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Engineering Management Services Division • Gaithersburg, Maryland

Executive Summary

Engineering Study for the Evaluation of Public Road Administration and Maintenance Alternatives

Iowa Department of Transportation
Iowa Highway Research Board
Project HR-265

August 1985

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Project Advisory Panel or personnel from the public and private agencies that provided assistance to this study.

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The project Advisory Panel met regularly with the project staff to review the project progress and provide input and guidance throughout the project. This participation and guidance contributed significantly to the successful completion of the project objectives. Panel members were:

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The interpretation of factual input to the analyses, opinions, findings and conclusions are those of the authors and are not necessarily consistent with the opinions of personnel from the public and private agencies that provided assistance to this study.

ABSTRACT

Iowa's public road system of 112,000 miles is one of the largest and the best in the nation. It represents a considerable financial investment of taxpayer revenues over the years. And, it requires a sustained investment to preserve an economical level of transport service into the future.

In 1982, a Governor's Blue Ribbon Transportation Task Force evaluated the effectiveness of Iowa's entire transportation system. Four important Task Force recommendations dealt with public road administrative issues in Iowa. These issues were related to:

1. design criteria and levels of maintenance;

2. consistency in the use of standards among jurisdictions;

3. consolidation of maintenance operations at one jurisdictional level; and

4. jurisdictional authority for roads.

The issues formed the background for Research Project HR-265.

Objectives

Research Project, HR-265, an "Engineering Study for the Evaluation of Public Road Administration and Maintenance Alternatives," was undertaken to provide the jurisdictional agencies with an independent, quantitative assessment of the issues. Specific objectives for HR-265 were to evaluate the economic and other impacts associated with:

1. the development of consistent and uniform design, maintenance and construction standards for use by public road agencies;

2. the consolidation of public road construction and maintenance operations, and

3. the transfer of public roads between various jurisdictions.

Uniform Standards

The Iowa Department of Transportation, the counties and the larger cities have adopted uniform design guidelines that generally conform to those of the American Association of State Highway and Transportation Officials. The findings of HR-265 indicate that there is not a great cost savings potential in simply lowering these design guidelines. The issue is more complex and involves the inclusion of all highway transport costs, not only the governments' investment costs. When all costs are considered, the findings indicate that most road and street improvements

made in accordance with current guidelines actually reduce total highway transport costs. This is true because the savings occur in highway user costs which typically represent more than 80 percent of the total highway transport costs.

In fact, the timely implementation of improvements, particularly those designed to protect and restore existing roads and streets, can significantly reduce user costs and consequently total highway transport costs in Iowa. HR-265 elaborates the various improvement types and their cost savings potential under varying traffic and other conditions.

Consolidation of Operations

Since 1919, Iowa's public roads and streets have been administered by the state, counties and cities. The responsibility for construction and maintenance of the 112,000 miles of public roads and streets has remained relatively stable except for an increase in the state primary system from 6,500 miles to 10,105 miles. HR-265 staff investigated several major consolidation alternatives and found that the consolidation of construction and maintenance operations does not offer substantial cost savings or improved operations. The staff found that:

1. there is little or no duplication of services among jurisdictions;

2. there would be increased costs related to the transition itself, as well as, inefficient resource utilization during the transition to consolidation; and

3. apparent cost savings to one jurisdiction appear as increased costs to the jurisdiction receiving the additional responsibilities -- a cost transfer not a savings.

The legal mechanisms already exist to accommodate the performance of services by entities outside the responsible jurisdictional agency. This can be accomplished as required on a case-by-case basis through either 28-E agreements between government agencies or private contracting.

Extensive general consolidation of operations does not offer a potential for cost savings. However, there is room for improvement in the delivery of maintenance services at the operational levels of all jurisdictions. This can result in some cost savings, and most likely will result in improved productivity or output.

The adoption and use by the local jurisdictions of formalized maintenance guidelines to develop annual maintenance budgets and execute work programs will result in more effective maintenance operations through increased uniformity in the levels of maintenance service and more efficient utilization of personnel, equipment and materials.

Jurisdictional Authority

Closely linked to the consolidation issue is the issue of the jurisdictional authority for roads. As with consolidation, the transfer of the jurisdictional authority for roads should be the result of the adoption of a plan for delivering public services that demonstates:

1. cost savings,

2. improved service levels, and/or

3. more equitable and practical public road financing.

In accordance with these three measures, changes in the current jurisdictional authority for roads are not warranted.

Specifically, the proposal to transfer county farm-to-market roads to the state would be the first step in establishing a centralized consolidated authority for all public roads in Iowa. As this occurred, the citizens would be one level of government further from the governmental agency responsible for performing the work. County maintenance organizations would be left with unacceptably low paved road mileages and the resulting inefficient use of paved road maintenance resources.

Experience in other states, demonstrates that it is the local road systems and programs that ultimately suffer the most when available revenues are inadequate and the rural road mileage is entirely under State control. Furthermore, it is recognized that legislative bodies are not receptive to the substitution of motor vehicle user funding for losses of non-user (local) funding. The net effect is a decline in total highway revenue. Revenues from local sources would not be available under the current Iowa Code to fund a state administered road program that included former local road mileage. Revenues from motor vehicle users probably could not be increased sufficiently to fund a road program that included these additional local secondary miles.

In summary, the premise that costs savings in Iowa's government road and street investment programs will compensate for a shortfall in existing and future program investment is unfounded. A policy of freezing the governments' investment in roads, based on this premise, risks increasing highway transport costs. Programs and projects designed to restore and protect the current road and street infrastructure offer the greatest potential for reduced highway transport costs in Iowa.

SUMMARY

BACKGROUND

The 1982 Report of the Governor's Blue Ribbon Transportation Task Force contained 26 recommendations covering a wide range of issues related to Iowa's highways, roads and streets. Although all of the recommendations were important, four dealt with major issues affecting the various jurisdictional agencies responsible for the public road systems in Iowa. The issues related to:

- Design Criteria and Levels of Maintenance;
- Consistency in Standards;
- Consolidation of Maintenance Activities; and
- Jurisdictional Responsibilities.

Due to time limitations for the 1982 study, the Governor's Task Force was unable to perform an in-depth, quantitative evaluation of the issues and impacts addressed in the discussions accompanying the recommendations. As a result, this study, Research Project HR-265, "Engineering Study for the Evaluation of Public Road Administration and Maintenance Alternatives", was undertaken to provide the jurisdictional agencies with an independent, in-depth, quantitative assessment of the key issues as a foundation for recommendations to the Legislature.

OBJECTIVES

Specific objectives for the study are to evaluate the economic and other impacts associated with:

1. the development of consistent and uniform design, maintenance and construction standards for use by public road agencies,
2. the consolidation of public road construction and maintenance operations, and
3. the transfer of public roads between various jurisdictions.

An Advisory Panel of state, county and city public road and street officials provided overall guidance and direction during the project through periodic meetings to review significant project activities and findings.

RESEARCH APPROACH

The approach to the study was twofold:

1. to elicit the perceptions and opinions of all levels of government within Iowa with respect to the issues, and

2. to collect and subsequently analyze information as part of an independent assessment of the issues corresponding to each of the study objectives.

Questionnaires were sent to all Iowa cities and counties. More extensive information was collected through on-site interviews with officials in 12 counties and 20 cities. Transportation agencies in four states were also visited to assess alternative approaches to public road administration.

In addition to opinions and procedural information gathered through questionnaires and interviews, technical, economic and financial information and data were collected and subsequently analyzed using two computer models. The analyses of all information were used to develop findings, conclusions and recommendations.

MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The major findings and conclusions reached as a result of this study pertain to each objective and are contained in the following three sections:

- Uniform Standards,
- Consolidation of Construction and Maintenance Operations, and
- Jurisdictional Changes.

Uniform Standards

While highway standards and guidelines can be generally applied to help form funding, budgeting and other policy, there is no place for their general and mechanistic application in the engineering practices of design, construction and maintenance. In order to be cost-effective in practice, standards should guide engineering actions. Actions must be tailored within guidelines to fit specific circumstances involving many technical, economic, social and political factors. Furthermore, the guidelines should be economical as well as uniform -- uniformly applied uneconomical guidelines produce uniformly uneconomical results. In light of the above, the following findings and conclusions resulted from the analyses of the impacts of applying uniform highway standards and guidelines.

1. In general, preventive maintenance and capital replacement made according to current design standards and guidelines and reconstruction improvements directed towards protecting and restoring the existing highway and street infrastructure are highly feasible from an economic viewpoint. The deferment of this type of improvement for whatever reasons, including funding, can significantly increase costs in the highway transport sector in Iowa.

Conversely, the timely implementation of this type of improvement through adequate funding can produce significant benefits. This is true because the total direct highway transport costs are comprised of user costs -- vehicle operating costs, safety costs, passenger time costs -- as well as government investment costs -- maintenance costs and construction costs. And, the governments' investment in keeping roads in good condition and up to standards reduces the user costs which make up the majority of the costs, typically more than 80 percent of the costs. The significant cost savings potential from applying uniform economical standards comes from reductions in the user costs, not the government investment costs.

Furthermore, under investment by government and the resulting poorer road conditions can dramatically increase total transport costs in Iowa. The risks of over investment are consideraly less, total transport costs increasing only a small fraction -- by the amount of the increased government investment. In light of current programs and program requirements to preserve the road infrastructure in Iowa, over investment is unlikely.

2. The timing of improvements is critical. For example, the premature paving of extensive mileages of low volume roads can result in significant economic loss to the state (less than 200 vehicles, marginal between 200 and 300 vehicles per day). Conversely, upgrading roads with the appropriate levels of traffic can provide significant benefits.

3. The types of improvements are also important. Geometric improvements according to current design standards and guidelines typically exhibit less economic benefit, but are important to public safety. If these types of improvements are combined with needed improvements to pavements, the result is a highly economically feasible project (for more than 300 vehicles per day). Examples are:

   - lane widening and shoulder improvements combined with resurfacing, and

   - curvature and grade improvements combined with pavement reconstruction.

The above findings indicate that the greatest potential for cost savings resulting from the uniform application of standards and guidelines actually occurs in the user costs, not in the government investment costs in construction and maintenance. These user savings can be realized by making the right types of government investment at the right times.

There is, however, some potential for cost savings in the government investment itself. These savings can occur through the application of two types of maintenance standards:

- Maintenance Levels of Service Standards -- how much maintenance is performed on certain roadway features; and

- Performance Standards -- how the maintenance is performed (the work method, crew resource composition and average daily production of the crew).

These standards are currently applied by the Iowa DOT in its maintenance operations. Generally, the counties and cities maintenance operations have not formally developed such standards. The development of maintenance work programs and budgets using standards and the reporting of accomplishment and utilized resources in terms of the work program are basic to sound maintenance administration.

The following recommendations are made considering the analyses and assessments of maintenance practices in Iowa.

1. Formal written maintenance performance and level of service standards should be adopted separately for the state, counties and cities based on road and street classifications.

2. Once established, maintenance service levels should be reviewed at least annually for their cost-effectiveness and cost savings potential when applied to budget development.

3. Performance standards should also be reviewed annually to improve maintenance work methods and productivity. These standards should be dynamic and updated as more efficient maintenance techniques are developed. The use of historical values for planning should be discouraged. The year by year acceptance of historical planning values tends to stagnate productivity and inhibit innovative practices.

4. Maintenance standards should be used to develop annual maintenance budgets, work programs and resource requirements for public agencies within the various jurisdictions.

5. The Iowa Department of Transportation, Iowa County Engineers Association and Iowa Chapter, American Public Works Association should initiate efforts to develop and apply uniform, economical road design/construction guidelines and maintenance standards.

Consolidation of Construction and Maintenance Operations

The arguments set forth in the Governor's Blue Ribbon Transportation Task Force Report for the consolidation of operations, particularly maintenance, are:

- There are inefficiencies and duplication of resources in the current government organization for the delivery of road maintenance services; and

- The consolidation of these services at one level of government can bring about substantial cost savings and improvements in operations.

In general, our findings indicate the following:

1. There is little duplication of maintenance work or resources among the various jurisdictions.

2. The overall consolidation of construction or maintenance operations at any level of government would result primarily in a transfer of costs and not significant cost savings.

3. The upfront costs of the transition of most consolidation alternatives appear to far outweigh the potential savings.

4. The risks of any sweeping consolidation of road construction or maintenance operations are high in light of transition costs and low potential for savings.

5. State primary system maintenance operations with very low mileage and/or very few personnel are potential candidates for consolidation either through 28E agreements with the counties or within the existing State maintenance organization itself. Likewise, county road and city street maintenance could be performed by the state through 28E agreements.

6. Consolidation of construction or maintenance operations at the State level would likely produce negative impacts in local maintenance service and the overall funding levels for roads and streets within the State.

7. There is improvement potential in the current maintenance operations at all levels of government. This potential for improvements is more discernable at the State level, because the State maintenance organization has better records than the county and city organizations. However, this potential for improvement is minimally related to organizational changes. It is related to operational improvements which can be realized within current organizational arrangements.

Jurisdictional Changes

The consolidation of government road construction and maintenance operations is closely related to the jurisdictional authority and responsibility for roads. Jurisdictional authority as set forth in Chapter 306 of the Code of Iowa, in essence, gives the designated level of government the authority to set its own course of action (policy) regarding the delivery of construction and maintenance services for the roads under its jurisdiction.

Alternative proposals for the consolidation of operations at any level of government must be analyzed for improvements over the status quo -- for example, better and more responsive service to the public, significant cost savings, and/or more equitable and practical financing. If the improvements of an alternative are significant, the alternatives might be adopted as a course of action. Subsequently, relevant authority should be established through jurisdictional change, if necessary, to bring about the most effective alternative. In summary, the transfer of roads between jurisdictions should be based on viable alternatives.

The findings, conclusions and recommendations which follow are based on the assessment of consolidation alternatives, as well as other assessments related to financing of roads and resource allocations to programs.

1. Jurisdictional responsibility for the state primary system should remain as it is. Transfers of authority should be mutually acceptable to the involved jurisdictions. The proposal to transfer the county farm-to-market/Federal aid secondary system to the State would be the first step in consolidating authority for operations at the State level. The proposal is difficult to justify from the standpoint of:

   - cost savings,
   - overall road financing in Iowa, and
   - level of service to the public.

2. Experience in other states where all rural roads are under the state's jurisdiction, demonstrate it is the local road systems and programs that ultimately suffer the most when revenues are inadequate.

3. Revenues from local sources would not be available under the current Iowa Code to fund a state administered road program of all rural roads and revenues from motor vehicle users would probably not be increased sufficiently to fund a road program of approximately 100,000 miles totally under the State's jurisdiction.

Our composite findings from each of the three areas -- uniform standards, consolidation of operations and the jurisdictional transfer of roads indicate:

1. There is some cost savings potential in the delivery of public road services in Iowa -- that is in the government's road investment programs. However, the potential is relatively small and can be achieved within the current governmental organizational arrangements and statutes.

2. The premise that potential cost savings in Iowa's highway, road and street government investment programs is sufficient to make up for the future funding needs in these programs is unfounded. Furthermore, a freeze on highway funding based on this premise creates the risk of dramatically increasing total highway transport costs in Iowa through increased user costs.

The remainder of this executive summary is organized in 5 parts:

PART 1 -- CURRENT JURISDICTIONAL FUNCTIONS

PART 2 -- ECONOMICS OF STANDARDS AND PRACTICES

PART 3 -- UNIFORM MAINTENANCE STANDARDS AND PRACTICES

PART 4 -- CONSOLIDATED OPERATIONS AND JURISDICTIONAL CHANGES

PART 5 -- FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The first part paints a picture of current road and street operations in Iowa. The second, third and fourth parts summarize the assessments and analyses developed as part of this research. Part 5 lists all the findings, conclusions and recommendations reached as a part of the assessments and analyses.

PART 1 - CURRENT JURISDICTIONAL FUNCTIONS

Responsibility for the 112,000 plus miles of public roads and streets in Iowa is divided among the state, counties and cities. System miles and vehicle miles of travel as of January 1, 1983 are shown in the following.

Iowa Public Road Miles and Vehicle Miles

Jurisdiction	1983 System Miles		1983 Vehicle Miles (Millions)	
	Total	Percent of Total	Total	Percent of Total
State Primary 1/	10,415	9.3	10,959	56.5
Counties	89,687	79.8	3,762	19.4
Cities	12,260	10.9	4,670	24.1
Total	112,362	100.0	19,391	100.0

Source: Iowa Department of Transportation

1/ Includes 310 Miles of State Parks & Institutions

IOWA DEPARTMENT OF TRANSPORTATION

The Iowa Department of Transportation (DOT) is responsible for the planning, construction and maintenance of the state primary system 10,105 miles. The Iowa DOT also administers the 310 miles of state parks and institution roads.

Organization

The State is divided into six geographic districts. The districts are further divided into residency areas for construction and maintenance with an engineer responsible for each area. Each district has four maintenance residency areas, with one area in each of three districts having responsibility for both maintenance and construction. The number of construction residency areas varies with the construction workload. In 1984 there were 18 construction residencies, plus the three responsible for maintenance as well as construction.

Maintenance

Each resident area is also divided into maintenance areas/garages with a highway maintenance supervisor in charge of each area. Maintenance areas total 137, with staffing assignments ranging from two to thirty-nine at the maintenance areas. Each district also has a traffic line

paint crew and a bridge crew that works throughout the district. The Interstate rest areas are maintained by district rest area crews. Additionally, there are three specialized statewide maintenance crews.

Primary extensions through cities are the joint responsibility of the state and cities. The state is responsible for the construction and right of way costs of the primary extension to the minimum design criteria established by the Iowa DOT. Additional costs beyond these criteria are the responsibility of the city. The state maintenance responsibility is limited to the surface, curb to curb features (excluding parking lanes and parking signs), traffic signs, pavement markings, bridges and snow removal from the traffic lanes. Other street maintenance, including the removal of windrowed snow, sidewalks and all areas between the curb and the right of way line are the responsibility of the city. The Iowa DOT does enter into maintenance agreements with some cities for the maintenance of the state's responsibility on all, or a portion of the primary extensions (Chapter 28E, Code of Iowa). Reimbursement to the city is on a lane mile basis, which is $695 per lane mile for fiscal year 1986.1/

State primary system maintenance is planned and controlled through the Office of Maintenance and district maintenance field personnel. Iowa's maintenance management system provides maintenance standards for approximately 95 work functions used for planning, budgeting and reporting work accomplishment. Maintenance standards consist of: (1) performance standards which define for each major maintenance work activity the most effective crew size, equipment and materials required, work methods and procedures to be used, and the planned average daily accomplishment of work by a standard crew; and (2) maintenance service level standards (quantity standards), which establish the level of service, or amount of maintenance work, that will be provided to the highways, or to specific classes of these facilites.

Private contract maintenance is utilized for specific maintenance work, such as major pavement patching, crack filling, bridge painting and other major maintenance work that can be quantifiably defined and accomplished within a designated time period. The contracting of other maintenance work for extended periods and work requiring responses to emergencies has not proven successful or cost-effective to the Iowa DOT.

Maintenance expenditures for the state primary system were $61.3 million for fiscal year 1984 and the 1985 budget is $66.6 million. Costs for private contract maintenance and city agreements to maintain primary extensions are not included in these amounts.

Construction

A state primary improvement program is prepared annually as specified by the Code of Iowa. In recent years, Iowa has shifted highway improvement emphasis from new construction to re-construction and/or preservation. Priorities for state highway funds are as follows:

1/ Iowa DOT Commission Order No. H-85-588, May 7, 1985.

1. maintenance;
2. preservation of existing highways and bridges; and
3. reconstruction/construction.

Based on the current 10,105 mile state primary system and design life of 20 years, approximately 500 miles should be improved each year. Of this "500 mile target", 160 miles should be reconstructed and 340 miles resurfaced/preservation work. Current funds available for highway improvements, after maintenance requirements, reduce the number of miles that can be reconstructed -- in 1984 this amount was approximately 50 miles. Future years may well reduce the annual miles of reconstruction due to additional cost increases that may exceed any increases in highway user funding.

State primary system allocations, including federal aid, for fiscal year 1985 are $322 million; maintenance and road preservations amount to $94 million, or 29 percent of the total primary allocations. In ten years more than 50 percent of the state primary system will be 40 years old or older. As pavement surfaces age, the rate of deterioration increases; and maintenance and surface restoration costs increase sharply.

IOWA COUNTIES

The County Board of Supervisors in each of the 99 Iowa counties is responsible for the construction and maintenance of the rural secondary road system in the county. The secondary system consists of 89,687 miles of public roads. This system is further classified as farm-to-market and local secondary. The farm-to-market system totals 29,401 miles, of which 12,523 miles are on the rural federal aid secondary and federal aid urban system (FAUS), which qualify for participation of federal-aid secondary and FAUS funds received by the Iowa DOT.

Approximately 94 percent of the secondary system has an all-weather surface and 15 percent has paved surfaces as shown in Figure 1.

Organization

The Board of Supervisors is required by the Code of Iowa to employ one or more registered civil engineers to direct and supervise all construction and maintenance work on the secondary system. The Code further authorizes the Boards of two, or more adjacent counties, to enter into agreements to jointly employ the same registered engineer to provide these services to the respective counties. To date, there have been no joint agreements of this type between any counties. However, one county and a major city in the county have entered into an agreement of this type, whereby one registered engineer provides engineering services to both jurisdictions.

Maintenance

Each county has similar organizations for maintaining the county secondary roads. In addition to a central garage location where the

FIGURE 1

COUNTY SECONDARY SYSTEM SURFACE TYPES
(January 1, 1983)

Miles by Surface Type

	Earth/ Oiled	Gravel	Low Type Bitum.1/	High Type Paved	TOTAL
Farm-to-Market	220.63	15,066.79	1,062.06	13,051.79	29,401.27
Percent of Total	0.8	51.2	3.6	44.4	100.0
Local Secondary	5,277.42	53,752.62	383.09	872.66	60,285.79
Percent of Total	8.8	89.2	0.6	1.4	100.0
TOTAL SECONDARY	5,498.05	68,819.41	1,445.15	13,924.45	89,687.06
Percent of Total	6.1	76.8	1.6	15.5	100.0

Source: Iowa Department of Transportation

1/ Less than 8 inches thickness.

majority of the personnel are assigned, each county has other locations throughout the county where equipment may be stored, or parked. The number of locations vary with the size of the county and the miles to be maintained, but 6 to 10 locations are typical. These locations may have heated garages or may only be a storage yard where one or more motor graders can be parked. The typical location is a small shed or garage where one to two equipment operators and motor graders are assigned to perform the blading of gravel and earth surfaces. During the winter season, snow removal is also performed from these locations. A typical motor patrol area consists of 45 to 65 miles of unpaved roads.

County secondary road maintenance expenditures for 1983 totalled $193.7 million. Blading unpaved surfaces and granular surfacing amounted to $62.4 million and equipment operations and purchases $60.7 million for a total of $123.1 million, or 63.5 percent of the total maintenance costs.

Although the majority of the county secondary roads primarily serve rural areas, 8 to 10 counties in the State have high concentrations of residential and commercial areas outside of city corporate limits. The roads and streets outside the corporate limits are the responsibility of the counties if they have been accepted for maintenance. Most of the affected counties have adopted development standards requiring these roads and streets to be built to adequate standards by the developer. However, frequently the existing secondary roads serving these areas are not adequate for the increased traffic volumes and usage. Improvement of these facilities can represent a necessary and significant cost to the county in order to adequately serve the road users.

Construction

The counties are required to submit five-year improvement programs of specific projects for the secondary system to the Iowa DOT for review and approval. Farm-to-market design guides for these improvements have been adopted by the county engineers association and the department.

In 1982 and 1983 the counties reported expenditures of $11.7 million and $12.8 million respectively from local revenues, for construction on the farm-to-market system. These amounts do not include Federal-aid secondary or farm-to-market construction funds administered by the Iowa DOT and expended on farm-to-market/FAS construction.

IOWA CITIES

The 956 cities in Iowa are responsible for the construction and maintenance of all public streets within their corporate limits, including the extensions into and through the city of county secondary roads. The extension of state primary highways are the combined responsibility of the cities and state.

City street mileage totals 12,260 miles of which 78 percent are paved surfaces, not including low type bituminous surfaces.

Organization

Cities over 10,000 population usually have a city engineer or public works director who is responsible for the construction and maintenance of the city streets. Cities less than 10,000 population typically have a street superintendent, when justified by the magnitude of their street program.

Maintenance

Except for a few of the smaller cities that contract with the counties to maintain the city streets, all cities are equipped to maintain the streets, although staffing and equipment may be limited. The smaller cities, less than 1,000 population, may have one to two full-time, or part-time, employees who perform all related city work, including street maintenance.

Street maintenance costs reported by the cities were $91.6 million for 1983, of which $48.5 million, or 52.9 percent, was reported as roadway and surface costs.

Construction

Cities of 5,000 population and greater are required to annually submit a five-year program of street construction and reconstruction projects and to report on the progress made in the completion of each project in the approved program. Cities less than 5,000 and greater than 1,000 population are required to submit proposed annual street improvement programs.

The majority of the cities over 5,000 population have formalized design guides for street construction and reconstruction, while the others rely on design consultants for specific projects. All cities over 5,000 population require developers to install specified utilities and build streets to specified standards within new developments before the streets will be accepted for city maintenance.

City street construction expenditures for 1983 were reported at $70.4 million, which was a decrease from previous years.

OTHER STATES

Public road and street responsibilities and operations in other states were reviewed to identify specific features or items that warranted consideration for Iowa. Specific applications identified included the following:

1. All rural roads maintained by the state;

2. State maintains the farm-to-market system; and

3. Counties maintain the state highway system.

Four states were selected for on-site interviews and data collection. Each offered a different approach to highway, road and street operations and responsibilities.The states selected were Kansas, Michigan, Missouri and North Carolina.

Comparisons with Iowa

The four states contacted, provided distinct differences in public road jurisdictional responsibilities and management policies to accomplish the state's transportation objectives -- except Kansas which is similar to Iowa in most areas.

Michigan -- The state contracts with 62 of the 83 counties and 152 municipalities to maintain the state highway system within the respective jurisdictions.

Missouri -- The state has jurisdictional responsibility and maintains the basic county farm-to-market system of 24,274 miles.

North Carolina -- The state has jurisdictional responsibility and maintains all rural public roads (76,307 miles).

Figure 2 compares for each state and Iowa the mileage, vehicle miles of travel and paved mileage for the state, county and city jurisdictions.

FIGURE 2

IOWA PUBLIC ROAD COMPARISONS WITH OTHER STATES

PUBLIC ROAD MILEAGE

STATE	State Highway System		County Roads		City Streets		TOTAL[1/]
	Miles	Percent	Miles	Percent	Miles	Percent	
Kansas	10,449	7.9	109,686	83.2	11,648	8.9	131,783
Michigan	9,476	8.1	88,835	75.6	19,107	16.3	117,418
Missouri	32,239	28.0	69,947	60.7	13,013	11.3	115,199
N. Carolina	76,307	85.5	NA	NA	12,963	14.5	89,270
Iowa	10,105	9.0	89,687	80.0	12,260	11.0	112,052

1/ Does not include toll roads, state parks, forest roads, institutions.

1982/83 ANNUAL VEHICLE MILES OF TRAVEL (Billions)

STATE	State System		County		City		Total	
	VMT	Percent	VMT	Percent	VMT	Percent	VMT	Percent
Kansas	9.3	52.5	3.5	19.8	4.9	27.7	17.7	100.0
Michigan	31.8	50.0	19.7	31.0	12.1	19.0	63.6	100.0
Missouri	26.6	72.9	2.6	7.1	7.3	19.9	36.5	100.0
North Carolina	43.2	96.6	NA	NA	1.5	3.4	44.7	100.0
Iowa	11.0	56.5	3.8	19.4	4.7	24.1	19.5	100.0

PAVED ROAD MILEAGE

STATE	Paved		Unpaved		Total	
	Miles	Percent	Miles	Percent	Miles	Percent
Kansas	32,777	24.9	99,006	75.1	131,783	100.0
Michigan	67,083	57.1	50,335	42.9	117,418	100.0
Missouri	51,810	45.0	63,389	55.0	115,199	100.0
North Carolina	68,986	77.3	20,284	22.7	89,270	100.0
Iowa	35,957	32.1	76,095	67.9	112,052	100.0

PART 2 - ECONOMICS OF STANDARDS AND PRACTICES

A major objective of this study was to evaluate the economic and other impacts associated with development of consistent and uniform design, maintenance and construction standards and guidelines for use by public agencies. Standards and practices are fundamental to highway policy. The benefits to Iowa from following sound engineering and economical standards and guidelines in the highway sector can be very substantial.

ANALYSIS APPROACH

The approach emphasized quantitatively supportable findings related to the economic impacts of applying, or not applying, uniform economical guidelines and standards. Six analyses were performed in which the cost impacts related to construction and maintenance of roads, vehicle operation, travel time and safety were measured. The analyses included:

1. Upgrading Gravel Roads

2. Resurfacing Paved Roads

3. Resurfacing Paved Roads with Improvements to Shoulders and Lane Widths

4. Rehabilitating Pavements with Improvements to Curvature and Grade

5. Maintaining Paved Road Surfaces

6. Maintaining Unpaved Road Surfaces

Design guides applied in the State Highway Needs Study were used in the analyses, as well as sample improvement costs from the "Quadrennial Need Study Report on Highways, Roads and Streets for Study years 1982-2001".

A highway economics computer model entitled the Highway Design and Maintenance Standards Model (HDM), developed by the World Bank, was used to calculate the economic costs for each analysis.

These costs include most of the direct economic costs in the highway sector -- vehicle operating costs by far representing the greatest part. It is possible to include other related costs and benefits in the model such as those related to economic development, etc. However, these must be determined outside the model. Typically, these other costs and benefits are specific to an area or particular project. This specificity makes these other costs difficult to fairly and adequately include in a general policy analysis of standards and practices. Furthermore, many other less quantifiable service objectives such as distances to a paved road are not considered in the analysis. The foregoing factors should be considered in the application of standards and guidelines to specific projects. These factors and others such as the assumptions related to current pavement strength and deterioration formulae make the estimates of highway benefits conservative in these analyses. Factors other than those considered in the economic analysis, e.g., economic development, system continuity, distance to a paved road, can become significant in determining whether or not a project should be implemented. As previously mentioned, these factors should be studied case-by-case.

While standards and guidelines can be generally applied to help form policy, set highway needs and assess system alternatives, there is no place for their general and mechanistic application in engineering practice during design, contruction, and maintenance. In these phases of highway development, standards and guidelines must guide actions which are taken under varying and specific circumstances and constraints. And, highway design and construction decisions must be tailored to meet specific project circumstances and many other technical, social and political factors and values.

Making policy as well as design and construction decisions with an understanding of the economics involved, can be valuable to decision makers at all levels. For each economic analysis the two major economic performance measures were -- rate of return and net present value of benefits as presented below.

1. The rate of return is calculated for an investment alternative compared to a base alternative. The base alternative is often referred to as a "do nothing" alternative. In our analyses the base or "do nothing" alternative represents the minimum practical investment -- typically stopgap maintenance. The rate of return indicates the annual percentage earned on the government investment alternative over the base or "do nothing" alternative. In principle, the concept of rate of return is similar for any investment be it in roads, personal savings, real estate, etc.; it is an annual percentage return on investment.

2. The net present values of the benefits represents the net benefit (+) or disbenefit (-) from pursuing an investment alternative over the base ("do nothing") alternative. The net present value can be compared to the bottom line in a financial report. It indicates how much money over a specified period of time will be gained or lost from pursuing a particular course of action or alternative.

FINDINGS AND CONCLUSIONS

The use of rate of return and net present value permitted a manageable interpretation of the results and facilitated the recognition of patterns and extension of the results to Iowa's road network. Major findings and conclusions of the six analyses are listed separately in each of the following sections.

Upgrading Gravel Roads

This analysis addressed the issues of:

1. When is it economical to pave a gravel road?

2. What are the cost impacts of applying or not applying a uniform economical standard and guideline for paving?

Major findings and conclusions were:

- Paving gravel roads between 300 and 400 vehicles per day results in rates of return near 15 percent, which is a reasonably good rate of return.

- The design guides, and more economically conservative alternate design guides, used by the State DOT in their needs studies correspond closely to the results of this analysis. They appear to be economically sound and not unreasonable for use by all jurisdictions.

- Deviating from the application of uniform economical guidelines for upgrading gravel roads can have significant economic implications for Iowa. For example, prematurely paving 1000 miles of gravel roads having 100 vehicles per day traffic, would result in over a 100 million dollar economic loss to the state during a 20-year period (at a 10 percent discount rate). Similarly, not upgrading 1000 miles of more highly traveled gravel roads would also result in losses to the state of an equal or greater order of magnitude.

Resurfacing Paved Roads

This analysis involved the resurfacing of existing paved roads that had deteriorated surface conditions. The three issues were:

1. Under what conditions is it economical to resurface a paved road?

2. What is the most economical thickness of the overlay?

3. What are the cost impacts of deviating from economical practices regarding resurfacing?

Major findings and conclusions were:

- Resurfacing improvements result in very high rates of return and net present values of benefits, making them high priority, highly feasible improvements. Deferring resurfacing needs is a higher economic risk than slightly premature resurfacing.

- Timing for cost-effective resurfacing depends on pavement condition, traffic volumes and vehicle characteristics.

- Resurfacing thickness up to 2.0 inches yield the highest net present values for roads with traffic volumes up to 2000; thicker overlays are more beneficial for pavements with higher traffic volumes and more specifically higher heavy vehicle traffic volumes.

- A fixed resurfacing cycle for new pavements -- one which is not specifically responsive to actual pavement condition throughout a pavement's life -- is not an economically viable approach to formulating resurfacing policy or identifying resurfacing projects.

- Timely resurfacing (one responsive to the actual physical condition of the pavement, particularly its roughness) can produce significant savings for the state of Iowa.

Resurfacing Paved Roads with Improvements to Shoulders and Lane Widths

This analysis was performed to answer the following two questions:

1. Under what circumstances is it economical to resurface, minor widen[1/] pavement and/or improve the shoulders[2/] of a road?

2. What are the cost impacts of following or not following economic practices regarding the above improvements?

Three resurfacing alternatives with variations of minor pavement widening and shoulder improvements were compared against a base alternative of maintenance without resurfacing. This analysis was performed for road surfaces in fair condition.

The findings and conclusions of this analysis are:

- Minor pavement widening and shoulder repair combined with resurfacing result in an overall highly feasible improvement project for roads with more than 300 vehicles per day traffic.

- In general, the additions of the minor pavement widening and shoulder improvements to resurfacing reduce the rate of return. However, the reductions do not make the overall improvement infeasible. This is due partially to the safety benefits of the minor pavement widening and shoulder improvement additions.

- Delays in implementing this type of improvement for whatever reasons -- lack of funding, restrictions of funding or non-responsive project identification -- significantly increase costs in the highway transport sector.

Rehabilitating Pavements with Improvements to Curvature and Grade

The issues addressed within this analysis were:

1. Under what conditions is it economical to improve only the base and surface or reconstruct a highway to improved geometric standards?

2. What are the cost impacts of pursuing or not pursuing economical policies in these areas?

Major findings and conclusions were:

- Reconstruction of pavements and alignments to design guidelines are highly feasible improvements for traffic flows over 300 vehicles per day.

1/ Minor widening means increasing the width of traffic lanes to standards, but not the number of traffic lanes.

2/ Shoulder improvements include widening shoulders to standard widths and/or upgrading shoulders to standard surface types.

- As with the addition of minor pavement widening and shoulder improvements in the previous analysis, the addition of alignment reconstruction (in accordance with current guidelines) to pavement reconstruction lowers the rate of return for the overall combined project. However, the reductions do not make the combined project infeasible. The safety benefits derived from the elimination of non-standard curves and grades, although not as cost-effective as pavement reconstruction, do contribute to the high feasibility of the overall improvement.

- Deferring required pavement rehabilitation on roads with greater than 300 vehicles per day for whatever reasons, results in significant economic loss to Iowa. Losses get significantly worse proportional to the time of deferment, the volume of traffic and the condition of the road.

Maintaining Paved Road Surfaces

In this analysis, various surface sealing frequencies were compared to a base alternative of minimum patching for paved roads over a 20-year period. Sealing used for this analysis consists of a single bituminous and chip seal coat on an asphalt pavement surface.

Sealing asphalt paved roads serves a physical need in the maintenance of the pavement -- to seal the pavement from water penetration, help prevent surface deterioration and loss of surface aggregate, and provide a skid resistant surface for motorists. Sealing is a preventive maintenance action which helps prolong the life of asphalt pavements and their corresponding need for resurfacing and reconstruction.

Findings and conclusions related to sealing cycles were:

- On asphalt paved roads, net present values peak at sealing frequencies between six and eight years for 300 and 500 vehicles per day traffic flow.

- The 500 vehicles per day traffic group for light pavement exhibits a net present value peak for a five-year sealing cycle.

- On asphalt paved roads, favorable net present values peak at sealing frequencies between two and four years for traffic flows greater than 750 vehicles per day.

Maintaining Unpaved Road Surfaces

The primary issues addressed for unpaved road maintenance were:

1. What is an economical blading frequency for earth roads?

2. What are economical regravelling and blading frequencies for gravel roads?

3. What are the cost impacts of following or not following economical unpaved road maintenance practices?

Blading and regravelling needs will vary from road to road and area to area. However, the economics of unpaved road maintenance do provide guidelines within which standard criteria and practices can be formulated to minimize loss and maximize economic benefit. Blading without regravelling and blading with various regravelling cycles were analyzed. The following are findings and conclusions.

- For earth roads with 25 vehicles per day traffic flow a peak net present value exists for a 60-day blading frequency.
- For earth roads with 50 vehicles per day traffic, a peak net present value exists near a 30-day blading frequency.
- Blading each 30 days with no regravelling exhibited the highest net present values for gravel roads with 50 vehicles per day.
- The peak net present value for blading gravel roads with 100 vehicles per day occurs at the 15-day frequency.
- The blading frequencies of 15 and 7 days for gravel roads with greater than 200 vehicles per day showed little economic differences. Each of these blading frequencies showed marked economic benefit over blading each 60 days without regravelling.
- The cost impacts of neglecting the regravelling and/or blading of gravel roads with greater than 200 vehicles per day can be significant. However, the economic risks of over blading and frequently regravelling to a fixed depth are small.

The above frequencies can be useful in calculating annual programs and budgets for earth and gravel road maintenance activities. In practice, actual blading and regravelling will be carried out in accordance with weather, traffic and actual surface conditions. And, it is not good practice to permit total gravel loss on gravel roads before regravelling.

RECOMMENDATIONS

The findings and conclusions from the six policy analyses provide the bases for recommendations related to the application of highway guidelines and maintenance practices. The following recommendations encompass all public roads and streets in Iowa.

1. Iowa's highway funding schemes and program controls should strongly discourage the premature paving of gravel roads by public agencies and promote their timely and economic upgrading.
2. Highway funding schemes and program planning should place high priority on the timely identification and implementation of resurfacing projects.

3. The identification and effective engineering analysis required for resurfacing projects should be based on adequate up-to-date pavement condition information and documented pavement improvement technical performance. The public agencies should consider establishing a pavement maintenance approach -- popularly referred to as pavement management -- oriented toward making decisions related to the formulation of programs for pavement maintenance, resurfacing and rehabilitation.

4. Minor pavement widening and shoulder improvements, in accordance with current design guides, should be combined with resurfacing projects on roads with greater than 300 vehicles per day traffic in Iowa's highway programs.

5. Geometric improvements should be combined with pavement reconstruction on roads with greater than 300 vehicles per day traffic in Iowa's highway programs.

6. Funding and capital improvement/maintenance programs should be responsive to the need for resurfacing, reconstruction and geometric improvement projects in light of their overall high rates of return and net present value of benefits to the State.

7. The need for asphalt surface sealing should be identified through current pavement information specifically established by public agencies for this purpose -- as part of a pavement management system. The system must be very responsive to decision making from the identification of need through implementation, because beyond a certain level of pavement deterioration sealing is technically not feasible.

8. Uniform guides for the maintenance of Iowa's more than 70,000 miles of gravel and earth roads should be established and applied by its public agencies.

9. The criteria for frequency of work should be combined with production standards to generate programmed budgets for paved and unpaved road maintenance activities.

The deferment due to a lack of funding of maintenance, resurfacing, rehabilitation and reconstruction projects designed to protect and replace the public's capital investment in roads can be extremely costly in terms of overall transport costs. Furthermore, the risk of deferment or neglect because of under investment is far greater than risk of over investment. In light of current funding levels for all roads and streets, and the program requirements to preserve the infrastructure in Iowa, over investment is very unlikely.

PART 3 - UNIFORM MAINTENANCE STANDARDS AND PRACTICES

The assessment of the impacts related to uniform maintenance standards concentrated on the two areas typically associated with the term maintenance standard -- performance standards and maintenance service levels, sometimes referred to as maintenance quantity standards.

These maintenance standards are two of the key elements of a maintenance management system. Therefore, a maintenance planning, programming and budgeting model provided the analytical procedure to assess the impacts of both types of uniform maintenance standards.

PERFORMANCE STANDARDS

Performance standards define for each major maintenance work activity: (1) the most effective crew size, equipment and materials required, (2) methods and procedures for performing the work, and (3) the planned average daily accomplishment of work by a standard crew. These standards represent typical conditions and are modified to reflect specific requirements for traffic conditions and haul distances for materials.

The Iowa DOT, Office of Maintenance, has developed maintenance performance standards for 82 maintenance work activities, plus 13 for maintenance overhead activities. These standards are used to develop annual maintenance work programs and budgets. Figure 3 illustrates the maintenance performance standard for one work function -- spall patching. The other maintenance activities have established performance standards in the same format.

Interviews with the 20 sample cities and 12 sample counties identified only one urban county that had developed comparable performance standards for use in developing the annual maintenance budget.

Performance standards represent an agencies' best determination of the most effective crew size, equipment compliment and expected average daily production. Deviations from these standards, without proper justification, can have a major impact on the cost effectiveness of the work activity. For example, the standard crew size for surface patching (Figure 3) is 5 men and 2 trucks. Figure 4 shows the cost impact per unit of work if 2 men and 1 truck are added to the operation. Although more work units are accomplished, the cost per ton of material placed increases from $137 to $156.

Improved work methods and procedures often result in improved performance standards. Uniform maintenance standards should be periodically reviewed and evaluated to identify potential areas for improvements and cost savings resulting from technological advances and better ways of performing the work.

SERVICE LEVEL STANDARDS

Maintenance service level standards (quantity standards) define the level of service, or amount of maintenance work, that will be provided

MAINTENANCE STANDARD

IOWA DEPARTMENT OF TRANSPORTATION
Highway Division
Office of Maintenance

APPROVED BY: _____ Maint. Engr. Date: Revised 7-2-84

FUNCTION TITLE: Spall Patching FUNCTION CODE: 609

FUNCTION CATEGORY: ROADWAY SURFACE

WORK PROGRAM CATEGORY: Routine Unlimited

DESCRIPTION & PURPOSE:

All operations associated with filling holes in roadway surfaces and bridge decks with bituminous mix to correct spalls, corner breaks, raveling and joint failures.

Incidental spall patching on paved shoulder may be charged to this function. For major shoulder repairs refer to the shoulder maintenance category.

LEVEL OF MAINTENANCE (Quality Std.):

Spalls which are likely to affect traffic safety are to be repaired as soon as practical after the DOT has notification of the condition.

Spalls, corner breaks, raveling, or other surface deterioration which can be repaired with bituminous mix and which may cause further surface damage are to be repaired as soon as the work can be scheduled.

SCHEDULING GUIDE: Normal monthly accomplishment as a percent of total program.

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
6	9	4	5	6	7	8	11	15	14	8	7

Accounts for 2.6% of total maintenance manhours.

PERFORMANCE STANDARD

FUNCTION: 609

RECOMMENDED PROCEDURES:

Refer to Appendix A to select the proper traffic control plan.

1. Remove loose material and unsound edges to provide near vertical sides.
2. Dry hole if necessary.
3. Apply tack if appropriate.
4. Fill hole with bituminous mix and tamp (Deep holes should be filled in lifts).
5. Final patch should be flush with roadway surface.
6. Clean up all loose material on surface.

Code traffic control to function 673.

The amount of accomplishment reported should balance the amount of bituminous mix used.

Provide safety equipment as required for the operation.

Reference:

MATERIALS:

Bituminous Mix
Emulsion Tack

RECOMMENDED CREW SIZE:

5 - Clean hole, tack, fill and compact

RECOMMENDED EQUIPMENT:

2 - Dump Truck
1 - Premix Heater (if available)
1 - Tack Tank
1 - Air Compressor
1 - Roller or Compactor
Hand tools as necessary

ACCOMPLISHMENT:

Unit: Ton of Material
Standard Rate: 0.13 ton per manhour
Daily Production: 3.9 - 5.2 - 6.5

SOURCE: Iowa DOT, Office of Maintenance

FIGURE 3

FIGURE 4

CURRENT PERFORMANCE STANDARDS

A C T I V I T Y S U M M A R Y

Activity: 1010 SURFACE PATCHING
Responsible Org: 0510 DISTRICT Type: RT

			Desired	Actual
Feature Inv: 4,108.5 LANE MILES				
Daily Prod: 5.0 TONS MIX				
Hours/Act Day: 8.0	Quantity Standard:		0.63	0.46
Cost/Crew Day: $ 685	Annual Work Quantity		2,590	1,895
Cost/Unit of Work: $ 137	Total Cost:	$	355,058	$ 259,782
Standard Crew Size: 5	Labor:	$	182,750	$ 133,711
Acceptable Deviation:	Equipment:	$	79,068	$ 57,851
Print Work Orders:	Material:	$	93,240	$ 68,220
Control Factor: N	Total Crew Days:		518	379
Authorization Level: S	Total Man Days:		2,590	1,895
	Cost/Unit of Inv:	$	86	$ 63

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CD Total
26	42	54	53	30	28	24	35	16	19	24	28	379

ADD 2 MEN AND 1 TRUCK

A C T I V I T Y S U M M A R Y

Activity: 1010 SURFACE PATCHING
Responsible Org: 0510 DISTRICT Type: RT

			Desired	Actual
Feature Inv: 4,108.5 LANE MILES				
Daily Prod: 6 TONS MIX				
Hours/Act Day: 8.0	Quantity Standard:		0.63	0.46
Cost/Crew Day: $ 935	Annual Work Quantity		2,592	1,896
Cost/Unit of Work: $ 156	Total Cost:	$	404,076	$ 295,574
Standard Crew Size: 7	Labor:	$	211,853	$ 154,966
Acceptable Deviation:	Equipment:	$	98,911	$ 72,351
Print Work Orders:	Material:	$	93,312	$ 68,256
Control Factor: N	Total Crew Days:		432	316
Authorization Level: S	Total Man Days:		3,024	2,212
	Cost/Unit of Inv:	$	98	$ 72

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CD Total
23	35	45	44	25	23	20	29	13	16	20	23	316

to the highways, roads and streets, or to specific classes of these facilities. These are defined for each major maintenance work activity and are usually expressed as work units per roadway feature to be maintained, for example, blade gravel roads two times per month, mow roadsides once per year. Other service levels are related to the amount of material required to maintain the feature to the established service level. For example, an agency has been averaging about 500 tons of bituminous premix each year for premix patching on 1,000 lane-miles of bituminous surface road. If the level of service is adequate, and engineering judgement says that material has not been wasted, a realistic quantity standard (service level) would be 0.50 ton per lane-mile of inventoried bituminous surface road.

Maintenance service level standards required to maintain each maintenance inventory feature to the desired service level vary from area to area depending on factors unique to the areas. These factors include the existing conditions, or extent of deterioration, traffic volumes, vehicle characteristics and climatic conditions.

The Iowa DOT utilizes maintenance standards to develop the annual maintenance work program and budget. The state primary system has been classified into four different service levels for maintenance purposes.

One of the twelve counties interviewed does use formalized maintenance performance standards and maintenance service levels (quantity standards) to develop the annual maintenance work program and budget. County responses to the questionnaire on the use of maintenance service level criteria for different classes of roads to develop the annual maintenance budget indicated 39 percent of the counties did utilize service level criteria for developing the maintenance budget. However, it was for a limited number of work activities, such as snow removal, gravel replacement and traffic signing and striping.

Some counties have adopted the Level B service for designated county roads, as authorized in the Code of Iowa, which permits a lower level of maintenance on those designated roads. However, less than 20 percent of the counties have formally adopted it. Interviews in counties that have adopted Level B service indicated the county residents accepted the Level B service, after being informed these roads would not be abandoned for maintenance, but merely receive a minimum level of maintenance.

The Code of Iowa also limits county liability for damages caused by snow and ice conditions as long as the agency has complied with its formal policy or level of service for snow and ice conditions. This legislation was enacted in 1984 and some counties already have adopted formal snow and ice control policies.

Currently, each county, through the Board of Supervisors, is authorized to establish the levels of maintenance for the county's roads service which may vary among counties. While there are valid reasons for varying maintenance levels of service standards among counties, the development of uniform performance standards for the counties provides

the potential for the Iowa County Engineers Association to continue a leadership role in promoting effective county road organization and operations.

The development and use of uniform maintenance standards results in more effective maintenance operations, increased uniformity in the level of maintenance services provided and more effective use of manpower, equipment and materials.

Questionnaire responses by cities on the use of maintenance service levels to develop maintenance budgets showed 3 of the 5 cities over 50,000 population responding affirmatively, whereas only 35 percent of the remaining cities responded similarly. However, as with the counties, this use was limited to a few maintenance items, such as snow removal and paved surface maintenance.

City interviews in the 20 sample cities support the finding that relatively few cities have adopted maintenance standards for street maintenance operations. One area of exception is for snow removal operations, where several cities have established service levels for designated street systems. The recent addition to the Code of Iowa relative to limiting agency liability for damages caused by snow and ice conditions, as long as the agency has complied with its formal policy or level of service for snow and ice conditions, should result in an increase of formal policies in this area.

The benefits of maintenance standards to effectively plan, budget, schedule, perform and evaluate comprehensive maintenance work programs also apply to cities.

APPLICATION AND USE OF MAINTENANCE STANDARDS

Maintenance standards provide an effective method of uniformly planning, scheduling, performing and evaluating a comprehensive maintenance work program and budget. Specific benefits include:

1. Maintenance objectives are formalized through the development and issuance of formal maintenance policy statements by the Chief Executive Officer.

2. Performance standards are developed for each major maintenance work activity. These standards specify the crew size, equipment and work methods and procedures to utilize for the most effective results.

3. Uniformity of maintenance effort is established through quantity standards which express the desired level of service in a uniform manner and reduce the variations of maintenance effort due to different supervisory judgements.

4. Annual routine maintenance work programs are based on quantity standards, performance standards and maintenance feature inventories which define the total amount of maintenance work to be performed by each management unit.

5. Manpower and equipment allocations can be made to individual maintenance units on the basis of maintenance work to be performed.

6. Maintenance supervisors are able to schedule and control individual maintenance work activities through work orders.

7. Reporting of work performed by the crews provides management at all levels with information required to evaluate work performance and to effectively control the maintenance work program.

The Iowa DOT utilizes both types of maintenance standards for developing the maintenance program of the state primary system. Since 1975, the Office of Maintenance, Highway Division, has been planning, scheduling and evaluating maintenance work through a maintenance management system. Performance standards have been formulated and are reviewed and updated periodically. The use of uniform maintenance standards results in more effective maintenance operations, increased uniformity in the level of maintenance service provided and more effective resource utilization.

PART 4 - CONSOLIDATED OPERATIONS AND JURISDICTIONAL CHANGES

The issue of jurisdictional responsibility and the most effective organization to administer and operate public roads and streets arises in every study seeking improvements in the public transport sector. Iowa's current designations of jurisdictional responsibility among the state, counties and cities originated in 1919 when the Legislature designated a 6,500 mile state primary system.

The consolidation of government road construction and maintenance operations is closely related to the jurisdictional authority and responsibility for roads. Jurisdictional authority as set forth in Chapter 306 of the Code of Iowa, in essence, gives the designated level of government the authority to set its own course of action (policy) regarding the delivery of construction and maintenance services for the roads under its jurisdiction.

Furthermore, Chapter 28E of the Code of Iowa authorizes public agencies to enter into agreements for construction and maintenance services. To a limited extent, state, county and city jurisdictions utilize this provision of the Code. The Iowa DOT enters into agreements to have some cities perform the state's maintenance for primary road extensions into the cities. The counties and cities enter into agreements for roads and streets on boundary lines and other locations. Some of the smaller cities have agreements with counties to provide the maintenance for all of their streets. To a limited extent, the Iowa DOT and the counties utilize Section 28E agreements for maintenance of specific primary or secondary road sections that are the jurisdictional responsibility of the other agency.

Through these agreements, the agencies have determined that it is mutually beneficial and more cost-effective to consolidate the maintenance of certain roads at a level of government not directly responsible for the roads. The Iowa DOT could also utilize Chapter 28E and contract with the counties to perform the maintenance and/or construction of the rural state primary system. Likewise the counties could utilize 28E agreements for Iowa DOT to maintain the county roads.

Conversely, consolidation of the delivery of government road construction and maintenance services at the state level would most certainly necessitate additional centralization of the authority for roads at that level.

Alternative proposals for the consolidation of operations at any level of government must be analyzed for improvements over the status quo -- for example, better and more responsive service to the public, significant cost savings, and/or more equitable and practical financing. If the improvements of an alternative are significant, it might be adopted as a course of action. Subsequently, relevant authority should be established through jurisdictional change, if necessary, to bring about the most effective alternative.

The assessment presented in this section includes seven possible alternatives each presented separately. The alternatives are:

1. Services for the county farm-to-market/federal-aid secondary system roads under the Iowa DOT.

2. Services for all rural roads under the Iowa DOT.

3. Services for all public roads and streets under the Iowa DOT.

4. County maintenance of the rural state primary system.

5. City maintenance of urban primary system extensions (5,000 population and over).

6. County maintenance of city streets (less than 5,000) population.

7. Maintenance by private contractors.

The first three alternatives relate to degrees of consolidation at the state level and would require additional jurisdictional authority at the state level for their implementation. The remaining four could be implemented under the current Code of Iowa.

FARM-TO-MARKET/FAS TO THE STATE

Under this alternative, approximately 12,523 miles of Federal-aid secondary (FAS) roads currently on the 29,401-mile county farm-to-market (FM) system would become the responsibility of the State. This transfer would increase the construction and maintenance responsibility of the Iowa Department of Transportation from 10,105 miles to 22,628 miles, an increase of 124 percent.

Additional maintenance costs amount to $36.8 million for 1985 and would require additional resources of 981 field maintenance personnel and 642 major equipment units. Annual construction requirements reported in the 1982 Needs Report are estimated at $80.1 million annually for the 20-year period. Total annual construction and maintenance costs amount to $116.9 million, which is conservative as the annual maintenance costs will not remain constant.

Road Use Tax Fund (RUTF) revenues allocated to the entire 29,401-mile Farm-to-Market Fund were $35.5 million in fiscal year 1984. Average annual RUTF revenue projections to this fund for the period 1985-1990 are $42.3 million. These allocations are for construction and reconstruction of the farm-to-market system and are far short of the estimated $80.1 million annual construction requirements. The deficit of $37.8 million ($80.1 million needs - $42.3 million revenues), plus annual maintenance requirements of $36.8 million, results in a $74.6 million shortfall for construction and maintenance of the FM/FAS system. And without adequate construction monies, annual maintenance costs for these roads will most certainly increase at an accelerated rate.

Therefore, additional revenues would be required from some source to meet the shortfall. Currently, the counties provide revenues from local sources to supplement the RUTF allocations to the farm-to-market system.

The existing state primary system, however, is funded from state and federal revenue sources, primarily road user taxes on motor vehicles and motor vehicle fuel. Legislators are not inclined to allocate funds from other sources to state road systems, because of economic needs in other areas. The practicable financial alternatives amount to: (1) a further relative reduction in the state road programs, or (2) an increase in the motor vehicle user taxes to meet the shortfall.

Within the priority structure of the state primary system, the FM/FAS roads would have the lowest priority level of the primary system. Currently, the counties place first priority on the paved roads of the farm-to-market system for snow and ice control. Consequently, these roads are often treated before low priority, state primary roads in the same area. Without judging the appropriateness of the service levels provided by the two jurisdictions, the FM/FAS roads would probably not receive the same level of service for snow and ice control maintenance as currently provided. Reduced maintenance service levels could occur for other maintenance work, as well, because of the new relative priority of the FM/FAS system. Also, the public would be removed one more level of government in establishing accountability for service levels on these roads.

The remaining county road program would also be adversely impacted. Removal of the FM/FAS miles from the counties would reduce the total maintenance costs, but increase the average cost per mile for the remaining county secondary miles. Most of the reductions occur on the paved mileage, but each county still would have paved surfaces to maintain. Loss of the existing RUTF revenues to the farm-to-market system for construction would require additional revenues be made available from either state or county sources to support the remaining 16,878 miles of farm-to-market roads.

ALL RURAL ROADS TO THE STATE

Transfer of maintenance and construction responsibility for 89,687 miles of county secondary roads to the Iowa DOT would be a major undertaking, even if it were politically feasible. The first alternative can be considered a step in the direction of this second alternative. And, all of the impacts related to the first alternative would be magnified under this alternative. There is one exception. Road organizations would no longer exist within the county governments. This degree of consolidation must be reached to begin to consider the apparent reorganizational benefits of consolidation. The arguments set forth in the Governor's Blue Ribbon Transportation Task Force Report for the consolidation of operations, particularly maintenance operations, are:

1. There are inefficiencies and duplication of resources in the current government organization for the delivery of road maintenance services; and

2. The consolidation of these services at one level of government can bring about substantial cost savings and improvements in operations.

Our findings, based on an examination of state and county maintenance organizations indicate:

1. There is very little duplication of either resources or work effort among the maintenance organizations. There is functional duplication--that is, all levels of government purchase and maintain equipment, employ personnel, etc. Functional or administrative consolidation would represent a small savings, if any net savings could be realized. For example, it might be possible to centralize equipment maintenance workshops as a result of consolidation. Centralization alone does not ensure that equipment maintenance would cost less. However, assume that some efficiencies could be realized. Would the cost savings from these efficiencies offset the upfront costs of upgrading workshops and the other transitional costs? The answer to this questions is "no" considering the current efficiency of equipment maintenance operations of the counties and the state. Furthermore, road maintenance intrinsically involves decentralized activities at changing work sites. If the resources (manpower, equipment and materials) are close to the work sites, the maintenance work is generally more responsive and cost-effective.

2. The consolidation of maintenance operations would result primarily in a transfer of costs and not a significant savings in costs related to the elimination of any apparent duplication.

3. There is improvement potential in the current maintenance operations at all levels of government. This potential for improvements is more discernable at the state level, because the state maintenance organization has better records than the county organizations. However, this potential for improvement is minimally related to organizational change. It is related to operational improvements which can be realized within current organizational arrangements.

The broad consolidation represented by this alternative would carry many risks. The minimum real cost savings potential versus the potential for increased costs during the reorganization period as well as the potential for decreased utilization of resources during the transition must be considered. Furthermore, the overall potential for a relative decrease in road revenues could tend to raise the overall transport costs in the highway sector in Iowa.

Revenues from local sources would not be available under the current Iowa Code to fund a state administered road program of this magnitude and revenues from motor vehicle users might not be increased sufficiently to fund a road program of approximately 100,000 miles.

Observation of experience in other states where all rural roads are within the state's jurisdiction, demonstrate it is the local road systems and programs that ultimately suffer the most when available revenues are inadequate. And, it is recognized that legislative bodies are not receptive to the substitution of motor vehicle user funding for losses of non-user (local) funding.

ALL PUBLIC ROADS AND STREETS TO THE STATE

Assigning all public roads and streets to the state would produce all of the impacts identified under the second alternative. These impacts would be extended to all the city construction and maintenance operations. In particular, the issue of having a relevant level of governmental authority for operations and related accountability to the public is important. Additionally, Iowa cities currently provide revenues from local sources, including bond issues, for city street maintenance and construction. The lack of these revenues would be devastating to the city street programs.

COUNTY MAINTENANCE OF STATE PRIMARY SYSTEM

The fourth alternative for consolidated maintenance operations, involves the use of maintenance agreements between the Iowa DOT and individual counties. The counties would maintain the state rural primary roads within their boundaries. The Code of Iowa currently authorizes these types of agreements (Chapter 28E), but to date, there have been no such agreements between the Iowa DOT and the counties, except for limited state primary sections.

The state primary system mileage of 10,105 varies in magnitude from county to county, with a high of 313 miles and a low of 44 miles. Maintenance of the primary system currently is performed by Iowa DOT personnel assigned to 137 maintenance areas plus specialized district-wide crews for each of the six field districts. Extensions of the rural primary system are also maintained by these personnel, except for the segments covered by the 34 city maintenance agreements (fiscal year 1984).

The states of Michigan and Wisconsin make extensive use of the county road organizations to maintain the state highway system. Basically, the counties are maintenance contractors to the state. The maintenance work is defined in the contract and reimbursement is made for actual costs, including overhead items, labor, equipment and materials as specified in the contract.

The application of this approach in Iowa is currently feasible under the Code. However, this approach is basically the same as the Iowa DOT contracting with private sources to provide all routine maintenance. Previous efforts with contract maintenance by the Iowa DOT did not prove to be successful, except for a limited number of maintenance activities where the work could be specifically defined and quantified.

In order for the counties to provide maintenance services for the state primary system within their county, it would be necessary for them to increase manpower and equipment resources, as well as to expand central maintenance garage facilities. The majority of the twelve counties interviewed indicated that they would be able to maintain the state primary routes, provided they had the additional resources. However, none of the twelve counties expressed the desire, or need, to contract for this additional maintenance workload. The consensus of the counties indicates the existing jurisdictional maintenance responsibilities of the counties and the Iowa DOT are satisfactory.

The annual maintenance work program for the state primary system in the county would require defining the work to be performed in a manner similar to that currently used by the Iowa DOT. This requires the use of maintenance standards--performance and levels of service--as well as maintenance feature inventories. The counties would need to administer the maintenance agreements consistent with the work programs and budgets which would likely become a part of the agreements. This is not meant to imply that the use of maintenance standards and annual work programs is an undesirable element. It would, however, be a procedural change for the counties and there would be associated costs.

Contracting with the counties to maintain the state primary system would require the development of a standard contract that defined the types and amounts of services to be provided, as well as the method of reimbursement. One state that uses counties to maintain the state system provides reimbursement on the basis of specified unit costs for labor, equipment and materials. Allowable overhead items are clearly defined and specified in the contract. The counties are guaranteed 90 percent of the contract amount, plus there is provision for a 10 percent overrun. Contracting on the basis of a defined maintenance work program provides the parameters of the work to be performed and an equitable basis for reimbursement.

The inspection of contract maintenance work presents unique problems and varies considerably from inspection of construction work. The Iowa DOT is familar with these problems through previous contract maintenance efforts. While some problems encountered with private contractors, such as lack of responsiveness and familiarity with the work might not occur with county maintenance organizations, there is still the difficulty of quantifiable work measurements for a number of maintenance activities. Even the current maintenance work program utilized by the Iowa DOT uses only manhours for reporting the work accomplished for several maintenance activities. The extent of field inspections for contract maintenance work in progress and accomplished, can be minimal or a major task depending upon the contractor's past performance, the activities underway and other circumstances. Nevertheless, contract administration in addition to inspection would represent some additional cost to the overall process.

The initial costs associated with a county contracting to maintain the state primary roads in a county could be significant. In addition to transitional costs, personnel costs and facility upgrading costs, additional major equipment units would be required. A typical county would require a relatively major investment for new and replacement equipment purchases necessary to maintain the state primary system. Few, if any, counties could finance these purchases with the revenues currently available to them. Additionally, to administer contracts they would be required to develop a costing system and rental rates, or other equipment cost reimbursement system agreed to by the Iowa DOT.

The annual state highway maintenance program performed by the Iowa DOT would be eliminated, or reduced severely, in those counties contracting to maintain the state primary roads. The Iowa DOT would probably need to retain the district-wide crews that perform specialized maintenance work, such as major bridge repairs. While the total maintenance workload performed by the state would be reduced in proportion to the number of counties contracting to maintain the state primary system, it is unlikely that all of the counties would or could accept this additional maintenance responsibility. Therefore, the Iowa DOT would still be required to retain field maintenance capability and adequate resources.

The quality and amount of maintenance work performed directly affects the current and future state primary improvement and rehabilitation program. Experience has demonstrated that inadequate maintenance increases physical deterioration and accelerates the time schedule for major rehabilitation.

Contracting maintenance of the state primary miles to the counties will not reduce total maintenance costs to the state--unless the counties can perform the same level of maintenance at lower unit costs. In fact, overall maintenance costs, could increase due to additional maintenance inspection and contract administration requirements by the state.

Consolidating maintenance operations, case by case, through mutual investigation and agreement would present less risk than any sweeping consolidation change. Those state primary system maintenance operations with low mileage or very few personnel would be potential candidates for consolidation either through 28E agreements with the county maintenance organization or within the current state organization itself. These would need to be examined on a case by case basis for feasibility.

CITY MAINTENANCE OF URBAN PRIMARY EXTENSIONS

State primary urban extensions total 1,351 miles. The state and cities have joint responsibility for these extensions. State maintenance responsibility is limited to the surface, curb to curb features (excluding parking signs and parking lanes), traffic signs, pavement markings, bridges and snow removal from the traffic lanes. Other street maintenance, including the removal of windrowed snow, sidewalks and all areas between the curb and the right of way line are the responsibility of the city.

Currently, the Iowa DOT has maintenance agreements with 34 cities for maintenance of the state's responsibility on all, or a portion of the primary extensions. Approximately 200 miles, or 15 percent, of the primary extensions are maintained by the cities under maintenance agreements. Of the cities providing maintenance of the primary extensions, 31 have populations of 5,000 or more. Although this is 31 of the total 67 cities over 5,000 population, several cities only maintain a portion of the primary extension mileage. Frequently, the primary extension mileage maintained by the city consists only of segments in the downtown business area where the city would be required to haul the snow from the street in any event.

Although three cities of less than 5,000 population perform contract maintenance of state primary extensions, the majority of the cities of this size do not have the organization or resources to provide additional maintenance services. It would not be feasible or economical for these cities to attempt maintenance of the primary extensions. Therefore, assessment of cities maintaining the extensions of the state primary system was limited to cities over 5,000 population.

Currently city personnel and equipment resources are utilized exclusively on current street maintenance functions. Additional resources would be required for cities to contract with the state to maintain the primary municipal extensions. The cities currently have partial maintenance responsibility for these primary extensions and for individual cities the additional maintenance work performed by the Iowa DOT would be minor in relation to the current city street maintenance workload. This is based on the finding that all of the eight cities over 50,000 population currently contract with the state to maintain all or a portion of the primary extensions within their jurisdiction. Without a clearly defined maintenance work program and corresponding resource requirements, it is not possible to determine the overall impact on current personnel and equipment resources.

Thirty-six of the cities have opted not to provide, through contract, maintenance of the primary extensions. There appear to be factors other than resource requirements that affected these decisions. In the sample cities contacted, inadequate cost reimbursement was cited frequently as the reason for not participating. Other cities indicated they currently would not contract to maintain the primary extensions under any conditions.

The assessments and findings for county contract maintenance are equally applicable to city maintenance of the municipal primary extensions. Contracting on the basis of maintenance standards and defined maintenance work program provides a mutual agreement as to the work to be performed and an equitable basis for reimbursement. Maintenance service levels used by the Iowa DOT for the primary extensions, currently not maintained by the cities, could be used to define the amount of work to be provided by the cities, as well as the corresponding maintenance service levels. By incorporating these items into the maintenance agreement with the city, the state could ensure that an adequate maintenance service level would be provided.

Current agreements for city maintenance of primary extension do not define service levels or the amount of routine maintenance to be provided. Reimbursement to the cities for this work is $695 per lane mile for fiscal year 1986.[1/] Surface/roadway maintenance costs for all city streets reported by cities over 5,000 population in 1983 were approximately $4,300 per street mile and $1,430 per lane mile. Undoubtedly, some of these costs were for maintenance of parking lanes and other features not

1/ Iowa DOT Commission Order No. H-85-588, May 7, 1985.

a part of the state's maintenance responsibility on primary extensions. However, the reported costs are for all streets and typically maintenance costs for major arterial streets, such as the primary extensions, are higher than the average for all streets which include local access residential streets. Without improved maintenance cost reporting, it is not possible to accurately determine the actual maintenance costs required for the primary extensions.

Additional use of city contract street maintenance of the primary extensions will not reduce the overall maintenance costs to the state, as long as the same level of service is provided by the cities as is currently provided by the Iowa DOT. And, in fact, the total maintenance costs to the state would likely increase if all city street maintenance agreements were based on defined workloads and actual maintenance costs reimbursed to the cities performing maintenance of the primary extensions.

COUNTY MAINTENANCE OF CITY STREETS

The maintenance of streets in some small Iowa cities is performed by the counties under 28E agreements as authorized by the Code of Iowa. Whether or not the cities contract with the counties for street maintenance services is a decision made by the individual municipal governing bodies. Frequently, this decision changes when the composition of the council or board changes.

Of the ten sample cities less than 5,000 population contacted, all provide city street maintenance with city personnel, including three cities less than 1,000 population. Discussions with these city representatives supported the questionnaire responses that better responsiveness was the key factor in providing these services with city personnel. Typically, the cities and counties have a good rapport and provide mutual assistance in serving the needs of the residents.

Reimbursement for street maintenance services provided by the counties is based on actual costs to the county at agreed to unit prices for labor, equipment and materials, plus any third party contract costs. On this basis, it does not cost the county to provide these services. There is no subsidy to the city. The counties' role is that of a private contractor.

Unless cities of less than 1,000 population have unique circumstances and other requirements that support the retention of equipment for street maintenance work and sufficient personnel for other reasons, cities of this size should consider contracting these services with the county. However, there must be mutual agreement between the two jurisdictions as to the amount of maintenance to be performed and method of reimbursement. Continuity of city and county maintenance policy supports contractual maintenance of this type and can result in better levels of maintenance service to the residents.

PRIVATE CONTRACT MAINTENANCE

Private contract maintenance offers public agencies the opportunity to provide specialized or additional maintenance work without large investments for equipment and additional staffing. The experience and findings of the Iowa DOT typifies the findings of other agencies on the use of private contractors to perform all road and street maintenance in the jurisdiction.

Specific maintenance work, such as pavement patching, crack sealing, slurry seals, seal coats, resurfacing/leveling and bridge painting, has proven very-cost effective and successful with private contractors, both by the Iowa DOT and the local jurisdictions. However, the contracting of all routine maintenance work for extended periods and work that involved responses to emergencies such as pavement blowups, accidents, traffic control failures and snow storms has not proven successful or cost-effective under current contracting procedures. Other cited contracting problems include inadequate equipment and lack of experienced/qualified personnel to perform some of the maintenance work.

Two of the sample Iowa counties also had experience with contracting the maintenance of all the gravel/earth roads in the county. One county terminated the contract after six months due to lack of responsiveness and poor workmanship. The other county's experience was favorable for 2-3 years. Then the contractor began to increase the prices for providing the maintenance service to the point where this county also terminated the contract.

Private contracting of maintenance relieves the governmental agency of some of the management responsibility associated with the actual performance of the work and mobilization of the necessary resources. However, the agency retains responsibility and subsequent liability, as well as the majority of the management responsibility for planning, budgeting, organizing, scheduling and controlling the maintenance work.

Agencies contemplating the use of private contractor maintenance must thoroughly consider the potential long-term impacts as well as any short-term benefits. This is particularly critical when considering the contracting of the total maintenance work program. While initial contract costs may be favorable, the potential exists for major cost increases in the future, particularly after the governmental agency no longer has the resource capability to perform the work. Another major consideration involves the service level and quality of work and the resulting affect on the overall condition of the road system. Inadequate maintenance increases road user costs as well as the costs for resurfacing, rehabilitation and other improvement programs.

PART 5 - FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings, conclusions and recommendations are listed in this part under the three headings:

- Uniform Standards,
- Consolidation of Construction and Maintenance Operations, and
- Jurisdictional Changes.

UNIFORM STANDARDS

The following findings and conclusions are related to the development and application of consistent and uniform design, maintenance and construction standards and guidelines for use by public road agencies in Iowa.

1. Preventive maintenance and capital replacement/construction improvements, geared to protecting and restoring the existing highway infrastructure in accordance with current design guides, are highly economically feasible, particularly for roads having traffic flows over 300 vehicles per day.

   The neglect of the highway infrastructure and deferment of these improvements for whatever reasons, including funding, can significantly increase costs in the highway transport sector in Iowa. Conversely, their timely implementation can produce significant benefits.

2. Timing in the upgrading of lower volume roads is critical. Premature paving of lower volume roads can result in significant economic loss within the State. Conversely, upgrading roads with the appropriate levels of traffic can provide significant benefits.

3. Guidelines for improvements to only grades and curves and/or only the dimensions of lanes and shoulders may be difficult to justify from a purely economic point of view. However, they do provide safety benefits and are a publicly accepted precedent for highway safety. Combining these geometric and dimensional improvements with pavement reconstruction and/or resurfacing improvements does result in highly feasible projects.

4. Sound engineering criteria and practices supported by adequate funding and uniformly applied by public agencies within economic guidelines can produce significant benefits for Iowa. The benefits from government investment in line with current guidelines, far outweigh the cost savings potential in (1) reduced levels of service to highway users and (2) increased efficiency in the delivery of government construction and maintenance services.

5. There is some potential for improved efficiency in the existing road maintenance operations through the establishment of uniform maintenance standards -- related to levels of service and performance of the maintenance work.

Recommendations in this area are listed below.

1. The Iowa Department of Transportation, Iowa County Engineers Association and Iowa Chapter, American Public Works Association should initiate efforts to develop and apply uniform economical construction and maintenance standards or guidelines. Guidelines should be sufficiently flexible to allow for the specific circumstances under which they will be applied. To be cost-effective they definitely should not promote their mechanistic application to specific circumstances.

2. Highway funding schemes and program planning should strongly support maintenance and capital replacement/rehabilitation projects designed to protect and preserve the current highway infrastructure.

3. The identification and effective engineering analysis required for pavement resurfacing and reconstruction projects should be based on adequate up-to-date pavement condition information and documented pavement improvement technical performance. The public agencies should consider establishing a pavement maintenance approach -- popularly referred to as pavement management -- oriented toward making decisions related to the formulation of policy for pavement maintenance, resurfacing and rehabilitation.

   Similarly, the need for pavement sealing should be identified through current pavement information specifically established by public agencies for this purpose -- as part of a pavement management system. The system must be very responsive to decision making from the identification of need to implementation, because beyond a certain level of pavement deterioration sealing is technically not feasible.

4. Maintenance standards should be adopted separately for the state, counties and cities based on road and street classifications. These standards include:

   - Performance Standards
   - Maintenance Levels of Service

   Performance standards should be dynamic and represent goals and targets for field maintenance personnel in work accomplishment and quality. The routine use of historical planning values should be avoided. Targets should be reassessed annually in light of performance comparisons and the opportunity for improvement in work methods.

Maintenance service levels should also represent goals in terms of providing the amounts of maintenance necessary to comply with established maintenance policies. Maintenance standards should differentiate between urban and rural facilities.

5. Maintenance standards should be used to develop annual maintenance budgets, work programs and resource requirements for public agencies within the various jurisdictions beginning with the counties and larger cities.

   Resource allocations for maintenance should be made in accordance with the work programs and budgets adopted for maintenance. Resources should be directed toward accomplishing work programs.

6. Levels of maintenance service on the county secondary system, should be classified as Service A and Service B as authorized by the Code of Iowa.

7. All jurisdictions should have a policy and level of service for snow and ice removal.

CONSOLIDATION OF CONSTRUCTION AND MAINTENANCE OPERATIONS

The following list of findings and conclusions relates to the assessment and analyses of alternatives for the consolidation of public road construction and maintenance operations.

1. There is little duplication of maintenance work or resources among the various jurisdictions.

2. The overall consolidation of construction or maintenance operations at any level of government would result primarily in a transfer of costs and not significant cost savings.

3. The upfront costs of the transition of most consolidation alternatives appear to far outweigh the potential savings.

4. The risks of any sweeping consolidation of road construction or maintenance operations are high in light of transition costs and low potential for savings.

5. State primary system maintenance operations with very low mileage and/or very few personnel are potential candidates for consolidation either through 28E agreements with the counties or within the existing state maintenance organization itself. Likewise, county road and city street maintenance could be performed by the state through 28E agreements.

6. Consolidation of construction or maintenance operations at the state level would likely produce negative impacts in local maintenance service and the overall funding levels for roads and streets within the State.

7. There is improvement potential in the current maintenance operations at all levels of government. This potential for improvements is more discernable at the state level, because the state maintenance organization has better records than the county and city organizations. However, this potential for improvement is minimally related to organizational changes. It is related to operational improvements which can be realized within current organizational arrangements.

8. The Code of Iowa (Chapter 28E) fully authorizes agreements for services between public agencies in Iowa, and to a limited extent, the state, county and city jurisdictions utilize this provision.

   Jurisdictional responsibility of the extensions of the rural state primary roads into the cities is shared by the Iowa DOT and respective cities. Maintenance agreements between the two entities provide one agency the responsibility of performing the specified work without the duplication of effort.

   Of the 34 cities providing maintenance of the primary extensions, 31 have populations of 5,000 or more. Although this is 31 of the total 67 cities over 5,000 population, several cities only maintain a portion of the primary extension mileage.

   Cities contacted that do not contract to maintain the primary extensions indicated that costs for the work would exceed current reimbursement.

9. None of the twelve counties contacted during the field interviews expressed a desire or interest to perform the maintenance of the state primary system under contract.

   Contracting maintenance of the state primary system to the counties will not reduce total maintenance costs to the state -- unless the counties can perform the same level of maintenance at lower unit costs. In fact, overall maintenance costs, could increase due to additional maintenance inspection requirements by the state of maintenance work performed by the counties.

   The inspection of contract maintenance work accomplished presents unique problems and varies considerably from inspection of construction work. While some problems encountered with private contractors, such as lack of responsiveness and familiarity with the work to be performed, might not occur with county maintenance organizations, there is still the difficulty of quantifiable measurements for a number of maintenance work activities.

10. Private contract maintenance offers public agencies the opportunity to provide specialized or additional maintenance work without large investments for equipment and additional staffing.

    Specific maintenance work, such as pavement patching, crack sealing, slurry seals, seal coats, resurfacing/leveling and bridge painting, has proven very cost-effective and successful with private contractors, both by the Iowa DOT and the local jurisdictions.

The contracting of routine maintenance work for extended periods and work that involved responses to emergencies such as pavement blow-ups, accidents, traffic control failures and snow storms has not proven successful or cost-effective in Iowa.

Private contracting of maintenance relieves the governmental agency of some of the management responsibility associated with the actual performance of the work and mobilization of the necessary resources. However, the agency retains jurisdictional responsibility and subsequent liability, as well as the majority of the management responsibility for planning, budgeting, scheduling and controlling the quality of the maintenance work.

Recommendations related to the consolidation of construction and maintenance services are:

1. The Iowa Department of Transportation should continue to provide construction and maintenance services for the state primary system with department personnel and resources. However, it should examine case-by-case the viability of its maintenance operations with very low mileage and very few personnel vis-a-vis consolidation either with the larger county operation through 28E agreements or within the State operation itself.

2. Cities under 5,000 population, and particularly under 1,000 population, should be encouraged to utilize services of the county road departments as authorized by Section 28E of the Code of Iowa.

3. Reimbursement of maintenance services by all agencies under Section 28E should be based on actual costs and work performed under approved maintenance work programs and budgets.

4. Counties with county engineer vacancies should consider sharing the services of one county engineer as authorized by Section 309.19 of the Code of Iowa. Cities with minimal engineering requirements should also consider sharing the services of the county engineer.

JURISDICTIONAL CHANGES

The transfer of jurisdictional authority and responsibility for roads should be the result of the need to implement a plan for the delivery of public services that demonstrates improvements in: (1) the services themselves, (2) cost savings, and (3) more equitable and practical financing. Findings and conclusions in this area are listed below.

1. There is no viable alternative which requires substantial changes in the current jurisdictional authority and responsibility for roads and streets.

2. Revenues from local sources would not be available under the current Iowa Code to fund a state administered road program of all rural roads and revenues from motor vehicle users probably would not be increased sufficiently to fund a road program of approximately 100,000 miles.

3. Experience in other states where all rural roads are under the state's jurisdiction, demonstrate it is the local road systems and programs that ultimately suffer the most when available revenues are inadequate.

4. Assigning the state the authority and responsibility for both rural and urban public roads and streets exhibits the same potential negative impacts related to service levels, the accountability for service, and overall revenue availability as the findings in items 2 and 3 above extended to the cities. Iowa cities currently provide revenues from local sources, including bond issues, for city street maintenance and construction. The lack of these revenues would produce negative impacts in city street programs.

5. The counties and cities do not favor changes in the current jurisdictional responsibilities as strongly indicated in the questionnaire results and interviews.

The recommendation related to jurisdictional change in the authority and responsibility is listed below.

1. Jurisdictional responsibility for the state primary system should remain as it is. Transfers of authority and responsibility should be mutually acceptable to the involved jurisdictions. The proposal to transfer the county farm-to-market/Federal aid secondary system to the State would be the first step in consolidating authority for operations at the State level. The proposal is difficult to justify from the standpoint of:

   - costs savings,
   - overall road financing in Iowa, and
   - level of service to the public.