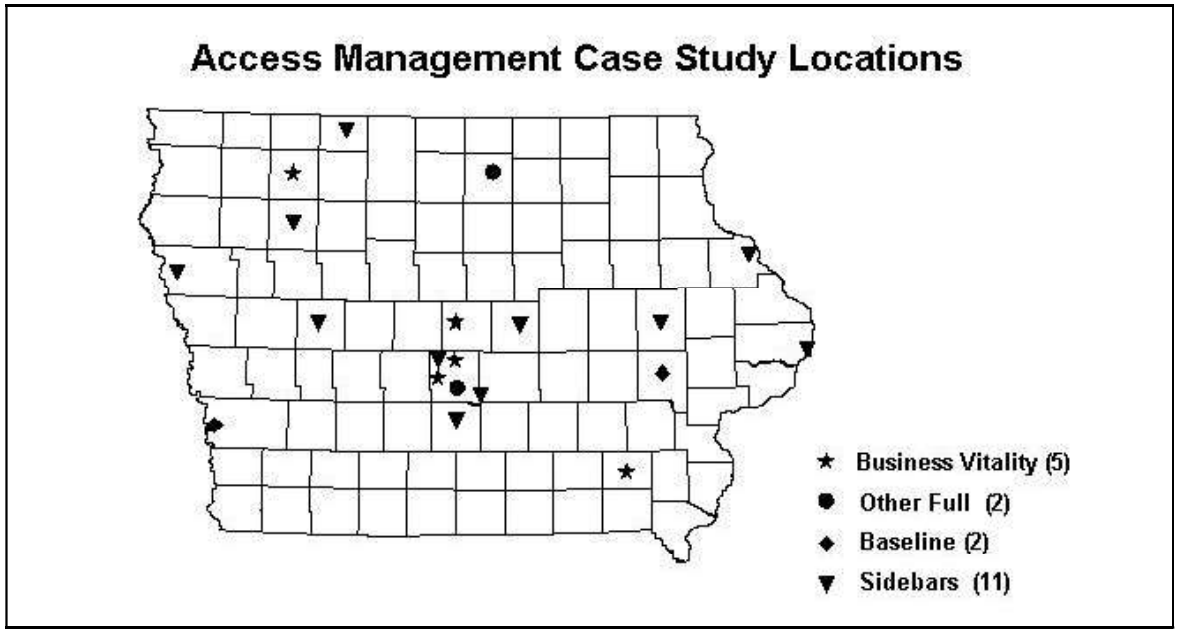
Figure 7: Case Study Selection Process



5. Case Study Map and Listings

The following map illustrates the geographic distribution of various case study types throughout Iowa (see Figure 8). Since the majority of access management problems are found in urban, suburban, and urban/rural fringe areas, this is reflected in the mapped distribution. However, communities studied range from under 10,000 to nearly 200,000 in population. Access management problems can be found in even small urban places.

Figure 8: Case Study Locations



Most of the access management case studies fell along federal or state numbered routes (see Table 1), indicating that access management problems arise when the dual roadway functions of serving property access and serving through traffic come into conflict.

Table 1: Full Case Study Information

Community	Federal or State Route	Street Name	Population (1990 or Latest)	Project Type And Length (In Miles)	Project Completion Year
Ames	US 69	S. Duff Ave.	47,198	Continuous two-way left-turn lane; 0.5 miles	1994
Ankeny	US 69	N. Ankeny Blvd.	21,485*	Median with turning lanes; 1.0 miles	1993
Clive	N/A	NW 86th St.	9,073	Median with turning lanes; 0.6 miles	1991
Des Moines	US 65/69	SE 14th St.	193,189	Median with turning lanes; 1.5 miles	1985
Fairfield	US 34	W. Burlington Ave.	9,768	Driveway consolidation; 0.6 miles	1992
Mason City	US 18	4th St. SW	29,040	Median at intersection; 0.2 miles	1991
Spencer	US 71	S. Grand Ave.	11,066	Continuous two-way left-turn lane; 0.6 miles	1992

*Based on a 1994 Special Census of Ankeny.

The eleven sidebar case studies were selected to illustrate a variety of access management issues found in urban and rural settings in Iowa (see Table 2).

Table 2: Sidebar Case Study Information

City or County	US or State Route	Issues Illustrated / Lessons Learned
Carroll	US 30	Shows a growing **commercial/industrial area** where access could have been managed more effectively; the roadway will need to be bypassed in the future.
Clinton	US 67	Illustrates a **mixed land use area** where access has not been managed effectively; a retrofit project is planned which will use a variety of techniques (medians, driveway consolidation, and frontage road improvement) to address safety and operational problems.
Dubuque	IA 32 (Northwest Arterial)	Highlights a newly constructed arterial that effectively integrates **land use planning**, land use regulations, and strong access management standards.
Estherville	IA 9	Shows the effective use of a **frontage road** system in a small city.
Marion	Business US 151	Highlights the integrated use of a variety of access management techniques, including medians, turning lanes, and the redesign of entrances.
Marshalltown	Old US 30	Shows the case of a **bypass** built several decades ago and where access was not managed effectively. A second bypass was eventually required, illustrating the high cost of not managing access.
Sioux City	IA 12 (Gordon Drive)	Illustrates the impacts of a lack of effective access management along a **commercial strip area**. This case is typical of access management problems in many cities in Iowa.
Storm Lake	Old US 71 and IA 7	Shows the effective use of a **three lane design** with a continuous center turning lane.
Urbandale	IA 28 (Merle Hay Road)	Illustrates the effective **retrofit of a major intersection** including turning lanes, medians at the intersection, and frontage road modifications.
Polk County	IA 163	Illustrates various **rural access management issues**: a single large traffic generator; restricted sight distance along a major arterial; and frontage road design issues. (A project is planned to address these problems).
Warren County	US 65/69	Illustrates various **rural access management issues**: access along a major arterial in an urban fringe area with high future growth potential; and restricted sight distance.

The full case studies provided valuable information on the impacts of access management projects because it was possible to study them on a before and after basis. Two additional corridors, in Coralville and Council Bluffs, were selected for development of detailed “before” information. These corridors are currently being modified to incorporate improved access management. They are both high volume arterials located in suburban areas.

6. Research Methods Used

During Phase II of the Iowa research, four primary methods of investigation were used to examine the selected case studies. Each case study was examined in the field and as much historic information as possible was gathered. For many of the projects, extensive Iowa DOT project files were available.

Detailed before and after accident studies were conducted for many of the case studies by employing the Iowa Department of Transportation's Personal Computer Accident Location Analysis System (PC-ALAS).

Business trends for corridors were primarily analyzed using retail sales tax data made available by the Iowa Department of Revenue and Finance. Other data sources, principally R.L. Polk City Directories, were used to augment the sales tax data.

Finally, opinion surveys of business owners and managers and motorists/customers were conducted using personal interviews. The School of Business of the University of Northern Iowa conducted these interviews on site. It should be noted that more emphasis was placed on obtaining a large sample proportion of business owners/managers than of motorists/customers. In some communities, the sample size for the motorist/customer survey is small. Results should be viewed with some caution, although because of their strongly positive nature it is doubtful that a larger sample size would have led to much of a difference.

C. Summary of Key Research Results

The key impacts of access management have been divided into three categories in the literature: traffic safety, traffic flow/operations, and business vitality. These categories were also used in Iowa's study, with great emphasis being placed on safety and business vitality. Since traffic congestion is not a serious problem in most places in Iowa, traffic operations and flow analysis was given much less emphasis in the study design than safety and business vitality. Clearly, the results indicate that access management projects have a positive impact when all factors, including safety, traffic operations, and business vitality, are factored in.

Results from the full case studies and business vitality case studies indicate that:

- A typical access management project in Iowa may be expected to lead to a reduction in annual accidents of between 10 and 65 percent and a similar range of reduction in the accident rate per million vehicle miles of travel. The average reduction in accidents and accident rates for all projects is around 40 percent. Both personal injury accidents and property damage only accidents are reduced significantly, but property damage accidents by a greater percentage.

- Access management projects studied in Iowa raised the level of traffic service to motorists at peak hour along a corridor by one level, providing significant benefits in terms of increased operating speed and reduced traffic congestion and delay.

- Corridors where access management projects have been completed actually perform better in terms of retail sales than their surrounding communities. In addition, business failure rates along access management corridors are at or below the statewide average for Iowa. This indicates that access management projects generally do not have an adverse effect on the majority of businesses. Some individual businesses may be affected.

- The vast majority of businesses (80 percent) along access management corridors reported sales at least as high after the project was in place. Relatively few businesses reported declines associated with the project, although these business owners clearly felt they were hurt by the project. Negatively-impacted firms were a mixture of business types. Similarly, about 80 percent of businesses reported no customer complaints regarding access to their businesses after project completion. Those businesses that tended to most often report complaints were highly oriented toward automobile traffic (e.g. restaurants and auto sales and service businesses).

- Motorist opinions about the access management projects studied were highly positive. In all cases 90 to 100 percent of motorists surveyed had a favorable opinion of improvements made to roadways that involve access management. The vast majority of motorists agreed that the improved roadways are safer, operate better, and are easier to drive on.

D. Safety Benefits

The single most significant benefits associated with the projects studied have to do with traffic safety (see Tables 3 and 4). These benefits are often highly significant and include:

- A decline in the overall number of traffic accidents. All but one (Spencer) of the full case study projects experienced a reduction in annual accidents. The number of accidents declined in a range from 30 to 70 percent with this one exception. Spencer experienced a small increase in accidents. However, this was partly explained by a large (nearly 20 percent) increase in traffic along the project after it was completed. A typical reduction in accidents was 39 percent, a figure consistent with previous experience in other studies.

- A decrease in the rate of accidents per vehicle mile of travel (VMT) (see Figure 9). The accident rate makes an adjustment for decreases or increases in the amount of travel on a roadway. Accident rates decreased for all the case studies; the average reduction in accident rates was over 40 percent. Rate reductions varied from under 10 percent (Spencer) to over 65 percent (Ames).

Table 3: Average Annual Total Traffic Accidents (By Case Study)

Case Study	Before Project	After Project	Change	Percent Change
Ames	53	17	-36	-67.9%
Ankeny	37	21	-16	-43.2%
Clive	69	43	-26	-37.7%
Fairfield	35	22	-13	-37.1%
Mason City	33	24	-9	-27.3%
Spencer	23	25	+2	Increased 8.7%
Total, All Cases	250	152	-98	-39.2%

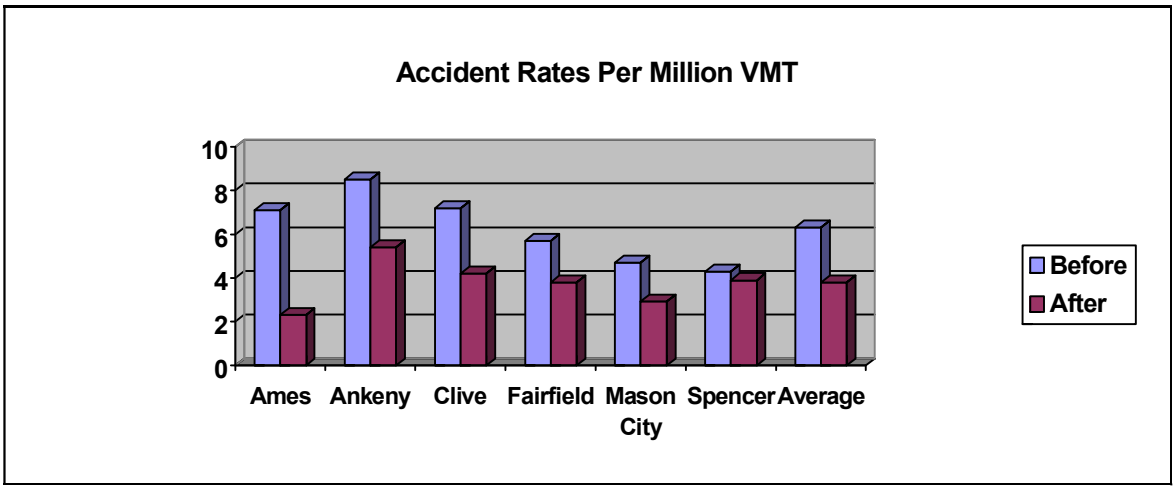
Note: The Des Moines case study is not included due to a lack of comparable "before" data.

Table 4: Accident Rate Per Million Vehicle Miles Traveled (By Case Study)

Case Study	Before Project	After Project	Percentage Change
Ames	7.1	2.1	-70.1%
Ankeny	8.5	5.4	-36.5%
Clive	7.2	4.2	-41.7%
Fairfield	5.7	3.8	-33.3%
Mason City	4.7	2.9	-38.3%
Spencer	4.3	3.9	-9.3%
Average, All Cases	6.3	3.8	-39.7%

Note: The Des Moines case study is not included due to a lack of comparable "before" data.

Figure 9: Accident Rates Reduction



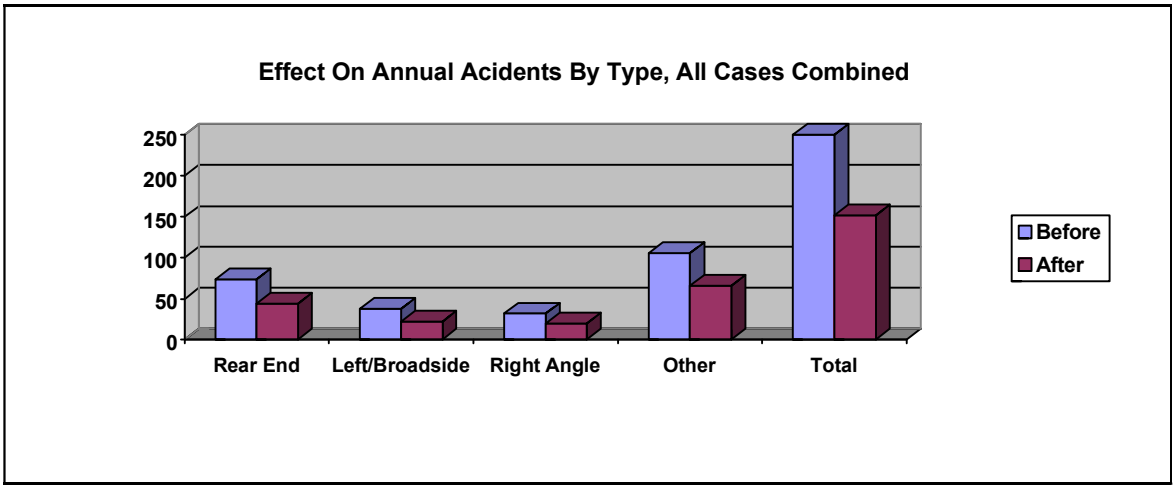
Although the access management projects studied were effective in decreasing many types of accidents (see Table 5 and Figure 10), there were above-average declines in two types of accidents generally associated with access problems: rear-end collisions and broadside/left turn accidents. These declined by over 40 percent combined for the six case studies for which before and after comparisons are possible.

Table 5: Accidents Per Year By Type (All Before And After Case Studies Combined)

Accident Type	Before Projects	After Projects	Percentage Change
Rear End	74 (29%)	44 (29%)	-40.5%
Broadside/Left Turn	38 (16%)	22 (16%)	-42.1%
Right Angle	32 (12%)	20 (13%)	-37.5%
All Other/Uncertain	106 (42%)	66 (43%)	-37.7%
Total, All Types	250 (100%)	152 (100%)	-39.2%

Note: The Des Moines case study is not included due to a lack of comparable "before" data.

Figure 10: Reduction in Accident Types



One full case study access management project (Des Moines) was of an age such that necessary comparative accident data from before the project in the early 1980s could not be gathered. However, some historic data and "after" data can be used to show how the SE 14th access management project affected traffic safety. Before the project in the period between 1975 and 1977, there were 323 accidents per year along SE 14th Street--almost one accident every day. The accident rate was calculated by the Iowa DOT to be over eight accidents per million vehicle miles during these three years. Accidents and the accident rate were growing. Once the raised median project was put in place, the accident rate fell to about 4.9 accidents per million vehicle miles for the years 1986 through 1988, a drop of 40 percent. This result is comparable with those for the other full case studies.

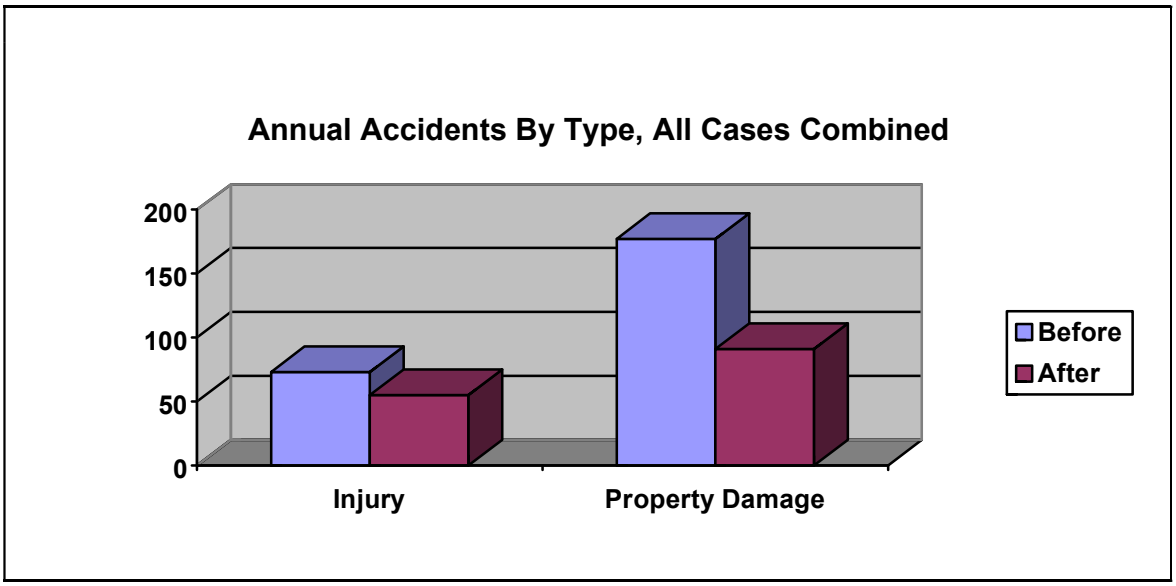
Both personal injury accidents and particularly property-damage-only accidents were significantly reduced after project completion. For the six case studies where complete before and after comparisons are possible, personal injury accidents dropped almost 25 percent and property damage only accidents were almost cut in half (see Table 6 and Figure 11).

Table 6: Average Annual Accident Statistics (Six Full Case Studies Combined)

Accident Type	Before Projects	After Projects	Absolute Change	Percent Change
Personal Injury Accidents	73	55	-18	-24.7%
Fatalities	0	0	0	No Change
Injuries	108	89	19	-17.6%
Property Damage Only Accidents	177	91	-86	-48.6%
Total Vehicles Involved, All Accidents	529	313	-216	-40.0%

Note: The Des Moines case study is not included due to a lack of comparable "before" data.

Figure 11: Annual Accidents



E. Operational Benefits

Operational concerns such as traffic speed and congestion are generally not as important as safety concerns in the selection of candidates for access management projects in Iowa. This has to do with the traffic patterns and roadway level of service conditions that tend to prevail in most of the state, including in metropolitan areas. For the most part, roadways in the state are not congested with traffic, and facilities operate at or near the free flow speed even during peak hour. Average Annual Daily Traffic (AADT) is an indication of the amount of traffic a roadway carries on an average day during a year. The seven full case study location roadways mainly carried moderate levels of traffic (15,000 to 25,000 vehicles) both before and after they were improved (see Table 7).

Table 7: Before And After Traffic Volumes (AADT At Full Case Study Locations)

Project Location	Traffic Before Project (AADT)	Traffic After Project (AADT)	Percentage Change In Traffic	Comments
Ames (US69/ S. Duff Ave.)	20,500	21,800	+6.3%	Some new land development occurred along the route after project completion
Ankeny (US 69/Ankeny Blvd.)	12,000	16,300	+35.8%	Significant new land development occurred along the route after project completion.
Clive (NW 86th St.)	26,000	28,000	+7.7%	100th Street opened parallel to 86th Street, diverting some traffic.
Des Moines (US 65-69/SE 14th St.)	25,900	27,800	+7.3%	A bypass is under construction for US 65 (to open in late 1997).
Fairfield (US 34/Burlington Ave.)	16,800	15,800	-6.0%	Other streets were paved during the project; a bypass is planned for US 34.
Mason City (US 18/4th St.)	19,000	22,000	+15.8%	A bypass is under construction for US 18.
Spencer (US 71/Grand Ave.)	14,800	17,600	+18.9%	A bypass is planned for US 71.

Only the Ankeny roadway experienced a very large increase in traffic after it was improved. It was widened from a two-lane roadway to a four-lane facility with raised medians and left turn lanes. There was considerable new commercial business development along the route after the project was completed, which raised the traffic count. In Fairfield, traffic actually declined on the route following the access management improvements. This may be due in part to the paving of some nearby streets. Traffic on the Clive route was partially relieved by the opening of a new major arterial, 100th Street, about one mile to the west. As a result, traffic on 86th Street did not increase as much as might have been expected with the completion of the access management project.

Level of Service (LOS) provides an overall indication of the quality of service that a roadway provides to motorists in terms of speed, travel time, traffic interruptions, freedom to maneuver, driving comfort, convenience, and probability of accidents (see Table 8). Level of Service A is the highest quality of service possible and indicates that there is little restriction on speed or maneuverability caused by other vehicles. Traffic flows freely. Quality of service declines under levels of service B and C and operating speeds and ability to maneuver begin to decline. At Level of Service D, traffic flow begins to become unstable and speeds become highly variable. The probability of accidents also rises. Level of Service E indicates the capacity of the roadway has been reached; driving becomes difficult and accident potential is high. Level of Service F is the lowest possible quality of traffic service; traffic flow is forced and speeds can drop to zero for short periods as traffic jams develop.

Table 8: Peak Hour Traffic Service Levels (Full Case Study Locations)

Project Location	Approximate Peak Hour Level of Traffic Service Before Project*	Approximate Peak Hour Level of Traffic Service After Project*
Ames	C	B
Ankeny	C/D**	B
Clive	D	B/C**
Des Moines	D	B/C**
Fairfield	B	B
Mason City	B	B
Spencer	B	B

* Based on estimated peak hour traffic volumes per lane and considering turning lanes and calculated based on the methodology for urban arterial streets contained in the Highway Capacity Manual.
** Indicates that roadway is operating near the boundary between two levels; both levels are shown.

In the cases of the Ankeny, Clive, and Des Moines locations levels of traffic service, travel speed, and congestion were of concern before the access management projects were initiated. The Clive and Des Moines locations had previously been two of the most congested arterial streets in the state. In all three cases, the access management projects contributed to a marked improvement in traffic operations.

According to the Iowa DOT, Level of Service C is considered the desirable performance for urban roadways in Iowa. Level of Service D is the minimum acceptable standard. All of the case study location roadways now meet or exceed Level of Service C (see Table 9).

Table 9: Travel Speeds And Level Of Service*

LOS	Approximate Travel Speed	Nature of Performance
A	Greater than 30 mph	Unrestricted flow
B	Greater than 25 mph	Stable flow
C	Greater than 20 mph	Stable flow
D	Approximately 15 mph	Approaching unstable flow
E	Approximately 10 mph	Unstable flow; moderate congestion; road capacity reached
F	Less than 10 mph	Forced flow; extreme congestion

*Based on an urban arterial with a posted speed limit of 35 miles per hour.

F. Impacts on Business Vitality

Business owners often express the concern that changes in access management will have temporary or permanent impacts on their sales. They are particularly concerned about access management projects, such as medians, that significantly reduce turning opportunities for motorists.

1. Economic Indicators

Analysis conducted for each of the five business vitality case studies using statistics from the Iowa Department of Revenue and Finance and other published sources indicates negative impacts on business tend to be confined to a small number of individual businesses. In fact, the five business study corridors where access management changes occurred generally performed better in terms of sales activities than their surrounding communities once the project was in place. The results of this analysis indicate that:

- There were no particular business categories that consistently decreased in number of establishments for any of the five corridors studied. Traffic-dependent businesses such as convenience stores and fast food restaurants did not appear to be affected in a significantly different manner than were all businesses.

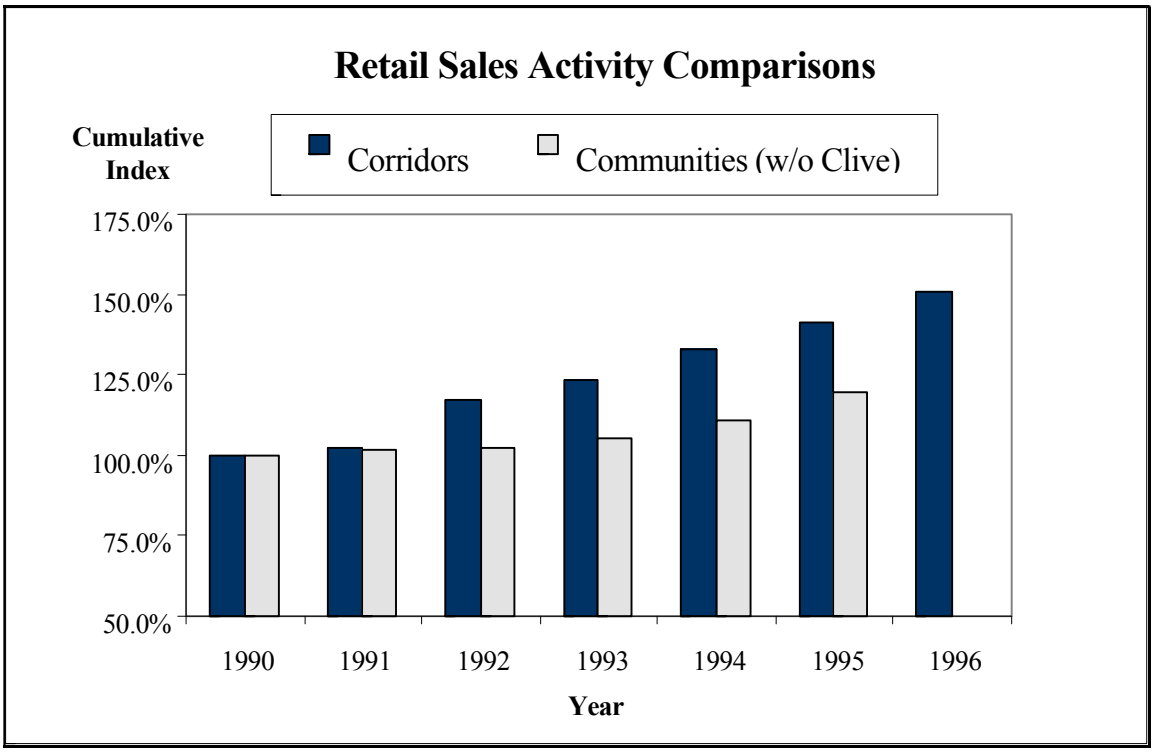
- The rates of business turnover in the study corridors ranged from about 2.6 percent to 10 percent per year, a range below or equal to the business turnover rate for Iowa as a whole, which is about 10 percent per year. Businesses located along the case study corridors turned over less than would normally be expected of retail businesses in Iowa. (Turnover in this case includes going out of business, moving out of the corridor, or changing the business's name.)

- With one exception, retail sales for businesses within the case study corridors significantly outpaced sales in their respective communities. The one exception was Clive, in which the community as a whole experienced phenomenal retail trade growth and draws customers from a large trade area. The corridor's growth was also exceptionally high after the project was completed, indicating that it did not harm business along the corridor in the aggregate.

- The following chart contrasts sales within the access management corridors with the sales in their respective communities (see Figure 12). Figures for Clive have been removed; that city's unusually dramatic retail sales performance would have made interpreting the results difficult. (Sales along the Clive corridor grew by 79 percent from 1990-1996, the second-highest growth rate of any corridor studied. Community-wide sales more than tripled, growing more than three times more than any other community examined).

- There do not appear to have even been any significant short term declines in retail activity associated with the access management projects. Corridor sales results outpaced community results throughout the period 1992 through 1995 and probably in 1996 as well.

Figure 12: Retail Sales



Note: 1996 community sales report numbers are not yet available from the Iowa Department of Revenue and Finance. The relative pattern of the bars is expected to continue in 1996.

2. Business Owner and Manager Opinions of Projects

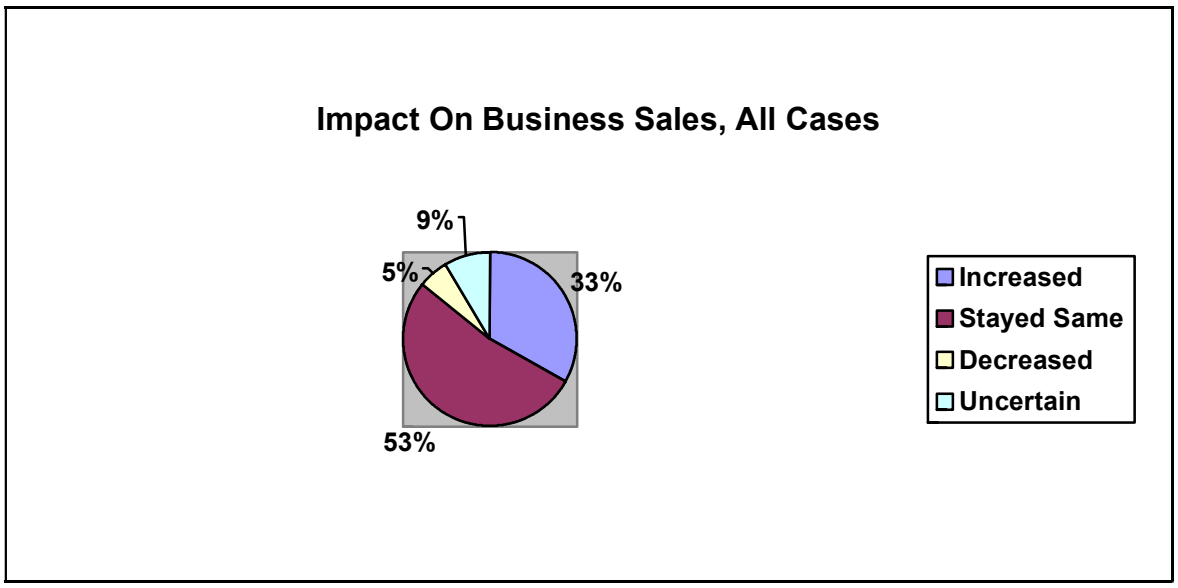
Access management projects, particularly those that involve a major reduction in direct access to property, are often controversial among business owners and managers. However, data collected for five case study corridors in Iowa strongly suggests that access management projects do not harm the great majority of businesses. This was confirmed by the results of a survey of business owners and managers conducted by the University of Northern Iowa.

Well over 80 percent of all business owners surveyed along the five business vitality corridors indicated that their sales had increased, stayed the same, or that they were uncertain about the impact. Interestingly, the business owners along raised median projects had both the highest percentage responses of both "increased" and "decreased" sales (see Table 10 and Figure 13).

Table 10: Reported Sales of Surveyed Businesses After Projects

Sales Impact	Ames	Ankeny	Clive	Fairfield	Spencer	Average, All Cases
Increased	18.2%	41.7%	40.0%	28.6%	36.4%	33.0%
Same	72.7%	25.0%	50.0%	71.4%	45.5%	52.9%
Decreased	0.0%	16.7%	10.0%	0.0%	0.0%	5.4%
Uncertain	9.1%	16.7%	0.0%	0.0%	18.2%	8.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Project	Two-way left-turn lane	Raised median	Raised median	Driveway consolidation	Two-way left-turn lane	All

Figure 13: Business Sales Impact



A few businesses (three of 63 interviewed, or five percent) did report decreased sales activity after the access management projects were completed. These were of no particular business type and included a real estate office, a supermarket, and a tanning salon. All three of these businesses were located along raised median projects in Ankeny and Clive.

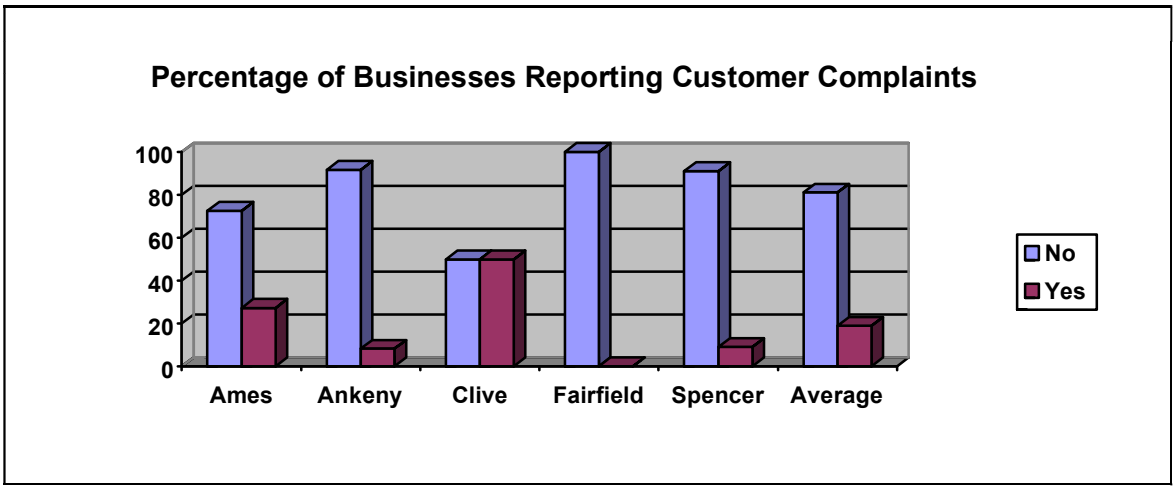
About 19 percent of businesses reported their customers complained or reported some difficulty in driving to their businesses after the completion of the access management project. The level of complaint varied significantly by case study, with the Ames and Clive projects being complained about most often. Over 80 percent of business owners reported no customer complaints about access to their businesses (see Table 11 and Figure 14).

Table 11: Reported Customer Complaints About Access to Businesses

Do Your Customers Complain?	Ames	Ankeny	Clive	Fairfield	Spencer	Average
No	72.7%	91.7%	50.0%	100.0%	91.0%	81.1%
Yes	27.3%	8.3%	50.0%	0.0%	9.0%	18.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Project	Two-way left turn lane	Raised median	Raised median	Driveway consolida-tion	Two-way left turn lane	All

The businesses that received complaints were concentrated in two communities—Ames and Clive (one two way left turn lane and one median project). Complaints were also concentrated by business type. Restaurants and automotive sales and service businesses were the business types most often reporting complaints. These are types of businesses that are especially sensitive to the ability of motorists to access them.

Figure 14: Businesses with Customer Complaints



3. Temporary Sales Impacts on Businesses During Construction

The Iowa study did not measure the temporary impacts of projects on businesses during construction. However, a 1996 study of twelve highway reconstruction projects in Indiana (Palmer, 1996) shows that the average loss of retail sales during a major construction project was 13 percent. Those businesses experiencing the biggest temporary losses were gas stations, grocery stores, consumer electronics stores, hardware stores, and automotive sales and service firms.

The Indiana study indicates that most businesses achieve a full recovery within two years, although 20 percent of businesses did experience a long-term negative impact on their sales. Mirroring the Iowa results, a majority of businesses actually reported they benefited from the project improvements. The majority also supported the projects as necessary. This was because traffic flowed better and access to their location was enhanced. Business types most likely to experience long-term negative effects were gas stations, car washes, and other automotive-related businesses. These findings appear to be along similar lines as those from Iowa.

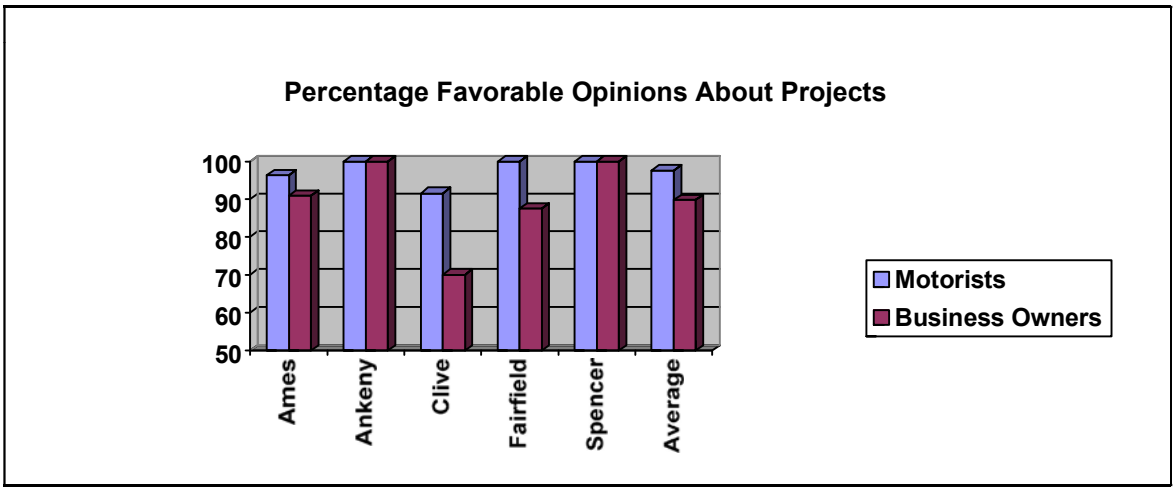
G. Motorist and Customer Opinions of Projects

For five of the case study projects, motorists were surveyed by the University of Northern Iowa to obtain their opinions about the projects. Nearly all motorists surveyed were aware that a roadway improvement had been made. (It must be noted here that for some communities, Ankeny, Clive, and Fairfield in particular, these results are based on a small sample of individuals). In all cases 90 to 100 percent of motorists surveyed had a favorable opinion of improvements made to roadways that involve access management. The vast majority of motorists agreed that improved roadways are safer, operate better, and are easier to drive on (see Table 12 and Figure 15).

Table 12: Respondents Expressing A Favorable Opinion About Projects (By Case Study)

Group Surveyed	Ames	Ankeny	Clive	Fairfield	Spencer	Average, All Cases
Motorists	96.3%	100.0%	91.6%	100.0%	100.0%	97.6%
Business Owners / Managers	90.9%	100.0%	70.0%	87.5%	100.0%	89.7%
Type of Project	Two-way left-turn lane	Raised median	Raised median	Driveway consolida-tion	Two-way left-turn lane	All

Figure 15: Favorable Motorist and Business Owner Opinions



Motorists always responded at least as favorably to projects as business owners and managers. In general, business owners are less enthusiastic about the projects than their customers. Further, rankings of support percentages are consistent across projects; the most controversial projects tend to be more controversial for both groups and the best-supported projects are well-supported by both groups. Those businesses indicating they were generally not supportive of the completed access management projects (6 out of 63 businesses surveyed, or 10 percent of the businesses responding) were located in three different communities and along three different types of projects. All six were different types of businesses.

H. Public Official Opinions of Projects

A cross-section of public officials in the five business vitality case study communities were interviewed to determine their opinion of the access management projects in their communities. Public officials interviewed included mayors, city council members, and school superintendents. (Several of the projects were located adjacent to or very near schools). Questions covered subjects including impact on business vitality, land use, traffic and pedestrian safety, and traffic operations. The results of these interviews were entirely positive. Most public officials interviewed also indicated that motorists had made positive comments to them about the projects.

I. Negative Findings and Caveats

Although the vast majority of findings in this study are positive there are some negative aspects or findings that should be cited to provide guidance for state and local transportation officials. For example, access management projects are very worthwhile from a safety and operational standpoint but can be difficult to implement because of the perceived impact on adjacent businesses. Some caveats from this research project are useful in providing a realistic and truthful marketing effort for access management improvements. These are:

- The safety analysis for the Iowa case studies indicates that access management projects are likely to be much more effective in reducing property damage accidents than in reducing accidents that are more serious and involve injuries. Still, the injury prevention potential of access management projects is significant.

- The operational impacts of access management projects can be lost to subsequent traffic increases. Traffic increases might be partly generated by the route becoming more attractive due to the project and partly generated by the area becoming a more attractive site for commercial development. Access management projects may delay but not prevent the need for long-term additions to capacity through such changes as bypasses for through traffic.

- A limited number of businesses should be expected to experience long-term sales declines when access management projects are implemented. The percentage might be estimated at up to 15 percent of the businesses in a project corridor, but this percentage may be lower than this or even zero depending on the project. More businesses may experience temporary sales declines, although most businesses will recover rather quickly.

- Some types of businesses will likely bear the brunt of customer complaints about difficulty of accessing their properties once projects are completed. These will tend to be businesses that depend heavily on highway access, such as fast food restaurants and automobile sales and service businesses.

- A minority of business owners and managers (up to 30 percent on some projects) will not be supportive of access management projects along their corridors even if the projects are clearly needed for traffic operations and safety reasons.

- Not all motorists will support access management projects, but the vast majority will. The percentage of non-support will probably be under 10 percent. Non-support will be higher for more complex projects (e.g. projects involving raised medians or continuous left turn lanes).

J. Preview: Phase III of the Project

Phase II of the Access Management Research and Awareness Project has demonstrated that access management is an effective tool for improving the safety and operations of Iowa's highway transportation system. It has also demonstrated that access management projects are generally not detrimental to local businesses.

The emphasis of Phase III of the project will be on translating the research results shown in this report into educational materials to help Iowa move forward on access management where appropriate. Some materials will be designed to raised awareness of access management and its benefits among stakeholder groups such as transportation professionals, local government decision-makers, businesspersons, urban planners, and land developers. Others will be designed to provide more in-depth education on access management concepts.

Phase III, to be completed by Summer 1998, will result in the production of a number of materials, including:

- A short videotape introduction to access management in Iowa.
- A number of printed brochures and manuals, some general an some technical in nature.
- Multimedia educational materials, including slide shows on access management benefits and concepts.
- A statewide conference on access management to be held in central Iowa in late spring 1998.
- An access management "tool kit" for local governments to help them get started in access management or continue an existing effort more effectively.
- An enhanced Iowa access management World Wide Web site providing most of the materials above in electronic form.

In addition, a full report on the Phase II research results will be published, including detailed documentation of all the case studies.

K. References

Palmer, James et. al. 1996. Effects of Road Reconstruction on Adjacent Economic Activity: A Retrospective Study. Transportation Research Center, Indiana University, Bloomington, Indiana.

II. Case Studies Documentation

A. Introduction

Phase II of the Access Management Research and Awareness Project involved much detailed research into the safety and traffic operational impacts of specific access management case studies within the state of Iowa. This undertaking consisted of detailed documentation on each of the case studies, as well as a study of the effect of controlling access on local businesses at the selected case study locations.

1. Selection Process

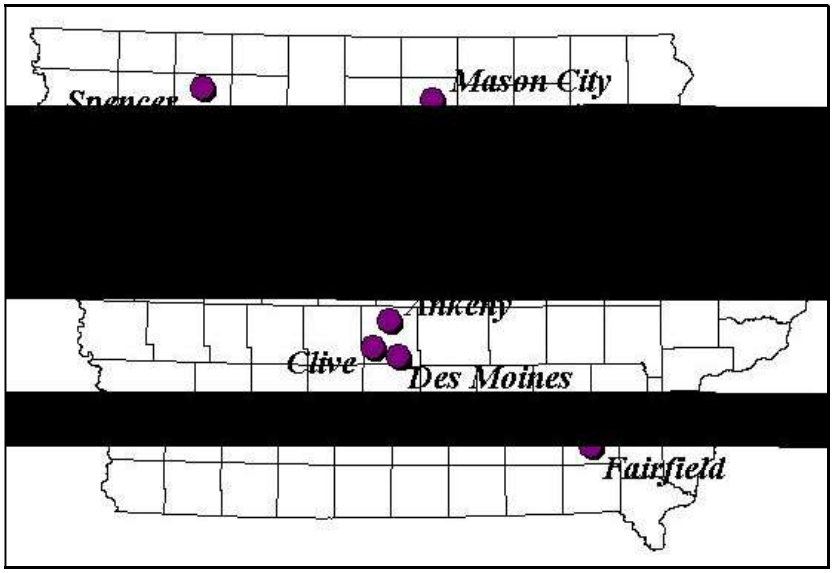
The research team was given the task of documenting the prevalent access management issues at these specific case study locations. These case study locations were selected to demonstrate the use of or lack of various access management techniques across the state of Iowa. These locations were selected by the Access Management Task Force based on two main criteria. The first criterion was the type of access management issues or access solutions illustrated at each location. A fair representation of the various access issues and techniques was needed to provide a thorough study. The second criterion was sufficient geographic diversity throughout the state of Iowa. The Access Management Task Force wished to study a variety of issues and solutions as well as a variety of locations and community sizes to represent the entire state.

The selection process first involved the nomination of specific locations for study throughout the state. Nominations were primarily solicited in two ways. First of all, direct mailings were sent to local and state transportation officials throughout Iowa. In addition to the mailings, a nomination form was made available on the Center for Transportation Research and Education's World Wide Web site. As a result, over 50 locations in Iowa were nominated as potential case studies through these two nomination processes. The case study locations documented in this report were selected from these nominations by members of the Access Management Task Force.

2. Case Study Types and Coverage

The Access Management Task Force identified four types of cases to be studied in Iowa. The first type of case study is the "full" case study. Seven full case study locations were chosen by the Task Force to receive intensive study in terms of safety and traffic operations (see Figure 16).

Figure 16: Full Case Studies



For the most part, these cases involved improvements made during roughly the last five years. The differing types of access improvements made at these seven locations varied from simple driveway consolidation to the full installation of medians and protected left turning bays. The complete documentation for these seven full case studies is located in section II of this report.

Five of these seven full case study locations were chosen to receive more intensive study into the impacts of their access management projects on local businesses. The five locations selected for this business study were Ames, Ankeny, Clive, Fairfield, and Spencer. Since all of these selected projects were completed within the past decade, area business owners and motorists were be able to make "before and after" comparisons of the business environment along the case study location. An analysis of the business environments and trends at these study locations was done as a separate report.

A second grouping of case studies were called "sidebar" case studies. Section C of this report gives documentation of these sidebar cases. These eleven additional sites were selected for study in less detail than the seven full case studies. These locations illustrate either good access management practices or current access management issues. The cases were chosen to provide additional diversity in terms of both access management issues and further geographic coverage across the state (see Figure 17).

Finally, Section IV contains documentation and preliminary information on two other noteworthy case study locations in the state of Iowa. These two locations, in Coralville and Council Bluffs, were selected as sites for gathering data which could be used in future "before and after" comparisons (see Figure 17). At these two "baseline" locations, access improvements were either in progress at the time of the access management research or too recently completed to allow for a thorough after analysis. Data collected at these locations will be valuable in future accident and traffic flow analyses.

Figure 17: Baseline and Sidebar Case Studies

The collection of these twenty case study locations has provided a wealth and variety of access management problems and solutions. They also provide a representative example of the diverse communities that have and will have to consider management of access as an important part of the planning of the community and its transportation system.

B. Full Case Studies

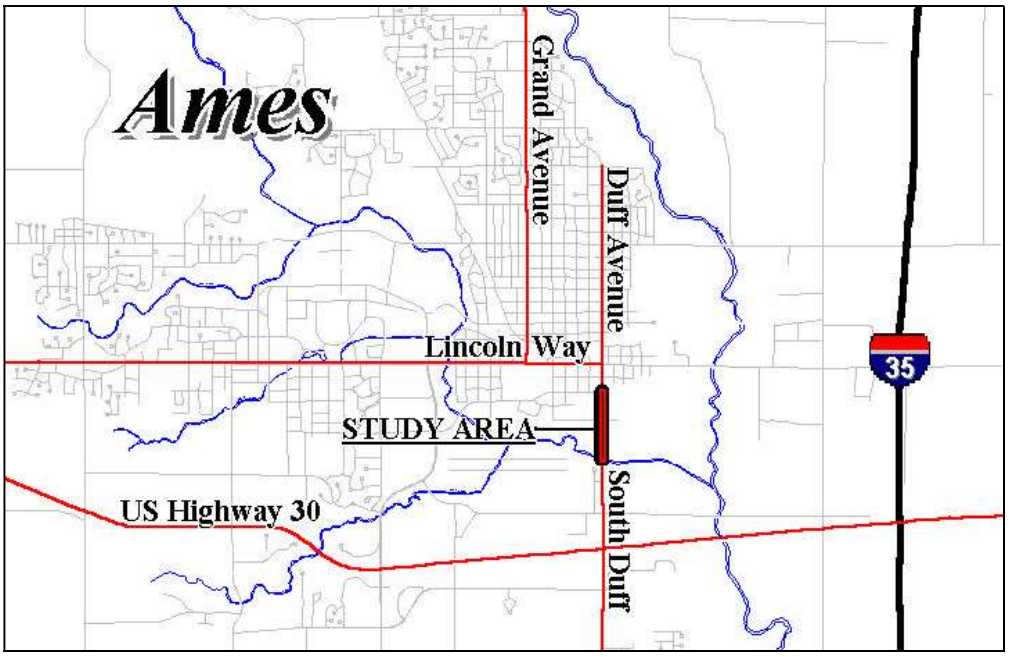
1. Ames Case Study
(Continuous Two-way Left-turn Lane)
US Highway 69 (South Duff Avenue)
from South 3rd Street to Squaw Creek

a. Background

The city of Ames is located near the center of the state of Iowa, about 30 miles north of state capital Des Moines. Ames is also conveniently located at the intersection of US Highway 30 and Interstate Highway 35. A city of almost 50,000 people, Ames is the home of Iowa State University and the Iowa Department of Transportation. Both of these institutions, along with its size and location, make Ames an important commercial transportation hub for the state of Iowa.

Study Area Duff Avenue is one of this city's major arterial streets, running nearly the entire length of Ames from north to south. South Duff Avenue is the more highly traveled section of this roadway. It is a part of US Highway 69 through the southern part of the city. South Duff begins at Lincoln Way on the north and carries US 69 southward past US Highway 30 out of the city (see Figure 18).

Figure 18: Ames Case Study Location



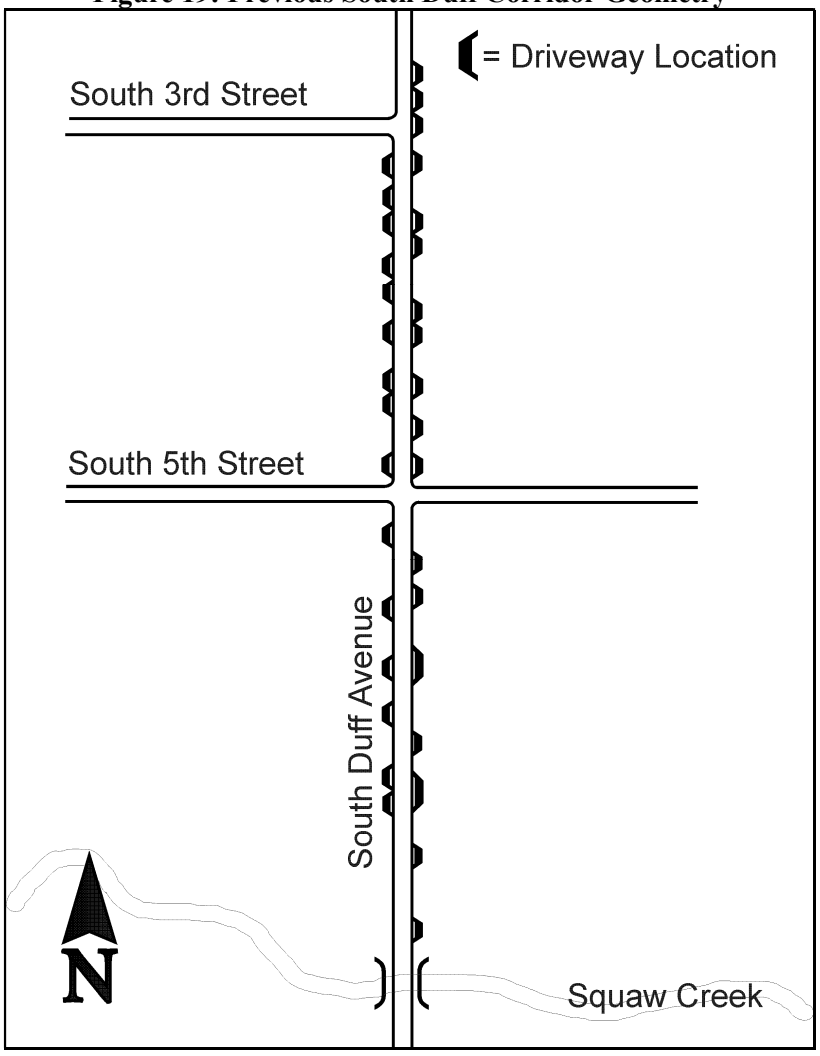
Although US Highway 69 is a national highway that runs through several states; only about 2 percent of the daily traffic on Grand Avenue, part of Lincoln Way, and South Duff (the route for US Highway 69 in Ames) is through traffic. Most of the volume of through traffic is carried by Interstate Highway 35, which runs parallel with US 69 two miles to the east. Fully 98 percent of the traffic that uses the US Highway 69 route in Ames has its origin and destination within the city itself. In addition, South Duff is the most heavily traveled portion of US 69 within the city. It serves as the main arterial access way to US Highway 30 for the eastern parts of Ames.

The area of focus for this case study is a section of South Duff Avenue from around South 3rd Street on the north to Squaw Creek on the south end. This case study area is approximately 0.5 miles in length, with the speed limit along this roadway section posted at 35 miles per hour. This portion of South Duff Avenue was originally reconstructed to a four-lane roadway in the mid 1960's. The vast majority of the US Highway 69 corridor was a 49 foot wide four-lane undivided limited access highway as of the early 1990's. This was also true for the South Duff study area.

Previous Corridor Environment For years, the South Duff area developed as one of Ames' major commercial business districts, with a variety of businesses locating along both the east and west sides of the roadway. Businesses that have traditionally located along South Duff include motels, recreational facilities, fast-food restaurants, convenience stores, service stations, small shopping centers and other commercial businesses.

Even with the large amount of commercial business activity existing along South Duff, access to this roadway was not sufficiently managed in the years prior to the early 1990's. As of 1992, there were 33 driveway access points along the study area. Of these, 15 driveways were along the west side of the roadway and 18 along the east side of the roadway (see Figure 19).

Figure 19: Previous South Duff Corridor Geometry



Furthermore, many of these commercial driveways were located close to the intersections at South 3rd and South 5th Streets. Driveways located too close to a busy intersection can cause traffic flow and access problems due to vehicle queues at the intersection. The problems associated with this type of configuration will be discussed further in the analysis section.

Traffic volumes along most of South Duff Avenue were between 20,000 and 21,000 vehicles per day in the early 1990's. The area around the South 5th Street intersection with South Duff had the highest AADT numbers along all of the US Highway 69 corridor in Ames. The case study area was near full development by the early 1990's, but the business area along South Duff south of Squaw Creek is still rapidly developing. These traffic volumes along South Duff were expected to increase as much as 50 percent along the southern sections of the US 69 corridor, due to abundant open space still available for future development. This expected development pointed to increased traffic volumes through the study area and on surrounding roadways.

b. Analysis

By the late 1980's and early 1990's, this study section of South Duff Avenue had become known for its safety problems. At this time, this stretch of roadway experienced numerous traffic accidents, many of which could be attributed to the lack of proper access management in prior years. As mentioned earlier, there were several commercial driveways along both the east and west sides of the South Duff Avenue study area. Many of these commercial driveways were located relatively close to the major intersections at South 3rd and South 5th Streets.

In July 1991, a corridor analysis was completed for the City of Ames and the Iowa Department of Transportation to look at many aspects concerning the entire US Highway 69 Corridor. The study was entitled the US 69 Traffic Corridor Analysis. The purpose of the analysis was to develop proposed transportation improvements that would provide safe, economical, and efficient travel along the US 69 Corridor in Ames. Furthermore, the study stated that these improvements should allow for a balance between traffic movement and access to adjacent property at an acceptable level. This report also provided information and suggestions on certain key transportation elements of the corridor. These elements would help the City of Ames and the Iowa DOT to make decisions concerning the feasibility and implementation of proposed transportation improvements.

Accident History The corridor analysis considered factors along the entire US 69 corridor, but many of the observations and suggestions concerned the South Duff area. Among other findings, this study determined that parts of South Duff Avenue had mid-block accident potential higher than the statewide average. The majority of the past accidents were the results of turning traffic into or out of businesses. The resulting access related accidents included left-turn, right angle, and rear end collisions. The study further found that many of these crashes could be eliminated with the addition of a center two-way left-turn lane along the study area. The study also found that the South Duff case study area had a higher intersection accident rate than the statewide average at its two major intersections. These intersections are at South 3rd and South 5th Streets. The majority of these intersection accidents were also left-turn, right angle, and rear end collisions. It also found that delays caused by turning vehicles waiting in the inside lane caused South Duff to operate more as if it were a two-lane roadway at these two intersections. It was suggested that separate protected left-turn lanes at these intersections would help to reduce accidents.

In addition, an accident analysis was done for the study area over a three-year period prior in the early 1990's. During the three year period from January 1990 to December 1992, there were 160 total reported accidents within the study area. The resulting accident rate was 712 accidents per hundred million vehicle miles (hmvm). This rate was significantly higher the statewide average of 562 accidents per hundred

million vehicle miles for that same time period. Of these accidents, a large percentage could be attributed to the lack of access control along South Duff Avenue. A large percentage of the accidents were broadside left-turn, rear end, and right angle collisions.

Traffic Flow and Congestion The US 69 Traffic Corridor Analysis also addressed the issues of traffic volumes and intersection capacity along the corridor, identifying possible increases or future volume and capacity problems. A few intersection locations in the analysis were found to have significant level of service (LOS) deficiencies. The level of service for signalized intersections is a measure of capacity and is defined in terms of average stopped delay in seconds per vehicle. Delay is also the measure of a driver's discomfort, frustration, and fuel consumption, as well as loss of travel time.

A LOS below "D" is an indication of a significant delay with poor progression and long cycle lengths. A level of service "D" describes operation with delay of between 15 to 40 seconds per vehicle. A level of service "F" describes operational delay in excess of 60 seconds per vehicle. This LOS rate, Level "F", is considered unacceptable to most drivers.

At the time of the corridor analysis, there were no intersections along South Duff where a level of service worse than LOS "D". Actually the level of service along most of South Duff was at LOS "C" in the early 1990's. However, it was noted that without improvements; the intersections along South Duff would experience eventual capacity problems as volumes increase to the projected levels for the coming years. As with mid-block and intersection accidents, separate left-turn lanes at the two major intersections were suggested to help reduce possible future capacity problems.

Access Improvement Process In 1992, the City of Ames began a formal process of applying for Iowa Department of Transportation Traffic Safety Improvement Program funds to reconstruct South Duff Avenue from near South 3rd Street to the bridge at Squaw Creek. The process of applying for this program involved the city hiring a consultant to prepare the application for this program. The application for a site specific project required several supporting documents, including a project narrative, itemized costs of the project, various maps of the proposed project area, and a time schedule for the proposed project.

The purpose of the narrative is to outline the project concept, assess existing conditions, and provide adequate transportation safety justification. To support this safety aspect, copies of accident reports from the previous 3 years are also included. The Iowa DOT assesses the need for the project based on the past accident rates as well as expected accident reduction as a measure of the project's benefit. A benefit/cost analysis was conducted using accidents correctable by the proposed improvements. A combined accident severity reduction of 40 percent for correctable accidents only was used along with a projected traffic growth of 1.4 percent per year to determine the benefit/cost ratio of such improvements. Subsequently, the proposed project was found to have a considerably high benefit/cost ratio of 3.08

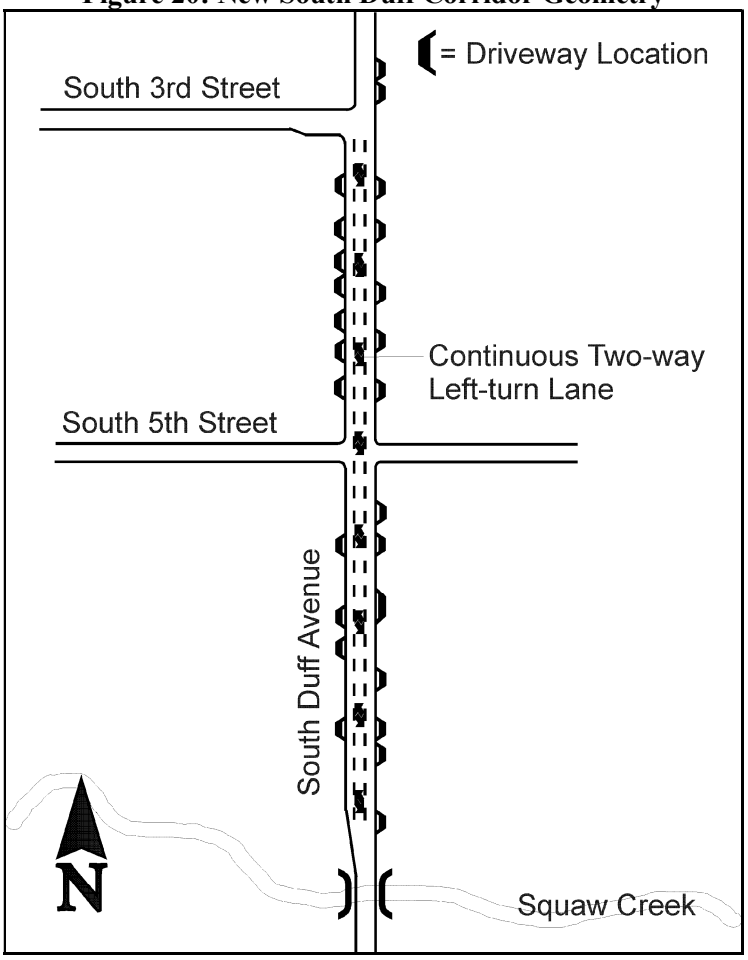
The access improvement project proposed by the City of Ames included the addition of a new two-way left-turn lane along the entire study corridor, driveway consolidations and closures at strategic locations, and signal upgrades at the South 5th Street and South 3rd Street intersections. Because of unusually high accident rates, lack of previous access management, and increasing traffic volumes; the proposed access changes were accepted by the Iowa DOT through the Traffic Safety Improvement Program. The program funded $500,000 of the $1.29 million total estimated project cost.

c. Results

In 1994, as a response to the aforementioned problems along South Duff, the Iowa DOT TSIP improvement project was undertaken to reconstruct this roadway section to a five-lane road with a center two-way left-turn lane. This reconstruction included, along with a two-way left-turn lane, some driveway consolidation and widening, channelization improvements to South 3rd Street, and signal upgrading at the South 3rd Street and South 5th Street intersections. The addition of a fifth lane was the largest portion of the project. To allow for the additional turning lane, a new 14 foot wide lane was added along the west side of South Duff. This addition widened the entire roadway from a 49 foot wide section to a 63 foot wide section throughout the study area. The additional center lane provided a two-way left-turn lane that would facilitate left turning traffic into local business locations. As mentioned earlier, this lane would help eliminate potential rear end accidents and help improve traffic flow by removing the turning vehicles from the other four lanes of through traffic.

In addition to the widening, several local commercial driveways were also closed or consolidated. This was done in order to protect intersection storage and to limit the number of access points along South Duff. Altogether, the project consolidated or closed 8 local business driveways, with 4 driveway access points eliminated from each side of the road. There are now a total of 25 driveways along the study area This was nearly a 25 percent reduction in the total number of driveways. Even more important than the number of driveways closed, the closures were in important or strategic locations. Some key driveway closures were made near the intersections of South 3rd Street and South 5th Street (see Figure 20).

Figure 20: New South Duff Corridor Geometry



In addition to the improvements made along South Duff, there were also important changes made along the two intersecting side streets. Along South 3rd Street, a right-turning lane was added along the south side of the street. Along the northwest side of South 5th Street, a driveway was installed a safe distance from the intersection to replace an access point closed along South Duff. Another driveway on the eastern side of South 5th Street was repositioned farther away from the intersection to allow access from South 5th and also allowing more storage at the corner traffic signal.

The other specific elements of the project were more minor modifications. Traffic signal modifications were made at the intersections of South 3rd Street and South 5th Street. The signals were replaced and upgraded to facilitate the new center turn lanes. A retaining wall near the South 3rd Street intersection and some minor sidewalk replacements were also done. The reconstruction of this facility was completed in early fall of 1994.

Accident Reduction Since the South Duff reconstruction project of 1994, very significant improvements have been seen in the area of overall traffic safety along the study corridor. In the 1995 calendar year, only 17 total accidents were reported between South 3rd Street and Squaw Creek. This is a very significant reduction from the average of about 53 accident per year before the project was undertaken. This is a reduction in accidents per year of about 70 percent. This new rate equates to only 213 accidents per hundred million vehicle miles, with an overall accident rate reduction of almost 500 accidents per hundred million vehicle miles.

In addition, specific reductions were made in accidents normally attributed to the access. There were only 4 reported rear-end accidents in all of 1995, and there were no broadside left-turning accidents reported. There were only 3 right angle accidents to report in 1995, though this reduction was smaller percentage than some of the other types of accidents (see Table 13).

Table 13: South Duff Accident Statistics

Accident Classification	1990-1992	1995
Collision type uncertain	49	1
Head-on	0	0
Broadside / Left-turn	35	0
Rear end	28	4
Rear end / Right-turn	0	1
Rear end / Left-turn	3	1
Side swipe / Opposite direction	1	0
Side swipe / Same direction	2	0
Sideswipe / Right-turn	3	0
Sideswipe / Left-turn	1	0
Sideswipe / Dual left-turn	0	0
Sideswipe / Dual right-turn	1	0
Right angle	15	3
Broadside / Right entering	0	1
Broadside / Left entering	2	0
Failure to yield from driveway	3	2
Sideswipe / Facing left-turns	1	0
Other / Single vehicle / Bicycle	16	4
Total Accidents	**160**	**17**

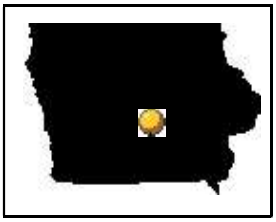
Improved Operation Traffic flow and congestion have also seen a considerable improvement since the reconstruction project. The Average Annual Daily Traffic along the study area has increased from 20,500 vehicles per day to almost 22,000 vehicles over the last 5 years. Even with this increase in traffic, the overall level of service for the South Duff study section has improved since the 1994 project. As a result, the level of service rating along South Duff has changed from a LOS "C" in the early 1990's to a current LOS of "B". The current configuration has been and should be better suited to handle the even greater increase in volume expected in years to come (see Figure 21).

Figure 21: South Duff Avenue Today

d. Conclusion

This successful access management project demonstrates the effectiveness of a continuous two-way left-turn lane as an access management tool. This type of improvement can be very effective in reducing traffic accidents resulting from turning activity in a commercial district. In addition, this project incorporated other techniques to improve the functional operation and safety of the study corridor. By reconfiguring driveways and providing other improvements, the corridor has seen a very significant reduction in accidents and congestion.

2. Ankeny Case Study
(Full Raised Medians with Left-turn Lanes)
US Highway 69 (North Ankeny Boulevard)
from 18th Street to 1st Street



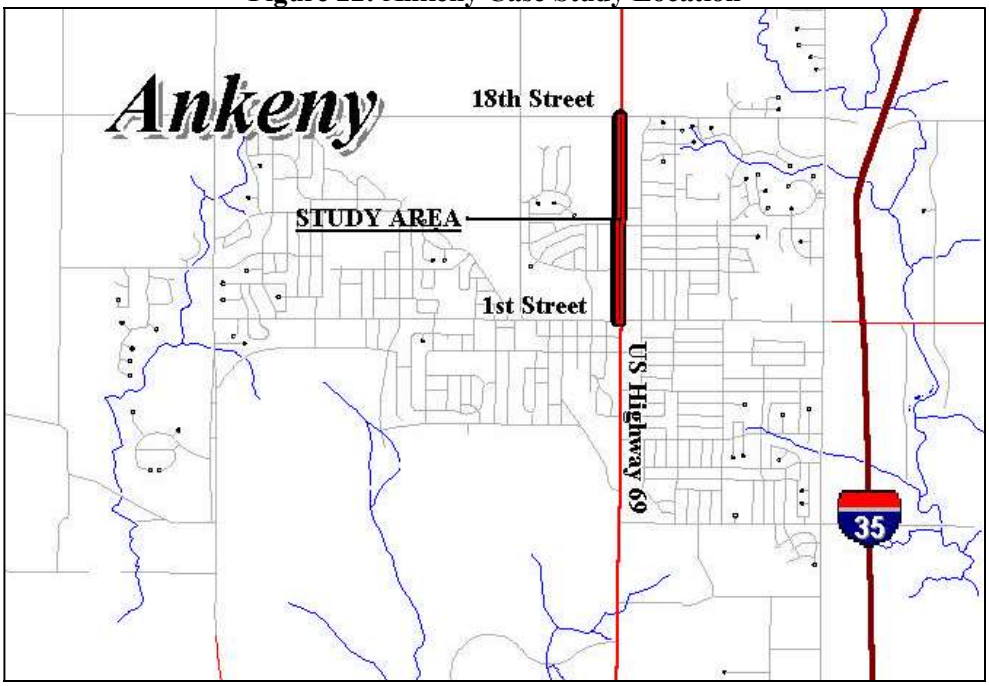
a. Background

Ankeny is a thriving city located just north of Des Moines, along Interstate Highway 35 and US Highway 69. Ankeny is a very rapidly growing suburban community. Its 1990 US Census population was about 21,500 people, but has grown considerably in the seven years since the census. In addition, Ankeny has historically been a major bedroom community of Des Moines, and is the major northern suburb of the state capital. Along with its growth in population, Ankeny has been very successful in recent years in expanding its economic base. In addition to the historically strong major employers of the area, like Casey's General Stores and John Deere Corporation, there has been a large industrial park expansion on the eastern side of town along Interstate 35. As a result, today Ankeny is one of the most prosperous and rapidly growing cities in the state of Iowa.

While Interstate 35 runs along the eastern edge of the City of Ankeny, US Highway 69 runs through the center of Ankeny from northern to southern city limits. Ankeny Boulevard, as it is known within the city, is a very heavily traveled section of roadway. It serves as a main north/south arterial of the city, and a major commuter route to and from the Des Moines metropolitan area's employment centers.

Study Area The area of focus for the case study is the northern section of US Highway 69, locally called North Ankeny Boulevard. This section is about 1.0 miles long and is located north of 1st Street. The study area runs north from this point to 18th Street at the northern city limits (see Figure 22). A busy roadway itself, 1st Street is the major east/west arterial through the heart of Ankeny and is the major access route to Interstate Highway 35.

Figure 22: Ankeny Case Study Location



The present route of North Ankeny Boulevard was originally constructed in 1921 as a 20 foot wide two-lane paved highway. The road has been re-paved several times, and was eventually paved at a width of 24 feet. It remained a two-lane undivided roadway into the early 1990's. The posted speed limits along this study area varied from south to north. The speed limit was posted as 35 miles per hour from 1st Street to just north of 5th Street, 45 mph from just north of 5th to just north of 11th, and 55 mph from just north of 11th Street to the northern city limits. In addition, A small section of the road just north of 1st Street was a divided four-lane with a left turn bay at this time. The remainder of the roadway remained a two-lane undivided road.

Previous Corridor Environment As of the early 1990's, North Ankeny Boulevard was developing into a mostly commercial shopping area. At that time, only about 40 percent to 45 percent of the commercial property adjacent to US Highway 69 had been or was being developed. Most of this development was concentrated toward the southern end of the study area. Some of the development located along the corridor at that time included service stations, grocery stores, office space, strip shopping malls, fast food restaurants, convenience stores, banks, and the local high school. Traffic along North Ankeny Boulevard was about 12,000 vehicles per day around the developed areas. These traffic volume levels were quite high for a two-lane roadway.

As of the early 1990's, access was not formally managed along this two-lane road. Somewhat random access was allowed directly onto US Highway 69 from almost all of the established businesses along North Ankeny Boulevard. At this time, there were several drives along the roadway. In September of 1989, a new YMCA facility was opened within the high school area north of 9th Street. Soon after, a new US Post Office building was opened just to the east of the high school, on the opposite side of North Ankeny Boulevard. For these and other reasons, additional turning and through traffic was expected around this area.

Due to rapid growth of the surrounding area, as well as the City of Ankeny as a whole; further development along the corridor was projected to increase significantly in the following years. Full development was expected as early as the late 1990's. This development was expected to remain almost exclusively non-residential along the study area. This type and amount of development meant more traffic and more commercial entities needing important access to US Highway 69 (see Figure 23).

Figure 23: North Ankeny Boulevard in the Early 1990's

b. Analysis

As predicted, commercial development exploded around the North Ankeny Boulevard corridor in the early to mid 1990's. Both the YMCA and US Post Office openings were cause for increased traffic volumes toward the north end of the corridor. Along with these generators, many more businesses have developed on the land on either side of North Ankeny Boulevard. Today, approximately 90 percent or more of the corridor is commercially developed. This number is still increasing. Most of that development has been concentrated toward the southern 50 to 75 percent of the North Ankeny Boulevard case study area.

Traffic Flow and Congestion As briefly mentioned previously, average daily traffic along North Ankeny Boulevard study area was about 12,000 vehicles in the late 1980's and early 1990's. As development increased, the two-lane roadway was no longer sufficient to handle the traffic volumes generated by the new commercial development. In addition, an AADT of 10,000 vehicles is generally considered the maximum capacity for a two-lane roadway. The problem of lane capacity and traffic flow needed to be addressed on US Highway 69.

An obvious solution to this problem was to widen the facility to four through lanes of traffic. In the early 1990's, most of North Ankeny Boulevard operated at a LOS "D" at most times and between a level of service "D" and LOS "F" in some places during peak hour traffic. These LOS ratings are considered highly unacceptable by most drivers.

Accidents Along with the large volumes of traffic and congestion along US Highway 69, came other problems. The area was beginning to experience a high number of accidents by the early 1990's. Many of these accidents could be attributed to the need for better access control along the commercial roadway. An accident analysis was completed for the study area for purposes of this report. This analysis focused on accidents over a three-year period from January 1989 to December 1991. This analysis found that there were a total of 112 reported accidents within the bounds of the study area. The corresponding accident rate for this number of accidents was 852 Accidents per hundred million vehicle miles. This rate was well above the statewide average. Of these 112 accidents, a large number were left-turn, rear end, and right angle accident types. These types of accidents are often highly attributed to lack of access control.

In addition, a separate study conducted by an independent consultant also found that many of the reported accidents along the study corridor were access related. The study predicted that this number of accidents could be reduced by about 35 percent with certain access related improvements being made along the corridor.

Access Improvement Process This independent study mentioned above was part of the City of Ankeny's efforts to receive Iowa DOT support and funding for improvements to North Ankeny Boulevard. The City of Ankeny followed a process very similar to that which the City of Ames followed to apply for Iowa DOT Traffic Safety Improvement Program funds. In mid 1990, the City of Ankeny formally applied for this funding. Total cost of the proposed improvement project between 1st Street to 18th Street was estimated at about $2.6 million.

These improvements, proposed by the city, included reconstruction of the current two-lane facility to a four-lane divided road and the installation of center medians with left-turning bays. New traffic signals were also proposed at two intersections in the study area. The medians with left-turn bays at strategic locations would provide control of left-turn access into and out of the businesses along the study corridor. Most of the safety benefits were to be derived just from the reconstruction from a two-lane to a four-lane facility. As mentioned earlier, a large percentage of the accidents along the corridor were rear end collisions. This type of problem is best remedied by more adequate turning lanes and better access control.

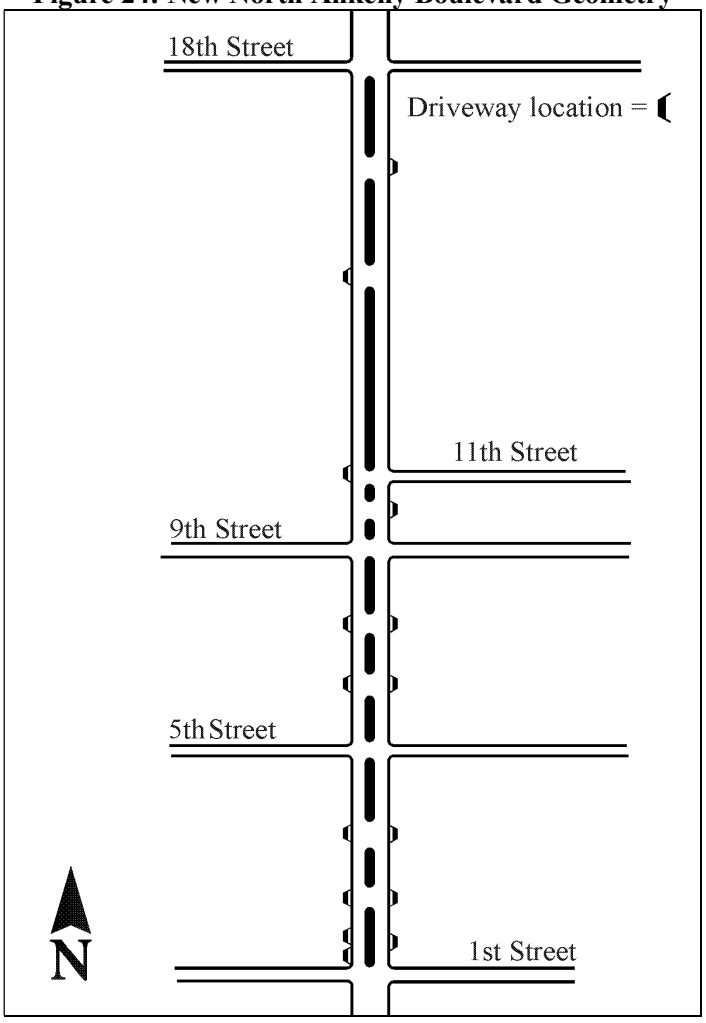
The high traffic volumes and traffic flow concerns were more of a consideration into the implementation of this project than in the Ames project.

c. *Results*

In fall of 1993, the proposed project was completed which reconstructed North Ankeny Boulevard from an undivided two-lane highway to a four-lane divided highway with protected left-turn bays. This reconstruction was done from just north of 1st Street to the 18th Street intersection. In addition to this construction, there were important consolidations and widening of business driveways on both sides of the case study roadway. The total cost of the improvement project was around 2.5 million dollars.

More specifically, the project widened the paved roadway from 24 feet to 65 feet. Right of way was taken on both the east and west sides of the roadway in order to complete this widening. A 15 foot wide median was added to divide the road for the entire length of the study area. Median openings with left-turn bays were left at the intersections of 5th, 9th, and 11th Streets. In addition to these openings, seven other median openings were distributed along the 1.0 mile length of the project (see Figure 24).

Figure 24: New North Ankeny Boulevard Geometry



Access to businesses along both sides of North Ankeny Boulevard is concentrated mostly at these specific points. There are now a greater total number of commercial driveways accessing the study corridor, but left turn access into and out of these businesses has been largely concentrated or eliminated. The new raised median has controlled much of this turning traffic.

In addition, the access project included minor improvements to some short existing frontage roads and the development of better direct access between adjacent businesses' parking lots. This eliminated the need for much of the turning traffic accessing North Ankeny Boulevard to other destinations along the study corridor. Today, the posted speed limit along the corridor is 35 miles per hour from 1st Street to just north of 11th Street. The speed limit is 45 miles per hour from that point north until 18th Street. This reduction in speed limits is also in direct response to the high rate of development along the corridor.

Accident Reduction Since the completion of the access project in 1993, there has been a very significant reduction in traffic accident rates within the study area. From January 1994 until December 1995, there were only 64 reported accidents along the North Ankeny Boulevard study area. Although this figures to a reduction of only 5 accidents per year, the traffic volumes along the corridor have increased considerably. These AADT traffic counts increased by over 4,000 vehicles per day on North Ankeny Boulevard from before to after the project was undertaken. As a result of these changes, the accident rate for the post-project period was 537 accidents per hmvm. This rate is a significant drop in the accident rate from before the access project to after, about 37 percent in that time period. As for reduction of specific types of accidents, there has been a drop in the types of accidents related to the previous lack of access management. The number of broadside, rear end, and right angle collisions have decreased since the project (see Table 14).

Table 14: North Ankeny Boulevard Accident Statistics

Accident Classification	1989-1991	1994-1995
Collision type uncertain	11	3
Head-on	0	0
Broadside / Left-turn	25	21
Rear end	38	16
Rear end / Right-turn	1	1
Rear end / Left-turn	2	1
Side swipe / Opposite direction	0	0
Side swipe / Same direction	0	0
Sideswipe / Right-turn	0	0
Sideswipe / Left-turn	1	0
Sideswipe / Dual left-turn	0	0
Sideswipe / Dual right-turn	0	0
Right angle	19	11
Broadside / Right entering	1	3
Broadside / Left entering	2	0
Failure to yield from driveway	1	3
Sideswipe / Facing left-turns	1	0
Other / Single vehicle / Bicycle	10	5
Total Accidents	**112**	**64**

Improved Operation In addition to the reduction in accidents, there has also been a marked improvement in the operational effectiveness of US Highway 69 through the study area. The traffic

volumes along the corridor have risen to over 16,000 vehicles per day since the completion of the project. At the same time, the traffic flow has improved along the corridor (see Figure 25). The corridor today is much less congested. After the 1993 improvements, the LOS for most of the study area was measured at a level of service "B". This is a considerable improvement over the LOS "D" ratings from before the access project.

Figure 25: North Ankeny Boulevard Today

d. Conclusion

This project demonstrates the effectiveness of using raised medians and protected left-turn bays to control access along a busy commercial roadway. Through access management techniques, such as raised medians and improved driveway alignment, very significant improvements can be made in the areas of congestion relief and safety.

3. Clive Case Study
(Full Raised Medians / Continuous Two-way Left-turn Lane)
Northwest 86th Street
from Franklin Avenue to Walnut Creek

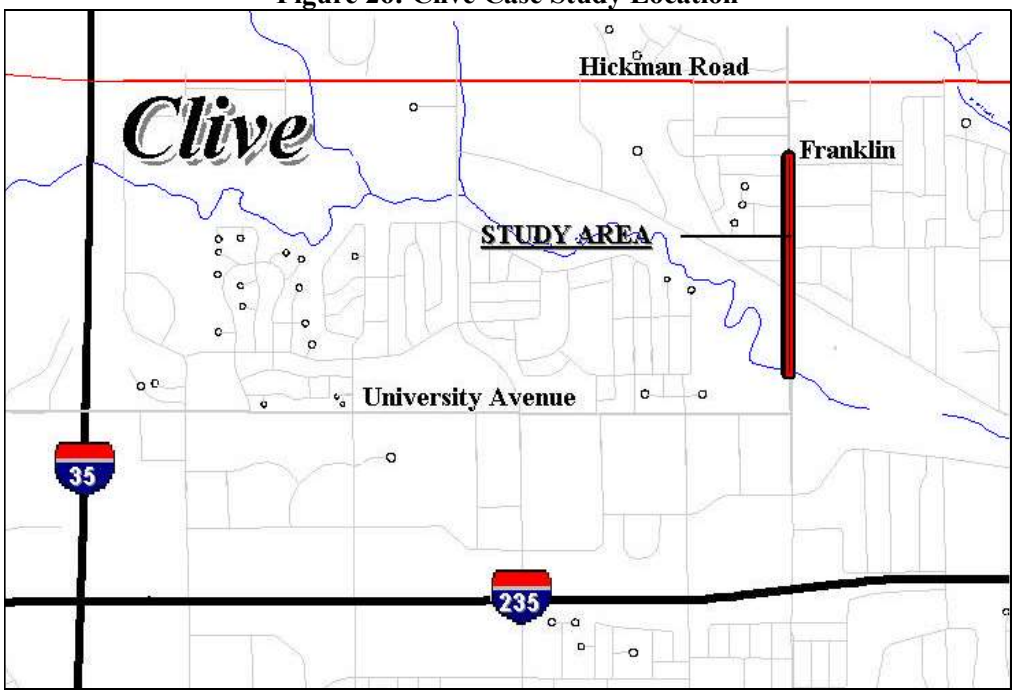
a. Background

Clive is a major Des Moines suburb of over 10,000 inhabitants located directly to the west of the capital city. Clive is a rather small city geographically and is almost completely landlocked between the suburbs of West Des Moines, Urbandale, Windsor Heights, and Waukee. Its location does, though, put the City of Clive directly in the middle of a large portion of the Des Moines metropolitan area's commuter population.

Northwest 86th Street is a major urban arterial that runs through the city form north to south. Northwest 86th extends to Interstate Highway 35/80 on the north end of the metro area and south to University Avenue at the very southern edge of the city at its border with West Des Moines. University Avenue is a major east/west arterial running the length of the metropolitan area itself. US Highway 6 runs east/west along the north edge of the City of Clive. Locally known as Hickman Road, US Highway 6 is also a major east/west arterial for the entire western metropolitan area.

Study Area The area of Northwest 86th Street the study focuses on begins at Franklin Avenue on the north and extends to the bridge at Walnut Creek on the southern end (see Figure 26).

Figure 26: Clive Case Study Location



The roadway in this area was a four-lane undivided arterial in 1990. At this time, the roadway was 49 feet wide. The study area is approximately 0.6 miles in length, and the speed limit along the study area corridor is posted at 30 miles per hour.

Previous Corridor Environment The Northwest 86th Street corridor has been a heavily traveled commuter route for several years. Traffic volumes in the late 1980's along this stretch of NW 86th were around 26,000 vehicles per day. This AADT number was expected to very likely increase as the western metropolitan suburbs continued to grow.

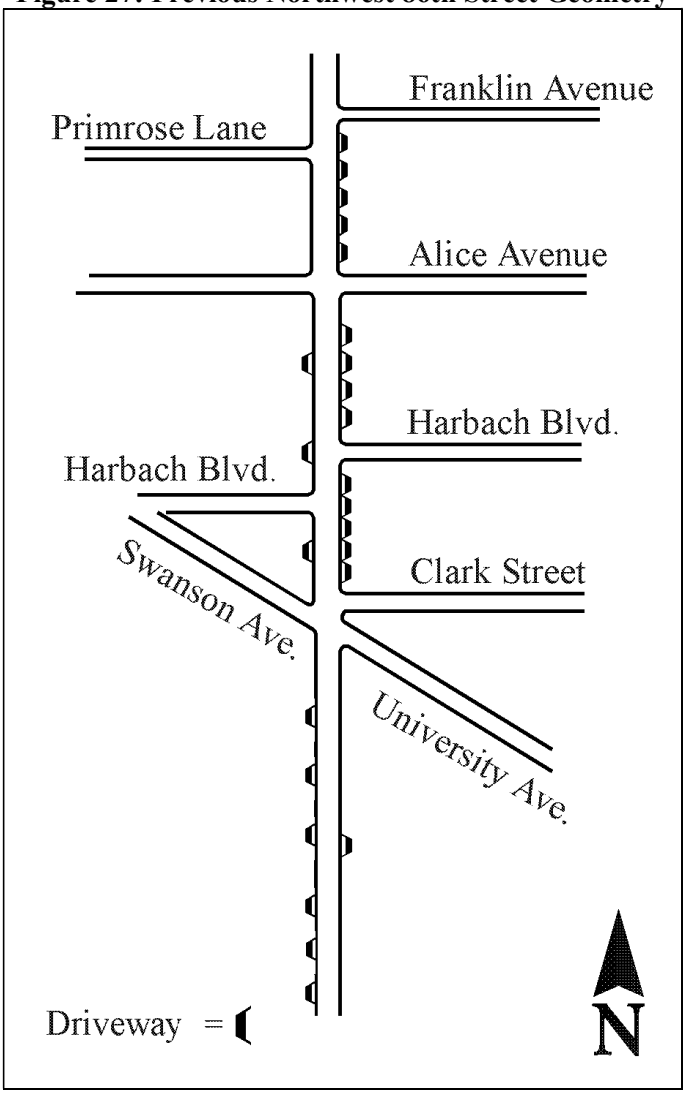
The land use makeup of this area is mostly commercial business activity. By the late 1980's, the area around the study corridor had been fully developed with commercial businesses, but there was some residential development on the north end of the corridor near Franklin Avenue. There is also a large area of industrial development at the southern end of the study area. The make-up of the commercial businesses included fast-food restaurants, gas stations, clothing stores, convenience stores, and other small businesses

In 1981, the traffic volumes along 86th Street between Hickman Road and University Avenue were approximately 19,000 vehicles per day. By 1984, just three years later, the volume increased to over 27,000 vehicles per day. At this time, there was considerable expansion by the western metropolitan suburbs, while 86th Street remained the only north/south arterial roadway in a four-mile wide corridor between Merle Hay Road to the east and Interstate 35/80 to the west.

To help alleviate some of this pressure, the cities of Clive, Urbandale, and West Des Moines applied for and received a RISE Grant for the construction of another north/south arterial. This roadway, Northwest 100th Street, would run from Hickman Road on the north to University Avenue on the south. This roadway was intended to help reduce traffic loading on Northwest 86th Street as the western suburbs continued to grow. Northwest 100th was opened to traffic in late 1988. By early 1989, the traffic volume on 86th Street had been reduced by about 2,000 vehicles per day from the 1984 volume. This new roadway, Northwest 100th Street, was also carrying about 13,000 vehicles per day at the beginning of the 1990's.

Access Problems With the high levels of commuter and business traffic and high density, the access around this study area was not sufficiently controlled prior to the early 1990's. As of 1990, there were numerous access points for the industrial, residential, and commercial properties along NW 86th Street. At that time, there were a total of 9 side street intersections and 23 access points along the stretch of the study area north of Swanson Boulevard. This is about one access or egress point every 88 feet. On the southern end of the study area, there are only seven drives along 86th Street. All but one of these entrances were on the west side of the roadway (see figure 27).

Figure 27: Previous Northwest 86th Street Geometry



b. Analysis

By the late 1980's, Northwest 86th Street had a long history of high accident rates and considerable traffic delays. Traffic volumes, along with the number of access points in the area, caused much of these problems for motorists.

Traffic Flow and Congestion While the 1990 AADT traffic volumes were about 26,000 vehicles per day, the local lack of access management was creating a level of service problem. Most of the study corridor at this time was functioning at a LOS of "D". At this level of service, delay for the drivers along NW 86th Street was becoming unacceptable.

The very busy commuter traffic along NW 86th Street, coupled with lack of proper access control, had now led to a need to significantly improve the traffic operations within the study area. There had also been, at this time, much concern by commuting motorists and businesses along this roadway for improvements to be made.

Accident History Along with this increase in traffic volumes and poor access management, there was resulting high accident rates along the study area corridor. An accident analysis was completed for the corridor, and found a high number of accidents related to the high traffic volume and lack of access management. From January 1988 to December 1990, there were a total of 206 total reported accidents between Franklin Avenue and the Walnut Creek bridge. The corresponding accident rate for this section of NW 86th was 723 accidents per hundred million vehicle miles. Of these 206 accidents, a large percentage were rear end, right angle, and left-turning accidents.

In addition, an earlier consultant study by found that approximately 69 percent of the accidents between Swanson Boulevard and Franklin Avenue were rear end collisions involving left turning vehicles waiting in the inside lane. The study also concluded that a significant reduction in accidents was feasible through proposed access improvements. These proposed improvements included a combination of a raised center median with left turn bays and continuous two-way left-turn lanes. Both would protect left-turning movements, and also provide sufficient storage for these left-turning vehicles while limiting some left-turn movement along portions of the busy commercial area.

Access Improvement Process This study was also included in the City of Clive's application for Iowa Department of Transportation TSIP funding. The city formally applied for this funding in the summer of 1989. The improvement process proposed by the City of Clive involved the same steps as the Ames and Ankeny projects. The proposed improvements included a combination of a raised center median with left-turn bays and continuous two-way left-turn lanes.

This proposed project area included the section of the study corridor from Franklin Avenue on the north to just north of Walnut Creek on the south. The project was later accepted by the Iowa DOT for funding. The pending access improvements were seen to provide sufficient storage for left-turning vehicles and therefore reduce exposure to rear end accidents. The elimination of access points would also reduce accident potential through elimination of some conflict points. The total project cost was estimated at almost $700,000.

c. Results

In the fall of 1991, the project was undertaken and completed to significantly reconstruct the study area corridor. As proposed, different access management techniques were used on different sections of the 0.6 mile section of Northwest 86th Street. First of all, the necessary widening was done on the west side of the roadway. The addition of this extra 16 feet of pavement allowed for the installation of a raised median from the Swanson Boulevard intersection to the Alice Avenue intersection. A fifth two-way left-turn lane was constructed from just north of Alice Avenue to Primrose Lane. A small section of median is located between Primrose Lane and the east leg of Franklin Avenue.

As the other half of the project, a continuous two-way left-turn lane was also constructed on the section of Northwest 86th south of the Swanson Boulevard intersection and the railroad tracks. This fifth turning lane extends from just south of the railroad tracks to the bridge at Walnut Creek. A median with left-turning bay was installed at the southern leg of the Swanson Boulevard intersection. This fifth lane serves the seven driveways along the southern leg of the study area. The two-way left-turn lane extends from this point for about 400 feet south. At this point, a median was installed. This median tapers off with the roadway into a four-lane undivided road, which then crosses the bridge at Walnut Creek. Along with the channelization along Northwest 86th Street; channelization was also completed along Swanson Boulevard, on the east and west sides of Northwest 86th Street.

In addition to the major geometrical improvements, there were a few other minor changes made to the study area. There were traffic signalization improvements made at four different intersections. The signals at Swanson Boulevard and Harbach Boulevard were completely replaced with a fully actuated system, while minor improvements were made at the intersections of Alice Avenue and Franklin Avenue. Today, Northwest 86th Street is a wider, safer, and better functioning arterial roadway (see Figure 28).

Figure 28: Northwest 86th Street Today

Accident Reduction As a result of the 1991 improvement project, the study area has seen tremendous improvements in the area of accident reduction. For the three-year period from 1992 to 1994, the study area experienced 128 total accidents between Franklin Avenue and Walnut Creek. This number is much lower than the 206 accidents between January 1988 and December 1990. The post-project corresponding accident rate for the corridor was 417 accidents per hundred million vehicle miles. This accident rate was obviously a significant reduction from the before project rate of 723 accidents per hundred million vehicle miles.

As expected, much of this accident reduction was in access related types of accidents. There were significant reductions in right angle, rear end, and broadside left-turn collisions. There were only 8 reported right angle accidents in the three years following the reconstruction of Northeast 86th Street (see Table 15).

Table 15: Northwest 86th Street Accident Statistics

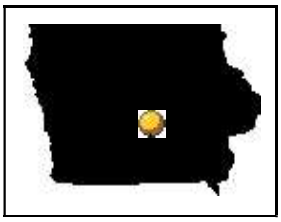
Accident Classification	1988-1990	1992-1994
Collision type uncertain	15	14
Head-on	1	0
Broadside / Left-turn	18	9
Rear end	95	68
Rear end / Right-turn	6	2
Rear end / Left-turn	1	1
Side swipe / Opposite direction	2	0
Side swipe / Same direction	3	0
Sideswipe / Right-turn	3	0
Sideswipe / Left-turn	6	1
Sideswipe / Dual left-turn	1	2
Sideswipe / Dual right-turn	1	0
Right angle	37	8
Broadside / Right entering	0	0
Broadside / Left entering	1	0
Failure to yield from driveway	0	5
Sideswipe / Facing left-turns	0	0
Other / Single vehicle / Bicycle	16	18
Total Accidents	**206**	**128**

Improved Operation Traffic flow and congestion have also been improved along the study area since the 1991 reconstruction of this arterial. After the completion of the project, the level of service for the study area improved from a LOS "D" to a level between LOS "B" and LOS "C". This improvement has come even with a traffic volume increase of almost 8 percent. This improvement can be largely attributed to the access improvements that have removed most left-turning vehicles from the four lanes of through traffic. This newer configuration has eliminated conflict points, as well as being better suited for the high traffic volumes in the area.

d. Conclusion

This project is an example of how access management can be successfully implemented with the use of a combination of access management techniques. Both the continuous two-way left-turn lanes and raised medians with turning bays provided increases in operational efficiency, while the medians provided control of much of the left-turning movements into and out of the area businesses. The result was a safer and more efficient roadway.

4. Des Moines Case Study
(Full Raised Medians)
US Highway 65/69 (SE 14th Street)
from Des Moines River to Indianola Avenue



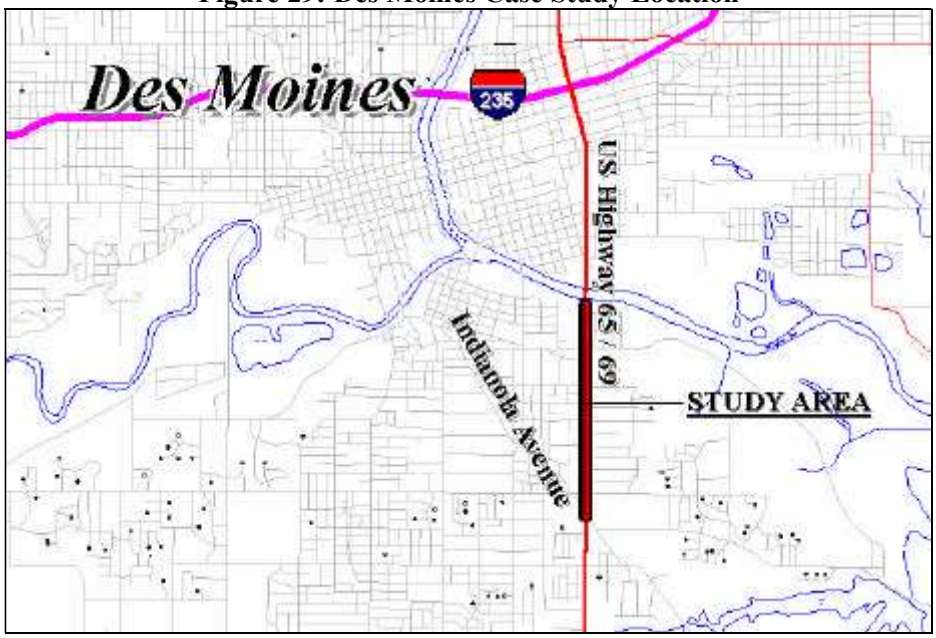
a. Background

Des Moines is the capital of the State of Iowa, and also its largest city. Des Moines is located about 30 miles south of the geographic center of the state at the intersection of Interstate 35 and Interstate 80. This city of almost 200,000 is about 200 miles north of Kansas City, Missouri and about 125 miles east of Omaha, Nebraska. In past years, Des Moines has become a business center for major insurance companies from all over the world. In addition, Des Moines is the home to many other corporations and manufacturers.

Its size and strategic location make Des Moines the most important transportation and commercial hub in the state of Iowa. Des Moines is also located along many other national highway routes. Two of these US Highways, US 65 and US 69, meet about fifteen miles south of Des Moines and travel through the city from south to north before separating again. The highways enter the city on its southeast corner and follow Southeast 14th Street north towards the downtown area. Southeast 14th Street is one of Des Moines busiest roadways. SE 14th was originally constructed in the early 1920's, and was mostly a four-lane undivided highway into the early 1980's.

Study Area The case study area of focus is a section of SE 14th Street between the Des Moines River and Indianola Avenue (see Figure 29). Indianola Avenue, itself, is a busy roadway. It serves as a major arterial access way from the south central part of Des Moines to the southeastern parts of the city and Polk County.

Figure 29: Des Moines Case Study Location



This study area section is about 1.5 miles long, with a posted speed limit of 40 miles per hour. The vast majority of this roadway was originally paved in 1938 to a width of 43 feet. The intersection with Indianola Avenue, at the southern end of the study area, was channelized with a median and turning bays in 1971.

Previous Corridor Environment Over the years, this area has developed as a mix of several different land uses. Residential, public, industrial, and commercial land uses can be found all along Southeast 14th Street. The largest portion of the development along the corridor has been commercial development. The types of commercial activity which have traditionally located along Southeast 14th include motels, fast food restaurants, taverns, convenience stores, service stations, furniture stores, grocery stores, and automobile sales lots. Amongst this commercial development is scattered the other land uses, including several private homes and some mobile home parks.

Access along this roadway section was very poorly controlled in the years leading up to the late 1970's. There were numerous driveways located along the study corridor by this time. Many of these driveways were located very close together as well (see Figure 30).

Figure 30: Driveways Along Southeast 14th Street

Traffic volumes along most of this portion of US Highway 65/69 were estimated at around 28,000 vehicles per day in the late 1970's. The intersection at Indianola Avenue was also one of the busiest traffic areas along US 65/69 at the time.

By the late 1970's, the case study area was already relatively highly developed. More development was rapidly approaching the southern end of US 65/69, around the Army Post Road intersection. Therefore, traffic volumes along the entire corridor were expected to increase dramatically in the coming years. It was estimated that volumes would reach around 33,000 vehicles per day by the early to mid 1980's. These numbers were projected to increase as development continued along the study area as well as towards the southern end of Southeast 14th Street.

b. Analysis

As of the late 1970's, Southeast 14th Street was already becoming a heavily traveled commuter thoroughfare. Nearly every one of the adjacent properties along US 65/69 had driveway access to the four-lane undivided roadway in the late 1970's and early 1980's. In addition, many of these driveways were spaced very close together and/or near intersections. The uncontrolled access and expected traffic volume increases spelled immediate and future operational trouble for those travelling through the study area. The numerous conflict points created by multiple driveways also presented a potential safety problem for the corridor.

Accident History Because of the poor access control and heavy traffic, safety was becoming a problem along Southeast 14th Street. There were high accident rates along the study area, as well as the southern section of the roadway, by the late 1970's. During the three-year period from January 1975 to December 1977, there was almost one accident per day along Southeast 14th Street. The total 3.4 mile length from Army Post Road to the Des Moines River experienced an average of 323 accidents each year. These numbers were actually slightly below the statewide average for 1977.

By 1978, the accident rate along this entire stretch was 972 accidents per hmvm. This increase was reflective of the steady increase in traffic congestion and development in the area. In addition, the northern end of Southeast 14th Street, which includes the study area, was the more developed part of the overall US Highway 65/69 corridor. For this reason, it could be assumed that a larger percentage of the driveway access problems and resulting accident occurrences were within this study area.

Traffic Flow and Congestion The operational characteristics of the study area were a greater concern in the late 1970's. The numerous driveway access points created a great number of conflict points that hindered traffic flow along the corridor. As in Ames and Clive, delays caused by left-turning vehicles waiting in the inside lanes of traffic caused severe operational problems. These turning vehicles caused Southeast 14th Street to operate often as if it were a two-lane roadway at many points.

By the late 1970's, much of the US 65/69 Corridor was experiencing a level of service around "D". Level of Service "D" generally describes vehicle operation with delay between 15 and 40 seconds. With the expected development and increases in traffic, this LOS could get worse over time if no access improvements were made. A series of medians, that would eliminate left-turning traffic, was seen as the best alternative to increase traffic flow.

Access Improvement Process The decision to make changes to the US 65/69 corridor was a complicated process involving the City of Des Moines and the Iowa Department of Transportation. This proposed project came many years before the Traffic Safety Improvement Program. The project became a very controversial subject in the capital city, but the raised median installation was decided to be very necessary to the functioning and safety of the corridor. By the early 1980's, the process was under way to reconstruct Southeast 14th Street with a center raised median. The impetuous to carryout these access changes were steered more by the future development and traffic flow than by safety, though safety was still a major concern.

c. Results

In the mid 1980's the ambitious project to reconstruct a large portion of Southeast 14th Street was finally undertaken. The project goal was the installation of the proposed raised median down the entire length of Southeast 14th Street. The overall project area actually extended from Army Post Road to the Des Moines River. The project was completed in two steps. The first phase of the median installation project was completed in late 1984. This project included the two-mile section of Southeast 14th street from Army Post Road to Park Avenue. Park Avenue intersects Southeast 14th just north of Indianola Avenue. As mentioned before, the southern part of this project was much less developed than the northern part at the time of the median installation. This part of the project cost $4.4 million

The second part of the project was completed a year later, in 1985. This project continued the median installation from Park Avenue north to the Des Moines River. The reconstruction of this one-mile section cost around $2.8 million. The whole project itself involved widening of the roadway to accommodate the median. Breaks were left in the median at certain locations to allow for left-turning access at intersections and some driveway locations. Outside of the widening and median construction, the project did not include much else in terms of access control. Few, if any, driveways were closed or relocated along the study area (see Figure 31).

Figure 31: Southeast 14th Street Today

Today, the development on the southern parts of Southeast 14th Street has also grown considerably. This area is a major commercial area for Des Moines and attracts business from the southern half of Des Moines, Indianola, and much of southeast Polk County. Areas along the whole corridor are spotted with a variety of land uses. Within the study area development has continued, and Southeast 14th Street remains a busy arterial for the surrounding area. With the raised median in place, left-turns along the corridor have been limited, and considerable benefits have resulted.

Improved Operation Since the installation of the median, left turning movements along US 65/69 have been reduced greatly. As a result traffic congestion and overall corridor safety have both been improved considerably. After the project, the level of service along the corridor was between a LOS "B" and "C". This level of service is very good for this type of arterial roadway, and a significant improvement from the LOS "D" from before the access project.

Daily traffic volumes have continued to increase along the corridor as expected. By the early 1990's, the traffic volumes along US 65/69 had increased to well over 30,000 vehicles per day at times. Even with this increased amount of traffic, the roadway functions much better than it would have functioned without the median installation.

Accident Statistics After the reconstruction project was completed, there was also a significant reduction in accident rates along the corridor. Over the time period January 1986 to December 1988, there were 279 total accidents on US highway 65/69 between Indianola Avenue and the Des Moines River (see Table 16).

Table 16: Southeast 14th Street Accident Statistics

Accident Classification	1986-1988
Collision type uncertain	40
Head-on	1
Broadside / Left-turn	28
Rear end	80
Rear end / Right-turn	4
Rear end / Left-turn	1
Side swipe / Opposite direction	3
Side swipe / Same direction	7
Sideswipe / Right-turn	11
Sideswipe / Left-turn	8
Sideswipe / Dual left-turn	0
Sideswipe / Dual right-turn	0
Right angle	50
Broadside / Right entering	0
Broadside / Left entering	4
Failure to yield from driveway	0
Sideswipe / Facing left-turns	1
Other / Single vehicle / Bicycle	41
Total Accidents	**279**

The corresponding accident rate is 485 accidents per hundred million vehicle miles. This rate is much lower than the accident rates from before the median installation of the mid 1980's. This rate is about one half that of the accident rate from before the improvements. This rate was, as mentioned earlier, for the entire Southeast 14th Street corridor from the Des Moines River to Army Post Road.

d. Conclusion

This access management project demonstrates the effectiveness of installing a raised center median to control left-turn access and consequently improve traffic flow along a major primary roadway with high traffic volumes. This type of improvement, along with improving traffic flow, can be very effective in terms of safety as well. By eliminating conflict points, medians can reduce the potential for some types of traffic accidents.

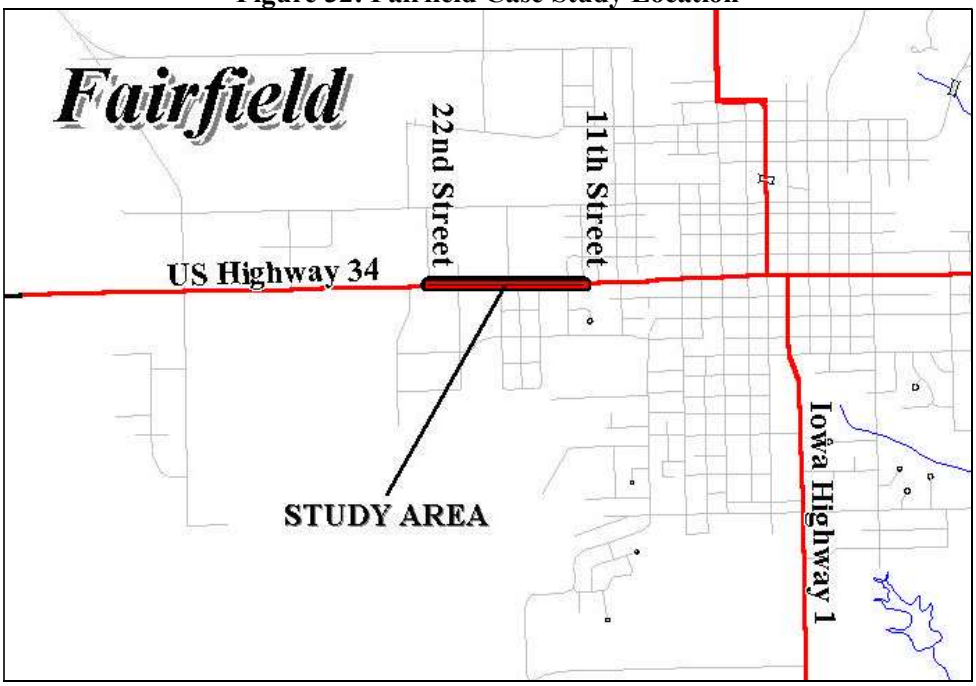
5. Fairfield Case Study
(Driveway Consolidation)
US Highway 34 (West Burlington Avenue)
from 22nd Street to 11th Street

a. Background

The city of Fairfield is a diverse community of about 10,000 people located in southeastern Iowa, about 50 miles west of the Mississippi and about 100 miles southeast of Des Moines. It also serves as the county seat of Jefferson County. Fairfield is the home of a variety of businesses and industries, with a number of high-technology companies among them. It is also the location of Maharishi International University of Management. Fairfield lies along US Highway 34, and is located where this highway meets Iowa Highway 1. US Highway 34 is a national highway that runs through many smaller towns in southern Iowa. Locally, US 34 is known as Burlington Avenue. West Burlington Avenue carries much of the east/west local traffic on the western side of Fairfield.

Study Area The study area along US Highway 34, or West Burlington Avenue, is a 0.6 mile section on the western side of Fairfield. The study area runs from 22nd Street on the western end to 11th Street on the eastern end (see Figure 32).

Figure 32: Fairfield Case Study Location



The posted speed limit along the study area is 35 miles per hour. US Highway 34 in this study area is a 49 foot wide four-lane undivided roadway. There is highly dense development adjacent to the highway throughout the western half of the city. This area along West Burlington Avenue has developed over time as a mixture of some residential land use, but mostly commercial businesses. The commercial businesses within the study area include recreation facilities, service stations, motels, grocery stores, hardware and

equipment dealers, discount and convenience stores, and restaurants. Because the area is a major shopping area for Fairfield, the traffic and turning movements in this area can be heavy at times.

Previous Corridor Environment With this large amount of activity, access to businesses is important. Unfortunately, though, access to the roadway was not sufficiently managed in the years prior to the early 1990's. As of 1990, there were approximately 30 driveways accessing US Highway 34 on both sides of the study area. This number of driveways equals about one drive every 100 feet. This large number of driveways results in a high number of conflict points, resulting in more places for potential accidents. As in Ames, many of these driveways were located very close to intersections.

This driveway situation can obviously cause traffic flow and safety problems at these intersections. Along this study area, the traffic volumes in 1990 ranged from about 11,000 vehicles per day on the western edge to almost 17,000 vehicles per day at the eastern end. The volumes in this area were not expected to change dramatically in the coming years. The roadway was functioning at about a level of service "B" in the early 1990's.

b. Analysis

Coupled with the relatively heavy traffic volumes, the numerous access points along West Burlington Avenue / US Highway 34 created concern for safety and possible operational problems in this area. This access management problem was considered the root cause for unusually high accident rates along sections of the study area.

Accidents Accident rates along West Burlington were noticeably high at certain locations in the late 1980's and early 1990's. An accident analysis of the study area from January 1988 to December 1990 shows that there were 105 total accidents between 22nd Street and 11th Street. Of these accidents, almost 30 percent were rear end collisions. The next highest accident numbers were for left-turning and right angle incidents. These accidents, as mentioned in other case studies, can be highly attributed to improper access control. The number and locations of the many business driveways along US 34 were most likely causing a safety problem.

A solution to these high accident rates was sought by local officials in the early 1990's. There were many aspects considered in the redesigning of this roadway and in the general relief of accident potential. In 1989, a transportation study was also completed to address these issues. The study addressed existing conditions and made some general preliminary recommendations. This study was called the Highway 34 Traffic Study.

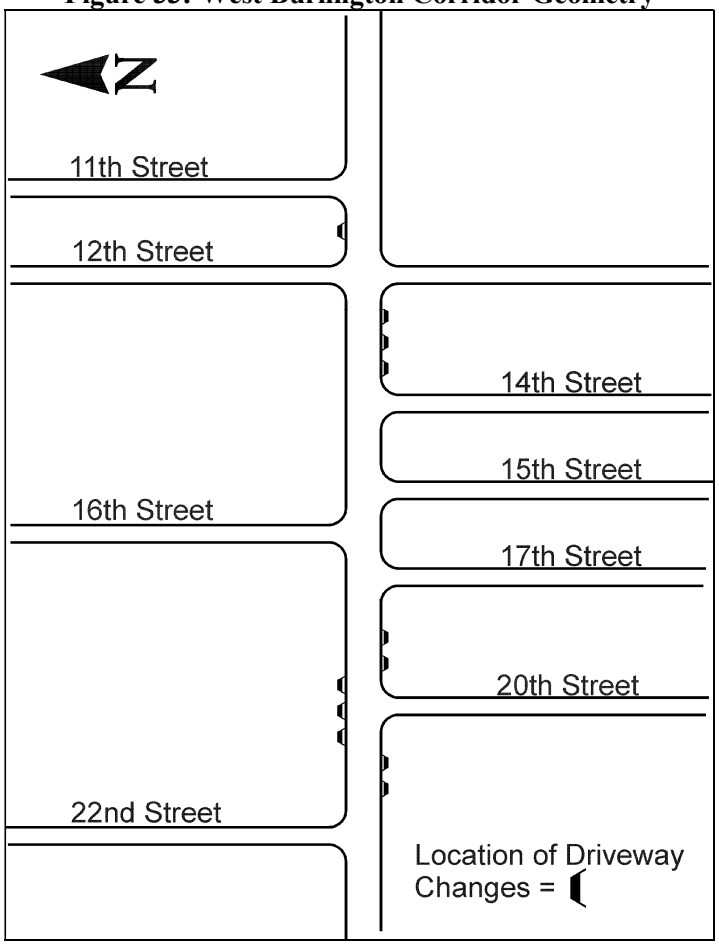
Access Improvement Process The eventual proposed solution involved three main parts. First of all, parallel streets to the north and south of West Burlington Avenue needed to be developed. This would be done to alleviate local traffic along US 34. Secondly, traffic signals needed to be installed at the intersections of 12th Street and 20th Street to improve traffic operations at and around these intersections. The final part of the proposed project involved limiting and relocating access along the study area. Some driveway closures were considered necessary along US Highway 34 in order reduce the number of turning movements and conflict points. Along with these driveway closures, alternative access would have to be provided for those businesses that lost driveway access along the study corridor.

In 1990, the City of Fairfield began the process of applying for Iowa DOT Traffic Safety Improvement Program funds. The City of Fairfield's proposed improvements, mentioned earlier, was a rather small-scale project compared to many of the other TSIP projects. The process that the City of Fairfield followed was, once again, similar to that followed in Ames, Clive, and Ankeny.

c. Results

In 1992, an improvement project was undertaken to consolidate selected commercial driveways along West Burlington Avenue and provide alternate access from side streets. As another important part of the improvement project, new traffic signals were installed at the intersections of 12th Street and 20th Street. In all, the project closed or consolidated 8 local driveways along the study area (see Figure 33).

Figure 33: West Burlington Corridor Geometry



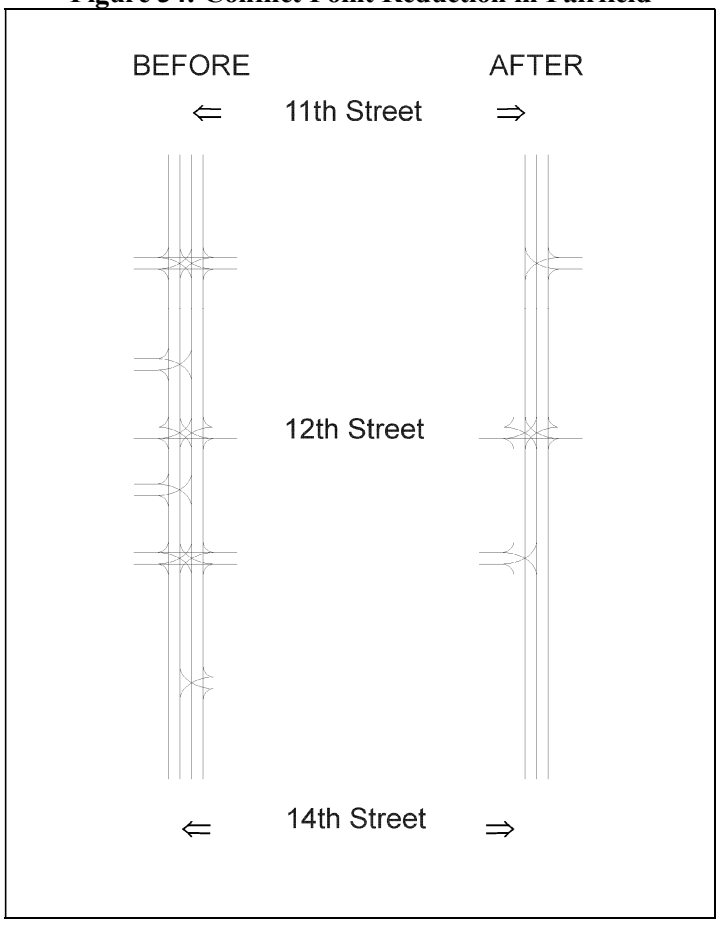
Driveways were closed for Hy-Vee, Wal-Mart, Pamida, Easter Foods, Movies America, Sears, Orscheln Home Center, and Pizza Hut. The total project cost was about $425,000. It was completed in the late fall of 1992.

In conjunction with these driveway closures, side streets along the study area were developed to provide alternative access locations for the businesses that lost direct access to US Highway 34. Sections of 12th Street, 14th Street, and 20th Street were paved to provide the alternative access. 12th Avenue was paved between Jefferson and US 34, and also from US 34 north 190 feet. This provided access for Easter Foods and Pamida on the south and Movies America on the south. In addition, 20th Street was widened south of US 34 to allow for access to Wal-Mart and Hy-Vee. 20th Street was also extended north to serve Sears and Orscheln. The third access involved paving a portion of 14th Street to south to the new Pizza Hut main driveway.

Along with the driveway closures, the other proposed improvement actions were done as well. Grimes Avenue, which is a parallel road running 4 blocks north of US 34, was paved previous to the project completion. In addition, Jefferson Avenue, a parallel street to the south was paved in late 1990. Both of these roadways reduced traffic and congestion on Burlington Avenue. These improvements were made apart from the TSIP funded access management project along US Highway 34.

The combination of all of these different improvements had a significant effect on accident reduction. This can be attributed to a reduction in the total number of conflict points within the limits of the study area. At the intersection of West Burlington Avenue and 12th Street, there was a considerable reduction in the total number of conflicts due to driveway closings (see Figure 34). In the areas where driveways were closed, there was a 20 to 60 percent reduction in total conflict points. This can have a tremendous effect on safety along such a busy commercial corridor.

Figure 34: Conflict Point Reduction in Fairfield



Improved Operation Traffic volumes along US 34 did eventually decrease, and traffic functioning along the study area remained at a level of service "B" after the project was completed. The traffic decrease was about 1000 vehicles per day since the project was completed in 1992. This traffic reduction can be attributed, in part, to the development of the parallel routes to the north and south of Burlington Avenue. After the project, AADT numbers were just below 16,000 vehicles per day. Today, traffic volumes are about the same as well. These volumes remain made up of local commercial traffic, as well as some through traffic (see Figure 35).

Figure 35: West Burlington Avenue Today

Accident Reduction Accidents along the area were reduced significantly as a result of the access changes made in 1992. In the time period from January 1993 to December 1995, there were a total of only 66 accidents within the West Burlington Avenue study area (see Table 17).

Table 17: West Burlington Avenue Accident Statistics

Accident Classification	1988-1990	1993-1995
Collision type uncertain	5	4
Head-on	1	0
Broadside / Left-turn	8	8
Rear end	29	8
Rear end / Right-turn	1	5
Rear end / Left-turn	9	10
Side swipe / Opposite direction	3	0
Side swipe / Same direction	2	0
Sideswipe / Right-turn	4	3
Sideswipe / Left-turn	1	0
Sideswipe / Dual left-turn	0	0
Sideswipe / Dual right-turn	1	0
Right angle	14	9
Broadside / Right entering	2	1
Broadside / Left entering	2	2
Failure to yield from driveway	2	6
Sideswipe / Facing left-turns	0	0
Other / Single vehicle / Bicycle	21	10
Total Accidents	**105**	**66**

The corresponding accident rate for this number is 381 accidents per hundred million vehicle miles. This accident rate went down over 38 percent from before the project in 1992. The most pronounced reductions in the types of accidents were in those types of accidents identified previously as highly access related. The overall reduction in number of accidents was about 37 percent from before to after the driveway consolidation project. The overall accident rate is adjusted for the reduction in traffic volumes.

d. Conclusion

This project demonstrates the effective use of driveway consolidation and closures in order to reduce conflict points in a busy commercial area. By reducing conflict points in this way, very significant improvements can be made in the area of safety. Benefits can also be seen in the area of congestion and traffic flow.

6. Mason City Case Study
(Raised Medians at Intersection)
US Highway 18 (4th Street Southwest)
at Pierce Avenue

a. Background

The northern Iowa community of Mason City is located about 120 miles north of Des Moines near Interstate Highway 35. Located just east of the interstate, Mason City is an industrial city of about 30,000 people. It is also located less than 25 miles from the Minnesota border. Mason City serves as the county seat of Cerro Gordo County, with the center of the city located near the intersection of US Highways 18 and 65. In addition, the future location of the Avenue of the Saints corridor will meet up with Interstate 35 just south of the city.

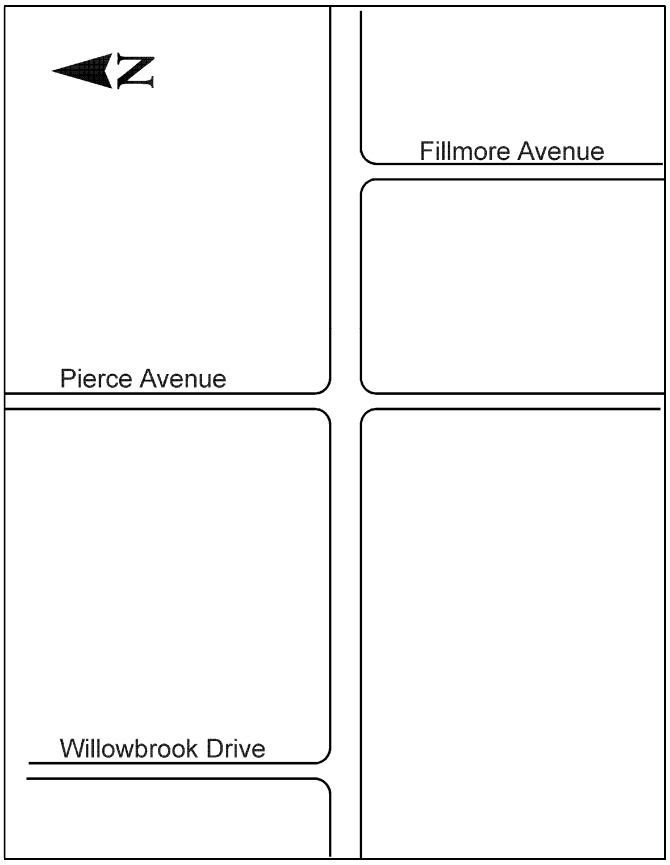
This future interstate corridor, the city's industrial activity, and the other major highway facilities make Mason City an important commercial hub for the northern region of the state of Iowa. US Highway 18 runs through Mason City from east to west and serves as a major arterial through the city. Locally, US Highway 18 is known as 4th Street Southwest. Although US Highway 18 is a national highway, the vast majority of traffic along has its origin and destinations within Mason City.

Study Area The area of focus for this case study is at the intersection of US Highway 18 and Pierce Avenue on the western side of Mason City (see Figure 36).

Figure 36: Mason City Case Study Location

The study area consists of a 0.17 mile long section of roadway from Willowbrook Drive on the west end to Fillmore Avenue on the east. The posted speed limit at this intersection is 35 miles per hour. This section of US Highway 18 was constructed in 1962 as a 49 foot wide four-lane undivided highway. US Highway 18, in this area, is functionally classified as a freeway/expressway. Pierce Avenue has a roadway width of 41 feet. Both north and south legs of Pierce Avenue have two turning lanes at this intersection (see Figure 37).

Figure 37: Previous 4th Street and Pierce Avenue Intersection Geometry



Previous Corridor Environment By the late 1980's, the area around this intersection was a mix of commercial and residential land uses. There were gas stations located at both the southeast and southwest corners of the intersection with several other retail business developments to the south and west. The residential homes are located on the northeast corner of the study area. A few of these houses had driveway access to 4th Street Southwest as of the early 1990's.

For many reasons, this intersection became one of the busiest in all of Mason City. Traffic estimates from the late 1980's saw heavy volumes of traffic at the intersection. Traffic on US 18 was around 9,100 vehicles per day in the westbound direction and 9,500 vehicle eastbound. On Pierce Avenue volumes were about 2,700 vehicles per day south bound and 2,400 vehicles northbound. In addition to this traffic volume, the city was planning an extension of Pierce Avenue to the south. This extension would provide access to the city's industrial park area. Once this future connection was made, turning movements at the study area intersection of Pierce and US 18 would increase significantly.

b. Analysis

The commercial access and heavy traffic volumes in this area were beginning to cause problems for the motorists in the area around this intersection. Much of this problem was due to the large amount of turning traffic in the area.

Accidents and Operations By the late 1980's the intersection at US Highway 18 and Pierce Avenue was experiencing high accident rates. Turning traffic was the major reason for these high accident numbers. The intersection had become one of the state's top 100 Improvement Candidate Locations. The intersection ranked number 75 on that list. For purposes of this case study, an accident analysis was done for this stretch of US Highway 18. During the three-year period from January 1988 to December 1990, there were 98 reported accidents at this intersection. The corresponding accident rate for the intersection was 470 accidents per hundred million vehicle miles.

As for traffic operations, the roadway section was functioning at a level of service "B" in terms of driver delay time. The potential increase in traffic volumes due to the proposed Pierce Avenue extension, was a possible problem for the future. Increased volumes and turning movements could result in longer delay times and lower level of service.

Access Improvement Process The City of Mason City was becoming concerned with the safety hazard this intersection was creating. The city decided to propose improvements to the access at this intersection as a result. When applying for funding through the Iowa Department of Transportation Traffic Safety Improvement Program, there was an accident analysis done for this area. During the five year period from January 1983 to December 1987, there were 79 reported accidents at the intersection. The corresponding accident rate for the intersection was 1.82 accidents per million entering vehicles (MEV). This number was more than twice the statewide average of 0.9 accidents per million entering vehicles. 48 percent of these accidents were caused by failure of a left turning vehicle to yield to oncoming traffic.

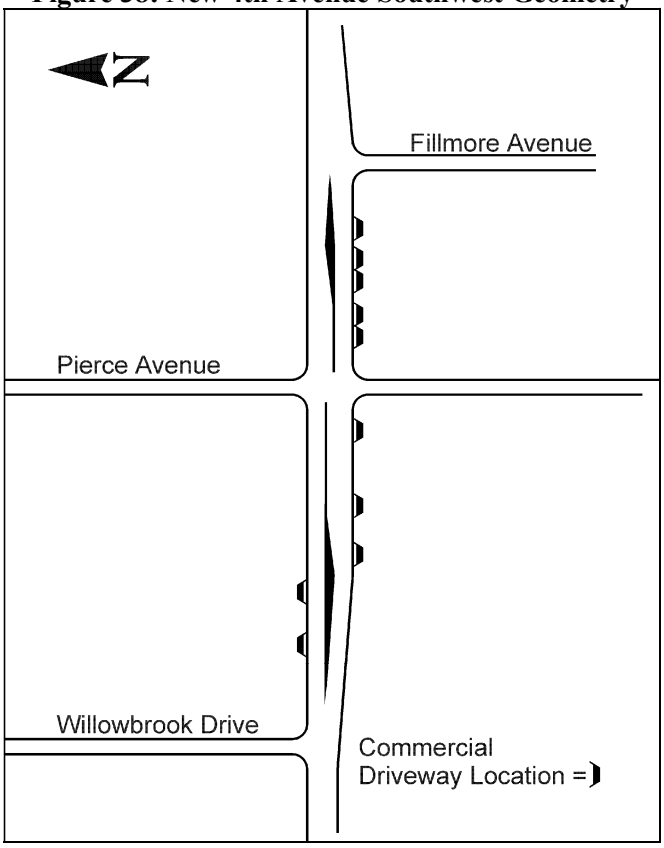
It was estimated that a 50 percent reduction in accidents could be realized if there were specific improvements made at this intersection. What was specifically proposed was a widening of US 18 around this intersection. This widening would allow for protected left turning lanes at the east and west approaches to Pierce Avenue. The proposed project was found to have a benefit/cost ratio of 1.87. The proposed improvements were expected to provide a cost-effective means for reducing accidents at this intersection. The objective of such an access management project would be to reduce total accidents, accident severity, and total dollar losses from such accidents. The proposed project was eventually accepted by the Iowa DOT as a Hazard Elimination Site.

c. Results

In the summer of 1991, in response to the high accident rates, a project was completed to reconstruct the intersection at Pierce and US Highway 18. The project included the widening of US 18 / 4th Street Southwest at Pierce, signal upgrades at this intersection, minor commercial driveway consolidations, and minor modifications to the Pierce Avenue approach.

Specifically, the project widened US Highway 18 from about 500 feet west of the Pierce Avenue intersection to 500 feet east of the intersection. Additional lane space was added to US 18 on both sides of the roadway. A center median was installed on both east and west legs of US 18 from Willowbrook Drive to Fillmore Avenue (see Figure 38). Left turn bays were included on each leg of US 18 at Pierce.

Figure 38: New 4th Avenue Southwest Geometry



In addition to the median, two driveways were closed along US Highway 18. On the northeast corner of the intersection there remains some residential development. These houses do have a few driveway accesses, but the movement to and from these driveways is minimal. The left turn bays at the intersection protected the high number of left turning vehicles from rear end collisions and oncoming vehicles. This reduced accident potential and improved traffic flow in the other four through lanes of traffic. The median also eliminated a small number of left-turning movements along US 18. These turns could also create delay and potential accidents.

Operations and Accident Reduction before the 1991 project, as mentioned earlier, traffic operations were rated at a level of service "B" along the study corridor. The major problem was the turning traffic and accident potential at the Pierce Avenue intersection. After the project was completed, the level of service in the area remained at a level of service "B". An LOS "B" is considered a good operating flow for this type of roadway.

The project at US 18 and Pierce Avenue also reduced the total number of conflict points and accidents within the study area. For the period from January 1992 to December 1994, there were a total of 71 reported accidents along this stretch of US Highway 18. This reduction in accidents came even though traffic volumes rose almost 16 percent at the intersection. The corresponding accident rate for this time period after reconstruction is only 290 accidents per hundred million vehicle miles. The accident rate before the access project was 470 accidents per hundred million vehicle miles. This was a reduction in the accident rate of almost 40 percent. The reduction in specific types of accidents is rather difficult to determine. This is due to the high number of accidents that were coded as "uncertain" (see table 18).

Table 18: 4th Street Southwest Accident Statistics

Accident Classification	1988-1990	1992-1994
Collision type uncertain	62	28
Head-on	1	0
Broadside / Left-turn	16	21
Rear end	13	12
Rear end / Right-turn	0	0
Rear end / Left-turn	1	0
Side swipe / Opposite direction	1	0
Side swipe / Same direction	0	0
Sideswipe / Right-turn	0	0
Sideswipe / Left-turn	1	1
Sideswipe / Dual left-turn	0	0
Sideswipe / Dual right-turn	0	0
Right angle	2	3
Broadside / Right entering	0	1
Broadside / Left entering	0	0
Failure to yield from driveway	0	0
Sideswipe / Facing left-turns	0	0
Other / Single vehicle / Bicycle	1	5
Total Accidents	**98**	**71**

d. Conclusion

This project demonstrates the use of protected left-turn lanes and raised medians to reduce conflict and accident potential. The project also maintained functionality at such a heavily traveled intersection. Today, the intersection functions smoothly, as well as more safely (see Figure 39).

Figure 39: 4th Street Southwest Today

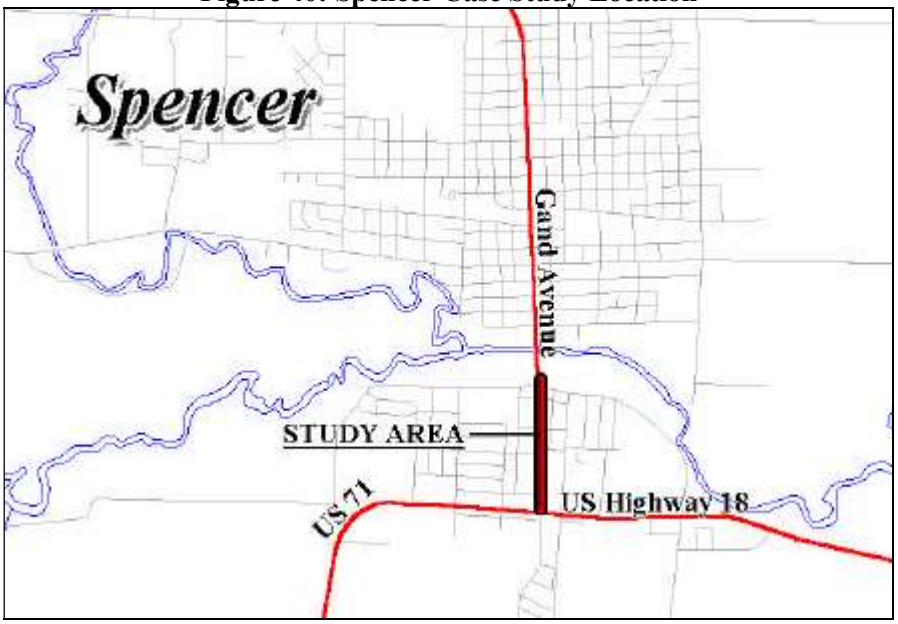
7. Spencer Case Study
(Continuous Two-way Left-turn Lane)
US Highway 18/71 (South Grand Avenue)
from Little Sioux River to South US 18/71 Junction

a. Background

The City of Spencer is located near the northwest corner of the state, about 180 miles from Des Moines. Spencer is also the county seat of Clay County, and has a population of about 11,000 people. It is located at the intersection of two US Highways. US Highways 18 and 71 both run through the City of Spencer. Both US 18 and US 71 meet near the southern end of the city. From this southern junction, they both follow Grand Avenue north through the center of town. Grand Avenue is the main north/south arterial roadway through the city. Grand Avenue receives a lot of through traffic from the two major highways carrying people between western parts of the state and the Iowa Great Lakes area. But, the roadway also sees a large amount of local traffic from within Spencer.

Study Area The study area along the US 18/71 route is locally known as South Grand Avenue. The study area runs from the Little Sioux River on the north end to the previously mentioned southern junction of US Highway 18 and US 71 (see Figure 40). The study area is approximately 0.6 miles in length and has a posted speed limit of 35 miles per hour.

Figure 40: Spencer Case Study Location



Previous Corridor Environment The land use along this corridor is quite highly developed with commercial business activity. This area is the southern half of the city's business district. Land use along the study area is almost entirely commercial, with one apartment complex on the west side of the roadway. The businesses located along South Grand included service stations, fast food restaurants, auto parts supply stores, automobile dealerships, motels, and convenience stores.

b. Analysis

During the years prior to the early 1990's, access management along the South Grand corridor study area was almost non-existent. Of the one-mile of adjacent property along both sides of US Highway 18/71, approximately 90 percent of the right-of-way was not formally controlled by any set driveway structure. The corridor was essentially like a large parking lot in many ways. Most of the property had complete access to the roadway at almost all points. With the heavy commercial business traffic in the study area and unlimited access almost everywhere along it, congestion and safety were becoming strong concerns of local motorists and business owners in the Spencer area.

Traffic and Accident History As of the early 1990's, heavy traffic along South Grand Avenue and the lack of access management accounted for high accident rates in the study area. During a three-year period, between January 1988 and December 1990, there were a total of 69 reported traffic accidents along the study area. This was a corresponding accident rate of about 430 accidents per hundred million vehicle miles. Of these 69 accidents, a large number were right angle, left-turn, or rear end accidents. As mentioned in previous case studies, these types of accidents are often attributed to improper access management along such a commercial corridor.

Traffic volumes along South Grand Avenue in 1990 were almost 15,000 vehicles per day. At this same time, the level of service was actually relatively good. There was stable traffic flow along South Grand Avenue. The LOS was approximately a level "B" in the study corridor.

Access Improvement Process This high number of accidents along with the uncontrolled access were the major factors in the city's decision to propose reconstruction of the roadway with a fifth lane for left-turning vehicles, a continuous two-way left-turn lane. This lane would be very similar to the project completed two years later in Ames.

In addition, there were plans to formalize the adjacent driveway accesses. As mentioned earlier, there was very little formal definition to the drives along the corridor. The city applied for funding from the Iowa DOT TSIP in early 1991. The project was accepted and was estimated to cost about $1.1 million.

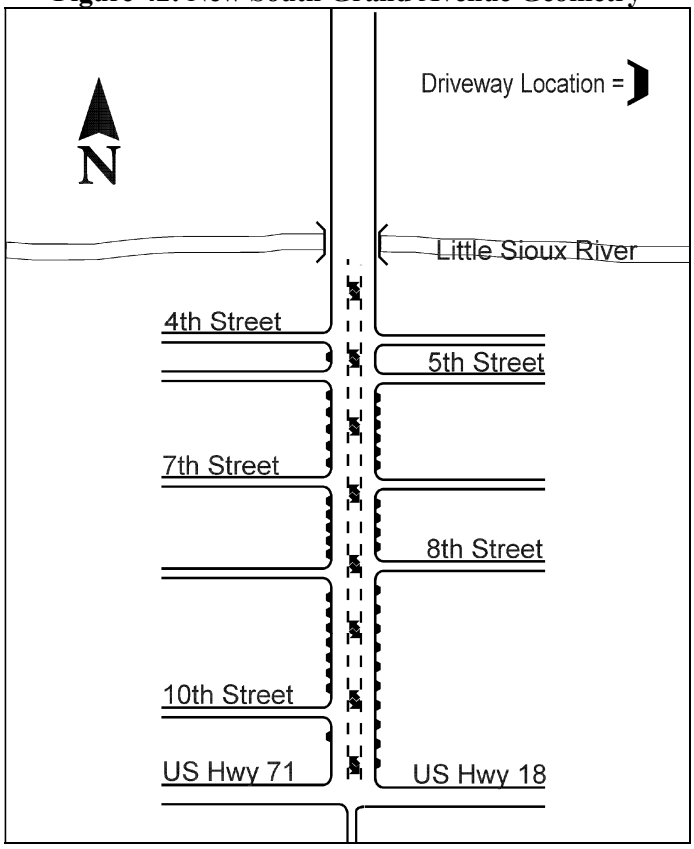
c. Results

An access management project was eventually undertaken, and construction was completed in the summer of 1992. The construction of this new facility included, first of all, the addition of a new center continuous two-way left-turn lane. In order to accomplish this, right of way was taken from both east and west sides of the roadway. In addition, numerous driveways were formalized along both sides of the US 18/71 study corridor (see Figure 41).

Figure 41: South Grand Avenue Driveway Access

As a result, there are now approximately 20 formalized driveways located along both sides of the case study corridor (see Figure 42).

Figure 42: New South Grand Avenue Geometry



Accident Reduction As a result of this project, the overall accident rate along South Grand Avenue have been reduced, but not by the margins seen in other case studies. Actually, the total number of accidents went up in the post-project study period. From January 1993 until December 1995, there were a total of 75 accidents along South Grand Avenue, resulting in an accident rate of 390 accidents per hundred million vehicle miles. At the same time, the traffic volumes in the study area went up to almost 18,000 vehicles per day. The accident rates, compared with the accident rates from before the project show a 13 percent reduction in total accidents.

When looking at the accident types, reductions were not made in the areas where access management usually reduces accidents. This fact is difficult to explain without further investigation. Broadside left-turning accidents were reduced by half from before the project. Right angle accidents were doubled after the project's completion (see Table 19).

Table 19: South Grand Avenue Accident Statistics

Accident Classification	1988-1990	1993-1995
Collision type uncertain	5	4
Head-on	1	1
Broadside / Left-turn	14	6
Rear end	18	17
Rear end / Right-turn	0	1
Rear end / Left-turn	1	3
Side swipe / Opposite direction	0	0
Side swipe / Same direction	7	0
Sideswipe / Right-turn	1	1
Sideswipe / Left-turn	1	0
Sideswipe / Dual left-turn	0	0
Sideswipe / Dual right-turn	0	1
Right angle	10	20
Broadside / Right entering	0	1
Broadside / Left entering	2	0
Failure to yield from driveway	0	2
Sideswipe / Facing left-turns	0	0
Other / Single vehicle / Bicycle	9	18
Total Accidents	**69**	**75**

Traffic Operation In addition to the small accident rate reduction, operations along the corridor remained fairly smooth. While the traffic volumes were increased, the level of service along South Grand remained at a LOS of "B". This level is considered smooth flow of traffic, and is acceptable for this type of roadway.

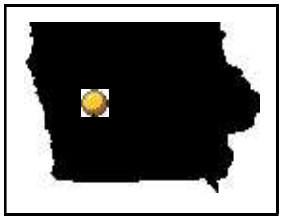
d. Conclusion

This project demonstrates the effectiveness limiting access points along a major commercial business area, and the successful use of a two-way left-turn lane to prevent left-turning accidents. Today, the corridor has a much more formalized driveway structure. The new continuos turning lane allows for more protected left-turning movements (see Figure 43).

Figure 43: South Grand Avenue Today

C. Sidebar Case Studies

1. Carroll Case Study
(Future Access Problems / Excessive Driveway Access)
US Highway 30
From Grant Road to County Road N-33



a. Background

The city of Carroll is located in the west-central part of Iowa, about 75 miles northwest of state capital Des Moines. Carroll is also located at the intersection of US Highway 30 and US Highway 71. The city serves as county seat of Carroll County and has a population of approximately 10,000 people.

US Highway 30 is a national highway that runs through several states, and was originally constructed in 1930 through Carroll. US Highway 30 is one of this city's major arterial routes, running through Carroll from east to west. US 30 is a major national highway, but most of the volume of east-west interstate through traffic is carried by Interstate Highway 80. In western Iowa, Interstate 80 runs parallel with US 30 approximately 35 miles to the south. US Highway 30 does serve as a main route for some intrastate east-west traffic through west-central Iowa. This stretch of US Highway 30 had a reported 1996 AADT of 8,100 vehicles in the area east of Carroll.

Study Area The study area includes approximately 2 miles of US highway 30 on the eastern side of the city. The study area runs from Grant Road on the eastern edge of town to County Road N-33 (see Figure 44).

Figure 44: Carroll Case Study Location

In 1996, this area of the highway was expanded to a four-lane facility due to high traffic volumes. This two-mile stretch of US Highway 30 currently has a speed limit of between 35 and 55 miles per hour.

Corridor Environment The development adjacent to this roadway is a mix of commercial, light industrial land uses. Existing businesses along this corridor include a restaurant, a golf course, two factories, a radio station, and several smaller businesses. There is also new construction, including a grocery store and a warehouse distribution center, located along the case study area. Currently, approximately two-thirds of the frontage adjacent to this corridor is occupied with buildings, so there is room for additional development. This development, along with through traffic, is responsible for a majority of the traffic volumes.

b. Analysis

Currently, there is a proposed US Highway 30 bypass around Carroll to the north of the city. This proposed re-routing would eventually bypass this particular stretch of US Highway 30. If this bypass does develop, a share of traffic volume on this corridor would be reduced to lower volumes. The local traffic would still use the study area though. Future development, which is encouraged, would continue to increase traffic.

Access in this area has been rather liberally allowed during most of the newer development. Access control for this project area was initially designed for a minimum driveway access every 1000 feet. However, as business and industry developed, the access control requirements were reduced to a minimum driveway access of only 300 feet (see figure 45). The main reason for this change was as an effort to attract this new development.

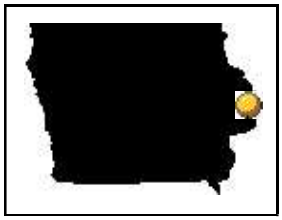
Figure 45: US Highway 30 in Carroll

Some frontage roads do exist near the west end of the corridor, but the majority of the accesses have no frontage, signals, or turning lanes. As more businesses develop and traffic exposure increases on this corridor, the level of service could be expected to drop and accident frequency could possibly increase. Potentially, this could create the need for retrofitting with future access management treatments.

c. Conclusion

This case study is an example of lack of proper access management along a developing corridor. The situation highlights the need to actively preserve the public investment by not allowing excessive access.

2. Clinton Case Study
(Driveway Consolidation)
US Highway 30/67 (Camanche Avenue)
from West US 30/67 Junction to South 4th Street



a. Background

Clinton is a city of about 30,000 people located on the very eastern tip of the state of Iowa. The city is located about 25 miles northeast of the Quad Cities and only about 150 miles west of Chicago, Illinois. Clinton is a highly industrial city, while its key location along the Mississippi River makes ita major port for shipment of goods by barge. Clinton is also strategically located along major east-west rail lines. This fact, coupled with the river's presence, make it an important hub of intermodal transportation links and commercial traffic in general. Clinton also lies at the intersection of US Highway 30 and US Highway 67. This also makes the city an important transportation hub for the region.

Case Study Area The area of interest Clinton is a section of US Highway 30. The study area runs from the western junction of US 30 and US Highway 67 east to the intersection at South 4th Street (see Figure 46).

Figure 46: Clinton Case Study Location

Corridor Environment This area is a mix of differing land uses; including heavy industrial, commercial, and residential uses. Typical businesses along this corridor include three large discount stores, convenience stores, taverns, car dealerships, restaurants, factories, auto service stations, banks, gas stations, and motels. On the eastern end of the study area, there are several homes adjacent to US Highway 30/67.

b. Analysis

The average annual daily traffic (AADT) on US 30/67 was reported in 1996 to range from 15,400 to 18,300 vehicles per day. The study area is slowly growing in terms of commercial development, while the industrial and residential development has lessened in previous decade. It is expected that the traffic volume through this corridor will continue to remain steady nonetheless.

Access along the study corridor has not been managed sufficiently over the last several years. Numerous driveway accesses have been installed along both sides of the corridor. In addition, several of these driveways are located close to side streets or other driveways. One frontage road had been installed near the western end of the study area; but with four mid-block access points it does not properly serve to reduce conflict points or subsequent potential accidents.

c. Results

As a result of the large volume of traffic along this corridor, and the almost unlimited access points, a project is currently being designed by the Iowa Department of Transportation to remedy some of the access problems. Proposed access improvements include adding a continuous center left-turn lane along a portion of the corridor, adding a raised center median along other portions, and rerouting access through driveway consolidation and closures.

d. Conclusion

This case study highlights the need to control access control along a heavily traveled corridor. Eliminating repetitive driveways and consolidating others driveways will serve to address access concerns. This, coupled with roadway improvements could help to significantly improve operation and safety along the study corridor (see Figure 47).

Figure 47: US Highway 30 in Clinton Today

3. Dubuque Case Study
(Strong Access Management Standards)

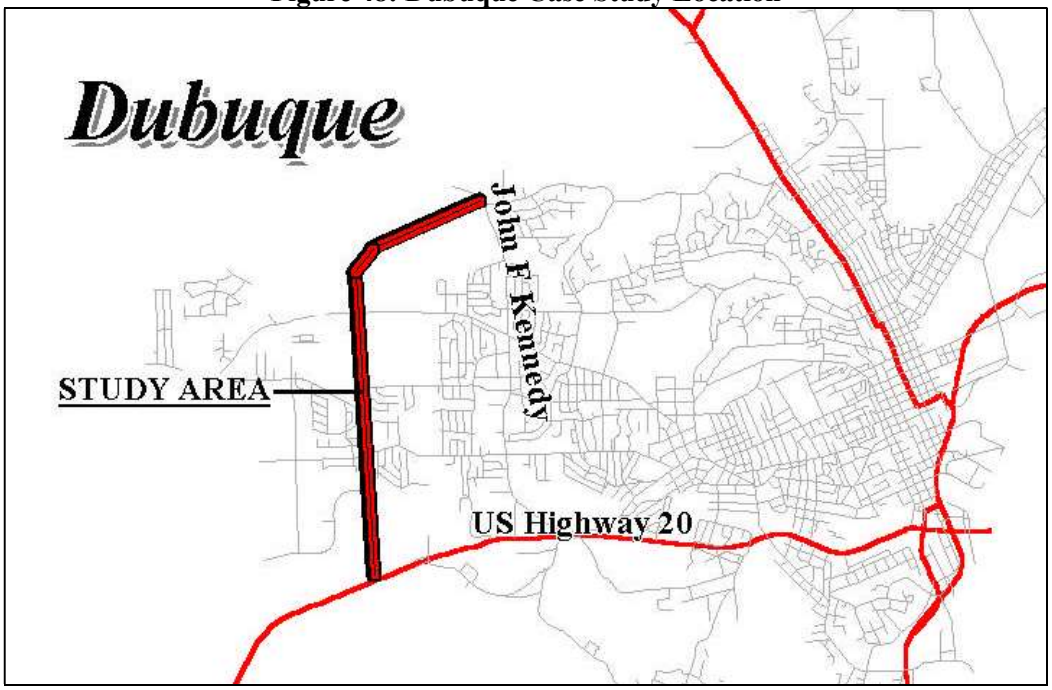
Iowa Highway 32 (Northwest Arterial)
from US Highway 20 to John F. Kennedy Road

a. Background

Dubuque is a northeastern Iowa city of about 60,000 people, located on the banks of the Mississippi River. Dubuque is the oldest city in the state, and serves as seat of Dubuque County. Dubuque is also located at the meeting point of US Highway 151, US Highway 20, US Highway 52, and US Highway 61. Much like Clinton, Dubuque is a heavily industrial city with a strategic location for several modes of transportation and considerable commerce.

Study Area The area of focus for this case study consists of the entire length of Iowa Highway 32 on the northwest side of Dubuque. The study area runs from its intersection with John F. Kennedy Road on the north end to US Highway 20 on the south end (see Figure 48). Locally, this road is known as the Northwest Arterial. It is the first phase of a partially completed bypass around the entire western side of Dubuque.

Figure 48: Dubuque Case Study Location



Corridor Environment Currently, this roadway is open as a two-lane highway with a further two lanes scheduled to be open in the late fall of 1997. At this time, the roadway will serve as a major divided four-lane through highway. In addition, the land in this study area was originally agricultural, but today is being developed for commercial and light industrial uses.

b. Analysis

Average daily traffic along the Northwest Arterial has been increasing dramatically over the last 5 years. Currently, the AADT volumes are around 8,000 vehicles per day. These volumes are expected to continue to increase significantly as more new development arrives along this corridor. Furthermore, there are plans to extend Iowa Highway 32 to the south. This expansion will create a loop bypass around the western side of Dubuque, and also increase traffic volumes considerably. This bypass would carry the north/south through traffic that currently must be routed through the city.

Currently, the City of Dubuque has carefully planned the management of access along the Northwest Arterial. Access for this corridor is designed to be allowed only at signalized intersections with a minimum separation distance of 1000 feet (see Figure 49).

Figure 49: Northwest Arterial Today

This requirement is very well suited for this type of development. Since the access is being consolidated at specific controlled access points, potential for conflict points have been greatly reduced. By keeping access to a minimum of 1000 feet, businesses can develop in a healthy area, while at the same time, there is no compromise of the original function of the roadway. That function being, once again, to bypass through traffic around the City of Dubuque.

c. Conclusions

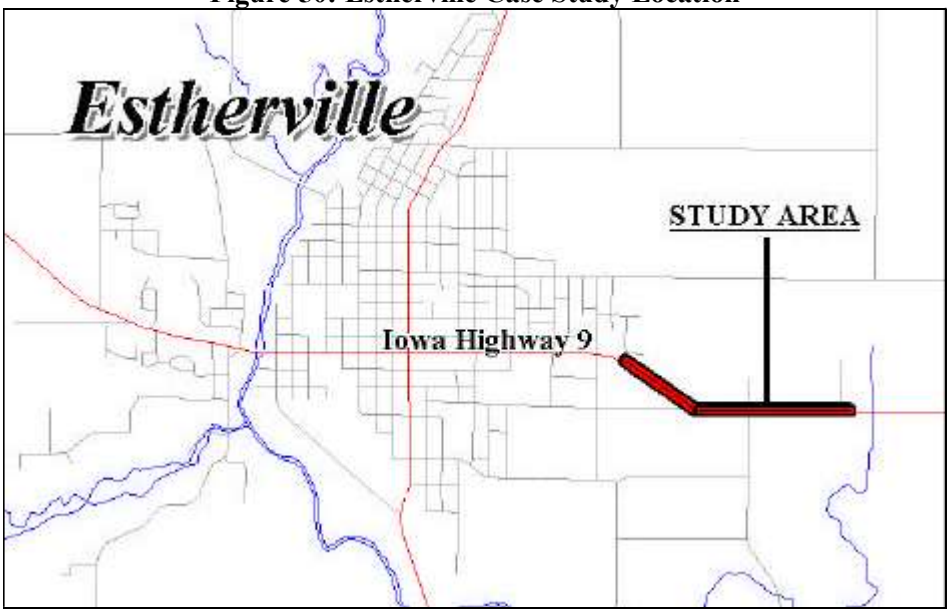
This case study demonstrates the effective use of land use planning and regulations to promote access management along a major roadway. By re-enforcing these standards, the function of the roadway and the adjacent development can both benefit.

4. Estherville Case Study
(Effective Use of Frontage Roads)
Iowa Highway 9
from 20th Street to east city limits

a. Background

Estherville is a northwestern Iowa community of about 8,000 residents. Estherville is located approximately eight miles from the Minnesota border, at the junction of Iowa Highway 4 and Iowa 9. Iowa Highway 9 serves as a major arterial through the city from east to west. In this case study, we examined a corridor of Iowa Highway 9 on the eastern edge of the city. The case study area runs from 20th Street in Estherville east to the city's corporate limits (see Figure 50).

Figure 50: Estherville Case Study Location



This corridor is approximately 0.5 miles in length. The highway along this corridor was originally constructed in 1931, and was widened to four lanes and resurfaced on 1984. The current speed limit is 45 mph. Traffic volumes along the study corridor were reported to be around 7,500 vehicles in 1995.

b. Analysis

An Iowa Department of Transportation maintenance garage and several small businesses occupy the land adjacent to the highway in this area. Access to these businesses has been relocated to a frontage road on the north side of Highway 9 to minimize conflict points along the highway. Additionally, an exclusive right-turn deceleration lane for eastbound traffic turning into the maintenance garage is under construction in 1997. This additional lane should serve to improve the traffic flow through this corridor as well as improve the safety at that location.

c. Conclusion

This case study highlights the effective use frontage roads and turning lanes in a small city. It is important to note that effective access management is critical to the proper functioning of arterial roads, regardless of the size of the surrounding city.

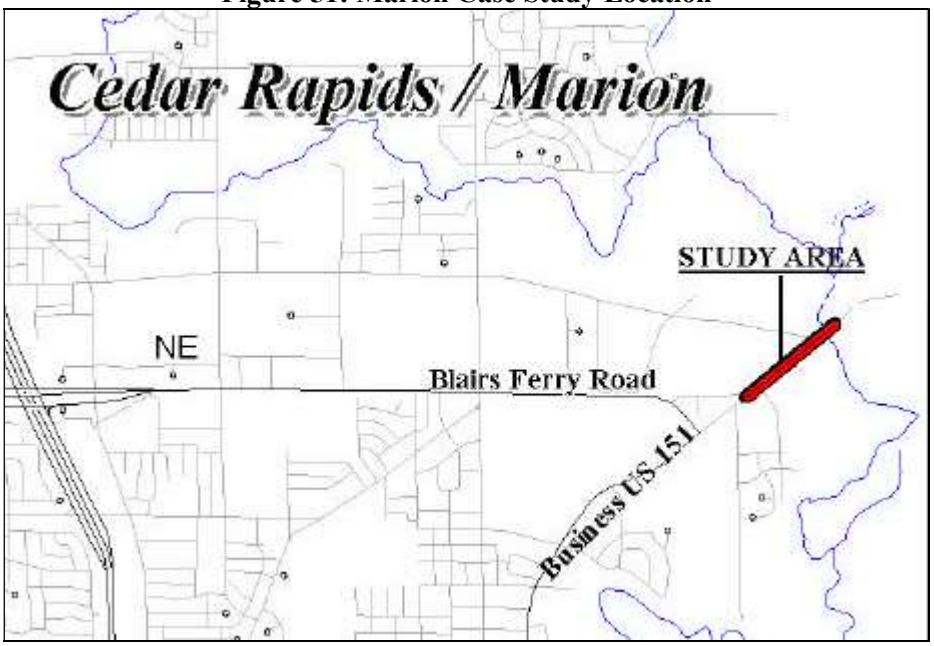
5. Marion Case Study
(Raised Medians at Intersection)
Business US Highway 151 (7th Avenue)
from Armar Drive to Indian Creek

a. Background

The City of Marion is located just northeast of Cedar Rapids in east central Iowa. US Highway (Business) 151 is the primary route between the city of Marion and the central business district of neighboring Cedar Rapids. In 1993, Business US Highway 151 had an AADT volume of around 26,000 vehicles per day within the study area.

The specific area of focus for this study is a section of Business 151 between Armar Drive east to the intersection at Blairs Ferry Road (see Figure 51). This study area is approximately 0.4 miles in length. The general complexion of the commercial businesses along this section of Business US 151 includes mostly service-related businesses. In addition, most of the business access is along the north side of the roadway. Along the south side of the roadway, there are only a couple of driveways. A city park is located along much of this side of the corridor.

Figure 51: Marion Case Study Location



b. Analysis

At the request of the city of Marion, the Iowa Department of Transportation analyzed the accident data from this corridor in 1991. The results from all accidents in this section from 1987 to 1990 showed that there were 105 total accidents. Of these accidents, 71 were rear end collisions. Several of these numerous accidents and the types of accidents along Business 151 could be attributed to lack of protection for left-turning vehicles within the study area. Many of these accidents were at the Blairs Ferry Road intersection where left turn lanes did not exist. In addition, The city park entrance and Blairs Ferry Road were offset, creating a difficult intersection and numerous conflict points.

c. Results

This accident problem led access changes along this corridor. The Iowa DOT Traffic Safety Improvement Project allocated funds for safety improvements. Work was begun on this project in 1994, and was completed in 1995. The corridor improvements included raised concrete medians with left-turning bays on 7th Avenue at Blairs Ferry Road. The project also included widening and the addition of a two-way left-turn lane west of the Blairs ferry intersection. Finally, a raised median was added from the west end of the continuous left-turning lane until Armar Drive. This median included a left-turn bay at Armar Drive for traffic turning left from the west bound lane.

There were also minor geometric improvements made at the intersections on the side streets. The entrance to the city park was also relocated to become part of the signalized intersection at Business 151 and Blairs Ferry Road (see Figure 52). This realignment reduced many of the conflict points along the corridor.

Figure 52: Business US 151 in Marion

d. Conclusion

This project highlights the integrated use of different access management techniques to improve traffic flow and to reduce accident potential along a busy arterial. These techniques include raised medians, continuous two-way left-turn lanes, and driveway redesign.

6. Marshalltown Case Study
(Poor Access Control)
Old US Highway 30
from west city limits to South Center Street

a. Background

The city of Marshalltown is located in central Iowa, about 40 miles northeast of Des Moines. Marshalltown has approximately 25,000 residents. The city is located at the intersection of Iowa Highway 14 and US Highway 30. US Highway 30 is a national highway that runs through several states. However, most of the interstate traffic is carried by Interstate Highway 80, which runs parallel with US Highway 30 approximately 25 miles to the south. US Highway 30 serves as a route mainly for intrastate traffic through central Iowa.

The study corridor is a portion of Old Highway 30 along the southern edge of Marshalltown. It is part of an original bypass that was constructed around Marshalltown in 1954. The corridor studied includes the section of highway from Marshalltown's west corporate limits east to Iowa Highway 14, called South Center Street locally (see Figure 53). The average annual daily traffic through this corridor was 6,600 vehicles per day in early 1996, when this corridor still served as the main route for traffic on US Highway 30.

Figure 53: Marshalltown Case Study Location

A new bypass was constructed to the south of Marshalltown in 1996. As through traffic now bypasses the study area, the traffic volumes noted above should show a very significant decrease in future traffic studies.

b. Analysis

This corridor has become nearly fully developed with mostly commercial businesses on both the north and south sides of the roadway. Following the original construction in the 1950's, access along the corridor was not sufficiently managed. As a result, almost all the adjacent properties enjoyed separate access points to US Highway 30. By the mid 1990's this uncontrolled access was beginning to have an adverse effect on safety and traffic flow along US 30.

In an effort to improve safety and service to the users of US Highway 30, the Iowa Department of Transportation found that the most realistic solution was the construction of a second bypass. This was found to be a more viable alternative than purchasing the additional right-of-way at the first bypass, relocating many of the businesses, and installing frontage roads for proper access. This second bypass is a four-lane facility with fully controlled access at non-at-grade interchanges.

c. Conclusion

This example shows the case of a bypass built several decades ago where access was not managed effectively. A second bypass was then required, illustrating the high cost of not properly managing access along a major highway.

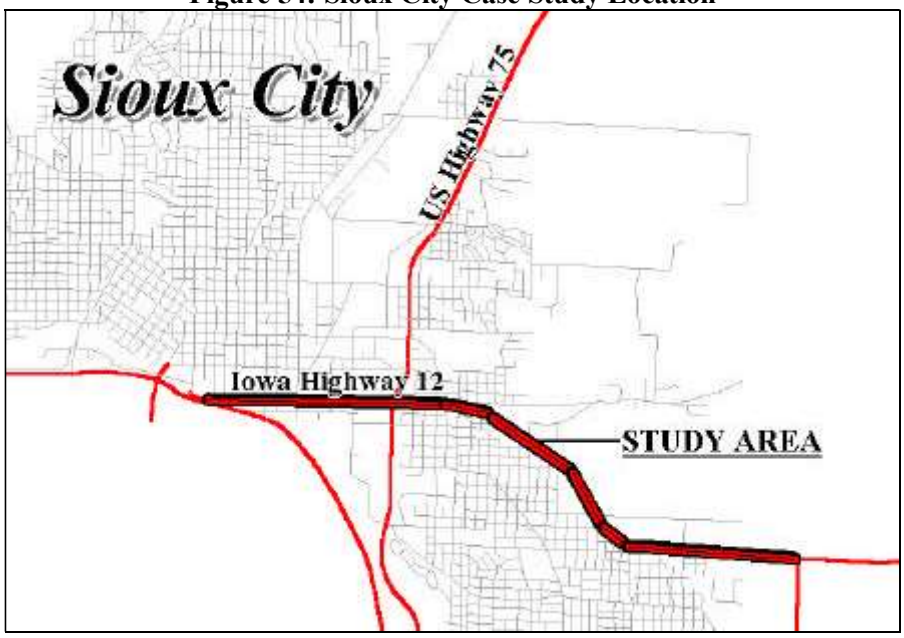
7. Sioux City Case Study
(Multiple Access Points)
Iowa Highway 12
from Pearl Street to US Highway 20

a. Background

Sioux City is a located in northwest Iowa along the Missouri River, approximately 150 miles northwest of Des Moines. Sioux City has a population of approximately 85,000 people.

Iowa Highway 12 serves to connect the downtown area of Sioux City to US Highway 20 in the east. The study area covers the corridor of Iowa Highway 12 from Pearl Street in the west to the junction with US Highway 20 to the east (see Figure 54). This corridor was reported to have 1996 AADT volumes ranging from a low of 10,200 near US Highway 20 to 27,800 near Pearl Street.

Figure 54: Sioux City Case Study Location



The majority of this roadway was originally constructed in 1954 and resurfaced from 1978 to 1983, with the Gordon Drive Viaduct and its approached constructed in 1964, and one short length near Pearl St. was constructed in 1939 and resurfaced in 1980. Iowa Highway 12 is four lanes wide throughout this corridor, divided by raised medians with left-turn lanes at access points.

b. Analysis

This corridor was improved in the 1970's as part of a statewide safety project, which included widening the highway to four lanes with raised medians. Since that time, the land use in the study area has changed. The land use along this corridor now consists mostly of commercial businesses. These businesses range from the numerous small businesses to new large office supply stores and large hardware superstores. A new strip mall is currently being developed between the Gordon Street Viaduct and South Martha Drive. The access along this corridor still consists mostly of individual entrances, many of which are located very close to intersections (see Figure 55).

Figure 55: Gordon Drive in Sioux City

There are currently plans to construct a bypass from Iowa Highway 75 to US Highway 20, around the northeast side of Sioux City. Upon completion, this should serve to reduce exposure on the eastern portion of this study area.

c. Conclusion

This case study illustrates the need to continually improve the access management of a corridor over time as business and land use changes along a corridor. Failure to improve access control will lead to a deterioration of traffic operation, ultimately leading to the recommendation of a bypass around the corridor.

8. Storm Lake Case Study
(Uncontrolled Access Along Bypass)
US Highway 71 (Flindt Drive)
from Lake Avenue to East Lakeshore Drive

a. Background

Storm Lake is located in northwest Iowa, approximately 60 miles east of Sioux City. Storm Lake is a community of about 9,000 residents. It is also the home of Buena Vista University. The university population is approximately 1,100 students. The community lies at the intersection of Iowa Highway 7 and US Highway 71. A new US Highway 71 bypass now runs to the east of the city, while the old route is called Old US Highway 71 in town.

The area of study for this case is a section of old US Highway 71 through Storm Lake from Lake Avenue to East Lakeshore Drive (see Figure 56). Old US Highway 71 is known as Flindt Drive through this corridor. This corridor is approximately 1.3 miles in length, and the land use is classified as highway commercial.

Figure 56: Storm Lake Case Study Location

b. Analysis

The corridor studied here is part of an original bypass constructed around Storm Lake several decades ago. Since that time, the city of Storm Lake has grown out around this bypass. During the growth of the city of Storm Lake, access rights were never purchased by the state. As the city grew many new access points were allowed liberally along the Highway 71corridor.

Accident History The number of accidents increased due to the many access points along this corridor. The Iowa Department of Transportation studied the area and found the corridor had a higher accident rate than the statewide average.

Access Improvements In the early 1990's, the Iowa DOT reconstructed the highway along this corridor from a four-lane highway to a two-lane highway with an additional center left-turn lane. According to city officials, this has served to significantly reduce the accident rates. This project is interesting in that by reducing the number of through lanes, the center left-turn lane could be installed without the purchase of additional right-of-way (see Figure 57).

Figure 57: Old US 71 in Storm Lake

In 1996, this corridor had an average annual daily traffic (AADT) level of about 7,000 vehicles. That same year a new bypass for US Highway 71 was opened east of Storm Lake. Due to this, the AADT should be significantly reduced.

c. Conclusion

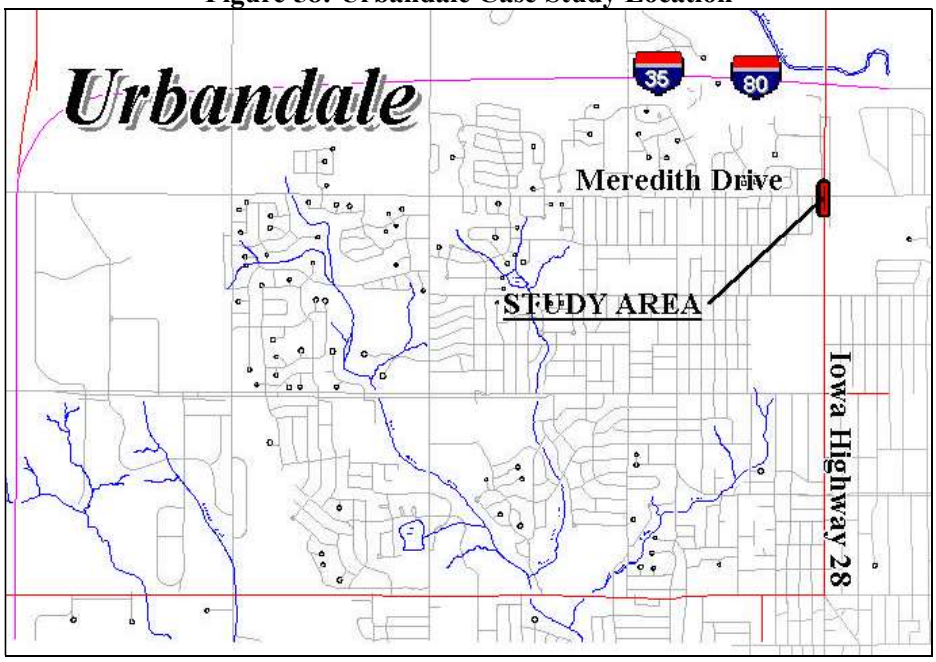
This case study highlights the need to protect the access control of new bypasses. If this is not done, the number of access points will tend to increase, resulting in higher accident rates. In this case the remedy for this was further construction, including a continuous center left-turn lane and also a second bypass around the city.

9. Urbandale Case Study
(Frontage Road Design)
Iowa Highway 28 (Merle Hay Road)
at Meredith Drive

a. Background

The city of Urbandale is a major suburb of Des Moines, with a population of about 20,000 people. Merle Hay Road (Iowa Highway 28) runs north and south on the eastern edge of Urbandale. It is the dividing line between this city and the City of Des Moines, and serves as an arterial access way to Interstate 35/80 for the cities of Des Moines, Johnston, and Urbandale. It also serves as the main access route for a regional shopping center, Merle Hay Mall. A major intersection on Merle Hay Road is with another arterial, Meredith Drive. This location is the area for this case study (see Figure 58).

Figure 58: Urbandale Case Study Location



Merle Hay Road was originally constructed in 1962. Meredith Drive was originally built in 1969. Neither street was improved in terms of cross-section between their original construction and 1993 even though traffic on them quadrupled during that time. Merle Hay Road has four through lanes with a raised median, while Meredith had a 42 foot cross section with curbing and no median. When Meredith was built in 1969 traffic on it was only about 3,000 vehicles per day. Left turn lanes were not provided.

A notable design feature at this location are the dual, two lane frontage roads running parallel to Merle Hay Road. These frontage roads were constructed less than 50 feet from Merle Hay Road and it was possible before 1994 for vehicles on the frontage roads to cross Meredith after stopping at stop signs.

b. Analysis

Average daily traffic on Merle Hay near Meredith ranged from 24,000 to 28,200 vehicles in 1992. Traffic along Meredith near Merle Hay was 7,000 to 11,700 vehicles per day that same year. Since 1987, traffic along the two routes and at their intersection has increased at a rate of 10 to 20 percent per year. The area is growing both in terms of commercial and residential development.

In the early 1990's, the intersection between Merle Hay and Meredith experienced numerous traffic accidents. Many accidents involved vehicles making left turns from Meredith onto Merle Hay. Over the six year period between January 1987 and December 1992, there were 79 reported accidents at or adjacent to the intersection, including 16 injury accidents and 63 property damage only (PDO) accidents. Most accidents (70 percent) were right angle, side-on collisions, indicating left-turn conflicts. The average number of accidents per year was 13, and accidents were increasing. The design of the frontage roads along Merle Hay was also thought to contribute to the large number of left-turning accidents.

c. Results

In the fall of 1994, a project was completed to reconstruct the Meredith Drive legs of the intersection to provide left-turn lanes. Traffic signalization was also improved to provide for protected left turns on Meredith. Raised medians were also installed east and west from Merle Hay along Meredith. These medians eliminated cross traffic on the frontage roads on either side of the intersection (see figure 59). Only right turns are allowed in and out near the intersection. The cost of the project was approximately $600,000.

Figure 59: Merle Hay Road at Meredith Drive Today

Accident statistics from the Iowa DOT's Accident Location Analysis System (ALAS) show that the project was effective in reducing crashes at and near the case study intersection. There were 31 percent fewer accidents reported in 1995 versus the average annual number for the three full years prior to the access project.

d. Conclusions

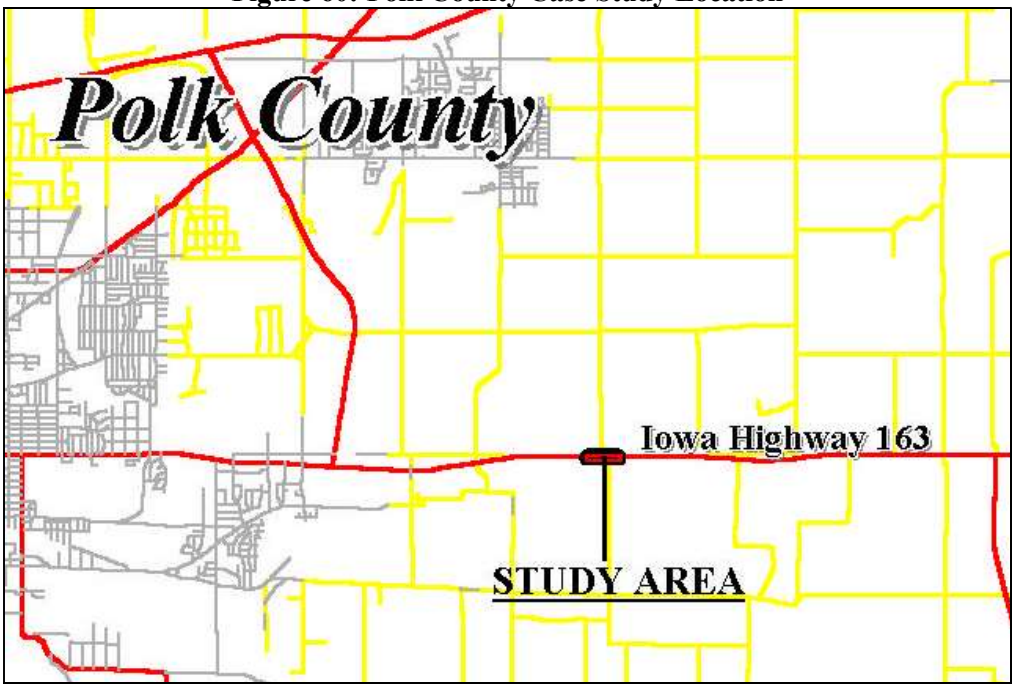
This case study demonstrates the effectiveness of incorporating access management measures, particularly raised medians, into the reconstruction of busy intersections. The case study also illustrates the need to ensure that frontage roads are designed so that they improve traffic safety rather than contribute to turning-related traffic accidents. This can be best be accomplished by locating frontage road entrances at least 100 feet away from an intersection. (The Transportation Research Board's Circular 456 suggests this spacing as a minimum standard for intersections between roads with speed limits of 30 to 35 miles per hour).

10. Polk County Case Study
(Poor Access Control)
Iowa Highway 163
at Northeast 80th Street

a. Background

This study focuses on one intersection in rural Polk County about three miles east of the Des Moines Corporate limits. The study area includes the area at the intersection of Iowa Highway 163 and Northeast 80th Street (see Figure 60). Southeast Polk High School is located to the southeast of this busy intersection.

Figure 60: Polk County Case Study Location



Iowa Highway 163 through this area is a four-lane divided highway. At this particular intersection, the highway is very heavily traveled, with a speed limit of 55 mph. Southeast Polk High School is a large traffic generator, with a large proportion of its traffic occurring at the daily peaks, before and after school.

b. Analysis

Safety has become a major concern at this intersection due to the large number of turning movements occurring during the peak traffic demand. Two other factors currently contribute to the safety problem. The first is a poor site distance looking west from the intersection. This lack of vision creates traffic flow and traffic safety problems both for eastbound and northbound traffic. The second factor is the frontage road in front of the high school. This road joins Northeast 80th close to Highway 163. When southbound traffic backs up on Northeast 80th waiting to turn onto this frontage road, the backup occurs very close to Highway 163.

The Iowa Department of Transportation is currently planning a safety improvement project at this location, with work scheduled to begin in the summer of 1998. This project will include widening eastbound Highway 163, construction of exclusive left turn lanes for eastbound and westbound traffic, and the installation of traffic signals at the intersection. The project will also include widening NE 80th to four lanes south of the intersection, and relocating the frontage road entrance further south from the intersection,

c. Conclusion

This study highlights several rural access management issues: a single large traffic generator, restricted site distance along a major arterial, and frontage road design issues (see Figure 61). The planned DOT construction project should serve to increase the safety of this study area, and increase the overall flow of traffic through the intersection.

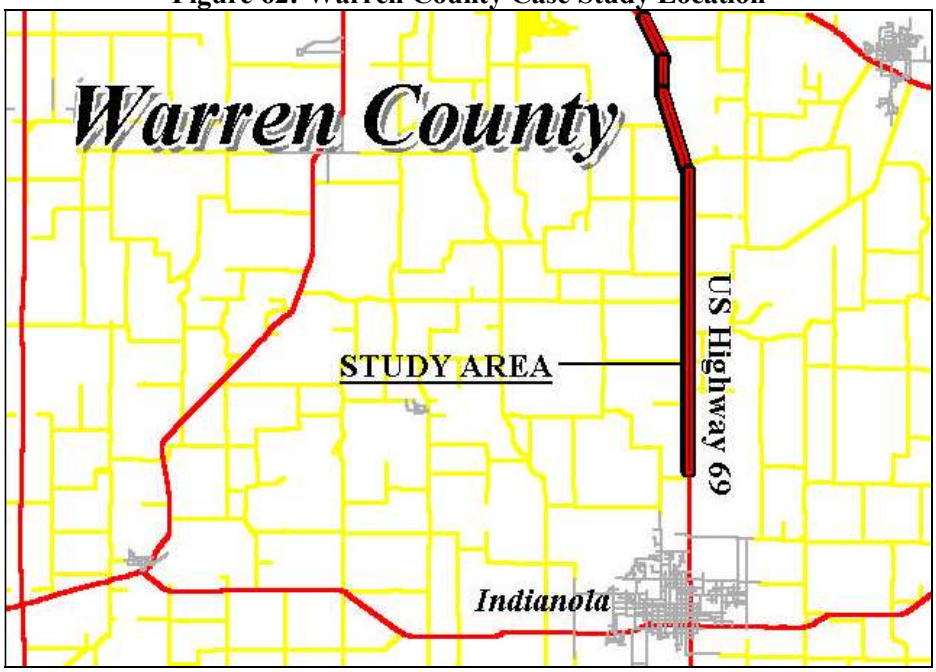
Figure 61: Iowa Highway 163 in Polk County

11. Warren County Case Study
Driveway Control and Future Land Use
US Highway 69
from Army Post Road to Indianola

a. Background

Warren County currently has about 40,000 residents, including over 11,300 in the City of Indianola. Although the populations of the county and city grew slowly in the 1970's and 1980's, activity is now picking up. In 1996, new housing permit activity for Indianola was almost $17 million, a figure resembling larger suburban communities surrounding Des Moines. Both the city and the county depend on agriculture and outside employment for a considerable portion of their economic livelihood. US 65/69 runs north and south and serves as an access way between Warren County and the rest of the Des Moines Metropolitan area (see Figure 62).

Figure 62: Warren County Case Study Location



US 65/69 was originally constructed in 1929 as the main highway route between Kansas City and Des Moines, however its long-distance travel role was supplanted by Interstate 35 in the 1970s. US 65/69 was originally a two-lane rural road, but was expanded to a four-lane facility in 1972 as traffic volumes increased.

The older sections (northbound lanes) of the roadway reflect the design practices of earlier times and have considerably more gradient than the newer (southbound) lanes. The road serves three main purposes: supporting a few long-distance trips between southern and central Iowa; serving considerable commuting and shopping traffic moving between Warren and Polk Counties; and providing access to farms, businesses and residences along the route. The area just north of this route is a fast-growing regional shopping center and also contains the region's commercial service airport.

b. Analysis

US 65/69 in Warren County is scheduled for preservation work only beyond 1999 in the Iowa DOT's long-range transportation plan. However, the construction of two nearby major routes will have a significant impact on the roadway. Relocated US 65 will create a new eastern bypass of Des Moines; relocated Iowa Highway 5 will create a similar bypass on the south side.

Both of these new routes will feed traffic to US 65/69 in Warren County. In addition, both these new routes will make northern Warren County a very attractive site for new land development. The result should be growing traffic volumes on US 65/69 and perhaps increased conflicts between traffic service and land access.

Traffic US 65/69 has four 12 foot traffic lanes with a posted speed limit of mainly 65 miles per hour with some 55 mile per hour limits in and near cities. The traffic volume (AADT) on the roadway was 13,500 vehicles in 1994. The volume of trucks is low at 590 per day (4 percent trucks), illustrating the highway's main role as a commuter and shopping traffic route. The facility operates at level of service "A" or "B" at present. The Iowa DOT has classified this route as Level 3 for access control, meaning that it would ideally have about 1300 foot spacing between private driveways.

There are 40 private driveway entrances to the roadway (about 20 per side) in 11.4 miles. There are fewer than 3 private driveways per average mile per side, equating to a spacing of about 1700 feet between private driveways. The roadway meets the Level 3 standard in terms of number of access points. There are also 15 public road intersections with the route in 11.4 miles. Most of these are with county roads. Some of the county roads only intersect in one direction, so the approximate spacing between them is about one mile (see Figure 63). A new interchange with relocated US 65 is under construction two miles south of the City of Des Moines limits.

Figure 63: US Highway 69 in Warren County

Accidents During the three years from 1993 through 1995, there were 177 accidents along the route, or about 59 per year. This equates to an accident rate of about 105 per 100 million vehicle-miles traveled, which is 13 percent below the average rate for rural roads in Iowa. There was one fatal accident in three years.

The accident characteristics of the route vary significantly from north to south. On the two mile portion located in Polk County, right-turning accidents predominate. Over 40 percent of all the accidents on this segment between 1993 and 1995 involved right-turning vehicles entering or leaving public roadways or driveways. There are several well-traveled driveways serving commercial developments and mobile home parks on this stretch of road. On the southern 9 miles of the route, located in Warren County, very few accidents (less than 10 percent) involved turning vehicles or driveways. Almost half of all the accidents along this segment involved single vehicles running off the road. Twenty percent of all these accidents involved animals in the roadway.

Well over 95 percent of the land along the route is currently agricultural, mainly cropland and pasture land, or rural residences on large lots. There has been little new land development recently along the route outside of the cities of Des Moines and Indianola. The current (1992) Land Use Plan for Warren County indicates that significant changes could lie ahead for this corridor. The urban service area for Des Moines is shown in the plan as expanding two miles to the south and the service area for Indianola is shown as expanding four miles to the north. This means that the route could change in character from predominantly rural to predominantly suburban with a mixture of agricultural, residential, commercial, and industrial land uses.

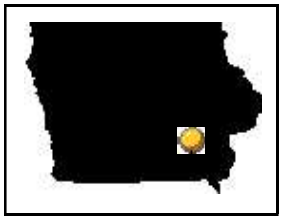
Warren County's land use plan is schedule to be updated in 1997 and 1998 and the update will likely envision additional land development in the northern part of the county. Other concerns for this route include the lack of turning lanes (particularly for left-turns) and sight distance problems associated with the northbound lanes' steep gradients.

c. Conclusion

This roadway has not been significantly improved in a number of years. However, it does currently meet the minimum acceptable access management standards laid out by the Iowa Department of Transportation. Access management will likely become of increased concern in the future as traffic volumes grow and land development accelerates in northern Warren County, the southern part of Des Moines and Indianola.

D. Baseline Case Studies

1. Coralville Case Study
(Raised Medians at Intersections / Continuos Two-way Left-turn Lane)
US Highway 6 (2nd Street)
from Clear Creek to Rocky Shore Drive



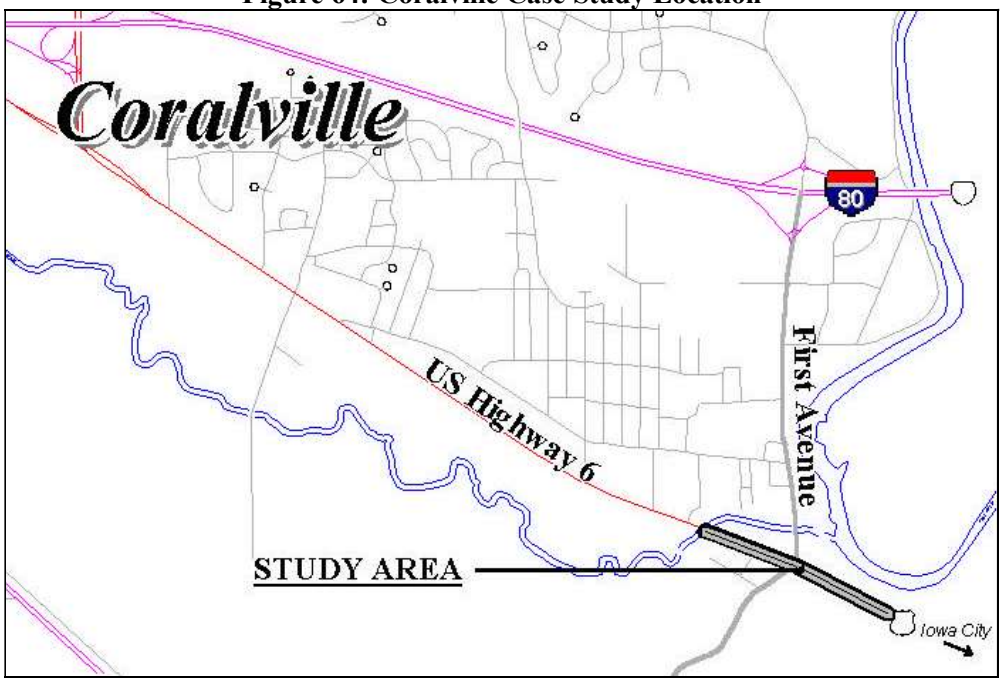
a. Background

The community of Coralville is located about 100 miles east of the Des Moines metropolitan area. Coralville lies just west of Iowa City, which is the location of the University of Iowa. While Coralville has a population of about 12,000 people, the total urbanized area is well over 75,000 people. Iowa City and Coralville lie along Interstate Highway 80

The University of Iowa campus, athletic facilities, University Hospital and Clinics, as well as The Veteran's Administration Hospital are located very close to Coralville, and are major traffic generators for the area. As a result, traffic volumes along US Highway 6 can be very heavy at times, especially during University of Iowa athletic events.

Study Area The area of focus for this case study is a section of US Highway 6 in Coralville. The study area extends from Clear Creek on the west to the city limits to Rocky Shore Drive on the east (see Figure 64). This section of US Highway 6 was a four-lane undivided roadway as of the early 1990's.

Figure 64: Coralville Case Study Location



The roadway itself had no curb and gutter system, and was considered a "rural" style of roadway. The study area is approximately 0.7 miles in length with a posted speed limit of 35 miles per hour. Within this study area traffic volumes are very high. 1994 AADT volumes were measured at about 30,000 vehicles per day.

Corridor Environment For years, this study area has developed as a major commercial area for Coralville as well as parts of Iowa City. Along the study area, land uses include several types of businesses. Among these businesses are service and auto repair stations numerous restaurants, motels, and business offices. The southern side of the study area east of 1st Avenue has historically been unused or used for athletic fields. Because of this, there had been no driveways along this side. Only recently, a driveway entrance was located for these athletic fields.

Over the years, as the "Coralville Strip" developed, access to the roadway was liberally allowed from the area businesses. For example, between 1st Avenue and Rocky Shore Drive, there were over 15 driveway access points on the north side of the roadway alone. This translates to almost 1 driveway every 100 feet. As a result, the entire study area started to see access related problems by the late 1980's and early 1990's.

b. Analysis

As of the early 1990's, the combination of high traffic volumes and unmanaged access had led to a safety and congestion problem within the study area. Because of concerns over these two points, steps were taken in the early 1990's to correct the problem along US Highway 6.

Plans to improve this area were only a small part of a greater improvement project planned for the whole US 6 corridor from the western Coralville city limits to Rocky Shore Drive. The first phase of the project was to be improvements along the eastern leg of the study area, form 1st Avenue to Rocky Shore Drive. The second phase of improvements would be the widening and modernizing of the western half of the study area. By the time the first phase was undertaken, this road section had one of Iowa's worst accident rates.

c. Results

As a result of this plan, a project was undertaken in 1994 to reconstruct the eastern leg of the study area. Federal HES funding was used to finance a portion of the project. The project completely modernized the existing roadway. Specifically, the first phase widened the roadway enough to allow for an additional lane. A continuous two-way left-turning lane was added down the center to accommodate the turning traffic into local business locations.

In addition the project consolidated the number of driveways along this stretch of road from 17 to only 9 driveway accesses. Of these, 8 were located along the north side of the road. The widening also allowed for sidewalks to be added along both sides of the roadway. At the far west end of this leg, at 1st Avenue, a raised median was installed with left-turn bays. This phase of reconstruction was completed in the fall of 1994.

Phase II of the overall US 6 improvement project included similar improvements on the western leg of the study area. Modernization of the roadway to "urban" specifications, the addition of a fifth center turning lane from the bridge to 1st Avenue, and driveway consolidation. About the same number of driveways were consolidated on the western leg of US 6, leaving 11 driveways for business access (see Figure 65).

Figure 65: US Highway 6 in Coralville

Also at the 1st Avenue intersection, a raised median was installed with a protected left-turning bay. This phase of the project was completed in the late 1995. The other two legs of the intersection were already channelized prior to 1994.

Currently, the third phase of the US 6 improvements is being completed at the far western end of Coralville. The fourth phase is expected to be completed in 1998. This phase includes the widening of the bridge at Clear Creek to allow for all 5 lanes and sidewalks. The final phase will be a total reconstruction and realignment of the 1st Avenue intersection. This large-scale project is scheduled to be undertaken in 1999.

d. Conclusion

The improvements made on US Highway 6 in Coralville were expected to make a significant impact on safety and traffic flow along the corridor. The use of a combination of access management techniques, as seen in other case studies, can be very effective in improving both of these aspects. A further after study can be expected to show these significant improvements

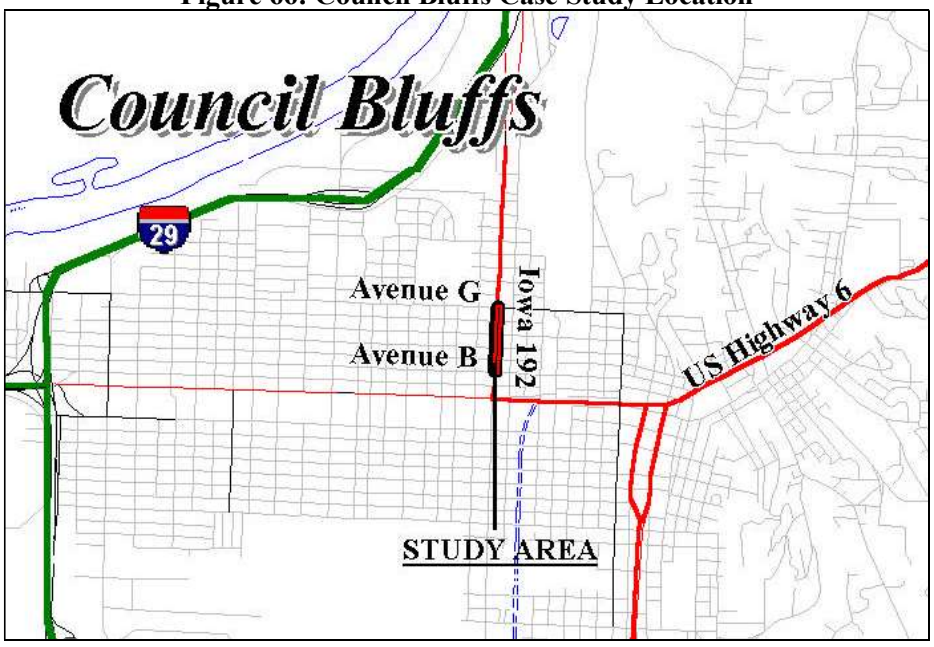
2. Council Bluffs Case Study
(Medians at Intersections)
Iowa Highway 192 (North 16th Street)
at Avenue B and Avenue G

a. Background

Council Bluffs is a large industrial city of about 55,000 people, located in southwestern Iowa. Council Bluffs lies directly across the Missouri River from Omaha, Nebraska. This location makes Council Bluffs an important part of the metropolitan area and also makes the city a commercial transportation center for the state and region. Here, Interstate Highway 29 and Interstate 80 meet. Other major highways, such as US Highway 6 and Iowa Highway 192, meet in Council Bluffs. Iowa Highway 192 is a major roadway running north/south through the center of Council Bluffs. Iowa 192 is locally known as 16th Street. It also serves as a major north/south arterial and commuter route within the city, and as an access route to the larger expressways in the downtown area.

Study Area The focus area for this case study is a section of Iowa Highway 192 in northern Council Bluffs. This stretch of Iowa 192 was originally constructed in 1958 as a 53 foot wide with a four foot raised median in the center. The study areas are at the intersections of Avenue B and Avenue G. Both are east/west roadways that intersect 16th Street. The two study intersections are five blocks or 0.3 miles apart (see Figure 66). As of the early 1990's, this roadway was still a four-lane divided roadway.

Figure 66: Council Bluffs Case Study Location



While a four foot wide median extended the length of most of North 16th Street. There were no turning bays at these major intersections, leaving turning traffic unprotected. As a major commuter route, this roadway sees relatively high traffic volumes. The 1992 AADT numbers showed about 14,000 vehicles per day traveled along this portion of Iowa Highway 192.

Corridor Environment The area surrounding the study area is a mix of residential and commercial land uses. Typical businesses around the two locations include gas stations, motels, and convenience stores. Many homes do exist along the corridor between Avenue B and Avenue G. Most driveway access along the corridor was located relatively safe distances from major intersections.

b. Analysis

The traffic along Iowa 192 had become a significant problem by the early 1990's. While the left-turning access along the roadway was already controlled through the median, the turning traffic at these two intersections was becoming a safety problem. By this time, the two intersections were both among the top five in the City of Council Bluffs in terms of overall accident rates.

Accidents At Avenue G, for example, there were a total of 62 total accidents recorded at the intersection in a three year period from January 1985 through December of 1987. Many of these accidents were rear end and broadside accidents that could be attributed to the lack of protection for left turning movements. Almost 65 percent involved vehicles turning left off of Iowa Highway 192 onto Avenue G. This pattern has been seen in many of the other case studies.

Access Improvement Process In 1994, a project was undertaken to reconstruct the roadway at the two intersections. The projects specifically channelized the intersections at Avenues B and G, allowing for left-turn protection. In the areas, approximately 1 block in each direction, the roadway was widened to allow for an additional protected turn lane along Iowa 192 (see Figures 67-68).

Figure 67: Avenue B in Council Bluffs

Figure 68: Avenue G in Council Bluffs

Along with the geometric reconstruction, there were also improvements made to the signals at both intersections. The old, outdated signals were replaced with new actuated controllers and radio transmitters. The project was completed in 1995. The total cost of both projects was estimated at almost $960,000.

c. Results

As the result of the access project in Council Bluffs, there has been a noticeable improvement in traffic flow and congestion during peak hours. According to the city, the reduction in the accidents at the two intersections has improved dramatically as well.

d. Conclusion

This project demonstrates the effective use of raised medians at intersections. These medians, with left-turning bays, can protect left-turning movements off of the main route. In addition, signal upgrades can help also with the traffic flow and congestion along such a busy commuter route.

E. Overall Conclusions

1. Accident Reduction

The collection of case studies has shown many distinctive advantages to implementing access management ideals in various locations in Iowa. As a result of these projects, overall, there has been a positive impact on safety that comes along with the implementation of these access management ideals.

As for the full case studies, access management has made entering and exiting these roadways safer and more efficient. In all, accident frequency and severity have been reduced significantly in the study areas (see table 20). Accidents, in some cases have been reduced by up to 70 percent. The average reduction in accidents is around 40 percent for the seven full case studies combined.

Table 20: Full Case Studies Accidents Statistics

	Ames		Ankeny		Clive		Des Moines		Fairfield		Mason City		Spencer	
Accident Classification	**90-92**	**95**	**89-91**	**94-95**	**88-90**	**92-94**	**NA**	**86-88**	**88-90**	**93-95**	**88-90**	**92-94**	**88-90**	**93-95**
Collision type uncertain	49	1	11	3	15	14	-	40	5	4	62	28	5	4
Head-on	0	0	0	0	1	0	-	1	1	0	1	0	1	1
Broadside / Left-turn	35	0	25	21	18	9	-	28	8	8	16	21	14	6
Rear end	28	4	38	16	95	68	-	80	29	8	13	12	18	17
Rear end / Right-turn	0	1	1	1	6	2	-	4	1	5	0	0	0	1
Rear end / Left-turn	3	1	2	1	1	1	-	1	9	10	1	0	1	3
Side swipe / Opposite direction	1	0	0	0	2	0	-	3	3	0	1	0	0	0
Side swipe / Same direction	2	0	0	0	3	0	-	7	2	0	0	0	7	0
Sideswipe / Right-turn	3	0	0	0	3	0	-	11	4	3	0	0	1	1
Sideswipe / Left-turn	1	0	1	0	6	1	-	8	1	0	1	1	1	0
Sideswipe / Dual left-turn	0	0	0	0	1	2	-	0	0	0	0	0	0	0
Sideswipe / Dual right-turn	1	0	0	0	1	0	-	0	1	0	0	0	0	1
Right angle	15	3	19	11	37	8	-	50	14	9	2	3	10	20
Broadside / Right entering	0	1	1	3	0	0	-	0	2	1	0	1	0	1
Broadside / Left entering	2	0	2	0	1	0	-	4	2	2	0	0	2	0
Failure to yield from driveway	3	2	1	3	0	5	-	0	2	6	0	0	0	2
Sideswipe / Facing left-turns	1	0	1	0	0	0	-	1	0	0	0	0	0	0
Other	12	3	4	2	12	15	-	25	17	9	0	5	4	12
Single vehicle	3	0	3	0	4	3	-	13	3	0	1	0	4	5
Pedestrian / Bicycle	1	1	3	3	0	0	-	3	1	1	0	0	1	1
Total Accidents	**160**	**17**	**112**	**64**	**206**	**128**	**NA**	**279**	**105**	**66**	**98**	**71**	**69**	**75**

2. Traffic Flow and Congestion

Access management principles, as with safety, can also have a significant impact on traffic flow and congestion of a roadway. The level of service for these seven full cases, overall, have been positively affected by access management projects. Since many of these areas are some of the most heavily traveled corridors in Iowa, access management is often a better way to improve traffic flow. Often, there is no room to widen a congested roadway. Therefore, while improving efficiency, access management is a cost-effective way to improve safety as well.

3. Lessons Learned

From the full case studies and the sidebar cases, there have been many noticeable lessons to be gained from the handling of access. Whether they are positive or negative examples, access management has shown to be important in almost all size communities and in many different situations.

While the full cases all showed specific examples of access management being successfully implemented, many of the sidebar cases show the negative effects of not managing access properly. The sidebars show a variety of access issues and lessons to be learned from different size communities with different transportation issues.

III. Business Vitality Trends Documentation

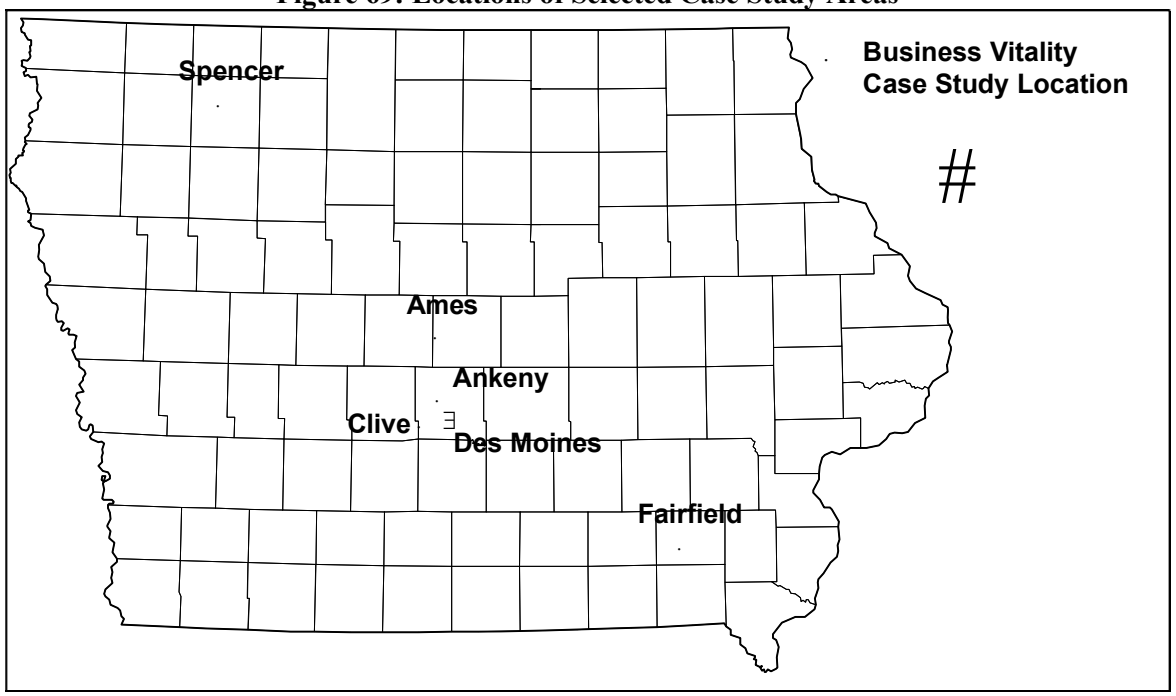
A. Introduction

The Access Management Task Force has been especially mindful of the impacts of access control activities within commercial corridors of Iowa communities. In order to determine whether there have been negative impacts on businesses within each of the five case study corridors, the research team has assembled information about community business patterns and trends in each of the case study corridor communities. This analysis assumes that consistent negative impacts from the implementation of access control measures should be reflected in the business activity decreases in each of the corridors.

In order to analyze corridor business activity, it is important that these patterns and trends can be compared to overall community business activities. This is in effort to provide evidence that impacts in the corridors are somehow different than the community-wide business environment. For example, if business activity within the corridors has not kept pace with community trends, this could indicate negative impacts of access changes. On the other hand, if business activity has increased in the case study corridors, this could indicate that there were no significant impacts of roadway changes, or, that positive impacts on businesses as a result of increased traffic flow and safety. The comparison of corridor and community business activity provides useful relative measures of business activity levels.

This analysis examines business trends in five case study communities; Ames, Ankeny, Clive, Fairfield, and Spencer (see Figure 69). Data on the change in total number of businesses, business composition, and retail sales activity levels are analyzed for each of the communities as well as the corridor in which access improvements were completed.

Figure 69: Locations of Selected Case Study Areas



Backgrounds of each of the case studies communities are as follows:

- Ames is a large, regional hub for trade serving an area covering several counties. It has a population of slightly under 50,000 persons. A large percentage of the residents are college students at Iowa State University. Ames has experienced slow but steady growth in retail trade activity since the mid-1980s.

- Ankeny is a rapidly growing suburban community of Des Moines with nearly 20,000 persons. Along with rapid increases in population, it has experienced strong growth in retail trade since the late 1980s. The number of retail firms in Ankeny has roughly doubled since the mid-1980s with well over 500 currently.

- Clive is also a suburban community of Des Moines with a population approaching 10,000. It has experienced very rapid growth in retail trade since the early 1990s and has been one of the fastest-growing communities in Iowa in terms of retail trade. Given current development trends, it is likely that the strong retail growth will continue over the next few years.

- Fairfield is a mid-sized, rural community with about 10,000 persons located in the southeast corner of Iowa. The city has experienced relatively stable levels of retail sales over the past two decades. The number of retail firms located in Fairfield has remained nearly constant at 400 to 450 for the past 10 years.

- Spencer is another mid-sized community with about 11,000 residents with a geographic trade area that is considerably larger than Fairfield. Spencer is located in a less densely populated region of Iowa with no other, similar regional centers in close proximity. Like Fairfield, it has experienced static inflation-adjusted retail sales since the mid-1980s.

B. Community Business Trends

The five business vitality case study communities represent a range of business activity levels - although all are generally prosperous and have maintained relatively stable business growth. In Iowa, only about 50 percent of businesses survive over a five-year period. For the five business vitality case study communities, this percentage varies from 41 percent (Fairfield) to 54 percent (Spencer). Clive, is a notable exception with a business survival rate of 64 percent (see Appendix 1, Stone and Baumler 1997).

All of the case study communities, with the exception of Fairfield, have expanded their retail sales markets. In 1996, each of the case study communities had retail sales pull factors over 1.00. A pull factor of more than 1.00 indicates that a community is serving the retail needs of persons beyond those living in the local community. The pull factors for these communities range from 1.06 (Ankeny) to 1.71 (Clive). Ames, Ankeny, and Clive all experienced significant increases in retail sales pull factors between 1990 and 1996 (see Table 21).

Table 21: Summary of Case Study Community Retail Business Trends

Community	Five Year Business Survival Rate	Five Year Change in Retail Sales	Five Year Change in Number of Retail Firms	Retail Sales Pull Factor 1990	Retail Sales Pull Factor 1996	Pull Factor % Change 1990-1996
Ames	44.6%	8.8%	2.1%	1.00	1.14	+14.0%
Ankeny	44.1%	57.2%	22.7%	0.86	1.06	+23.3%
Clive	63.7%	346.2%	171.0%	0.44	1.71	+388.6%
Fairfield	41.2%	7.0%	10.4%	1.20	1.16	-0.3%
Spencer	54.3%	5.5%	3.4%	1.56	1.57	+0.1%
State of Iowa	49.8%	-	-	1.00	1.00	-

In terms of total retail sales activity for this period, all five case study communities experienced increases in total retail sales activity ranging from 5.5 percent (Spencer) to 346.2 percent (Clive). Clive has experienced explosive growth in business activity as a result of rapid development in the West Des Moines area. The other four case study communities have had somewhat slower rates of growth, averaging approximately 1 to 10 percent annual growth (adjusted for inflation).

C. Corridor Business Patterns

The previous results indicate that the business vitality case study communities have been successful retail markets over the past seven years. These trends can then be compared to business activities within each of the case study corridors. Currently, there is very little published information about the relationship of access management and business vitality. Reports from the Transportation Research Center at the University of Florida have addressed the impacts of median alternatives. Included in their analyses are questionnaire data from merchants that characterize the impacts of median construction on business activity (Long and Helms 1991). However, their analyses do not look at specific changes in sales activities; rather, they only report the subjective opinions of business owners.

A common assumption is that when vehicular access to properties is regulated, the net effect will be a decrease in site accessibility and therefore, sales. What this does not take into account is that greater control of ingress and egress can result in fewer conflicts between vehicles or between pedestrians and vehicles. In addition to increased safety, access management can result in reduced congestion with fewer interruptions of vehicular movement to and from properties. Motorists may avoid congested roads and routes they perceive as unsafe or inconvenient. It is likely that these benefits are not as visible to business and property owners, instead they are a perceived inconvenience to potential customers. For this reason it is important to document how access management projects have impacted local businesses in Iowa. This information is a vital element for increasing the level of awareness about access management, especially if there are positive impacts on economic activities.

D. Business Types and Changes

In the cases of Ankeny, Clive, and Fairfield, the total number of businesses in the corridor increased from the period before access improvements were constructed to the period after. For Ames and Spencer, the number of total businesses within the case study corridor declined slightly (8.0 percent and 13.7 percent respectively). These numbers account only for businesses by address and not by square footage or number of employees. For example, a commercial corridor may lose 10 percent of its businesses, but at the same time gain a large Wal-Mart or Hy-Vee size grocery store. In this case the number of businesses has declined, while the overall level of business and sales activity may have increased.

As might be expected, the most frequent types of businesses in each of the corridors are services, eating and drinking, miscellaneous, automotive, and specialty retail. These categories range from 10 to 45 percent of the businesses in each corridor. By comparison, services, specialty retail, and miscellaneous businesses are the most prevalent in each of the respective communities. In general, the corridors differ from their community business composition primarily in the proportion of motor vehicle, eating and drinking, and to a degree, specialty retail and service establishments.

Corridors tend to have a greater share of auto related and restaurant establishments. Corridors also tend to have a smaller share of specialty retail and services compared to their communities. Such businesses might instead be located within shopping malls or downtown areas. Because there are not dramatic differences in overall composition of businesses, changes in business activity for each corridor should be comparable to changes in business activity for the community in which they are located (see Table 22).

Table 22: Difference in Current (1996) Business Composition (City Compared to Corridor)

Business Type	Ames	Ankeny	Clive	Fairfield	Spencer
Utilities/Transportation	1.3%	1.6%	0.0%	2.7%	2.3%
Building Materials	-2.6%	-1.4%	0.0%	-5.5%	0.3%
General Merchandise	2.1%	0.5%	0.0%	-0.4%	1.2%
Food Dealers	-0.1%	-4.9%	0.0%	-5.5%	-2.5%
Motor Vehicle	-19.9%	0.6%	-5.1%	-28.7%	-16.0%
Apparel	4.3%	-2.1%	-7.1%	2.8%	1.9%
Home Furnishings	2.2%	3.8%	5.7%	3.6%	4.6%
Eating and Drinking	-20.1%	-3.2%	-10.0%	1.8%	-5.1%
Specialty Retail	14.6%	4.2%	-4.1%	12.0%	12.2%
Services	10.8%	-13.5%	6.6%	12.3%	-5.7%
Miscellaneous	5.1%	5.5%	7.5%	-1.8%	1.1%
Mobile Home Sales	na	na	na	na	na
Residential	na	na	na	na	na

Source: R.L. Polk Directory and Iowa Retail Sales & Use Tax Report

E. Change in Business Composition

In addition to analyzing the changes in total business activities within the study corridors, the changes in specific categories of businesses are also of interest. Impacts of access modifications can have different affects on different types of businesses, as well as on overall business activity. A review of the five case study corridors does not indicate a consistent pattern of business composition changes. This means that there does not appear to be a proportionately larger impact on one type of business compared to another in these areas (see Table 23).

Table 23: Change in Business Composition (By Corridor)

Business Type	Ames	Ankeny	Clive	Fairfield	Spencer
Utilities/Transportation	na	-100.0%	na	na	na
Building Materials	0.0%	-25.0%	na	200.0%	0.0%
General Merchandise	na	100.0%	na	0.0%	-100.0%
Food Dealers	-50.0%	66.7%	na	0.0%	0.0%
Motor Vehicle	10.0%	50.0%	100.0%	85.7%	-25.0%
Apparel	-100.0%	0.0%	0.0%	na	100.0%
Home Furnishings	0.0%	-100.0%	na	na	-100.0%
Eating and Drinking	40.0%	33.3%	66.7%	0.0%	0.0%
Specialty Retail	100.0%	50.0%	266.7%	400.0%	100.0%
Services	-42.9%	24.1%	11.1%	250.0%	-5.6%
Miscellaneous	-50.0%	100.0%	100.0%	25.0%	-55.6%
Mobile Home Sales	0.0%	na	na	0.0%	na
Residential	na	na	na	na	0.0%
Total	-8.0%	21.3%	68.0%	85.7%	-13.7%

Source: R.L. Polk Directory

There were no particular business categories that consistently decreased in number of locations for the case study areas. Home furnishings, services, and miscellaneous were the only business types to decrease in number of establishments in more than one corridor for the periods analyzed. Each decreased in two corridors. The loss of the home furnishings, services, and miscellaneous businesses (a total of 18 for all case study corridors) did not have a significant impact on total business locations, with the total number of businesses increasing an average of approximately 20 percent for each of the five corridors. It should also be noted that some of the business categories listed have high thresholds for business success. For example, a large, new, home furnishings establishment in a nearby community could easily disrupt local home furnishing sales; resulting in a nearly 100 percent loss to the local business mix. This is especially the case for specialty business types such as home appliances or home furnishings.

The business changes previously discussed represents ***net*** changes in number of businesses. The composition of the current stock of businesses in each corridor is the result of businesses existing before and after access improvements, new businesses (or name changes), and loss of businesses (or name changes). Because the business information was collected from the R.L. Polk directories, the differences between name changes and new or lost businesses are not entirely clear. Ames and Spencer have the highest rates of remaining businesses (67 and 64 percent respectively). Ankeny, Clive, and Fairfield had the highest rates of new business locations (61, 67, and 54 percent respectively). The rates of business losses or turnovers ranged from 13 percent for Fairfield to 50 percent for Spencer over a five-year period. This equates to approximately a 3 percent to 10 percent annual turnover of businesses. A typical community may experience anywhere from a 5 to 15 percent annual change, so these rates can be viewed as indicating somewhat stable business environments (Appendix 1).

These results suggest that access management activities have not adversely affected overall business locations within the selected case study corridors. In general, business activity has continued to expand. Losses in numbers of total businesses within the Ames and Spencer corridors may simply be the result of changing trends in business - a trend toward larger, multiple service establishments in a single location (e.g., Wal-Mart, K-Mart, Target, Hy-Vee, and Sam's Club). In both of these cases, overall sales activity has increased (or remained stable) during the time periods analyzed. In addition, the only consistent changes in specific business categories were increases in numbers of eating and drinking and specialty retail.

F. Corridor Sales Trends

This analysis used disaggregate retail sales data for each of the five case study corridors. The Iowa Department of Revenue and Finance was able to report sales tax summaries for the street addresses which fell within corridor boundaries. Breakdowns by business type were not possible because of data confidentiality rules. From 1990 to 1995 retail sales activity increased within each of the five business vitality case study communities. Inflation adjusted annual increases ranged from 0.9 percent in Spencer to 57.7 percent in Clive (see Table 24).

Table 24: Sales Activity for Corridors and Communities

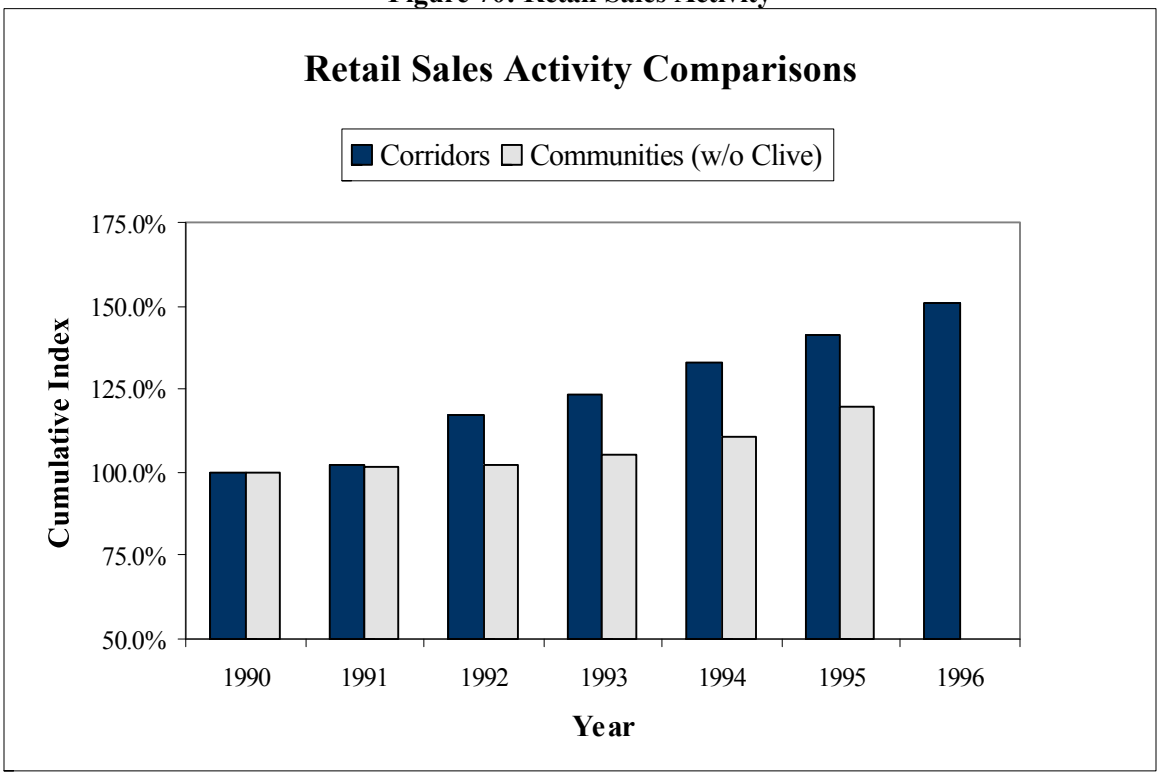
Year	Corridor Sales	Community Sales	Corridor Index	Community Index	Completion
Ames					
1990	15,068,900	384,328,804	100.0%	100.0%	
1991	13,445,019	388,862,320	89.2%	101.2%	
1992	14,215,046	388,774,727	94.3%	101.2%	
1993	14,393,570	399,426,817	95.5%	103.9%	
1994	13,846,263	402,207,192	91.9%	104.7%	Fall 1994
1995	14,693,133	418,148,170	97.5%	108.8%	
1996	15,798,306	na	104.8%	na	
Ankeny					
1990	8,211,100	116,564,938	100.0%	100.0%	
1991	10,132,321	128,618,282	123.4%	110.3%	
1992	13,989,674	136,846,533	170.4%	117.4%	
1993	13,456,890	137,075,948	163.9%	117.6%	Fall 1993
1994	16,492,770	154,852,588	200.9%	132.8%	
1995	17,067,945	183,212,866	207.9%	157.2%	
1996	18,595,836	na	226.5%	na	
Clive					
1990	6,478,100	24,020,089	100.0%	100.0%	
1991	6,745,108	49,518,974	104.1%	206.2%	Fall 1991
1992	8,800,195	66,399,337	135.8%	276.4%	
1993	9,564,852	74,415,863	147.6%	309.8%	
1994	10,773,843	103,397,595	166.3%	430.5%	
1995	10,890,861	107,170,336	168.1%	446.2%	
1996	11,588,433	na	178.9%	na	
Fairfield					
1990	18,261,350	86,837,886	100.0%	100.0%	
1991	17,354,959	83,458,500	95.0%	96.1%	
1992	17,549,619	83,106,800	96.1%	95.7%	Fall 1992
1993	17,840,378	87,605,920	97.7%	100.9%	
1994	17,776,399	88,784,797	97.3%	102.2%	
1995	19,211,631	92,891,667	105.2%	107.0%	
1996	20,720,973	na	113.5%	na	
Spencer					
1990	4,583,850	129,098,725	100.0%	100.0%	
1991	4,521,337	126,634,993	98.6%	98.1%	
1992	4,130,907	123,987,367	90.1%	96.0%	Summer 1992
1993	5,158,390	126,038,810	112.5%	97.6%	
1994	4,976,689	132,828,612	108.6%	102.9%	
1995	5,834,589	136,202,113	127.3%	105.5%	
1996	6,027,244	na	131.5%	na	

Source: Iowa Department of Revenue and Finance.

Note: State of Iowa Fiscal Years, 7/1-6/30. Figures adjusted to 1990 dollars. 1996 community sales not available.

At the same time, all of the case study corridors experienced retail sales growth between 1990 and 1996. The annual corridor increases ranged from 0.7 percent in Ames to 18.1 percent in Ankeny. Overall, the average annual sales growth rate for the five corridors was 7.3 percent compared to an average of 14.1 percent for the communities. However, excluding Clive, the average rate of growth for communities was 3.3 percent. Clive has experienced such phenomenal retail sales growth that its sales figures distort the average of the five communities. With this in mind, the results suggest that on average, the corridors have out-paced the communities in terms of retail sales activity over the past seven years (see Figure 70).

Figure 70: Retail Sales Activity



To examine the short term impacts of the access management projects, this analysis looked at changes in sales activity from the year before and the year after access improvements were completed. In each of the five case study corridors, sales activity increased the year after the projects were completed. Retail sales activity increases ranged from 1.6 percent (Fairfield) to 37.0 percent (Ankeny) with a 19.7 percent average rate of increase. The average for the corridors was slightly higher than the 'before and after' average changes for the communities (19.3 percent). The average corridor sales activity increases are even more dramatic if Clive is excluded from the community average, with the comparison then becoming 19.7 percent (corridors) to 6.5 percent (communities).

The results of the corridor sales trend analysis do not indicate that access changes have had a negative impact on business corridors for the five case study communities. In each case, corridors and communities have sustained stable or increasing rates of business growth. The results also suggest that there have been no short-term negative impacts (i.e., lower sales activity) from access management projects within these commercial corridors.

G. Summary

From the data for the case study areas, there are instances of decline in business activity. For example, the retail trade area for the City of Fairfield has contracted during the period from 1990 to 1996. In addition, Ames and Spencer experienced a decline in the total number of businesses within their case study corridors. However, in terms of economic vitality, business locations and turnover within case study corridors and communities; corridor business composition changes and overall retail sales activities for each corridor and community; there is no evidence that access management projects have disrupted retail business trade within the case study corridors of Ames, Ankeny, Clive, Fairfield, and Spencer. In fact, sales activity has generally increased in each of these cases after improvements were made. To provide a reliable assessment of business impacts, this analysis has compared relative business activity changes between corridors, cities, and state-wide trends. In this way, localized economic trends can be examined in light of regional economic changes.

H. References

Harpole, Kathy. 1997. Iowa Sales Revenue Data. Iowa Department of Revenue and Finance, Des Moines, Iowa.

Iowa Department of Revenue and Finance. 1990. Iowa Retail Sales and Use Tax Report: Annual Report, Des Moines Iowa.

_____. 1991. Iowa Retail Sales and Use Tax Report: Annual Report, Des Moines Iowa.

_____. 1992. Iowa Retail Sales and Use Tax Report: Annual Report, Des Moines Iowa.

_____. 1993. Iowa Retail Sales and Use Tax Report: Annual Report, Des Moines Iowa.

_____. 1994. Iowa Retail Sales and Use Tax Report: Annual Report, Des Moines Iowa.

_____. 1995. Iowa Retail Sales and Use Tax Report: Annual Report, Des Moines Iowa.

Long, Gary and Jeff Helms. 1991. Median Design for Six-Lane Urban Roadways. Transportation Research Center, University of Florida, Gainesville, Florida.

R.L. Polk & Co. 1990. Polk City Directory. Detroit, Michigan.

_____. 1991. Polk City Directory. Detroit, Michigan.

_____. 1992. Polk City Directory. Detroit, Michigan

_____. 1993. Polk City Directory. Detroit, Michigan

_____. 1994. Polk City Directory. Detroit, Michigan

_____. 1995. Polk City Directory. Detroit, Michigan

_____. 1996. Polk City Directory. Detroit, Michigan

I. Appendix 1: Summary of Community Business Trends

(Ken Stone and Scott Baumler, ISU Extension)

Starting and maintaining a small business is a difficult proposition. A high proportion of businesses do not survive in the long run for a variety of reasons. In Iowa, only about 50 percent of all businesses survive (continue to hold the same sales tax permit) over a five year period. For the five business vitality case study communities, this percentage generally varies from 41 percent (Fairfield) to 54 percent (Spencer). Clive, with a business survival rate of 64 percent, is a notable exception.

Community	Five Year Business Survival Rate
Ames	44.6%
Ankeny	44.1%
Clive	63.7%
Fairfield	41.2%
Spencer	54.3%
State of Iowa	49.8%

Clive also has a notably strong business environment in terms of retail sales captured from outside of the community. The retail sales pull factor indicates whether sales dollars are coming from outsiders. A pull factor of more than 1.00 indicates that a community is serving the retail needs of persons beyond its borders.

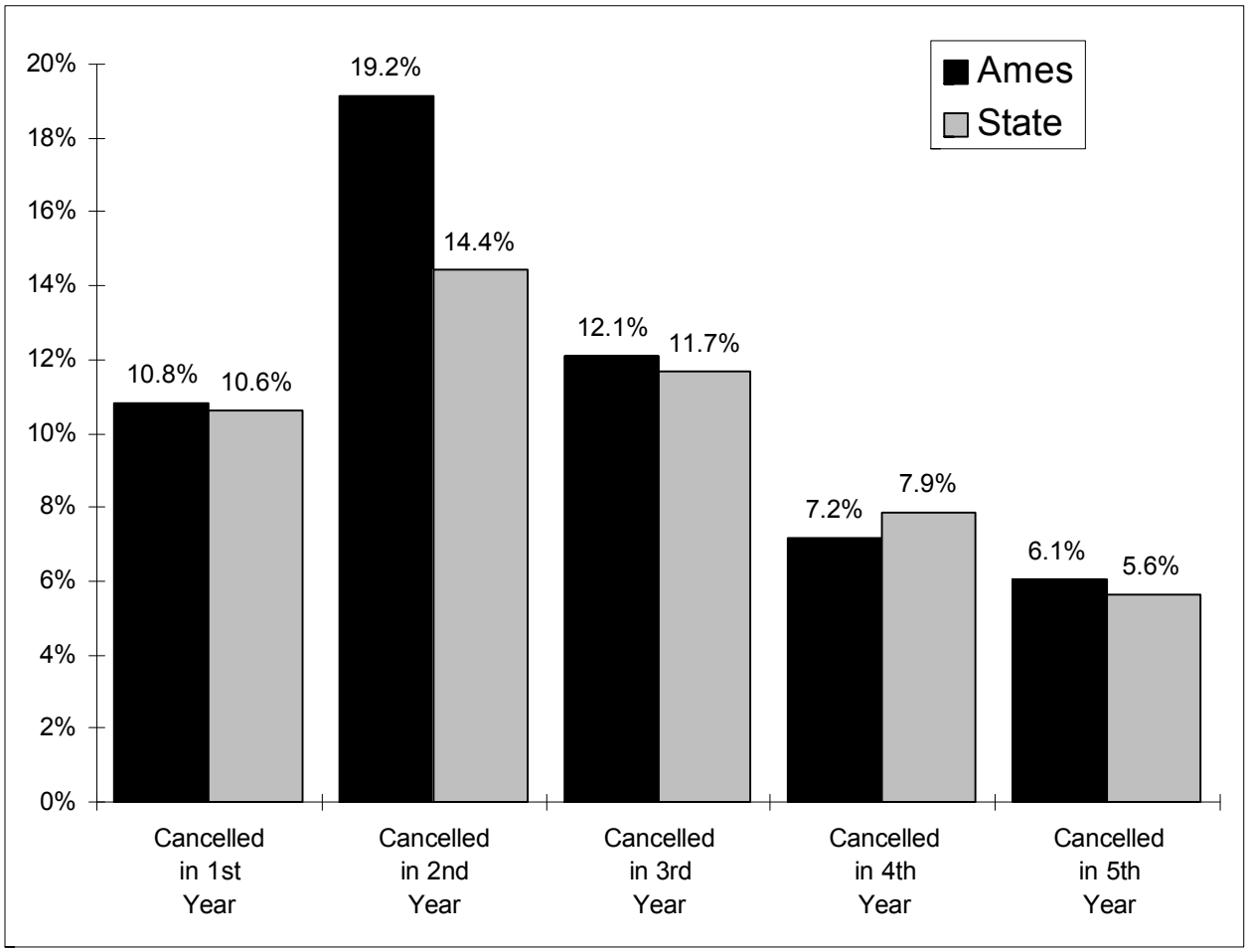
Community	1990 Retail Sales Pull Factor	1996 Retail Sales Pull Factor	Percentage Change 1990-1996
Ames	1.00	1.14	+14.0%
Ankeny	0.86	1.06	+23.3%
Clive	0.44	1.71	+388.6%
Fairfield	1.20	1.16	-0.3%
Spencer	1.56	1.57	+0.1%
State of Iowa	1.00	1.00	----

Clive and Spencer have the largest retail trade pull factors, indicating that they have been able to capture significant trade beyond their borders. However, Clive's pull factor has been growing much more rapidly. Fairfield has actually lost sales to other communities over the past six years. Ames and Ankeny have increased their pull factors moderately.

All Retail Firms

Permits Issued From FY88 Through FY91

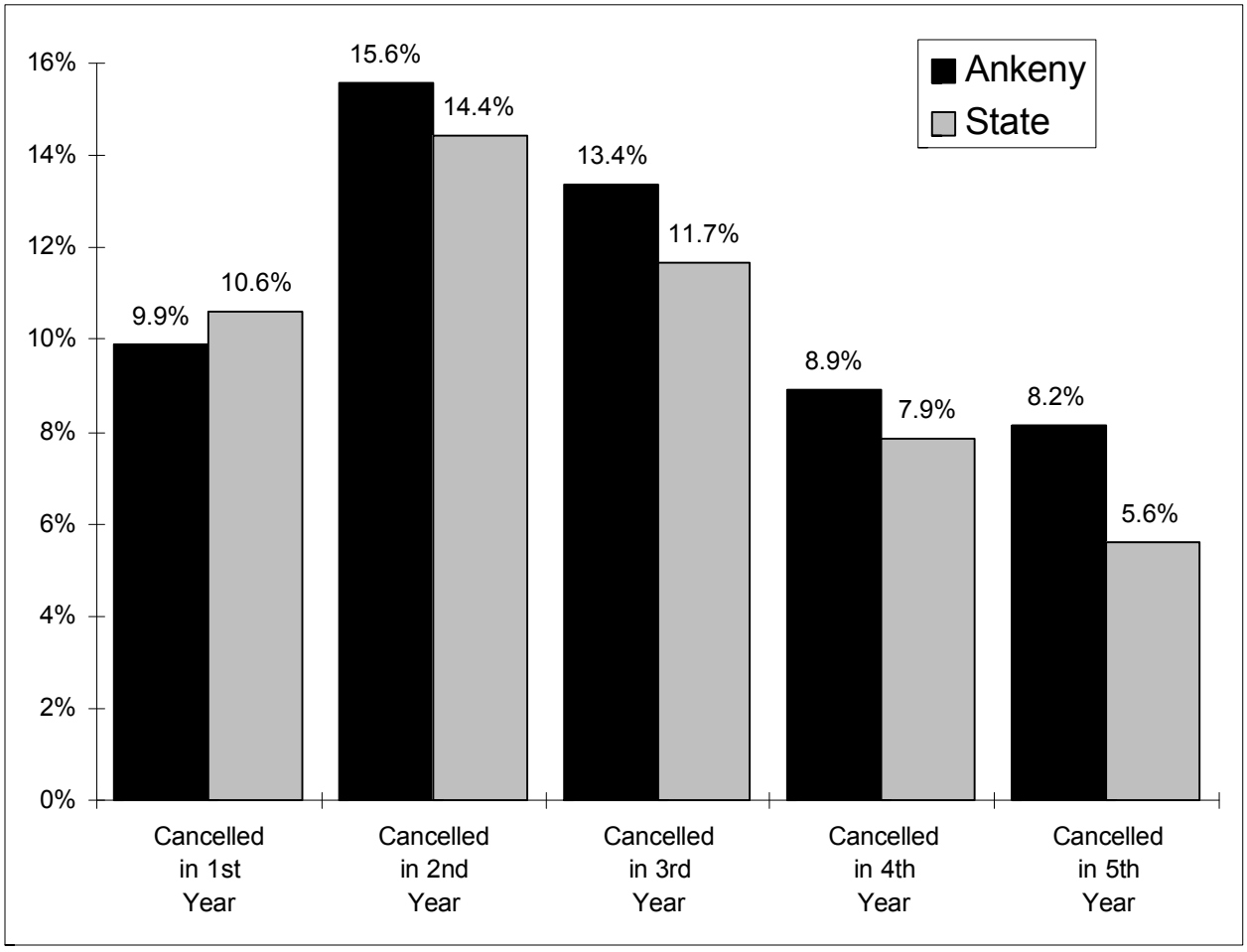
	Ames		**State**	
	Count	Percent	Count	Percent
Permits Issued	710	100.0%	51,489	100.0%
Canceled in 1st Year	77	10.8%	5,466	10.6%
Canceled in 2nd Year	136	19.2%	7,421	14.4%
Canceled in 3rd Year	86	12.1%	6,009	11.7%
Canceled in 4th Year	51	7.2%	4,050	7.9%
Canceled in 5th Year	43	6.1%	2,888	5.6%
Total Remaining More Than 5 Years	317	44.6%	25,655	49.8%



All Retail Firms

Permits Issued From FY88 Through FY91

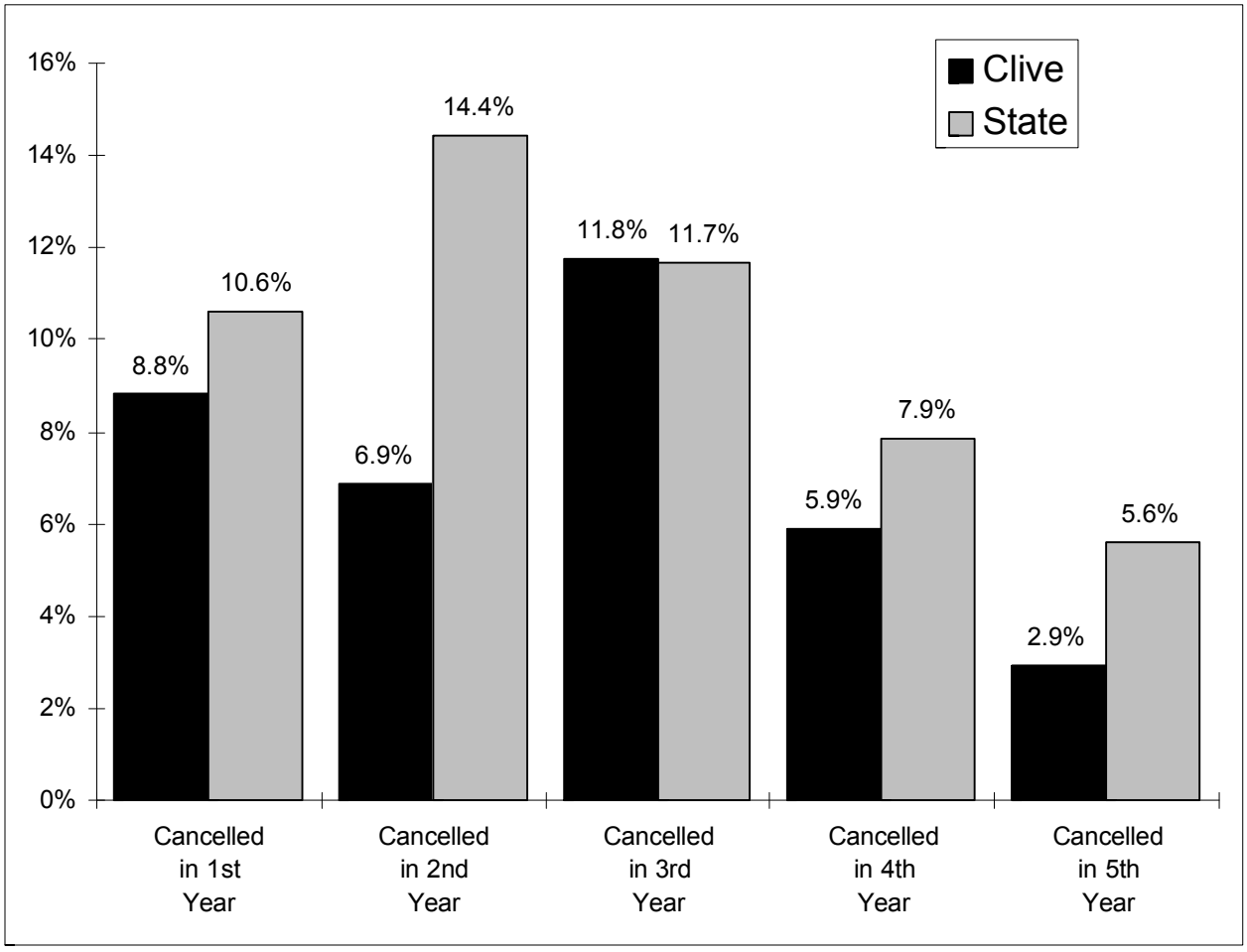
	Ankeny		**State**	
	Count	Percent	Count	Percent
Permits Issued	404	100.0%	51,489	100.0%
Canceled in 1st Year	40	9.9%	5,466	10.6%
Canceled in 2nd Year	63	15.6%	7,421	14.4%
Canceled in 3rd Year	54	13.4%	6,009	11.7%
Canceled in 4th Year	36	8.9%	4,050	7.9%
Canceled in 5th Year	33	8.2%	2,888	5.6%
Total Remaining More Than 5 Years	178	44.1%	25,655	49.8%



All Retail Firms

Permits Issued From FY88 Through FY91

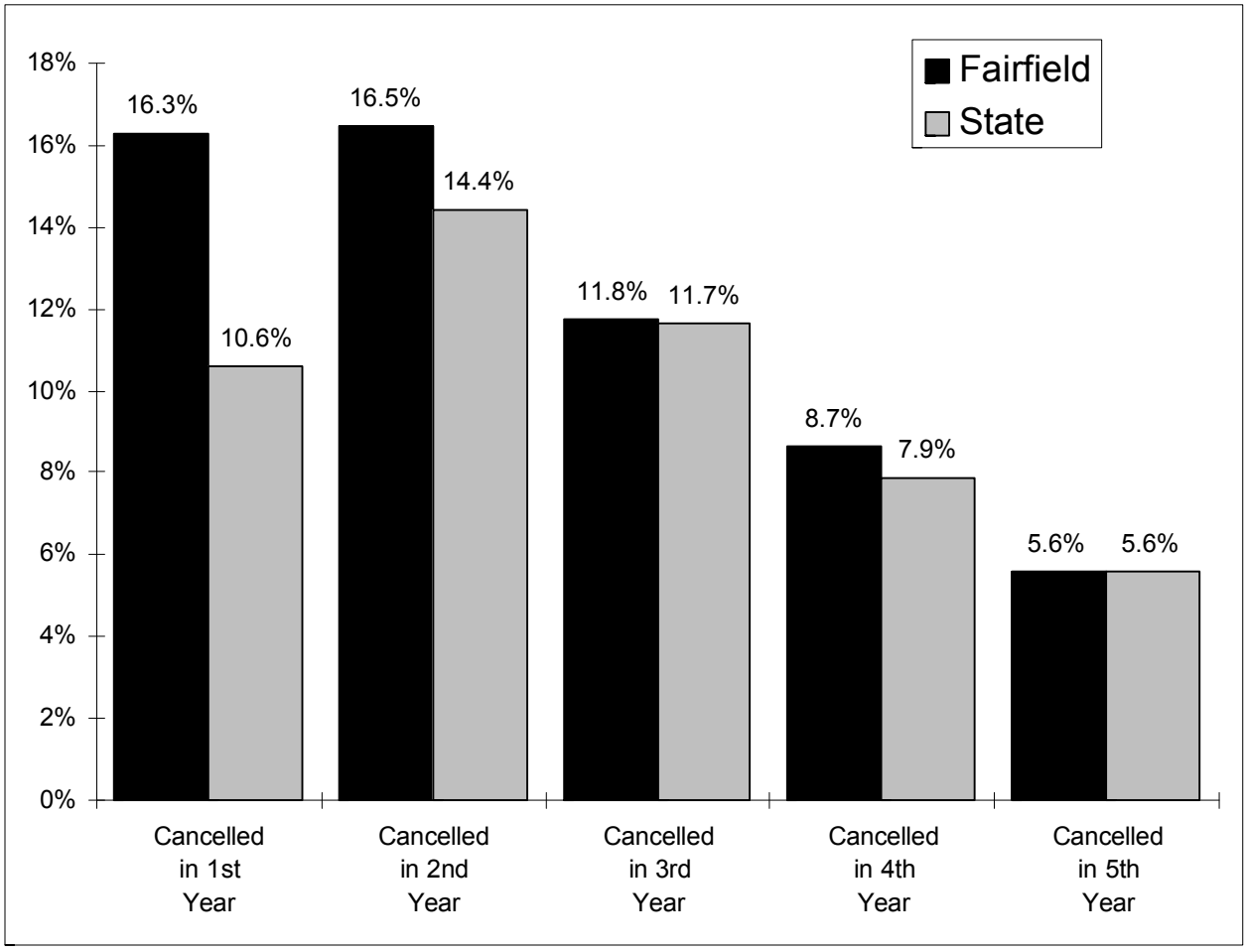
	Clive		State	
	Count	Percent	Count	Percent
Permits Issued	102	100.0%	51,489	100.0%
Canceled in 1st Year	9	8.8%	5,466	10.6%
Canceled in 2nd Year	7	6.9%	7,421	14.4%
Canceled in 3rd Year	12	11.8%	6,009	11.7%
Canceled in 4th Year	6	5.9%	4,050	7.9%
Canceled in 5th Year	3	2.9%	2,888	5.6%
Total Remaining More Than 5 Years	65	63.7%	25,655	49.8%



All Retail Firms

Permits Issued From FY88 Through FY91

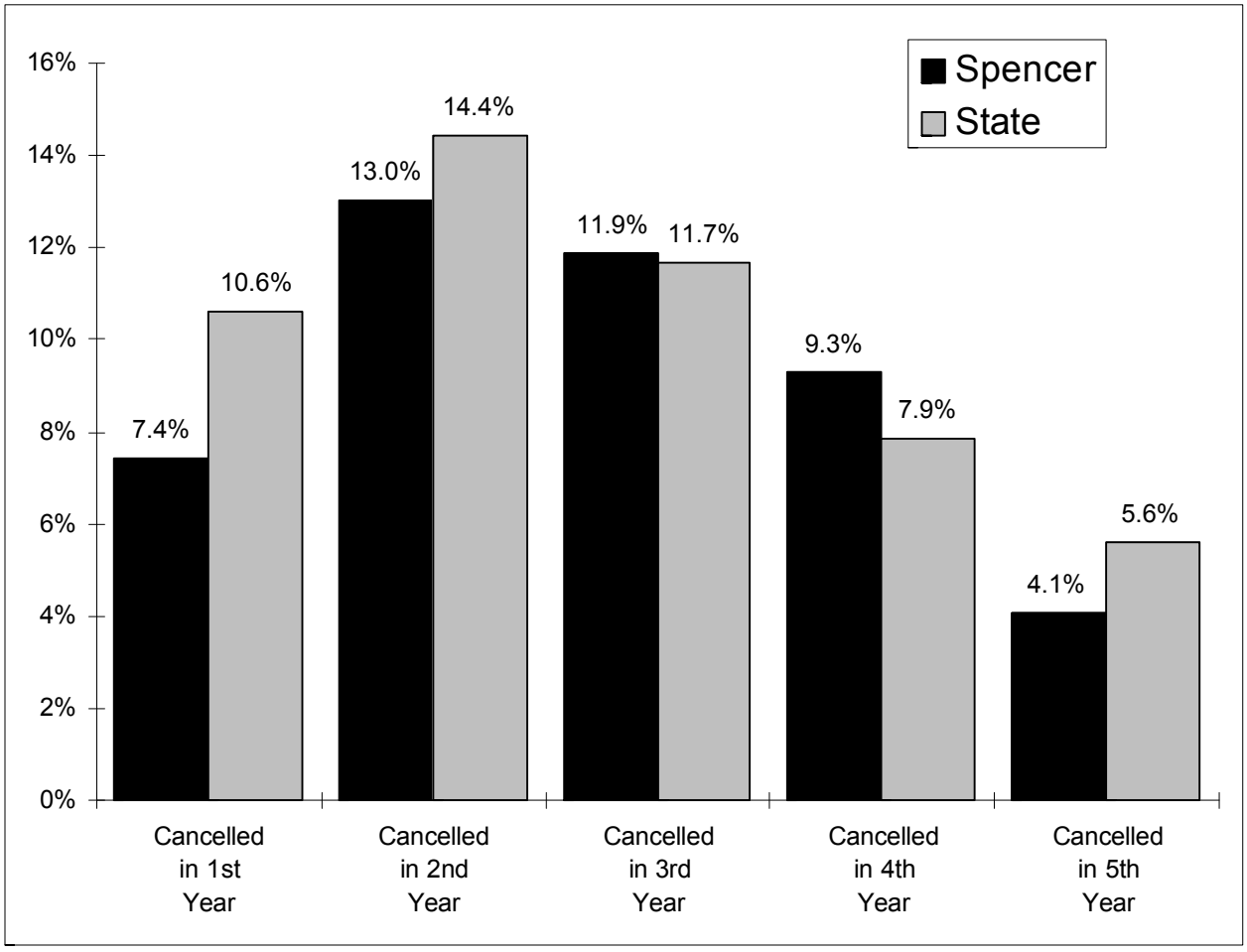
	Fairfield		State	
	Count	Percent	Count	Percent
Permits Issued	485	100.0%	51,489	100.0%
Canceled in 1st Year	79	16.3%	5,466	10.6%
Canceled in 2nd Year	80	16.5%	7,421	14.4%
Canceled in 3rd Year	57	11.8%	6,009	11.7%
Canceled in 4th Year	42	8.7%	4,050	7.9%
Canceled in 5th Year	27	5.6%	2,888	5.6%
Total Remaining More Than 5 Years	200	41.2%	25,655	49.8%



All Retail Firms

Permits Issued From FY88 Through FY91

	Spencer		**State**	
	Count	Percent	Count	Percent
Permits Issued	269	100.0%	51,489	100.0%
Canceled in 1st Year	20	7.4%	5,466	10.6%
Canceled in 2nd Year	35	13.0%	7,421	14.4%
Canceled in 3rd Year	32	11.9%	6,009	11.7%
Canceled in 4th Year	25	9.3%	4,050	7.9%
Canceled in 5th Year	11	4.1%	2,888	5.6%
Total Remaining More Than 5 Years	146	54.3%	25,655	49.8%



Town	Fiscal Year	Utilities	Building Mat.	General Mdse.	Food Stores	Motor Veh.	Apparel Stores	Home Furn.	Eating & Drinking	Specialty Stores	Services	Whse.	Misc.	Total
Ames														
	80	0.94	0.69	1.72	1.07	0.75	1.91	1.39	1.56	1.22	1.35	0.29	0.46	0.98
	81	0.93	0.68	1.69	1.06	0.74	1.85	1.35	1.60	1.23	1.53	0.29	0.48	1.02
	82	0.93	0.62	1.68	1.08	0.71	1.81	1.43	1.51	1.28	1.51	0.25	0.45	1.02
	83	0.92	0.61	1.69	1.07	0.71	1.75	1.48	1.54	1.33	1.50	0.28	0.50	1.05
	84	0.85	0.74	1.73	1.08	0.72	1.68	1.32	1.56	1.36	1.36	0.32	0.46	1.04
	85	0.82	0.76	1.72	1.11	0.74	1.72	1.38	1.58	1.38	1.37	0.34	0.54	1.06
	86	0.85	0.76	1.81	1.16	0.76	1.76	1.37	1.57	1.32	1.33	0.28	0.72	1.09
	87	0.84	0.64	1.83	1.11	0.73	1.67	1.31	1.52	1.25	1.27	0.28	0.60	1.06
	88	0.84	0.84	1.86	1.12	0.68	1.68	1.21	1.51	1.21	1.22	0.31	0.69	1.08
	89	0.85	0.91	1.83	1.11	0.72	1.65	1.23	1.44	1.21	1.20	0.37	0.64	1.09
	90	0.85	0.89	1.83	1.15	0.71	1.68	1.07	1.46	1.15	1.28	0.41	0.62	1.10
	91	0.88	0.88	1.73	1.26	0.72	1.70	1.15	1.42	1.13	1.33	0.48	0.61	1.11
	92	0.90	0.85	1.72	1.43	0.80	1.70	1.16	1.36	1.25	1.21	0.49	0.61	1.11
	93	0.89	0.96	1.69	1.31	0.82	1.83	1.12	1.51	1.33	1.28	0.44	0.66	1.13
	94	0.89	0.94	1.61	1.26	0.84	1.64	1.16	1.55	1.34	1.27	0.41	0.66	1.12
	95	0.90	0.93	1.62	1.25	0.88	1.63	1.18	1.62	1.31	1.36	0.42	0.85	1.15
	96	0.90	0.85	1.75	1.32	0.89	1.59	1.11	1.67	1.27	1.35	0.39	0.66	1.14

Town	Fiscal Year	Utilities	Building Mat.	General Mdse.	Food Stores	Motor Veh.	Apparel Stores	Home Furn.	Eating & Drinking	Specialty Stores	Services	Whse.	Misc.	Total
Ankeny														
	80		1.42		1.39	0.62	0.68	0.38	1.04	1.25	0.66	0.71	2.84	0.82
	81		1.19	0.36	1.40	0.81	0.80	0.40	0.98	1.25	0.68	0.48	2.53	0.78
	82		1.10	0.33	1.48	0.72	0.71	0.31	0.85	1.18	0.75	0.45	2.88	0.74
	83		1.15	0.30	1.45	0.77	0.63	0.29	0.89	1.09	0.82	0.41	3.33	0.76
	84	1.09	1.29	0.32	1.42	1.04	0.59	0.24	0.87	1.19	0.86	0.53	0.65	0.83
	85	1.08	1.64	0.32	1.58	1.21	0.44	0.22	1.10	1.21	0.82	0.55	0.46	0.86
	86	0.59	1.49	0.43	1.60	1.37	0.39	0.26	1.11	1.11	0.79	0.42	0.62	0.79
	87		1.31	0.92	1.53	1.60	0.39	0.32	1.13	0.96	0.72	0.52	1.37	0.80
	88		1.35	0.93	1.42	1.75	0.32	0.34	1.22	0.94	0.69	0.60	1.63	0.84
	89		1.28	1.02	1.09	2.09	0.30	0.39	1.19	0.95	0.65	1.11	1.56	0.90
	90		1.25	1.22	1.01	1.37	0.23	0.46	1.19	0.99	0.65	1.06	1.36	0.86
	91		1.51	1.52	1.05	1.28	0.22	0.49	1.19	1.14	1.18	1.06	1.27	0.94
	92		1.27	1.51	1.12	1.36	0.20	0.57	1.11	1.34	0.81	1.10	1.31	0.96
	93	0.27	1.07	1.12	1.15	1.22	0.37	0.39	1.18	1.14	0.87	1.56	0.69	0.92
	94	0.28	1.06	1.12	1.46	1.24	0.30	0.72	1.05	1.09	0.92	1.54	1.19	0.98
	95	0.29	2.41	1.14	1.57	1.20	0.34	0.72	1.19	1.06	0.94	1.35	1.56	1.10
	96	0.27	3.03	1.11	1.75	0.80	0.29	0.69	1.11	0.94	0.82	1.32	1.41	1.06

Town	Fiscal Year	Utilities	Building Mat.	General Mdse.	Food Stores	Motor Veh.	Apparel Stores	Home Furn.	Eating & Drinking	Specialty Stores	Services	Whse.	Misc.	Total
Clive														
	80													0.30
	81													0.31
	82													0.35
	83													0.34
	84													0.27
	85													0.28
	86													0.27
	87								1.63	0.42	0.52	0.01	0.50	0.28
	88								1.60	0.57	0.64		0.84	0.33
	89								1.81	0.45	0.65		0.97	0.36
	90								1.74	1.19	0.96		0.82	0.44
	91					0.18			2.00	3.39	1.47	0.43	2.55	0.89
	92					0.19			3.31	3.67	1.55	0.54	4.24	1.17
	93					0.31			3.71	2.68	1.76	0.69	5.69	1.27
	94					0.51		2.16	4.56	3.23	1.97	0.66	8.31	1.71
	95					0.58		2.50	4.40	3.70	2.10	0.61	7.34	1.72
	96					1.35		2.30	4.49	2.52	2.32	0.65	7.71	1.71

Town	Fiscal Year	Utilities	Building Mat.	General Mdse.	Food Stores	Motor Veh.	Apparel Stores	Home Furn.	Eating & Drinking	Specialty Stores	Services	Whse.	Misc.	Total
Fairfield														
	80	1.60	1.36	1.33	1.82	1.30	1.71	1.32	1.03	1.30	0.88	0.89	1.96	1.27
	81		1.49	1.23	1.77	1.59	1.82	1.21	1.02	1.25	1.05	0.86	4.81	1.27
	82	1.58	1.69	1.17	1.77	1.34	1.88	1.05	1.07	1.25	0.91	0.86	1.53	1.24
	83	1.57	1.57	1.21	1.82	1.37	1.86	1.03	1.09	1.31	0.81	0.74	1.59	1.23
	84	1.63	1.71	1.16	1.83	1.36	1.81	0.98	1.16	1.29	0.92	0.63	1.60	1.26
	85	1.56	1.62	1.21	1.80	1.40	1.75	0.89	1.17	1.50	1.16	0.85	1.42	1.30
	86	1.55	1.62	1.12	1.79	1.36	1.69	0.86	1.23	1.71	1.27	0.96	1.34	1.34
	87	1.51	1.38	1.43	1.73	1.63	1.51	0.73	1.27	1.71	1.20	0.80	1.19	1.31
	88	1.60	1.33	1.78	1.72	1.56	1.43	0.74	1.22	1.66	1.18	0.74	0.94	1.34
	89	1.59	1.23	1.83	1.77	1.44	1.34	0.93	1.17	1.68	1.17	0.81	0.95	1.35
	90	1.23	0.99	1.61	1.77	1.41	1.17	0.80	1.08	1.68	1.08	0.62	0.88	1.20
	91	1.26	0.87	1.53	1.56	1.45	1.07	0.81	1.09	1.59	1.01	0.63	0.74	1.15
	92	1.23	0.88	1.47	1.51	1.56	1.06	0.84	1.12	1.45	0.99	0.53	1.02	1.14
	93	1.37	0.91	1.43	1.59	1.57	0.73	1.12	1.15	1.63	0.95	0.54	1.06	1.17
	94	1.40	0.92	1.36	1.52	1.56	0.65	0.91	1.19	1.48	0.95	0.52	1.07	1.14
	95	1.39	0.71	1.32	1.62	1.52	0.95	0.85	1.18	1.32	0.94	1.08	1.01	1.16
	96	1.42	0.79	1.17	1.92	1.46	0.64	1.81	1.04	1.41	0.95	0.68	1.19	1.16

Town	Fiscal Year	Utilities	Building Mat.	General Mdse.	Food Stores	Motor Veh.	Apparel Stores	Home Furn.	Eating & Drinking	Specialty Stores	Services	Whse.	Misc.	Total
Spencer														
	80	1.29	2.06	2.20	1.79	2.44	2.88	2.30	1.78	2.02	1.79	1.78	1.24	1.83
	81	1.24	1.99	2.61	1.81	2.40	3.40	2.36	1.69	2.10	1.88	1.64	1.36	1.87
	82	1.24	1.92	2.53	1.91	2.67	3.51	2.62	1.69	2.11	1.73	1.48	1.13	1.83
	83	1.22	1.77	2.49	1.94	2.75	3.43	2.32	1.65	2.19	1.66	1.47	0.95	1.79
	84	1.16	1.87	2.17	1.92	2.62	3.13	2.77	1.76	2.21	1.74	1.39	0.99	1.77
	85	1.10	1.64	2.73	1.72	2.39	2.92	2.87	1.64	2.10	1.59	0.98	0.68	1.67
	86	1.05	1.20	2.52	1.67	2.38	2.98	2.21	1.56	1.94	1.40	0.96	0.68	1.56
	87	1.06	1.07	2.26	1.86	2.75	2.99	2.15	1.48	1.71	1.34	1.01	0.71	1.53
	88	0.95	0.92	2.23	1.72	2.99	3.02	2.00	1.50	1.62	1.45	0.89	1.10	1.54
	89	1.03	0.77	2.27	1.90	3.20	3.14	2.57	1.48	1.60	1.41	0.78	1.15	1.59
	90	0.98	0.96	2.21	1.98	3.13	2.52	2.69	1.35	1.61	1.43	0.75	1.18	1.56
	91	0.96	1.07	1.98	2.05	3.10	2.32	2.64	1.38	1.63	1.45	0.77	1.23	1.54
	92	0.97	0.90	1.74	2.10	3.23	2.32	2.71	1.26	1.65	1.44	0.76	1.14	1.49
	93	1.03	1.08	1.68	2.17	3.15	2.43	2.97	1.32	1.60	1.39	0.73	1.04	1.49
	94	1.05	1.08	1.83	2.13	3.43	2.60	2.92	1.43	1.46	1.45	0.80	1.11	1.55
	95	1.05	0.99	1.98	2.10	3.51	2.66	2.60	1.49	1.45	1.44	0.94	1.04	1.56
	96	1.04	0.97	2.01	2.17	3.46	2.59	2.53	1.50	1.47	1.53	0.96	1.02	1.57

J. Appendix 2: Community Business Patterns

(Dave Plazak, CTRE)

Ames is a large, regional hub for trade serving an area covering several counties. It has a population of slightly under 50,000 persons. A large percentage of the residents are college students at Iowa State University. Ames has experienced slow but steady growth in retail trade activity since the mid-1980s. The number of retail firms in Ames has remained very steady since the mid-1980s at about 1000; per firm sales have also remained stable. Current per capita sales are about $10,000. Ames has several times the total trade activity of the other four business vitality case study locations, with inflation- adjusted sales of around $126 million per year.

Retail Trade Trends: Ames

Year	Firms	Total Sales	Per Capita Sales	Per Firm Sales
1971	612	$81,851,200	$2,040	$133,744
1975	720	$130,279,679	$3,055	$181,070
1980	868	$233,130,159	$5,093	$268,738
1985	985	$294,087,710	$6,326	$298,718
1986	1003	$305,843,836	$6,559	$305,005
1987	996	$316,459,686	$6,766	$317,810
1988	1010	$340,309,628	$7,254	$336,857
1989	1035	$361,417,067	$7,681	$349,280
1990	1030	$384,328,804	$8,143	$373,225
1991	1001	$405,226,075	$8,586	$404,922
1992	996	$417,330,483	$8,842	$419,112
1993	1033	$441,600,421	$9,356	$427,493
1994	1052	$456,060,489	$9,772	$433,415

Source: Iowa Public Resources On-Line

Inflation-Adjusted Retail Sales: Ames

Year	Firms	Total Sales	Per Firm Sales
1971	612	$81,851,200	$133,744
1975	720	$101,148,819	$140,582
1980	868	$121,930,000	$140,553
1985	985	$111,565,899	$113,322
1986	1003	$112,236,270	$111,928
1987	996	$114,617,778	$115,107
1988	1010	$118,409,752	$117,208
1989	1035	$120,673,478	$116,621
1990	1030	$122,319,798	$118,786
1991	1001	$122,572,920	$122,481
1992	996	$122,026,457	$122,547
1993	1033	$125,347,834	$121,343
1994	1052	$126,122,923	$119,860

Source: Iowa Public Resources On-Line

Ankeny is a suburban community of nearly 20,000 persons that has experienced strong growth in retail trade since the late 1980s. The number of retail firms in Ankeny has roughly doubled since the mid-1980s and now is well over 500. Inflation-adjusted retail sales have increased at a rate of about five percent per year over the past decade and are now almost $50 million. Current per capita sales are about $9,000 in Ankeny, and growing quickly.

Retail Sales Trends: Ankeny

Year	Firms	Total Sales	Per Capita Sales	Per Firm Sales
1971	173	$15,970,133	$1,633	$92,580
1975	224	$30,992,631	$2,522	$138,206
1980	340	$63,274,943	$4,101	$186,103
1985	396	$85,382,698	$5,036	$215,885
1986	419	$79,880,703	$4,628	$190,760
1987	426	$88,379,979	$5,031	$207,465
1988	423	$98,558,321	$5,515	$233,274
1989	443	$113,133,064	$6,224	$255,524
1990	454	$116,564,938	$6,307	$257,034
1991	460	$134,030,681	$7,252	$291,688
1992	480	$146,898,000	$7,948	$306,357
1993	527	$151,549,154	$8,200	$287,706
1994	557	$175,586,485	$8,970	$315,519

Source: Iowa Public Resources On-Line

Inflation-Adjusted Retail Sales: Ankeny

Years	Firms	Total Sales	Per Firm Sales
1971	173	$15,970,133	$92,580
1975	224	$24,062,602	$107,303
1980	340	$33,093,589	$97,334
1985	396	$32,391,008	$81,899
1986	419	$29,314,019	$70,004
1987	426	$32,010,134	$75,141
1988	423	$34,293,083	$81,167
1989	443	$37,773,978	$85,317
1990	454	$37,098,962	$81,806
1991	460	$40,541,646	$88,230
1992	480	$42,952,631	$89,578
1993	527	$43,017,075	$81,665
1994	557	$48,558,209	$87,256

Source: Iowa Public Resources On-Line

Clive is another suburban community with a population approaching 10,000. It has experienced very rapid growth in retail trade since the early 1990s and has been one of the fastest-growing communities in Iowa in terms of retail trade. It might be described as a retailing "magnet". Inflation-adjusted sales have increased by nearly 700 percent over the past decade. In 1985, Clive had only 32 retail businesses; it now has over 160 and the number continues to grow very quickly. Current sales per capita are almost $14,000.

Retail Trade Trends: Clive

Year	Firms	Total Sales	Per Capita Sales	Per Firm Sales
1971	NA	NA	NA	NA
1975	15	$3,289,610	$725	$223,024
1980	21	$8,937,404	$1,474	$430,718
1985	32	$10,940,407	$1,618	$347,315
1986	35	$10,864,742	$1,574	$310,421
1987	44	$12,341,372	$1,752	$280,486
1988	53	$15,508,011	$2,159	$295,391
1989	55	$18,022,671	$2,461	$330,691
1990	59	$24,020,089	$3,219	$408,853
1991	100	$51,602,787	$6,915	$514,741
1992	115	$71,276,412	$9,552	$622,501
1993	133	$82,273,085	$11,026	$617,434
1994	160	$117,241,956	$13,814	$731,619

Source: Iowa Public Resources On-Line

Inflation-Adjusted Retail Sales: Clive

Year	Firms	Total Sales	Per Firm Sales
1971	N/A	N/A	N/A
1975	15	$2,554,045	$173,156
1980	21	$4,674,374	$225,271
1985	32	$4,150,382	$131,758
1986	35	$3,987,061	$113,916
1987	44	$4,469,892	$101,588
1988	53	$5,395,968	$102,780
1989	55	$6,017,586	$110,414
1990	59	$7,644,841	$130,125
1991	100	$15,608,829	$155,699
1992	115	$20,841,056	$182,018
1993	133	$23,353,132	$175,258
1994	160	$32,423,107	$202,328

Source: Iowa Public Resources On-Line

Fairfield is a mid-sized, rural community with about 10,000 persons that has experienced rather static retail sales over the past two decades once the effect of inflation is accounted for. The number of retail trade firms located in Fairfield has remained nearly constant at 400 to 450 for the past decade. Inflation adjusted sales have also remained stable at $27 to $30 million per year. Current per capita sales are about $10,000.

Retail Sales Trends: Fairfield

Year	Firms	Total Sales	Per Capita Sales	Per Firm Sales
1971	327	$27,012,667	$3,074	$82,734
1975	304	$38,055,994	$4,195	$125,081
1980	340	$62,642,039	$6,644	$184,106
1985	401	$74,241,690	$7,735	$185,257
1986	418	$77,077,122	$8,002	$184,505
1987	427	$81,295,569	$8,410	$190,388
1988	415	$86,999,818	$8,969	$209,638
1989	408	$92,454,884	$9,498	$226,883
1990	424	$86,837,886	$8,890	$205,048
1991	411	$86,970,526	$8,904	$211,607
1992	426	$89,211,049	$9,133	$209,539
1993	450	$96,855,818	$9,916	$215,116
1994	468	$100,672,585	$10,236	$215,227

Source: Iowa Public Resources On-Line

Inflation-Adjusted Retail Sales: Fairfield

Year	Firms	Total Sales	Per Firm Sales
1971	327	$27,012,667	$82,734
1975	304	$29,546,579	$97,113
1980	340	$32,762,573	$96,290
1985	401	$28,164,526	$70,280
1986	418	$28,285,182	$67,708
1987	427	$29,444,248	$68,956
1988	415	$30,271,336	$72,943
1989	408	$30,869,744	$75,754
1990	424	$27,637,774	$65,260
1991	411	$26,306,874	$64,007
1992	426	$26,085,102	$61,269
1993	450	$27,492,426	$61,060
1994	468	$27,840,870	$59,521

Source: Iowa Public Resources On-Line

Spencer is another a mid-sized community with about 11,000 residents that serves a considerably larger geographic trade area than Fairfield. Spencer is located in a less densely populated part of Iowa and there are no other, similar regional centers located nearby. Like Fairfield, it has experienced static inflation-adjusted retail sales since the mid-1980s. The number of retail firms in Spencer has remained constant at around 500 for years. Inflation-adjusted sales have stayed in a range near $40 million per year. Current per capita sales are about $13,500 per year.

Retail Trade Trends: Spencer

Year	Firms	Total Sales	Per Capita Sales	Per Firm Sales
1971	416	$41,431,133	$3,975	$99,714
1975	418	$67,116,118	$6,100	$160,469
1980	487	$111,517,487	$9,510	$229,106
1985	524	$114,150,487	$10,017	$218,053
1986	507	$106,824,154	$9,428	$210,802
1987	493	$111,327,313	$9,883	$225,816
1988	494	$116,603,212	$10,413	$236,039
1989	503	$125,859,192	$11,306	$250,342
1990	498	$129,098,725	$11,666	$259,234
1991	489	$131,963,933	$11,925	$270,003
1992	486	$133,094,320	$12,027	$273,998
1993	509	$139,346,657	$12,592	$273,766
1994	515	$150,613,621	$13,536	$292,738

Source: Iowa Public Resources On-Line

Inflation-Adjusted Retail Sales: Spencer

Year	Firms	Total Sales	Per Firm Sales
1971	416	$41,431,133	$99,714
1975	418	$52,108,788	$124,588
1980	487	$58,325,045	$119,825
1985	524	$43,304,434	$82,721
1986	507	$39,201,525	$77,359
1987	493	$40,321,374	$81,788
1988	494	$40,571,751	$82,129
1989	503	$42,023,103	$83,586
1990	498	$41,088,073	$82,506
1991	489	$39,916,495	$81,671
1992	486	$38,916,468	$80,116
1993	509	$39,553,408	$77,708
1994	515	$41,651,997	$80,956

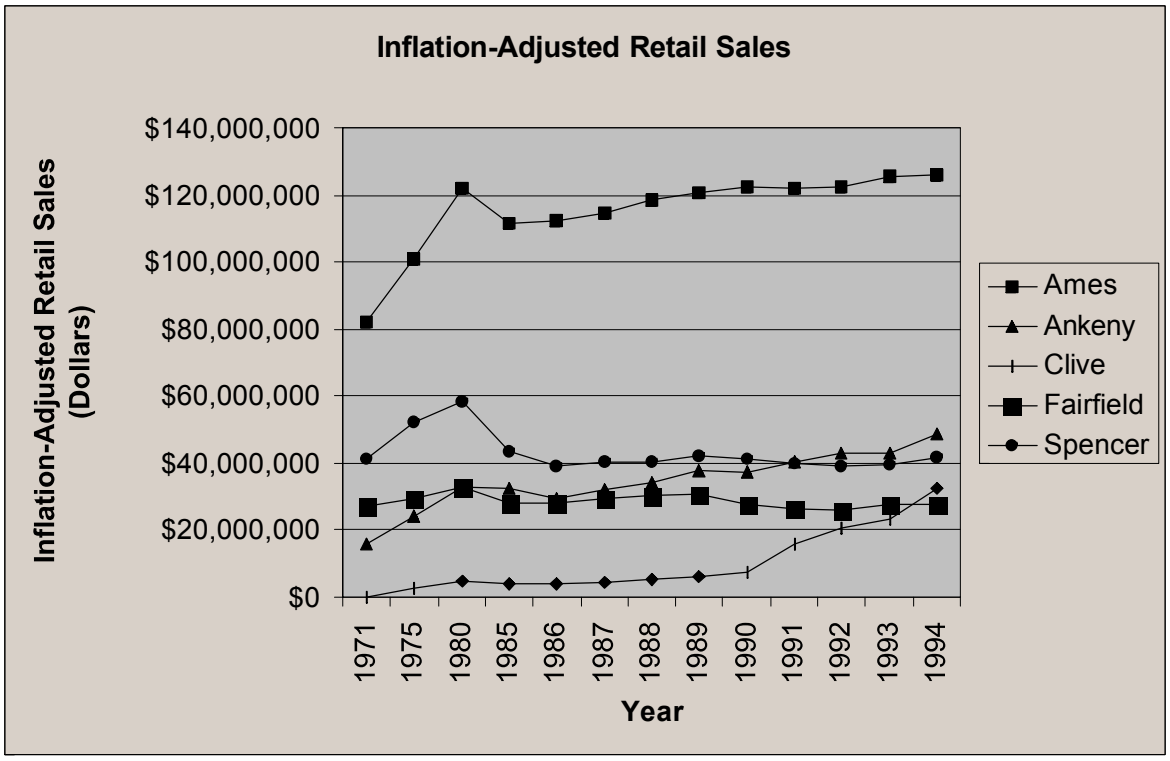
Source: Iowa Public Resources On-Line

Comparing trends of inflation-adjusted retail sales for the five communities shows that all except Ames have similar-sized retail markets in the range of about $30-$50 million per year. Ames has a market three times that large. Patterns of growth diverge more. Ankeny and especially Clive are fast-growing markets. Ames has experienced steady growth. Fairfield and Spencer have experienced little or no growth in inflation-adjusted retail sales.

Inflation-Adjusted Retail Sales: Five Case Study Communities

Year	Ames	Ankeny	Clive	Fairfield	Spencer
1971	$81,851,200	$15,970,133	NA	$27,012,667	$41,431,133
1975	$101,148,819	$24,062,602	$2,554,045	$29,546,579	$52,108,788
1980	$121,930,000	$33,093,589	$4,674,374	$32,762,573	$58,325,045
1985	$111,565,899	$32,391,008	$4,150,382	$28,164,526	$43,304,434
1986	$112,236,270	$29,314,019	$3,987,061	$28,285,182	$39,201,525
1987	$114,617,778	$32,010,134	$4,469,892	$29,444,248	$40,321,374
1988	$118,409,752	$34,293,083	$5,395,968	$30,271,336	$40,571,751
1989	$120,673,478	$37,773,978	$6,017,586	$30,869,744	$42,023,103
1990	$122,572,920	$37,098,962	$7,644,841	$27,637,774	$41,088,073
1991	$122,026,457	$40,541,646	$15,608,829	$26,306,874	$39,916,468
1992	$122,347,834	$42,952,631	$20,841,056	$26,085,102	$38,916,468
1993	$125,347,834	$43,017,075	$23,353,132	$27,492,426	$39,553,408
1994	$126,122,923	$48,558,209	$32,423,107	$27,840,870	$41,651,997

Source: Iowa Public Resources On-Line



IV. Opinion Surveys Documentation

A. Introduction

The state of Iowa and its cities and counties are legally responsible for managing roadway access to various types of properties (e.g. residential, commercial, recreational). The Iowa Department of Transportation's Access Management Task Force was created to establish and promote the concept of access management. Access management refers to the control of the design and operation of driveway and street connections in order to improve traffic safety, improve access to businesses and homes, reduce traffic congestion, and protect costly roadway investments.

It is difficult for state agencies to establish access management programs without involving members of the public (motorists, businesses, public officials such as the mayor, council members, school officials) that are affected by the access management. To accomplish the Task Force's goals, the research team from the University of Northern Iowa was assigned the following responsibilities:

- Develop a methodology for surveying the motorists, businesses, community leaders (mayor, council members, and school administrators) at the five selected locations — Ames, Ankeny, Clive, Fairfield, and Spencer. Types of roadway modification vary: Two-way left-turn lane at Ames and Spencer, driveway consolidation at Fairfield and raised median at Ankeny and Clive.

- Design questionnaires for surveying motorists/business customers, business owners or managers, and public officials.

- Collect data from the three groups of public.

- Write a report and present findings and conclusions.

1. Methodology

After reviewing the literature, questionnaires were developed. They were revised several times based on the feedback received from the Task Force members. Using systematic sampling techniques, businesses were selected for participation in the study. The sample was finally adjusted to make sure that all types of businesses were represented, especially ones with high traffic such as fast food restaurants and grocery stores. Sample size for each site was determined based on the number of businesses affected by roadway modification.

Motorists were surveyed on the business premises or in the immediate vicinity. Most motorists contacted completed the surveys on the spot, while some took the surveys and mailed them in later. The following public officials were contacted to participate in the study: mayors, council members, and school administrators.

In total, we received 63 completed surveys from the business owners/managers, 65 surveys from motorists/business customers, 10 surveys from public officials and 4 surveys from school superintendents. In order to encourage a higher response rate, motorists who were approached to participate in the survey were told that their names would be placed in a drawing which involved two prizes: one for a $50.00 Pizza Hut gift certificate and the other for a $100.00 gift certificate good at any Target store. A drawing was made in September and the two certificates awarded to the two winners.

2. Results

For all of the five sites surveyed, the overwhelming majority of the target groups surveyed (businesses, motorists, and public officials) supported the current roadway modification after weighing the pro's and con's. A majority of them considered the modified roadway to be safer with smoother traffic flow and better access to the businesses. For all of the sites surveyed, a solid majority of business respondents didn't report any impact on vehicular access to their businesses.

A clear majority of business respondents reported either same level of sales or an increase in sales after the current modification. In total, eight businesses either moved or closed their operations. Several of these businesses were interviewed to ascertain the reason for the move. Not all businesses that moved were in direct response to the roadway modifications. However, several did experience declines in sales. Respondents' comments about roadway configuration were mixed, with comments being more positive than negative. Some business owners/managers consented to participate in a video-taped interview.

From the limited study of five sites, it is apparent that the roadway modifications had generally positive effect on the three types of public groups surveyed. In spite of the variety of roadway modifications at five sites, it is very noteworthy to see the overall consistency in responses from the three groups surveyed. It should be noted, however, due to small sample sizes, care should be taken not to generalize the results to the target groups or other sites in the state.

B. Research Design and Methodology

This section describes the methodology used for the following three types of surveys:

1. surveys of motorists
2. surveys of business owners and managers
3. other surveys (city officials, school administrators, etc.)

The same methodology was used for all of the five sites surveyed.

1. Motorist Surveys

Two graduate students from the University of Northern Iowa went to each of the five sites and distributed 99 surveys, in person, to each of the motorists, or business customers, who were at or near the businesses that were located close to the roadway modifications. The target for the number of completed surveys to each site depended on the number of businesses affected by the roadway modification. Most of the respondents receiving the surveys completed the questionnaires right on the spot. A small portion of respondents returned the surveys by mail. In total, sixty-five respondents completed the surveys out of the 99 surveys that were distributed, representing a response rate of 66%. The response rates for the motorist surveys varied from a low of 53.33% at Fairfield to a high of 77.14% at Ames. The low response rate at Fairfield can be attributed to the RAGBRAI bikers rally held during the same period. Response rates for the motorist surveys at each site are as follows:

- Ames 77.14%
- Ankeny 60.00%
- Clive 65.00%
- Fairfield 53.33%
- Spencer 57.14%

2. Survey of Business Owners and Managers

Another group that was surveyed was owners and managers of the businesses located along the roadway that was modified. We used a two-step process to select the businesses. First, from the list of businesses located along the roadway, businesses were selected based on the systematic sampling method. Then, if a particular type of business was over-represented, it was replaced by the type of business that was under-represented. Also, businesses with heavy traffic flow (e.g. fast food restaurants and grocery stores) were included.

Two graduate students from the University of Northern Iowa met the business owners/managers of the selected businesses and personally administered the surveys. In some cases, the owners and managers took the surveys and mailed them later. A total of 63 completed surveys were received out of 78 surveys distributed at the five sites. The response rates varied across sites with a low of 61.54% at Fairfield and a high of 100% at Ames. The main reason for the low response rate at Fairfield was the RAGBRAI bicycling rally held during the same time. Response rates for the individual sites are as follows:

- Ames 100%
- Ankeny 70.59%
- Clive 76.92%
- Fairfield 61.54%
- Spencer 84.82%

3. Agency Surveys

Surveys were also conducted among local government and public officials. They included mayors, council members, and school administrators. They were first contacted by telephone and later interviewed by the graduate students. In some cases, they took surveys and returned them by mail at their convenience. Out of 14 officials surveyed, we received 10 completed surveys. Mayors for Ankeny, Fairfield, and Spencer did not respond. The school superintendent at Clive was not included as there is no school close to the roadway modification.

4. Questionnaire Development

Questionnaires for the three groups surveyed were developed after reading the relevant literature sent by CTRE. A cover letter also was attached explaining the purpose of the survey. To increase the survey response rate among the motorist group, survey participants were informed about the opportunity to win a raffle for two prizes, drawn from those returning the surveys. Several revisions were made based on the input received from the Task Force members. Questionnaires used for data collection are shown in Appendix 1, 2, and 3.

C. Survey of Business Owners and Managers

Results from business surveys are discussed below for each site.

1. Ames

The roadway modification involved installing two way left-turn lanes along the corridor. All of the 22 respondents from the business surveys said that they were familiar with the roadway modification. About 90.9% of them had been at that location before the roadway modification was done. When asked about the influence of roadway modification on truck deliveries to their businesses, 54.6% of them said that they were not affected. Those who responded positively to the question expressed satisfaction with the modification as the modification provided better access for many of them.

In terms of impact of modification on sales, 73% said their sales remained the same and about 18% said their sales increased. The roadway improvement leads to a more desirable environment as 63.64% responded positively. According to the business owners and managers, only 27% of their customers complained about access to their businesses. An overwhelming majority of business respondents (91%) supported the current modification, considering the trade-off between the motorists' convenience, smooth traffic flow, safety, and effects on businesses. Only two businesses (a real estate office and an auto parts store) moved out that area as a direct result of the current roadway configuration, and three businesses were adversely affected by the modification.

For questions on roadway safety, traffic flow, and left turns, most respondents strongly agreed that the roadway modification had a positive impact. In terms of demographics of the respondents, 82% of them were male and 18% female. Out of those who completed the surveys, 55% were owners and 45% were managers. Over half of the businesses had 21 employees or more. Sixty percent of the respondents agreed to participate in a video-taped interview.

2. Ankeny

The roadway modification at this site involved installing raised median along the corridor. The majority of respondents said they were familiar with the roadway modification. All businesses were in operation at that location prior to the year the roadway was modified. Roadway modifications did not affect vehicular access to the businesses. About 67% of the respondents reported that sales increased or had remained the same after the roadway was modified. Most of them acknowledged that roadway improvement leads to a more desirable business environment and very few customers complained about access to their businesses.

Recognizing the trade-off between the motorists' convenience, smooth traffic flow, safety, and effects on businesses, the current roadway modification received support from all respondents (100%). It was interesting to know that none of the businesses moved out of the area as a direct result of roadway modification. Respondents generally felt the roadway to be safer, with smoother traffic flow, and easier left turns resulted from the roadway modification. None of the businesses were adversely affected by the improvements.

In terms of demographics of the respondents, 75% of them were male and 25% female. Over half of them were managers with the rest divided between owners and presidents. About 83% of the respondents agreed to participate in a video-taped interview.

3. Clive

The roadway modification at Clive involved installing raised median along the corridor. Ten businesses

participated in the study, and all of them were familiar with the roadway modifications. These businesses were also in operation at that location prior to the modification. About 40% of the businesses surveyed reported that the modifications affected vehicular access to their establishments. However, they did not mention how it affected them. Sales of 90% of the businesses surveyed either remained the same or had increased, and business environment improved as a result of roadway modification. However, half of the respondents said that the customers complained about access to their businesses. Considering the trade-off between costs and benefits, a majority (70%) of them supported the current roadway configuration.

Their perceptions of the impact of roadway modification on safety, smooth traffic and ease of driving were less positive compared to responses obtained from other sites. It should be noted that Clive has experienced a dramatic increase in traffic along the improved roadway modifications. As a result of roadway modification, four businesses were either closed or moved out of the area. They agree that the roadway is safer with smoother traffic flow and better access after the roadway modification. In the opinion of one respondent, all businesses with an island (raised median) were affected as a direct result of the roadway modification.

In terms of demographics, 90% of them are male and 10% female. Sixty percent of the respondents were managers and the rest were owners. Only 30% of the respondents agreed to participate in a video-taped interview.

4. Fairfield

The roadway modification at Fairfield involved driveway consolidation along the corridor. Five of the eight respondents were not familiar with the roadway modification. Four of the businesses surveyed moved into their current locations along the corridor after the roadway modification. About 29% of them said that the modifications affected vehicular access to their businesses. Sales either remained the same or had increased for all of the businesses surveyed.

Most of the respondents agreed that the roadway improvement leads to a more desirable business environment. No complaints were received from the customers about the roadway modification. Only two of the eight surveyed did not support the current roadway configuration. None of the businesses were closed or adversely affected as a direct result of the roadway modification. Respondents somewhat agreed that the roadway is safer with smoother traffic flow and convenient access, after roadway modification. They were neutral about easiness of making left turns.

In terms of gender, about 63% of them are male and 37% female. A large majority (75%) of the respondents were managers. About half of those surveyed have 30 or more employees. Only one person was willing to participate in a video-taped interview.

5. Spencer

The roadway modification at Spencer involved installing two way left-turn lanes along the corridor. All of the eleven people surveyed are familiar with the roadway modification. They also had their businesses in operation at that location prior to the year the roadway was modified. Only 18% of them said that the roadway modifications affected vehicular access to their businesses. A majority of the respondents (81%) reported their sales to be the same or had increased after the roadway modification. About 82% of them reported a more desirable business environment after the modification. Only one business received complaints from customers about the roadway modification.

There was an overwhelming support for the roadway modification (100%), considering the trade-off between the motorists' convenience, smooth traffic flow, safety, and effects on businesses. As reported by respondents, none of the businesses closed or moved out of the area as a direct result of roadway modification. According to the respondents' knowledge, no business was adversely affected by the roadway modification.

Those surveyed reported that the roadway is safer with smoother traffic flow and better access to the businesses, after the roadway modification. In terms of demographics of the respondents, a majority of them (73%) are male. Out of the eleven respondents, 55% were managers and 36% were owners. Number of employees at their businesses varied from 2 to 30. About half of the respondents are willing to participate in a video-taped interview.

D. Survey of Motorists and Business Customers

1. Ames

Almost all of the 27 motorists surveyed were familiar with the roadway modification. Most of them (96.3%) also had driven on the road before the roadway was modified. Motorists agreed that the roadway is safer now with better traffic flow and easier access to the businesses, after the roadway modification. They also believe that it is easier to make left turns now, compared to the condition before the roadway was modified.

A majority (96.3%) of the respondents supported the roadway modification considering motorist convenience, smooth traffic flow, safety, and effects on businesses. In terms of gender, the respondents were equally divided between male and female. Age of the respondents varied from 18 to 77 years.

2. Ankeny

Out of nine motorists surveyed, four of them were neither familiar with the roadway modification nor drove on the road before it was modified. The respondents somewhat agreed that the roadway is safer with better traffic flow and easier access to the business is available after the roadway was modified. They also said that it is easier and safer to make left turns than before.

They were unanimous about their support for the current roadway modification, considering motorist convenience, smooth traffic flow, safety, and effects on business. In terms of demographics, about 56% of the respondents are male and 45% female. Their age varied from 22 to 41 years.

3. Clive

Only two of the thirteen respondents in the study were not familiar with the current roadway modification. Perhaps the same two motorists didn't drive on the road before it was modified. The motorists surveyed somewhat agreed that the roadway is safer, with better traffic flow and better access to the businesses since the modification. They agreed that left turns are safer and easier than before.

All but two motorists supported the current roadway configuration after considering factors such as motorists' convenience, smooth traffic flow, safety, and effects on businesses. In terms of demographics, their age varied from 21 years to 58 years. About 54% of the participants in the survey are male and 46% female.

4. Fairfield

Out of the eight respondents, three of them were not familiar with the roadway modification. Hence, the subsequent results are based on only five respondents. The respondents somewhat agreed that the roadway is safer, with better traffic flow and easier access to the businesses since the modification was done. They also reported that it is easier to make left turns after the modification.

All of the five respondents unanimously supported the current roadway configuration, considering motorists' convenience, smooth traffic flow, safety, and effects on businesses. Out of five respondents, 3 were female and 2 were male. Their age varied from 22 years to 28 years.

5. Spencer

Out of the eight motorists surveyed, only one was not familiar with the modification and two did not drive on

the road prior to modification. The rest of the results are based on six respondents. All six motorists in this study strongly agreed that the roadway is safer, with better traffic flow and easier access to businesses since the roadway was modified. They also said it is safer to make left turns now compared to the condition before modification.

The six respondents unanimously supported the current roadway configuration, considering factors such as motorists' convenience, smooth traffic flow, safety, and effects on businesses. In terms of gender of the respondents, four were male and two were female. Their ages varied from 23 years to 28 years.

E. Surveys of Public Officials

To get some feedback from public officials, mayors, council members, and school superintendents of schools were interviewed.

1. Ames

Completed surveys were received from the deputy superintendent of schools and a part-time mayor. Both were familiar with the roadway modification, and they also happened to drive on the road before it was modified. They both said that the roadway is now safer, with smoother traffic flow in the through lanes. They also agreed that motorists were not inconvenienced by the roadway modification, and they felt left turns to be better.

Both officials somewhat agreed on the increase of land development along the roadway. The school official and the mayor supported the current roadway configuration, considering motorists' convenience, smooth traffic flow, safety, and effects on businesses. Both received positive comments about the roadway modification from the public, and both officials served in the same position before and after the road was modified. The school official mentioned that it is tough turning left onto Duff Avenue. Both were willing to participate in a video-taped interview.

2. Ankeny

The two public officials that participated in the survey were a city councilman and the executive director of support services. Both agreed that the roadway is now safer, with smoother traffic flow in both lanes. The school representative had no opinion about the impact of modification on motorists' convenience. They both agreed on better left turns and increased usage of land after the modification.

Considering all factors, both supported the current modification. They received a lot of positive comments about the modification from the public. According to the school representative, the modification certainly enhanced community image and traffic safety for the children. The councilman agreed to participate in a video-taped interview.

3. Clive

The city manager and the mayor of Clive participated in the study. Both were familiar with the roadway modification and also drove on the road prior to it being modified. Both were positive about roadway safety, left turns, traffic flow, and motorists' convenience as a result of roadway modification. The mayor did not agree that land use increased after the modification, and the city manager did not offer any opinion at all on land usage. However, both supported the current roadway configuration. Both are willing to participate in a video-taped interview.

4. Fairfield

The superintendent of schools was the only person who responded to this survey. He was familiar with the modification and also drove on the road before it was modified. He agreed that the roadway is now safer, with better traffic flow and safer left turns. He received positive comment from the public.

5. Spencer

The superintendent of schools and a city councilman (also part-time mayor) participated in the study. Both were familiar with the roadway modification, and both agreed that the roadway is now safer, with smoother traffic flow, easier left turns, and better convenience for motorists. Both officials support the current roadway configuration and have received positive comments from the public. The South Grand Avenue project greatly improved the appearance of the area, according to the councilman. Both respondents agreed to participate in a videotaped interview.

F. Conclusions

Based on the findings from the study, the following conclusions can be drawn. Since the sample sizes for all of the three groups of surveys were relatively small, care should be taken in not generalizing the findings for the entire target groups. However, we don't expect any systematic bias in the data collected. Accordingly, the following conclusions are more applicable for the three samples of respondents, rather than for the entire target groups.

1. A large majority of businesses surveyed, expressed the opinion that the roadway modifications created a somewhat more desirable business environment (see Table 25). After considering all of the factors such as motorists' convenience, smooth traffic flow, safety, and effects on businesses, an overwhelming majority of the businesses surveyed supported the current roadway modification. About 30% of businesses at Clive, however, did not support the modification (see Table 26). It should be noted that the level of business activities and the amount of traffic at Clive increased dramatically along the corridor when comparing to the other sites.

Table 25: Percentage of Businesses Expressing the Opinion that Modification Created a Better Business Environment

Ames	Ankeny	Clive	Fairfield	Spencer
86.6	91.7	60.0	87.5	81.8

2. A majority of motorists also showed a strong support for the current roadway access modifications (see Table 26).

Table 26: Percentage Expressing Support for the Roadway Modifications

	Ames	Ankeny	Clive	Fairfield	Spencer
Businesses	91	100	70	87.5	100
Motorists	96	100	92	100	100

3. A large majority of the businesses reported sales to be either the same or had increased due to the roadway modifications (see Table 27).

Table 27: Percentage of Businesses Reporting Sales (Increase, Same, Decrease or Uncertain)

	Increase	Same	Decrease	Uncertain
Ames	18.2	72.7	0.0	9.1
Ankeny	41.7	25.0	16.7	16.6
Clive	40.0	50.0	10.0	0.0
Fairfield	28.6	71.4	0.0	0.0
Spencer	36.4	45.4	0.0	18.2

4. As a direct result of roadway modification, four businesses at Ames and four at Clive were closed or moved out.

5. Most participants (businesses, motorists and public officials) agreed that the roadway are safer after the modifications, with better traffic flow and better access to the businesses. They also reported left turns to be easier after the modifications (see Table 28).

Table 28: Perceptions After Roadway Modifications (Business and Motorists)

	Ames	Ankeny	Clive	Fairfield	Spencer
Safer to drive on now:					
Businesses	1.72	1.67	2.50	2.13	2.00
Motorists	1.84	2.00	2.25	1.60	1.17
Traffic flow is better now:					
Businesses	1.63	1.50	2.30	2.00	1.27
Motorists	1.62	2.14	1.92	2.20	1.17
Not inconvenienced by the change in trying to get to destination:					
Businesses	1.68	2.25	2.70	1.50	1.63
Motorists	1.77	2.14	2.17	2.40	1.50
It is easier to turn left now:					
Businesses	1.68	1.92	1.70	2.75	1.73
Motorists	1.73	1.57	2.17	1.80	1.50

Based on scales: 1 (strongly agree) to 5 (strongly disagree)

6. No public official reported a decrease in land development after the roadway modification.

7. Some businesses were adversely affected by the roadway modifications--one at Ames, two at Fairfield, all businesses along the raised median at Clive and five businesses at Spencer.

V. Acknowledgments

Iowa Access Management Task Force Members
- Dale Harrington, Task Force Chair (Private sector)
- Les Beck (County government)
- Jolee Belzung (City government)
- Sue Cosner (City government)
- Larry Heintz (Iowa DOT Maintenance Division)
- Jack Latterell (Federal Highway Administration)
- Dave Little (Iowa DOT Project Development Division)
- Tom Welch (Iowa DOT Research Project Manager, Engineering Division)

Iowa Access Management Research and Awareness Project Team Members
Iowa State University, Center for Transportation Research and Education (CTRE)
- Dr. Tom Maze, Principal Investigator
- David Plazak, Project Manager
- Dr. Tom Sanchez
- Marilyn Kuntemeyer
- Chris Albrecht, Steve Schrock, and Tim Simondynes, Graduate Students
- Hwang Gwo-Yih, Undergraduate Student

Iowa State University, Department of Economics
- Dr. Ken Stone
- Scott Baumler

University of Northern Iowa, Department of Marketing
- Dr. Paul Chao, Principal Investigator
- Dr. Pola Gupta, Investigating Researcher
- Brent Meyer and Darrin Tebbe, Graduate Students

University of Iowa, Public Policy Institute
- Dr. John Shaw (during Phase I)

For Further Information
Several other reports are currently available from the Iowa Access Management Research and Awareness Project. These reports provide in-depth information on the research effort and results. Each is described below and is available for the Center for Transportation Research and Education (CTRE) at Iowa State University. The project research reports are:

- A review of the United States and Canada access management literature as of October 1996. This report is entitled *Access Management: A Review of Recent Literature*.
- *Access Management: Current Policies And Practices In Iowa*, an April 1997 survey of current access management practices in Iowa, focusing on metropolitan areas, large cities, and large counties.

In addition, the CTRE project staff has developed and maintained a site on the World Wide Web for this project located at: http://www.ctre.iastate.edu/access. The web site contains all the research results and reports plus links to other access management information in the United States and Canada. The web site will be updated as the project continues into Phase III.

Sponsored by the Project Development Division of the Iowa Department of Transportation and the Iowa Highway Research Board, Iowa DOT Project TR-402