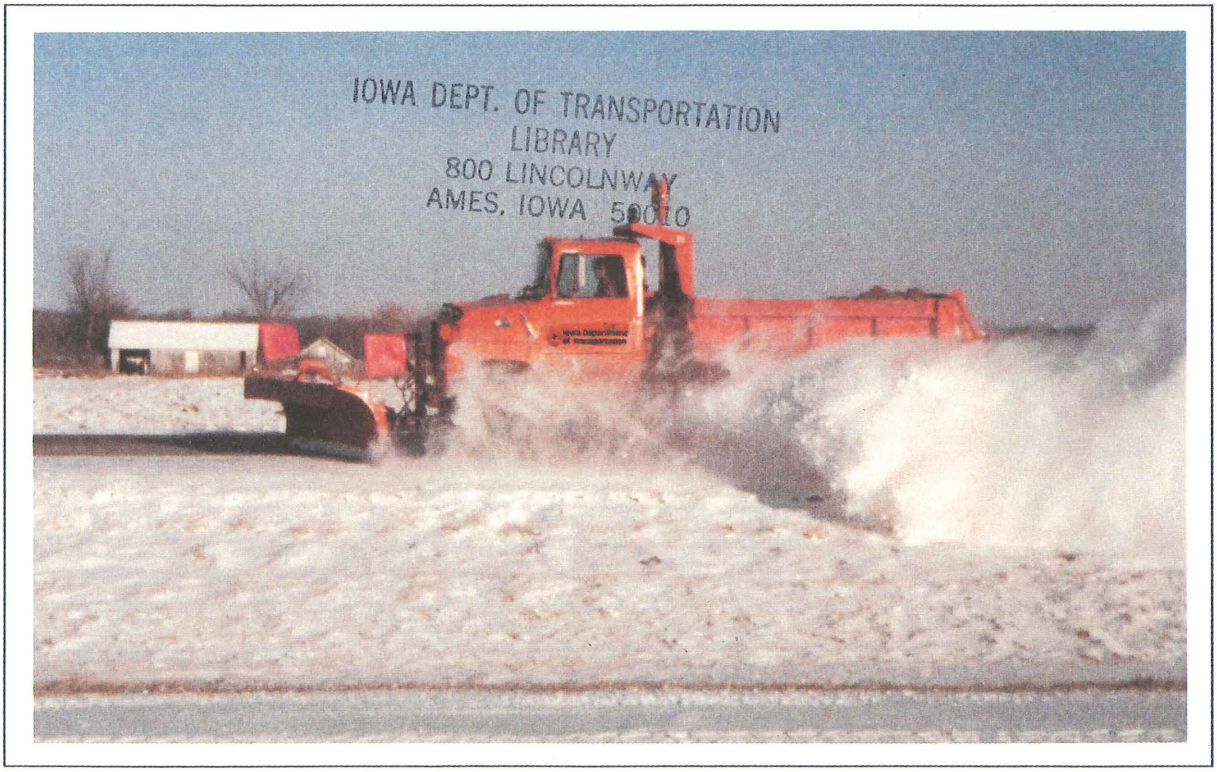
Continuous Quality Improvement Snow Plow Accident Study Report



June 1995

GPC20363
6/26/95

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ACKNOWLEDGMENT

The team members wish to extend sincere appreciation to the members of the Snowplow Study Guidance Team for their support, cooperation and counseling. The Guidance Team includes the following individuals:

Rodolfo Laudencia	CITC Maintenance
Leland Smithson	Maintenance Division
Dwight Stevens	Engineering Division
Keith Hyland	Director's Staff

The team members also would like to thank the Maintenance Management Team for initiating and supporting this project. Special thanks are extended to Neil Volmer and Kevin Mahoney for leading the project implementation.

All of the assistance and recommendations have been greatly appreciated.

Study Team Members

Ron Stutzel - Team Leader	Dave Kardell
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Scott Falb	Roxane McCaskey
Dave Hipnar	Don Schumann
Jean Houston	Dennis South

REPORT OF

TQM SNOW PLOW ACCIDENT
STUDY TEAM

JUNE 1995

Mission Statement:

Identify processes to modify in order to reduce snow plow accidents.

Study:

1. Reviewed all D.O.T. snow plow vehicle accidents that occurred in calendar years 1992 and 1993.
   - The number of accidents was 270.

2. Categorized those 270 accidents into 11 different accident categories.
   - Developed a Pareto Diagram indicating the number of accidents in each category (Figure 1).
   - Sanding related accidents constituted 76 out of 270 (28%) accidents but windshield/paint damage are low cost items that cannot be substantiated.
   - Decided to further study accidents that had resulted in personal injuries because of the high costs associated with injuries and property damage.

3. Categorized the accidents that had resulted in personal injuries.
   - The number of accidents was 24.
   - Developed a Pareto Diagram (Figure 2).
   - Rear end accidents accounted for 17 of the 24 (71%) accidents.
   - Defined problem as one of D.O.T. snow removal trucks being rear ended while doing snow removal work.
   - Decided to further study rear end accidents in order to reduce injuries caused by those accidents.

4. Developed a Cause & Effect Diagram to illustrate the various causes of rear end accidents (Figure 3).

5. Reviewed investigating officer's report for each of the rear end accidents to compile information and determine existing conditions that might have contributed to the accident.
   - Driver of non-D.O.T. vehicle was charged with failure to have control in 42% of the accidents.
   - Non-D.O.T. driver was at fault in 97% of the accidents.
   - Surface condition of pavement was ice and/or snow covered in 70% of the accidents.
   - Weather condition was snowing or blowing snow in 58% of the accidents.
   - 31% of the accidents occurred in left lane of divided multi-lane highway.

1992 & 1993 Iowa DOT

Vehicle Accidents (Snow Plows Only)

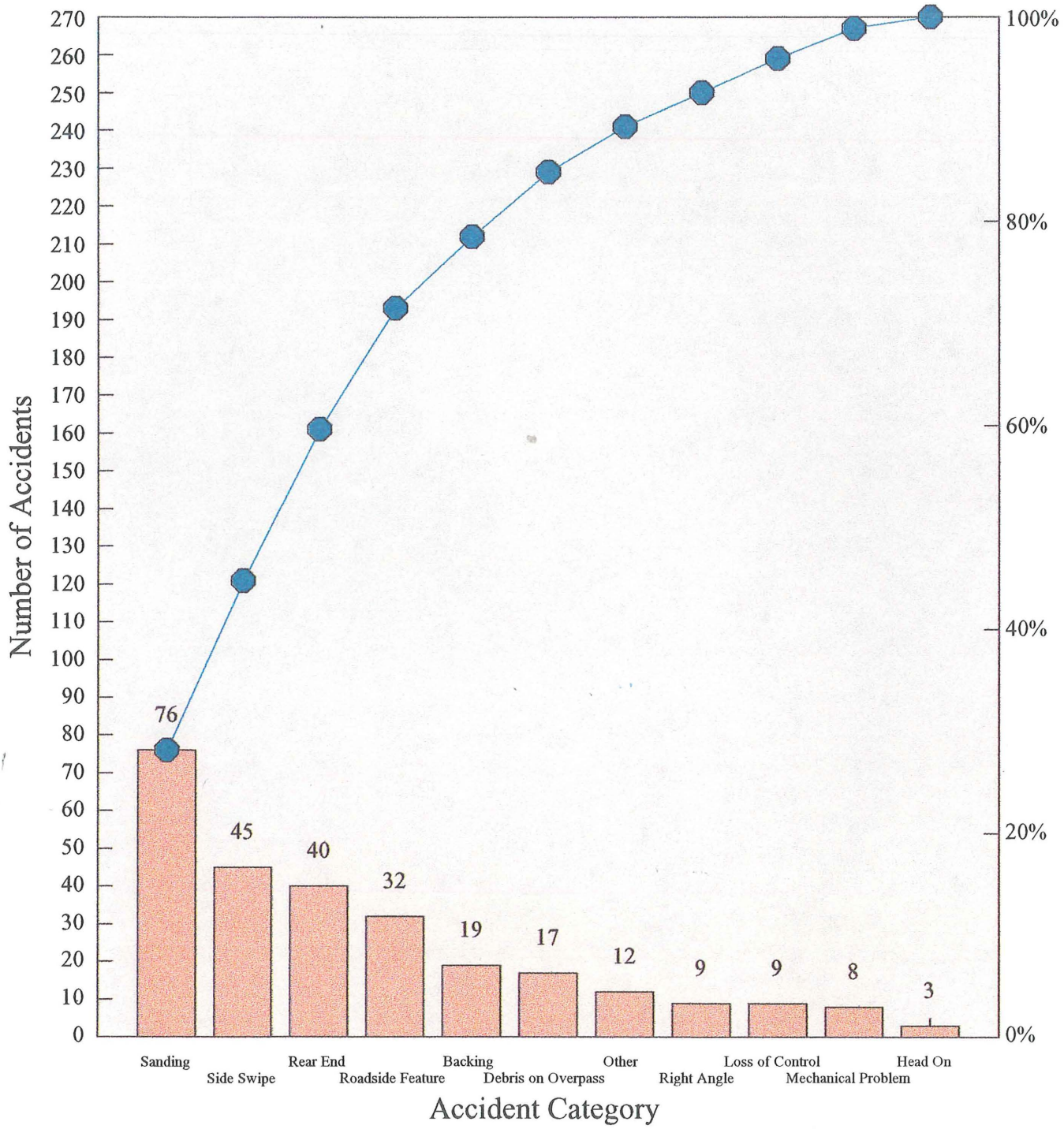

Figure 1 - Pareto Diagram of Accident Types
November 9, 1994

1992 & 1993 Iowa DOT

Vehicle Accidents (Snow Plows Only)

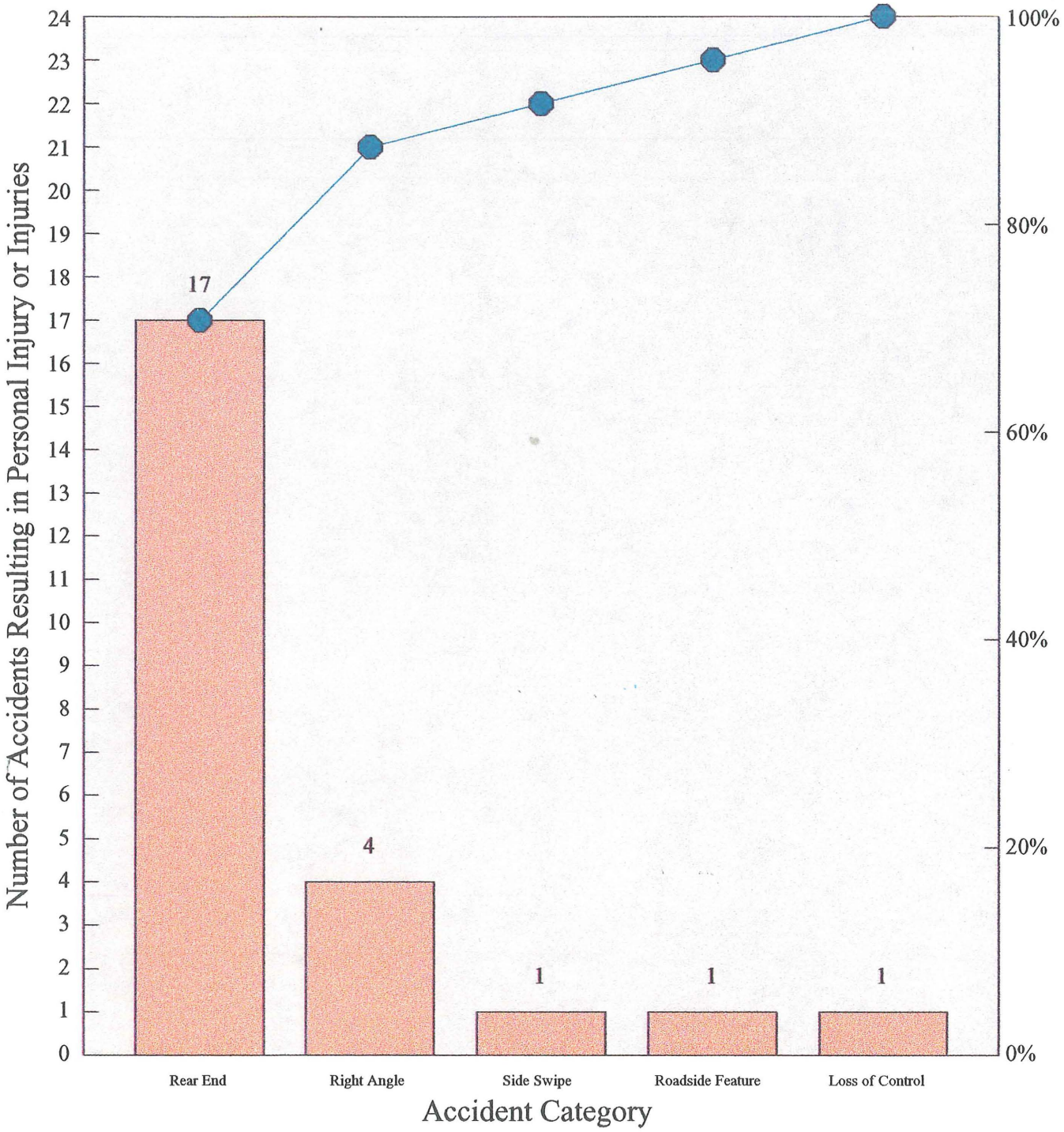

Figure 2 - Pareto Diagram of Accident Types Resulting in Personal Injuries
November 9, 1994

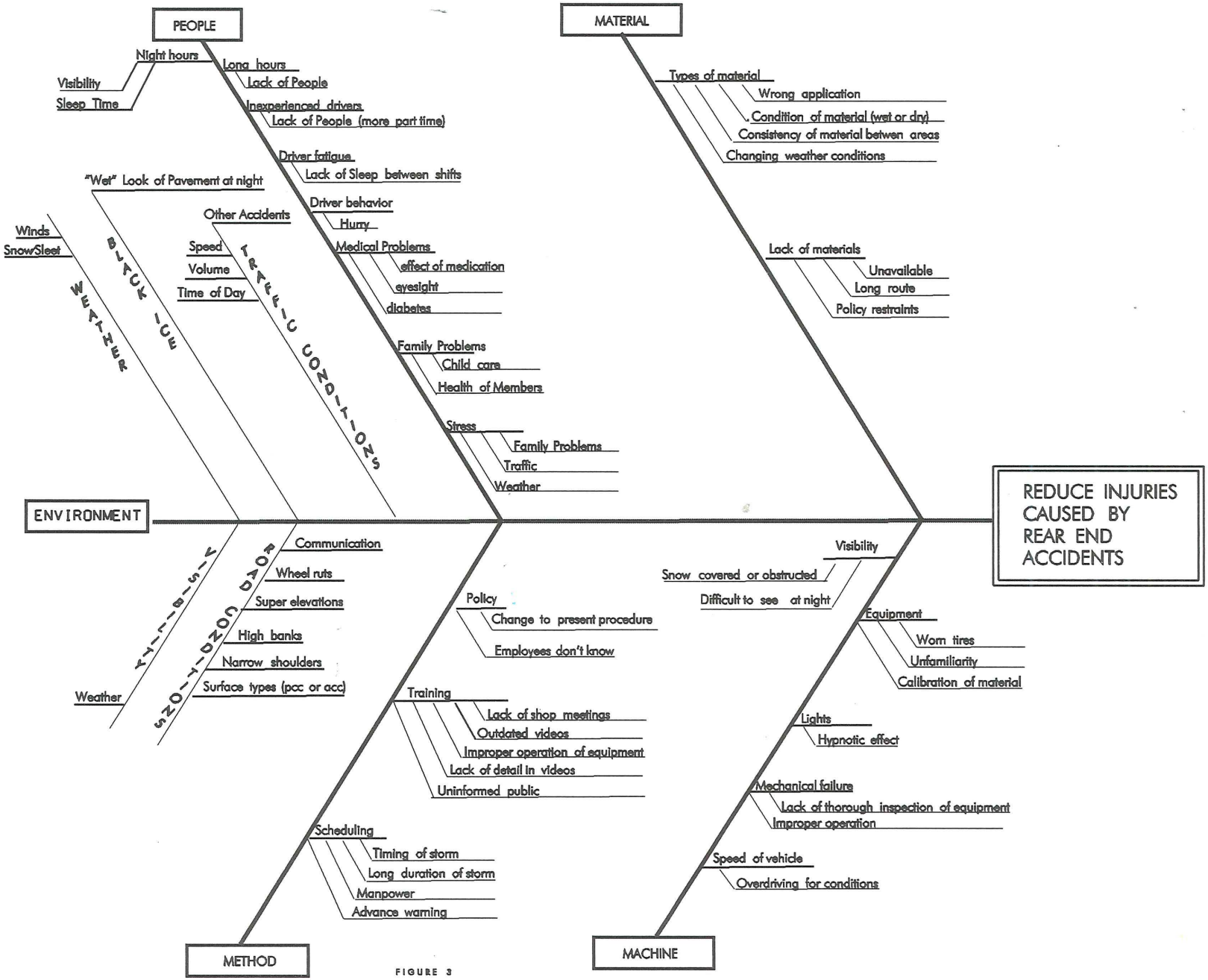

FIGURE 3

CAUSE AND EFFECT DIAGRAM
1992/1993 IOWA D.O.T.
SNOW PLOW ACCIDENTS

6. Determined that the rear end of D.O.T. snow plow trucks need to be more visible to provide drivers of approaching vehicles more time to respond.

Recommendations:

1. Provide better illumination on the rear of the truck so approaching motorists can better see the truck in time to prepare to change lanes, slow down or stop.

   A. Obtain or develop a set of special diverging lights consisting of one lens to be mounted near each of the upper rear corners of the dump box and facing to the rear. These two lenses would each contain a special source of light that would be controlled to change the intensity of the light three times during a complete cycle of the light. The light would be low, middle and high intensity in order to give approaching drivers the illusion they are closing in on the truck faster than is actually the case.

   This set of lights should be developed by an outside source and be installed on a snow removal truck at the Ames Maintenance Garage prior to October 15, 1996.

   The team has developed a report form (Appendix A) that will be completed by the truck operator after each use. This form will also be completed by the field team members and the highway patrol to compare the effectiveness of the special diverging lights to the standard lighting system. At the end of one winter, the team will determine if it is beneficial to recommend expanding the program of special diverging lights.

   B. Obtain one set of diverging lights that were developed and used for a SHRP project (Figure 4) and install on a snow removal truck at the Ames Maintenance Garage prior to October 15, 1995. The lights would be placed in a position on the rear of the truck similar to the position used in the SHRP project. The form in Appendix A and the evaluation procedure will be the same as the diverging lights above.

   NOTE: The team has concerns that these lights might misguide an approaching driver to pass the truck on the wrong side.

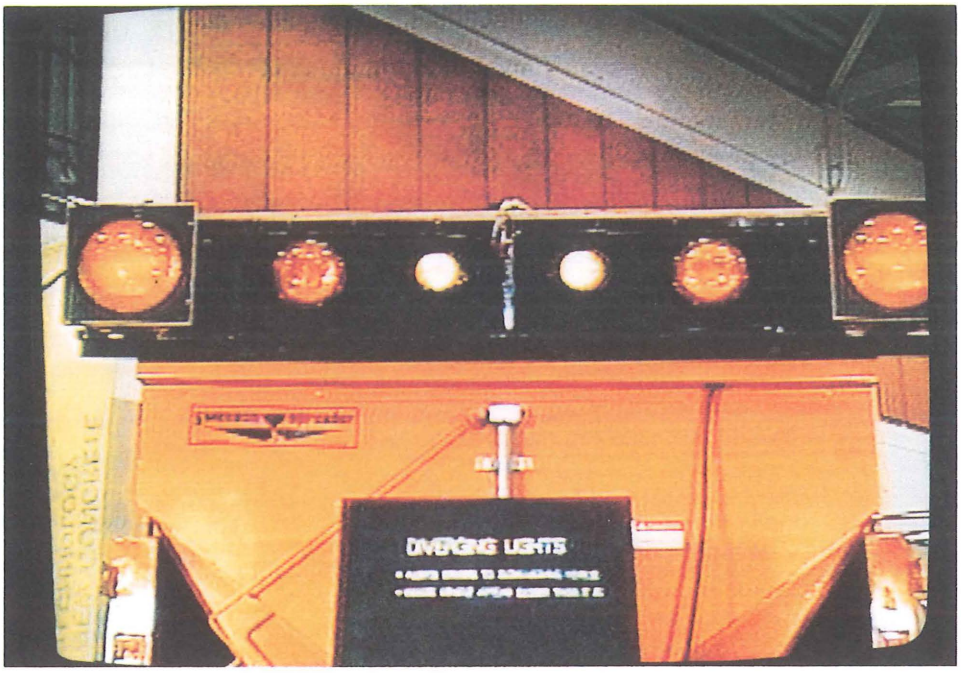

Figure 4 - SHRP Diverging Lights

C. A research project should be pursued, possibly with Iowa State University or the University of Iowa, to determine what is the optimum lighting system that could be used on the rear of the trucks under snow removal conditions to warn the approaching motorist. This study would include, but may not be limited to evaluating the items below:

- Color of lights.
- Position of lights such as on cab protector or mounted some distance above the rear of the dump box.
- Size of lights.
- Shape of lights.
- Detector that would turn the lights on or off depending on the closeness of a following vehicle.

2. Reduce the amount of airborne snow in order to reduce or eliminate accumulation of snow on the rear of the truck. Snow frequently covers the lights on the rear of the truck and reduces visibility for approaching motorists.

A. Install a snow plow deflector (Figure 5) on at least one truck in each field team member's area before October 15, 1995. This will improve vision for the truck operator and will have to be studied to determine the effect of snow behind the truck.

B. Install a rear deflector (Figure 6) on the rear of the dump box on one truck in each field team member's area before October 15, 1995.

Figure 5 - Snow Plow Deflector

Figure 6 - Rear Deflector

C. Equip one truck in each field team member's area with both a plow deflector and a rear deflector before October 15, 1995.

D. The team has developed a report form (Appendix B) to be completed by the operators of the trucks equipped with deflectors after use. The team has also developed an evaluation form (Appendix C) to be completed by the field team members and the highway patrol when observing the use of equipment without the deflectors and with the defectors during snow removal operations.

E. Research work should be done, perhaps by Iowa State University or the University of Iowa, to determine the optimal design for a plow deflector, a rear box deflector and perhaps a wing deflector. This would provide deflection of snow downward to avoid it becoming airborne and covering the windshield, rear of the truck and lights with snow and reducing the visibility for the approaching motorists. This research should also study the appropriate shape for the front mount snow plow deflector, the snow plow wing and high speed underbody snow plows to decrease or eliminate snow becoming airborne during snow removal operations.

3. Increase visibility of the truck by the use of reflective tape (Figure 7).

A. Install 3M Scotchlite Diamond Grade Conspicuity Sheeting Series 980 tape, Grote Conspicuity tape, or an approved equal on each truck equipped with a deflector and one truck not equipped with any deflector before October 15, 1995, in each field team member's area.

B. Install the maximum width reflective tape that the dump box will accommodate in the following locations:

- Upper sides of dump box
- Upper side of tailgate, unless truck is equipped with a rear air deflector, then the tape should be installed on center of tailgate.
- Upper part of the cab protector, if equipped with a cab protector.

C. The report form in Appendix B will be completed by the truck operator after snow removal operations. The form in Appendix C will be completed by the field team members as well as the highway patrol in comparing trucks equipped with tape to a truck without any tape on it.

D. Research should be done in coordination with the research identified above to determine the effectiveness of the tape and the optimal placement of that tape.

4. Establish a Training Aid Committee to develop videos for use in training employees about snow removal equipment, use of that equipment and snow/ice control materials and procedures.

A. Video tapes need to be developed and distributed to each Shop and RME Office by no later than September, 1996.

Figure 7 - Reflective Tape

B. Videos need to include, but not be limited to, the following items:

- Promote safety, including lights and warning devices.
- Be live action, limited to approximately 20 minutes each, and separated into categories such as what the equipment is, how it is to be used, and the proper maintenance of that equipment.
- Cover different chemical deicing agents and materials that are presently being used and the proper use of them.
- Use present day terminology for description of equipment, materials, staffing and other resources. For example, use "delineators" rather than "guide stakes", "supervisor" rather than "foreman" and "staff" rather than "men".
- Cover all equipment used in snow removal operations such as light duty wings, underbody ice blades, high speed underbody, snow plows, tailgate spreaders, heavy duty wings, front mount snow plows, forward dumping dump boxes and controls.
- Include helpful tips such as the plow height being changed as a load is being decreased on a truck; checking of a dump box and spreader before filling, in case items such as shovels have been left in the dump box; use of cable chains on the front wheels of trucks being used on super elevated ramps and roadways; and, use of orange flags and other appropriate safety markings on plows, wings and the truck itself.
- Minimize any review section within the training presentation.
- Have a separate section on a video of the calibration procedure for spreaders and also for calcium chloride applicators if they are still being used.
- Need to have live footage showing the use of each type of equipment under actual snow/ice control operations. Equipment would include, but not be limited to, high speed underbody snow plows, ice blades, right hand wings, left hand wings, tailgate spreaders, forward dumping dump box, front mount funnel snow plows, front mount reversible snow plows, calcium chloride applicators and any other snow/ice removal equipment.

C. The Committee should be made up of a good cross section of individuals, including Equipment Operators, Mechanics, Supervisors, Resident Maintenance Engineer and others that are appropriate.

The Committee should identify the tasks required to produce training aids and then determine if the department has the resources needed to accomplish the tasks or if outside services will be required.

APPENDIX A

DIVERGING LIGHTS EVALUATION FORM

Date: _____ Hours Used: From _____ (AM/PM) to _____ (AM/PM)

Cost Center: _____ Route Traveled: _____ Average Speed: _____ (mph)

A #: _____

Equipment in Use
(Check all that apply)
_____ Front Plow
_____ Underbody Plow
_____ Wing

Weather Conditions
(Check all that apply)
_____ Dry Snow
_____ Wet Snow
_____ Blowing Snow

DRIVER'S EVALUATION
(Fill out all that apply)

	GOOD	FAIR	POOR
Visibility with Diverging Lights:	_____	_____	_____
Visibility with Standard Lights:	_____	_____	_____

Opinion of Traffic Reaction: _____

_____

Other Comments: _____

_____

Driver's Name: _____

FOLLOWER'S EVALUATION

	GOOD	FAIR	POOR
Visibility with Diverging Lights:	_____	_____	_____
Visibility with Standard Lights:	_____	_____	_____

Comments on Lights: _____

_____

Other Comments: _____

_____

Follower's Name: _____

APPENDIX B

SNOW PLOW STUDY EVALUATION FORM

Date: _____ Hours Used: From _____ (AM/PM) to _____ (AM/PM)

Cost Center: _____ Route Traveled: _____ Average Speed: _____ (mph)

Vehicle Data
(Check all that apply)

A #: _____

Safety Device Being Tested
_____ Plow Deflector
_____ Tailgate Deflector
_____ Reflective Tape
_____ None of the above

Equipment in Use
_____ Front Plow
_____ Underbody Plow
_____ Wing

Weather Conditions
(Check all that apply)

_____ Dry Snow _____ Wet Snow _____ Blowing Snow

DRIVER'S EVALUATION
(Fill out all that apply)

	GOOD	FAIR	POOR
Plow Deflector:			
Windshield Clarity:	_____	_____	_____
White Out Reduction:	_____	_____	_____

Comments: _____

_____

	GOOD	FAIR	POOR
Tailgate Deflector:			
Snow Build Up Reduction:	_____	_____	_____

Comments: _____

_____

	GOOD	FAIR	POOR
Reflective Tape Visibility:	_____	_____	_____

Comments: _____

_____

Driver's Name: _____

APPENDIX C

FOLLOWER'S EVALUATION

Date:_____ A#:_____ Cost Center:_____

	GOOD	FAIR	POOR
Plow Deflector:	=====	====	=====
White Out Reduction:	_____	_____	_____

Comments: _____

_____

	GOOD	FAIR	POOR
Tailgate Deflector:	=====	====	=====
Snow Build Up Reduction: (tailgate/lights)	_____	_____	_____
White Out Reduction:	_____	_____	_____

Comments: _____

_____

	GOOD	FAIR	POOR
	=====	====	=====
Reflective Tape Visibility:	_____	_____	_____

Comments: _____

_____

Follower's Name: _____

****

Other Comments: _____

_____

Recommendations: _____

_____