NEEDS ASSESSMENT STUDY OF THE IOWA DOT MAINTENANCE FACILITY CONSTRUCTION NEEDS

Iowa Department of Transportation

Wilbur Smith Associates, BTML Division

NEEDS ASSESSMENT STUDY OF THE IOWA DOT MAINTENANCE FACILITY CONSTRUCTION NEEDS

PREPARED FOR THE

IOWA DEPARTMENT OF TRANSPORTATION

BY

WILBUR SMITH ASSOCIATES,
BTML DIVISION

AUGUST 1989

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to Carol D. Coates, Director of the Bureau of Support Services of the Iowa Department of Transportation for all the support we received during this study and to the Offices of Project Planning and Maintenance Operations for providing us the information on Maintenance Management Systems, policy and various other data relevant to this study effort.

We specifically wish to thank Mr. Lee Smithson, Mr. Robert Samuelson and Ms. Kim Kammerer for their cooperation and assistance. In addition, the support provided throughout the public hearings by the District Engineers was greatly appreciated.

Finally, we wish to express our gratitude to all the city and county officials, and Chamber of Commerce directors, who provided us with additional information pertinent to the study and to all those, including public school administrators and personnel, who provided the facilities in which the public hearings were held.

TABLE OF CONTENTS

LIST OF EXHIBITS

EXECUTIVE SUMMARY

The purpose of this study is to provide recommendations relative to the location and construction needs for highway maintenance facilities within the state of Iowa. These recommendations were to be developed with consideration being given to the public's expectations and priorities for highway maintenance services. As a part of the study effort, a review was made of the methods used by other states to deliver highway maintenance services.

To accomplish the study, Wilbur Smith Associates undertook a series of tasks. These efforts included gathering of data and information to characterize the various maintenance programs and the delivery of maintenance and operations services by the Department. We researched the delivery of highway maintenance services in other states. Interviews with Iowa DOT maintenance personnel were accomplished. A schedule of public hearings was developed and ten hearings were held. All the information was integrated and various analyses were made. From these analyses we drew conclusions and developed recommendations.

PUBLIC HEARINGS

Ten public hearings were held across the state. The diversity of the groups represented at the hearings provided insight into the citizen concerns. It was very clear that highway maintenance in the eyes of the public is primarily snow and ice control activity and emergency repairs. Satisfaction with current levels of service was high. The primary concern was maintaining the current level of service. Everyone seemed to believe that quality and timeliness would be diminished if garages were relocated. Expectations expressed at the hearings indicated that people wanted and needed to be able to travel safely at highway speeds, 24 hours per day, 365 days per year.

Economic issues were also discussed. Each maintenance facility represents an economic benefit to the community where the workers reside. Local government officials described how their communities have had to cope with very fragile economic conditions and how the loss of jobs or another family is unacceptable to their communities.

REVIEW OF OTHER STATES

To obtain the information concerning maintenance operations in other states, a literature search and telephone interviews were conducted. A total of fourteen states provided information. As a result of our research we concluded that no one state has a better method of providing highway maintenance services.

Most states are successfully contracting some of their maintenance activities. Wisconsin and Michigan have successfully contracted their road maintenance responsibilities to their county highway departments. Almost all states contacted agree that while small maintenance crews can be effective for winter operations, they are inefficient and uneconomical because the crew is limited in what routine maintenance activities it can accomplish. Some states successfully take advantage of the small crews by using some sort of satellite facilities in the winter. The more numerous but smaller crews operating from such facilities provide responsive snow and ice control services in the winter. The satellite facilities are not usually manned in the summer.

MAINTENANCE TRENDS

In examining those items which impact on highway maintenance, we concluded that from a macro point of view, the highway system will not materially change and the number of lane miles maintained should remain at approximately 25,000. About 100 lane miles of high level of service road is added to the system annually and some lower level of service road is transferred to counties and cities. Traffic will continue to increase and will, to a large degree, reflect the continuing population shifts from rural to urban. The aging highway system, coupled with increased traffic, means more highway maintenance will be required in the future.

This increasing need for routine highway maintenance requires that the Department change its strategy for maintenance facilities from an emphasis on winter maintenance to a strategy reflecting a combined emphasis on both summer and winter maintenance operations. Such a strategy retains the present amount of equipment and personnel, but the equipment and personnel are consolidated into a smaller number of facilities. The consolidation provides crews of sufficient size to accomplish all maintenance. Each facility would have a larger operating radius than at present. Using equipment capabilities, we estimate this radius to be about 30 miles in rural areas and 15 miles in urban areas.

FACILITY NEEDS

Three strategic approaches to organizing field maintenance facilities were developed. These provided 4 specific strategies to provide emphasis to warm weather (routine maintenance), cold weather, (snow and ice control) and two levels of a combined approach.

Each approach used the existing facilities to the extent possible. An analysis of age, condition, and size, revealed that 70 of the 138 existing garages were adequate for such purposes. Some of these required improvements to accommodate the extra equipment. Depending on the approach analyzed, from 3 to 36 new maintenance facilities would be required.

COSTS

Costs were estimated for the four strategies. The warm weather emphasis approach utilizing the existing adequate facilities outlined above was the most economical at $6,320,000. This approach did not provide the same level of winter service as is currently provided. The use of unstaffed satellite locations in the winter would provide the additional service needed. Using this approach, the costs are $8,120,000. The use of staffed satellite locations would incur costs of $12,620,000. The cold weather maintenance emphasis strategy would cost about $17,775,000.

ECONOMIC

As a result of consolidations, the relocation of personnel will be required. This provides both a positive benefit and a negative benefit to the receiving and losing communities respectively. The economic value associated with each transfer is about $33,000 in community earnings and 1.8 jobs. Depending on the approach selected we estimate that from 75 to 270 maintenance personnel may be transferred.

CONCLUSIONS

Overall we concluded that approximately 50 percent of the current facilities are inadequate and their locations provide a priority to snow and ice control activities. This leads to inefficiencies. Approximately 40 percent of these facilities are not needed as the level of maintenance services now being provided can be matched or improved upon by operating larger, more productive crews that are based from adequate maintenance facilities. The public does not want any changes in the present facility locations. The perceive that such changes will result in lower levels of service. However, the Department must sooner or later adopt an approach which will align their facilities, capabilities, and maintenance needs. Delaying or utilizing an ad hoc approach only makes the future solutions less effective and more costly. In this respect we do not see any approaches or options which are totally satisfactory to the public or to the Department's field maintenance employees. The legislative requirement that maintenance facilities be located in all counties in Iowa with populations greater than 8,000 is not compatible with optimum location of maintenance facilities.

We also concluded that the most important citizen concern is mobility and that every effort should be made to continue the high level of mobility enjoyed by the citizens of Iowa. The long term economic benefit of a well operated and maintained highway system is an asset to every community in the state.

RECOMMENDATIONS

- That the Department establish a program whose goal will be to involve and educate the public and DOT employees concerning maintenance needs and requirements.

- That the Department adopt a facility organizational strategy that provides a better balance between snow and ice control and routine maintenance.

- That the Department implement their selected facility strategy over a 5 or 6 year period.

- That the Department take action prior to implementing their selected strategy to modify or rescind the current legislative requirement for a maintenance facility in every county with a population of 8,000 or greater.

- That the Department do away with the Level of Service "D" designation on the primary road system.

- That the Department

  - Measure the Level of Service provided
  - Revise its Maintenance Management System
  - Implement an Equipment Management System.

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

The facilities most common to highway departments are those associated with maintenance. These facilities are often referred to as "maintenance yards" or "maintenance garages". Functionally the maintenance facilities provide administrative offices, equipment repair facilities, fuel storage and dispensing, equipment and materials storage, accommodations for personnel and other related features.

With continuous and often increasing pressures to provide expanded services at reduced costs, many maintenance organizations are re-examining everything they do in order to assure that the most efficient and effective maintenance services are provided.

The Iowa Department of Transportation feels these same pressures for expanded services at reduced cost and has for many years continually strived to improve its efficiency and effectiveness in the delivery of highway maintenance services. Active programs have included larger, more versatile and more productive maintenance equipment; consolidation of maintenance facilities into larger more capable facilities; adoption of maintenance management systems; and the realignment of maintenance staff levels to levels more consistent with the improved facilities, equipment, and defined maintenance activities.

During the past several years the community leaders and their legislative representatives in Iowa have actively resisted the closure of the Department's maintenance facilities being brought about by consolidations. They are adamant in their views that the presence of state highway maintenance facilities are a crucial asset for the community which directly impacts the economic well-being and quality of life within a community and is a key factor in its ability to attract and maintain business.

The purpose of this study is to provide recommendations relative to the location and construction needs for highway maintenance facilities within the state of Iowa. A requirement in the development of recommendations was that consideration must be given to public input regarding expectations and priorities relative to highway maintenance facilities. Another objective was to look at the economic impact that a maintenance facility has on a community. A review of the delivery of similar maintenance services in other states was made to determine if methods used might be considered for Iowa.

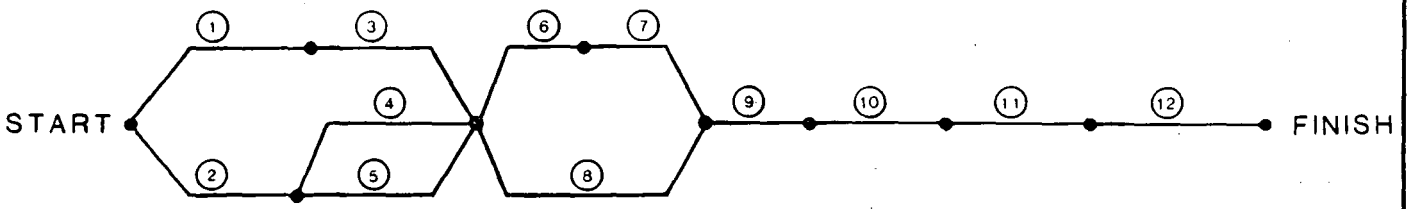
To satisfy the objectives of this study we used a methodology that is straight-forward. It involves:

- Identifying existing conditions.
- Developing future needs.
- Determining how the needs will be met.
- Determining facility requirements.
- Determining the location of the facilities.

Twelve tasks were undertaken to accomplish the study objectives. These are shown in Exhibit 1-1. Our first efforts involved the initial gathering of data to enable the study team to become completely familiar with the current highway maintenance needs, maintenance and operation programs and the delivery of maintenance and operations services by the Department. We researched the delivery of highway maintenance service in other states. Interviews with Department maintenance personnel were accomplished. A schedule of public hearings was developed, and mailing lists were compiled. Handouts were developed, and public notifications and other preparations made for holding the public hearings. The hearings were held and new information obtained and recorded. This information was integrated with the existing information that was gathered. Analyses and evaluations were made and a full report drafted. The draft report was provided to the Department for comment. The Department's comments were received, then considered and the appropriate changes were made to the draft study report. The final report was then provided to the Department.

Exhibit 1-1

WORK TASKS



1. Compile Existing Information
2. Interview Department Personnel
3. Conduct Statistical Analysis of MMS Data
4. Research Maintenance Services of Other States
5. Coordinate with Other Organizations
6. Plan Public Participation
7. Inform Public and Solicit Input
8. Prepare Public Hearing Materials
9. Hold Public Hearings
10. Develop Findings
11. Prepare Draft Final Report
12. Prepare Final Report

Our initial plan for this study included the statistical analysis of three years of the Department's Maintenance Management system data. The MMS data tapes were not available and although computer printed copies of the data were available, it was not practical to manually compile more than a year of data and enter it into computer data bases. Consequently our analysis of maintenance accomplishments only includes data for FY 88. For purposes of this study the limited data may not provide as true a picture of the maintenance performed as a two or three year cycle might provide. We have taken extra care with the data and its analysis and do not believe that the lack of this additional data will materially affect the validity of our recommendations.

This report is organized into chapters and appendices. The appendices contain the data collected and used. The information, recordings, etc. that are part of the record of each public hearing have been compiled into a separate volume and a single copy provided to the Department. The remaining chapters in this report contain our findings and recommendations.

CHAPTER 2

EXISTING CONDITIONS AND TRENDS

CHAPTER 2

EXISTING CONDITIONS AND TRENDS

INTRODUCTION

Developing a clear picture of existing conditions provides an information base upon which problems can be identified, analyses made, and future plans generated. In this chapter we discuss the existing conditions and trends that were considered in this study.

Discussion of the existing conditions will include topics related to the maintenance organization, current resources and facilities, the existing highway system, and other elements which affect the maintenance activities and the need for maintenance garages.

HIGHWAY SYSTEM

Within Iowa, there are 112,693 miles of roads, streets, and highways. Of these, 10,507 miles are maintained by the Iowa Department of Transportation and the remainder are maintained by counties or cities. The Department of Transportation maintains all interstate and primary highway systems and the counties and cities maintain the secondary and local road systems. The Department of Transportation also maintains roads located in state parks or at state institutions. The mileage maintained by state forces is:

Interstate	782 centerline miles
Primary	9,387 centerline miles
Parks and Institutions	338
Total	10,507 miles

These 10,507 centerline miles comprise 25,006 lane miles of highway pavement. These lane miles are further defined as follows:

Urban Interstate Highways	690 lane miles
Rural Interstate Highways	3,146 lane miles
Primary (LOS B) Highways	8,152 lane miles
Primary (LOS C) Highways	6,836 lane miles
Primary (LOS D) Highways	5,440 lane miles
Park and Institution Roads	742 lane miles
Total	25,006 lane Miles

In terms of lane miles, the existing highway system is not scheduled for any large changes. There are additions and deletions to the system that occur continuously. Each year the department adds approximately 100 lane miles to the interstate and to the level of service B and C primary highways. They also transfer portions of highways to city and county jurisdiction. The transferred mileage is usually of a lower service level. The overall trend is a small but steady increase in the lane mileage associated with the highways that are maintained at the higher service levels and a small but steady decrease in the lane mileage associated with lower service level highways.

There are three basic pavement types used - Portland Cement Concrete, Asphalt Overlay Over Concrete, and Asphalt Pavement. The overall condition of the pavements and bridges is good. A visual survey of pavement conditions indicated that very little pavement is in poor condition. Maintenance is high and the deterioration rate appears to be low. This low deterioration rate is probably due to high quality design, construction and maintenance, and the relatively low traffic volumes on much of the system mileage. Further discussion of pavement condition will be provided later in this chapter under the heading entitled Pavement Management.

Highway traffic for all roads in Iowa continues to increase as shown in Exhibit 2-1a. The average growth between 1980 and 1987 was 249 million vehicle miles per year. Urban areas had the largest total growth. As shown in Exhibit 2-1b, approximately 55% of total vehicle miles traveled occurred on state highways. Almost three quarters of these miles were driven on the Level of Service A and B type roads. These traffic trends are expected to continue.

Exhibit 2-1a

Vehicle Miles Traveled
For All Roads in Iowa
(x Million)

Year	Rural	Urban	Total
1980	12,377	7,562	19,939
1981	12,428	7,664	20,092
1982	12,479	7,873	20,352
1983	12,631	8,095	20,726
1984	13,081	8,585	21,666
1985	12,889	8,391	21,280
1986	12,982	8,444	21,426
1987	13,216	8,715	21,931

Exhibit 2-1b

Vehicle Miles Traveled
For State Maintained Roads in 1987
(x Million)

Level of Service	VMT	Percent of State VMT
A	3,950	33
B	4,788	39
C	2,240	18
D	1,158	10
Total	12,136	100

MAINTENANCE

The objectives of the highway maintenance function are to protect and preserve the capital investment that has been made in the State of Iowa's highway transportation system and provide service to the highway users. Providing maintenance to this highway system and service to its users is a complex management responsibility that is one of the key responsibilities of the Department of Transportation (DOT).

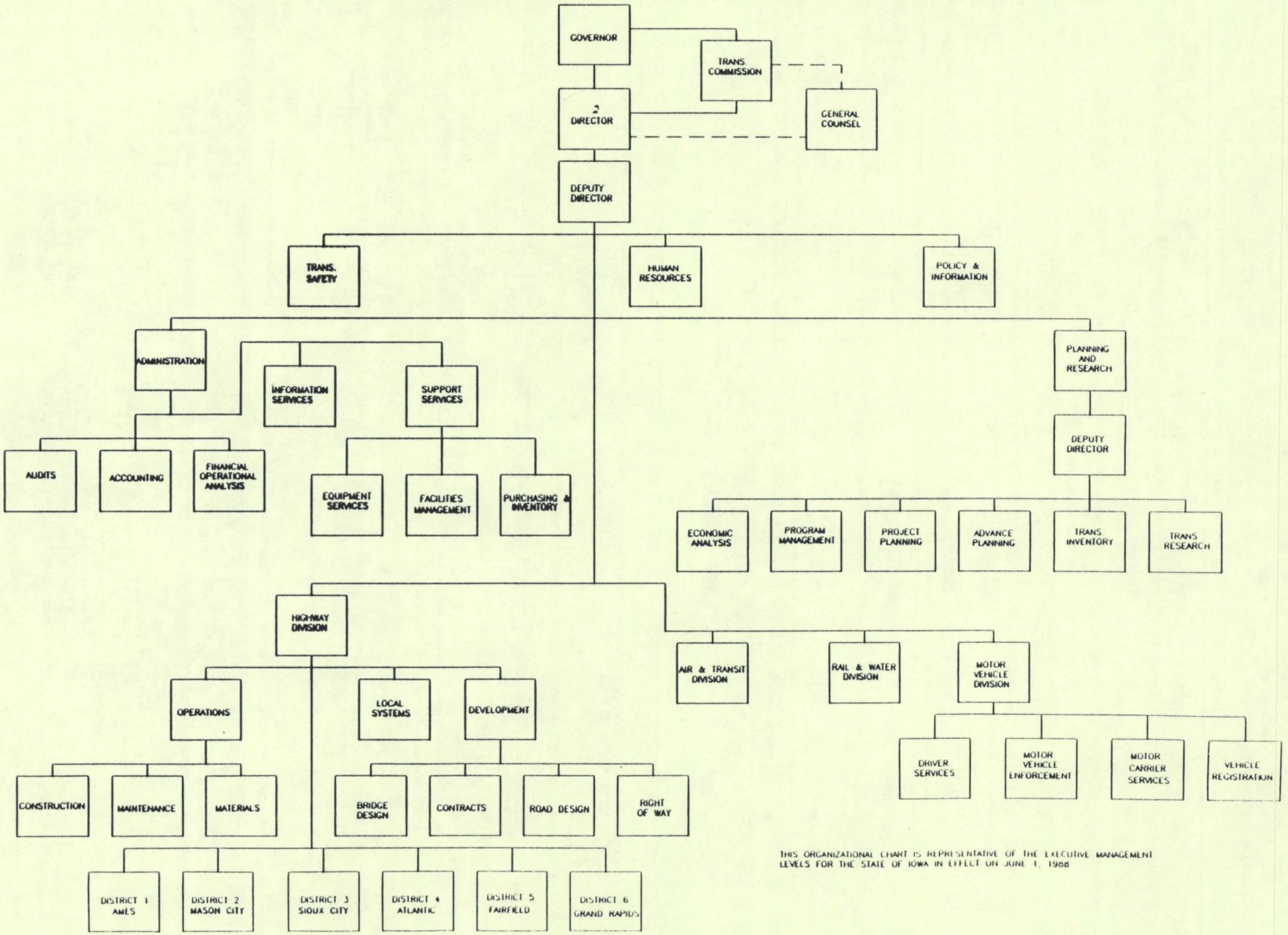
Within the Department of Transportation, the Division of Highways is responsible for the design, construction, operation, and maintenance of the highway system. Maintenance responsibilities are assigned to the Districts with policy, direction, and monitoring by the Office of Operations. The Bureau of Support Services within the Administration Division of the Department of Transportation has the responsibility for providing the facilities and equipment resources necessary for the Highway Division to carry out its maintenance responsibilities.

The organization for accomplishing maintenance provides for assignment of responsibilities, delegation of authority and positive control. It also provides the organizational structure to accomplish the numerous functions and complex procedures required. Exhibits 2-2 through 2-5 graphically portray the organization arrangement from the highest to the lowest organization level. Exhibit 2-6 defines the six district boundaries and Exhibit 2-7 shows the assigned service areas of responsibility of the Resident Maintenance Offices.

Assuring the quality of the highway maintenance activities and developing maintenance policy are the primary responsibilities of the Bureau of Operations' Maintenance Office. Part of its purpose is to provide technical guidance and statewide direction for all maintenance activities. It also plans and administers the Department's maintenance programs and monitors and evaluates the performance of field operations in all maintenance functions in order to assure uniform compliance with policies and procedures.

The District Engineer is responsible for all maintenance functions within the district's geographic area of responsibility. Under the direction of the District Engineer, the District Maintenance Engineer directs the district maintenance organization and assures accomplishment of the district's maintenance activities. The Office of the District Maintenance Engineer supervises and coordinates, through the Resident Maintenance Engineer, all highway maintenance and related activities within a district and, within established policies and agreements, performs maintenance activities for other divisions of the Department of Transportation.

Exhibit 2-2
IOWA DEPARTMENT OF TRANSPORTATION



THIS ORGANIZATIONAL CHART IS REPRESENTATIVE OF THE EXECUTIVE MANAGEMENT LEVELS FOR THE STATE OF IOWA IN EFFECT ON JUNE 1, 1988

Exhibit 2-3

FIELD ORGANIZATION

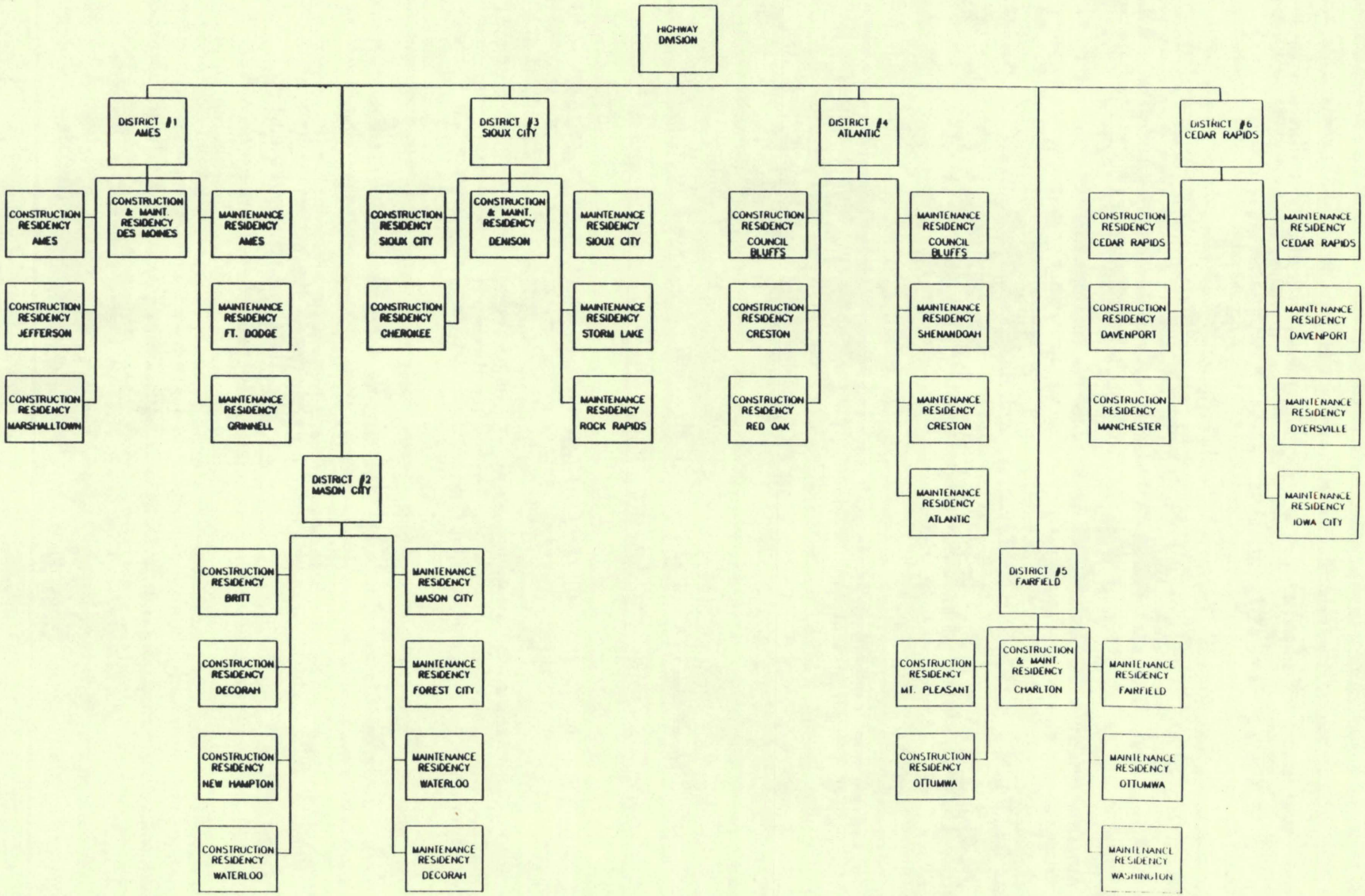


Exhibit 2-4

DISTRICT 1 OFFICE

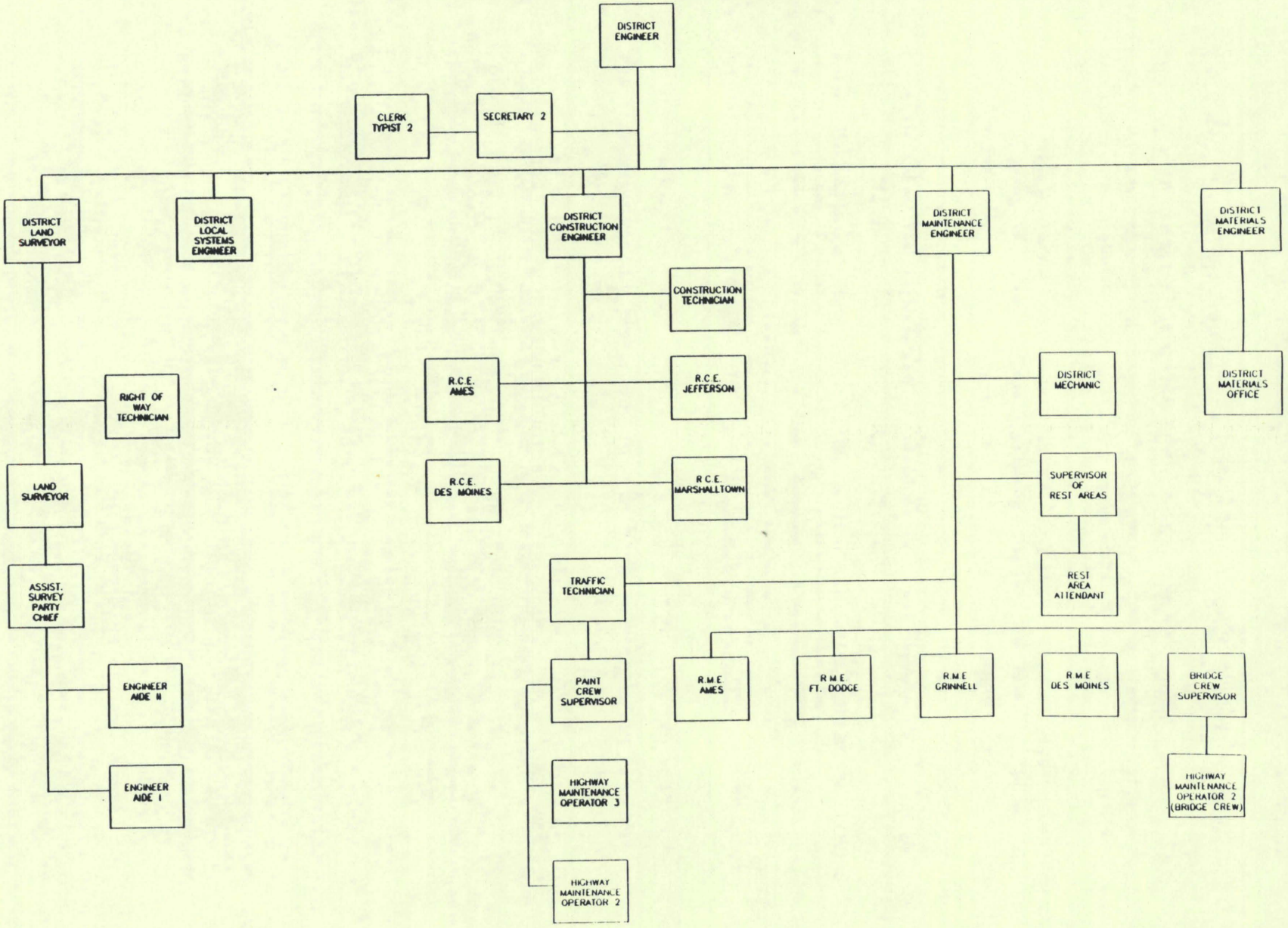
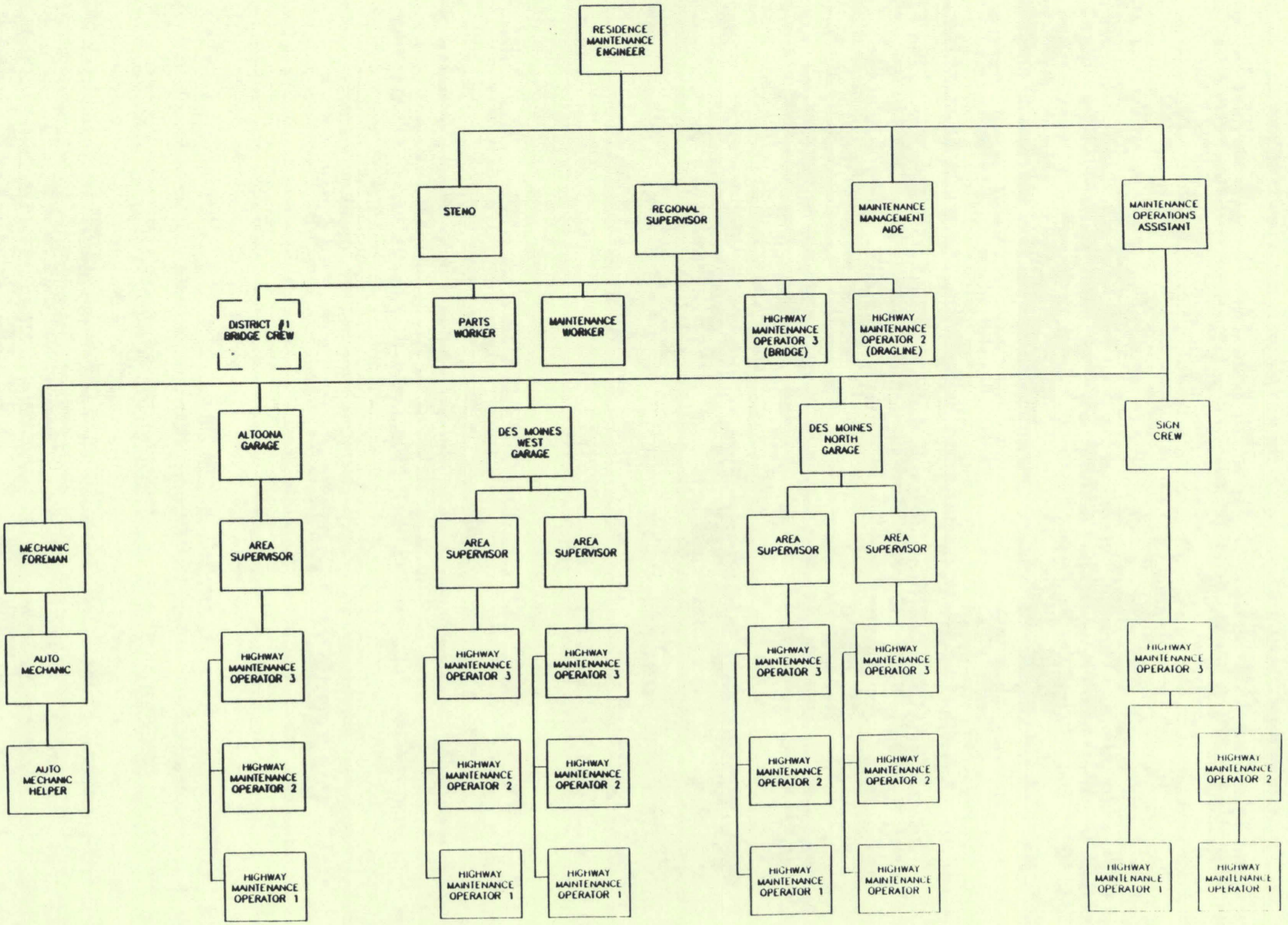


Exhibit 2-5

DES MOINES MAINTENANCE RESIDENCY



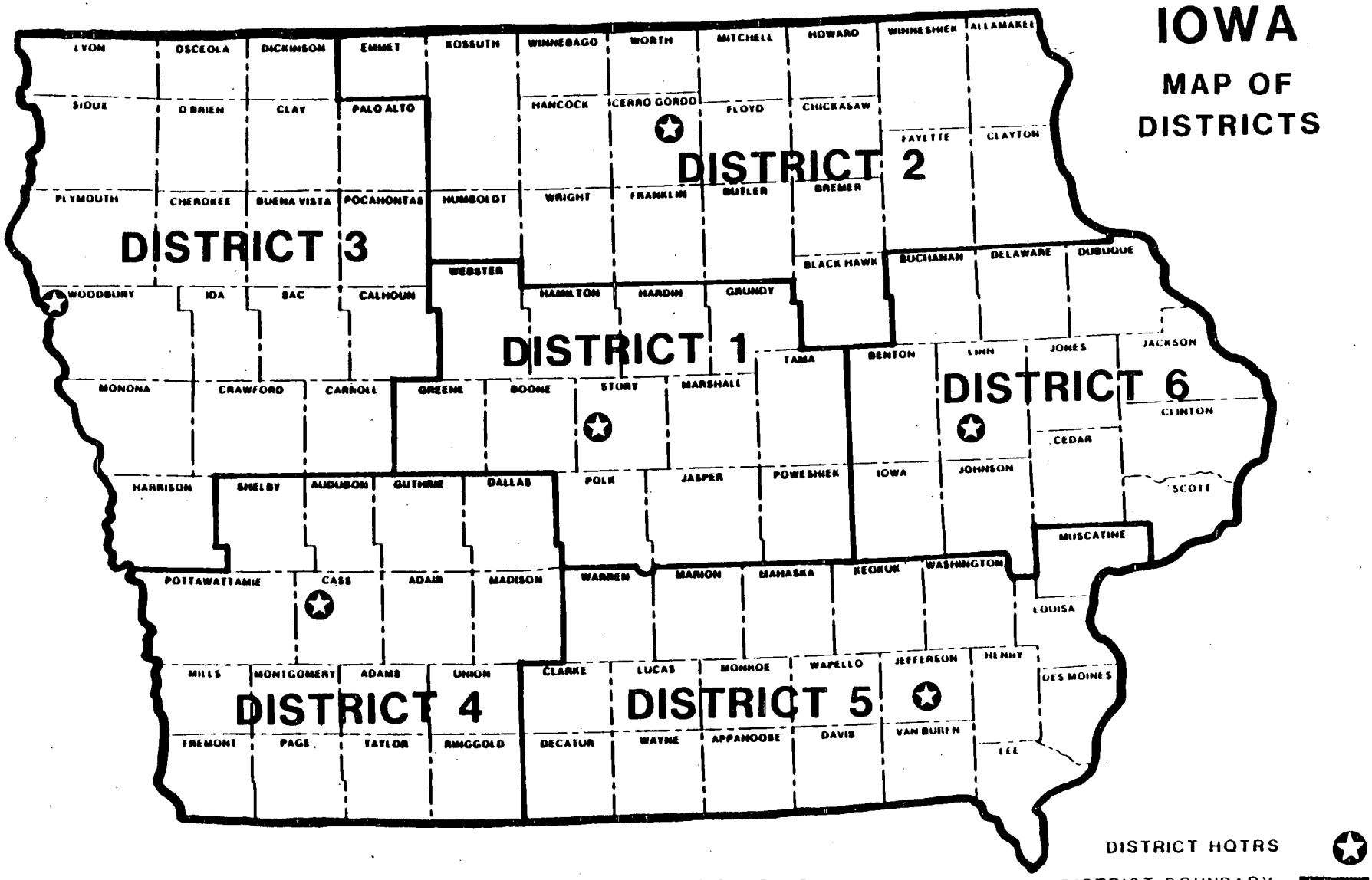

IOWA
MAP OF
DISTRICTS
DISTRICT 1
DISTRICT 2
DISTRICT 3
DISTRICT 4
DISTRICT 5
DISTRICT 6
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
SIOUX
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
WEBSTER
BLACK HAWK
BUCHANAN
DELAWARE
DUBUQUE
WOODBURY
IDA
SAC
CALHOUN
HAMILTON
HARDIN
GRUNDY
TAMA
BENTON
LINN
JONES
JACKSON
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
CLINTON
CEDAR
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
JASPER
POWESHIEK
IOWA
JOHNSON
SCOTT
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MARION
MAHASKA
KEOKUK
WASHINGTON
LOUISA
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
WAPELLO
JEFFERSON
HENRY
DES MOINES
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE
DISTRICT HQTRS
DISTRICT BOUNDARY

Exhibit 2-6

IOWA DEPARTMENT OF TRANSPORTATION

Iowa Department of Transportation

Exhibit 2-7

AREAS OF MAINTENANCE RESPONSIBILITIES NOVEMBER 1, 1988

LEGEND

DISTRICT NUMBER 1

RESIDENCY NUMBER □

RESIDENCY LOCATION ▲

(OVER)

Gra. 532
5500 10/13/87

IOWA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MAINTENANCE FIELD OFFICES

November 1, 1988

DISTRICT 1 1020 S. Fourth St., Ames, 50010 — Area Code 515, Office Phone 239-1635
Kenneth M. Meeks, District Engineer
Rodolfo L. Laudencia, District Maintenance Engineer

Resident Maintenance Engineers

No.	Name	Address	Res.
11	Donald L. Schumann Dave Witman, M.O.A.	U. S. 30 E., Ames 50010	515 233-3734
12	Michael J. Kennerly Don Blasnitz, M.O.A.	Box 854, Fort Dodge 50501	515 955-3766
13	Vince Ehlert Keith Harvey, M.O.A.	Box 25, Grinnell 50112	515 236-6581
14	Paul J. McGuffin William S. Kreinbring, M.O.A.	1530 NE 53rd Ave., Des Moines 50313	515 262-5692

DISTRICT 2 Box 741 (1420 4th St. SE), Mason City 50401 — 515 423-7584
Robert I. Bortle, District Engineer
M. Dean Browning, District Maintenance Engineer

Resident Maintenance Engineers

No.	Name	Address	Res.
21	Jim Sommer Jon Tisor, M.O.A.	672 6th St. SE, Mason City 50401	515 423-8516
22	Jim Hemberger Robert Hadacek, M.O.A.	Box 430, Forest City 50336	515 582-4298
23	James A. Nelson Willie Meyerhoff, M.O.A.	Box 1888, Waterloo 50704	515 235-9503
24	Robert W. Davis Larry Gunhus, M.O.A.	Box 140, Decorah 52101	515 382-3631

DISTRICT 3 Box 987 (2800 Gordon Dr.), Sioux City 51103 — 712 276-1451
James R. Bump, District Engineer
Harry W. Nelson, District Maintenance Engineer

Resident Maintenance Engineers

No.	Name	Address	Res.
31	Cecil L. Sutliff Warren (Dewey) Wulf, M.O.A.	Box 85L, Sioux City 51108	712 239-2113
32	Jerry Arn Keith Duncan, M.O.A.	Box 70, Denison 51442	712 263-5628
33	Clyde M. Bartel Howard Witcombe, M.O.A.	Box 1166, Storm Lake 50588	712 732-4514
34	Patrick H. Waters Billy Carmichael, M.O.A.	Box 430, Rock Rapids 51246	712 472-2315

DISTRICT 4 Box 406 (U.S. 71 & 6), Atlantic 50022 — Area Code 712, Office Phone 243-3355
Alan C. Samson, District Engineer
Donald R. Shaw, District Maintenance Engineer

Resident Maintenance Engineers

No.	Name	Address	Res.
41	James R. Whetstone Robert Hollander, M.O.A.	Box 7, Council Bluffs 51501	712 366-0438
42	George Heaberlin Robert Foster, M.O.A.	Box 460, Shenandoah 51601	712 246-4610
43	Thomas Donahey Edward M. Fletcher, M.O.A.	Box 346, Creston 50801	515 782-4310
44	Vacant Martin Boston, M.O.A.	Box 311, Atlantic 50022	712 243-1510

DISTRICT 5 Box 587 (307 W. Briggs St.), Fairfield 52556 — 515 472-4171
Thomas J. McDonald, District Engineer
Frederick Bartos, District Maintenance Engineer

Resident Maintenance Engineers

No.	Name	Address	Res.
51	Roger Boulet Donald D. Chapman, M.O.A.	Box 280, Fairfield 52556	515 472-6142
52	Larry E. Jackson Kermit L. Farrier, M.O.A.	Box J., Ottumwa 52501	515 683-3331
53	Ron Chapman Daniel Frye, M.O.A.	Box 733, Chariton 50049	515 774-2420
54	Blinn E. Sourwine Warren McConahay, M.O.A.	Box 512, Washington 52353	319 653-3561

DISTRICT 6 430-16th Ave. SW, Cedar Rapids 52404 — 319 364-0235
Maurice F. Burr, District Engineer
John J. Saunders, District Maintenance Engineer

Resident Maintenance Engineers

No.	Name	Address	Res.
61	James L. Phinney David Svoboda, M.O.A.	5455 Kirkwood Blvd. SW, Cedar Rapids 52404	319 365-3558
62	Kevin Mahoney Joseph Benda, M.O.A.	Box 2646, Davenport 52809	319 391-4643
63	Art Gourley Steve L. Wilson, M.O.A.	Box 325, Dyersville 52040	319 875-2375
64	Michael Jackson Peter Dallman, M.O.A.	Box 427, Iowa City 52242	319 351-8818

The Resident Maintenance Engineer directs the maintenance operations in an assigned geographic area. The Area Supervisor, under the Resident Maintenance Engineer's direction, is responsible for the administration and supervision of maintenance work in a specific area of the district. The Area Supervisor is responsible for an extensive number of lane miles of highway, and state maintenance personnel. Resident Engineers, Area Supervisors and the assigned maintenance personnel occupy the maintenance facilities which are the subject of this study.

The Area Supervisors provide direction to maintenance crews, which usually consist of highway maintenance operators and maintenance mechanics. These crews are responsible for the day-to-day maintenance functions throughout the assigned geographic service area.

PERSONNEL AND EQUIPMENT RESOURCES

Labor and equipment are the permanently assigned resources utilized by maintenance. In order to allocate and assign the authorized labor and equipment among the established crews, the Iowa Department of Transportation uses the following basic allocation formula.

LMau	+	LMar	+	LMb	+	LMc	+	LMd	+	LMp & i	+	Ramps	+	RA	+	WS
20		25		30		40		50		50		12		4		4

Where:

LMau = Lane Miles of Level of Service (LOS) A urban in cities of 50,000 population or more
LMar = Lane Miles of LOS A rural
LMb = " " " LOS B roads
LMc = " " " LOS C roads
LMd = " " " LOS D roads
LMp & i = Lane Miles of Park and Institutional Roads
Ramps = Number of Interchange Ramps
RA = Number of Rest Areas
WS = Number of Weight Stations

For labor, these values are then multiplied by a staffing factor to arrive at the number of staff needed for each crew. The staffing factor will vary based on the number of positions that are authorized by the State Legislature.

The equipment assignment uses the formula only for the trucks that plow snow. For this, the assignment value is first multiplied by 1.1 for dead-heading and then multiplied by a "downtime" factor to arrive at the number of trucks to be assigned to each crew. The "downtime" factor is changed periodically to reflect the actual "downtime" experienced by the trucks.

The computed values for staffing and equipment are used as a general guide by each district in determining its crew and equipment assignments. The District Maintenance Engineer, with the concurrence of the District Engineer, can rearrange the numbers between crews as long as the total for the district remains the same. This practice allows local situations to be taken into account.

Maintenance Staffing

The current field maintenance staff is 1,671 people. This includes 1530 persons involved with highway, bridge, and rest area maintenance, 99 persons who staff the 24 maintenance residency offices and 42 persons on the State Bridge Inspection crews. Within the districts there are separate highway maintenance, bridge, rest area and paint crews. The majority of the field maintenance personnel are assigned to highway maintenance crews.

At the present time, the highway maintenance crews range in size from 2 to 38 people. Many have one or more supervisors and one to three mechanics while the number of maintenance workers or Highway Equipment Operators (HEOs) varies between 2 and 32. Exhibit 2-8 and Appendix A contain a breakdown by district of total staff, number of supervisors, number of mechanics and number of maintenance workers (HEOs). Exhibit 2-9 provides a summary of the number of crews and crew sizes by district. Exhibit 2-10 shows a similar distribution but includes only the number of HEO's.

Exhibit 2-8

Maintenance Crews Staff Summary

District	No. of Supervisors	No. of Mechanics	No. of HEO's	Total
1	26	26	239	291
2	24	28	169	221
3	25	27	180	232
4	25	22	215	262
5	21	22	172	215
6	28	27	254	309
Residency Staff				99
Statewide Bridge Inspection Crews				42
	149	152	1,229	1,671

Exhibit 2-9

Summary of Maintenance Crews
by Crew Size and District

Size of crew	District						Total
	1	2	3	4	5	6	
0-2		1	1	1			3
3		3		1	1	1	6
4			2			2	4
5	1	1	2	1	2	1	8
6	2	2	4	2	2	1	13
7	2	3	2	2	3		12
8	1	2	6	4	2		15
9		4	1	2	1	1	9
10	4	4	3	1	1	2	15
11	1	1	3		1		6
12	3	1		3	5	1	13
13	1				2	2	5
14	1		1		1		3
15					1		1
16		2	2			1	5
17	1	1		2		1	5
18				1		1	2
19						1	1
20				1			1
21						1	1
23	1						1
32						1	1
34		1					1
36	2					1	3
38						1	1
	20	24	27	23	22	19	135

Exhibit 2-10

Summary of Highway Equipment Operators in Crews

No. of HEO's	Size of crew	District						Sub-Total	Total
		1	2	3	4	5	6		
0-2	2		1	1	1			3	3
3	3		3		1	1	1	6	
	4			1				1	
	5			1		1		2	9
4	4			1			2	3	
	5				1	1		2	
	6		2	3	2	1		8	13
5	5	1	1	1			1	4	
	6	2		1				3	
	7	2	3	2	2	3		12	19
6	6					1	1	2	
	8	1	2	6	4	2		15	
	9		2					2	
	10		1					1	20
7	9		2	1	2	1	1	7	
	10	1	1					2	9
8	10	3	2	3	1	1	2	12	
	11		1					1	13
9	11	1		3		1		5	
	12		1		1	1		3	8
10	12	3			2	4	1	10	
	13						1	1	11
11	13	1				2	1	4	
	14	1		1				2	6
12	14					1		1	
	16						1	1	2
13	15	1				1		1	
	16			1				1	
	17						1	1	3
14	16			1	2			3	
	17		1					1	
	18						1	1	5
15	17	1			2			3	
	19						1	1	4
16	18				1			1	1
17	21						1	1	1
18	20				1			1	
	23	1						1	2
26	32						1	1	1
29	34		1					1	1
30	36	1					1	2	2
31	36	1						1	1
32	38						1	1	1
		20	24	27	23	22	19		135

Equipment

The equipment fleet assigned to maintenance is substantial. It includes dump trucks, front-end loaders, motor graders, air compressors, asphalt distributors, and other equipment needed for maintenance. Trucks equipped for snow and ice control operations are assigned as follows:

District 1	-	187 Trucks
District 2	-	147 Trucks
District 3	-	154 Trucks
District 4	-	165 Trucks
District 5	-	145 Trucks
District 6	-	202 Trucks
Total		1,000 Trucks

A review was made of the utilization of the major classes of equipment by the maintenance crews. These classes included:

Class	Description
7	Medium Duty 2-Axle dump truck (diesel)
8	Medium Duty 2-Axle dump truck (gas)
10	Heavy Duty 2-Axle dump truck (4X4)
11	Heavy Duty 3-Axle dump truck (6X6)
12	Heavy Duty 3-Axle dump truck (4X6)
16	Motor Grader
70	Medium Duty 3-Axle dump truck (4X6)

The utilization of each of these classes for the last three complete fiscal years was examined. Exhibit 2-11 shows the average engine hours of utilization for each unit within each of the classes and the average utilization for the last three years.

Exhibit 2-11

Average Engine Hours of
Equipment Utilization Per Unit

Class	FY'86	FY'87	FY'88	Average
07	673	596	610	626
08	432	308	408	383
10	213	115	144	157
11		86*	306	306**
12	394	291	347	344
70	81*	435	485	460**
16	270	256	319	282

* Class introduced late in FY
** Does not include FY usage for year introduced

Engine hours are but one measure of utilization. Most fleet operators in the public and private sectors gauge the quality of the fleet and its maintenance by the percentage of time the piece of equipment is available to do work. The need for the equipment or vehicle is normally based on the amount of time it is assigned to work and the actual hours worked (engine hours). The need for maintenance is developed, in part, through the actual hours worked and the work conditions. A low number of engine hours is not necessarily bad. For instance, in farm operations a combine or a corn picker could be considered essential and yet be used only a small amount of time each year. The same is true of highway maintenance. Some equipment is specialized. The Class 10 trucks in use by the Iowa Department of Transportation have permanently mounted hopper spreaders and the trucks can only be used for snow and ice control. They are old and are being phased out and replaced by Class 11 trucks. The utilization of Class 11 trucks is low due to late delivery in FY 1987, the first year that they were assigned to the fleet.

Overall, the utilization of the Department's truck fleet appears to be low. Assuming a 40 hour work week, each vehicle could be assigned to maintenance work activities a total of 2080 hours annually. If the truck had an availability rate of 90 percent, then the potential assignment time would be reduced to 1872 hours a year. Using the average engine hours in Figure 2-11, the highest average rate that any class of truck is being used is 33 percent. In reality utilization may be even lower because operations outside of normal work hours and weekend work were not considered. Accordingly, it appears that a portion of the truck fleet is primarily needed for peak requirements such as snow and ice control operations.

When utilization of a particular piece of equipment is less than 50 percent, a review should be made to determine the need for this item. The Iowa Department of Transportation does not have an Equipment Management System that would provide the data base necessary to make such a review in a timely fashion.

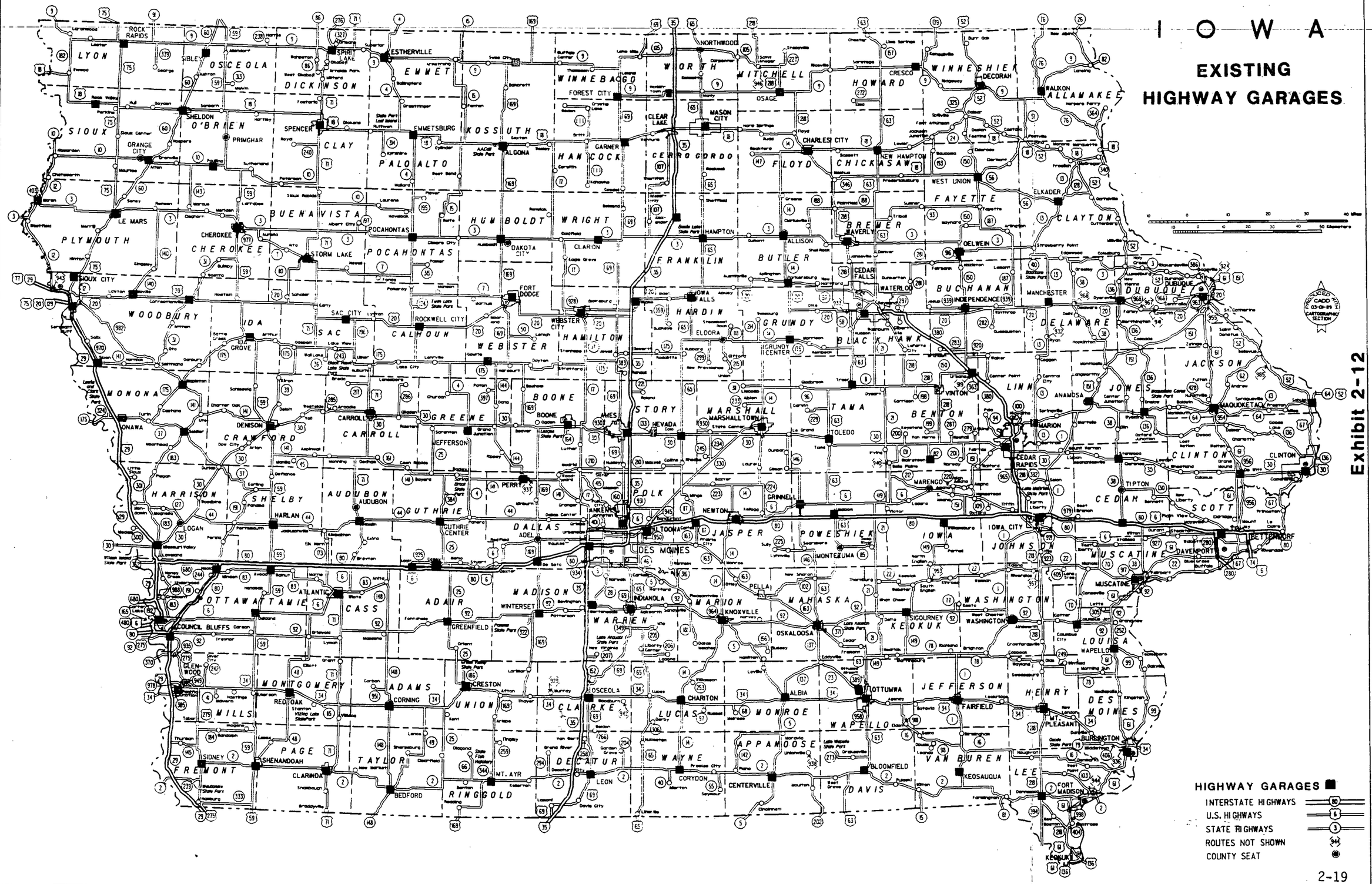
FACILITIES

Currently Iowa has 134 maintenance facilities, one satellite reporting station, and three bridge crew facilities for a total of 138 facilities located across the state. Exhibit 2-12 shows the location of each of these maintenance facilities. The facilities range in size from 2 to 35 stalls, with most in the 6 to 17-stall range. The age of these maintenance facilities ranges from 6 to 69 years. The number of facilities by various age groups is shown in Exhibit 2-13.

A number of the facilities are past their useful life span. The Department of Transportation, recognizing this fact, has recently performed a condition and suitability assessment of all their facilities. As a result of this assessment, a sufficiency rating was given to each facility. The rating was based on efficiency factors such as operations, combination potential, size of lot and garage, and maintenance and energy costs, with a total possible rating of 38. The ratings ranged from a low of 4 to a high of 38

IOWA

EXISTING HIGHWAY GARAGES



HIGHWAY GARAGES ■

- INTERSTATE HIGHWAYS (80)
- U.S. HIGHWAYS (6)
- STATE HIGHWAYS (3)
- ROUTES NOT SHOWN (344)
- COUNTY SEAT ◉

Exhibit 2-12

Exhibit 2-13

Distribution of Maintenance Facilities
by Age and Year Built

Year Built	Age Years	Number of Facilities	Percentage of Facilities
1980-1989	0-9	9	6
1970-1979	10-19	41	30
1960-1969	20-29	22	16
1950-1959	30-39	6	4
1940-1949	40-49	6	4
1930-1939	50-59	27	20
1920-1929	60-69	27	20

with the average being 26. These values have been used to determine the priority of facility replacement. In general, the sufficiency rating corresponds with the age of the facility. Appendix A provides a table of the sufficiency ratings, year built, and number of stalls by facility. Based on the size of the buildings, those built prior to 1950 generally are too small to allow the present snow plow trucks to be stored inside with the plow blades attached.

This study is concerned with the number and location of the maintenance facilities. Chapter 5, ANALYSIS, provides much additional information concerning the adequacy of the maintenance facilities.

MAINTENANCE MANAGEMENT

The goals of highway maintenance are to maintain a road network that provides a safe and comfortable ride to the traveling public and provide for the preservation of the investment that has already been made in the highway network. To achieve this goal, two general types of maintenance activities are performed. The first type is scheduled maintenance, meaning that the work required and its location are known in advance and accomplishment of the work can be planned and scheduled. Scheduled maintenance might include such activities as crack sealing, mowing, and those functions which tend to be primarily concerned with preserving the highway system. The second type of maintenance is unscheduled maintenance. In this case the approximate workload can be predicted but the amount and location are known only a short time before the maintenance must be performed. Functions of unscheduled maintenance include repair of damage caused by accidents, pavement blow-up repair, snow and ice control and those functions which are generally concerned with providing mobility and restoring safety conditions for the traveling public.

The department has a computer-based Maintenance Management System (MMS) that provides information on accomplishments, resources used, and costs. Reports are provided to management based on this information.

The MMS is a first generation system. Like most first generation MMS's, the focus of the information in the system is financial cost accounting. Such systems are not totally responsive to management's need to plan, budget, allocate, perform, report, and evaluate. The input to the system is manual, the system is relatively inflexible and the output reports are produced well after the end of the reporting period. We found the data within the system difficult to use because only summarized hard copies were available. We noted that the Department had developed modeling factors to apply to the data and that in some cases the data was reported from the field in a summarized fashion. Overall it appears that the MMS is primarily useful to the planning and budgeting processes and less useful in providing the information and evaluations managers need. A more modern MMS would provide the Department with a system that is fully responsive to management's needs.

Maintenance Activities

The State has grouped the activities performed by its maintenance crews into the following eleven categories: These categories allow the MMS to track costs and accomplishments in a programmatic fashion.

Category	Title
01	Supervision and Support
02	Roadway Surface
03	Shoulder Maintenance
04	Roadside Maintenance
05	Drainage Maintenance
06	Traffic Services
07	Snow & Ice Control
08	Bridge Maintenance
09	External Services
10	General Maintenance
11	Work for Others

Categories 02-08 deal directly with roadway maintenance, while the remaining three concern work done by field personnel in support of the actual maintenance work. Exhibit 2-14 provides information concerning the cost and labor hours that have been expended in each of the eleven categories. Our best estimate of this data indicates that about 30 percent of the labor hours and 22 percent of the costs are used for administration and support. Approximately 70 percent of the labor hours and 78 percent of the costs are applied directly to the maintenance of the highway system. This compares favorably with results achieved in other states.

In recent years the size of the maintenance staff has declined and this limits the amount of maintenance work that can be performed. To help offset this problem, some of the maintenance requirements have been fulfilled by contracting the work. Currently these contracts are at a cost of 10 to 12 million dollars per year. The types of work performed under these contracts

Exhibit 2-14

5 Year Cost and Labor Hour Trends by Category

Cost Trend
(x 1,000)

	Category	1984 Cost	%	1985 Cost	%	1986 Cost	%	1987 Cost	%	1988 Cost	%	5 Year Average Cost	%
1	Super. & Support												
	Supervision *	9,302	15	9,492	15	10,126	15	10,643	16	11,520	16	10,217	15
	Support **	7,899	13	8,172	13	8,941	13	8,754	13	10,090	14	8,771	13
2	Rdwy. Surf. Maint.	5,921	10	6,009	9	6,783	10	6,610	10	7,002	10	6,465	10
3	Shoulder Maint.	5,506	9	6,668	10	4,791	7	7,026	10	6,604	9	6,119	9
4	Roadside	3,170	5	4,066	6	3,830	6	4,765	7	5,437	7	4,254	6
5	Drainage	1,349	2	1,764	3	1,370	2	1,673	2	1,867	3	1,605	2
6	Traffic Service	9,118	15	9,917	15	11,450	17	11,525	17	11,393	16	10,681	16
7	Snow & Ice Control	11,587	19	9,611	15	11,999	18	7,942	12	9,708	13	10,169	15
8	Bridge Maint.	1,530	2	1,788	3	2,132	3	1,976	3	2,069	3	1,899	3
9	Ext.Serv. Contracts	317	1	1,088	2	306	0	1,286	2	653	1	730	1
10	General Maint.	5,009	8	4,930	8	5,533	8	5,837	9	6,313	9	5,524	8
11	Work for Others	615	1	558	1	476	1	574	1	492	1	543	1
Total		61,323	100	64,063	100	67,737	100	68,611	100	73,148	100	66,976	100

Labor Hour Trend
(x 1,000)

	Category	1984 Hours	%	1985 Hours	%	1986 Hours	%	1987 Hours	%	1988 Hours	%	5 Year Average Hours	%
1	Super. & Support												
	Supervision *	616	17	615	17	624	17	619	17	612	17	617	17
	Support **	640	17	637	18	651	18	655	18	688	19	654	18
2	Rdwy. Surf. Maint.	312	8	293	8	325	9	325	9	326	9	316	9
3	Shoulder Maint.	187	5	210	6	172	5	197	5	182	5	190	5
4	Roadside	228	6	285	8	265	7	304	8	304	8	277	8
5	Drainage	77	2	103	3	79	2	88	2	96	3	89	2
6	Traffic Service	488	13	510	14	545	15	579	16	532	14	531	15
7	Snow & Ice Control	535	15	402	11	472	13	317	9	405	11	426	12
8	Bridge Maint.	108	3	118	3	125	3	120	3	122	3	119	3
9	Ext.Serv. Contracts	20	1	20	1	12	0	12	0	8	0	14	0
10	General Maint.	405	11	390	11	393	11	369	10	374	10	386	11
11	Work for Others	55	1	44	1	33	1	36	1	24	1	38	1
Total		3,671	100	3,627	100	3,696	100	3,621	100	3,673	100	3,658	100

* Function codes 601, 602, 603, 604, 608

** Function codes 005, 010, 022, 079, 097, 098, 099, 1xx

are the routine, or scheduled type of work. This includes pavement, drainage and roadside maintenance. Due to less than satisfactory results, the State has discontinued its efforts to contract out unscheduled maintenance work, such as snow and ice removal, pavement blow up repair, etc.

MAINTENANCE EFFECTIVENESS

A critical aspect of managing maintenance programs is knowledge concerning the effectiveness of maintenance operations. The following questions need to be answered: Are the right things being done? In the right amount? At the right times? Iowa has two programs that track the condition of the highway system on a continuing basis and provide a measurement of maintenance effectiveness.

Pavement Management System

One aspect that identifies the need for maintenance is the condition of the pavement surface. The state performs several rating routines that produce two measurements used in determining the condition of the pavement. These are the Pavement Condition Rating (PCR) and Pavement Serviceability Index (PSI). The PCR reflects factors which are associated with the condition of the pavement such as cracks, friction, rutting structural capacity, etc., while the PSI measures the ride quality or the roughness of ride. The PCR is a numerical rating that is scored between 0 and 100, with 100 indicating no defects. The PSI is rated between 0 and 5 with 5 being the smoothest possible ride.

Exhibit 2-15 and 2-16 provide information on the latest average values for PCR and PSI. The tables show average values, the standard deviation from the average, as well as the maximum and minimum values for each of the different levels of service for the entire state. The average decrease in PSI from the results of testing performed 6 years previously is also included.

Exhibit 2-15

1989 PCR Values by Levels of Service

Level of Service	Average PCR	Standard Deviation	Maximum PCR	Minimum PCR
A	63	16	98	18
B	68	12	93	29
C	64	13	90	17
D	56	14	88	18

The PCR for level of service "A" roads incorporates additional factors that produce lower PCR values than "B" and "C" level roads in the same relative condition.

Exhibit 2-16

1989 PSI Values by Levels of Service

Level Of Service	Average PSI	Standard Deviation	Maximum PSI	Minimum PSI	Avg. 6 Year Decrease in PSI
A	3.36	0.54	4.31	1.55	0.06
B	3.26	0.47	4.21	1.52	0.05
C	3.19	0.47	4.17	1.38	0.05
D	3.01	0.61	4.11	0.01	0.05

Both these measurements indicate that on the average, the roads in Iowa are in good condition. Most of the needs relating to pavement should be able to be handled by Iowa Department of Transportation maintenance staff with little change to their current maintenance activities. However, based on the PSI data and some of the comments received during interviews with district personnel, the highway system is gradually deteriorating and will soon reach a point where a much greater effort will be required to maintain the roads at the levels expected by the motoring public.

Maintenance Quality Control

The Office of Maintenance conducts a yearly quality evaluation survey to determine the quality of the maintenance program. The survey is conducted by an inspection team who makes a subjective review of approximately 10 percent of the highway network. Appendix A provides a sample inspection form which shows how total scores are produced. The field portion is generally conducted in October and November. The field review looks at 11 items which equate to about 15 maintenance activities. Because of the change in inspection teams from year to year and the subjective nature of the review, the results are primarily intended for comparison between residencies and districts. Exhibits 2-17 and 2-18 are tables from the "Maintenance Quality Evaluation FY'88" report and show the resulting scores. In general, the scores indicate that only a small amount of needed maintenance is not being performed. Based on the last three years reports, the scores have not dropped much, which means that the maintenance crews are keeping up with most of the work reviewed in this system.

Interviews with Department of Transportation Personnel

In the early part of March, a series of meetings were held with district maintenance personnel to gain their input on the significance of various activities performed by their staff. All District Maintenance Engineers and Resident Maintenance Engineers were interviewed along with 10 supervisors.

Exhibit 2-17

Maintenance Quality Comparison
FY 88
State Tabulation

DISTRICT	Unit 10	Unit 80	Unit 90	Pavement Surface	Shoulders	Traffic Services	Roadside	Composite	n*
1	88.6	87.0	89.1	87.7	91.8	91.0	93.8	90.2	147
2	89.0	90.7	90.9	90.1	93.6	90.9	92.5	91.6	153
3	82.0	90.0	91.1	87.6	91.7	91.6	93.1	90.2	173
4	90.5	88.4	91.7	89.7	91.1	92.1	86.6	90.3	151
5	84.4	89.9	90.6	87.7	88.9	91.7	89.5	89.0	176
6	86.6	87.9	89.3	87.6	89.7	92.6	91.0	89.6	151
AVERAGE	86.9	89.0	90.5	88.4	91.1	91.7	91.1	90.2	

**Number of test sections reviewed*

Unit 10 – Portland Cement Concrete Pavement
Unit 80 – Asphalt Mat Surfaced Portland Cement Concrete
Unit 90 – Asphalt Pavement (Total thickness eight inches or more)

Exhibit 2-18

Maintenance Quality Comparison
FY 88
Residency Tabulation

#	Residency	Unit 10	Unit 80	Unit 90	Pavement Surface	Shoulders	Traffic Services	Roadside	Composite	n*
11	Ames	90.8	82.6	84.8	84.8	90.7	91.9	95.3	89.1	44
12	Fort Dodge	95.6	91.6	90.3	92.8	92.0	90.9	94.5	92.4	46
13	Grinnell	79.1	93.5	90.4	85.2	93.9	90.6	92.5	89.6	39
14	Des Moines	88.4	86.1	79.0	86.8	89.5	90.3	90.8	88.7	18
21	Mason City	91.1	93.2	88.8	91.7	92.4	91.6	93.1	92.0	39
22	Forest City	83.6	89.3	96.8	89.7	95.5	91.5	93.7	92.2	39
23	Waterloo	88.8	89.9	91.4	89.8	92.3	89.1	91.1	90.5	33
24	Decorah	88.8	91.2	88.2	89.3	93.8	90.9	91.9	91.3	42
31	Sioux City	81.0	88.2	93.0	87.2	92.0	92.4	92.0	90.2	41
32	Denison	87.7	90.0	91.4	89.4	89.6	89.7	87.9	89.4	39
33	Storm Lake	82.7	91.0	85.5	86.9	91.8	92.7	95.9	90.4	47
34	Rock Rapids	75.7	90.3	95.1	87.0	93.1	91.1	95.7	90.5	46
41	Council Bluffs	96.7	85.9	92.4	91.0	88.5	91.0	86.8	89.8	31
42	Shenandoah	91.3	80.3	91.5	87.7	89.5	90.7	82.1	88.3	35
43	Creston	88.8	92.7	90.4	90.8	92.9	94.3	88.4	91.9	39
44	Atlantic	86.6	89.8	92.5	89.3	92.5	91.9	88.5	90.7	45
51	Fairfield	79.0	88.1	89.4	84.3	88.0	91.2	88.3	87.2	39
52	Ottumwa	88.8	90.7	92.1	90.0	87.3	91.3	89.7	89.5	41
53	Chariton	86.0	90.1	93.7	88.7	91.1	90.7	90.5	90.0	53
54	Washington	84.5	89.6	89.6	87.2	88.6	93.6	89.2	89.1	43
61	Cedar Rapids	92.0	83.3	89.8	87.8	92.9	94.0	93.2	91.1	40
62	Davenport	85.0	93.8	89.8	90.0	86.7	88.7	87.8	88.5	34
63	Dubuque	87.4	84.4	88.0	86.8	90.0	94.9	89.8	89.7	38
64	Iowa City	82.9	90.8	89.9	86.2	88.8	92.3	92.7	88.8	39
	Average	86.8	89.0	90.2	88.4	91.0	91.6	90.9	90.0	

**Number of test sections reviewed*

Unit 10 - Portland Cement Concrete Pavement
Unit 80 - Asphalt Mat Surfaced Portland Cement Concrete
Unit 90 - Asphalt Pavement (Total thickness eight inches or more)

The interviews with district personnel were conducted during the monthly maintenance meetings held by each district while most of the supervisors were interviewed at their maintenance facilities. Many of those participating in the meeting completed a study questionnaire and offered a number of comments regarding available resources, number of maintenance facilities, and location of maintenance facilities. Information from the completed questionnaire is summarized on the Questionnaire located in Appendix B. Among other items, this summary shows that safety activities are generally provided by Iowa Department of Transportation maintenance personnel. The emphasis on those activities indicated an admirable bias toward public safety by the Iowa Department of Transportation employees. There was general approval of the type and condition of equipment furnished by the Department. All comments received concerning the equipment stated there was continuing improvement in this area. Several of those interviewed stated that there were some specialty items, such as a more efficient and larger backhoe, that would be helpful. Comments were also expressed on the need for outfitting equipment for easier use by the operators.

Other comments made during the interviews concerned the formulas by which resources are allocated to the Districts and to the maintenance facilities. The most significant comments to the objectives of this study are:

- Winter maintenance is the basis by which equipment operators are assigned to maintenance facilities. Since interstate highways have the highest priority, they have the most equipment assigned per mile plowed. It is the perception of some maintenance personnel that maintenance facilities responsible for interstate maintenance tend to be overstaffed for summer work because interstate highways are the easiest to maintain in the summer

- Another perception voiced was that facilities from which Level of Service "D" highways are primarily maintained are understaffed for summer work since the maximum miles per truck are assigned based on winter work and "D" roads often require more maintenance than higher classified roads.

- The general concensus appears to be that the minimum number of personnel assigned to a garage should be 7 or 8. This number is required to accomplish most activities when traffic control requirements are considered.

- Most of those interviewed believed that winter maintenance needs should dictate the required number of maintenance facilities. This permits minimum deadheading and the shortest response time. There also seemed to be a general belief, however, that response time and the distance to the job site are less significant than having the right number of people to perform activities during the summer. The obvious discrepancy the two points of view would cause in determining the number of maintenance facilities was mentioned in several interviews.

- There are some supervisors who are responsible for two maintenance facilities, one of which is a satellite facility. This works fairly well for winter maintenance but less so for summer maintenance.

- Good community relations seem to be governed primarily by winter maintenance and the response time when winter storms occur.

The comments were accepted at face value. The perception that interstate maintenance facilities are overstaffed in the summer while other facilities are understaffed was not examined in detail. It is true that the interstate facilities have sufficient staff to form crews of the proper size to accomplish the majority of the maintenance activities while the smaller facilities may not have sufficient staff to form crews of a size to perform many of the maintenance functions. The perception could stem from the apparent ease with which each type of facility can organize to perform summer maintenance. Districts do establish special crews and combine crews from several locations in order to perform maintenance that is beyond the capability of the local maintenance facility. The Department also utilizes summer temporary employees to augment crew staffing.

OTHER FACTORS

Other factors considered in the examination of currently existing conditions in Iowa are Levels of Service, weather patterns, demographics, and terrain.

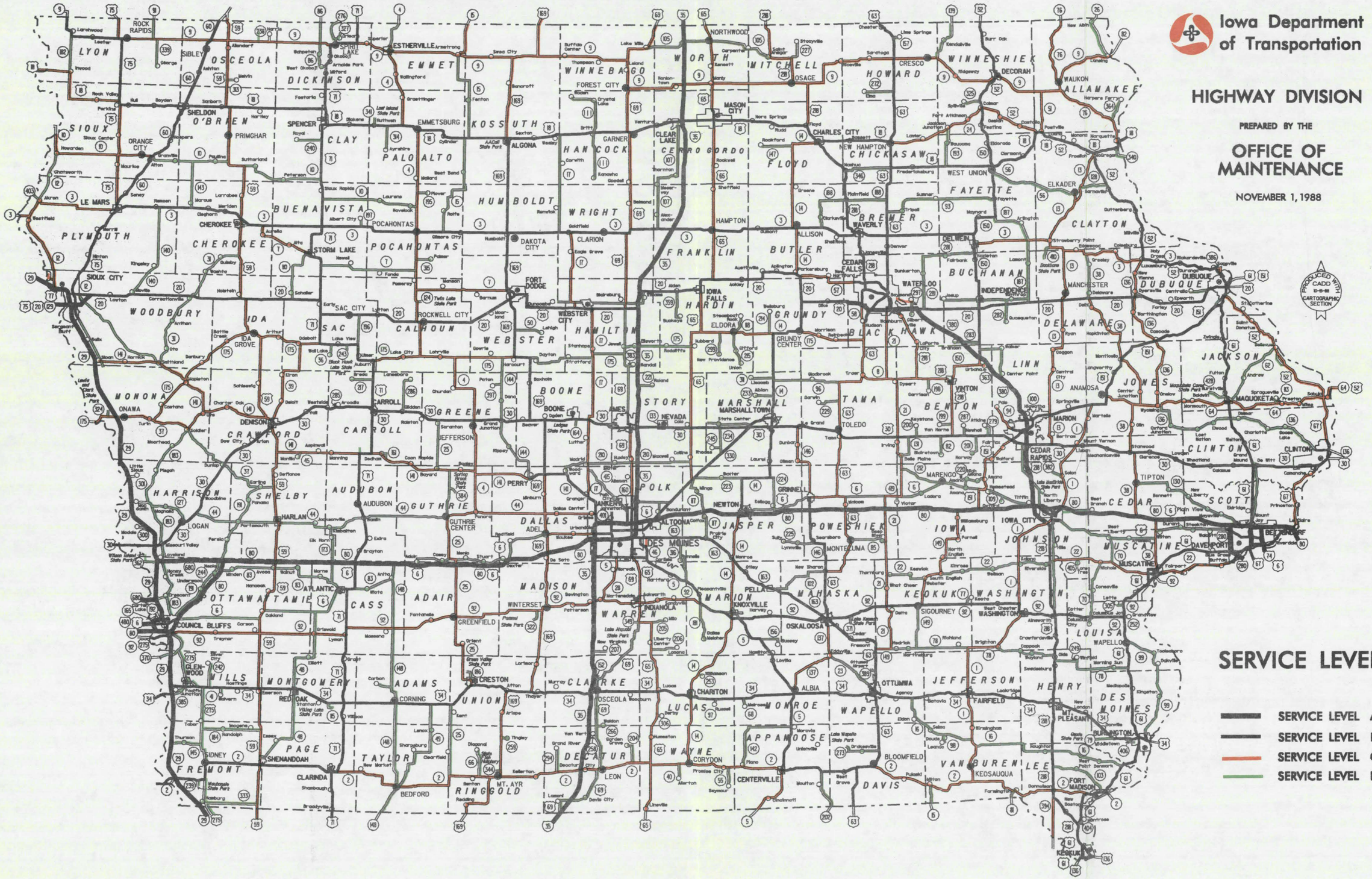
Levels of Service

Four Levels of Service (LOS) ratings were developed by the Office of Maintenance to define different classifications of roads and the amount of snow and ice control effort that each level received. The levels are designated A, B, C, and D. Exhibit 2-19 defines the latest Level of Service assignment of each road segment. Staffing and equipment assignments are based in part on the Levels of Service assigned to each roads segment as previously discussed in connection with the resource allocation formula. Although these levels of service were originally designed for snow and ice control work, they have unofficially defined the amount of maintenance delivered for other types of work as well. This has been accomplished through the amount of resources assigned to the various maintenance facilities around the state. Field personnel also use the LOS assignment to establish priorities.

Iowa Weather Patterns

The climatological data available for Iowa is voluminous, with recorded data going back to 1890 in many instances. The primary weather concern of the Highway Department is snow and ice. The basic weather data used in this study is taken from a publication of the Iowa Department of Agriculture State Climatology office, titled "Iowa Snow Climatology, Climatology of Iowa Series No. 5", published in 1982. Additional weather data was obtained from the National Oceanic and Atmospheric Administration (NOAA). This data was analyzed to determine significant changes in weather patterns since 1982. The NOAA data indicates a slight decrease in the amount of annual snow fall since 1982 which can be attributed to several years of mild winter weather. For the purposes of this study, the State Climatologist data has been used.

MAINTENANCE SERVICE LEVEL MAP



Iowa Department of Transportation

HIGHWAY DIVISION

PREPARED BY THE

OFFICE OF MAINTENANCE

NOVEMBER 1, 1988

PRODUCED WITH CADD 10-15-88 CARTOGRAPHIC SECTION

SERVICE LEVEL

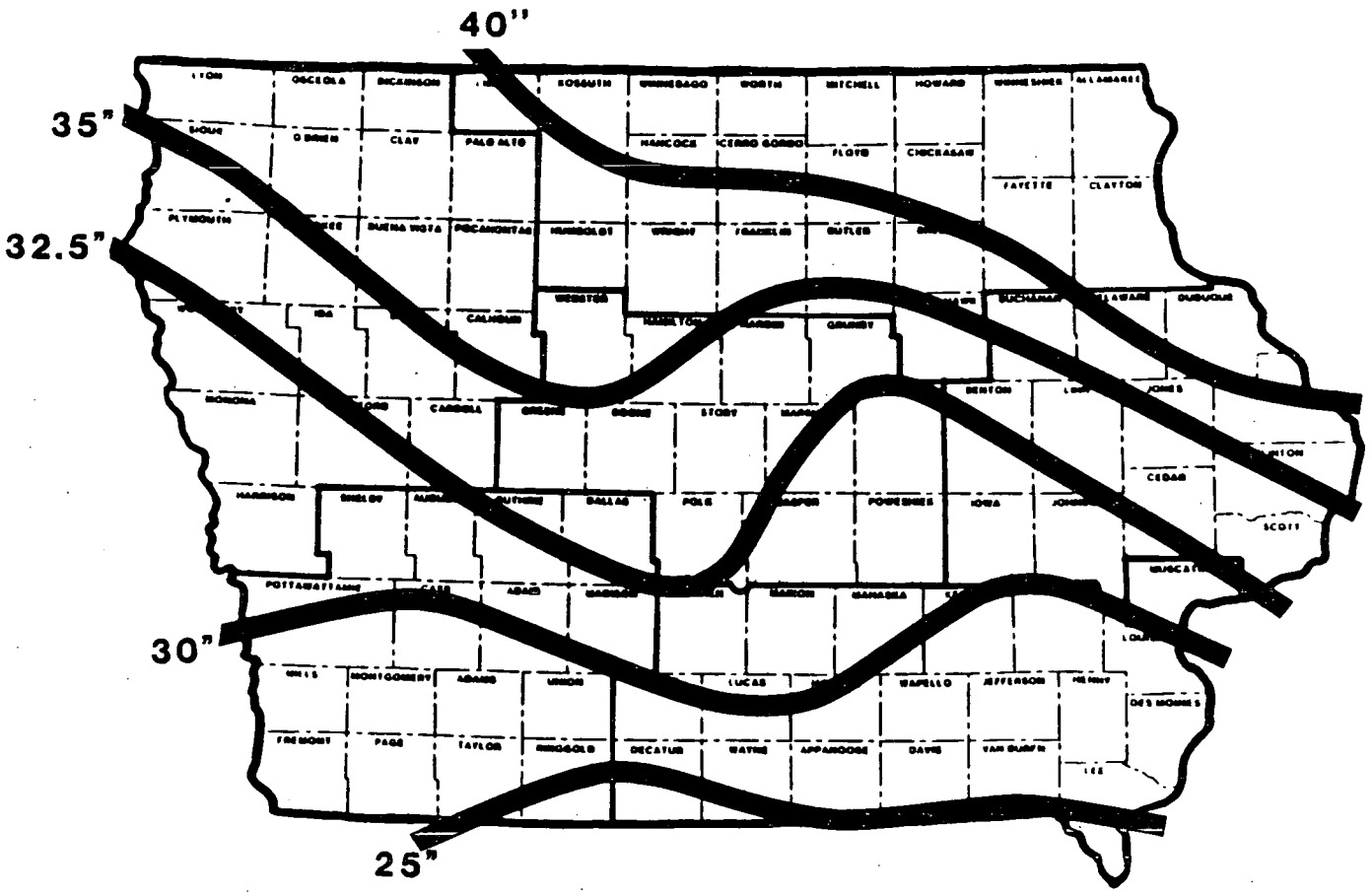
- SERVICE LEVEL A
- SERVICE LEVEL B
- SERVICE LEVEL C
- SERVICE LEVEL D

Exhibit 2-19

As shown in Exhibit 2-20, the average total annual snow fall for the entire state is 32.5 inches of snow. This ranges from a high of 40 inches in the northeastern part of the state to a low of 25 inches across the extreme southern portion of the state. The highest single winter average snowfall in the state is 59 inches occurring in 1961-62. The lowest single statewide average snowfall was in 1965-66 with 11.9 inches of snow. The highest single-season snowfall in Iowa was measured at Elkader during the winter of 1950-51 with 93.1 inches of snow. The least single-season snowfall was 2.4 inches of snow, measured at Keokuk in 1965-66.

Exhibit 2-20

AVERAGE ANNUAL SNOWFALL



Further analysis of the average annual snowfall indicates that snowfall can be expected in some portion of the state as early as the middle of October and as late as the end of April. Statewide snowfalls generally begin around the end of October and end around the middle of April. The month of March is historically the month receiving the most snow, followed by January, February December, November, April, and October, respectively. Snowfall has been recorded in May and September in Plymouth and Butler counties; however this was during the 1940s.

On the average, the greatest 24-hour snowfall ranges from slightly less than 6 inches in the southeastern part of the state to approximately 8 inches in extreme northeast Iowa. The single greatest snowfall in a 24-hour period was 24 inches in Taylor and Page counties in 1918 and 1912. The single greatest snowfall in a single snowstorm was 27.2 inches recorded at the Iowa City airport in 1951. On the average, the maximum snowfall in a 24-hour period ranges from a high of 10 inches in the east-northeast portion of the state, to a low of 7.5 inches in the southeast corner of the state. Exhibit 2-21 provides snowfall information for each county cross-indexed with Districts.

Winter snowstorms and the cleanup efforts of highway maintenance crews are further complicated by windblown snow. Drifting and restricted visibility can occur not only during storms but after the storm has passed. Due to the generally flat terrain, especially in the northcentral part of the state, drifting snow can become a continual problem. On the average, the state can expect to receive one to two life endangering blizzards per winter season, and 9 to 10 days of substantially reduced visibilty due to blowing snow. The prevailing winter winds are generally northwesterly which result in quartering crosswind conditions on most of Iowa's north-south or east-west oriented roads.

Winter snow storms generally pass from the southwest to the northeast part of the state. The storms passing closest to the southeast corner of the state tend to bring the heaviest snowfalls. The farther northwest in Iowa a storm passes, the lesser the amount of snowfall received in southeastern Iowa.

Exhibit 2-21

Iowa Snowfall Information

COUNTY	COUNTY NUMBER	MAINT DISTRICT	AVERAGE NUMBER OF DAYS WITH TRACE	0-1.9 INCHES	2-3.9 INCHES	4-5.9 INCHES	6-11.9 INCHES	>12 INCHES	AVG NO. STORMS	TOTAL SNOWFALL	MAXIMUM SNOWFALL
ADAIR	1	4	8.6	6.4	3.8	1.1	0.8	0.0	21	25.3	60.0
ADAMS	2	4	9.2	5.6	3.2	1.0	0.5	0.1	20	22.8	56.0
ALLAMAKEE	3	2	20.9	9.5	4.8	1.5	0.7	0.1	38	33.1	62.8
APPANOOSE	4	5	7.4	5.7	3.2	0.9	0.4	0.0	18	20.6	53.4
AUDUBON	5	4	5.5	9.2	4.3	1.6	0.8	0.0	22	31.1	64.0
BENTON	6	6	18.2	13.5	3.9	1.6	0.6	0.1	38	31.5	64.0
BLACK HAWK	7	2	19.8	15.2	3.7	1.1	0.5	0.1	41	29.3	60.9
BOONE	8	1	18.2	12.4	4.2	1.3	0.8	0.0	37	31.1	61.4
BREMER	9	2	14.8	10.8	4.0	1.4	0.8	0.1	32	32.4	68.6
BUCHANAN	10	6	13.8	7.0	3.6	1.3	0.5	0.0	26	24.5	52.7
BUENA VISTA	11	3	13.6	10.1	3.8	1.5	0.8	0.0	30	30.2	62.7
BUTLER	12	2	16.0	7.3	6.3	1.5	0.8	0.0	32	34.6	60.5
CALHOUN	13	3	13.4	10.6	3.6	1.5	0.9	0.1	30	33.7	71.0
CARROLL	14	3	10.1	10.0	4.1	1.5	0.6	0.1	26	30.2	59.7
CASS	15	4	11.7	10.1	3.4	1.0	0.7	0.0	27	26.3	58.2
CEDAR	16	6	10.5	7.1	4.3	1.3	0.8	0.1	24	30.3	62.3
CERRO GORD	17	2	28.0	12.0	4.6	1.7	0.9	0.1	47	36.0	67.2
CHEROKEE	18	3	10.9	8.4	3.4	1.5	0.7	0.0	25	26.9	57.3
CHICKASAW	19	2	11.3	9.1	5.2	1.8	1.0	0.1	29	36.4	72.5
CLARKE	20	5	8.8	5.3	4.1	1.4	0.7	0.0	20	26.0	56.6
CLAY	21	3	12.6	7.5	3.9	1.3	0.9	0.1	27	30.5	65.5
CLAYTON	22	2	10.0	6.9	3.9	1.4	0.6	0.0	23	26.4	59.2
CLINTON	23	6	12.6	11.0	3.5	1.2	0.7	0.1	29	30.0	66.4
CRAWFORD	24	3									
DALLAS	25	4	11.1	7.4	3.3	1.1	0.6	0.1	24	23.3	54.1
DAVIS	26	5	10.4	7.0	3.9	1.5	0.6	0.0	23	26.5	54.4
DECATUR	27	5	16.2	9.4	3.4	1.1	0.3	0.0	30	23.0	50.0
DELAWARE	28	6	15.0	10.6	4.2	1.3	0.4	0.0	32	27.2	52.2
DES MOINES	29	5	19.2	9.8	3.2	0.9	0.5	0.0	34	23.0	54.9
DICKINSON	30	3	16.6	10.0	4.5	1.7	0.9	0.1	34	35.1	68.5
DUBUQUE	31	6	10.8	15.0	4.4	1.5	0.9	0.1	33	36.7	67.3
EMMET	32	2									
FAYETTE	33	2	8.6	8.7	4.0	1.6	0.8	0.1	24	31.1	65.9
FLOYD	34	2	22.6	18.4	4.7	1.5	0.8	0.0	48	37.3	63.9
FRANKLIN	35	2	12.6	11.2	4.2	1.4	1.0	0.0	31	33.1	65.4
FREMONT	36	4	8.7	5.5	2.7	0.9	0.6	0.0	19	21.6	54.6
GREENE	37	1	12.5	9.6	4.5	1.5	0.7	0.0	29	30.1	55.7
GRUNDY	38	1	19.2	11.6	4.3	1.4	0.7	0.0	37	30.9	57.9
GUTHRIE	39	4	9.8	7.6	3.3	1.2	0.7	0.0	23	26.0	59.6
HAMILTON	40	1	13.3	9.1	4.4	1.2	0.8	0.0	29	29.4	58.3
HANCOCK	41	2	9.2	10.3	4.9	1.5	0.7	0.0	27	33.9	54.7
HARDIN	42	1	8.4	7.8	4.2	1.4	0.9	0.0	23	30.7	62.2
HARRISON	43	3	12.0	6.9	4.0	1.4	0.9	0.1	25	28.7	64.3
HENRY	44	5	7.3	7.4	3.4	1.1	0.6	0.0	20	23.4	55.4
HOWARD	45	2	19.6	6.2	3.6	1.2	0.7	0.1	31	25.4	57.0
HUMBOLT	46	2	16.8	10.0	3.9	1.4	0.8	0.0	33	30.0	58.6
IDA	47	3	11.4	9.4	4.4	1.6	1.1	0.1	28	35.6	70.1
IOWA	48	6	8.4	2.6	4.2	1.7	0.9	0.1	18	26.6	60.6
JACKSON	49	6	14.2	9.5	3.8	1.2	0.5	0.1	29	28.1	57.1
JASPER	50	1	13.9	7.1	3.1	0.9	0.7	0.0	26	24.1	56.8
JEFFERSON	51	5									
JOHNSON	52	6	20.3	9.8	3.3	1.4	0.4	0.0	35	24.6	57.1

Exhibit 2-21 Cont'd

Iowa Snowfall Information

COUNTY	COUNTY NUMBER	MAINT DISTRICT	AVERAGE NUMBER OF DAYS WITH TRACE	0-1.9 INCHES	2-3.9 INCHES	4-5.9 INCHES	6-11.9 INCHES	>12 INCHES	AVG NO. STORMS	TOTAL SNOWFALL	MAXIMUM SNOWFALL
JONES	53	6	9.3	11.2	3.7	1.2	0.7	0.0	26	27.4	57.2
KEOKUK	54	5	8.6	4.2	2.4	0.9	0.6	0.0	17	17.8	49.1
KOSSUTH	55	2	18.1	9.6	4.4	1.5	1.0	0.1	35	34.2	64.8
LEE	56	5	22.4	7.6	3.3	0.7	0.4	0.0	34	20.3	51.1
LINN	57	6	19.8	13.4	3.5	1.1	0.6	0.0	39	27.6	58.6
LOUISA	58	5	11.3	9.0	3.4	1.5	0.9	0.1	26	29.1	67.4
LUCAS	59	5	14.0	7.6	3.9	1.5	0.9	0.0	28	28.7	59.8
LYON	60	3	18.7	11.0	4.3	1.4	0.8	0.1	36	33.4	62.7
MADISON	61	4	10.0	8.9	3.5	1.1	0.4	0.0	24	23.5	49.6
MAHASKA	62	5	16.0	12.2	4.1	1.3	0.7	0.1	35	32.8	62.5
MARION	63	5	12.4	8.6	3.9	1.3	0.7	0.0	27	27.2	59.6
MARSHALL	64	1	15.3	9.8	4.0	1.3	0.8	0.1	31	31.7	71.8
MILLS	65	4	10.6	6.7	2.6	0.9	0.6	0.1	22	24.7	60.4
MITCHELL	66	2	13.5	12.8	4.2	1.9	1.1	0.1	34	37.2	70.0
MONONA	67	3	12.6	10.0	4.4	1.4	1.0	0.0	30	32.6	65.9
MONROE	68	5	13.0	8.3	4.1	1.2	0.9	0.1	28	29.6	65.6
MONTGOMER	69	4	15.4	11.0	3.4	1.2	0.9	0.1	32	31.0	69.8
MUSCATINE	70	5	18.8	8.5	3.5	1.3	0.5	0.0	33	25.3	55.6
O'BRIEN	71	3	15.7	10.4	4.2	1.3	0.9	0.1	33	34.6	69.9
OSCEOLA	72	3	9.3	6.4	5.0	1.5	1.1	0.1	24	33.7	69.5
PAGE	73	4	9.3	7.3	3.2	1.2	0.8	0.0	22	24.6	59.6
PALO ALTO	74	3									
PLYMOUTH	75	3	11.5	8.5	3.6	1.2	0.7	0.0	26	28.4	61.7
POCAHONTAS	76	3	11.8	8.2	3.6	1.3	0.8	0.1	26	28.5	62.1
POLK	77	1	15.2	8.1	3.2	1.1	0.7	0.1	29	24.5	58.8
POTTAWATTA	78	4	13.5	7.4	3.5	1.2	0.6	0.1	26	25.1	58.0
POWESHIEK	79	1	12.4	9.9	3.3	1.4	0.7	0.0	28	27.3	57.4
RINGGOLD	80	4	9.2	6.8	3.2	1.0	0.5	0.0	21	21.9	54.8
SAC	81	3	15.3	9.3	4.0	1.4	0.9	0.0	31	30.5	60.7
SCOTT	82	6	20.8	7.6	3.0	1.2	0.5	0.0	33	22.2	55.3
SHELBY	83	4	25.4	16.3	3.7	1.1	0.8	0.1	47	31.4	63.9
SIOUX	84	3	17.9	9.6	4.3	1.3	0.7	0.1	34	31.3	63.6
STORY	85	1	13.5	8.8	3.9	1.2	0.6	0.0	28	26.5	60.3
TAMA	86	1	12.4	6.0	3.9	1.4	0.6	0.0	24	25.4	57.1
TAYLOR	87	4	6.5	4.7	3.1	0.9	0.5	0.0	16	20.0	50.8
UNION	88	4	7.7	5.4	4.1	1.4	0.9	0.0	19	27.5	59.4
VAN BUREN	89	5	11.2	7.4	3.2	1.0	0.5	0.0	23	21.9	56.2
WAPELLO	90	5	20.5	11.0	3.2	0.9	0.6	0.0	36	25.3	55.5
WARREN	91	5	13.6	10.3	4.0	1.1	0.7	0.1	30	28.6	62.5
WASHINGTON	92	5	8.2	7.2	3.8	1.2	0.5	0.0	21	24.6	56.3
WAYNE	93	5	7.6	8.0	3.0	1.2	0.6	0.0	21	24.1	60.8
WEBSTER	94	1									
WINNEBAGO	95	2	21.8	11.8	3.9	1.7	1.1	0.0	40	34.3	63.1
WINNESHIEK	96	2									
WOODBURY	97	3	20.2	12.5	2.9	1.0	0.5	0.0	37	26.3	55.9
WORTH	98	2	8.9	9.0	4.3	1.8	0.9	0.1	25	35.3	69.6
WRIGHT	99	2	27.6	10.0	5.0	1.9	0.8	0.1	45	34.3	61.9

Weather data to indicate ice formation on the highways is not available in any significant amount. Attempts to correlate precipitation and temperatures with ice did not provide information for which we had a high level of confidence.

Demographics

The county population demographics are referenced to the current census taken in 1980. Estimates have been made by the U.S. Census Bureau for 1987 and Iowa Department of Transportation projections of population trends for the year 2010. The statewide estimates for 1987 indicate a net population loss of approximately 2.7 percent. The internal shift in population within the state has been from rural areas to urbanized areas In Exhibit 2-22 we have indicated the population gains and losses for each county. Nine counties have experienced a population loss of more than 10 percent and nine counties have experienced a population gain. The Department of Transportation projections for the year 2010 indicate a statewide recovery of lost population with a 0.5% net increase over the 1980 population figures. The shift in population from rural areas to the urban areas in the 2010 projections is more widespread across the state. The 2010 projections also show 37 counties losing more than 10 percent population and 27 counties gaining more than 10 percent in population over the 1980 census figures as shown in Exhibit 2-23.

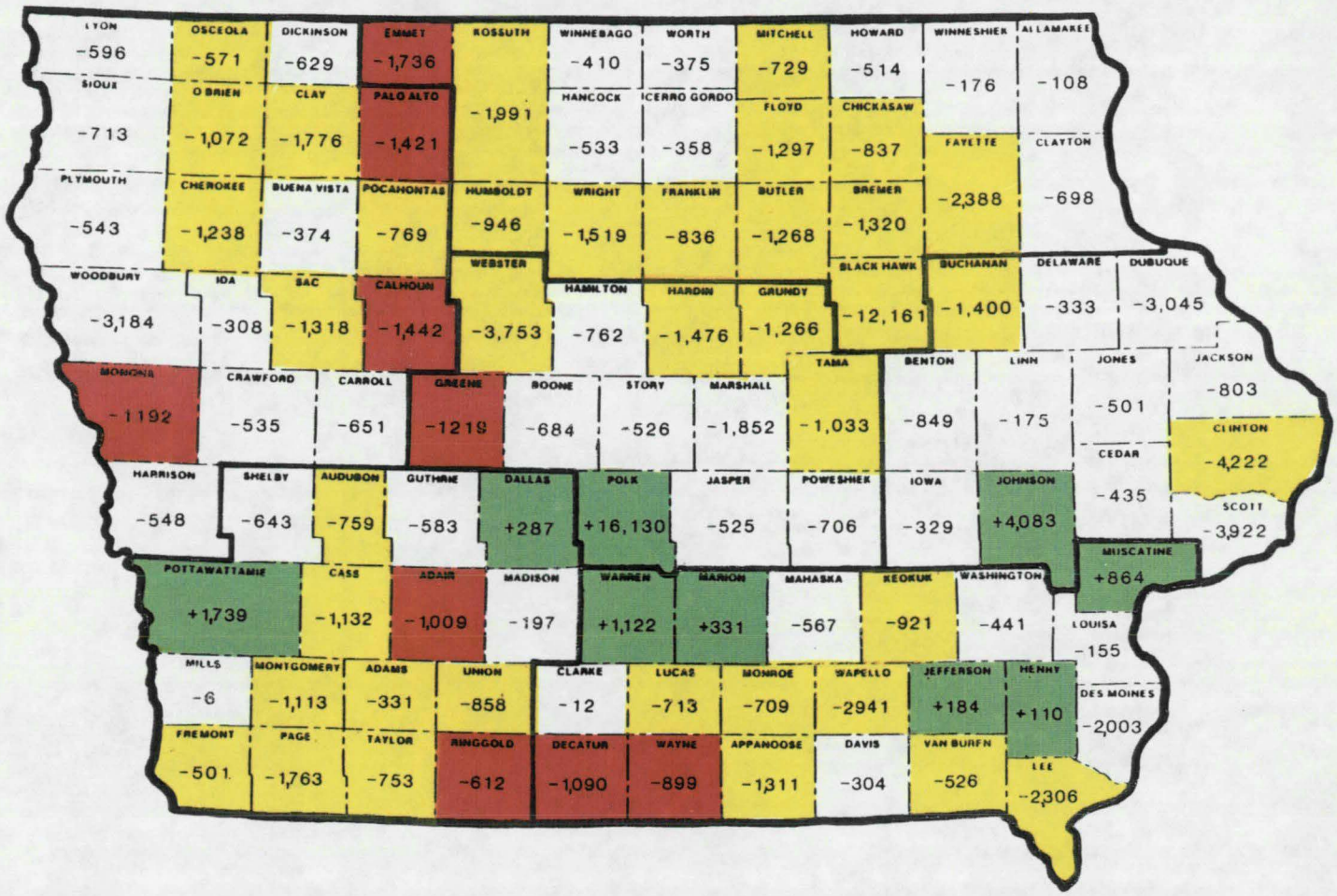
Terrain

Terrain oftentimes affects highway design, which in turn affects the amount of maintenance, the drifting of snow, as well as the amount of effort and speed that is required to move loads. We have classified each county in one of five terrain classifications that range from flat to hilly. This is shown in Exhibit 2-24.

Virginia and some other states use maintenance performance standards for some maintenance activities that are based on flat, rolling, hilly and mountainous terrain. Iowa is obviously not flat. However, there is not sufficient data available to substantiate the need for a different resource allocation formula to accommodate terrain considerations. A new MMS could provide such data.

Exhibit 2-22

POPULATION CHANGE FROM 1980 - 1987



LOSS OF 10% OR MORE

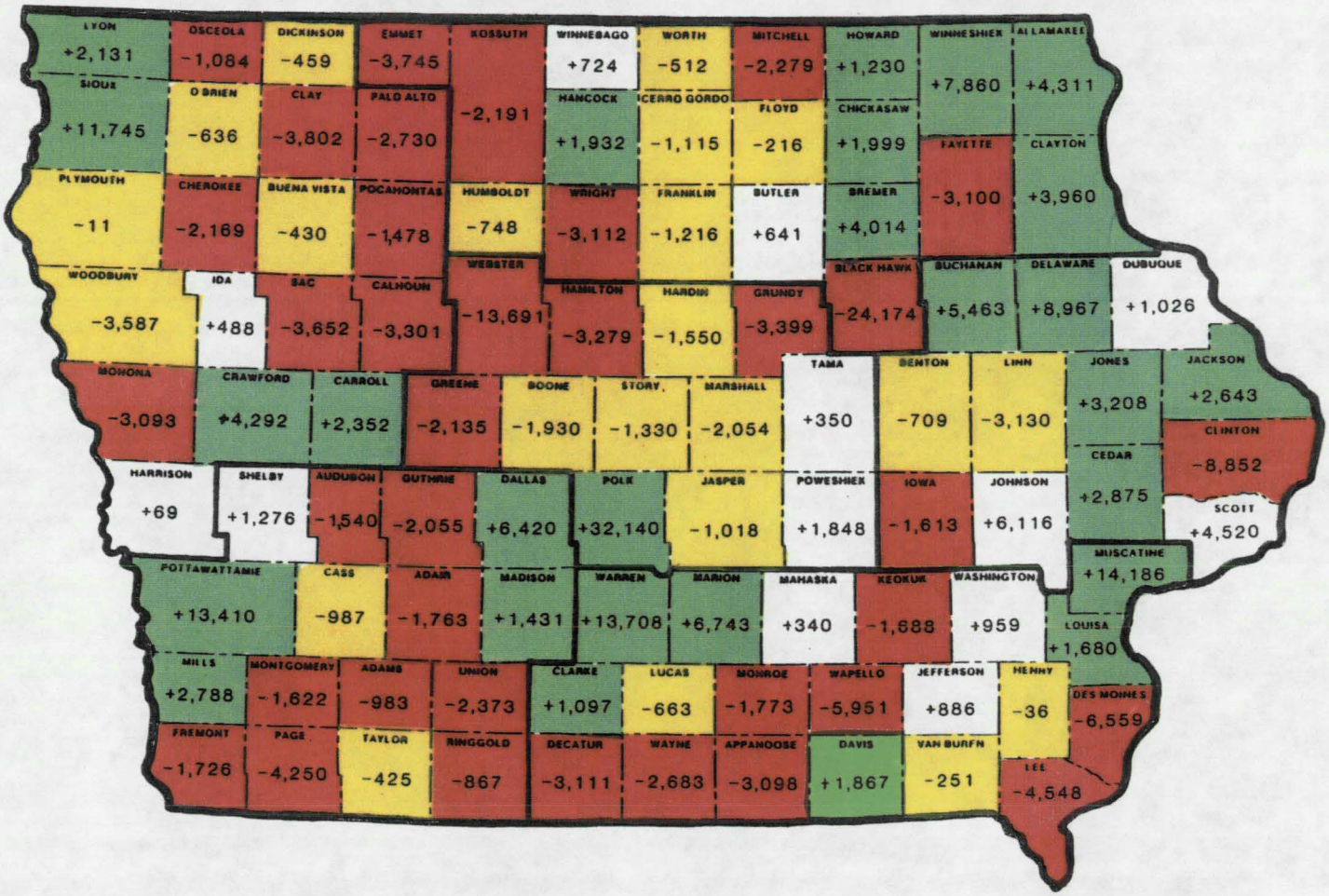
LOSS OF 5% - 10%

LOSS OF 0% - 5%

POPULATION INCREASE

Exhibit 2-23

PROJECTED POPULATION CHANGE 1980 - 2010



LOSS OF 10%

LOSS OF 0% - 10%

GAIN 0% - 10%

GAIN 10% OR MORE

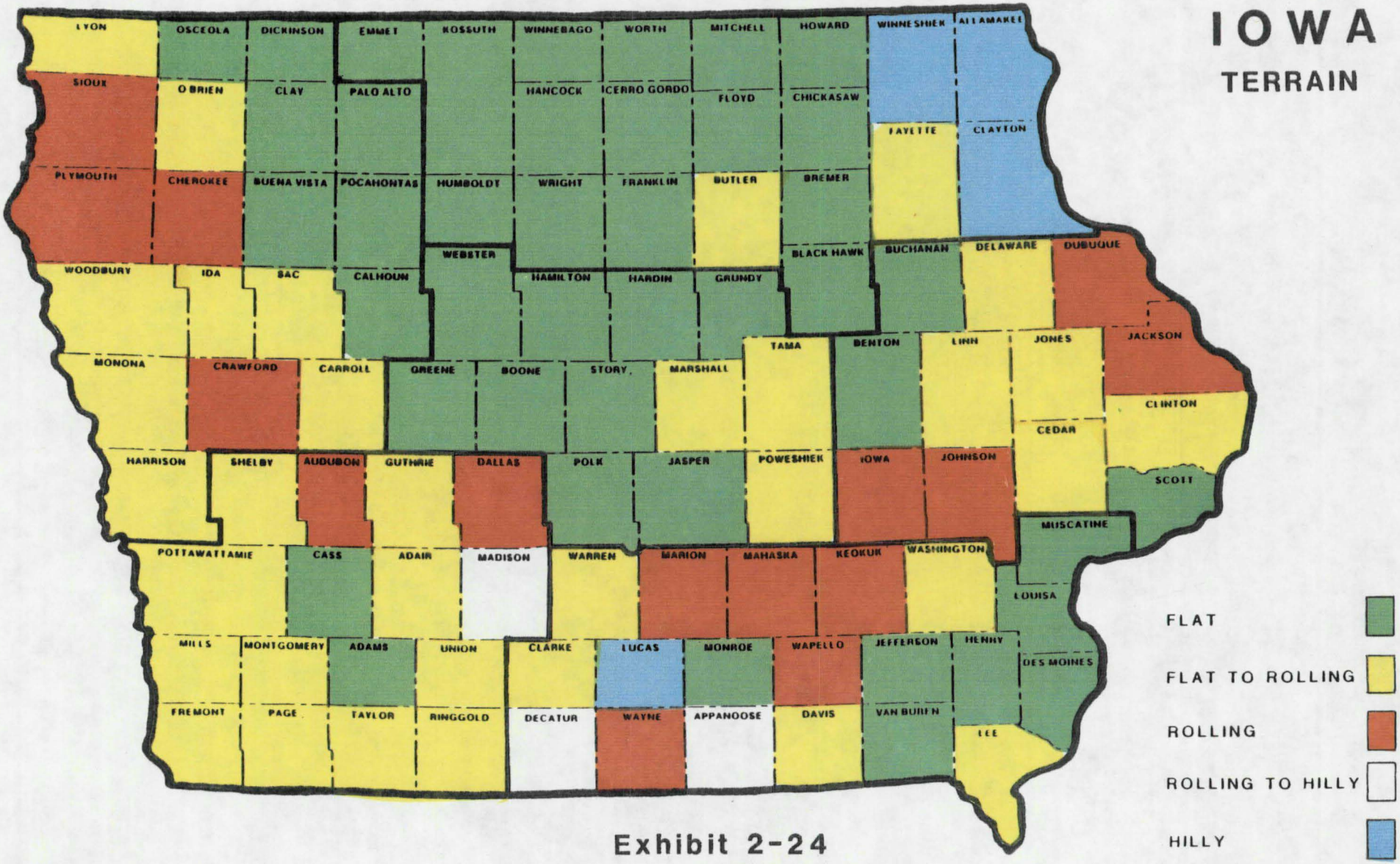

IOWA
TERRAIN
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
SIOUX
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
WEBSTER
BLACK HAWK
BUCHANAN
DELAWARE
DUBUQUE
WOODBURY
IDA
SAC
CALHOUN
HAMILTON
HARDIN
GRUNDY
TAMA
BENTON
LINN
JONES
JACKSON
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
CLINTON
CEDAR
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
JASPER
POWESHIEK
IOWA
JOHNSON
SCOTT
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MARION
MAHASKA
KEOKUK
WASHINGTON
LOUISA
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
WAPELLO
JEFFERSON
HENRY
DES MOINES
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE
FLAT
FLAT TO ROLLING
ROLLING
ROLLING TO HILLY
HILLY

Exhibit 2-24

CHAPTER 3

DELIVERY OF HIGHWAY MAINTENANCE SERVICES IN OTHER STATES

CHAPTER 3

DELIVERY OF HIGHWAY MAINTENANCE SERVICES IN OTHER STATES

INTRODUCTION

The delivery of highway maintenance services in other states is an appropriate consideration for this study. While the highway maintenance function in each state is unique, their approach may be adaptable to Iowa. To obtain the information concerning maintenance operations in other states, a literature search and telephone interviews were conducted. A total of fourteen states were contacted and requested to provide information concerning their highway maintenance services. The states contacted were:

- Colorado
- Illinois
- Indiana
- Kansas
- Michigan
- Minnesota
- Missouri
- Montana
- Nebraska
- North Dakota
- Ohio
- South Dakota
- Wisconsin
- Wyoming

Six of these states, Illinois, Minnesota, Missouri, Nebraska, South Dakota, and Wisconsin, were chosen because they share a common border with Iowa and have some of the same general terrain and weather patterns common to Iowa. The other eight states not neighboring Iowa were chosen because they are midwestern or western states experiencing operational and weather patterns similar to Iowa.

LITERATURE SEARCH

The literature search was conducted at the Federal Highway Administration Library, the AASHTO library, and through personal contacts. This search revealed applicable data from the March 1988, Transportation Research Circular, Number 331 and the AASHTO publication, "Organization Charts of State

Highway Transportation Departments", 1988. Individual state reports were found in Transportation Research Record Report 727, titled "A Systems Approach to Maintenance Station Location," and a Maine Department of Transportation report titled, "Highway Maintenance Study 1983."

Transportation Research Circular - The Transportation Research Circular data was used to contrast the various highway maintenance organizations. Exhibit 3-1 compares the lane mile responsibilities in each state by primary and secondary roads and shows that in Iowa the average lane mile responsibilities per crew is lower than the average for each category. Appendix C contrasts the various state highway maintenance organizations by job title and the number of personnel in each position. In comparison to the other states, Iowa is not top heavy in their grade rankings or structure among the highway maintenance organizations. Exhibit 3-2 illustrates the highway maintenance personnel distribution and the amount of maintenance that is contracted outside of the department. The state percentages indicate amounts contracted to private enterprises with the exception of Wisconsin, which contracts all of its highway maintenance services to the county highway departments.

AASHTO - The AASHTO publication gives the organizational charts for State Departments of Transportation. Located in Appendix C are the charts for the fourteen states contacted which illustrate the organization from the top level to the District Engineer level only.

Transportation Research Record - The Transportation Research Record article titled "A Systems Approach to Maintenance Station Location," published in Report Number 727, outlines a procedure for determining highway maintenance facilities. The report describes a study conducted by the California Department of Transportation to determine the best procedure for locating facilities to support its maintenance requirements. The evaluation revealed that over a 30 to 40 year period, California's highway system has evolved and changed considerably from the system the maintenance stations originally served. The older facilities were found to no longer be in the best locations to effectively support the maintenance mission. As a result, a maintenance

Exhibit 3–1

Lane Mile Statistics

STATE	INTERSTATE/ FREEWAY	PRIMARY/ SECONDARY	COUNTY/ TWNSHP/MUNI	TOTAL	LANE MILES PER CREW
COLORADO	7,557	17,500	400	25,457	85
ILLINOIS	7,525	30,874	2,014	40,413	370
INDIANA	4,725	24,950	0	29,675	265
IOWA	3,832	20,891	0	24,723	184
KANSAS	4,012	18,843	1,295	24,150	210
MICHIGAN	3,168	4,233	0	7,401	218
MINNESOTA	4,096	24,676	0	28,772	213
MISSOURI	6,406	65,027	2,432	73,865	200
MONTANA	4,722	11,656	2,473	18,851	144
NEBRASKA	1,972	20,089	0	22,061	248
NORTH DAKOTA	3,266	12,530	548	16,344	150
OHIO	6,579	35,864	0	42,443	482
SOUTH DAKOTA	3,073	14,651	678	18,402	256
WISCONSIN	4,053	21,996	0	26,049	0
WYOMING	3,784	11,953	425	16,162	269
averages	4,585	22,382	1,283	27,651	235

Data extracted from Transportation Research Circular, No. 331, March 1988

Exhibit 3-2

Highway Maintenance Facility Statistics

STATE	PERCENT OF BUDGET	NO OF DISTRICTS	NO OF GARAGES	PEOPLE/ GARAGE	MAINT PERSONNEL
COLORADO	24%	8	250	4-5	1,550
ILLINOIS	20%	9	110*	6-50	2,547
INDIANA	47%	6	122	15-20	4,300
IOWA	17%	6	138	3-38	1,530
KANSAS	9%	6	115	9-10	1,350
MICHIGAN	73%	9	34	6-28	800
MINNESOTA	7%	9	145	3-50	1,488
MISSOURI	10%	10	300	3-19	3,000
MONTANA	0%	5	135	3-4	574
NEBRASKA	11%	8	102	2-18	1,250
NORTH DAKOTA	10%	8	72	3-4	333
OHIO	35%	12	88+62*	VARIES*	4,200
SOUTH DAKOTA	20%	4	75	4-12	550
WISCONSIN	100%	8	200-250*	N/A	1,660
WYOMING	12%	5	70	UNK	544
averages	30%	8			

* Varies with the season

Data extracted from Transportation Research Circular, No. 331, March 1988

facilities siting model was developed to examine the capital and maintenance operating cost elements. The model presents these cost elements in a format that allows management to make valid trade-off decisions.

The maintenance operating cost element assembles maintenance management system (MMS) data on work and support costs associated with the highway sections in the study area. This data is analyzed for existing work and travel patterns and costs. Estimates of the impact of proposed changes to the system elements are made and a network of the new pattern of stations is reconstructed. With service boundaries established, a work force can be estimated and station operating costs can be computed.

The capital cost element includes all planned or anticipated expenditures over a 30-year period. The work requirements and work force size estimated in the maintenance operating cost element will identify the basic size of the building and supplemental facilities at a given location. Other cost factors included in this element are land values, costs of retaining existing facilities, investment costs in building new facilities, cost of replacing existing facilities, depreciation, economic impacts, and station maintenance and upkeep costs.

The study projected a slight rise in the costs of providing highway services without any increase in service level. The study assumed little or no change in productivity and a slight rise in travel times.

The first year results associated with one new station showed a less than expected rise in travel time and an extremely significant increase in productivity. Operating costs decreased despite an increase in travel costs. The decrease in operating costs were attributed to increased efficiency as a result of crew augmentation, modification of work methods made possible by a larger crew, and a reduction in the quantity of nonproductive effort. There was no reduction in service level and it became economical to increase snow and ice patrol service to 20 hours/day, 7 days/week from the previous 8 hours/day, 5 days/week.

Maine Highway Maintenance Study - This study was accomplished to determine the staffing levels, equipment levels, and the number and location of maintenance facilities for the state. The study was completed six years ago after road maintenance responsibilities were partially transferred to local governments. The option selected by the Maine Department of Transportation resulted in some maintenance facility locations being open only in winter, and limited personnel reductions. Equipment requirements for winter snow removal resulted in an excess of equipment for summer maintenance operations. The solution implemented was to park the excess equipment in the summer. Total personnel strength was already low due to attrition and retirements, therefore, the personnel reductions recommended in the study were not required. Vacant positions were not filled and were eliminated on paper. Maintenance facility responsibilities were realigned with some facilities being closed and others being utilized only in the winter as unstaffed storage facilities.

INTERVIEWS

The State Maintenance Engineer or equivalent level person in each of the fourteen states was contacted by telephone and interviewed concerning their highway maintenance operations and how highway maintenance services were delivered. They were asked to describe their maintenance organization and send an organizational chart. Budget information was requested to answer the following questions:

- Are budgets prepared on an annual or multiyear basis? What is the annual budget?
- Into what major categories is the budget divided? What are the amounts for these categories?
- What is the overall cost per lane mile for winter maintenance, roadside maintenance, road structure maintenance, and other categories?

- Is any portion of maintenance work contracted out? If so, what amount/percentage?
- How many maintenance facilities/garages does the state operate?
- How many lane miles is a person, crew, or maintenance facility responsible for?
- How many trucks and people are in each facility?
- Do you have a central equipment maintenance facility or shop?
- What is the total number of maintenance personnel? How many maintenance personnel are there per highway district?

Concerning snow removal operations, four questions were asked.

- How are roads classified?
- When do snow plowing operations begin?
- Are chemicals or abrasives used?
- At what point are snow plowing operations suspended?

Most states answered the questions and in several instances sent organizational charts and more detailed budget information. Appendix C shows organizational charts below the district level for the states of Illinois, Minnesota, Montana, Nebraska, and South Dakota.

Colorado - The Colorado Highway Department operates on an annual budget of approximately $100 million for 25,457 lane miles of roadway. Snow and ice removal operations consume approximately 18 percent of the annual road maintenance budget. Contracting is done for material production and hauling, rest area maintenance, weed control, striping, and machine patching of pavement. Colorado has approximately 250 storage areas or patrols staffed by

1,200 people and spread evenly over eight maintenance districts. Each maintenance facility is assigned 4 to 5 people, including a foreman, and 3 to 4 trucks. For snow removal operations, Colorado has three classifications of roads. Class A is for interstates and roads with an ADT over 2500. Class B roads have an ADT between 1000 and 2500, and Class C are roads with an ADT below 1000. The maintenance foreman in each patrol determines when snow removal operations begin. Class A roads are then plowed continuously until the roadway is clear. Class B roads are plowed continuously during the storm with cleanup operations performed during normal work hours. Class C roads are plowed a maximum of 14 hours a day unless the road would be closed if plowing did not continue. Clean up operations are done during normal work hours. A salt and sand mixture of abrasives is used statewide.

Illinois - The Illinois Highway Department operates on an annual budget of approximately $180 million for 45,400 lane miles of roadway. It averages $3,847 per lane mile in maintenance costs. Urban Chicago and interstate average lane mile costs are higher than the statewide averages. Contract maintenance is performed for bridge painting, sweeping, weed control, crack sealing and seal coating, ditch cleaning, and rest area maintenance. Illinois has 110 maintenance facilities with additional facilities opened in the winter snow removal season and some closed in the summer season. Maintenance facilities have an average of 25 to 30 people assigned with some facilities having 50 people assigned. Past experience in Illinois indicated that maintenance crews of three to five persons generally were not as productive as larger crews. There are 2,547 people in operations, assigned to the nine highway districts. Illinois has four classifications of roadways. These are the expressways in Chicago, interstate routes, U.S. and State routes, and frontage/unmarked routes. Snow plowing operations begin with one-half inch of accumulation and continue depending on the ADT for the road, instead of the road classification.

Indiana - The Indiana Department of Transportation operates on a biennial budget system and has an annual operating budget of $16.4 million for state maintenance forces and $15.3 million for contracted maintenance. Contract maintenance is done for interstate mowing, weed control, resurfacing of

pavements, and bridge repair and painting. Indiana has 122 maintenance facilities staffed by approximately 2,550 people. Maintenance facilities average 15 to 20 people in the six maintenance districts. Information on their snow removal operations was not provided.

Kansas - The Kansas Department of Transportation has an annual maintenance budget of approximately $38 million, excluding personnel costs, for 24,150 lane miles of roadway. There was no information available concerning average lane mile costs. Contract maintenance is done for concrete patching and bituminous overlays, chemical spraying, and mowing. Kansas has 115 maintenance facilities distributed across six districts. Each facility has nine to ten people with four to five trucks assigned. There are 1350 operators and 115 supervisors assigned to the 115 maintenance facilities. Roads are placed in one of three classifications based on ADT. Class A are roads with greater than 2500 ADT. Class B roads have an ADT of 750 to 2500, and Class C roads have an ADT of less than 750. Snow removal operations begin at the discretion of the supervisor and continue until near normal road conditions exist. The use of chemicals and abrasives is also at the discretion of the supervisor.

Michigan - The Michigan Department of Transportation has an annual maintenance budget of approximately $173 million for over 19,000 lane miles of roadway. Contract maintenance is done for expressway sweeping, catch basin cleaning, rest area maintenance, resurfacing, and concrete joint repair. The state contracts with 62 of the 83 county highway departments to do routine maintenance. All of the 34 state maintenance facilities are located in the 21 rural counties not under contract. There are six to 28 people assigned to these facilities with a total of 800 assigned. There are three levels of classification for roads. The green classification is for roads with more than 5,000 ADT. Yellow classification has an ADT between 2,500 and 5,000, and red has an ADT under 2,500. The facility supervisor decides when snow removal operations begin. Plowing continues until bare pavement is achieved for the green and yellow classifications with red classification roads receiving overtime plowing only to keep the roads passable. Chemicals and abrasives are used only in areas where safety is a concern.

Minnesota - The Minnesota Department of Transportation has an annual maintenance budget of approximately $125 million for 28,772 lane miles of roadway. The maintenance costs per lane mile in urban areas is $1,550 and $850 for rural roads. Snow and ice removal costs are $920 per lane mile. Contract maintenance is performed to balance the highway department workload and for specialized types of maintenance. Minnesota has 145 maintenance facilities in nine highway districts and 1,488 operators and laborers. Facilities are staffed with from three to 50 people. Roads are classified by ADT and broken into five classifications. Super commuter roads have an ADT of over 30,000; urban commuter roads are those with an ADT between 10,000 and 30,000; rural commuter roads have an ADT between 2,000 and 10,000; primary roads have an ADT between 800 and 2,000; and secondary roads have an ADT under 800. Snow removal operations begin when there is an accumulation. Super and urban commuter roads receive 24 hour plowing, rural commuter roads receive 20 hours-a-day plowing, primary roads receive 18 hours-a-day plowing, and secondary roads receive 12 hours-a-day plowing. Both chemicals and abrasives are used as required.

Missouri - The Missouri Highway Department has an annual maintenance budget of approximately $205 million for 32,468 centerline miles of roadway. Snow removal operations cost approximately $310 per mile or 15 percent of the annual road maintenance budget. Some contract maintenance is done for rest area maintenance, pavement overlays, seal coats, and bridge painting. Missouri has approximately 300 maintenance facilities which employ 3000 people. Maintenance facilities are assigned from three to 19 people, depending on the location. Information on the number of trucks per maintenance facility was not available. There are three groups of roadway classifications. Each classification is based on ADT. The interstate roads have three classifications, the primary roads have three classifications, and the supplementary roads have four classifications. Snow removal operations begin with one inch of accumulation and continue until the roads are clear. Each snow plow has a salt spreader and applies chemicals while plowing. Priorities for plowing are based on the road classification, with the highest ADT receiving the most attention.

Montana - The Montana Department of Transportation uses a two-year budget cycle and has an annual maintenance budget of approximately $40 million for 18,851 lane miles of roadway. The average maintenance cost per lane mile of roadway is $2,030. The urban roadways have the highest cost at $5,669 per lane mile and the interstate roadways have the lowest cost at $1,465 per lane mile. Materials production is the only work contracted by Montana. There are 135 maintenance facilities in five districts that are staffed by 574 maintenance personnel. Each maintenance facility has an average of three to four people assigned with the mountainous areas having greater staffing assignments. There are five classifications of roads based on ADT. Class 1 roads have an ADT of over 4,000, Class 2 roads have an ADT between 1,000 and 4,000, Class 3 roads have an ADT between 250 and 1,000, Class 4 roads have an ADT between 50 and 250, and Class 5 roads have an ADT under 50. Snow plowing operations begin at the discretion of the supervisor and continue until bare pavement is achieved on Class 1 roads. The other classifications of roads are plowed frequently enough to keep the roads open but some packed snow is allowed on the roadway. Chemicals and abrasives are used when plowing.

Nebraska - The Nebraska Department of Transportation operates on a two-year budget plan with an annual maintenance operating cost of $51 to $52 million plus a $5 million equipment budget for a 22,061 mile road system. Contracting is done for chemical spraying, crack sealing, and seal coating. Nebraska has 102 maintenance facilities staffed by 1,250 operations personnel and 90 supervisors. There are eight districts and 31 maintenance areas. Each maintenance facility is assigned between two and 18 people. There are three classifications of roads based on ADT. Level 1 roads have an ADT over 3,000, Level 2 roads have an ADT between 800 and 3,000, and Level 3 roads have an ADT under 800. Snow plowing operations begin when there is an accumulation and continue 24 hours-a-day until the wheel track is clear for Level 1 roads. Levels 2 and 3 roads receive 14 to 16 hours-a-day plowing until the wheel track is clear. Chemicals and abrasives are used depending on the weather conditions.

North Dakota - The North Dakota Department of Transportation also operates on a two-year budget cycle with an annual maintenance operating budget of $36 million for 16,344 lane miles of roadway. There was no information available concerning costs per lane mile or contracted activities. North Dakota has 72 rural maintenance facilities staffed by 333 operations personnel in eight districts. Its facilities have three to four people assigned. There is no special system or classification of roads for snow removal operations, however, higher ADT roads do receive preference. Chemicals and abrasives are used in an attempt to keep all roads passable. Plowing of roads to bare pavement is done during normal work hours.

Ohio - The Ohio Department of Transportation operates on a biennial budget system with an annual maintenance operating cost of $150 million for a road system of 42,443 lane miles. Costs per lane mile were not available. Contract maintenance is done for rest area maintenance, ditch cleaning, and some mowing. Ohio has 88 county maintenance facilities and 62 other facilities. Some of these 62 facilities are seasonal facilities open only in the winter. There are 4,200 people in operations and maintenance. The number assigned to a maintenance facility varies depending on the season, with more assigned to the urban areas. There are four classifications of roads. Class 1 roads are interstate roads, Class 2 roads are primary system roads, Class 3 roads are minor arterial roads, and Class 4 roads are rural roads (less than 2,000 ADT). Snow removal operations begin when there is an accumulation. Plowing continues throughout the storm. Class 3 and 4 roads receive only 14 hours-a-day plowing until a storm has stopped. Chemicals and abrasives are used during plowing.

South Dakota - The South Dakota Department of Transportation operates on an annual maintenance budget of approximately $30 million for 18,402 lane miles of road. The average cost per lane mile is $2,556. Contract maintenance is done in all maintenance areas but in no specific amount. South Dakota has 75 maintenance facilities with approximately 600 people assigned in the four maintenance regions. Between four and 12 people are employed by each facility. South Dakota has only two classifications of roads. Priority 1 roads have an ADT over 1,000 and Priority 2 roads have an ADT under 1,000.

Snow plowing operations begin at the discretion of the supervisor and usually continue for only 16 hours-a-day or when traffic flow is considered to be normal. Chemicals and abrasives are used.

Wisconsin - The Wisconsin Department of Transportation has a biennial budget system with an annual maintenance operating cost of $110 million for a 26,049 lane miles of road system. All maintenance activities are contracted with the county highway departments. There was no cost per lane mile information available. Special maintenance projects and large maintenance jobs are the only items contracted to private contractors. The counties operate between 200 and 250 maintenance facilities and have approximately 1,660 people assigned. The counties have the latitude to open and close facilities seasonally. Wisconsin has three classifications of roads based on ADT. Class 1 roads are interstates and major trunk roads, Class 2 roads are state roads and arterials, and Class 3 roads are rural roads. The ADT breakdown was not available. The individual counties determine when snow plowing will begin. Class 1 roads are plowed 24 hours-a-day. The other classes are plowed in daylight hours only, unless nighttime plowing is necessary to keep roads open. Chemicals and abrasives are used at the discretion of each county.

Wyoming - The Wyoming Department of Transportation operates on an annual budget with a three-year plan. Their annual maintenance budget is approximately $41.2 million for a 16,162 lane mile road system. Approximately 24 percent of their annual budget is spent for snow removal operations which is also contracted out to private enterprises. Costs per lane mile were not available. Wyoming operates 70 maintenance facilities with 544 permanent employees and 116 temporary employees. There are between two and three trucks per maintenance facility while the number of people assigned varies with the season and location. Wyoming has three classifications of roads. Level 1 consists of interstates, most primaries and some secondaries. Level 2 are the remaining primaries and secondaries, and Level 3 are local roads. Snow plowing begins with one inch of accumulation and continues 24 hours-a-day on interstates. Other Level 1 roads are plowed 20 hours-a-day, while the other

levels are plowed only during normal work hours. Chemicals and abrasives are used as required.

Interview Summary - The data received from interviews with state officials indicates that the composition and size of these state highway departments varies considerably. The number of people involved in maintenance and operations ranges from a low of 300 to a high of over 4000. Lane mile-per-person responsibilities vary significantly between states and within states. Lane miles-per-person ranged from 13 miles to 50 miles. Seven states vary their lane mile responsibilities depending on the road classification and the traffic load. Some states contract a considerable amount of their road maintenance to counties or the private sector and therefore do not require large maintenance organizations. These contract figures range from zero to 73 percent of their annual road budget, with Wisconsin being the one exception, contracting 100 percent of its maintenance activities. The number of highway districts ranges from four regions in South Dakota to twelve districts in Ohio, with the majority of the states having eight or nine districts. The number of garages is equally as diverse among the states. The number of garages varies from 34 to 300. Three states open and close garages with the change in season and the type of maintenance work performed. There are three states with between 200 and 300 garages, seven states with between 102 and 145 garages and three states have less than 72 garages. Each state has one garage in each district that performs heavy maintenance on that district's vehicles. One state has one central garage for specialized maintenance.

The number of people assigned to a patrol or maintenance facility also varies within each state. Maintenance facilities range in personnel strength from three to 50 people, depending on the type of maintenance work being performed, road classification, and the season of the year. Six of the states have facilities staffed with less than five people. The total number of personnel in the road maintenance work force is equally widespread. Four states have fewer than 1,000 people assigned to road maintenance. Six states have between 1,250 and 1,660 people assigned and four other states have between 2,500 and 4,300 people assigned to road maintenance.

Contracting of road maintenance work is done to some degree by most states. The average amount of road maintenance contracted by the states is 23 percent of their annual road budget. Some of the maintenance functions typically contracted to private companies are, mowing, chemical spraying for weed control, bridge painting, ditch cleaning, asphalt overlaying, and striping. Some states contract with counties and other local governments for maintenance services, while others use the private sector. Most states attempt to fully utilize their own resources and contract the remaining requirements. Snow removal is one function that is generally retained by the state or contracted to a county highway department. Private industry contracts for snow removal are not widely used in the midwest. Wisconsin contracts with the counties for all road maintenance functions and therefore has no state-employed road maintenance work force. On the other hand, Missouri does not have a county road maintenance system, which means its state road maintenance organization is much larger in order to handle all road maintenance functions within the state.

The organization for snow removal operations varies between the states surveyed. Most states use average daily traffic (ADT) in some manner to prioritize roads, distribute forces, and plan the hours of snow removal operations. The interstates and high ADT roads receive more concentrated effort and generally around-the-clock attention, while the rural roads with low ADT's receive less personnel and equipment, and limited hours of snow removal operations. States usually have at least three levels, or classifications, of roads used in prioritizing roads for snow removal. The only reason for stopping snow removal operations was for a lack of visibility or to assure the safety of the operator. All states perform cleanup operations during normal work hours after the storm.

Three states (Illinois, Ohio, and Wisconsin) vary the number of garages in operation based on the season of the year. Winter road maintenance functions are generally a one truck/plow and one driver operation. Summer road maintenance functions are generally geared to a road crew type of operation requiring several pieces of equipment and operators. The flexibility in

consolidating and dispersing personnel and equipment allows for efficient scheduling of road maintenance forces and projects.

Illinois has four types of garages: two types are staffed year-round and two types are used only in winter. Those garages staffed year-round are the section headquarters and the sub-section garage. The section headquarters are staffed with between 15 and 50 people, but with a minimum of eleven people. The two types of garages opened only in winter are the remote sites and the salt storage sheds. Remote sites are staffed with 6 to 8 people and are in operation between November and April for winter snow removal operations. The salt storage sheds are unstaffed and open only in winter when a storm is approaching. These sheds are located at the end of several snow routes to eliminate deadheading time. These facilities include a salt storage building and a garage for a front-end loader which is left onsite for the winter.

Ohio operates primarily year-round garages with one garage located in each of the 88 counties. Urban areas have sub-county or outpost type garages with approximately ten people assigned. Both are operated year-round. Several districts allow a few of the rural counties to have outposts open only for the winter months. These outposts are generally staffed with approximately 3 to 5 people but are not considered to be very efficient in performing most maintenance work other than snow removal. In addition to these staffed sites, Ohio uses storage yards with salt buildings and a front-end loader. Ohio Department of Transportation personnel feel this is a good concept that has the advantage of more garage sites and less deadheading time without the disadvantage of small crews that are hard to manage and utilize efficiently.

Wisconsin also has county garages that are open only in the winter months. Since Wisconsin contracts with the county highway departments for all highway maintenance services, the decisions on garage locations and operations are left up to the counties. The state pays established equipment utilization rates and provides materials for the maintenance of state roads. This method allows the counties to have the equipment and trained personnel needed for maintenance services of their county road system and to take advantage of economy of scale when purchasing materials.

At the other end of the spectrum is Missouri, which has no county highway departments. The State Highway Department provides all highway maintenance services and contracts constitute very little of its highway maintenance budget. Its personnel structure is very large in order to provide all services required to maintain all classifications of roads.

CONCLUSIONS

As a result of our research we have concluded there is no one particular state with the best method of providing highway maintenance services. After discussions with the state maintenance officials and review of the reports discovered in the literature search, we have concluded that the three to five person crew is inefficient and uneconomical. A small maintenance crew is limited in the number of maintenance functions it can accomplish. This is especially the case for summer maintenance activities that require traffic control or are labor-intensive. Vacation and sick leave further reduce the effectiveness of these small crews. However, for winter operations in a one plow/one person scenario, the small crew concept can be responsive and workable. Several states solve this problem by using satellite facilities and storage sheds only in the winter snow season. This solution seems to take advantage of both situations by having larger crews available for summer operations and dispersed crews for winter snow removal operations. The sparsely populated rural states have used the small maintenance crew concept successfully on their rural roads with very low ADTs, however, in urban areas larger crews are utilized.

The use of storage sheds also help in the reduction of deadheading time back to a central storage location. Several states have storage locations that serve several snow routes. By strategically locating these satellite storage locations, snow plow routes were extended and no loss in coverage or response time was experienced. Each storage location has chemicals and abrasives and a front-end loader stored under cover. This was particularly effective for those states that apply chemicals and abrasives as they plow.

The California report pointed out the fact that its highway maintenance system was not responsive to, or representative of the current highway system. Their facility siting model pointed out inefficiencies that when corrected provided greater than expected returns.

Wisconsin and Michigan have successfully contracted their road maintenance activities to their county highway departments. This concept effectively maintains the responsibility and responsiveness at the local level. The added benefit is the fact that the county highway departments have the additional resources available to better maintain county and local roads. Contracting of weed control, striping, seal coating and overlaying, and bridge painting to private enterprises is successfully done by most states to supplement state maintenance forces.

Unlike the fourteen states contacted, Iowa is the only state that does not routinely use chemicals on all classifications of roads during winter snow removal operations. Most states use a mixture of salt and sand on all roads, but especially on the lower classifications of roads to help reduce and break up packed snow on the roads. Iowa's policy provides for the use of extensive amounts of abrasives on all service level roads and also allows for use of chemicals on all service level roads. The stockpile of sand that is used as a winter abrasive on all service levels roads is mixed with CaCl and Iowa's policy states that salt can be used on all service level roads and provides guidelines to control excessive use. On "D" level roads, sand is used extensively as an abrasive and a mixture of salt and sand may be used with the approval of the District Maintenance Engineer if the abrasive alone is not sufficient. As a routine practice, salt is not used on LOS D highways.

CHAPTER 4
PUBLIC INPUT

CHAPTER 4

PUBLIC INPUT

INTRODUCTION

This study effort was to address several issues, one of which is the question, "What highway maintenance needs and services are required and desired?" This can be translated to defining the public's expectations and perceptions in relation to the delivery of highway maintenance services.

Information to help define these requirements was gathered through input received at the public hearings held during the months of March and April across the state. This approach is unique with respect to maintenance operations. In the past, public input has not been sought on the part of state Departments of Transportation in their effort to improve the efficiency of their operations.

Public hearings were scheduled statewide in order to solicit information from the citizens of Iowa concerning:

- the public's expectations of state highway maintenance;
- the economic impact of maintenance facilities on a region; and
- other impacts the facility may have on a community.

The hearings acquainted the citizens with the proposed study and solicited input in the form of prepared and spontaneous testimony, and written comments. In addition, questions directly related to the study were answered by our personnel.

After meeting with Department personnel and District Engineers, locations for the meetings were selected and scheduled. The public hearings were scheduled to begin at 6:30 p.m. on the following dates:

Date	Town	Meeting Hall
March 21, 1989	Humboldt	Jr. High Auditorium
March 22, 1989	Shenandoah	National Guard Armory
March 23, 1989	Winterset	High School Gym
March 27, 1989	Mt. Pleasant	High School Auditorium
March 28, 1989	Colfax	High School Gym
March 30, 1989	West Union	Parish Hall
April 3, 1989	Sheldon	Community Building
April 4, 1989	Ida Grove	Community Hall
April 5, 1989	Anamosa	Middle School Auditorium

Due to a conflict with Holy Week services, and at the request of a local legislator, a second hearing was later scheduled for April 6, 1989 in Winterset, and was held at their Junior High School Auditorium.

In order to notify as many interested citizens as possible, Public Hearing Notices were dispatched to the local newspapers, radio stations, and public television stations. Exhibit 4-1 is an example of the public hearing notice. In addition, notices were sent to the media in the counties surrounding the actual hearing site and the Des Moines Register. The Iowa Newspaper Advertising Service, Inc., was utilized and notices were also sent by our office to local newspapers, radio, and television stations. Personalized letters of invitation to the hearings were sent to city officials, county engineers, Boards of Supervisors and District Engineers. In reply, a number of responses were received from concerned citizens and officials who were unable to attend the hearings. A project statement was provided to all citizens who attended the hearings and in advance to the Chamber of Commerce Director in each town in which the hearing was held. Exhibit 4-2 contains the project statement that was distributed. This statement included a postage-paid mailer. The Chamber of Commerce Director was asked to post this statement in conspicuous areas in town and many duplicated the mailer so that citizens who did not attend the hearings could send in their comments. A number of these were received and have been incorporated into our findings.

Exhibit 4-1

PUBLIC HEARING

WILBUR SMITH ASSOCIATES
Under contract with the
Iowa Department of Transportation
will hold a

PUBLIC HEARING

to obtain information on the

- Public's expectation of state maintenance
- Economic impact of garages on the region
- Other impacts garages have on the community

in order to make recommendations
on the number and location of
State maintenance garages in Iowa

on March 23, 1989
at 7:00 PM in the
Winterset High School
Gymnasium
624 West Huskey
Winterset, Iowa

WSA Personnel will be available prior
to and after the formal meeting.

Exhibit 4-2

PROJECT STATEMENT

FOR THE PUBLIC HEARINGS SOLICITING INFORMATION FROM THE CITIZENS OF IOWA CONCERNING:

- the public's expectations of state highway maintenence,
- the economic impact of garages on a region, and
- other impacts on the communities

FOR USE IN THE WILBUR SMITH ASSOCIATES STUDY OF MAINTENANCE FACILITIES FOR THE IOWA DEPARTMENT OF TRANSPORTATION

Date	MEETING PLACE	Town
March 21, 1989	Humboldt Junior High Auditorium	Humboldt
March 22, 1989	National Guard Armory	Shenandoah
March 23, 1989	Winterset High School Gymnasium	Winterset
March 27, 1989	Mount Pleasant High School Auditorium	Mount Pleasant
March 28, 1989	Colfax-Mingo Comm. High School Gymnasium	Colfax
March 30, 1989	Holy Name Catholic Church Parish Hall	West Union
April 3, 1989	Sheldon Community Building	Sheldon
April 4, 1989	Ida Grove Community Hall	Ida Grove
April 5, 1989	West Middle School	Anamosa

Exhibit 4-2 Cont'd

Wilbur Smith Associates and the Iowa Department of Transportation wishes to thank you for attending this public hearing soliciting information from the citizens of Iowa for use in a "Needs Assessment Study of the Iowa DOT Maintenance Facilities Construction Needs."

The purpose of this meeting is to acquaint you with the proposed study, solicit your input in the form of prepared testimony and written comments, and to answer any questions that you may have.

BACKGROUND

The Highway Division of the Iowa Department of Transportation maintains approximately 24,500 lane miles of Interstate, Primary, and Secondary highways. Maintenance activities on these 24,500 lane miles are performed by about 1450 maintenance workers employed by the State of Iowa. These workers are deployed throughout the state, working in one of the 138 maintenance areas. Each area is responsible for maintaining its assigned portion of the highway network.

Organizing for highway maintenance on a geographic or area basis is practiced in some manner by almost all states. In recent years, as maintenance has become more complex and costly, there has been a trend throughout the U.S. in consolidation of maintenance activities and facilities. The rationale for consolidation has been efficiency, driven by the requirement for larger maintenance crews, more requirements for specialized equipment, a need for higher skill levels within the work force and the capability to better predict, plan, schedule and perform maintenance activities.

The direction for state highway maintenance within Iowa has been to provide the best maintenance service possible at the lowest cost. This has resulted in a proactive stance being taken toward efforts to purchase larger and more versatile maintenance equipment, reducing the number of maintenance field facilities through the consolidation of current facilities and the reduction of field maintenance staff while continuing to provide at least equal or better service.

Exhibit 4-2 Cont'd

Not everyone agrees that the consolidations and closures are beneficial. Community leaders, legislative representatives and citizens have resisted the closure of maintenance facilities. This study will address major concerns relative to the location and construction needs for highway maintenance facilities within the State of Iowa.

It is the Department's objective to seek input from the public regarding their priorities relative to the location and construction needs of maintenance facilities, and as a logical extension of that question, what the public's expectations are as to the delivery of highway maintenance services. It is planned that the results of this study and needs assessment will be reviewed with the Transportation Commission and the Governor and presented to the General Assembly by January 1990.

Note: The background portion of this project statement contained an error. The state DOT does not maintain secondary highways as they are defined in Iowa. In Iowa secondary highways are county and city roads. In addition there are 25,000 miles of state maintained highways, not 24,500.

The initial three hearings were chaired by Mr. William Buglass, Mr. Clifford C. McMullen and Mrs. Robin Brian. Mr. McMullen and Mrs. Brian chaired the remaining hearings. The following is a typical agenda for the public hearings:

6:30-7:00	Informal Discussion Period
	Sign-up of Citizen Speakers
7:00-7:15	Project Information
	Hearing Format
7:15-8:15	Citizens' Presentations
8:15-8:45	Open Discussion
8:45-9:00	Summary
9:00	Adjourn

The Project Information and Hearing Format section consisted of a slide presentation and introductory speech given by one of the hearing chairpersons. This talk defined Wilbur Smith Associates's identity and purpose and provided a background regarding the study and our role in it. We provided the citizens with the parameters of the study and the type of information we were hoping to obtain during the meeting.

Many of the towns had organized, prior to the hearings, a group of speakers to present prepared statements. A few towns presented material given previously to the Department of Transportation regarding their maintenance facility. Other towns presented spontaneous remarks and comments, with no predetermined speakers.

All in all, the hearings were successful. Coverage prior to the hearings by the local newspapers was well done and favorable articles were written regarding the hearing outcomes. Many of these articles were received in our office. Although there were some comments made that the individual written notices were not received in time to allow the towns to more adequately prepare for the hearings, representation was sufficient to provide the cross-section of information necessary to the study. The citizens were fairly receptive to the study team and were eager to provide additional written information for use in the study.

In presenting the public's perceptions and expectations, the discussion has been organized under the following categories:

- Representation of Interests
- Issues
- Expectations and Conclusion

REPRESENTATION OF INTERESTS

Exhibit 4-3 outlines the attendance of the public hearings. In general, the hearings were well-attended. Attendance ranged from the low of 3 in Anamosa, to 85 in Sheldon. The total attendance of the two hearings held in Winterset was 105, however, a great number of the citizens attending the second hearing were also present at the first. The actual attendance at the second hearing in Winterset, excluding those who attended the first hearing, was approximately 18, bringing Winterset's total representation to 88.

The exhibit illustrates the diversity that existed not only in the numbers attending but in the representative groups who were present. State, city, and county officials were present at all hearings.

Most hearings included representation in other areas of community affairs as well. This representation came from a variety of citizen interest groups, local business and industry, emergency services, and transportation providers.

The state officials consisted of legislators and Department of Transportation personnel. The county representation was comprised of County Supervisors and engineers. City officials included mayors; council members; city managers; public works directors; city clerks; city administrators and attorneys; Chamber of Commerce officials included directors, presidents, and members.

Citizen concerns were widely represented. The exhibit outlines those groups. Many citizens were also representing a particular group in addition to their personal concerns for the quality of life in their respective towns.

REPRESENTATION

PLACE	HUMBOLDT	SHENANDOAH	WINTERSET 1	MT. PLEASANT	COLFAX	WEST UNION	SHELDON	IDA GROVE	ANAMOSA	WINTERSET 2
DATE	March 21	March 22	March 23	March 27	March 28	March 30	April 3	April 4	April 5	April 6
ATTENDANCE	75	40	70	10	6	11	85	17	3	35
OFFICIALS										
State	•	•	•	•	•	•	•	•	•	•
County	•	•	•	•		•	•	•		•
City	•	•	•	•		•	•	•		•
CITIZEN GROUPS										
Commuters	•	•	•				•			•
Attorney	•						•			
Sr. Citizens	•	•	•				•	•		•
Public Library		•	•						•	
Maintenance Empl.	•	•	•							•
HEALTH CARE	•	•	•				•	•		•
SCHOOLS	•	•	•				•	•		
UTILITIES	•	•	•				•	•		
ECONOMIC DEVELOPMENT	•	•	•	•			•	•		
TOURISM			•							•
LOCAL BUSINESS & INDUSTRY										
Sales	•	•					•	•		•
Media	•	•	•	•			•	•		
Manufacturing	•	•	•							
Shipping		•						•		
Insurance		•						•		
Real Estate		•						•		
Postal Service		•					•	•		•
Small Business	•	•	•							•
Pharmacy		•	•				•	•		•
Industry	•	•	•	•						
EMERGENCY SERVICES										
Ambulance	•									
Fire	•									
Civil Defense	•							•		•
Law Enforcement			•							
TRANSPORTATION										•
Bus Service	•	•						•		
Trucking	•	•	•							
COMMERCE	•	•	•			•	•	•		•

Exhibit 4-3

The concerns of the health care industry were represented by hospital administrators, local physicians, hospital employees, emergency technicians, pharmacy owners, and senior citizens.

Speaking in behalf of the school system were school superintendents, transportation directors, principals, bus drivers, and parents.

The various public utilities concerned with the delivery of highway maintenance services included regional electrical cooperatives, power companies and telephone companies.

Many of the towns were represented by organizations whose chief concern was the economic development of the area and the state of Iowa. The general areas of concern were the economic growth and stability of the town and the state, and maintaining the enthusiasm that the new tourism thrust has generated in the state of Iowa. These groups were mainly comprised of historical societies, civic clubs, tourism development groups, and organized economic development commissions and corporations within a community.

Local business and industry concerns were represented by employees, company officials, Chamber of Commerce members and directors, and city officials. The major representative groups are listed on Exhibit 4-3.

The groups representing the concerns of emergency services were sheriffs and other local law enforcement personnel, ambulance, and disaster services, including fire departments and volunteer emergency services.

The transportation issues, in addition to being represented by nearly every other group present, were particularly addressed by city and county bus services, commuter services, trucking companies and other industries who rely heavily on transportation for shipment of their raw materials and finished goods or provide transport services. Finally, commerce was represented by banking officials. The overall attendance was adequate to provide the diversity of opinions needed for the study.

ISSUES

Over the duration of the public hearings, the testimony indicated the apparent areas of concern to the citizens of Iowa with respect to highway maintenance could be classified into the following seven categories:

- Winter Maintenance
- Economic Impacts
- Safety
- Level of Service/Road Classification
- Emergency Response
- Schools
- Community

Winter Maintenance

The topic of winter maintenance, or more specifically, snow and ice control, was the foremost issue discussed during the hearings. Nearly all comments received were in some fashion concerned with the issue of snow and ice removal.

The opinion of the citizens of Iowa, as expressed at the hearings, was that any constraints placed upon the ability to have safe and timely transportation will significantly impact 1) economic development; 2) the ability for the commuting population to get and keep jobs; 3) the safety of the population; 4) tourism; 5) the sales and service industries that must travel; and 6) any and all industries that rely heavily on transportation for their success.

The voiced perception concerning winter maintenance is that the current level of service will change if maintenance facilities are consolidated or relocated. Everyone wants to be at the beginning of a snow plow route. The citizens also believe that a local maintenance facility is more responsive to the community because the maintenance workers live in the community and understand its particular needs.

Economic Impact

Of all the major areas of concern voiced by the citizens of Iowa, the economic impact a maintenance facility, or the potential loss of the facility, has on an area was second only to snow and ice removal. The citizens of the towns and the surrounding areas are convinced that the location of a maintenance facility directly impacts their economic well-being. The comments received were made under the assumption that the existing local facility would be abandoned and relocated elsewhere.

All of the town's officials were naturally opposed to any negative economic impacts such as the loss of jobs as a result of the facility closure and a loss of the revenue generated for the towns by these jobs. The citizens also felt that, in addition to the maintenance workers directly impacted if the facility should close, other local business workers would be impacted as well.

Commuters both into and out of the areas testified that they would be impacted. They perceive that any delay in starting snow and ice control activities would make it difficult for them to arrive on time at their places of employment. In addition, this continuing hardship could place their jobs in jeopardy, ultimately resulting in either the loss of jobs or relocation of commuters to areas closer to their place of employment. Either of these would result in an adverse effect on the community.

As Exhibit 4-4 illustrates, the types of new industry that have located or expanded in the state since 1983 are mainly those that rely heavily on transportation. For this reason, the quality of roads and early snow removal are seen by the citizens as having a direct effect on their ability to attract this type of industry. In their opinion, these industries expect to be able to move products 24 hours a day, and any decrease in the level of service now received would impact this ability. The impact of the decrease could ultimately result in the relocation of current industries and the refusal by others to locate in these areas. Other industries on the list, such as

Exhibit 4-4

State of Iowa

TYPES OF NEW INDUSTRY AND EXPANSION EFFORTS - 1983-1989

1983	1984	1985
Agriculture Coop	Accounting Center	Agriculture Distributor
Agriculture Equipment	Agriculture Equipment	Agriculture Labs
Agriculture Products	Agriculture Processing	Automotives
Automotives	Automotives	By-Products Processing
Banking	Beer Distributor	Candy
Computer Manufacturing	Building Materials	Clothing Manufacturing
Credit Card	Bulk Foodstore	Concrete Products
Data Processing	Castings	Direct Mail Marketing
Furnaces	Clothing Manufacturing	Food Products
Garment Distributor	Communication Equipment	Food Stores
Home Equipment	Department Store	Foundry
Insurance	Direct Mail	Fuel Systems
Meat Packing	Distillery	Glasswear
Medical Supplies	Electronic Transformers	Graphic Arts Products
Pen Barrel Manufacturing	Ethanol	Ice Cream Manufacturing
Pharmaceuticals	Furniture Manufacturing	Insulation
PVC Pipe	Laminates	Meat Packing
Research & Development	Meat Packing	Mobile Radio-Manufacturing
Retail Distribution	Metalworking	Mortgage Service
Retail Warehouse	Microchips	Motor Manufacturing
Rubber	Novelty Items	Packaging Products
Slaughtering	Paper	Prepared Food-Distribution Center
Soft Drink Bottling	Paper Recycling	Race Car Manufacturing
Soy Processing	Pharmaceuticals	Refrigeration Storage
Telephone Supply	Plastics	Research
Tape Manufacturing	Real Estate	Retail
Utilities	Retail Warehouse	Satellite Receivers
Vehicles	Snack Foods	Sheet Metal Products
	Soybean Processing	Technologic Products
	Tool Manufacturing	Vinyl Products
	Utility Products	Wood Products
		Wooden Window-Manufacturing

SOURCE: "Significant Announcements and Expansions Report", Iowa Department of Economic Development, Des Moines, Iowa.

TYPES OF NEW INDUSTRY AND EXPANSION EFFORTS - 1983-1989 (Continued)

1986

Agriculture Coop
Agriculture Laboratories
Airline Maintenance
Automotives
Bulk Mail
Can Manufacturing
Carbon Dioxide Distributor
Combines
Computer Forms
Discount Warehouse
Display Products
Egg Production
Electronic Motors
Electrical Switch-Production
Fiberglass Products
Food Distributor
Glassware
Honey
Incentive Network
Industrial Fasteners
Industrial Hoses
Loan Collection Service
Meat Packing
Meat Packing Machinery
Pharmaceuticals
Plastics
Protein Food Products
Retail Credit
Snack Foods
Software
Sportswear
Storage
Technologic Equipment
Telephone Service
Trucking Services
Tubing
Utility Equipment
Window Manufacturing

1987

Agriculture Equipment
Agriculture Products
Aluminum Windows and Doors
Appliances
Automotives
Automotive Training
Avionic Products
Biotechnology
Driveline Components
Electrical Equipment
Glass Products
Insulated Glass

1987

Meat Packing
Metal Products
Paper Products
Plastics
Prepared Foods
Printing Equipment
Printing Plant
Pulleys
Refrigerated Warehouse
Retail Distributor
Slaughterhouse
Specialty Trailers
Telemarketing
Truck Rest Area
Trucking Company
Warranty Service

1988

Agriculture Laboratory
Agriculture Processing
Ball Bearings
Building Materials
Can Production
Credit Card
Convenience Store-Headquarters
Electrical Products
Fumigants
Fund Raising Products
Life Insurance
Machine Manufacturing
Metal Packaging
Pay Phones Manufacturing
Pen Barrel Manufacturing
Powdered Foods
Recreational Vehicles
Rubber
Sportswear
Telemarketing
Trucking

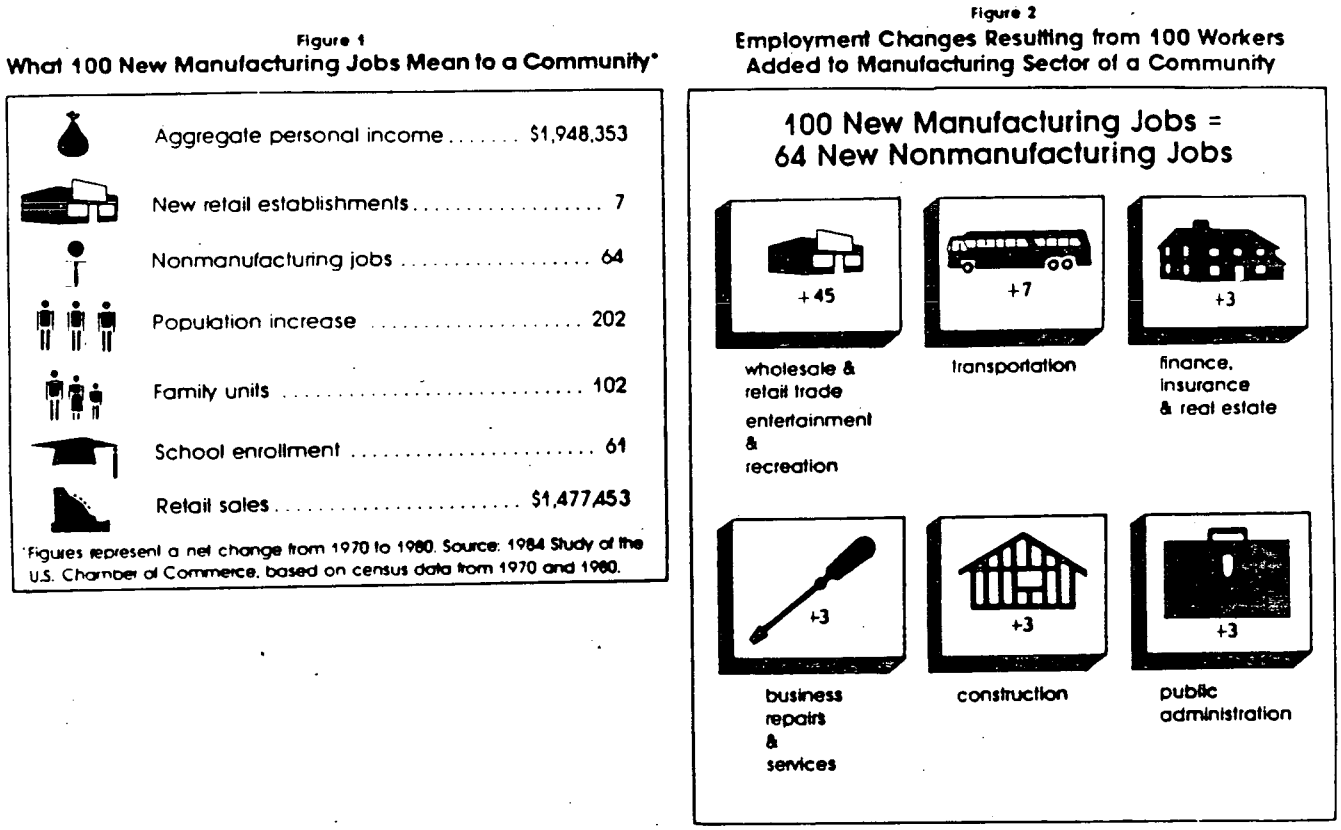
1989

Electrical Controls-
Manufacturing
Farm Machinery
Financial Services
Insurance
Luggage Manufacturing
Meat Processing
Milling
Packaging
Vacuum Systems

insurance, banking, telemarketing, and real estate do not rely on the shipping or receiving of goods, but these are the exception.

Economic development is now actively being undertaken by all the towns represented, as well as towns across the state, and the citizens feel the quality of their roads, particularly in the winter, is a "bargaining chip" to be used when attempting to attract new industry. Exhibit 4-5 illustrates the economic changes resulting in the location of a new industry. Based on these findings, it is understandable that loss of industry or inability to attract industry is an area of great concern.

Exhibit 4-5



Source: 1984 Study of the U.S. Chamber of Commerce, based on census data from 1970 and 1980.

Another adverse economic effect mentioned was the increase in taxes that would possibly result if a new facility was constructed. In general, the citizens feel the present facilities are sufficient and any efforts to improve the maintenance service should concentrate on minor improvements to these existing structures.

These small communities boast a lower tax base and feel that any increase in taxes could impact real estate values and the ability to attract population from areas with a higher tax base. These rural areas are now struggling to maintain their present population, and feel that "they need all the help they can get."

The revenue generated by products purchased in the town for use by the maintenance facility - for instance, sand, gravel, and fuel - while not being a significant amount - would be viewed as a loss by the citizens if the facility was eliminated.

The effect of perception on community economic development was presented in one of the hearings. It was suggested that whether a transportation hardship actually exists or not, if the perception that it exists is there, the adverse effect upon a community will be the same.

Other unique opinions concerned an alternative use for the maintenance facility, should the relocation or closure be warranted. This suggestion was to use the abandoned facility to house the school buses which are currently kept in a downtown garage location. Another community suggested a prime site within the city for the construction of a new maintenance facility. These two alternative solutions were the exception, rather than the rule, however the desire to cooperate with the State did exist in the communities. They felt that any changes should be clearly cost-justified and weighed against the possible results of the change.

Safety

The next issue of major concern to the citizens of Iowa was the safety of their roads. It was felt that the safety of the individual and the community would be put in jeopardy by the following:

- Ice,
- Poor pavement conditions, and
- Blowing snow.

Again, the majority of the comments centered around winter road conditions. It was felt that any decrease in service would place many people at risk as they travel the roads. Listed below are the groups considered to be most at risk.

- Commuters into and out of town
- School children on buses
- Consumers
- Medical workers
- Traveling salespeople
- Emergency workers
- Mail carriers
- Truck and bus drivers
- Senior citizens
- Tourists

The consensus throughout the public hearings was that any consolidation of maintenance efforts would result in a decrease in the level of service provided, particularly in the winter months. The increased response time that would result from the consolidation would place an unnecessary risk and burden upon a community.

With respect to the potential decrease in service, it was mentioned that the tort liability exposure of the Department of Transportation would increase as a result of any wintertime accidents that may occur. Should these be

proven to have been caused by negligence on the part of the Department of Transportation, these tort liability costs would translate into an added expense to the taxpayers.

The citizens stated that in a situation where minutes are critical, any added response time due to the winter road conditions could place lives in jeopardy. The safety of the medical and emergency workers themselves could be at greater risk in addition to the danger placed on the victims in winter emergency situations.

A point made at a number of the hearings was that the snow and ice removal efforts must be continued both day and night due to the traffic over the roads at all times from shipping goods, and shift workers who must travel the roads at night and early morning hours.

The immediacy of ice control efforts was particularly stressed. The feeling was that the maintenance forces would give priority to interstates and rightly so. However, it was continually stated that if a facility located near an interstate was responsible for a community's road maintenance, the roads serving the community would not receive the immediate attention they deserve.

The quality of pavement maintenance was a minor issue in the hearings. The main concern was that high volume truck traffic would deteriorate the roads more quickly if the present level of service was not maintained.

Level of Service/Road Classification

This issue was of great concern to the citizens of Iowa. A large amount of disagreement exists across the state regarding the current classification of certain highways. The consensus was that the state misunderstands the impact that a particular classification of a road may have on an area. An example given by a citizen during one of the hearings was that although a particular highway was currently classified as a lower level road, the road is

now being widened from two lanes to four lanes due to increased traffic counts. It was their opinion that the required widening should have warranted an upgrade in the classification.

Another community pointed out that although certain highways may be considered a certain LOS classification based on the criteria developed by the Department of Transportation, C and D level roads are actually considered interstates to the people in the communities they serve. These highways are their link to the major marketplaces. In addition, they stressed the importance of considering topography in addition to traffic volume in determining road Level of Service classifications.

Particular traffic counts cited throughout the hearings indicated an increase in commuter and truck traffic on a number of the main highways across the state. The comments indicated that an increase in both commercial and other traffic volume is anticipated and that the towns serve as a "hub" of activity due to this traffic. It was felt that a centrally located maintenance facility would better serve their needs. However, most of the communities felt that the site of their present facility was the best central location.

All in all, the general feeling was that the highways serving these communities are primary accesses to major interstates and connect marketplaces in eastern and western Iowa. According to the citizens, these highways should be upgraded to a higher level of classification or at least provided service equal to that of the higher level roads.

Emergency Response

The response time to emergency situations was also of concern to the citizens. The following list outlines those groups that were vitally concerned with emergency response.

- Fire (volunteer and other)
- Police
- Ambulance
- Medical
- Disaster Service
- Utilities

The overall opinion was that emergency response time would be increased during the winter months due to the inability to have the roads cleared of snow and ice promptly if the DOT maintenance facilities in town were not maintained. The fear that the community would be at the "bottom of the barrel" or last priority for snow removal fueled this concern.

The citizens feel the winter months are possibly the months when a greater percentage of emergency situations occur. In addition to the emergency response time for accidents, fire, and the medical emergencies that may result from these disasters, the citizens were concerned with the response time of the utility companies to restore service.

Speaking on behalf of this issue were not only emergency workers but citizens, particularly senior citizens, who may face a life-threatening situation should power restoration be delayed in cold winter months. With the apparent growing number of senior citizens in these communities, at particular risk would be those citizens who may be receiving medical attention in their own homes. While most medical facilities and skilled nursing care facilities may be equipped with a generator to combat a power outage, the homes of most of these senior citizens would not. A power outage situation could pose a significant threat.

Finally, the inability to transport grain or veterinary care to the livestock in these areas that are heavily dependent on farming would pose an emergency situation for these communities.

Schools

A new issue that came to the forefront regarding schools was the new "Open Enrollment" policy for the state of Iowa. This policy is anticipated to bring about changes in the operation of the school systems in the state. One of these changes could be the transportation of students to schools of their choice by private means. The number of students and parents on the roads may increase due to this policy. The top-rated schools could potentially attract a great number of students from neighboring areas. If the bus routes were expanded, then the increased bus traffic would require safe roads to transport the school children.

The safety of the students who would be traveling on buses for athletics and extra curricular activities was also a major concern. Athletics in the state are emphasized and encouraged. The schools are very active in the athletic conferences and the buses are required to be on the road both day and night.

Most of the communities boasted that their school system seldom has winter weather-related closings and therefore the school year is not extended into the summer. They feel the students get a better education as a result of having a regular and full school year.

A great many of the teachers commute to the schools, and teachers and students also commute to the regional community colleges. Their safety and ability to arrive at work and to class on time was stressed.

Finally, the economic development efforts of the communities could potentially encourage more families to locate to the area. The quality of their schools, dependability of school bus transportation and athletic competitiveness are seen to be factors that could attract more population. The local maintenance facility provides the assurance to the citizens of Iowa that the roads will be made safe and passable in a timely manner. This assurance is a high priority to the communities.

Community

The final area of concern covered in the public hearings was related to the community. Some of these issues are as follows:

- Community Pride
- Quality of Life
- Rural Issues
- Commitment

Many of the communities represented at the hearings are county seats. In addition, they consider themselves primary business and industrial centers, regional shopping and work centers, or bedroom communities to larger cities. For this reason, the citizens view quality roads as a necessity, not simply a convenience. They feel that by the improper classification of their roads, or the possible closing of their maintenance facility they are being made to feel like "second class citizens". By having priority given to their needs by the State, their faith in the "system" would be improved.

The economic efforts that are being initiated at the state level and encouraged at the community level appear to be having a positive effect. There was a feeling that any effort to relocate a facility was detrimental to these efforts. A number of the communities have exhibited growth in population and industrial base in the past few years, and they want these trends to continue. The opinion exists that any consolidation or closure could only undermine this enthusiasm and inhibit community growth.

The opinion that the quality of life would be reduced if the maintenance facility was relocated was prevalent throughout the hearings. Not only would the community be impacted economically by the loss of job of the workers employed by the facility, but the loss of those employees and their families would have an emotional impact. The disruption of this community fiber was felt to be significant, as the loss of their contributions to the social, economic, and cultural aspects of the area would be felt.

The quality of life could also be decreased by the loss of industry that could result if the ability to transport products efficiently is decreased. Partner to that concern is the supposed inability to attract new business for the same reason. These hardships could impact the economic viability of already struggling rural communities.

Many rural issues were discussed in the hearings. Mail delivery was a concern to a number of the communities. The senior citizen population relies on timely delivery of Social Security and other checks, and the rural small businesses rely on dependable delivery of supplies, payments and invoices in order to maintain a successful business and avoid potential cashflow or credit problems.

Discussions by leaders of rural communities indicated that they are still attempting to recover from the "farm crisis". They feel a certain amount of isolation and lack of support from the State. The community morale would be negatively affected as they may view a change in the location of their facility as a threat to the community's continued success. These community leaders feel that the towns' efforts to "get back on their feet" should be weighed and the positive trends that could result from these efforts should be considered in the overall plan for improvement of maintenance operations.

Finally, the commitment of the local maintenance workers was particularly stressed during the hearings. The employees of the local facility have a sense of commitment to the community they reside in. Their pride in their community and accountability to the citizens helps to ensure good maintenance services. It is felt that as a local citizen, they are aware of the impact their work has and this acts as a "check and balance" mechanism for the maintenance services provided. This mechanism would not exist if the workers responsible for a community's roads were not residing in the community as a result of any consolidation.

One unique opinion brought out during the hearings was the concern that the citizens of Iowa have been "spoiled" by the response of the maintenance facilities in the past. There is concern that perhaps their expectations are

unrealistic and have not changed as the demands placed on the maintenance operations in the state have increased. A small group of communities pointed out that they have received adequate maintenance services from a neighboring facility and expect that consolidation could result in equal, if not better provision of services.

EXPECTATIONS AND CONCLUSION

The citizens of Iowa have high expectations of their maintenance services. These expectations are fostered in part, by the excellent service they have received in the past. Their primary concern is ensuring this excellent service continues.

The state of Iowa was widely represented. The diversity of the representative groups provided insight into a wide variety of areas of concern. Although there was a great diversity among the communities in representation, a surprisingly strong consensus of opinion became apparent.

The major areas of concern: Winter Maintenance, Economics, Safety, Classification of Roads, Emergency Response, Schools and Community Issues were presented in nearly every community. The theme of the hearings, however, seemed to be LEVEL OF MAINTENANCE SERVICE. There is a clearcut perception among the communities that the quality of service would diminish if the facilities in these and surrounding communities were eliminated and relocated. The quality includes timeliness and effectiveness of service, particularly as it relates to snow and ice removal and emergency situations. Less emphasis was placed on the quality of other types of maintenance services.

The key word is "mobility." One woman testified, with much audience support, that she wanted and needed to be able to travel safely at highway speeds 24 hours per day, 365 days per year. The state of Iowa has industry that relies heavily on transportation and therefore has come to expect optimum mobility. Many of the towns who do not have enough industry to support the population have a great amount of people commuting to work at other

locations. A portion of the commuters are coming into the communities, as well. Mobility is also a factor the citizens of Iowa feel enables a community to remain competitive in attracting new industry and expanding and maintaining its present industry. Mobility also enables the citizens to acquire and keep a good job by providing safe and passable roads on which to commute. These factors in turn affect the economic stability of the communities which ultimately affects their ability to grow in population.

A national survey conducted by pollster Lou Harris for the business real estate firm, Cushman and Wakefield, indicates the most essential factor for locating wholesale, retail or manufacturing operations is easy access to domestic markets, customers or clients. The citizens of Iowa feel this easy access is directly related to the winter snow removal and maintenance provided by the local maintenance facilities. Therefore, the community leaders felt that location of the facility is a crucial factor in the decision-making process a wholesale, retail or manufacturing operation may make when choosing a location.

This survey by Lou Harris also indicates that the top criterion regarding what governments can do to entice business to locate in a specific city, is responsiveness on the part of city and economic development officials to each businesses' specific needs. The citizens of Iowa feel their cities are fulfilling their part of these expectations. Comments indicate that this same responsiveness is expected on the part of the Department of Transportation in realizing the impact any actions may have upon the communities.

The cities represented during the hearings exhibited a great deal of community pride and seemed to be making genuine strides in improving their quality of life. The pride the maintenance workers have in their community coupled with the added accountability they have to the citizens contributes to the quality of maintenance services provided. The absence of a facility in a town is thought to directly impact this quality of service. The citizens, on the whole, do not feel the quality would be equal when provided by a neighboring facility.

In conclusion, the citizens of Iowa are satisfied with their present service and are skeptical that any change would benefit their communities. The only changes that would be acceptable would be those that are clearly cost-justified in their eyes and would provide equal or better service to their communities. The expected level of service should provide optimum mobility nearly 24 hours a day in the winter as well as in the summer.

CHAPTER 5
FACILITY REQUIREMENTS

CHAPTER 5

FACILITY REQUIREMENTS

INTRODUCTION

The development of a viable plan for facility construction needs requires that we identify trends, estimate future conditions, and factors that must be considered in order to develop practical courses of action to meet the demands required by those conditions.

Chapters 2, 3, and 4 provide the information to identify trends, future conditions and other factors for consideration. We will use that information to develop criteria for establishing and locating maintenance facilities. Our analysis will concentrate upon determining which current facilities meet that criteria and what courses of action are available for consideration and analysis.

FUTURE CONDITIONS, TRENDS, AND FACTORS FOR CONSIDERATION

The future operating parameters for the maintenance operations in the state of Iowa are characterized as follows:

- No relaxing of demand by the public and industry for vehicular mobility, on the current basis of 24 hours per day and 365 days per year. Levels of Service for snow and ice control must remain as high as currently perceived by the public.

- The highway system will not materially change. Widening, reconstruction, relocation, and new construction will continue. However the net changes to the highway network will be minor in comparison to the 25,000 lane miles of highway currently maintained. The trends indicate that about 100 lane miles of higher service level highway will be added annually and varying amounts of lower service level highways will be transferred to local jurisdictions.

Maintenance requirements will increase due to aging of the highway system and increasing traffic. Emphasis will need to be placed on accomplishing greater amounts of routine maintenance.

- Total highway traffic will continue to increase both for truck and automobile traffic. Population shifts within the state will continue with the urban areas generally becoming more populated and the rural area population remaining static or decreasing. Traffic will reflect the population shifts to some degree with traffic in urban areas increasing more than in rural areas. This steady increase in traffic, particularly the truck traffic, will intensify the amount of highway maintenance required.

- Weather cycles do not appear to be permanently changing. Snow and ice control needs will remain at the traditional levels.

- The basic structure of the maintenance organization will not materially change. There will be a central maintenance function, a district maintenance function, and resident maintenance engineers responsible for maintenance areas. There will be continued pressures to control the staffing levels and perhaps reduce staff. Efficiency, productivity, and levels of service will demand constant attention. Management attention will focus on the performance of highway facilities as well as the performance of the maintenance organization.

- The need for more equipment to increase productivity will continue. Equipment capability, reliability and complexity will also increase. The added reliability would indicate that the need for mechanics, tooling, and repair space should decrease, but this will be partially offset by the increased amount of equipment to maintain and repair. Increased complexity indicates that specialized diagnostic equipment, tooling, and training needs will increase. Overall it appears that facility requirements for equipment and mechanics will not materially change.

MAINTENANCE FACILITY CRITERIA

In order to evaluate the applicability of any maintenance facility schema it is first necessary to define the design criteria that should be used to develop the locations of the facilities.

The following factors were used as design criteria in this analysis. These included:

- Required crew size to accomplish maintenance.
- Maximum travel distance to establish a service area.
- Minimum facility requirements to house the people, equipment and materials.
- Legal requirements to locate in counties with populations of 8,000 or more.

Each of these criteria are discussed below.

Required Crew Size

In the analysis, the first area examined was the crew size necessary to adequately staff the maintenance facilities. This was accomplished by reviewing current maintenance function standards for the Office of Maintenance. These are in the "Standards for Maintenance Activities Manual" provided to all the maintenance supervisors. From this manual, 46 activities were selected as work capable of being performed by the maintenance crews without assistance from district or central crews. Of these 46 activities, five are directly related to snow and ice control and are not used in determining crew size. Exhibit 5-1 shows the remaining 41 activities identified as normal highway maintenance activities along with the estimated crew size necessary to perform the work. A complete key to the category and maintenance activities is found in Appendix D. Based on information gathered during the interviews, between one and three people are necessary to safely perform traffic control at the site. This estimate includes those additional

Exhibit 5-1
ESTIMATED CREW SIZE BY ACTIVITY

CATEGORY 02 - ROADWAY SURFACE

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
609	Spall Patching	8
610	Temporary Blow-up Repair and Hand Leveling	5
612	Joint and Crack Filling	9
613	Pavement Replacement	10
615	Pavement Expansion Relief Joints	6
616	Joing and Crack Routing and Sealing	8
617	Permanent Surface Repair	8
618	Strip Sealing - Edge Sealing	14
619	Burn/Plane or Mill Surface	9
620	Brooming or Sweeping	6
621	Undersesl/Raise Pavement	9
622	Aggregate Surface Maintenance	4
625	Other Surface Maintenance Activities	6

CATEGORY 03 - SHOULDER MAINTENANCE

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
628	Repair Shoulders with Bituminous Mix	11
629	Seal Edge Ruts and Bituminous Shoulders	8
632	Shoulder Joint & Crack Filling/Sealing	7
633	Paved Shoulder Repair	4
634	Repair with Aggregate	2
636	Mow Shoulders	3
638	Hand Mowing	2
640	Blade Shoulders	10
641	Rebuild Shoulders with Earth	7
643	Other Shoulder Maintenance Activity	5

CATEGORY 04 - ROADSIDE MAINTENANCE

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
645	Roadside Mowing	2
646	Foliage Spraying	3
647	Brush and Tree Control	4
649	Litter Pick Up	4
650	Erosion Control	4
653	Other Roadside Maintenance Activities	3

CATEGORY 05 - DRAINAGE MAINTENANCE

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
655	Clean & Restore Roadside Ditches	7
655	Culvert Maintenance	7
659	Drain Tidle, catch Basins and Inlets	8
660	Other Drainage Activities	5

CATEGORY 06 - TRAFFIC SERVICES

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
667	Sign Maintenance	2
670	Guardrail Maintenance	5
671	Non-Primary Detours	2
672	Impact Attenuator Maintenance	5
674	Other Traffic Services Activities	4

CATEGORY 07 - SNOW AND ICE CONTROL

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
679	Snow Fencing	5

CATEGORY 08 - BRIDGE MAINTENANCE

ACTIVITY NUMBER	ACTIVITY	ESTIMATED CREW SIZE
683	Deck Repair	7
684	Clean Decks, Piers, Abutments, Expansion Joints.	8

personnel. Exhibit 5-2 shows the number of activities within the eight highway maintenance categories by the size of crew necessary to perform the work. Exhibit 5-3 provides a visual representation of the percentage of activities that can be performed by crews of various sizes.

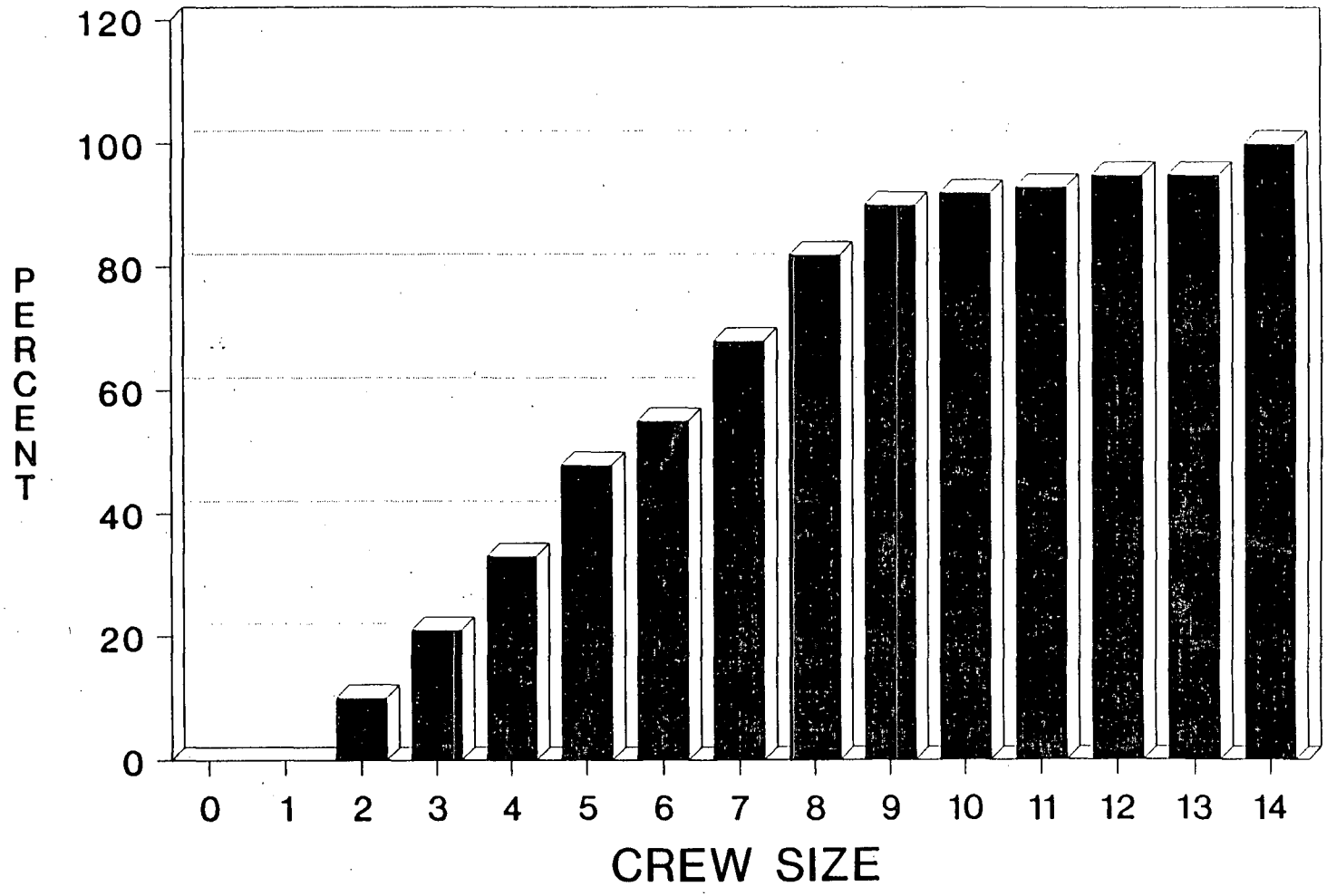
Exhibit 5-2

NUMBER OF ACTIVITIES BY CREW SIZE

Crew Size	Category 02	03	04	05	06	07	08	No. of Activities	Percent of Activities
2		2	1		2			5	12
3		1	3					4	10
4	1	1	2		1			5	12
5	1	1		1	2	1		6	15
6	3							3	7
7		2		2			1	5	12
8	3	1		1			1	6	15
9	3							3	7
10	1	1						2	5
11		1						1	2
12									
13									
14	1							1	2
Total	13	10	6	4	5	1	2	41	99

Exhibit 5-3

Percent of Activities by Crew Size



The number of activities that can be performed in a given month was examined. The data used in this analysis was also obtained from the activity standards. Exhibit 5-4 illustrates the number of activities which can be performed in each month. It can be noted that during the months of January through April, the number of maintenance activities that can be performed is reduced.

As Exhibit 5-3 illustrates, a minimum of 14 HEO's are required to perform all the maintenance activities required of a crew. Two additional HEO's should be added to the crew to allow for any individual absences without reducing the capability of the crew. This would indicate that a desired minimum crew size should be 16 HEO's. A review of the types of activities performed during the period between December and April indicates that a smaller crew size can be used. For December through April, the minimum number of HEO's is nine. This means that a minimum crew size could be 11 HEO's during this time period. This includes additional workers to allow for any leave or vacation.

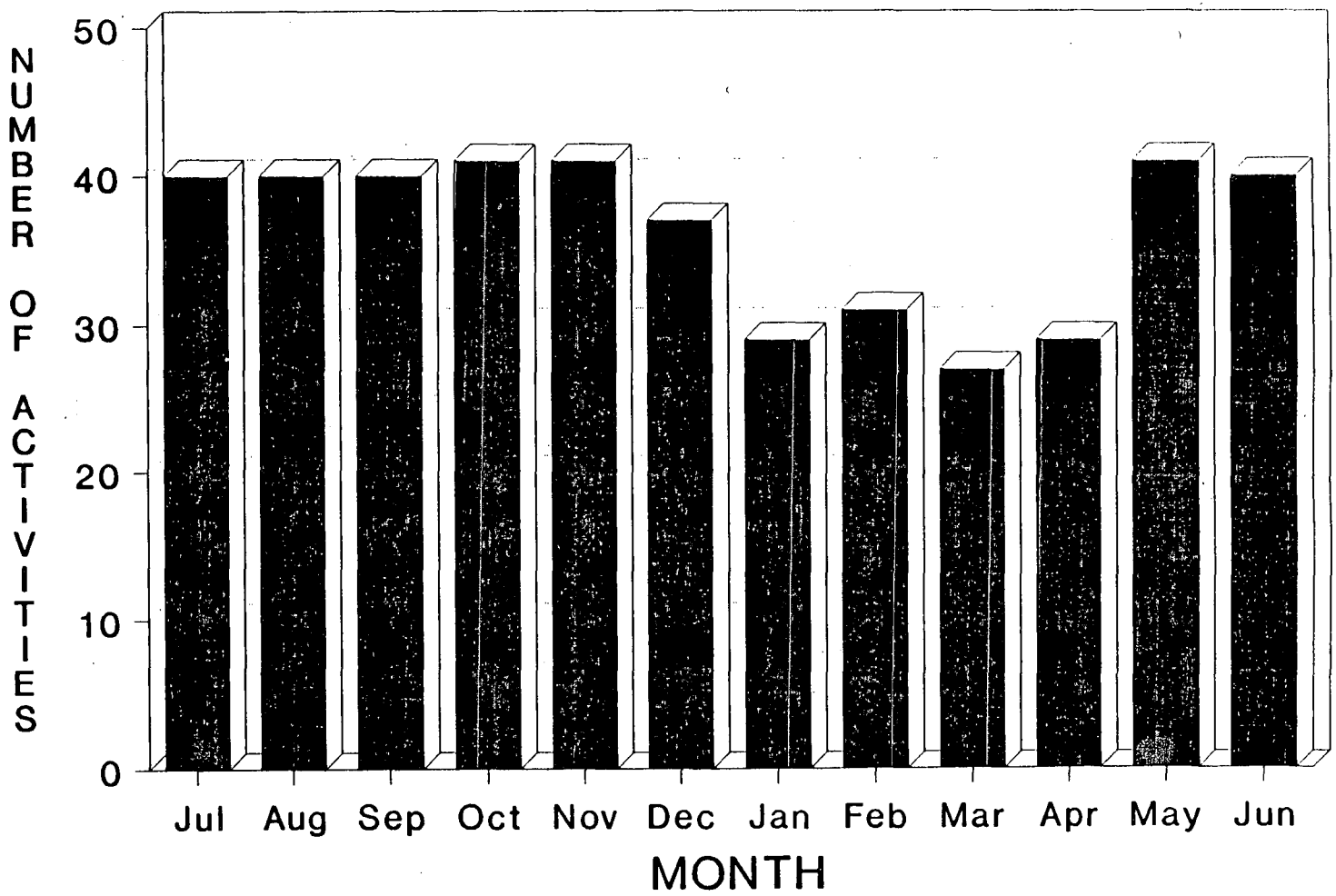
Based on interview comments received from maintenance supervisors throughout the state, when less than the recommended number of people are available for work, they take one of the following actions - labor resources must be combined with other crews, work is performed with fewer resources than recommended or the activities performed must be limited to those requiring smaller crews. It was also noted that using less than recommended resources potentially results in short cuts being taken and less than desired quality could result. As an example, in crack sealing operations the cracks may not be routed or thoroughly cleaned prior to sealing. Taking this shortcut means that the seals last about 2 years instead of 5 years.

Travel Distance

In order to locate facilities effectively, it is necessary to know the maximum distance from the maintenance facility which the crews can properly perform maintenance work. This aspect has been considered in two ways. These

Exhibit 5-4

Activities Performed by Month



include the travel time required to arrive at the work site from the facility, and the appropriate cycle time for snow and ice control operations on a portion of highway.

The amount of time required to arrive at the site where maintenance is to be performed is the travel time. This time is an important factor in establishing the distance a crew can travel from a facility before the productivity and efficiency suffers. The travel time is used primarily for the routine or scheduled type of work. The data gathered from other states and from the interviews of Iowa maintenance forces indicates the maximum time spent traveling to a site should be no more than 45 minutes. The travel speed is at about 40 miles per hour in rural areas and 20 miles per hour for urban areas. From this, the recommended travel distances are 30 miles for rural facilities and 15 miles for urban facilities.

Cycle time is related to travel time. It is used to define the interval of time between one complete performance of an activity. In this case, the controlling activity that defines the size of the service area is plowing snow and applying ice control chemicals. The cycle time for this activity is a function of the rate that the snow falls. To determine the cycle time, it is first necessary to determine the normal maximum intensity that a storm deposits snow. From the snowfall information, examined for this study, 1/2" per hour was selected as the normal maximum amount deposited. Next the number of inches that can be allowed to fall before it must be removed from the roadway must be determined. One inch was selected, as this is a common snow accumulation level before plowing is effective. If 1/2" of snow falls per hour and 1" accumulation is needed to effectively plow the snow on the roadway, the cycle time should be two hours. Of these two hours, approximately 1/2 hour would be used for deadheading, reloading, and driver rest periods which results in 1-1/2 hours of productive time in the cycle. Based on an average plow speed of 20 miles per hour, an average plow route should be 15 miles or 30 miles round trip. Under these criteria, the minimum recommended length for snow and ice control should be 15 miles. The Department currently uses a one-way distance of 20 miles and a higher plow speed.

Facility Requirements

The facility requirements for this analysis are buildings and land. Generally two types of buildings are needed. The first is the enclosed building that contains a crew assembly area, inside storage for winter snow fighting equipment, an office, and one or more work bays for equipment repair. It is important that the bay areas for the equipment storage be large enough to accommodate the trucks when snow blades are mounted. The second type of building is the covered storage area which is used to store equipment when not in use and materials that needs to be kept dry. The actual size of these buildings will vary with the size of crew, but as a minimum should be built to house the recommended minimum crew size of 16 HEO's.

The requirements for land area must consider the amount required for buildings, vehicle movement, outside storage and a buffer area between the maintenance area and surrounding neighbors. Sixe acres is considered the minimum lot size. Again the actual size will vary depending on the size of crew assigned to the facility. The facility should be located on the outskirts of a city but be able to take advantage of local utilities while causing the least disturbance to the citizens.

Legal

Certain legal requirements exist for the location of maintenance facilities in Iowa. The primary requirement is that any county over 8,000 in population must have a maintenance facility. The only other legal requirements of a legal or regulatory nature are that all OSHA and union requirements be met.

EXISTING FACILITIES REVIEW

The current facilities were reviewed to determine if they possessed the necessary capabilities. Three areas were reviewed; the age, the overall condition of the facility and their size in terms of lot size, building size and number of stalls. This review was performed for each of the 138 maintenance facilities included in the study.

The first area reviewed was the age of the facility. Buildings that are more than 50 years old are considered to have reached their design life expectancy and are based on obsolete design requirements. As mentioned in Chapter 2, 40 percent of the facilities are 50-59 years old and 20 percent are 60 or more years old. The replacement of these structures can cost many millions of dollars.

For the analysis of existing facilities we selected an age of 30 years or less in order to plan for the next 20 years and still have no facility older than 50 years. Very few facilities are between 30 and 50 years old and those that are have other deficiencies so that the number of current facilities that meet minimum age standards does not change.

The second area reviewed was the condition of the facility. Iowa DOT recently performed an analysis of this type through the use of an assessment procedure. This procedure examined six items, including efficiency of operation, combination potential, size of lot, size of garage, building maintenance cost and energy cost. From this assessment, a sufficiency rating was developed. This rating was combined with other subjective considerations by the Iowa DOT to develop a priority rating for replacing, upgrading or combining facilities. In our facility condition assessment, we used the size of garage data from this assessment developed by the DOT as a gauge to meeting the current needs of the facility.

The next assessment factor was the size of the lot where the current facility was located. Here we used a minimum lot size of six acres. It was determined that this amount of land is needed to adequately contain the facility and provide an adequate space to store equipment and maintenance materials. This is also the minimum size lot that is used by the Office of Maintenance in developing requirements for new maintenance facility sites.

The final assessment factor was the energy and building maintenance costs that are being experienced at the existing facilities. Again this data was taken from the DOT's sufficiency rating data. These costs were identified in the study as high, moderate, and low in the rating study. Any building with a high maintenance and operations cost was identified a candidate for replacement.

From these criteria, a total of 70 facilities met the minimum requirements for age, size, lot size, and cost of maintenance and operations. The number of facilities that met the various criteria are tabulated below.

Criteria	Number of Facilities
Age - 30 years or less	= 71
Building Capacity	= 84
Lot Size - 6 Acres or more	= 76
Energy and Maintenance Cost	= 75

Number of Criteria Met	Number of Facilities
Met all 4 criteria	= 70
Met 3 criteria	= 0
Met 2 criteria	= 7
Met 1 criteria	= 6
Met no criteria	= 55

A list of the 70 facilities that met the minimum requirements are shown on Exhibit 5-5. In addition 5 other sites have facilities currently under design or construction. These are:

Facility No.	Location
1308	Tama
2302	Waverly
3308	Sac City
5103	Sigourney
5303	Chariton

Exhibit 5-5

FACILITIES MEETING MINIMUM SIZE REQUIREMENTS

FACILITY NUMBER	FACILITY LOCATION	FACILITY NUMBER	FACILITY LOCATION
1103	IOWA FALLS	4104	C.B. 4TH STREET
1104	MARSHALLTOWN	4106	NEOLA
1105	AMES	4201	SIDNEY
1201	BOONE	4210	PACIFIC JUNCTION
1206	WABSTER CITY	4301	CORNING
1207	WILLIAMS	4303	DESOTO
1208	FORT DODGE	4401	ADAIR
1209	GOWRIE	4404	ATLANTIC
1304	NEWTON	4409	GUTHRIE CENTER
1305	GRINNEL	4410	HARLAN
1306	MALCOM	4412	PERRY
1401	ALTOONA	5101	BLOOMFIELD
1402	D.M. WEST	5106	KEOSAUQUA
1403	D.M. NORTH	5201	CENTERVILLE
2108	HANLONTOWN	5204	ALBIA
2109	LATIMER	5206	OTTUMWA
2202	ESTHERVILLE	5301	OSCEOLA
2203	GARNER	5302	LEON
2210	CLARION	5306	MARTENSDALE
2301	WATERLOO	5401	BURLINGTON
2403	ELKADER	5405	MUSCATINE
2411	CRESCO	5408	WASHINGTON
2414	DECORAH	6102	URBANA
3101	CHEROKEE	6106	CEDAR RAPIDS
3104	CORRECTIONVILLE	6107	MARION
3107	S.C. HAMILTON	6201	CLINTON
3108	S.C. LEEDS	6202	DeWITT
3109	SLOAN	6204	DAVENPORT
3201	DENISON	6206	SABULA
3202	MISSOURI VALLEY	6301	INDEPENDANCE
3205	ONAWA	6304	MANCHESTER
3305	EMMETSBURG	6307	DYERSVILLE
3402	SPIRIT LAKE	6401	TIPTON
4101	AVOCA	6405	WILLIAMSBURG
4103	C.B. NORTH	6407	OAKDALE

The state currently has land for one other site (2410 West Union) and is looking for land at 6 other sites.

Facility No.	Location
2105	Osage
4105	Oakland
4302	Greenfield (Legislative Mandate)
4308	Creston
5202	Oskaloosa
5402	Mt. Pleasant

Exhibit 5-6 shows all of the sites that meet the minimum requirements established for facilities (70), those currently under design or construction (5) and where the state currently has or is looking for land.

Crew Assigned

The next step taken was to examine the current maintenance facilities and determine how many meet the criteria as defined previously. In reviewing the crew size of the existing facilities, only 10 met the minimum of 16 or more HEO's. These included:

Crew	Facility Location	Number of HEO's
1105	Ames	18
1402	D.M. West	31
1403	D.M. North	30
2301	Wateloo	29
4103	C.B North	18
4106	Neola	16
6102	Urbana	17
6106	Cedar Rapids	26
6204	Davenport	32
5407	Oakdale	30

IOWA

EXISTING HIGHWAY GARAGES MEETING MINIMUM REQUIREMENTS

Exhibit 5-6

CURRENTLY UNDER DESIGN OR CONSTRUCTION

FACILITIES MEETING MINIMUM REQUIREMENTS

HIGHWAY GARAGES

INTERSTATE HIGHWAYS 80

U.S. HIGHWAYS 6

STATE HIGHWAYS 3

ROUTES NOT SHOWN 948

COUNTY SEAT

REVISED 03-01-89 CARTOGRAPHIC SECTION

All of these crews are located along interstate roads. Exhibit 5-7 illustrates that only about 9% of the crews have 16 or more HEO's. Based on the recommended minimum crew size (16) and the number of current HEO's, (1153), there should be sufficient personnel to staff approximately 70 facilities throughout the state.

Travel Distance

Currently all of the facilities serve areas that fall within the maximum distances as previously defined.

Legal

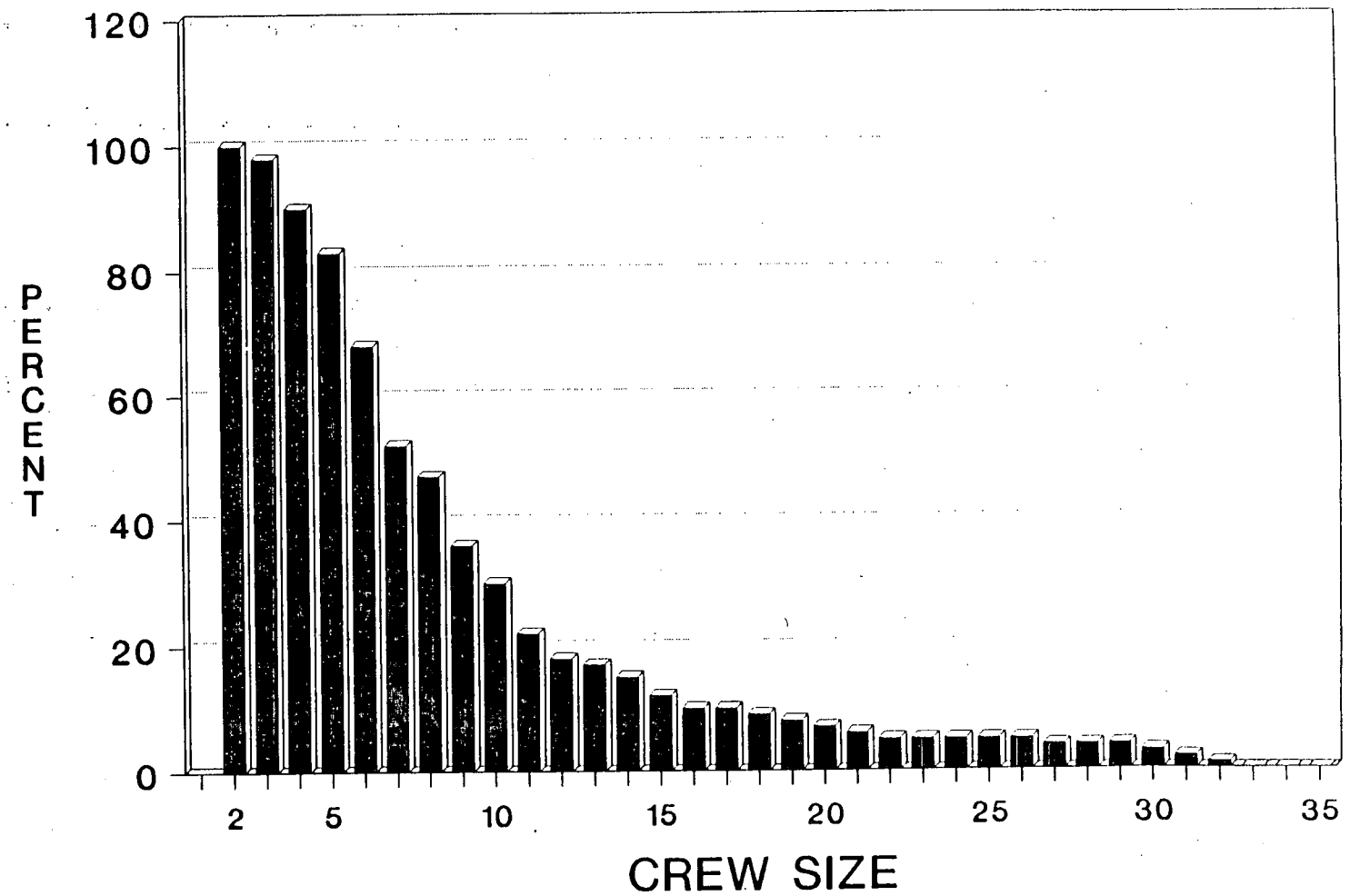
In order to determine the counties having a population of under 8000; data from 3 years was examined. The 3 years examined were 1980, 1987 and 2010. The population for 1980 is actual census data and 1987 is an estimate based on the most recent census counts. The 2010 estimate is based on DOT projections of population for future years.

The following tabulation shows the counties that have or are anticipated to have a population of less than 8,000.

County	1980	(Est) 1987	(Est) 2010
Adair	9509	8500	7746
Adams	5731	5400	4798
Audubon	8559	7800	7019
Decatur	9794	8700	6683
Freemont	9401	8900	7675
Monroe	9209	8500	7436
Osceola	8371	7800	7287
Ringgold	6112	5500	5245
Taylor	8353	7600	7928
Wayne	8199	7300	5516

Exhibit 5-7

Percent of Crews by Size



The facilities located in those with population projected to be less than 8,000 counties are:

County	Facility No.
Adair	4302,4401
Adams	4301
Audubon	4403
Decatur	5302
Freemont	4201
Monroe	5204
Osceola	3406
Ringgold	4307
Taylor	4209
Wayne	5307

Of these eleven facilities, facility No. 4401 in Adair County and those in Freemont, Adams, Decatur, and Monroe Counties meet the requirements for minimum size facilities.

ORGANIZATIONAL OPTIONS

There are three basic strategies for organizing the maintenance facilities. These include organizing to accommodate primarily cold weather (winter) maintenance operations, primarily warm weather (summer) maintenance operations, or some combination of winter and summer operations.

There is little doubt that the current maintenance organizational strategy is to provide winter maintenance (snow and ice control) on a priority basis; accomplish other maintenance in the cold and warm weather seasons when possible, and contract the remainder. This is a strategy that has evolved and one which the public accepts. It also accommodates the public's demands for high levels of service during the winter. This strategy lends itself to smaller but more numerous maintenance facility locations.

Organizing for summer or "warm weather" maintenance requires larger crews and consequently larger, but less numerous, maintenance facilities. The scheduled highway maintenance programs would be emphasized. Due to longer travel distances the initial response to snow and ice control would not initially be as effective under this strategy as the response under a winter maintenance strategy.

A "combination" strategy allows a high level of service to be provided on a year-round basis. Depending on the organization base that one starts from, this strategy requires that personnel and equipment be consolidated for summer operations or conversely augmented and dispersed for snow and ice control functions.

Each of these strategies will first be examined in terms of its feasibility, economic costs and its advantages and disadvantages.

Warm Weather Organizational Strategy

This approach is designed to best provide the maintenance services for the scheduled type of activities associated with spring, summer and fall. According to cost data provided by the state, scheduled maintenance work constitutes 70 percent of the money spent on highway maintenance related activities. Condition information available on the highway system indicates a trend of increasing deterioration which will accelerate unless more effort is concentrated on scheduled maintenance. One way to achieve that extra effort is through increased productivity. The California facility reorganization experience cited in Chapter 4 indicated significant gains in productivity were achieved when larger crews were formed. Larger crews ultimately allow the full spectrum of maintenance functions to be performed.

Based on the analysis of the activity needs and interviews, the size crew under this type of arrangement should be 16 HEO's, and one supervisor. Although the minimum number of workers is 14, two additional people have been added to the crew to allow for normal absences and still provide the minimum staff to accomplish the work. The drawback to this option is that during the

winter months, the assigned plow routes might be located far from the facility. Some initial response may occur as it may require a snow plowing unit to travel 15 miles or more to the start of the snow plow route. Prepositioning of equipment before a storm could alleviate the deadheading at the beginning of the storm but later trips to material storage locations to replace an abrasive or chemical load would still be required.

Cold Weather Organizational Strategy

This option is designed to locate the facilities in such a way that all snow plow routes begin at or near the facility. This method of locating facilities is used when the emphasis of the maintenance effort is placed on snow and ice control. Iowa spends only about 20 to 30 percent of its effort on snow and ice control. It places a very high emphasis on being on-site when needed during a storm. This expectation was also expressed by the public in the public hearings held throughout the state. From the analysis of activities and interviews with district personnel, the minimum crew size for this organizational strategy is eight HEO's and one mechanic.

This size of a crew will be capable of performing about 80 percent of the maintenance activities. Crews must be combined to perform tasks that demand a large number of crew members. Combining for large crew operations results in additional lost time for crews to team up and travel to the work site.

Combination Cold and Hot Weather Strategy

A third strategy is to establish the larger crew facilities for use during the spring, summer and fall periods and have staffed or unstaffed satellite facilities that are used only during the winter months. The staffed satellite option provides the larger crews required for a number of activities that are performed during the summer months and also disperses them to locations near the snow plow routes during the winter. The staffed satellite areas would only require a crew of five HEO's, therefore the summer maintenance area could be subdivided into as many as three areas for winter

operations. If the satellite facilities are unstaffed, they should provide material storage, communications and fuel, etc. so that crews working far from their central facility would not have to dead head. This should materially increase winter maintenance productivity.

Facility Requirements

In determining the number of facilities for each of the three strategies, the travel times or cycle times developed earlier were utilized. We attempted to use all of the existing maintenance facility sites that currently met the requirements criteria as discussed earlier. For the cold weather strategy, we were able to use 72 existing or programmed facilities, for the warm weather and combination strategies we were able to utilize 70 facilities. The total number of facilities required to provide statewide coverage was determined by defining the circumference of the service area assigned to these existing garages. This circumferences was defined by using the maximum driving distances as the radius. After the service areas were defined, new facility locations were established for the geographic areas that were not covered by the new service areas of adequate existing facilities.

The warm weather strategy allows use of 70 of the existing facilities and by adding three new facilities, the state highway network could be serviced. The cold weather strategy uses 72 of the existing facilities and requires 37 new facilities to cover the state wide highway network. Six of the new facilities are in towns that presently do not have facilities. The combination strategy offers two options; the first would be to use the same 73 facilities as identified in the warm weather strategy, plus 36 new satellite facilities. All of the satellite facilities would be in the same locations as those identified in the cold weather strategy but smaller in size. The second option would be to use the 73 facilities as identified in the warm weather strategy and to use the 36 satellite facilities for material and equipment storage only. This unstaffed satellite facility would include an enclosed storage facility, a garage for storing a front end loader and a small break/communications facility. Exhibit 5-8 indicates the number and type of facilities needed for each of the strategies.

Exhibit 5-8

Facility Needs

Facilities	Warm Weather Strategy	Cold Weather Strategy	Combination Strategies: Staffed Satellites	Combination Strategies: Unstaffed Satellites
Existing*	70	72	70	70
New				
- Warm Weather	3		3	3
- Cold Weather		37		
- Satellite (Staffed in Winter)			36	
- Satellite (Stockpile)				36
	73	109	109	109

It is clear from this macro type analysis that the DOT can provide maintenance to the highway system with significantly fewer facilities than it currently operates.

In the sections that follow, the personnel requirements and the cost of each of the facility options is presented. These represent estimates of staffing needs and the costs associated with facility rehabilitation and new construction and personnel transfer. We recognize that closure of facilities and transfer of personnel represent significant social and economic costs both to the individuals and families involved as well as the communities in which they live. The discussions presented are rather sterile. Once the magnitude the responsible and financial issues are known then a discussion of the social and economic considerations is presented.

Staffing Requirements

For each of the strategies, a different number of personnel are required to staff the number of facilities identified. Exhibit 5-9 shows the amount of personnel required for each strategy. These numbers were derived by leaving those individuals presently assigned to the facilities and augmenting as required, to reach the minimum number of HEO's for each strategy. All new garages were assumed to have at least the minimum number of HEO's called for by the strategy. The supervisory positions were similarly obtained by leaving the current numbers in those areas where the crews remain and assigning supervisors for each new facility. The mechanics for the warm weather and combination strategies were reassigned in a similar fashion. For the cold weather strategy, we assumed all of the facilities would have one working mechanic who could double as an HEO, and those facilities having over 16 HEO's would be assigned a full time mechanic.

As can be seen in Exhibit 5-9, the warm weather and combination strategies have a lower total staffing requirement than the maintenance staff that is currently maintained. It must be kept in mind that the analysis used the minimum crew sizes. Some of the crews will require more than the minimum to properly maintain their assigned service area. The cold weather strategy requires more staff than is currently authorized. Therefore, the authorization will have to be the increased or the crews will be short staffed. Actual staffing at individual facilities will depend upon work requirements in the service area.

A review was made of the different strategies and their ability to meet the legal requirement which stipulates that a facility must be located in all counties with a population of 8,000 or greater. Exhibit 5-10 provides a list of all counties where facilities would not be placed for each of the strategies. As illustrated in the warm weather strategy, 39 counties would have no facility in the county. Of these counties, are projected to have populations below 8,000 by the year 2010. In the cold weather strategy seven counties are projected to have no maintenance facility. One of these counties is projected to have a population less than 8,000 by the year 2010. The

combination strategy would require year-round crews in only 61 counties and facilities that would be used part of the year in all but five of the counties. However, we feel that use of satellite facilities that are used only part of the year do not qualify as meeting the legal requirement of having a true facility in the county. Thus none of the strategies satisfy the current law requiring a facility in all counties with a population over 8,000.

Exhibit 5-9

Minimum Field Personnel Requirements by Strategy

Labor Type	Warm Weather Strategy	Cold Weather Strategy	Combination Strategy	Current*
Supervisor	84	118	84	133
Mechanic	95	129	95	145
HEO	1,254	1,285	1,254	1,153
Total	1,433	1,532	1,433	1,431

*Excludes Bridge, Paint, Traffic, and Statewide Crews

Exhibit 5-10

COUNTIES WITHOUT MAINTENANCE FACILITIES BY STRATEGY

COUNTY	WARM STRATEGY	COLD STRATEGY
Adair*	X	
Allamakee	X	
Audubon	X	
Boone	X	
Buena Vista	X	X
Butler	X	X
Calhoun	X	
Carroll	X	
Chickasaw	X	
Clay	X	
Emmet	X	
Fayette	X	
Floyd	X	
Greene	X	
Grundy	X	
Henry	X	X
Humboldt	X	X
Jefferson	X	
Jones	X	
Kossuth	X	
Lee	X	
Lyon	X	
Madison	X	X
Mahaska	X	
Marion	X	
Mitchell	X	
Montgomery	X	
O'Brian	X	
Osceola*	X	
Page	X	
Pocahontas	X	
Plymouth	X	
Ringgold*	X	
Tama	X	
Taylor*	X	X
Union	X	
Wayne	X	
Winnebago	X	X
Wright	X	

* Counties with estimated population of less than 8,000 in the year 2010.

COSTS

The costs associated with the facility requirements for each of the strategies are the capital and personnel costs incurred by the Iowa DOT. The major cost items considered were costs associated with:

- obtaining new facilities,
- upgrading existing facilities,
- transfer of personnel, and
- the ongoing maintenance and utility requirements.

Capital Costs

In our three strategies we have identified four types and sizes of facilities.

- Warm weather facilities that will have at least 14 stalls.
- Cold weather facilities that will have at least nine stalls.
- Manned satellite facilities that would have five stalls.
- Stockpile Satellite facilities that would have a material storage building, stall for a front-end loader, and a building for crew rest area and communications.

The most costly portion of the facility costs is acquiring the land and constructing the building. We independently estimated and also reviewed cost estimates developed by the State for use in previous studies on facility replacement. From these two estimates we developed cost ranges for the construction of the four types of new facilities. Exhibit 5-11 identifies these four ranges and the selected estimating values used in this study.

Exhibit 5-11

New Facility Cost Estimates

Facility	Cost Range	Selected Estimating Value
New warm weather garage	$600,000 - $800,000	$700,000
New cold weather garage	$400,000 - $500,000	$450,000
New satellite (manned)	$100,000 - $250,000	$175,000
New satellite (stockpile)	$ 25,000 - $ 75,000	$ 50,000

Exhibit 5-12 provides the estimated capital cost of each of the three strategies and options.

Upgrading Existing Facilities

A number of the facilities that meet the minimum facility criteria do not have the number of garage stalls as specified in the capital costs section. However, the lot size allows for expansion of the facility to this size. The estimated cost to add stalls was determined by using $20 per square foot and assumed a bay of 25'x50' or $25,000 per stall needed. The warm weather and combination strategies requires 62 stalls to be added to existing facilities and 15 stalls for the cold weather strategy to bring them up to the required minimum.

Exhibit 5-12

ESTIMATED CAPITAL COST

TYPE OF FACILITY	WARM WEATHER STRATEGY	COLD WEATHER STRATEGY	COMBINATION STRATEGY OPTION 1	COMBINATION STRATEGY OPTION 2
REHABILATION				
NO. OF IMPROVEMENTS	62	15	62	62
COST AT $25,000	$1,550,000	$375,000	$1,550,000	$1,550,000
NEW-WARM WEATHER/COMBINATION				
NO. OF FACILITIES	3	0	3	3
COST AT $700,000	$2,100,000	$0	$2,100,000	$2,100,000
NEW-COLD WEATHER				
NO. OF FACILITIES	0	37	0	0
COST AT $450,000	$0	$16,650,000	$0	$0
NEW-COMBINATION SATELLITE (STAFFED)				
NO. OF FACILITIES	0	0	36	0
COST AT $175,000	$0	$0	$6,300,000	$0
NEW-COMBINATION SATELLITE (STOCKPILE)				
NO. OF FACILITIES	0	0	0	36
COST AT $50,000	$0	$0	$0	$1,800,000
TOTAL	$3,650,000	$17,025,000	$9,950,000	$5,450,000

Personnel Transfer Costs

Depending on the strategy selected a number of existing facilities could be closed and the work force transferred to other facility locations. Since the move would be directed by the DOT, the employee would be compensated. We assumed a cost of $10,000 per employee. For the warm weather and combination strategies, 401 people could potentially be potentially transferred. For the cold weather strategy 112 people could be transferred. We assumed that only 2/3 of these people would actually have to relocate. The remainder would live close enough to their workplace to commute or would choose not to move.

Exhibit 5-13 provides the estimated Transfer Costs for each of the strategies.

Exhibit 5-13

ESTIMATED PERSONNEL TRANSFER COST

	WARM WEATHER STRATEGY	COLD WEATHER STRATEGY	COMBINATION STRATEGY OPTION 1	COMBINATION STRATEGY OPTION 2
TOTAL POSSIBLE TRANSFERS	401	112	401	401
ESTIMATED NO. OF TRANSFERS	267	75	267	267
COST AT $10,000 PER TRANSFER	$2,670,000	$750,000	$2,670,000	$2,670,000

Exhibit 5-14 provides a table showing the estimated total cost of the strategies.

Exhibit 5-14

ESTIMATED TOTAL COST

	WARM WEATHER STRATEGY	COLD WEATHER STRATEGY	COMBINATION STRATEGY OPTION 1	COMBINATION STRATEGY OPTION 2
FACILITY CONSTRUCTION				
REHAB.	$1,550,000	$375,000	$1,550,000	$1,550,000
NEW-WARM WEATHER/COMBINATION	$2,100,000	$0	$2,100,000	$2,100,000
NEW-COLD WEATHER	$0	$16,650,000	$0	$0
NEW-COMB. SATELLITE (STAFFED)	$0	$0	$6,300,000	$0
NEW-COMB. SATELLITE (STKPL)	$0	$0	$0	$1,800,000
TOTAL	$3,650,000	$17,025,000	$9,950,000	$5,450,000
TRANSFER OF PERSONNEL	$2,670,000	$750,000	$2,670,000	$2,670,000
TOTAL COST	$6,320,000	$17,775,000	$12,620,000	$8,120,000

Maintenance and Utility Costs

Maintenance and energy costs are relatively minor and should not be significantly different for the various options and will not be factor in comparing course of action. The overall maintenance and energy costs will decrease in each of the strategies presented. This results from the reduction of the number of facilities and replacing older, less efficient structures with more energy-efficient buildings. The amount of savings will vary with the number and type of facilities in each strategy and we have no way of estimating those actual costs at this time. The important fact is that this cost element will decrease.

ECONOMIC CONSIDERATIONS

In order for the DOT to be more efficient and effective they need to consolidate their maintenance facilities. This allows them to take better advantage of equipment capabilities and to reap the benefits of larger maintenance crews. Unfortunately under the three options examined closures of existing facilities and the transfer of personnel would be required. We estimate that up to 20% of the maintenance staff may be transferred if the DOT decides to implement the consolidation options. There is a direct economic cost associated with these transfers. Individuals may be required to commute further, buy and sell real estate, spouses may need to leave a job and obtain employment in the new area. The DOT can pay for some of the relocation expenses and we have estimated some of the costs which are considerable.

The transfer of personnel, the closure of facilities and the opening of others provides the affected communities with net gains and losses. Under current pay scales in effect for maintenance workers, the average salary does not exceed $25,000. A goodly portion of this money will be spent within the community. Economic data published for Iowa by the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Input-Output Modeling System indicates that the loss per individual transferred would represent an earnings

loss of about $33,000 to the community and could result in a total reduction of 1.8 jobs (including the person transferred). The gain of a transferred employee would represent a similar increase in employment and earnings. For the warm weather and combination strategies there will be no economic change on a statewide basis as approximately the same number of workers will be employed throughout the state. In the cold weather strategy approximately 100 new maintenance workers would be added to the work force.

The concerns expressed by citizens at the public hearings were heavily directed at level of service and economic issues. In the long term, the DOT's major contribution to the economics of each community should be that of providing a well-maintained highway system to support industry and commerce throughout the state. This includes making changes to the system from time to time as the population traffic, urbanization and state needs dictates. As shown in Exhibits 5-13 through 5-15, there are considerable cost differences between maintenance organization strategies. Extra costs incurred on inefficient strategies mean less maintenance applied to the roadways. If the DOT is allowed to provide efficient maintenance levels to all communities, it will allow each community equal opportunity to attract industry without having to compete with its neighbors.

It is also our belief that the presence or absence of a maintenance facility in a community will not materially influence the underlying economic base. The economic health of a community is dependent on factors other than the presence or absence of DOT maintenance facility. In the short term, the local economic benefit of a facility may help treat symptoms, but it is not a cure.

ADVANTAGES AND DISADVANTAGES

Each of the strategies have certain advantages and disadvantages. The following table identifies some of the major advantages and disadvantages for the four strategies:

ADVANTAGES AND DISADVANTAGES BY STRATEGY

STRATEGY	ADVANTAGES	DISADVANTAGES
Warmer Weather	• Lowest cost strategy. • Places greater emphasis on highway maintenance. • Provides higher productivity due to larger crew size. • Maximizes utilization of adequate existing facilities.	• Does not meet legal population requirement for counties. • Requires relocating approximately 20% of maintenance work force. • Poor initial public perception. • Winter level of service may decrease.
Cold Weather	• Little change from current practice. • Maintains current public perception. • Affects the least number of communities.	• Most expensive strategy. • Does not easily accommodate increasing highway maintenance needs. • Least efficient operations. • Does not meet legal population requirement for counties.
Combination Staffed Satellites	• Provides appropriate balance between scheduled and unscheduled maintenance activities. • Maintains current public perception.	• Second most costly strategy. • Efficiency dependent upon seasonal conditions. • Personnel dissatisfaction may result. • Does not meet legal population requirement for counties.
Combination Unstaffed Satellites	• Second lowest cost strategy. • Places greater emphasis on highway maintenance. • Provides higher productivity due to larger crew size. • Maximizes utilization of adequate existing facilities. • Allows more efficient service of expanded operation area.	• Does not meet legal population requirement for counties. • Requires relocating approximately 20% of maintenance work force. • Poor initial public perception.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented in this chapter are the result of the facts and information gathered and the analysis made by the study team.

CONCLUSIONS

1. The level of the highway maintenance services now being provided by the DOT can be matched or improved upon, by operating larger, more productive crews that are based from an adequate maintenance facility.

2. The DOT does not need to operate 138 maintenance facilities. Analysis suggests that the proper number of facilities ranges from 70 to approximately 110. The exact number will depend on the organizational strategy chosen to accomplish maintenance.

3. At the present time, about 50 percent of the highway maintenance facilities in the state are in need of major rehabilitation or replacement due to their size, condition, or both. Many of the older facilities are not large enough to allow for storage of assigned trucks with snow plows attached. Many facilities have inadequate sized lots for accommodating the material and equipment storage requirements. Replacement of these inadequate existing garages will cost many millions of dollars.

4. The current location scheme of the maintenance facilities is geared primarily for snow and ice control. This has led to inefficiencies in maintenance from the resulting small sized crews. Many of the facilities were originally located based on equipment capabilities that existed when the structures were built. However, with today's equipment, the current capabilities are now much greater and the current facility locations and associated operational service areas do not take full advantage of the current equipment capabilities.

5. The citizens of Iowa expect a fairly high level of service on the roads they travel. In general, they believe the state is currently providing them with a high level of service. They expect this level to continue. The citizens do not believe that any improvements in the way in which the maintenance facilities are currently organized will provide a level of road maintenance service to their communities equal to that which they currently receive.

6. The public does not want any changes to the present facility locations. Change to the citizens means lower levels of and less responsive service. Change also causes adverse economic impacts on the communities which lose their facilities. The Department's on-site employees generally align themselves with the public's opinion. The DOT being forced to operate with less efficiency was not a concern.

7. The Department must sooner or later adopt an approach which will align their facilities, capabilities, and maintenance needs. Delaying or utilizing an ad hoc approach only makes the future solutions less effective and more costly. In this respect we do not see any approaches or options which are totally satisfactory to the public or to many of the Department's field maintenance employees. There will be social and economic hardships. These may be mitigated to some degree through actions taken by the Department but not everyone will be satisfied. The Department needs to approach this in a deliberate and committed manner and fully inform the public.

8. The legislative requirement that maintenance facilities be located in all counties in Iowa with populations greater than 8,000 serves purposes other than highway maintenance. This requirement is not compatible with optimum location of maintenance facilities. Significant shifts in population are occuring and will continue to occur in Iowa. The DOT cannot be expected to base their maintenance facilities locations on the shifts in population.

9. Citizens do not like the Level of Service "D" designation for highways. The Department would reap a large public relations benefit at almost no cost if this designation was done away with. If the Department chooses to do so, the resource allocation formula and the policy with respect to chemical usage on these roads may need to be altered.

10. The Department needs to update its Maintenance Management System so that it can take advantage of the vastly improved capabilities of modern systems.

11. The Department needs to develop an Equipment Management System. The equipment fleet is too large and too costly not to have a formalized management information system for use by the Department's managers.

RECOMMENDATIONS

1. We recommend that the Department establish a program whose goal will be to involve and educate the public and DOT employees concerning maintenance needs and requirements. It is our opinion that if the public and Department field staff better understand what the Department is trying to accomplish and why, they will be more supportive of Departmental needs regarding maintenance activities. This program could be developed in two phases. The first would be to establish a Citizens Advisory Committee on highway maintenance at district or higher levels of the DOT. This would provide the Department means to routinely involve the citizens of the state in the decisions that affect their communities. The second phase would be to establish a public information program that would educate the citizens of Iowa in the long-term maintenance concerns and goals of the Department.

2. We recommend that the Department adopt a facility organizational strategy that provides a better balance between snow and ice control and routine maintenance. Iowa should no longer continue with the present organization. The road system is reaching an age where more

and more effort will be required to keep the roads in their current condition. Maintaining the current number of facilities could require replacement of approximately 63 facilities. Although this would do much for the public perception of "local" crews, it would be very costly for the Department and the State. Thus, the Department must select a facility reduction strategy that provides the best mix of the Department's goal of providing efficient and effective service with the goal of creating a positive public image and gaining public support. While our personal preference would be a combination strategy using unstaffed satellite facilities, we feel that it would be presumptuous to offer a single best strategy to the Department. We can, however, relate each of the strategies to these two goals through the following table. The Department can then select the strategy that best reflects the State's desires. The strategies are listed from the lowest implementation costs to the highest.

	GOALS	
Strategy	DOT	PUBLIC
Warm Weather	Provides the best in effectiveness and efficiency.	Winter response may be slow. Affects the largest segment of the public due to the large number of closings. Also requires a large number of transfers of personnel.
Combination-Unstaffed Satellites	Provides the best overall balance and effectiveness but has a higher cost than warm weather strategy due to building unstaffed satellite facilities.	Similar to warm weather but still provides some local personnel in the satellite locations during winter storms which is the time thought most critical by the public.

Combination-Staffed Satellites	Provides fair effectiveness and efficiency during summer months. Winter response good, but not as efficient or balanced during time when satellites are staffed. Higher costs due to building satellites facilities.	Similar to unstaffed satellites strategy but has a higher presence during the winter months.
Cold Weather	Poor summer/winter balance. Not as effective due to smaller staff requiring sharing of labor to perform some activities. Highest cost due to building the most full size facilities.	Affects the least number of public due to less closings. Also has the lowest number of transfers of DOT personnel.

3. It is recommended that the Department implement the consolidation outlined above over a five or six year period. For example, one district per year could be consolidated. District 3 requires the most changes and District 1 and 6 require the least. Because Districts 2, 4, and 5 will have approximately an equal number of closures, it is recommended that the implementation begin in District 2, 4 or 5.

4. It is recommended that the Department take action prior to implementing their selected strategy to modify or rescind the current legislative requirement for a maintenance facility in every county with a population of 8,000 or greater. These conditions would require a much larger number of maintenance facilities to meet the future maintenance demands of the highway system. Further, as population shifts continue, the number and location of counties with more or less than 8,000 population can change and create compliance problems.

5. We recommend that the Department do away with the Level of Service "D" designation on the primary road system. The State maintains the Interstate and Primary Systems, while local governments maintain the Secondary System. Level of Service "D" is used on about 23 percent of the State-maintained lane mileage. This Level of Service provides snow plowing on a daytime basis, abrasives are used but existing policy does not allow for the routine use of chemicals to encourage the melting of ice and snow. This is a fairly low level of winter service for a primary highway. Comments received during the public hearings indicated that the public was not in favor of the "D" service level. The inconvenience and safety aspects were truly a concern to many people. The "D" level roads can demand more maintenance effort because the packed snow and ice requires extensive mechanical effort to return the roads to a clear condition. The additional use of chemicals on these roads should not adversely affect the environment since the state has a current procedure on the application rate of chemicals.

6. We recommend that the level of maintenance services provided by the Department be measured. This will provide a means for the Department to document and inform the public of the changes in levels of service that will occur as a result of the transition to a more balanced maintenance program. Also, by measuring the levels of service provided by the various crews, management will be provided with a gauge to identify those crews that might need help in terms of training or additional resources to provide the quality of maintenance expected by the Department and the public.

7. It is recommended that the Department improve the amount and quality of the management information provided to the maintenance managers on their highway and equipment maintenance operations. This can be accomplished by revising the current Maintenance Management System (MMS) to one that takes advantage of the latest concepts of managing maintenance. We also recommend that the Department develop an

Equipment Management System (EMS) to help control the large fleet of equipment the Department currently maintains. Such a system can track utilization, costs and repair histories; schedule preventive maintenance; provide information for determining optimum replacement times for equipment, provide specification information; and help achieve an appropriate fleet size and mix of equipment.

APPENDICES

A. Sufficiency Ratings and Year Built by Facility
   Sample Inspection Form
   Iowa Maintenance Facilities Statistics

B. Summary of Responses to Questionnaire
   Completed by Iowa Maintenance Personnel

C. Road Maintenance Personnel by State
   State Highway Maintenance Organizations

D. Maintenance Category and Activity Key

APPENDICES

A. Sufficiency Ratings and Year Built by Facility
Sample Inspection Form
Iowa Maintenance Facilities Statistics

Sufficiency Ratings and Year Built by Facility

NO.	FACILITY NAME	SUFFICENCY RATING	YEAR BUILT
1101	GRUNDY CENTER	16	29
1103	IOWA FALLS	36	76
1104	MARSHALLTOWN	35	71
1105	AMES	36	66
1106	COLO	16	20
1201	BOONE	36	71
1204	JEFFERSON	22	27
1206	WEBSTER CITY	36	73
1207	WILLIAMS	36	69
1208	FORT DODGE	37	78
1209	GOWRIE	36	75
1301	COLFAX	18	28
1304	NEWTON	36	63
1305	GRINNELL	36	76
1306	MALCOM	35	65
1308	TAMA	5	28
1309	TRAER	15	28
1401	ALTOONA	36	67
1402	D. M. WEST	33	71
1403	D. M. WEST	33	60
2101	MASON CITY	24	29
2102	CHARLES CITY	19	33
2104	HAMPTON	22	30
2105	OSAGE	15	30
2108	HANLONTOWN	36	71
2109	LATIMER	35	74
2202	ESTHERVILLE	36	73
2203	GARNER	38	81
2204	HUMBOLT	18	30
2205	ALGONA	16	28
2206	GERLED	18	29
2209	FOREST CITY	18	30
2210	CLARION	36	62
2301	WATERLOO	33	72
2302	WAVERLY	11	36
2304	ALLISON	12	41
2306	PARKERSBURG	12	29
2307	NEW HAMPTON	25	35
2402	WAUKON	20	29
2403	ELKADER	36	76
2409	DELWEIN	15	30

NO.	FACILITY NAME	SUFFICENCY RATING	YEAR BUILT
2410	WEST UNION	14	30
2411	CRESCO	35	72
2414	DECORAH	36	75
3101	CHEROKEE	36	75
3102	AKRON	26	52
3103	LEMARS	14	30
3104	CORRECTIONVILLE	35	71
3107	S. C. HAMILTON	31	61
3108	S. C. LEEDS	35	78
3109	SLOAN	36	62
3201	DENISON	NA	New
3202	MISSOURI VALLEY	35	66
3203	IDA GROVE	13	39
3204	MAPLETON	17	30
3205	ONAWA	33	63
3206	SOLDIER	16	30
3301	STORM LAKE	24	40
3302	ROCKWELL CITY	12	31
3303	CARROLL	23	27
3305	EMMETSBURG	36	76
3306	POCAHONTAS	19	29
3308	SAC CITY	4	28
3401	SPENCER	15	40
3402	SPIRIT LAKE	36	76
3403	ROCK RAPIDS	18	29
3404	PAULLINA	18	30
3405	SHELDON	16	41
3406	SIBLEY	22	30
3407	ALTON	21	54
3409	ROCK VALLEY	22	30
3901	MOVILLE	29	NA
4101	AVOCA	36	65
4103	C. B. NORTH	36	73
4104	C. B. 4TH STREET	36	59
4105	OAKLAND	5	39
4106	NEOLA	36	70
4201	SIDNEY	36	72
4204	RED OAK	15	30
4205	CLARINDA	5	42
4208	SHENANDOAH	5	28
4209	BEDFORD	16	36

NO.	FACILITY NAME	SUFFICENCY RATING	YEAR BUILT
4210	PACIFIC JUNCTION	36	70
4301	CORNING	36	76
4302	GREENFIELD	15	28
4303	DESOTO	34	68
4306	WINTERSET	14	27
4307	MOUNT AYR	14	27
4308	CRESTON	15	28
4401	ADAIR	19	60
4403	HAMLIN	30	31
4404	ATLANTIC	38	81
4409	GUTHRIE CENTER	36	73
4410	HARLAN	36	76
4412	PERRY	36	70
4901	CASEY	28	31
5101	BLOOMFIELD	36	76
5102	FAIRFIELD	22	28
5103	SIGOURNEY	10	37
5105	DONNELLSON	30	34
5106	KEOSAUQUA	36	70
5201	CENTERVILLE	NA	New
5202	OSKALOOSA	19	28
5203	KNOXVILLE	19	28
5204	ALBIA	36	75
5206	OTTUMWA	31	65
5301	OSCEOLA	36	61
5302	LEON	36	70
5303	CHARITON	22	28
5304	INDIANOLA	13	28
5306	MARTENSDALE	36	59
5307	CORYDON	12	28
5401	BURLINGTON	36	70
5402	MOUNT PLEASANT	17	30
5403	COLUMBUS JCT.	18	30
5404	WAPELLO	23	61
5405	MUSCATINE	36	70
5408	WASHINGTON	36	74
5900	OLD OTTUMWA	29	29
6101	BLAIRSTOWN	5	28
6102	URBANA	38	82
6103	ANAMOSA	20	30
6105	WYOMING	17	41

NO.	FACILITY NAME	SUFFICENCY RATING	YEAR BUILT
6106	CEDAR RAPIDS	34	71
6107	MARION	38	82
6201	CLINTON	36	70
6202	DeWITT	36	74
6204	DAVENPORT	34	63
6205	MAQUOKETA	11	31
6206	SABULA	36	70
6301	INDEPENDENCE	36	79
6304	MANCHESTER	36	72
6306	DUBUQUE	15	56
6307	DYERSVILLE	NA	NEW
6401	TIPTON	36	63
6402	STANWOOD	22	29
6405	WILLIAMSBURG	36	65
6407	OAKDALE	36	64

Pub. 167
12-87

Iowa Department of Transportation

Sample Inspection Form

Maintenance Quality Survey Evaluation Form

Date _____

Highway Number _____ Maintenance Area _____ Milepost No. From-To _____ Miles Surveyed _____

Surface Type _____ Res. No. _____

Pavement Surface

Item	Criteria For Deductions	Weight (Effect.)	Score (1-10)	Subtotal
Patching	Any spalls, corner breaks, pitting, raveling or other surface defects.	35%	( ) / 10	(.35)
Joint & Crack Filling or Sealing	Any area needing to be sealed to correct map cracking, abrasion, raveling, checking, dry surface, weathering and wheel rutting. Also to seal centerline and pavement widening cracks.	35%	( ) / 10	(.35)
Surface Restoration	Any surface needing to be leveled or burned/planed to correct uneven surface, bumps, ripples, heaved joints, and eliminate wheel ruts.	30%	( ) / 10	(.30)

Total for Pavement Surface _____

Shoulder Maintenance

Item	Criteria For Deductions	Weight (Effect.)	Score (1-10)	Subtotal
Surface Condition	a.) Ruts and distortions b.) cracks and holes needing to be sealed or filled c.) general ability to carry road speed traffic in emergency for short distance	40%	( ) / 10	(.40)
Pavement Edge Drop-Off & Joint	Any edgerut 1½" deep or more. Any joint needing to be sealed or sterilized.	40%	( ) / 10	(.40)
Slope	When slope is 1" or more plus or minus from standard.	20%	( ) / 10	(.20)

Total for Shoulder Maintenance _____

Traffic Services

Item	Criteria For Deductions	Weight (Effect.)	Score (1-10)	Subtotal
Signs & Guardrail	General rating based on condition, readability & plumbness of signs. Check overall condition of guardrail.	50%	( ) (.50) / 10	
Markings	Any high-fill marker, Delineator, R.R. marking, and directional arrow missing or needing paint. Also check for plumbness.	50%	( ) (.50) / 10	

Total for Traffic Services _____

Roadside

Item	Criteria For Deductions	Weight (Effect.)	Score (1-10)	Subtotal
Median & ROW	Weeds needing to be sprayed or mowed to improve appearance or sight distance. Any trees or brush on foreslope or bottom of ditch.	40%	( ) (.40) / 10	
Roadside Ditch Drainage & Litter Control	Look for any slides or blockages in ditches that would inhibit drainage. Cattails are good indication of standing water.	30%	( ) (.30) / 10	
Shoulder, Median & ROW Mowing	Not conforming to Policy.	30% / 10	( ) (.30)	

Roadside Total _____

Condition	Weight (Effectiveness)	Score (1-10)	Subtotal
Pavement Surface	40%	( ) (.40) =	
Shoulder	30%	( ) (.30) =	
Traffic Services	20%	( ) (.20) =	
Roadside	10%	( ) (.10) =	

Maintenance Quality Level _____

Surface Type

Mile Post No. Beg. End

Additional Comments

_____
Signature of Rater

Iowa Maintenance Facilities Statistics

GARAGE NO.	LOCATION	NO OF STAFF	NO OF SUPVR	NO OF MECHS	NO OF WRKRS	NO OF TKS	CNTR LINE MILES	LANE MILES
1101	GRUNDY CENTER	7	1	1	5	5	62	129
1103	IOWA FALLS	8	1	1	6	7	77	150
1104	MARSHALLTOWN	14	1	2	11	9	125	277
1105	AMES	23	2	3	18	15	110	321
1106	COLO	6	1	0	5	4	53	113
1201	BOONE	12	1	1	10	10	94	230
1204	JEFFERSON	10	1	2	7	6	87	180
1206	WEBSTER CITY	10	1	1	8	8	67	176
1207	WILLIAMS	17	1	1	15	12	103	275
1208	FORT DODGE	13	1	1	11	9	89	223
1209	GOWRIE	5	0	0	5	5	71	144
1301	COLFAX	10	1	1	8	8	64	161
1304	NEWTON	12	1	1	10	8	83	206
1305	GRINNELL	12	1	1	10	7	76	190
1306	MALCOM	11	1	1	9	8	84	201
1308	TAMA	7	1	1	5	5	56	121
1309	TRAER	6	1	0	5	5	67	140
1401	ALTOONA	10	1	1	8	8	71	184
1402	D. M. WEST	36	2	3	31	25	123	442
1403	D. M. NORTH	36	3	3	30	26	146	439
		265	23	25	217	190	1707	4311

GARAGE NO.	LOCATION	NO OF STAFF	NO OF SUPVR	NO OF MECHS	NO OF WRKRS	NO OF TKS	CNTR LINE MILES	LANE MILES
2101	MASON CITY	12	1	2	9	6	71	181
2102	CHARLES CITY	8	1	1	6	6	62	131
2104	HAMPTON	3	0	0	3	3	39	78
2105	OSAGE	8	1	1	6	6	75	159
2108	MANLONTOWN	17	1	2	14	12	104	289
2109	LATIMER	11	1	2	8	8	53	157
2202	ESTHERVILLE	6	1	1	4	4	63	131
2203	GARNER	7	1	1	5	5	73	150
2204	HUMBOLT	0	0	0	0	0	0	0
2205	ALGONA	10	1	2	7	6	95	202
2206	GERLED	3	0	0	3	3	40	82
2209	FOREST CITY	6	1	1	4	4	67	139
2210	CLARION	9	1	2	6	6	86	185
2301	WATERLOO	34	3	2	29	25	180	547
2302	WAVERLY	10	1	1	8	7	90	192
2304	ALLISON	7	1	1	5	4	58	122
2306	PARKERSBURG	3	0	0	3	2	32	67
2307	NEW HAMPTON	9	1	1	7	6	76	149
2402	WAUKON	9	1	1	7	6	97	206
2403	ELKADER	10	1	1	8	7	99	214
2409	OELWEIN	5	0	0	5	4	56	123
2410	WEST UNION	10	2	2	6	6	104	213
2411	CRESCO	7	1	1	5	5	69	144
2414	DECORAH	9	1	2	6	6	85	182
		213	22	27	164	147	1775	4044

GARAGE NO.	LOCATION	NO OF STAFF	NO OF SUPVR	NO OF MECHS	NO OF WRKRS	NO OF TKS	CNTR LINE MILES	LANE MILES
3101	CHEROKEE	8	1	1	6	5	75	166
3102	AKRON	6	1	1	4	5	60	123
3103	LEMARS	9	1	1	7	6	75	184
3104	CORRECTIONVILLE	8	1	1	6	5	72	163
3107	S. C. HAMILTON	16	1	2	13	9	45	149
3108	S. C. LEEDS	11	1	1	9	8	68	196
3109	SLOAN	11	1	1	9	6	66	183
3201	DENISON	11	1	1	9	8	102	226
3202	MISSOURI VALLEY	16	1	1	14	12	119	294
3203	IDA GROVE	6	1	0	5	4	53	107
3204	MAPLETON	4	0	1	3	3	32	66
3205	ONAWA	14	1	2	11	8	72	197
3206	SOLDIER	2	0	0	2	2	107	71
3301	STORM LAKE	10	1	1	8	8	102	216
3302	ROCKWELL CITY	8	1	1	6	6	79	157
3303	CARROLL	10	1	1	8	7	83	230
3305	EMMETSBURG	7	1	1	5	5	74	156
3306	POCAHONTAS	10	1	1	8	8	104	215
3308	SAC CITY	8	1	1	6	5	74	155
3401	SPENCER	8	1	1	6	6	70	154
3402	SPIRIT LAKE	7	1	1	5	5	69	162
3403	ROCK RAPIDS	8	1	1	6	5	76	161
3404	PAULLINA	4	0	0	4	3	52	105
3405	SHELDON	5	1	1	3	3	81	61
3406	SIBLEY	6	1	1	4	5	61	124
3407	ALTON	6	1	1	4	4	51	108
3409	ROCK VALLEY	5	0	0	5	3	49	102
		224	23	25	176	154	1973	4232

GARAGE NO.	LOCATION	NO OF STAFF	NO OF SUPVR	NO OF MECHS	NO OF WRKRS	NO OF TKS	CNTR LINE MILES	LANE MILES
4101	AVOCA	16	1	1	14	13	68	203
4103	C. B. NORTH	20	1	1	18	13	64	210
4104	C. B. 4TH STREET	12	1	2	9	10	59	172
4105	OAKLAND	7	1	1	5	5	77	162
4106	NEOLA	13	1	1	16	13	74	224
4201	SIDNEY	12	1	1	10	9	103	258
4204	RED OAK	10	1	1	8	6	96	212
4205	CLARINDA	3	0	0	3	2	30	63
4208	SHENANDOAH	8	1	1	6	5	55	115
4209	BEDFORD	8	1	1	6	4	79	164
4210	PACIFIC JUNCTION	16	1	1	14	10	96	267
4301	CORNING	6	1	1	4	5	67	141
4302	GREENFIELD	6	1	1	4	4	52	104
4303	DESOTO	17	1	1	15	10	81	224
4306	WINTERSET	5	1	0	4	5	58	120
4307	MOUNT AYR	7	1	1	5	5	69	139
4308	CRESTON	8	1	1	6	5	71	157
4401	ADAIR	17	1	1	15	11	69	211
4403	HAMLIN	2	0	0	2	2	70	77
4404	ATLANTIC	12	1	1	10	8	131	276
4409	GUTHRIE CENTER	8	1	1	6	6	90	186
4410	HARLAN	9	1	1	7	7	96	199
4412	PERRY	9	1	1	7	7	79	176
		236	21	21	194	165	1732	4059

GARAGE NO.	LOCATION	NO OF STAFF	NO OF SUPVR	NO OF MECHS	NO OF WRKRS	NO OF TKS	CNTR LINE MILES	LANE MILES
5101	BLOOMFIELD	7	1	1	5	4	72	151
5102	FAIRFIELD	6	1	1	4	5	47	100
5103	SIGOURNEY	10	1	1	8	8	110	226
5105	DONNELLSON	12	1	1	10	8	134	300
5106	KEOSAUQUA	5	0	1	4	5	72	148
5201	CENTERVILLE	8	1	1	6	6	90	190
5202	OSKALOOSA	11	1	1	9	7	101	219
5203	KNOXVILLE	12	1	1	10	8	108	236
5204	ALBIA	7	1	1	5	5	59	125
5206	OTTUMWA	12	1	2	9	7	79	197
5301	OSCEOLA	15	1	1	13	10	85	229
5302	LEON	14	1	1	12	10	104	261
5303	CHARITON	9	1	1	7	6	73	151
5304	INDIANOLA	6	0	0	6	5	69	170
5306	MARTENSDALE	13	1	1	11	8	53	170
5307	CORYDON	7	1	1	5	5	60	127
5401	BURLINGTON	12	1	1	10	8	90	217
5402	MOUNT PLEASANT	8	1	1	6	7	75	171
5403	COLUMBUS JCT.	5	1	1	3	4	47	95
5404	WAPELLO	3	0	0	3	2	81	67
5405	MUSCATINE	13	1	1	11	9	115	262
5408	WASHINGTON	12	1	1	10	8	122	251
		207	19	21	167	145	1844	4064

GARAGE NO.	LOCATION	NO OF STAFF	NO OF SUPVR	NO OF MECHS	NO OF WRKRS	NO OF TKS	CNTR LINE MILES	LANE MILES
6101	BLAIRSTOWN	5	0	0	5	4	48.69	102
6102	URBANA	21	2	2	17	15	112.13	307
6103	ANAMOSA	9	1	1	7	6	81.81	171
6105	WYOMING	4	0	0	4	3	55.07	111
6106	CEDAR RAPIDS	32	3	3	26	23	87.38	289
6107	MARION	10	1	1	8	8	58.8	186
6201	CLINTON	6	0	0	6	5	44.36	117
6202	DeWITT	19	2	2	15	13	100.08	271
6204	DAVENPORT	38	3	3	32	26	151.39	463
6205	MAQUOKETA	10	1	1	8	6	82.79	171
6206	SABULA	3	0	0	3	2	62.13	125
6301	INDEPENDENCE	13	1	1	11	11	107.68	267
6304	MANCHESTER	13	1	2	10	11	107.87	253
6306	DUBUQUE	16	2	2	12	10	100.95	259
6307	DYERSVILLE	12	1	1	10	10	75.97	191
6401	TIPTON	17	2	2	13	9	66.78	189
6402	STANWOOD	4	0	0	4	4	37.62	77
6405	WILLIAMSBURG	18	2	2	14	13	111.72	283
6407	OAKDALE	36	3	3	30	23	191.94	533
		286	25	26	235	202	1685	4366

APPENDICES

B. Summary of Responses to Questionnaire Completed by Iowa Maintenance Personnel

Questionnaire Summary

1. How well do you feel the department is doing in terms of comfort of ride, appearance of the highway in general and the overall condition?

Overall		Your Area	
	Excellent	1	Excellent
22	Good	21	Good
9	Fair	9	Fair
	Poor		Poor

2. Rank the following maintenance functions in the order of importance to you. (1 most important and 10 least important)

6	Pavement Patching
1	Blow up Repair
5	Sign Replacement or Repair
9	Mowing
3	Snow Removal
7	Drainage
4	Shoulder Drop-off
2	Ice Control
10	Litter Pick up
8	Overlays

3. How responsive do you feel the Department of Transportation is in terms of responding to various emergency or unscheduled maintenance functions? If inadequate please provide a reason.

	Adequate	Inadequate	Reason
Emergency Pothole Patching	27	4	
Plowing Snow	28	3	
Emergency Sign Repair	29	2	
Ice Control	27	4	
Blow-up Repair	31	0	
Guardrail Repair	28	3	

4. Based on the work requirements of your portion of the highway network, do you feel you are doing:

	All of the Required Work	Most of The Required Work	Some of The Required Work
Permanent Patching	0	13	18
Overlays	1	10	20
Sign Replacement	13	17	1
Guardrail Repair	12	19	5
Drainage	0	16	14
Bridge Repair	1	15	15
Mowing	6	22	3
Litter Pick-up	3	22	6
Crack Sealing		6	5

5. Have you received complaints about maintenance services in your area? Check Yes or No and give information requested for that response.

___ yes, how long does it take for them to respond. (If over 4 hours give in terms of days or partial days)

Unscheduled maintenance	5.3 hours (1hour to 5 days)
Scheduled maintenance	4.75 days

___ No, explain why you think you do not receive complaints?

_____

_____

6. How important do you believe the proximity of a maintenance garage is to a work location for responding to maintenance work?

	Very Important	Important	Somewhat Important	Not Important
Unscheduled maintenance	18	9	4	0
Scheduled maintenance	2	18	10	1

7. What do you feel is the maximum distance a garage should be from a work site and give your reasons?

	Distance	Reasons
Unscheduled maintenance	20.5	
Scheduled maintenance	24.8	

8. What impacts do you feel are gained by having the garages located at these present location? Better service (10); Faster (13); Better public relations (5); Better understanding of local problems (7)

9. What impact do you feel would occur if the number of garages were reduced?

Response time (18); Poorer Service (6); Increased legal (1); Larger work crews (1); Increased complaints (5); Travel time (8); Economic impact (4); Little (1).

10. What staffing level do you feel is necessary for a typical garage and state your reasons?

	Staffing Level	Reasons
Serving Interstate Roads	14.8	
Not Serving Interstate Roads	10	

11. Currently levels of service are applied only to snow and ice control functions. Do you feel they should be applied to other activities. Please give your reasons

APPENDICES

C. Road Maintenance Personnel by State
State Highway Maintenance Organizations

Road Maintenance Personnel by State

Title	#	IOWA
Chief Engineer	1	Dir of Hwys Chief Engr
State Maint Engr	1	Maint Engineer
Asst State Maint Engr	1	Asst Maint Engr
District Engineer	6	District Engineer
Dist Maint Engr	6	Dist Maint Engr
Asst Dist Maint Engr		
Resident Maint Engr	24	Resident Maint Engr
Area Supervisor	123	Hwy Maint Supt 1,2,3
Gang Foreman	22	Hwy Maint Supt 2&3
Sectionman		
Laborer	2	Maint Worker I
Skilled Craftsman		
Shop Superintendent		
Garage/Shop Foreman		
Mechanic	135	Auto Mech
Mechanic Helper	14	Auto Mech Helper
Equipment Oper I	754	Equip Oper I
Equipment Oper II	246	Equip Oper II
Equipment Oper III	136	Equip Oper III
Time Keeper/Clerk		
Total Personnel	1462	

Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	COLORADO	#	ILLINOIS
Chief Engineer	1	Chief Engineer		Dir of Highways
State Maint Engr	1	Staff Maint Supt	1	Dir of Highways
Asst State Maint Engr	1	Asst Staff Maint Supt	1	State Maint Engineer
District Engineer	11	District Engineer	3	Section Chief
Dist Maint Engr	8	Hwy Maint Supt	9	District Engineer
Asst Dist Maint Engr	5	Asst Hwy Maint Supt	9	Dist Maint Engr
Resident Maint Engr				
Area Supervisor	36	Sr Hwy Supv	35	District Field Engr
Gang Foreman	43	Highway Supv		
Sectionman	360	Sr Hwy Maint Wkr	278	Hwy Maint Lead Wkr
Laborer	815	Hwy Maint Wkr B	1678	Hwy Maintainer
Skilled Craftsman				
Shop Superintendent	8	Prin Auto Shop Supv		
Garage/Shop Foreman	10	Sr Auto Shop Supv		
Mechanic	89	Auto & Equip Mech	28	Automotive Mech
Mechanic Helper	23	Auto Mechanic		
Equipment Oper I			376	Hwy Maint Equip Oper
Equipment Oper II			56	Hwy Const Equip Oper
Equipment Oper III	37	Hvy Equip Oper	17	Power Shovel Oper
Time Keeper/Clerk				
Total Personnel	1434		2486	

Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	INDIANA	#	KANSAS
Chief Engineer			1	State Transp Engr
State Maint Engr	1	Chief, Div of Maint	1	Ch, Bureau Const/Maint
Asst State Maint Engr			1	Asst Ch, Const/Maint
District Engineer	6	District Engineer	6	District Engineer
Dist Maint Engr	6	Dist Maint Engr	6	Dist Maint Engr
Asst Dist Maint Engr	6	Dist Maint Opns Engr		
Resident Maint Engr	37	Subdistrict Supt	26	Area Engineer
Area Supervisor	37	General Foreman	35	Dist & Area Supt
Gang Foreman	150	Unit Foreman	43	Dist & Area Supv
Sectionman	354	Maint Wkr III,Work Ldr	115	Sub-Area Supv
Laborer	1156	Maint Worker III	6	
Skilled Craftsman				
Shop Superintendent			6	Shop Supt
Garage/Shop Foreman	40	Hwy Mech Supv IV	7	Equip Mech III
Mechanic	170	Mechanic III	111	Equip Mech I & II
Mechanic Helper	40	Mechanic IV	38	Auto Mech Helper
Equipment Oper I			512	Equip Oper I
Equipment Oper II	97	Maint Worker II	457	Equip Oper II
Equipment Oper III			180	Equip Oper III
Time Keeper/Clerk	38	Subdist Clerk IV	29	Area Off Manager
Total Personnel	2131		1571	

Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	MICHIGAN	#	MINNESOTA
Chief Engineer	1	Deputy Dir Highways	1	Deputy Commissioner
State Maint Engr	1	Engr of Maint	1	Asst Dir, Contr Admin
Asst State Maint Engr	1	Asst Engr of Maint	4	Asst State Maint Engr
District Engineer	9	District Engineer	9	District Engineer
Dist Maint Engr	9	District Oper Engr	15	Dist/Area Maint Engr
Asst Dist Maint Engr	4	Asst Dist Maint Engr	5	Maint Opers Engr
Resident Maint Engr				
Area Supervisor	13	Area Supt	25	Bridge Supv
Gang Foreman	34	Garage Foreman	101	Bridge & Maint Supv
Sectionman	34	Lead Worker	1359	Hwy Maint Wkr/Sr
Laborer	28	Laborer IB	8	Labor I, II
Skilled Craftsman	37	Bridge Wkr IIIB,IV,V	98	Bridge Worker
Shop Superintendent	1	Equip Supt	2	Hwy Equip Supv
Garage/Shop Foreman	7	Equip Foreman	13	Shop Supv
Mechanic	77	Auto Mech IVB	151	Mech & Hwy Equip Mech
Mechanic Helper	31	Trades Helper IIB	25	Mech Apprentice
Equipment Oper I	40	Maint Worker II		
Equipment Oper II	270	Maint Worker III	5	Heavy Equip Oper
Equipment Oper III	57	Maint Worker IV		
Time Keeper/Clerk	30	Clerk		
Total Personnel	672		1807	

Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	MISSOURI	#	MONTANA
Chief Engineer	1	Chief Engineer	1	Dir of Highways
State Maint Engr	1	Div Engr Maint & Traf	1	Admin Maint&Equip Div
Asst State Maint Engr	1	Asst Div Engr, Maint	1	Asst Admin Maint&Equip
District Engineer	10	District Engineer	5	District Engineer
Dist Maint Engr	10	Dist Maint & Traf Engr	11	Maintenance Chief
Asst Dist Maint Engr	20	Maint Supt		
Resident Maint Engr				
Area Supervisor	104	Maint Area Supv	22	Maint Supt
Gang Foreman	39	Special Maint Foreman		
Sectionman	350	Maint Supt	129	Field Maint Supv A & B
Laborer			6	Laborer
Skilled Craftsman			10	Carpenter
Shop Superintendent	9	District Equip Supv	12	Division Shop Supt
Garage/Shop Foreman	9	Chief Shop Mech	10	Working Shop Supt
Mechanic	50	Shop Mechanic	57	Working Shop Foreman
Mechanic Helper			39	Stockman/Serv Comb A&B
Equipment Oper I	1700	Maint Crew Member	191	Truck Driver <5ton
Equipment Oper II	1040	Maint Crew Leader	48	Equip Oper I
Equipment Oper III	6	Dragline Operator	123	Equip Oper II
Time Keeper/Clerk	14	Dist Stock Clerk	5	Dist Service Supv
Total Personnel	3351		663	

Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	NEBRASKA	#	NORTH DAKOTA
Chief Engineer	1	Director - State Engr	1	Chief Engineer
State Maint Engr	1	Engineer VII	1	State Maint Engineer
Asst State Maint Engr	1	Maint Operns Manager	1	Asst State Maint Engr
District Engineer	8	Hwy District Engineer	8	District Engineer
Dist Maint Engr	8	Hwy Maint Dist Supt	8	Asst Dist Engr
Asst Dist Maint Engr			8	Hwy Maint Supt
Resident Maint Engr				
Area Supervisor	30	Hwy Maint Supt		
Gang Foreman	84	Hwy Maint Supv	6	Hwy Maint Foreman
Sectionman			35	Leadman
Laborer			4	Maint Worker I
Skilled Craftsman				
Shop Superintendent	1	Hwy Mech Supt	8	Mtr Veh Shop Foreman I
Garage/Shop Foreman	8	Hwy Mech Supv		
Mechanic	67	Auto/Diesel Mech	39	Mechanic I & II
Mechanic Helper	50	Auto Mech II	12	Auto Service Worker
Equipment Oper I	114	Hwy Maint Worker	18	Equip Oper I
Equipment Oper II			212	Equip Oper II
Equipment Oper III	641	Hwy Maint Wkr/Senior	35	Leadman
Time Keeper/Clerk	28	Office Clerk II	8	Gen Office Clerk
Total Personnel	1031		393	

Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	OHIO	#	SOUTH DAKOTA
Chief Engineer	2	Assistant Director	1	Director of Engr
State Maint Engr	2	Engr of Maintenance	1	Maint Engineer
Asst State Maint Engr	1	Maint Engr 2	1	Maint Opers Engr
District Engineer	12	Div Deputy Director	4	Regional Manager
Dist Maint Engr	12	District Opers Engr		
Asst Dist Maint Engr	12	Dist Maint Engr		
Resident Maint Engr	29	Hwy Maint Supt 3	16	Oper Engr, Area Engr
Area Supervisor	88	County Supervisor	8	Maint Coordinator
Gang Foreman	357	Hwy Worker Supv		
Sectionman	12	Hwy Worker 3	75	Leadman
Laborer	1141	Hwy Worker 2	0	Maint Worker I
Skilled Craftsman	92	Painter,Welder,etc		
Shop Superintendent	6	Equip Maint Supt 3	0	MtrVeh Shop Foreman II
Garage/Shop Foreman	17	Equip Maint Supt 2	6	Equip Shop Foreman
Mechanic	181	Auto Mechanic	36	Mechanic I & II
Mechanic Helper	16	Asst Auto Mech	12	Equip Serv Wkr I & II
Equipment Oper I	345	Equip Oper 1		
Equipment Oper II	251	Equip Oper 2	308	Hwy Maint Wkr II
Equipment Oper III	80	Equip Oper 3	107	Senior Hwy Maint Wkr
Time Keeper/Clerk	159	Clerk Specialist	83	Adm Serv Asst/Off Supv
Total Personnel	2798		651	

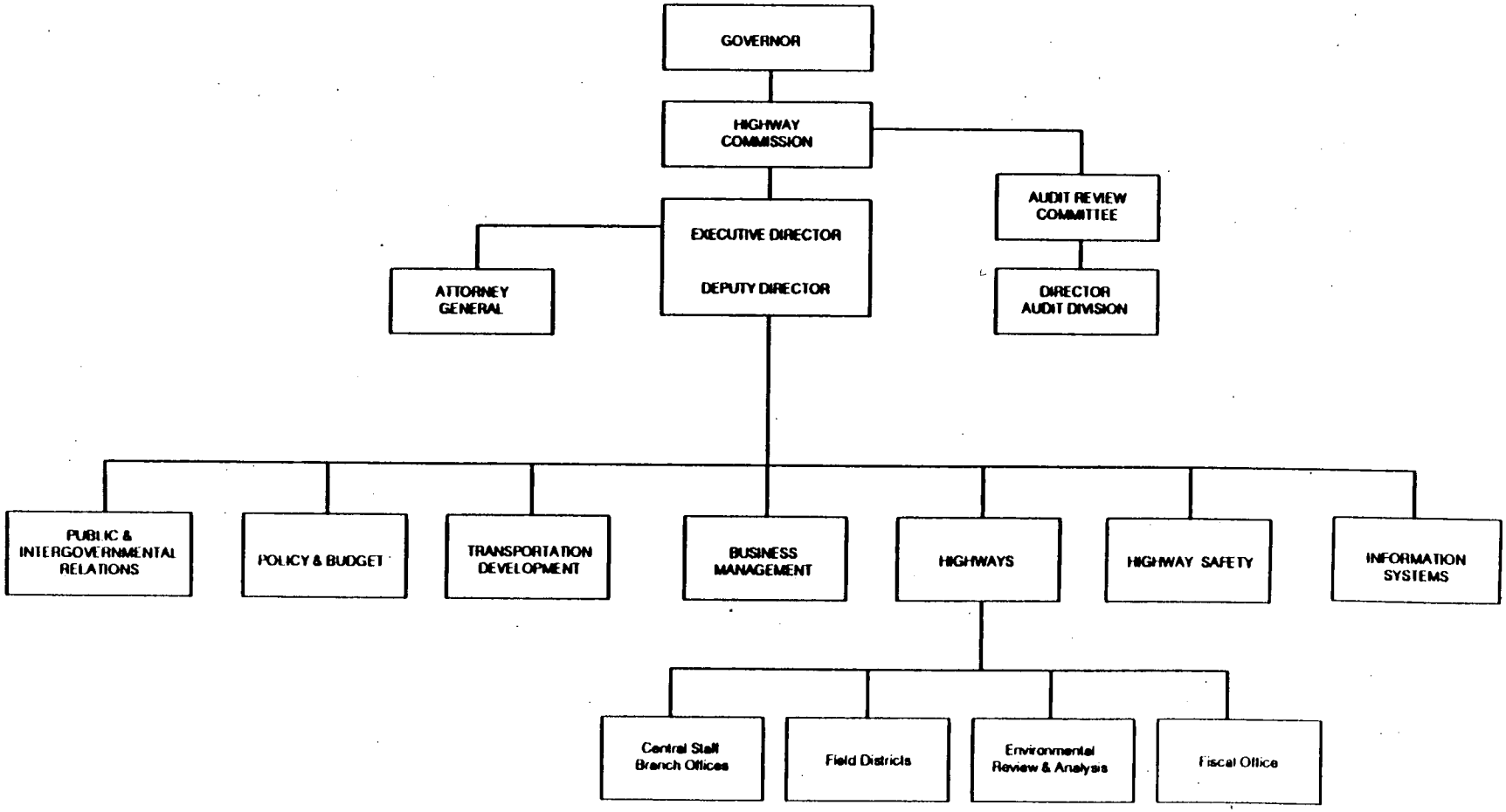
Data extracted from Transportation Research Circular, No. 331, March 1988.

Title	#	WISCONSIN	#	WYOMING
Chief Engineer				
State Maint Engr	1	State Maint Engr	1	State Const&Maint Engr
Asst State Maint Engr	4	Regional Maint Engr		
District Engineer	8	District Engineer	5	District Engineer
Dist Maint Engr	8	Dist Maint Engr	5	Dist Maint Engr
Asst Dist Maint Engr	30	Asst Dist Maint Engr		
Resident Maint Engr				
Area Supervisor	32	Patrol Supt	29	Hwy Maint Area Supv
Gang Foreman			35	Area Crew Leader
Sectionman				
Laborer			22	Hwy Maint Wkr I
Skilled Craftsman				
Shop Superintendent			6	Dist Equip Supv
Garage/Shop Foreman			24	Shop Foreman I & II
Mechanic			51	Mechanic II
Mechanic Helper			11	Mechanic I
Equipment Oper I			56	Hwy Maint Wkr II
Equipment Oper II			225	Hwy Maint Equip Opr
Equipment Oper III			87	Hwy Mnt Hvy Equip Oper
Time Keeper/Clerk				
Total Personnel	70		551	

Data extracted from Transportation Research Circular, No. 331, March 1988.

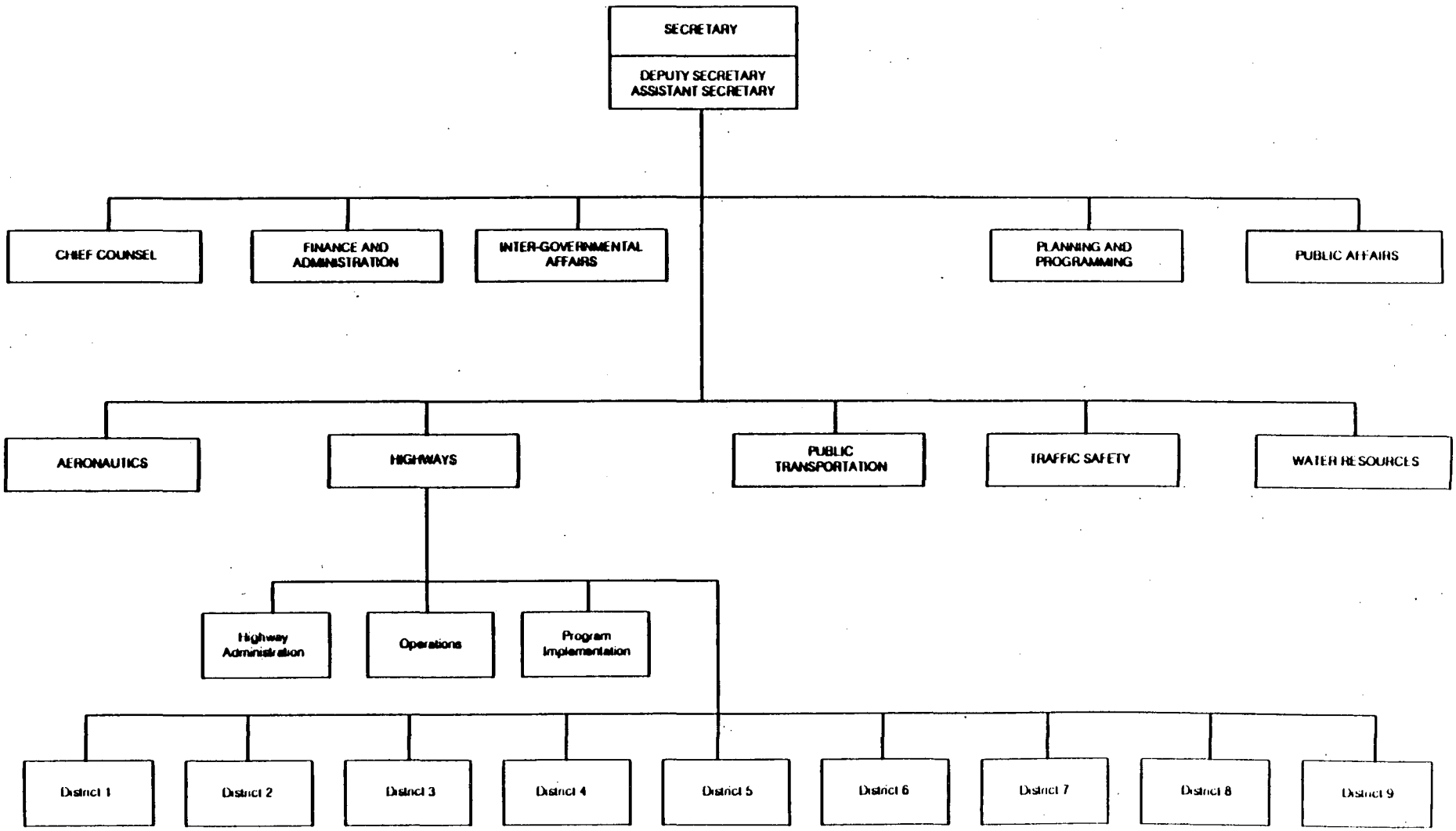
State Highway Maintenance Organizations

COLORADO
DEPARTMENT OF TRANSPORTATION



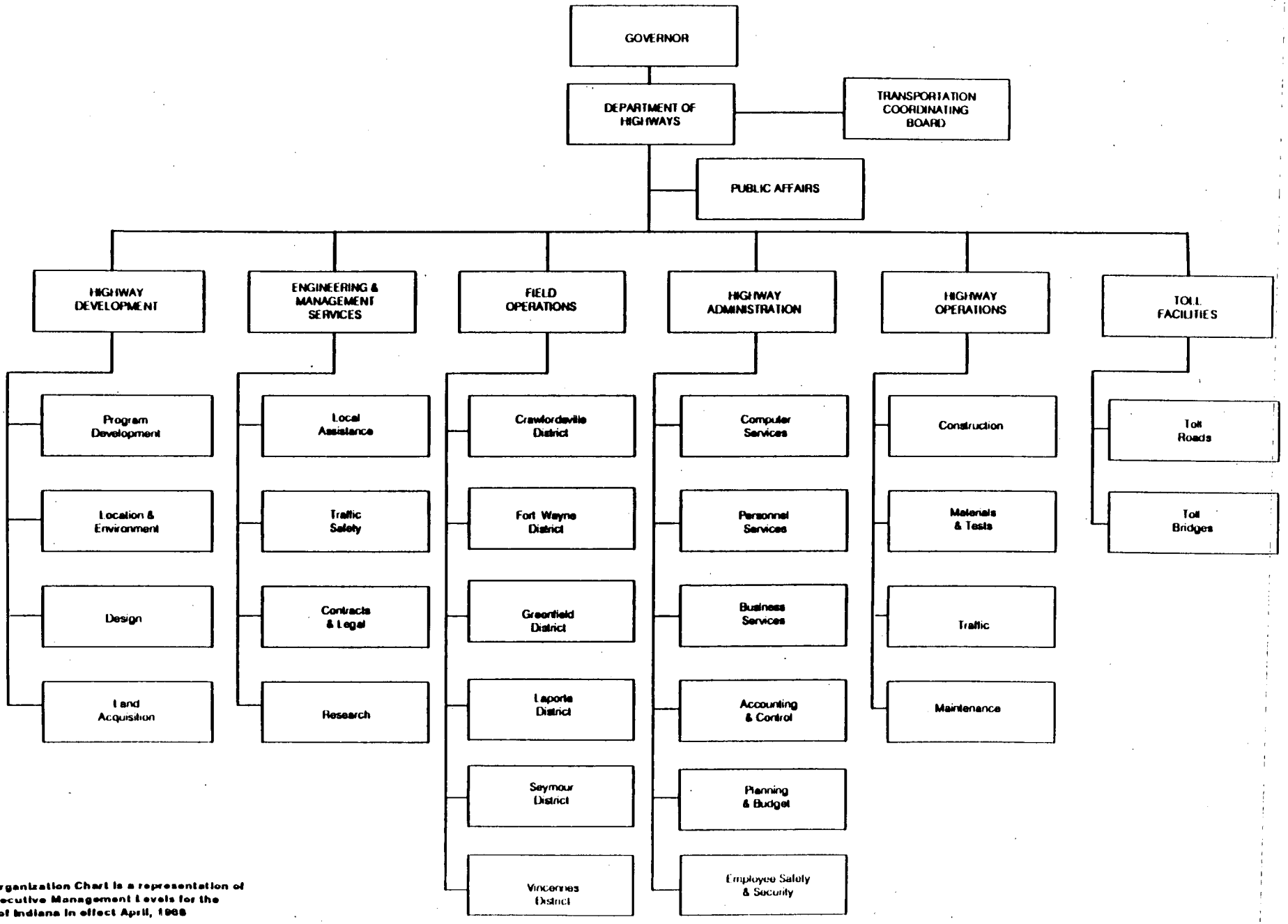
This Organization Chart is a representation of the Executive Management Levels for the State of Colorado in effect on January 22, 1988

ILLINOIS
DEPARTMENT OF TRANSPORTATION



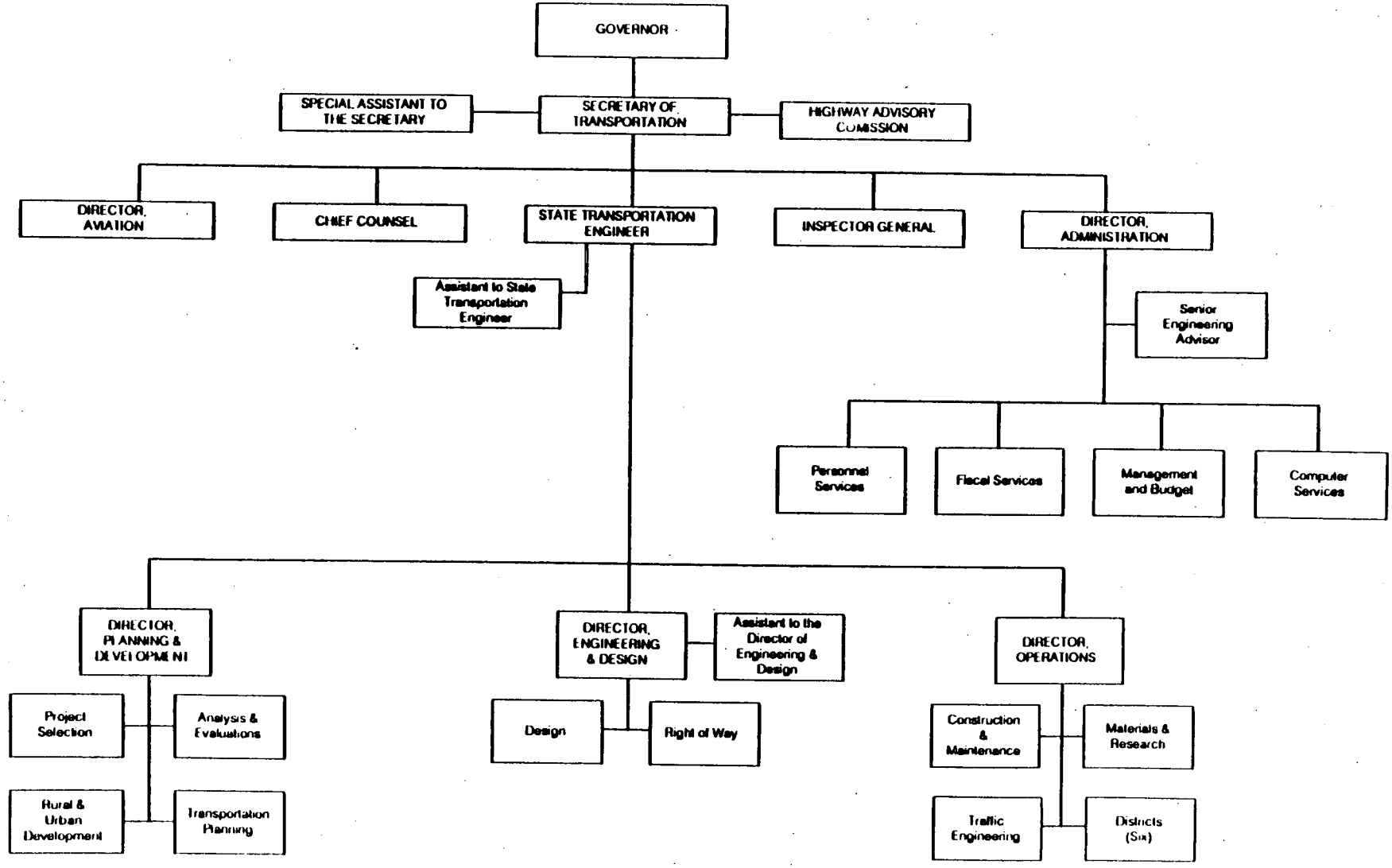
This Organization Chart is a representation of the Executive Management Levels for the State of Illinois in effect on May 25, 1988

INDIANA
DEPARTMENT OF TRANSPORTATION



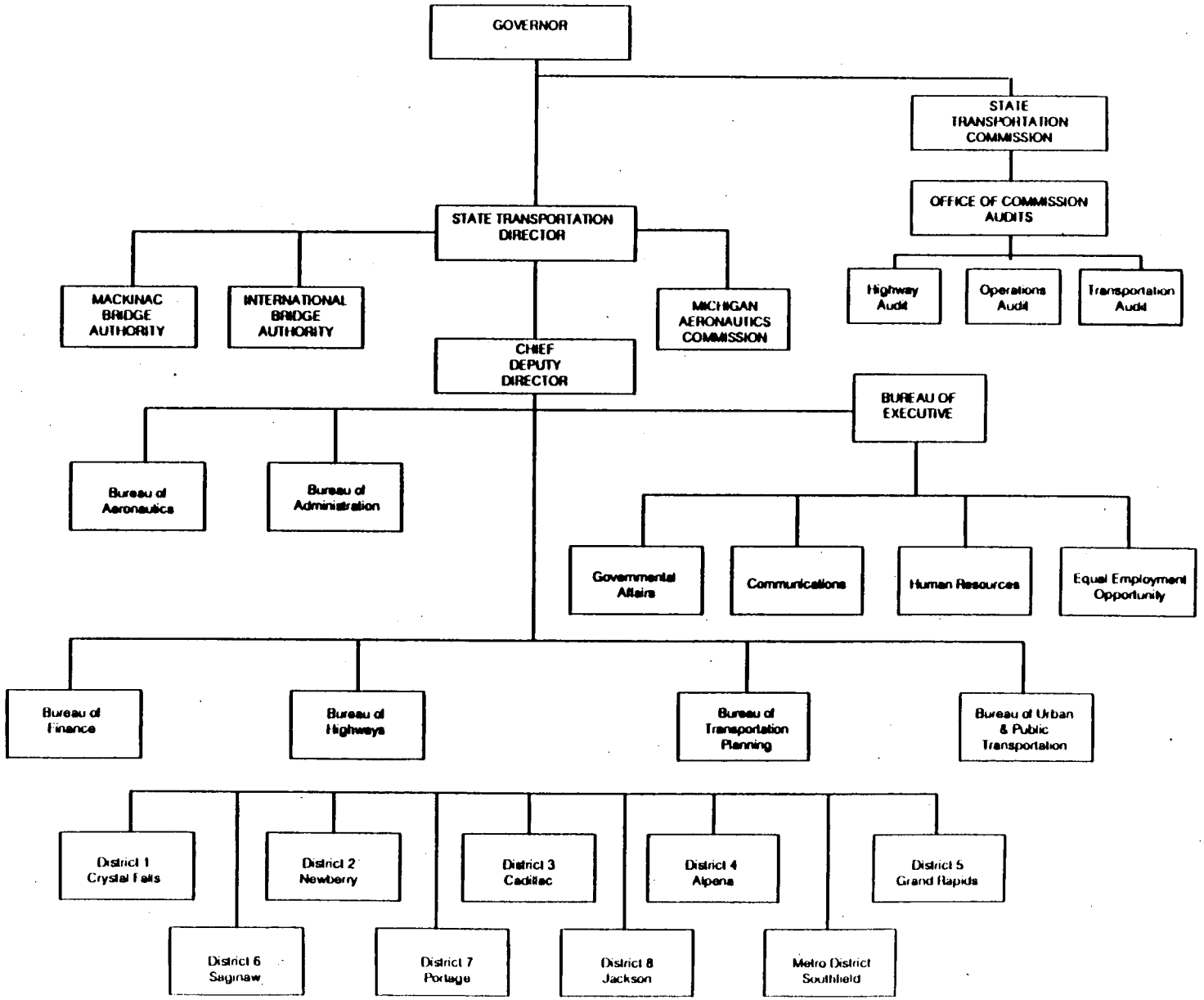
This Organization Chart is a representation of the Executive Management Levels for the State of Indiana in effect April, 1988

KANSAS
DEPARTMENT OF TRANSPORTATION



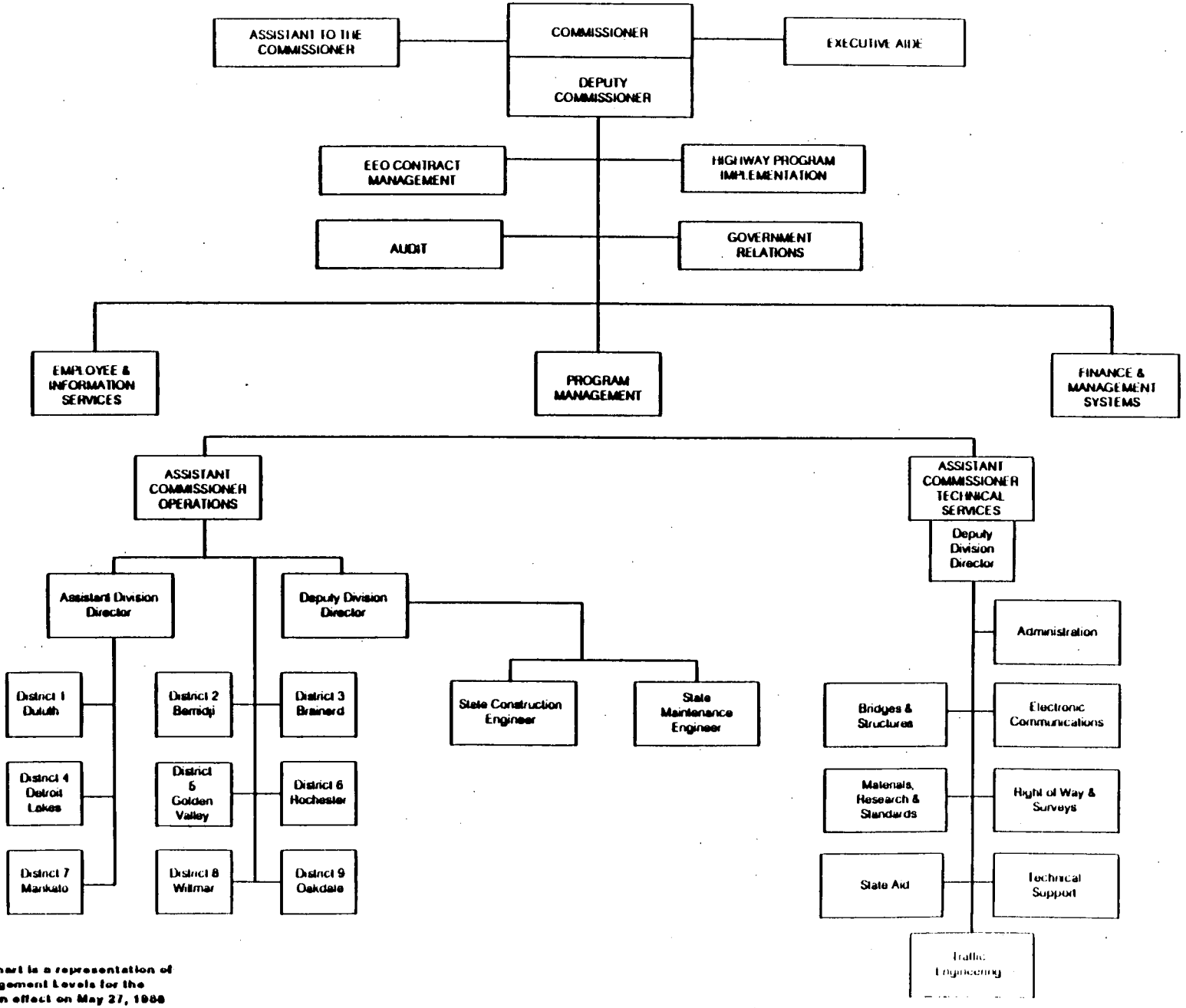
This Organization Chart is a representation of the Executive Management Levels for the State of Kansas in effect on July 5, 1988

MICHIGAN
DEPARTMENT OF TRANSPORTATION



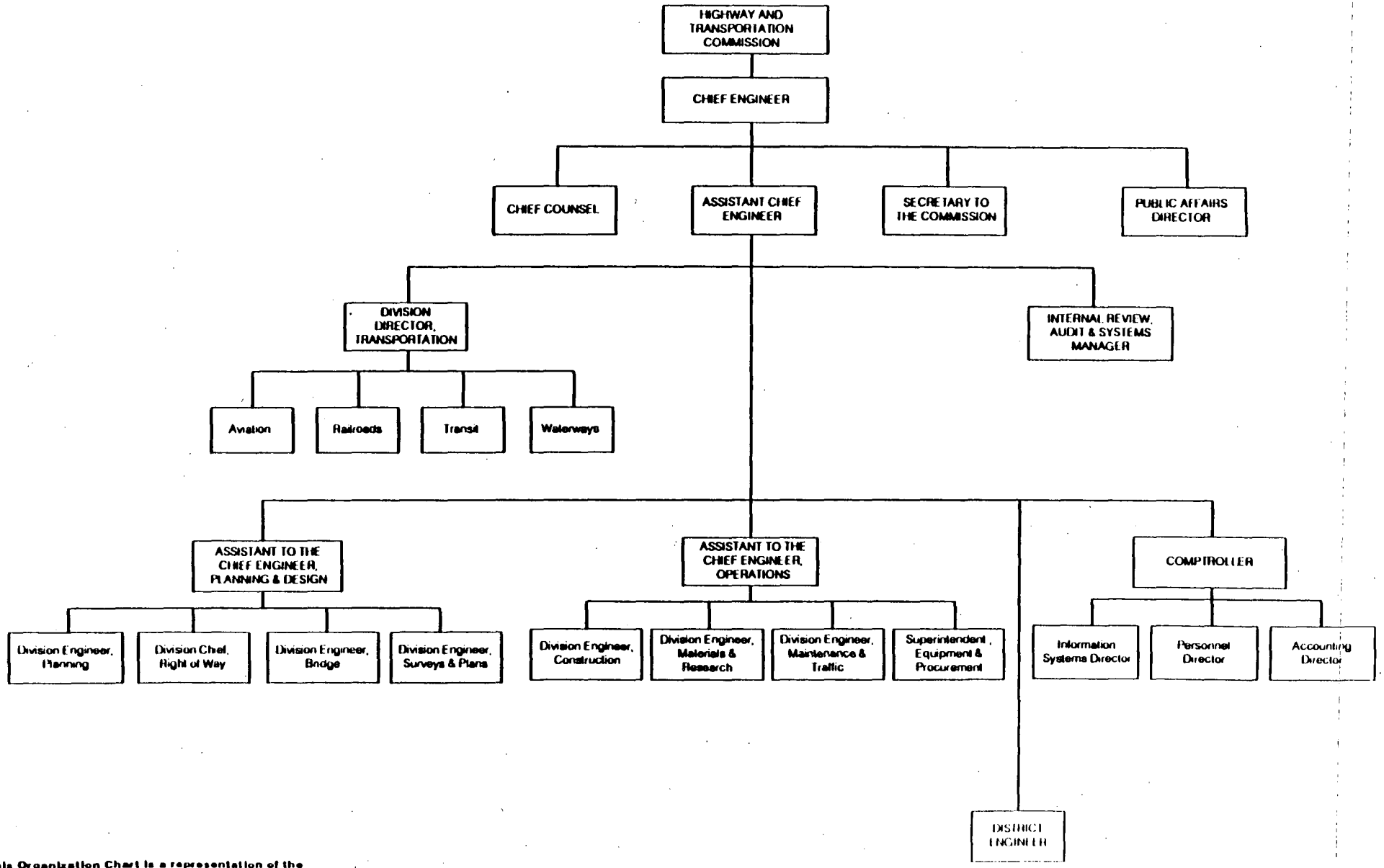
This Organization Chart is a representation of the Executive Management Levels for the State of Michigan in effect on June 7, 198[illegible]

MINNESOTA
DEPARTMENT OF TRANSPORTATION



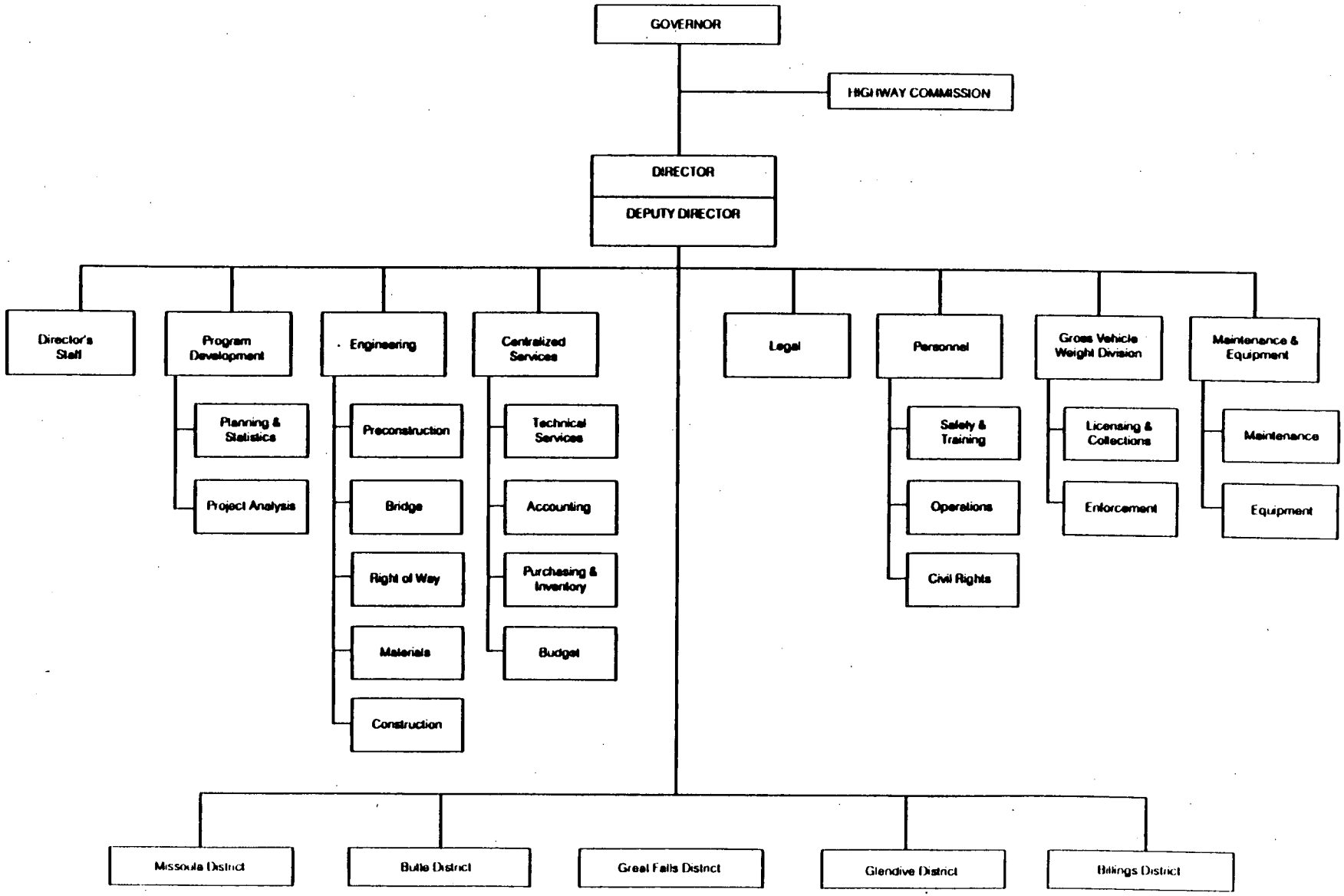
This Organization Chart is a representation of the Executive Management Levels for the State of Minnesota in effect on May 27, 1988

MISSOURI
HIGHWAY AND TRANSPORTATION DEPARTMENT



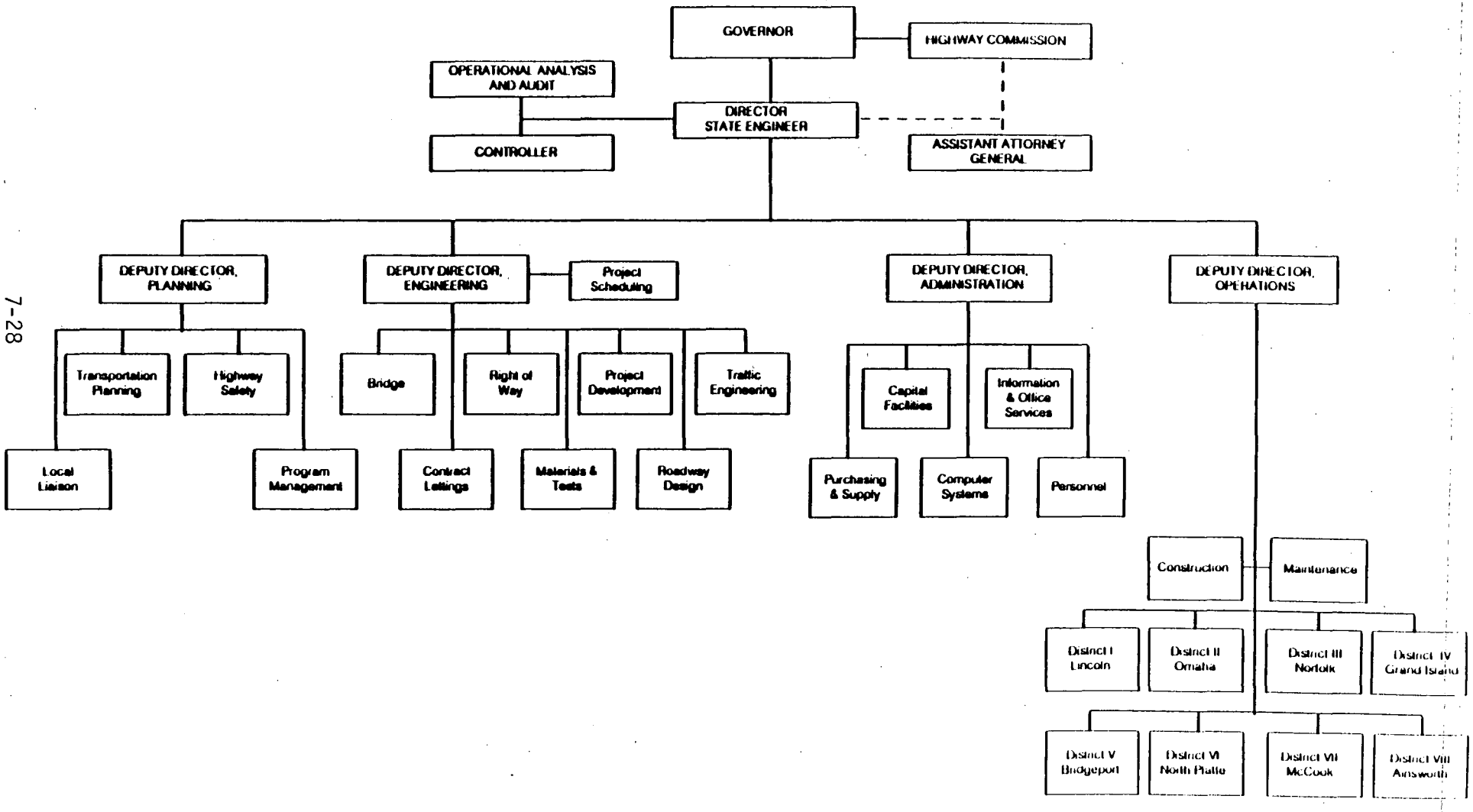
This Organization Chart is a representation of the Executive Management Levels for the State of Missouri in effect on November 4, 1988

MONTANA
DEPARTMENT OF TRANSPORTATION



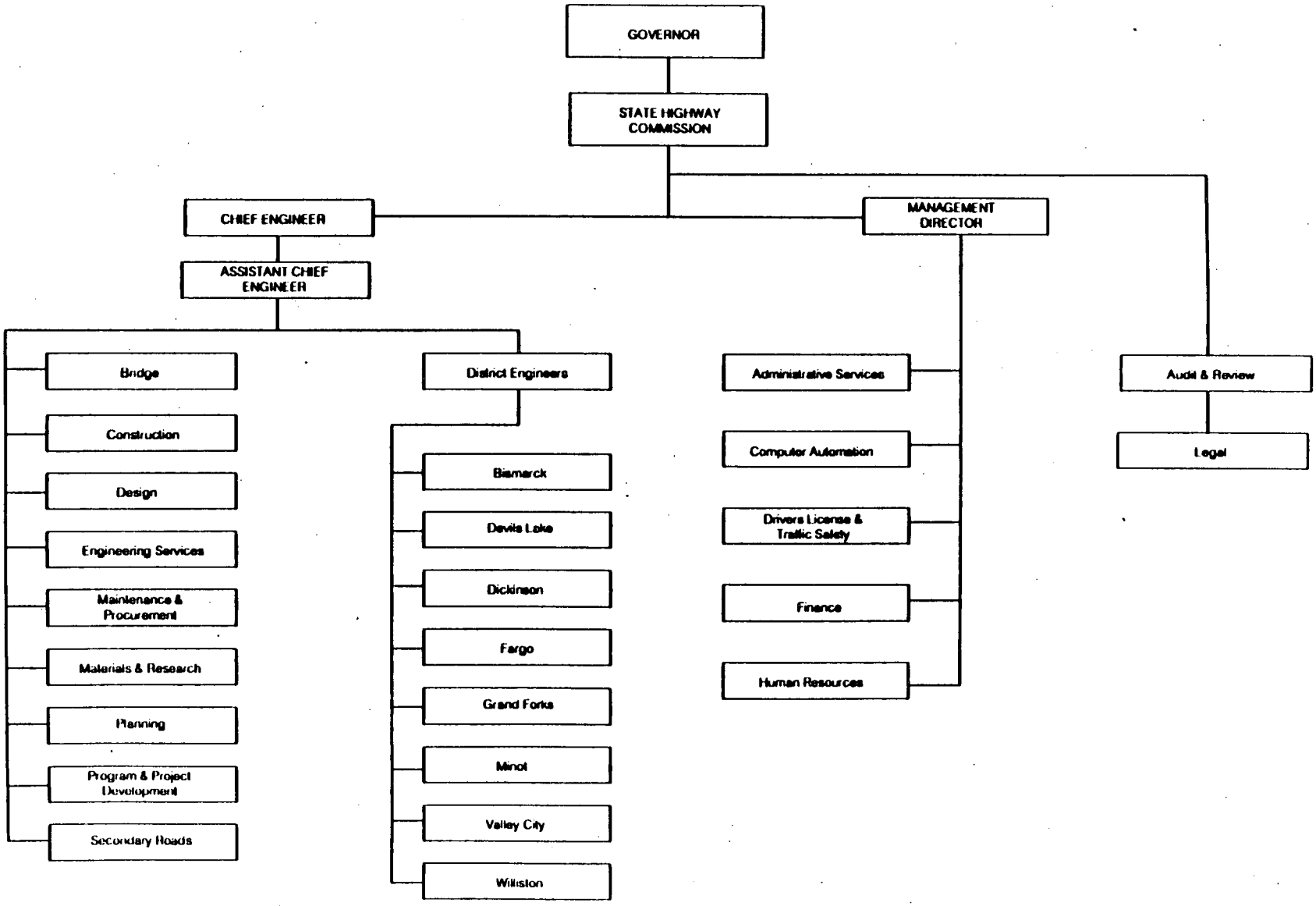
This Organization Chart is a representation of the Executive Management Levels for the State of Montana in effect on June 10, 1988

NEBRASKA
DEPARTMENT OF ROADS



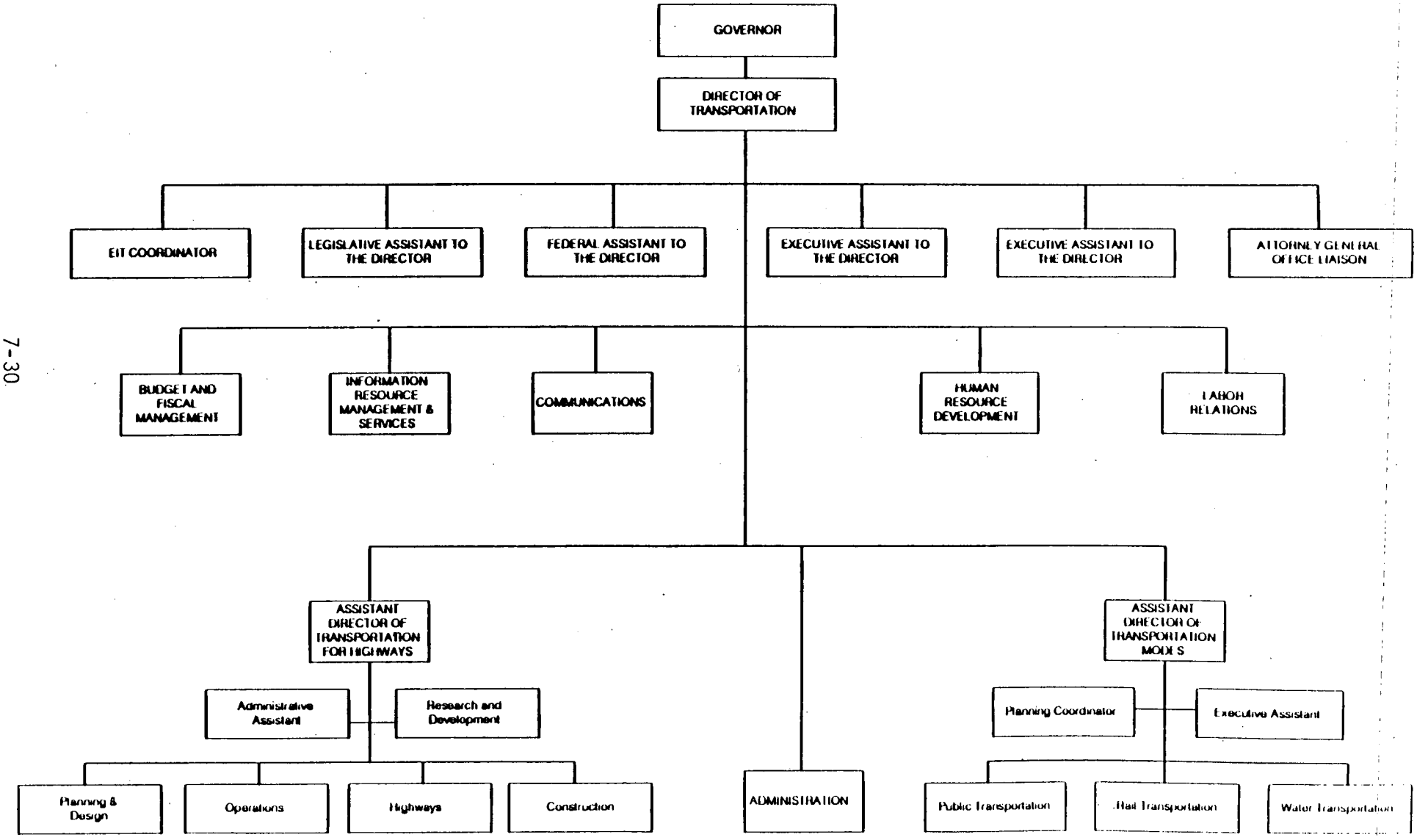
This Organization Chart is a representation of the Executive Management Levels for the State of Nebraska in effect on May 25, 1988

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION



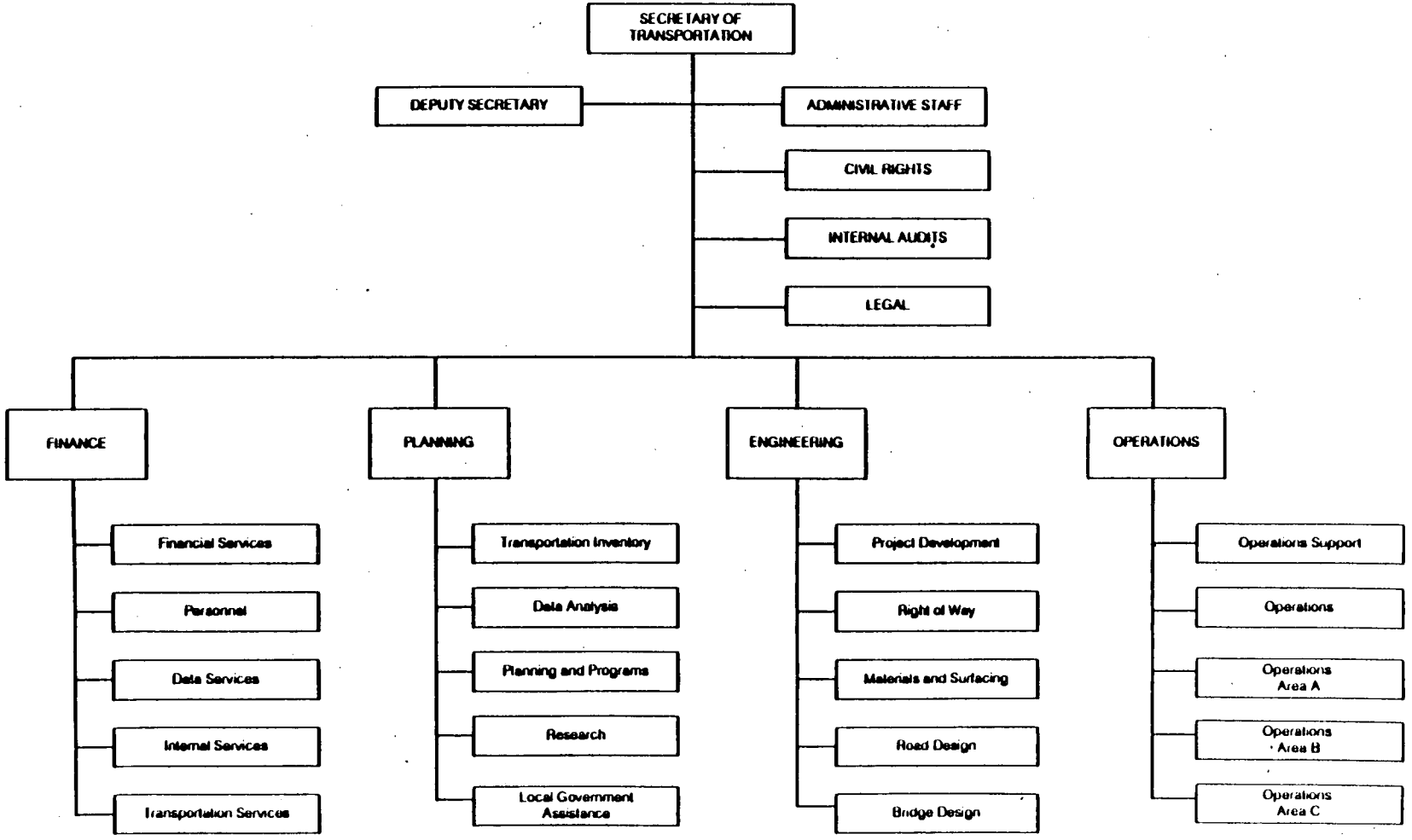
This Organization Chart is a representation of the Executive Management Levels for the State of North Dakota in effect on May 25, 1988

OHIO
DEPARTMENT OF TRANSPORTATION



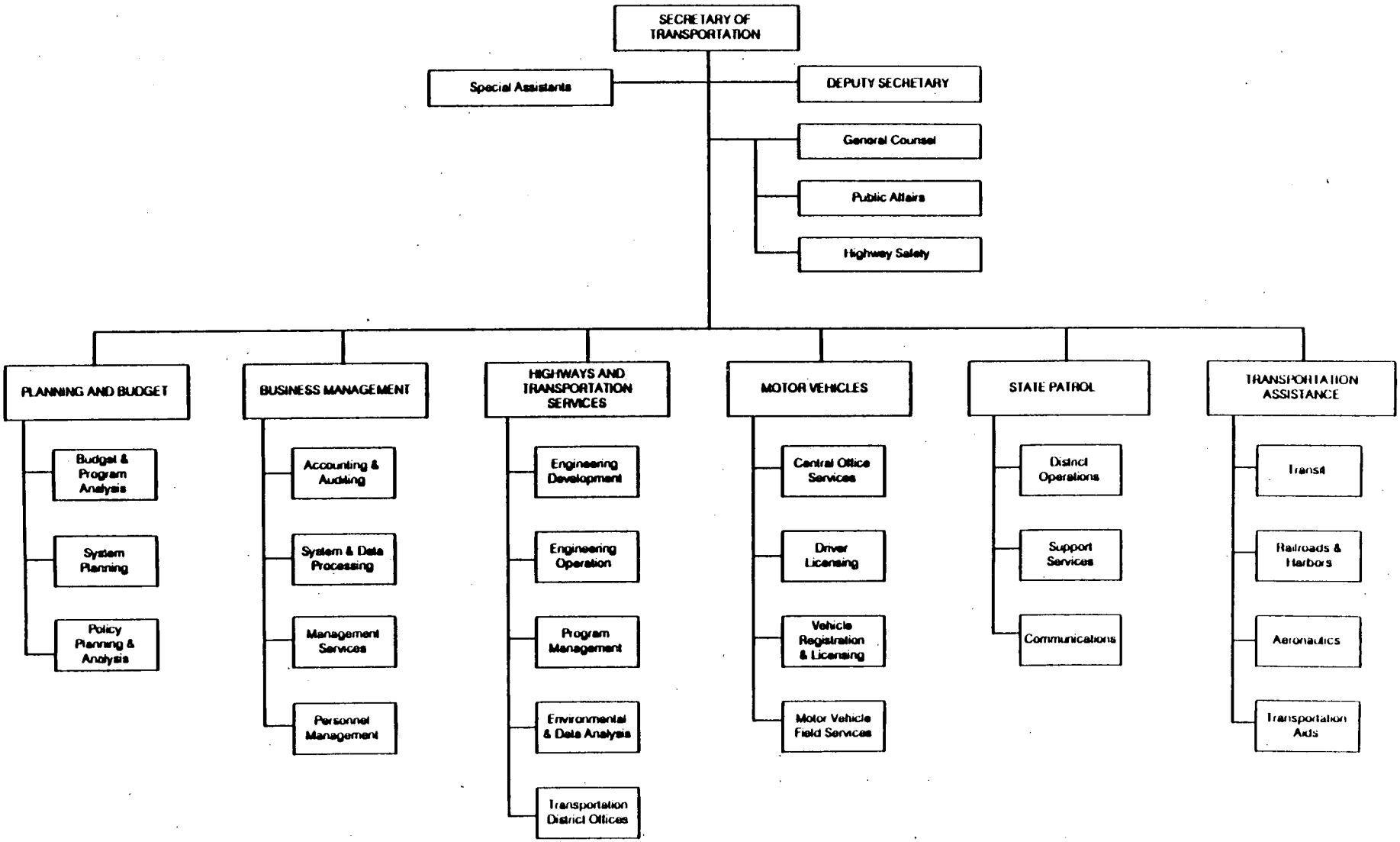
This Organization Chart is a representation of the Executive Management Levels for the State of Ohio in effect on May 26, 1988

SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION



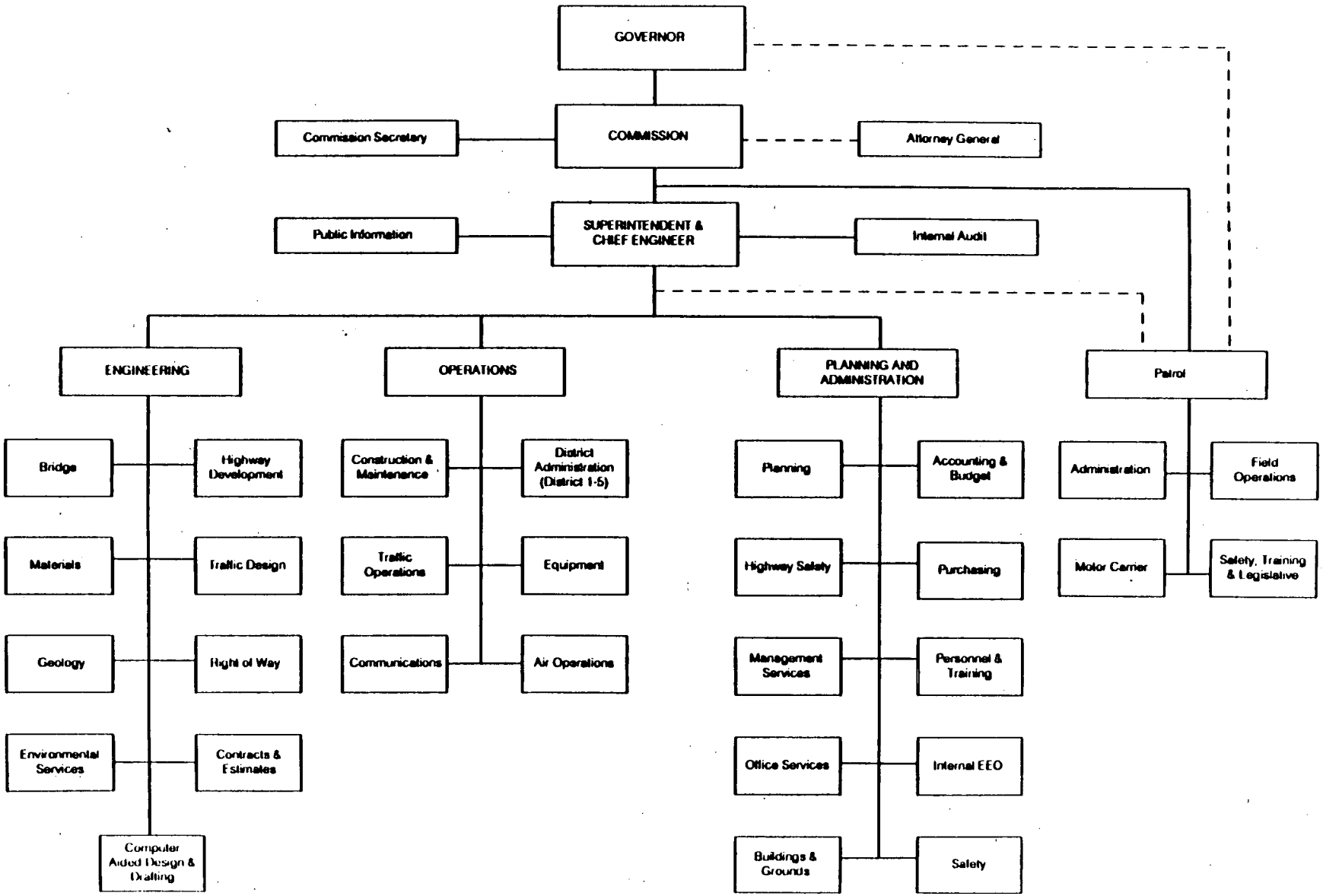
This Organization Chart is a representation of the Executive Management Levels for the State of South Dakota in effect on May 23, 1988

WISCONSIN
DEPARTMENT OF TRANSPORTATION



This Organization Chart is a representation of the Executive Management Levels for the State of Wisconsin in effect on May 16, 1988

WYOMING
DEPARTMENT OF TRANSPORTATION



This Organization Chart is a representation of the Executive Management Levels for the

APPENDICES

D. Maintenance Category and Activity Key

Maintenance Category and Activity Key

CATEGORY 01- SUPERVISION & SUPPORT

Activity Number	Activity
010	Administration
022	Safety
097	Compensatory Time Off
098	Terminal Leave
099	Time Off
1xx	Employee Training
601	Resident Maintenance Engineer Office
602	Field Supervision
603	Maintenance Garage & Yard Operation
604	Maintenance Area Administration
608	Other Support Activities

CATEGORY 02 - ROADWAY SURFACE

Activity Number	Activity
609	Spall Patching
610	Temporary Blow-up Repair & Hand Leveling
611	Machine Surface Restoration & Leveling
612	Joint and Crack Filling
613	Pavement Replacement
614	Seal Coating - Slurry Sealing - Fog Sealing
615	Pavement Expansion Relief Joints
616	Joint and Crack Routing and Sealing
617	Permanent Surface Repair
618	Strip Sealing - Edge Sealing
619	Burn/Plane or Mill Surface
620	Brooming or Sweeping
621	Underseal/Raise Pavement
622	Aggregate Surface Maintenance
625	Other Surface Maintenance Activities

CATEGORY 03 - SHOULDER MAINTENANCE

Activity Number	Activity
628	Repair Shoulders with Bituminous Mix
629	Seal Edge Ruts and Bituminous Shoulders
632	Shoulder Joint & Crack Filling/Sealing
633	Paved Shoulder Repair
634	Repair with Aggregate
636	Mow Shoulders
638	Hand Mowing
640	Blade Shoulders
641	Rebuild Shoulders with Earth
643	Other Shoulder Maintenance Activity

CATEGORY 04 - ROADSIDE MAINTENANCE

Activity Number	Activity
645	Roadside Mowing
646	Foliage Spraying
647	Brush and Tree Control
649	Litter Pick Up
650	Erosion Control
651	Interstate Rest Areas & Welcome Centers
653	Other Roadside Maintenance Activities

CATEGORY 05 - DRAINAGE MAINTENANCE

Activity Number	Activity
655	Clean & Restore Roadside Ditches
657	Culvert Maintenance
659	Drain Tidle, Catch Basins and Inlets
660	Other Drainage Activities

CATEGORY 06 - TRAFFIC SERVICES

Activity Number	Activity
663	Painting Center and Barrier Lines
664	Paint Edge Lines
665	Paint Curbs & Miscellaneous Pavement Markings
667	Sign Maintenance
669	Roadway Lighting Maintenance
670	Guardrail Maintenance
671	Non-Primary Detours
672	Impact Attenuator Maintenance
673	Traffic Control for Maintenance Operations
674	Other Traffic Services Activities

CATEGORY 07 - SNOW & ICE CONTROL

Activity Number	Activity
675	Phase 1 - Snow Removal
676	Phase 2 - Snow Removal
677	Frost Runs
678	Abrasives and Chemicals
679	Snow Fencing
680	Equipment Cleanup
681	Other Snow and Ice Control Activities

CATEGORY 08 - BRIDGE MAINTENANCE

Activity Number	Activity
683	Deck Repair
684	Clean Decks, Piers, Abutments, Expansion Joints
685	Repair Bridge Structure
687	Bridge Painting
689	Maintain Waterway
691	Intensive Bridge Inspection
692	Other Bridge Maintenance Activities

CATEGORY 09 - EXTERNAL SERVICE CONTRACTS

Activity Number	Activity
693	Surface Maintenance Contracts
694	Shoulder Maintenance Contracts
695	Bridge Maintenance Contracts
696	Snow and Ice Control Contracts
697	Traffic Services Contracts
698	Roadside and Drainage Contracts

CATEGORY 10 - GENERAL MAINTENANCE

Activity Number	Activity
605	Maintain and Repair "B" Equipment
801	Service & Repair "A" Equipment

CATEGORY 11 - WORK FOR OTHERS TITLE

Activity Number	Activity
023	Facilities Construction and Maintenance
070	Toll Bridges
384	Advertising Device Removal
401	Work for Construction
496	Haul Roads
699	Unusual or Disaster Maintenance
823	"F" Equipment (Radio)