

# DRAFT

## Results of the Workgroup Interviews *For the I-93 Salt Reduction Workgroup*



July 16, 2007

Jeffrey H. Taylor & Associates  
And

The Center for the Environment, Plymouth State University



Inside front cover with Agency and funding information?

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## I. Introduction and Statement of Purpose

The New Hampshire Department of Transportation (NHDOT) intends to add four new lanes to the southern section of Interstate 93, Salem to Manchester, starting in 2007. As a condition of the 401 Water Quality Certification issued for the I-93 expansion, and pursuant to the Memorandum of Agreement between NHDOT and New Hampshire Department of Environmental Services (NH DES), NHDOT will fund NH DES to complete Total Maximum Daily Load (TMDL) studies of chlorides in four impaired watersheds. The purpose of these studies is to determine the TMDL of chlorides permitted in each watershed such that water quality standards for chlorides will be met. In addition, NH DES will develop an implementation plan to reduce chloride loads to the TMDL. The expansion of I-93 is expected to accelerate population growth in southern New Hampshire. This growth will increase road salt usage in the area which may cause other watersheds to be impaired for chlorides. Increasing chloride concentrations are a regional and national issue.

The NHDOT and NH DES have, in conjunction with the TMDL studies, established a Salt Reduction Workgroup. This *Results of the Workgroup Interviews* report to the Salt Reduction Workgroup summarizes the findings from face-to-face interviews conducted during May and June of 2007 with thirty-six Workgroup members and other key informants. The focus of this report is on the barriers to reducing salt usage in the targeted watersheds along Interstate 93.

The consultant team, Jeffrey H. Taylor & Associates and the Center for the Environment at Plymouth State University, developed a standardized survey instrument (see Appendix A) that was used to capture information from members of the Salt Reduction Workgroup. In addition to the Workgroup interviews, the consultant team also interviewed researchers from Plymouth State University who are currently researching chloride loading by private contractors.

This process is the first step in a comprehensive research and facilitation project involving the Salt Reduction Workgroup that will identify existing barriers and possible solutions to reducing salt usage on roadways and parking lots.

### **Key Conclusions from the Workgroup Interviews**

#### ***Best Management Practices, Techniques, and Technologies***

- The surfaces being treated by the state/local/private maintenance crews are quite different, and can have vastly different conditions and needs during storm events.
- More training is needed overall. There may even be a need to go on the road to the towns. All new information should be delivered by a peer from the same field.
- Solutions should be focused on training, equipment and infrastructure upgrades, and behavior changes, rather than finding a new product to apply to surfaces.
- In general, if information is well presented by unbiased people, the respondents were open to new information on alternatives.

## **Key Conclusions from the Workgroup Interviews (*Continued*)**

### ***Behaviors Relative to Application, and Communication Strategies***

- Most everyone recognizes that the general public is key to resolving this issue.
- Changes in the expectations of winter road surface conditions seem to be needed, and that message needs to come from all levels.
- Most road maintenance professionals are open to changes, but need them to come as a directive that will be backed by the town (regulation, policy change, etc.).
- There is the potential for conflict between some police officers and road maintenance staff during storm events, given their different perspectives and areas of responsibility.
- The private sector plowing community is very transient, and the structure of their contracts often dictates the degree of treatment that they provide.
- Because the private sector performs winter maintenance under annual contracts, permanent storage or cover of salt is seldom established.
- Towns are having trouble attracting contractors due to the rising costs of operating such a seasonal service.
- Town staff that get trained on new information and technology related to winter maintenance are often constrained in their town financially and don't get to implement the new approaches.
- Black and dry road conditions are expected by most stakeholders. Although there is no such official policy here in New Hampshire, an expectation has been created over time.

### ***Salt Usage Data***

- More data is needed on the impacts of salt in New Hampshire, and on recommended surface treatment levels.
- Improvements need to be made in the reporting of salt usage, and in communicating why this data is important.
- Currently salt usage data is viewed as most critical for budgeting and purchasing needs.
- Although most decision making on surface treatment follows a similar process, the tools available vary quite a bit. The State has access to advanced decision making technology for some routes, while some of the smaller towns don't even have access to weather radar on the internet.

### ***Regulations***

- There were many concerns over how regulations will be implemented, but the majority felt that was the only way to change practices.
- Depending on the structure of the regulations, and the salt application reductions required, many Workgroup members felt that some funding will be necessary for implementation.

### ***Funding***

- Although there may be a need for some general distribution of funding, most Workgroup members felt that the funding should be used to address problem areas and to create positive examples in New Hampshire.

## II. Methodology

This portion of the Salt Reduction Workgroup effort is designed to provide decision makers with usable information about various alternatives to current road maintenance techniques, alternatives that may potentially reduce the use of chlorides and the negative impacts associated with their use in the I-93 corridor. To achieve these goals this project used multiple social research methods to compensate and capitalize on the strengths and weaknesses of the various methodologies employed.

The project began with a review of available documents concerning national and international efforts to reduce the use of chlorides as a winter road treatment. Sources included internal communication documents, public records, reports from municipalities and nations, and scholarly publications. In combination these materials provided the researchers with a basic understanding of the issues and their development over time.

Dr. Brian Eisenhauer of the Center for the Environment at Plymouth State University and Steve Whitman of Jeffrey H. Taylor and Associates developed a standardized survey instrument to structure data collection on topics of interest from members of the Workgroup. The questionnaire was reviewed and approved by members of the steering committee, and 36 face-to-face interviews were conducted with Workgroup members and other key informants (defined as professionals who are active in the winter road maintenance field) using the standardized survey instrument. All but three of the agencies or people contacted for interviews participated in the study. The interview protocol consisted of three types of questions:

- yes/no responses
- scaled responses (both nominal and ordinal)
- open-ended responses

Together, these three types of questions will provide more complete data than would an interview consisting of simple yes or no responses {Singleton, 2005:337}. Interviews lasted from 30 minutes to more than two hours, and in the course of the interviews extensive hand-written notes were taken. At the conclusion of the interview process, the results were coded, checked for completeness, and verified by the researcher.

The data from closed-ended questions was entered into a statistical database, and statistical software (Statistical Package for the Social Sciences (SPSS)) was used to describe the data in univariate (single variable) and bivariate (multiple variable) analyses, to assess potentially important relationships, and to determine if stakeholders with varying professional perspectives on road salt issues regard perceptions of, and barriers to, the reduction of road salt differently. Questions were developed and their coding was conducted following appropriate survey techniques for the social sciences to ensure the validity and reliability of findings (Dillman 2000).

Responses to the open-ended questions were written by the interviewer, and the notes were reviewed individually and recorded using a coding sheet that followed the interview protocol based on the questions used to guide this research developed by the steering committee, the

Workgroup, and the project team. The coding sheet was used to organize findings from the interviews. Once the data were organized according to the topics identified, another stage of analysis was performed in which the information was inductively analyzed (Glaser and Strauss 1969) into conceptual categories and patterns that emerged from the data itself (Miles and Huberman 1984) and were relevant to the research questions. Findings are presented in the form of summary comments and identifications of key issues uncovered in the interviews relevant to each of the topical areas examined.

In combination the analysis of the results conducted using SPSS and the qualitative information provides usable data to address the research questions guiding this study, which are identified below. Key findings of these procedures are highlighted in Section IV of this report, and the full content of the statistical and qualitative analyses appear in the Appendix. The implications of these findings are addressed in the Conclusion.

### **III. Broad Research Questions Guiding the Research**

As identified in the proposal for this work and subsequent steering committee and other meetings, the following are the broad research questions addressed by utilizing the methodology described above (II):

- *3(a). Identification of specific best management practices, techniques, and technologies used to reduce the application of salt to roadways and parking lots.*
- *3(b). Identification of behaviors of the driving public, of safety personnel, of elected officials, and of road maintenance staff relative to the application of salt to roadways and parking lots*
- *3(c) Identification of target audiences and communication strategies for a salt reduction outreach, education, and hands-on technical assistance program within the corridor communities.*
- *3(d). Identification of feasible methods by which to obtain accurate information on salt usage for winter road maintenance by state, private, and municipal applicators.*
- *3(e). Identification of possible regulatory approaches for reducing the application of salt to roadways and parking lots, and the effects it would have on their operations*
- *3(f). Identification of optimal criteria for distributing funds under the Salt Reduction Grant Program*

#### **IV. Salient Findings from the Survey: Univariate Statistical Analyses and Qualitative Results from Interviews**

##### *Using and interpreting this report*

To provide information about the research questions in the best manner, the report presents findings organized by the research questions themselves. Qualitative and quantitative techniques were utilized to analyze the data used to answer the research questions, and the report organizes both in combination to provide the most accurate data possible.

Findings from the closed-ended questions are analyzed statistically, and the findings are presented in graphic form, as well as in tables to provide more information when appropriate. The key implications of the findings are presented succinctly before the data is reported. A complete set of results from the statistical analyses appears in the Appendix to this report.

When interpreting the tables below the column headers identify different forms of data analysis. The frequencies are simple counts of the number of responses. The percent column includes missing data, which are responses such as “don’t know,” “not applicable,” or places where a respondent did not indicate an answer. The valid percent is the column of most use, as it indicates the distribution of responses with missing data removed from the analysis.

To analyze the qualitative data collected using the open-ended questions, a coding sheet for the interview notes was designed that followed the outline of the interview protocol. The protocol itself was based on the questions identified by the Workgroup and Steering Committee used to guide this research. The coding sheet was used to organize the interview data according to the topical themes used to structure the inquiry, and once the interview responses were categorized in this manner another stage of analysis was performed in which the information was inductively analyzed (Glaser and Strauss 1969) into conceptual categories and patterns that emerged from the data itself (Miles and Huberman 1984) and are relevant to the research questions. Findings are presented below in the form of summary comments and the identification of key issues uncovered in the series of interviews that are relevant to each of the topical areas examined. The complete collection of data from the qualitative questions is also available in the Appendix of this report.

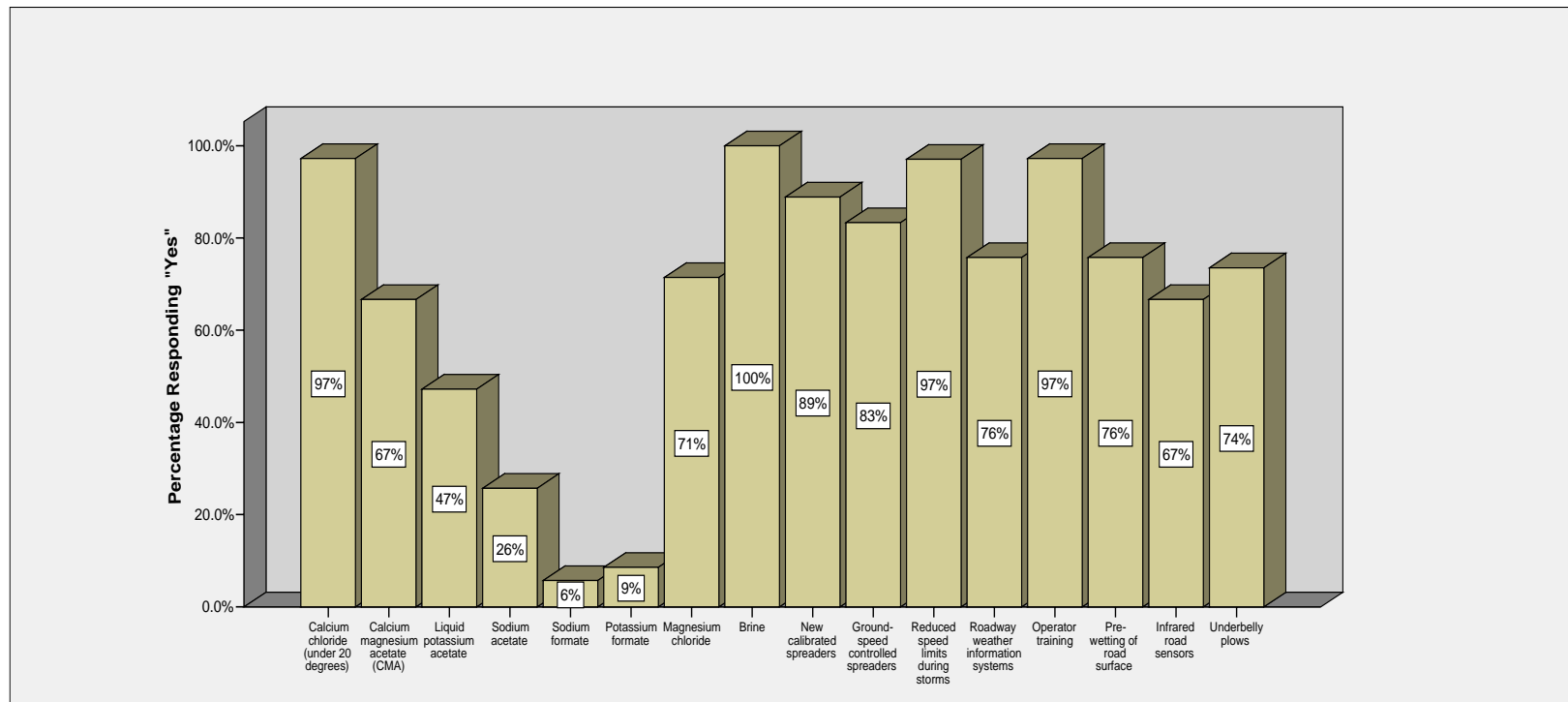
## IV-A Best Management Practices, Techniques, and Technologies

The first section of the survey instrument was designed to answer the following research question by examining a number of complex concepts and ideas: **3(a). Identification of specific best management practices, techniques, and technologies used to reduce the application of salt to roadways and parking lots.**

### Awareness

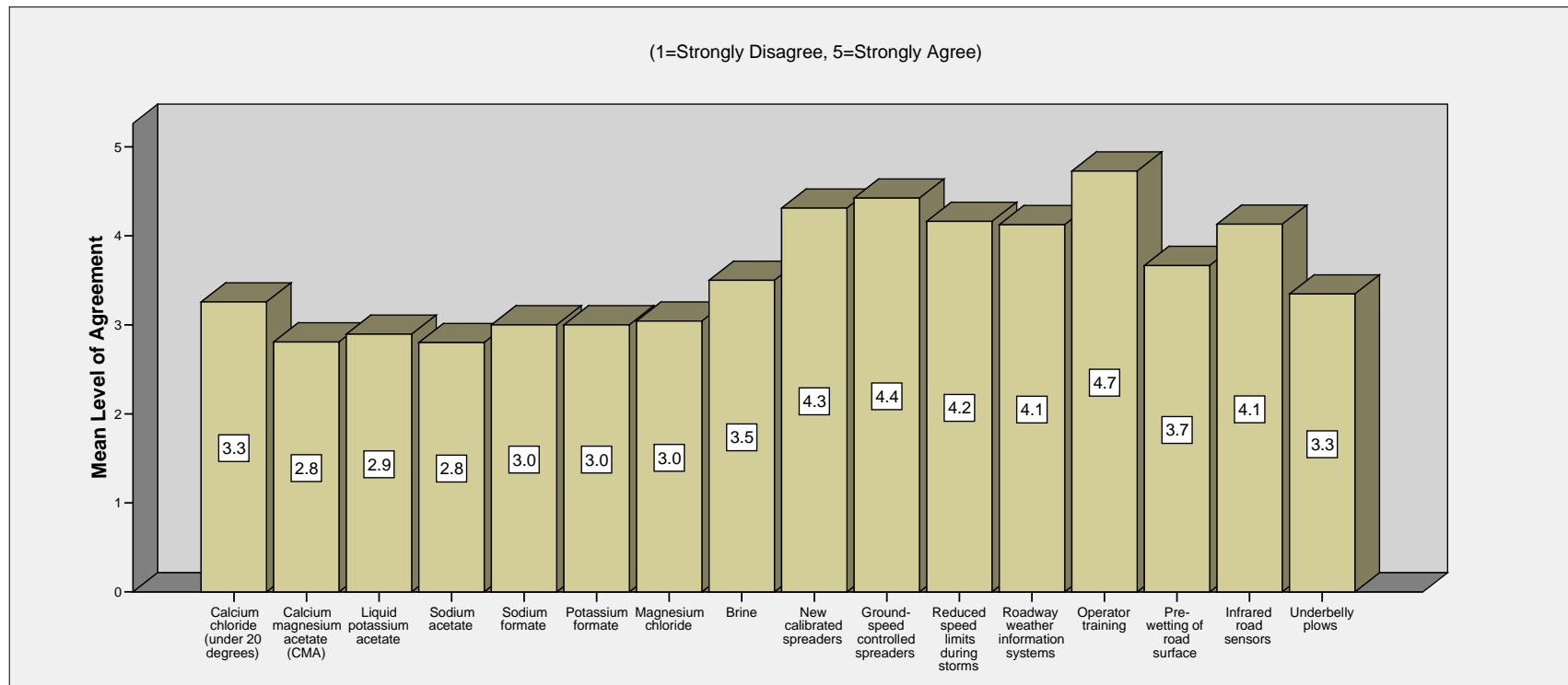
The first question of the survey asked respondents which of the techniques identified in the following chart they were aware of at the time of the interview. The results indicate that while there is variance in respondents' awareness of these alternatives, the vast majority are known to most respondents. The alternatives known to the fewest respondents are some of the more recently developed chemical alternatives, which likely represents a normal learning curve in the field.

Percentage of Respondents Indicating They Are Aware of the Potentially Chloride Reducing Road Maintenance Option



The follow-up question asked respondents to indicate their level of agreement with the assertion that each of the following road maintenance options represents a realistic alternative for reducing the impacts of road salt use. The data present responses from those who knew of the alternatives in question: “Don’t know” responses are removed from this comparison, but are identified in the complete data report in the Appendix. There is a relatively high level of confidence in all alternatives respondents were asked about, with behavioral and equipment options being favored over chemical treatments.

**Mean of Respondents' Level of Agreement with the Assertion Each of the Following Road Treatments is a Realistic Alternative for Reducing the Impacts of Road Salt**



Respondents were also asked if there are specific techniques for reducing the impacts of salt they find promising that they were not asked about. The most popular responses included:

- Certification and education of operators
- Public education
- Sign low salt or no salt areas.
- Porous pavement.
- Policy change: Delay in time tables for clear roads.

Based on the alternatives that were rated most promising, respondents were then asked why they considered it a realistic alternative for addressing issues related to salt use. The responses included:

- *Brine* - Still a salt, but more effective for pre-treating
- *Spreaders: Calibrated and speed control* - Effective use of less salt
- *Roadway Weather Information System* – Weather data guides treatment
- *Reduced speed limits* – Reduces expectations for surface treatment during storms
- *Operator training* – More effective treatment with less salt

Respondents were then asked about the barriers to these alternatives becoming used more frequently. The following barriers were identified overall:

- More expensive
- Challenge to mandate and enforce
- Not sure of the environmental impacts
- Education and training needed

Respondents were asked what the major issues are with the least viable alternatives. They include:

- All Acetates
  - Cost
  - Not as viable because of organics and other impacts
- Underbelly plow
  - Obstacles in road surfaces
- Reduced speed limits
  - Public perception of safety issues
- Brine
  - Still uses lots of salt
  - Local level equipment needs
- Calcium Chloride
  - No Chloride reduction
  - Cost

Respondents were asked if the Best Management Practices they were aware of are well understood among their peers. The responses were fairly split:

- Yes - 12
- No - 12
- Not sure - 6

The respondents and their peers are getting their information about these alternatives from:

- T<sup>2</sup> at UNH
- Internet
- Trade magazines
- NH Department of Transportation
- Workshops and seminars

The following sources of information would not be considered reliable:

- Vendors
- Salt Institute
- NH Department of Environmental Services (DES) and Environmental Protection Agency (EPA)
- Environmental organizations in general

These sources of information would not be considered reliable because:

- Vendors are vague, sales motivated, and push products.
- DES is not responsible for safety and is removed from the consequences.
- Environmental organizations grab onto concerns without understanding issues.
- Distrust of government agencies and inconsistent message.

The following approaches were considered the most effective ways to create awareness of these types of alternatives:

- Training - especially if it includes incentives to attend (like food)
- Publications that are user friendly and reference specific studies
- Getting information to public officials
- Education of the public (including children) and professionals

## **Responses by Employment Sector**

**There are particularly meaningful differences about the belief that brine, RWIS, or pre-wetting are realistic alternatives, with “On the ground” road maintenance staff being most skeptical of these options. In contrast, overall “Transportation field professionals” were most skeptical of alternatives, as a whole.**

**With the exception of calcium magnesium acetate, federal employees ranked every alternative lower than the other groups. Other variances among employment sector included significant preference from state regulatory agencies for both sodium acetate and magnesium chloride; state regulatory agency employees also ranked underbelly plows well below the mean.**

**Peer-based education is needed, as interviews indicated that there is frequent skepticism about information that comes from sources outside the type of work stakeholders perform.**

***Best Management Practices, Techniques, and Technologies – Trends and Issues Identified:***

- The surfaces being treated by the state/local/private maintenance crews are quite different, and can have vastly different conditions and needs during storm events.
- More training is needed overall. There may even be a need to go on the road to the town. All new information should be delivered by a peer from the same field.
- Solutions should be focused on training, equipment and infrastructure upgrades, and behavior changes, rather than finding a new product to apply to surfaces.
- In general, if information is well presented by unbiased people, the respondents were open to new information on alternatives.

## IV-B Behaviors Relative to Application, and Communication Strategies

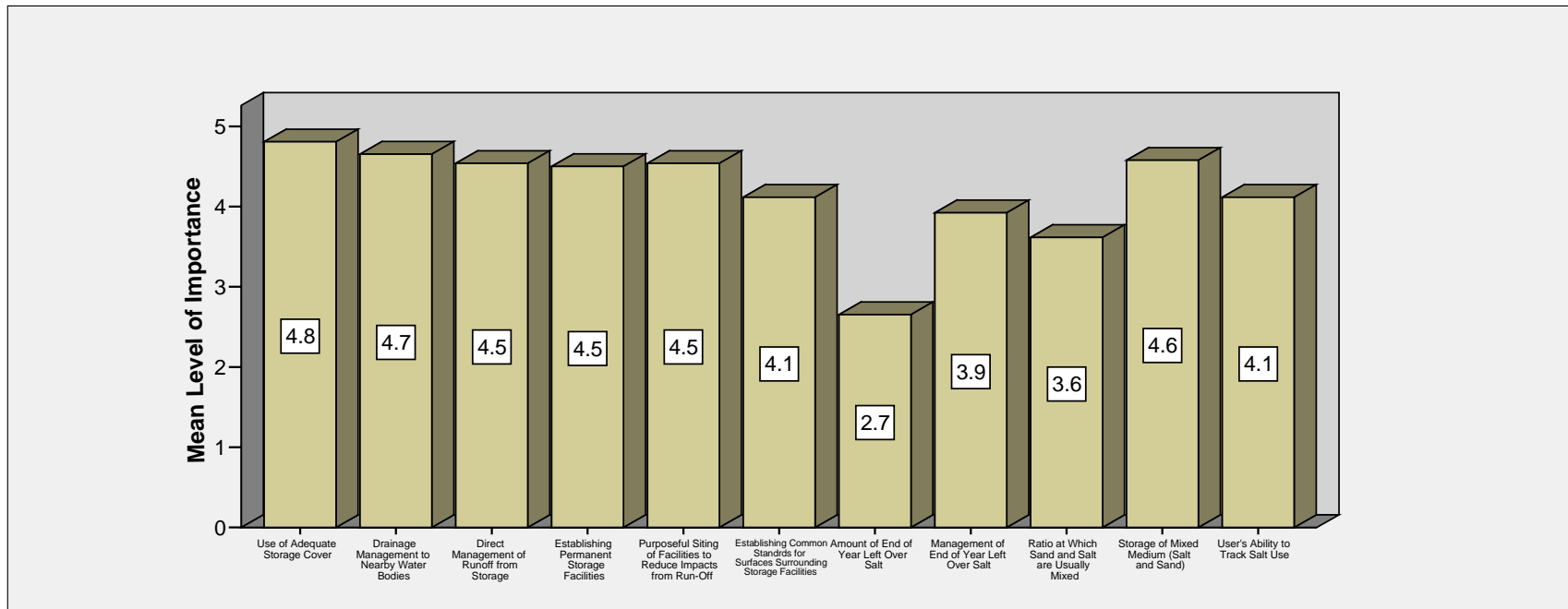
The second section of the survey was designed to provide information about the behaviors of various audiences and stakeholders relevant to road salt use reduction efforts. The information will be supplemented in the upcoming focus group research stages of the project, and the survey data collection was specifically designed to address the following research need:

**3(b). Identification of behaviors of the driving public, of safety personnel, of elected officials, and of road maintenance staff relative to the application of salt to roadways and parking lots; and 3(c) Identification of target audiences and communication strategies.**

### IV-B-1 Overview

The first question focused on respondents' perceptions of how important issues of salt use and storage are in efforts to reduce the impacts of salt. Many issues of storage are perceived as important, and overall addressing these issues is seen as very important.

### Respondents' Beliefs About How Important Each of the Following Issues Related to Salt and Salt Usage are to Efforts to Reduce the Impacts of Salt



Respondents were asked what is most important for addressing issues related to salt use and storage. The most popular responses included:

- Storage cover/Permanent storage
- Salt tracking
- Draining management

Based on these responses the respondents were then asked to identify the barriers that exist to addressing these issues. They include:

- Storage cover/Permanent storage
  - Cost
  - Private lots contract annually: leave storage to contractor.
- Salt tracking
  - Time
  - Measurement techniques
- Drainage management
  - Cost
  - Lack of information on impacts

Respondents were then asked who is in the best position to provide information on these issues. They identified:

- Department of Environmental Services
- DPWs
- Department of Transportation
- T<sup>2</sup> at UNH

### **Responses by Employment Sector**

**Surprisingly there were few differences between respondents with different types of employment. The only important difference between the groups was in regards to how important an issue “what is done with salt “left over” at the end of the year” is perceived to be. The data below indicate that “On the ground” road maintenance staffs think this issue is of relatively low importance, while “Regulatory” and “Transportation field professional” workers think it is one of the most important issues.**

## STAKEHOLDER GROUPS SECTION

The next section of the survey asked respondents about their perceptions of the behaviors, attitudes, beliefs, and concerns of various stakeholders in road salt reduction issues in an effort to address research questions 3b and 3c (above). The following data represent a series of identical questions asked about each stakeholder group to identify important similarities and differences.

### IV-B-2 Contractors Working for DPWs

Each respondent was asked what kind of training is typically given to **contractors working for DPWs**.

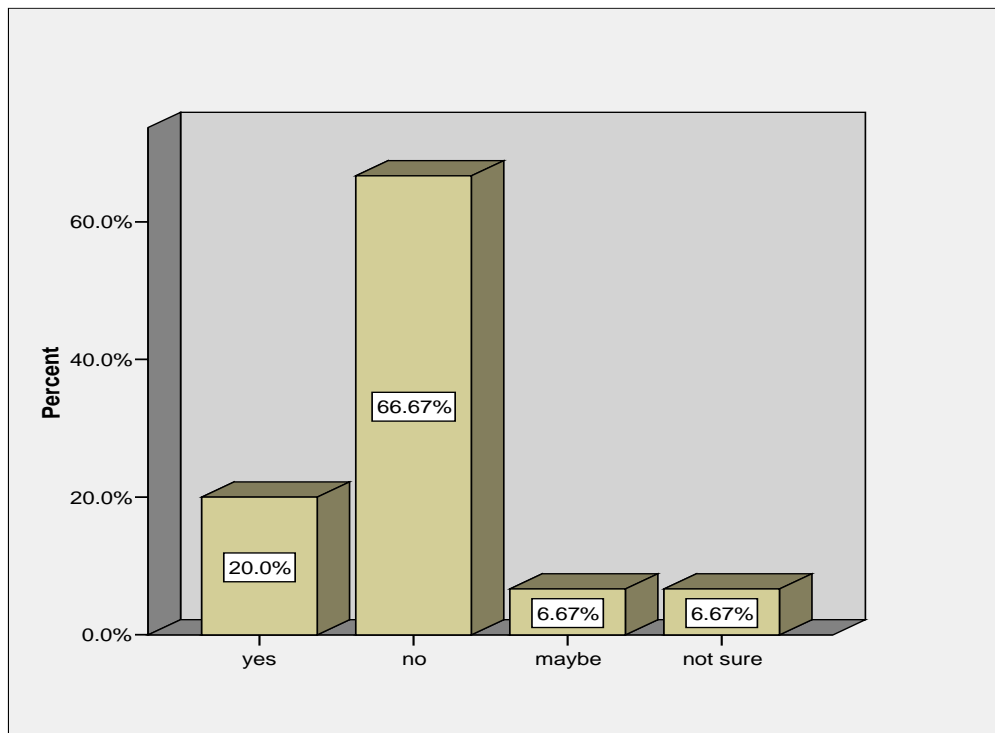
- Overall there is limited training provided to contractors. The training that they do receive is provided by their employer at the beginning of the winter, and tends to focus on the basics of winter maintenance and their role as contractors.

Each respondent was also asked what the likely expectations of that training are, and most felt the training focused on the basics related to maintenance operations.

### Awareness

Respondents predominantly were of the belief that DPW contractors are not aware of the negative impacts of salt use on water quality. Two thirds of respondents answered “no” when asked, while only one out of five replied in the affirmative. The responses indicate that respondents did not believe DPW contractors to be well versed in the impacts of salt use.

**Are DPW Contractors Aware of the Negative Impacts of Salt Use on Water Quality?**



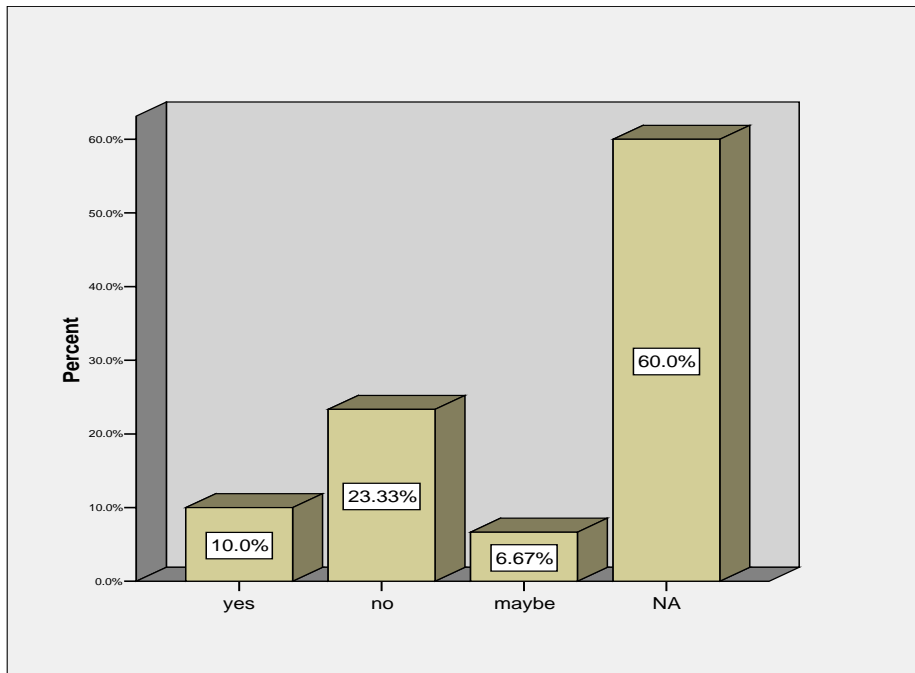
**Are DPW Contractors Aware of the Negative Impacts of Salt Use on Water Quality?**

		Frequency	Percent	Valid Percent
Valid	yes	6	16.7	20.0
	no	20	55.6	66.7
	maybe	2	5.6	6.7
	not sure	2	5.6	6.7
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

**Concerned?**

Generally, when asked if DPW contractors were concerned about negative effects of salt use, respondents declined to answer. Of those respondents who did hazard a guess, more than twice as many respondents felt that DPW contractors were not concerned, as those who felt that they were.

**Are DPW Contractors Concerned?**



**Are DPW Contractors Concerned?**

		Frequency	Percent	Valid Percent
Valid	yes	3	8.3	10.0
	no	7	19.4	23.3
	maybe	2	5.6	6.7
	NA	18	50.0	60.0
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

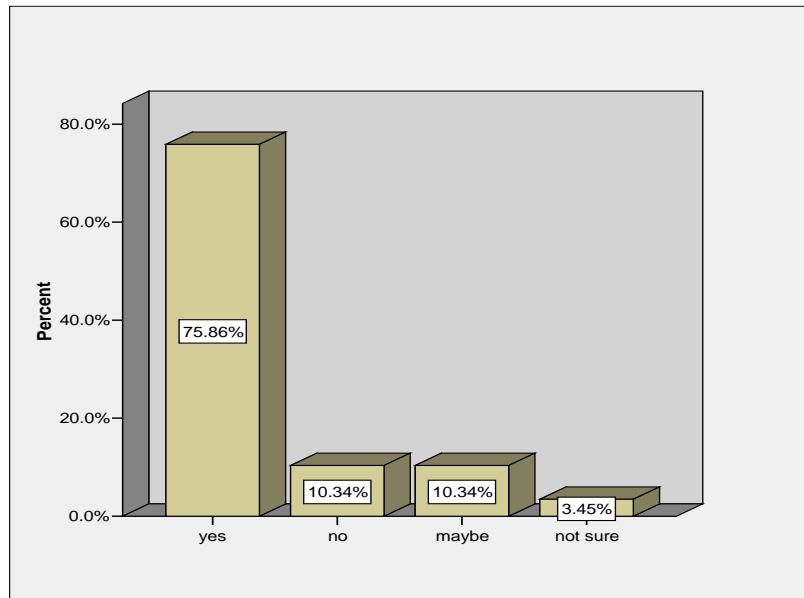
Respondents were asked what the most important information is that **Contractors working for DPWs** should know:

- Knowledge of when/ how much of specific treatments should be applied
- Environmental impacts of treatment
- How to reduce salt usage
- Why things are changing in the way treatment is handled

**Open to Alternatives?**

More than three fourths of respondents felt that DPW contractors would be open to using alternatives to reduce impacts from road salt use. Just over ten percent felt they would not be open, and an equal proportion thought that they may be. The responses to this question imply that respondents believe use of alternatives could be viable with this group.

**Are DPW Contractors Open to Using Alternatives to Current Practices to Reduce Impacts from Salt Use?**



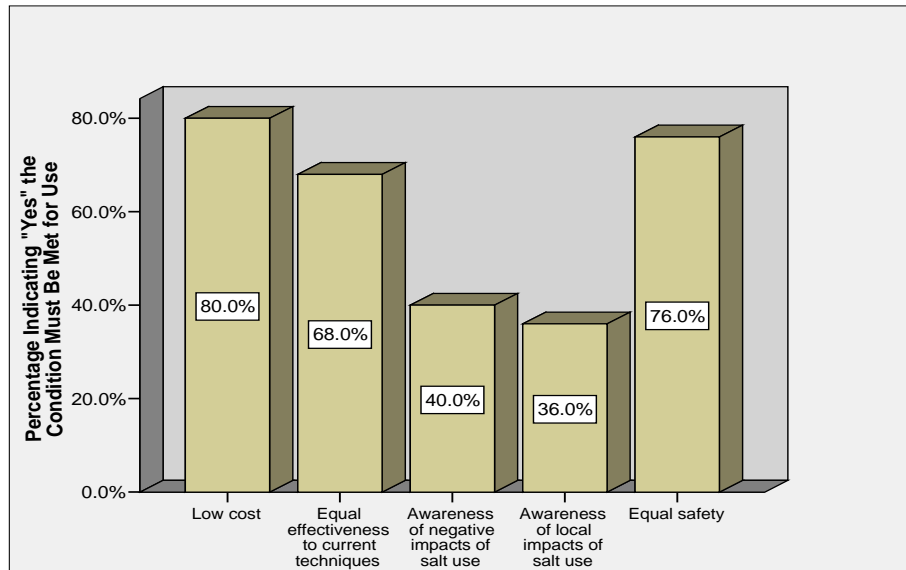
**Are DPW Contractors Open to Using Alternatives to Current Practices to Reduce Impacts from Salt Use?**

		Frequency	Percent	Valid Percent
Valid	yes	22	61.1	75.9
	no	3	8.3	10.3
	maybe	3	8.3	10.3
	not sure	1	2.8	3.4
	Total	29	80.6	100.0
Missing		7	19.4	
Total		36	100.0	

## Conditions for Acceptance

A majority of respondents felt that for DPW contractors to accept an alternative, it must have a low cost, and provide equal effectiveness and equal safety. While many respondents did suggest that DPW contractors needed increased awareness of impacts of salt use to accept alternatives, they were slightly in the minority.

**Percentage of Respondents Indicating the Conditions Under Which They Believe Contractors Working for DPW Are Willing to Use Alternative Road Treatments**



Other conditions that would make them willing to use alternatives:

- Requirement of contract work
- Less equipment wear and tear
- Equipment availability
- Financial Incentives

What are the barriers that need to be addressed?

- Costs
- Training
- Driver turnover
- Impact on equipment

What do you believe is the most effective way to provide DPW employed contractors with needed information about road salt?

- From their peers
- Orientation meetings/training/workshops (required through their contract)
- DPW

**IV-B-3 DPW Staff**

Each respondent was asked what kind of training is typically given to **DPW staff**.

- The amount of training provided varies quite a bit between organizations. Most DPW staff appear to be receiving training in-house on the basics of winter maintenance, and some are being sent for additional training elsewhere.

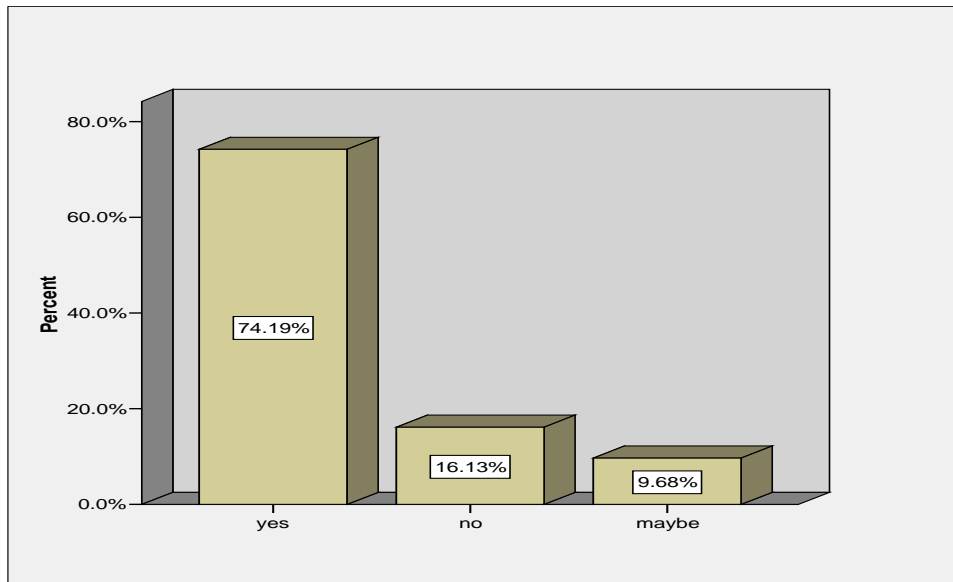
Each respondent was also asked what the likely expectations of that training are.

- Training that takes place in-house tends to focus on the basics, but training offered elsewhere is a combination of basics and new sources of information.

**Awareness**

In sharp contrast to DPW contractors, DPW staff were seen by respondents as being far more aware of negative impacts of salt use. Nearly three fourths of respondents felt that DPW staff were aware of negative impacts. A sizeable group of respondents, however, did not believe that DPW staff were aware.

**Are DPW Staff Aware of the Negative Impacts of Salt Use on Water Quality?**

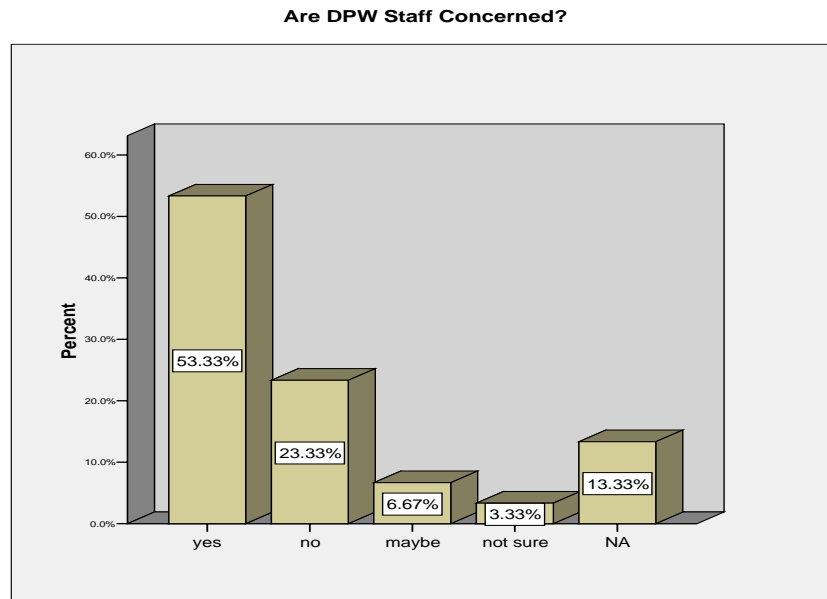


**Are DPW Staff Aware of the Negative Impacts of Salt Use on Water Quality?**

		Frequency	Percent	Valid Percent
Valid	yes	23	63.9	74.2
	no	5	13.9	16.1
	maybe	3	8.3	9.7
	Total	31	86.1	100.0
Missing		5	13.9	
Total		36	100.0	

### Concerned?

More than half of respondents felt that DPW staff were concerned, a significant portion of respondents also declined to answer, and almost a quarter felt that DPW staff were not concerned. The responses to this question indicate a view that DPW staff are not entirely apathetic to the problems arising from road salt.



**Are DPW Staff Concerned?**

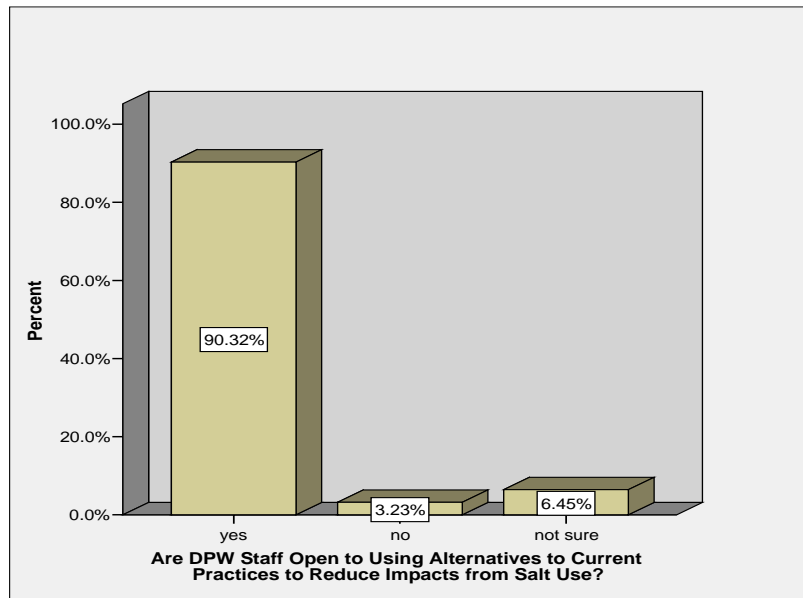
		Frequency	Percent	Valid Percent
Valid	yes	16	44.4	53.3
	no	7	19.4	23.3
	maybe	2	5.6	6.7
	not sure	1	2.8	3.3
	NA	4	11.1	13.3
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

Respondents were asked what the most important information is that **DPW Staff** should know:

- Environmental impact
- How to reduce salt usage (and save money)

### Open to Alternatives?

Nine out of ten respondents felt that DPW staff would be open to use of alternatives. This view indicates a prevalent thought that DPW staff will likely embrace reasonable alternatives.



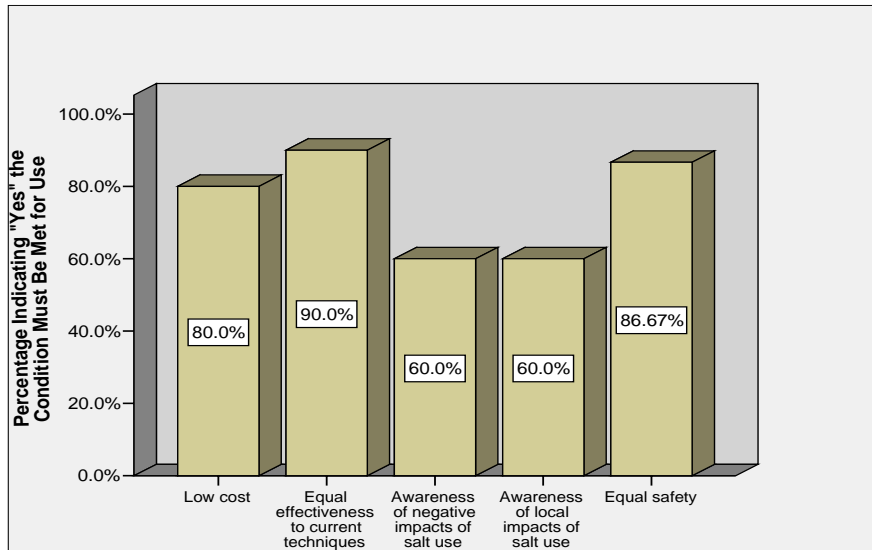
**Are DPW Staff Open to Using Alternatives to Current Practices to Reduce Impacts from Salt Use?**

		Frequency	Percent	Valid Percent
Valid	yes	28	77.8	90.3
	no	1	2.8	3.2
	not sure	2	5.6	6.5
	Total	31	86.1	100.0
Missing		5	13.9	
Total		36	100.0	

### Conditions for Acceptance

More than half of respondents indicated that each condition would have to be met for DPW staff to be willing to use alternatives; again awareness of negative effects of salt was seen as less relevant than cost, effectiveness, and safety. These responses suggest that viability and reasoning for alternatives will have to be well proven to be embraced by DPW staff. The belief shown in the previous question, that DPW would likely embrace alternatives, is tempered by the realities of the task at hand for DPW staff. More than half of respondents felt that each of the listed criteria must be held to gain willingness of DPW staff; implying that embracing of alternatives will take place only with education, cost benefits, and an effective approach to road surface care.

**Percentage of Respondents Indicating the Conditions Under Which They Believe DPW Staff Are Willing to Use Alternative Road Treatments**



Other conditions that would make them willing to use alternatives:

- When supervisors will support added time input or quality sacrifices
- Political will
- Regulations or enforcement
- Support from safety services

What are the barriers that need to be addressed?

- Support from town
- Education
- Cost and Time constraints
- Mindset and resistance to new things

What do you believe is the most effective way to provide DPW Staff with needed information about road salt?

- From their peers
- Orientation meetings/training/workshops, especially if food and other incentives are offered
- T<sup>2</sup> at UNH
- DOT

**IV-E Private Contractors**

Each respondent was asked what kind of training is typically given to **Private Contractors working for private property owners.**

- The only training that seems to be available to this group is from others within their company.

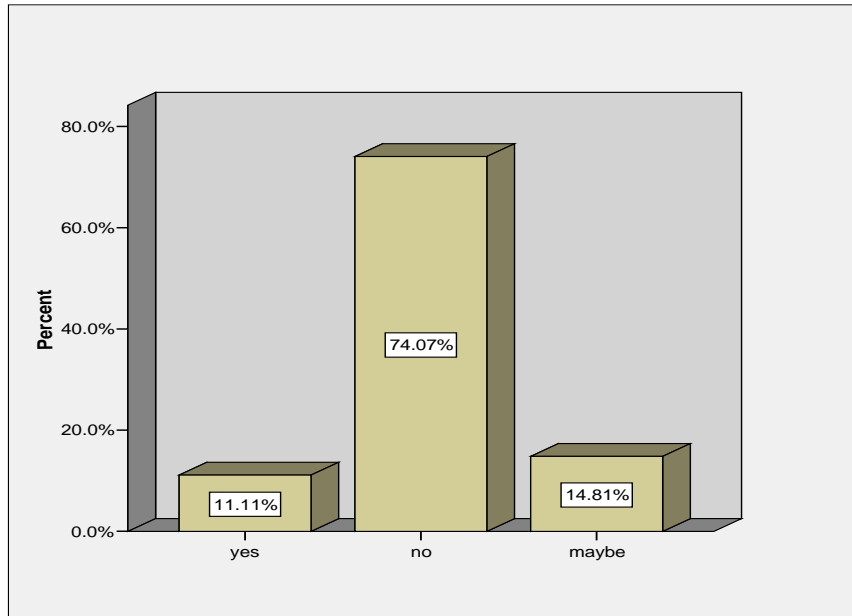
Each respondent was also asked what the likely expectations of that training are.

- The basics on how to plow each lot, and safety procedures.

**Awareness**

Almost three quarters of respondents felt that private contractors were not aware of the negative impacts of salt use, one out of nine respondents felt that they were aware, and almost fifteen percent answered “maybe”.

**Are Private Contractors Aware of the Negative Impacts of Salt Use on Water Quality?**



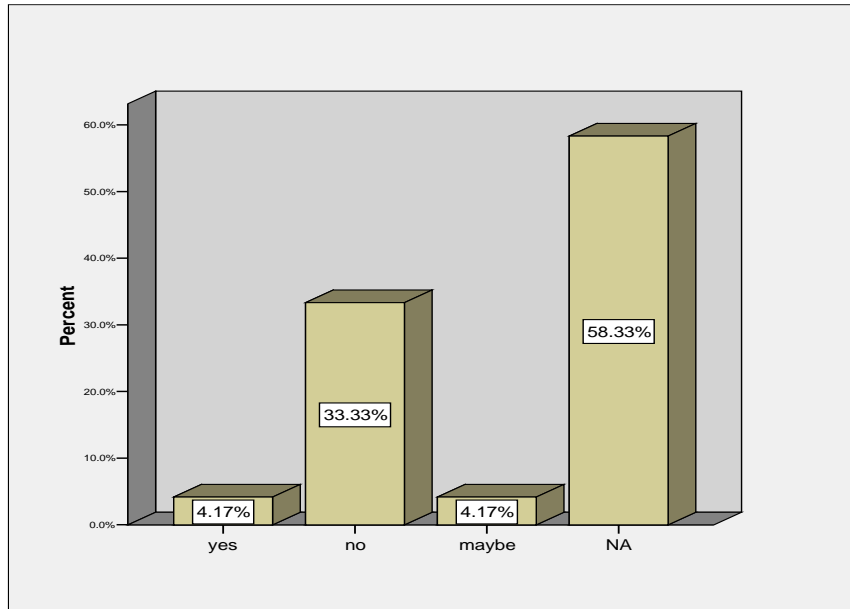
**Are Private Contractors Aware of the Negative Impacts of Salt Use on Water Quality?**

		Frequency	Percent	Valid Percent
Valid	yes	3	8.3	11.1
	no	20	55.6	74.1
	maybe	4	11.1	14.8
	Total	27	75.0	100.0
Missing		9	25.0	
Total		36	100.0	

### Concerned?

While most respondents did not express whether or not they felt private contractors were concerned about the negative impacts of salt use, one out of three respondents felt that they were not concerned. Only one respondent indicated a belief that private contractors were concerned, and another thought that they may be.

Are Private Contractors Concerned?



Are Private Contractors Concerned?

		Frequency	Percent	Valid Percent
Valid	yes	1	2.8	4.2
	no	8	22.2	33.3
	maybe	1	2.8	4.2
	NA	14	38.9	58.3
Total		24	66.7	100.0
Missing		12	33.3	
Total		36	100.0	

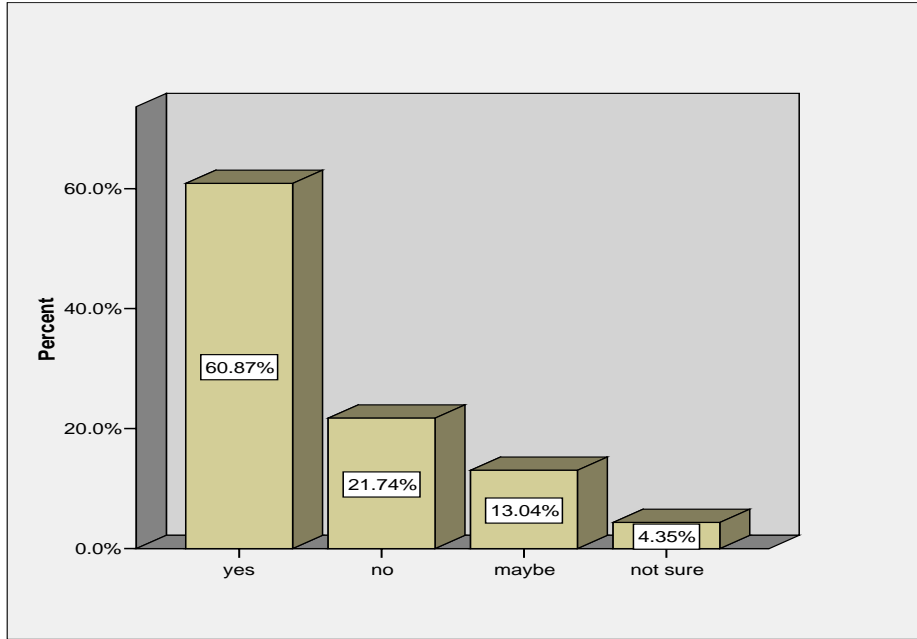
Respondents were asked what the most important information is that **Private Contractors** should know:

- Impacts of Salt Use
- Legal Information
- Information on safe storage of salt

### Open to Alternatives?

Respondents were far less likely to indicate that they felt private contractors would be open to alternatives than other groups, but a majority still felt that they would be. A much larger portion, however, felt that private contractors would be less likely to be open to change.

**Are Private Contractors Open to Using Alternatives to Current Practices to Reduce Impacts from Salt Use?**



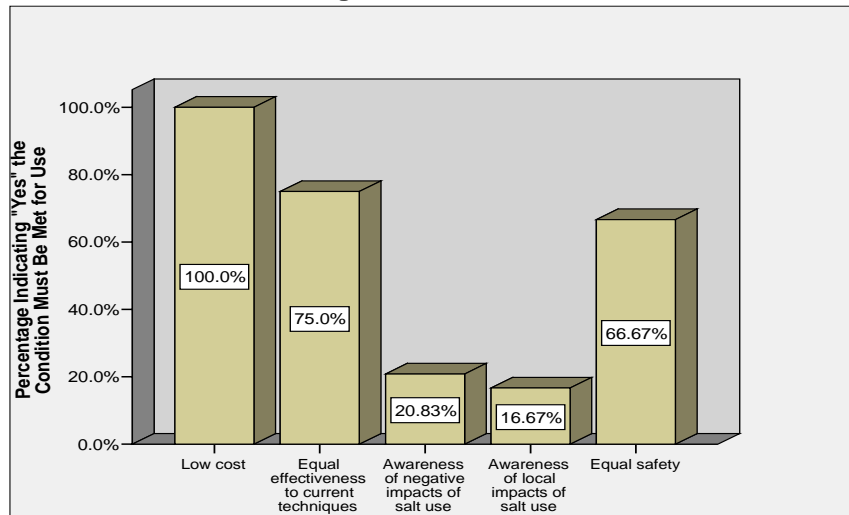
**Are Private Contractors Open to Using Alternatives to Current Practices to Reduce Impacts from Salt Use?**

		Frequency	Percent	Valid Percent
Valid	yes	14	38.9	60.9
	no	5	13.9	21.7
	maybe	3	8.3	13.0
	not sure	1	2.8	4.3
	Total	23	63.9	100.0
Missing		13	36.1	
	Total	36	100.0	

## Conditions for Acceptance

Every respondent indicated that cost was paramount to receiving support from private contractors. Effectiveness and safety were also indicated as necessary by more than half of respondents. Awareness and education were thought to be far less important for this group.

**Percentage of Respondents Indicating the Conditions Under Which They Believe Private Contractors Working on Road and Lot Maintenance Are Willing to Use Alternative Road Treatments**



Other conditions that would make them willing to use alternatives:

- If required by property owners
- If it effects competition
- Regulation

What are the barriers that need to be addressed?

- This group is difficult to track and locate
- Liability concerns
- Property owners wishes and contracts

What do you believe is the most effective way to provide Private Contractors with needed information about road salt?

- Through Property Owners
- Training/seminars/certification/workshops
- Planning Boards and Professional Planning Staff

**IV-F Safety Service Personnel**

Each respondent was asked what kind of training is typically given to **Safety Service Personnel**.

- o No training opportunities are currently available.

Each respondent was also asked what the likely expectations of that training are, but no training is currently available.

The following question was asked to identify whether safety service personnel are required to receive training related to surface treatment. There was only one respondent to this inquiry, which implies a lack of knowledge about the safety service personnel’s training requirements.

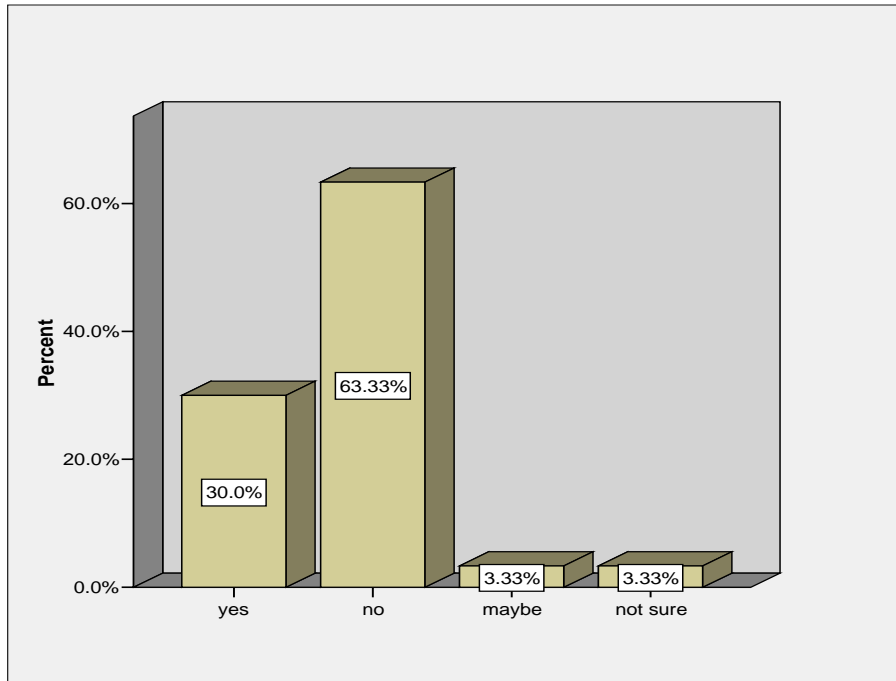
**Is Training Related to Surface Treatment Mandatory for Safety Service Personnel?**

		Frequency	Percent	Valid Percent
Valid	no	1	2.8	100.0
Missing	99	35	97.2	
Total		36	100.0	

**Awareness**

Respondents were asked about safety service personnel’s awareness of the negative impacts of salt use on water quality. Twice as many respondents believed that safety service personnel were not aware of the negative impacts of salt use on water quality. The results identify a need for outreach and education.

**Are Safety Service Personnel Aware of the Negative Impacts of Salt Use on Water Quality?**



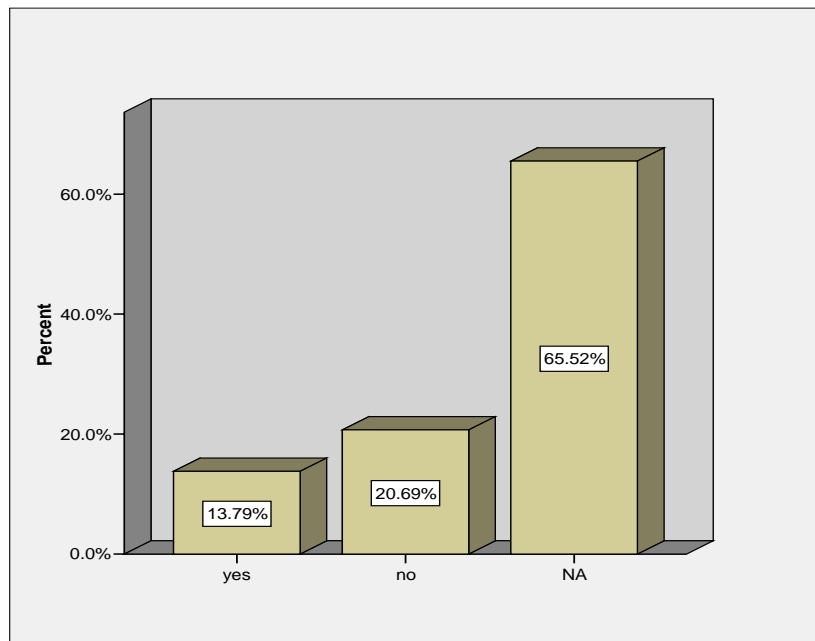
**Are Safety Service Personnel Aware of the Negative Impacts of Salt Use on Water Quality?**

		Frequency	Percent	Valid Percent
Valid	yes	9	25.0	30.0
	no	19	52.8	63.3
	maybe	1	2.8	3.3
	not sure	1	2.8	3.3
	Total	30	83.3	100.0
Missing	99	6	16.7	
Total		36	100.0	

### Concerned?

The follow up question was asked to identify this group's level of concern. Because many respondents indicated the safety service personnel were not aware of negative impacts, this question was not applicable for most. Of the respondents who answered yes or no, there was a minor difference, with *no* eight percentage points higher than *yes*. If there was greater awareness, concern may also increase.

Are Safety Service Personnel Concerned?



Are Safety Service Personnel Concerned?

		Frequency	Percent	Valid Percent
Valid	yes	4	11.1	13.8
	no	6	16.7	20.7
	NA	19	52.8	65.5
	Total	29	80.6	100.0
Missing		7	19.4	
Total		36	100.0	

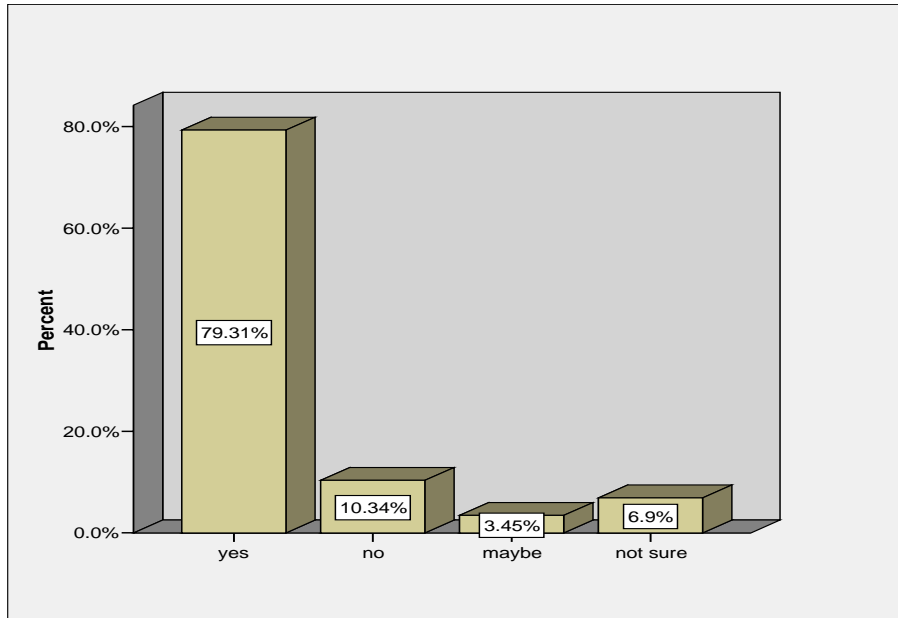
Respondents were asked what the most important information is that **Safety Services Personnel** should know:

- Water quality and other environmental impacts
- Maintenance personnel are doing their job based on an informed methodology
- Effectiveness of alternative treatments

**Open to Alternatives?**

An overwhelming majority of respondents, almost eighty percent, felt that safety service personnel would support alternatives to current practices to reduce impacts from salt use.

**Would Safety Service Personnel Support Alternatives to Current Practices to Reduce Impacts from Salt Use?**



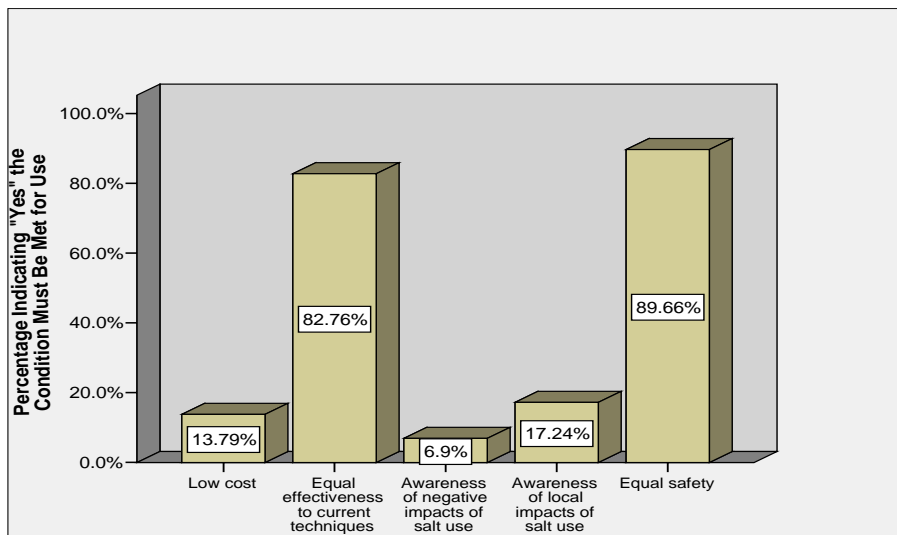
**Would Safety Service Personnel Support Alternatives to Current Practices to Reduce Impacts from Salt Use?**

		Frequency	Percent	Valid Percent
Valid	yes	23	63.9	79.3
	no	3	8.3	10.3
	maybe	1	2.8	3.4
	not sure	2	5.6	6.9
	Total	29	80.6	100.0
Missing		7	19.4	
Total		36	100.0	

## Conditions for Acceptance

Following up on the previous question, most respondents indicated that the conditions under which safety service personnel would support alternatives if they provided equal safety and, similarly, if they had an effectiveness equal to current techniques. Safety is the major concern for this group because of the role they play in storm events. Other conditions, like awareness of the local impacts, low cost, and awareness of negative impacts of salt use are of little concern, perhaps due to lack of awareness and outreach.

**Percentage of Respondents Indicating the Conditions Under Which They Believe Safety Services Personnel Would Support the Use of Alternative Road Treatments**



Other conditions that would make them willing to use alternatives:

- Proven effectiveness (and timeliness) of treatment
- Political pressure
- Safety maintained

What are the barriers that need to be addressed?

- Power and authority balance (DOT/DPW and Police) there needs to be respect for professional expertise
- Narrow focus on safety at troop level
- Education and training

What do you believe is the most effective way to provide safety service personnel with needed information about road salt?

- Workshops/Seminars offered by Peers and/or Leaders in their field
- Top down (chain of command)

**IV-G General Public**

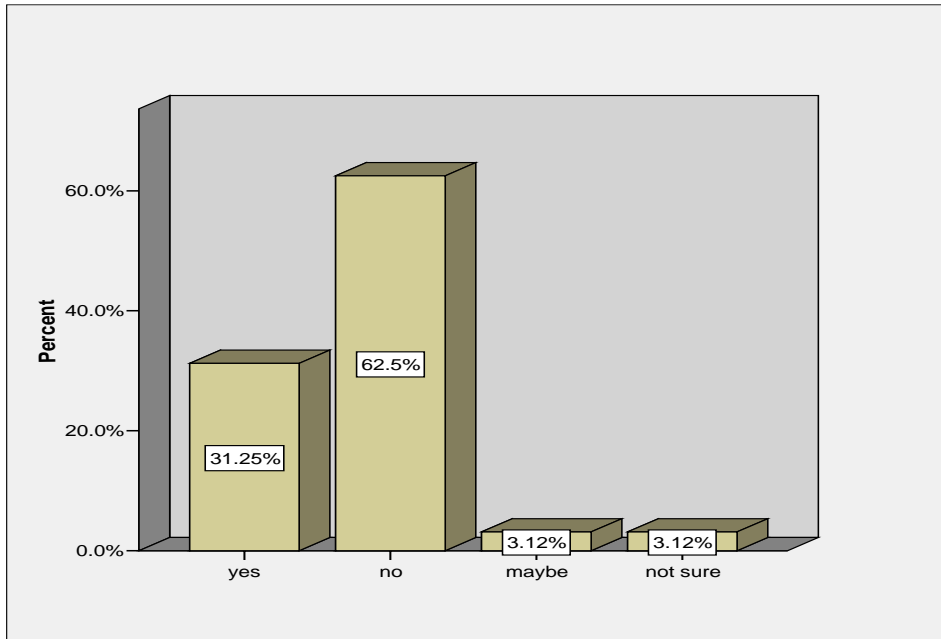
Each respondent was asked what they felt the **general public’s** expectations of road treatment were.

- No need to change driving habits dependent upon weather
- Clear roads all the time
- Short periods of inconvenience

**Behavior**

Twice as many respondents indicated that the general public was not willing to change their driving behaviors than indicated they were willing to change their driving behaviors to address issues relating to road salt. This identifies the need for behavior modification programs for the driving public as an important element in achieving the goal of reduced application of salt to roadways.

**Is There Willingness Among the General Public to Change Driving Behaviors to Address Issues Related to Road Salt?**

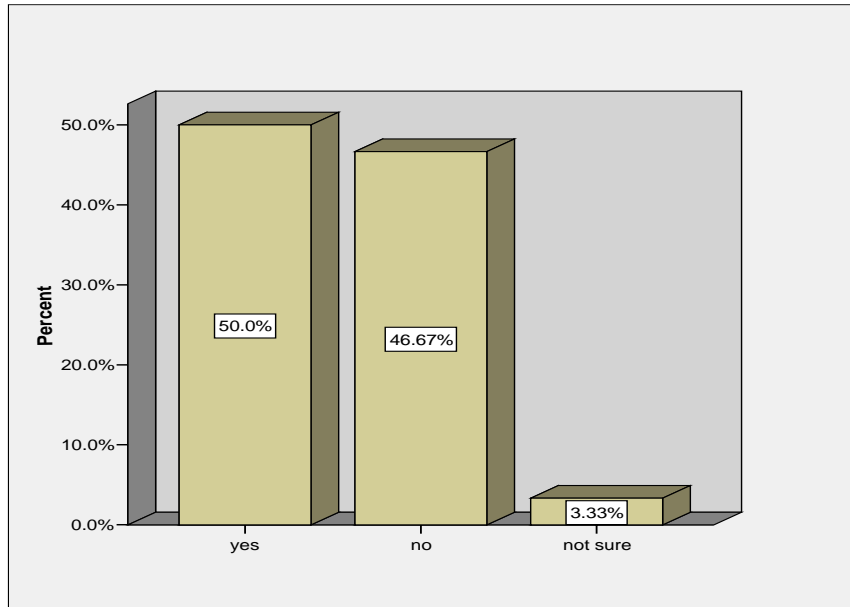


**Is There Willingness Among the General Public to Change Driving Behaviors to Address Issues Related to Road Salt?**

		Frequency	Percent	Valid Percent
Valid	yes	10	27.8	31.3
	no	20	55.6	62.5
	maybe	1	2.8	3.1
	not sure	1	2.8	3.1
	Total	32	88.9	100.0
Missing		4	11.1	
Total		36	100.0	

Respondents were closely divided in their responses to the following question about expectations for public roads vs. private lots. While fifty percent of respondents believed expectations differ, nearly forty-seven percent did not.

**Does the General Public Have Different Expectations for the Treatment of Public Roads vs. Private Lots?**



**Does the General Public Have Different Expectations for the Treatment of Public Roads vs. Private Lots?**

		Frequency	Percent	Valid Percent
Valid	yes	15	41.7	50.0
	no	14	38.9	46.7
	not sure	1	2.8	3.3
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

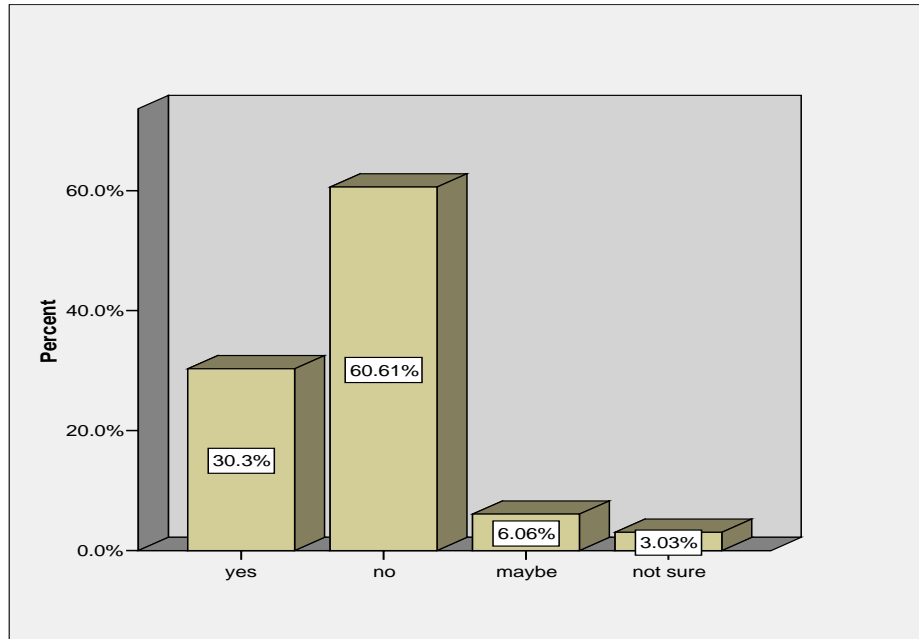
What are these differences?

- All the same
- Public roads are superior
- Higher expectations for private lots because they are also used for foot traffic

## Awareness

Twice as many respondents believed that the general public is not aware of negative impacts than those who believe they are aware. The results identify the need for outreach and education of the general public.

**Is There Understanding Among the General Public of the Impacts of Road Salt on Water Quality?**

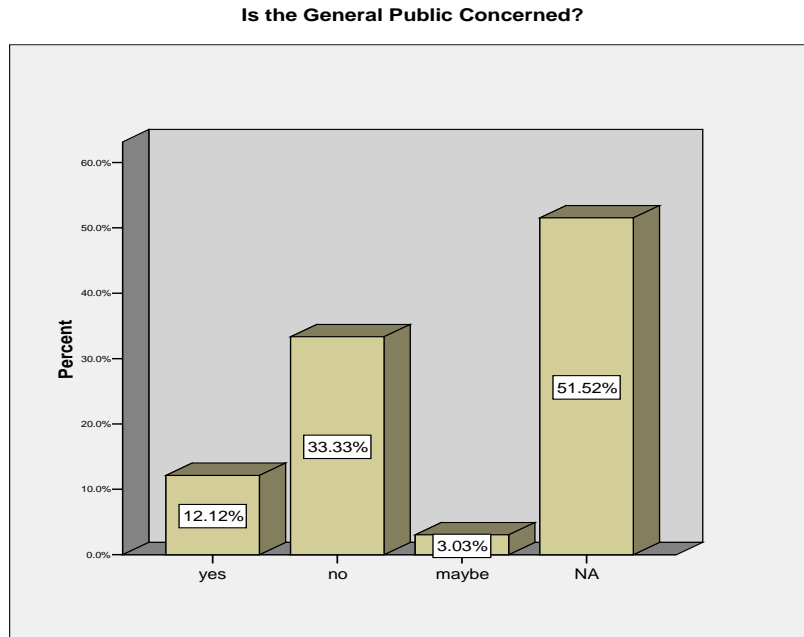


**Is There Understanding Among the General Public of the Impacts of Road Salt on Water Quality?**

		Frequency	Percent	Valid Percent
Valid	yes	10	27.8	30.3
	no	20	55.6	60.6
	maybe	2	5.6	6.1
	not sure	1	2.8	3.0
	Total	33	91.7	100.0
Missing		3	8.3	
Total		36	100.0	

### Concerned?

The follow up question was asked to identify the group’s level of concern. Because many respondents indicated the general public was not aware of negative impacts, this question was not applicable for most. Of the respondents who believe the general public is aware, most believe they are not concerned. If there was greater awareness, outreach, and education, concern may also increase.



**Is the General Public Concerned?**

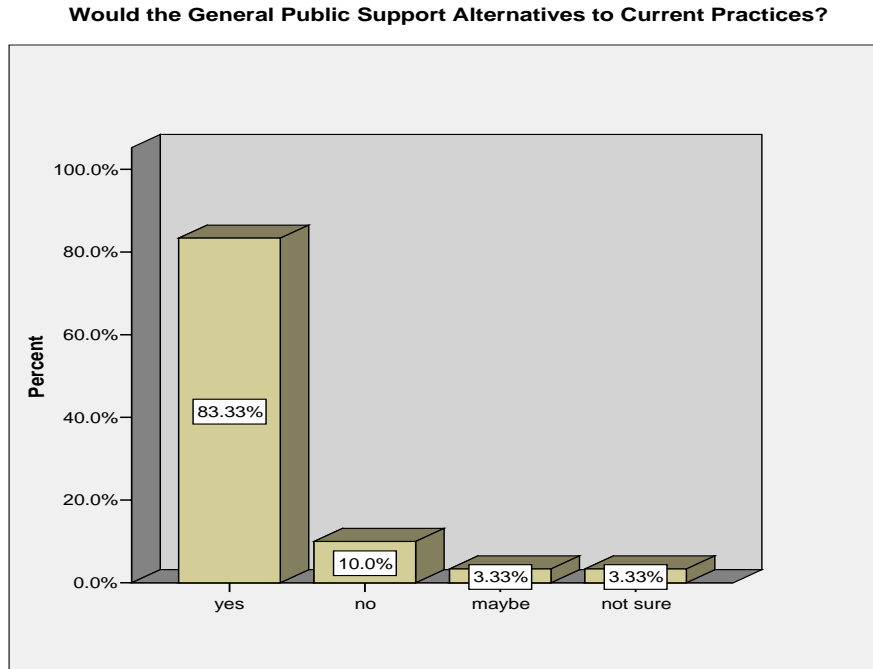
		Frequency	Percent	Valid Percent
Valid	yes	4	11.1	12.1
	no	11	30.6	33.3
	maybe	1	2.8	3.0
	NA	17	47.2	51.5
	Total	33	91.7	100.0
Missing		3	8.3	
Total		36	100.0	

What is the most important information the **General Public** should know?

- Behavior impacts treatment, and pressure is put on the DPW by these expectations
- Environmental impact of salt use
- Long term issues

### Open to Alternatives?

An overwhelming majority of respondents felt that the general public would support alternatives to current practices to reduce impacts from salt use.



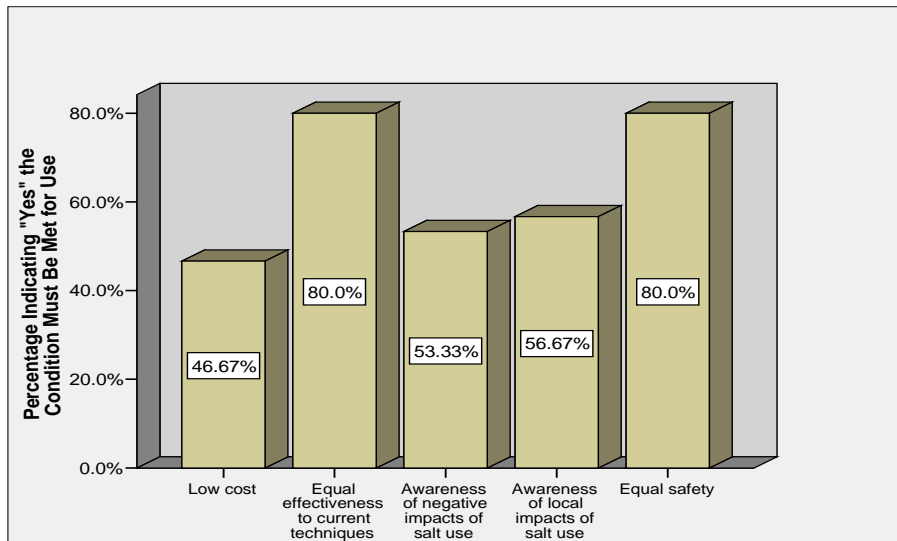
**Would the General Public Support Alternatives to Current Practices?**

		Frequency	Percent	Valid Percent
Valid	yes	25	69.4	83.3
	no	3	8.3	10.0
	maybe	1	2.8	3.3
	not sure	1	2.8	3.3
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

### Conditions for Acceptance

Following up the previous question, most respondents indicated that the conditions under which the general public would support alternatives were if they provided equal safety and if they had equal effectiveness to current techniques. While these two conditions were believed to be the biggest factors for gaining public support, all the conditions were believed to have a significant impact.

**Percentage of Respondents Indicating the Conditions Under Which They Believe the General Public is Willing to Support the Use of Alternative Road Treatments**



Other conditions that would make them willing to use alternatives:

- Convenience
- An understanding of how alternatives can reduce impacts
- They will not no matter what - because they are concerned with reduced Level of Service

What are the barriers that need to be addressed?

- Education/awareness of Salt impacts
- Changing behavior/driving expectations
- Understanding of Level of Service and expectations of drivers

What do you believe is the most effective way to provide the General Public with needed information about road salt?

- Media – television, newspaper, internet, Public Service Announcements, ad campaign targeting drivers (i.e. Freshie the Frog)
- Public education system (children)

**IV-H Local Leaders**

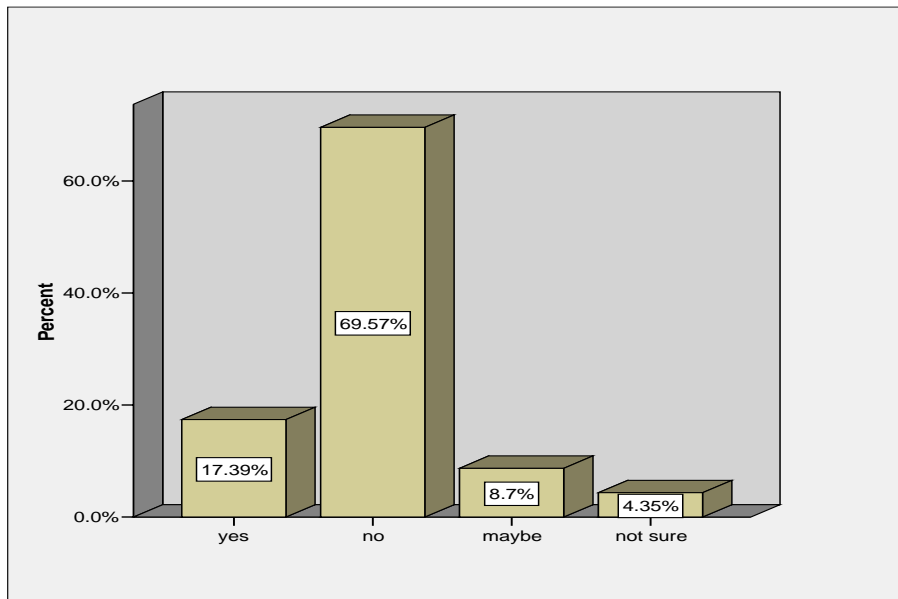
Respondents were asked to comment on **Local Leaders'** expectations of road service.

- Perceive road conditions as a direct reflection of themselves
- Roads should be safe and clear at all times
- No complaints or accidents
- Cleared in most cost effective manner

**Behavior**

Roughly seven out of ten respondents felt that local leaders would not believe that the general public would be willing to change driving habits to address issues related to road salt. Roughly two out of ten felt that they would, and the remainder of respondents did not indicate a strong belief either way. If the respondents have an accurate sense of local leaders, these findings suggest that reductions in speed limits, and reduced driving during storm events are not likely to gain the support of local leaders.

**Do Local Leaders Believe that the General Public Would be Willing to Change Driving Behaviors to Address Issues Related to Road Salt?**

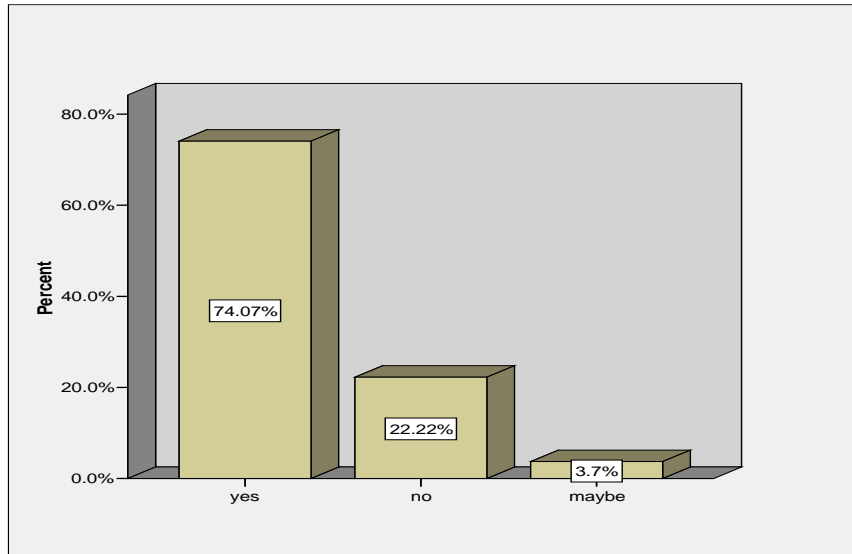


**Do Local Leaders Believe that the General Public Would be Willing to Change Driving Behaviors to Address Issues Related to Road Salt?**

		Frequency	Percent	Valid Percent
Valid	yes	4	11.1	17.4
	no	16	44.4	69.6
	maybe	2	5.6	8.7
	not sure	1	2.8	4.3
	Total	23	63.9	100.0
Missing		13	36.1	
Total		36	100.0	

Most respondents indicated a belief that local leaders do have different expectations for public and private roads.

**Do Local Leaders Have Different Expectations for the Treatment of Public Roads vs. Private Lots?**



**Do Local Leaders Have Different Expectations for the Treatment of Public Roads vs. Private Lots?**

		Frequency	Percent	Valid Percent
Valid	yes	20	55.6	74.1
	no	6	16.7	22.2
	maybe	1	2.8	3.7
	Total	27	75.0	100.0
Missing		9	25.0	
Total		36	100.0	

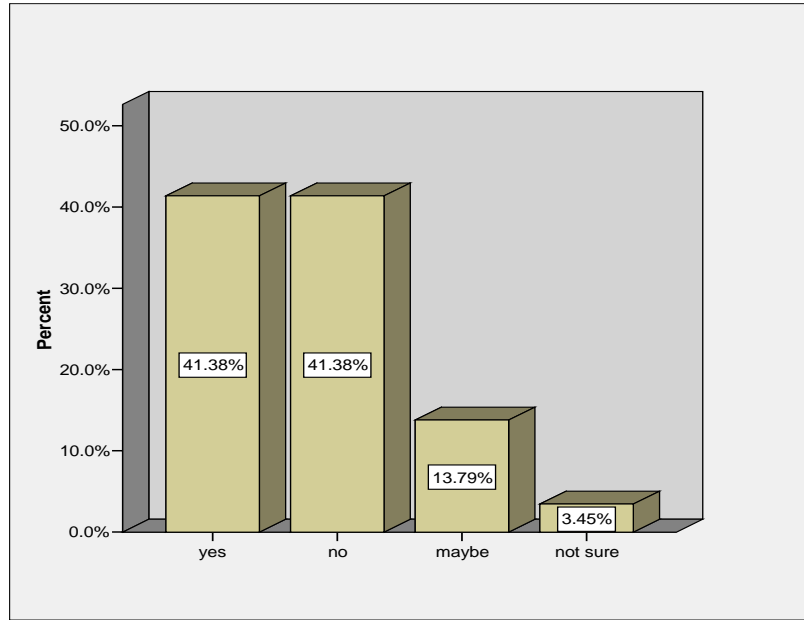
What are these differences?

- Primarily concerned with public roads
- Higher Level of Service for their roads
- Have a concern with environmental impacts of private lots

## Awareness

An equal number of respondents indicated a belief that local leaders did have an understanding of impacts of road salt on water quality, as that they did not. The results suggest disagreement about the level of knowledge held by local leaders about road salt issues.

**Is There Understanding Among Local Leaders of the Impacts of Road Salt Use on Water Quality?**

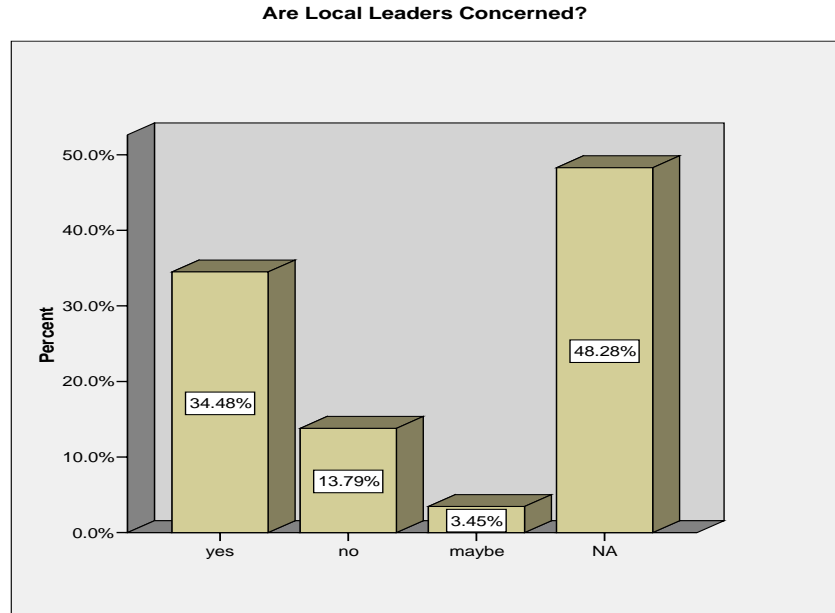


**Is There Understanding Among Local Leaders of the Impacts of Road Salt Use on Water Quality?**

		Frequency	Percent	Valid Percent
Valid	yes	12	33.3	41.4
	no	12	33.3	41.4
	maybe	4	11.1	13.8
	not sure	1	2.8	3.4
	Total	29	80.6	100.0
Missing		7	19.4	
Total		36	100.0	

**Concerned?**

While most people did not feel that this question applied, or declined to provide an answer, of those who did provide definitive responses, more than twice as many respondents felt local leaders were concerned as those who believed they were not.



**Are Local Leaders Concerned?**

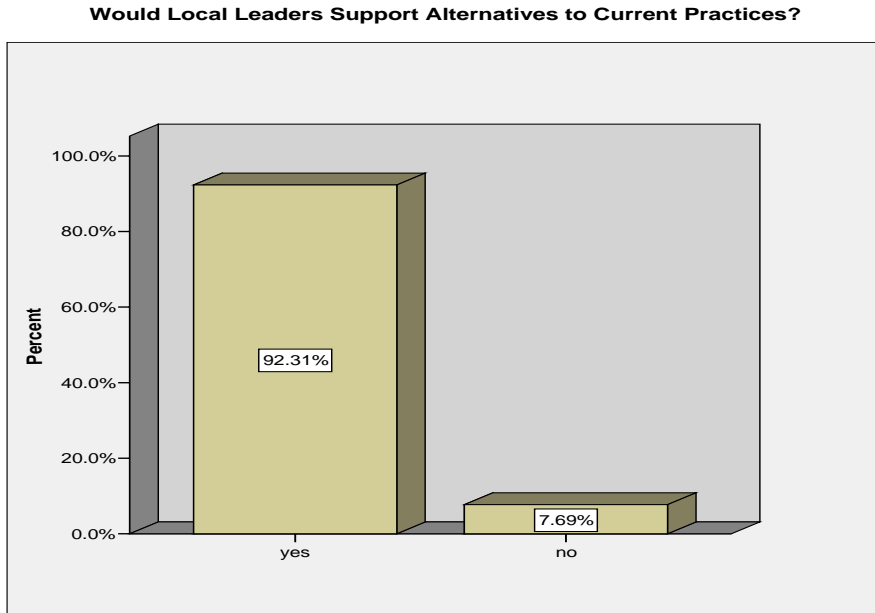
		Frequency	Percent	Valid Percent
Valid	yes	10	27.8	34.5
	no	4	11.1	13.8
	maybe	1	2.8	3.4
	NA	14	38.9	48.3
Total		29	80.6	100.0
Missing		7	19.4	
Total		36	100.0	

What is the most important information **Local Leaders** should know?

- Legal information about alternatives
- Environmental impacts
- Costs related to treatment and available funding

### Open to Alternatives?

Almost all of the respondents believed that local leaders would support alternatives to current practices.



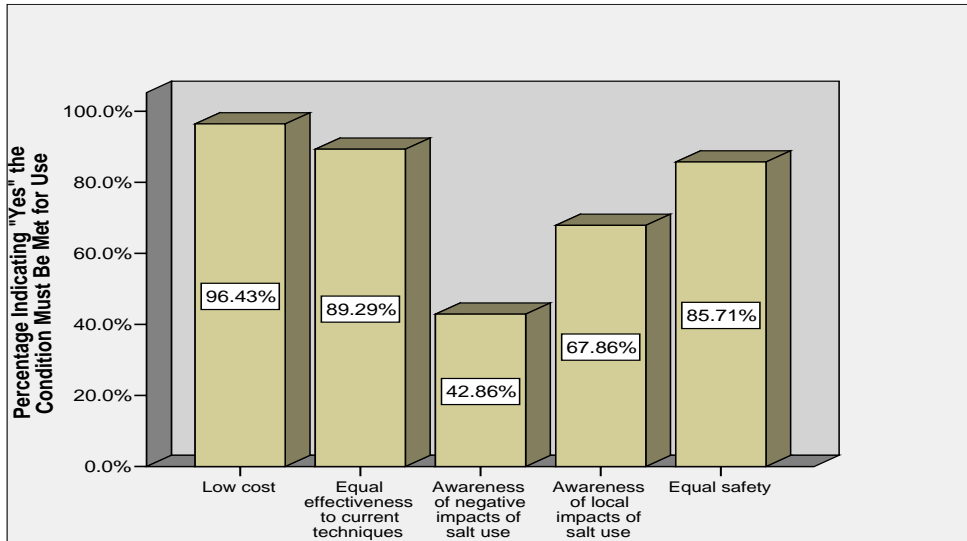
**Would Local Leaders Support Alternatives to Current Practices?**

		Frequency	Percent	Valid Percent
Valid	yes	24	66.7	92.3
	no	2	5.6	7.7
	Total	26	72.2	100.0
Missing		10	27.8	
Total		36	100.0	

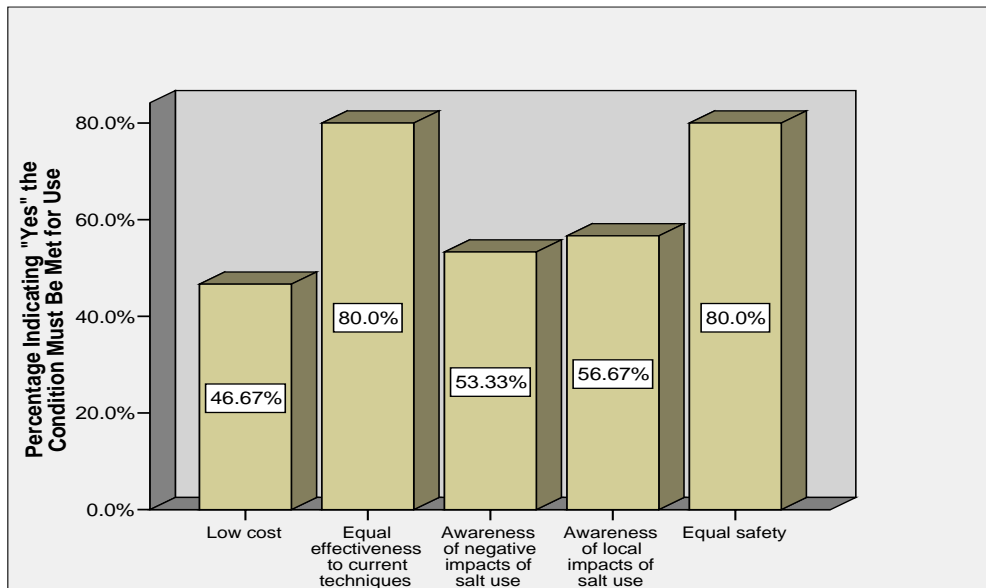
### Conditions for Acceptance

Following up the previous question, most respondents indicated that the condition under which the local leaders would support alternatives was if they were low in cost. Equal effectiveness to current techniques and equal safety were also indicated as conditions by most respondents. Local impacts were indicated as a condition by nearly seventy percent of respondents.

**Percentage of Respondents Indicating the Conditions Under Which They Believe Local Leaders Are Willing to Support the Use of Alternative Road Treatments**



**Percentage of Respondents Indicating the Conditions Under Which They Believe the General Public is Willing to Support the Use of Alternative Road Treatments**



Other conditions that would make them willing to use alternatives:

- If alternatives promote a progressive image
- Public pressure
- If regulated
- Cost and available funding

What are the barriers that need to be addressed?

- Effectiveness of alternatives must be shown
- Cost
- Education
- Liability concerns

What do you believe is the most effective way to provide Local Leaders with needed information about road salt?

- Meeting/Conference/Seminars – through the Local Government Center and others
- TV and other media
- Through town staff

## **Actions**

Respondents were asked which of the stakeholder groups is most important to educate on the issues related to road salt use to stimulate change in practices. They identified:

*Most important:*

- DPW staff and Public Works Directors

*Followed by:*

- Local Leaders
- The Public

Respondents were then asked what they would consider most important to tell these groups about.

- DPW and other professional Staff
  - Long term effects of salt issues
  - They are frontline and can make changes
- Local Leaders
  - Changing the expectations for road service
  - There are effective alternatives (safe and affordable)
- The Public
  - The environmental damage being done
  - Changing the expectations for road service

## **Responses by Employment Sector**

**The previous set of Stakeholder research questions were also examined by looking at respondents' perceptions of the conditions under which different stakeholders in road salt issues would be willing to explore road salt alternatives in a series of questions asking about each group. After extensive analyses no important differences were found, again highlighting an area of agreement among respondents.**

***Behaviors Relative to Application, and Communication Strategies – Trends and Issues Identified:***

- Most everyone recognizes that the general public is key to resolving this issue.
- Changes in the expectations of winter road surface conditions seem to be needed, and that message needs to come from all levels.
- Most road maintenance professionals are open to changes, but need them to come as a directive that will be backed by the town (regulation, policy change, etc.).
- There is the potential for conflict between some police officers and road maintenance staff during storm events, given their different perspectives and areas of responsibility.
- The private sector is very transient, and the structure of their contracts often dictates the degree of treatment they provide.
- Because the private sector plowing community performs winter maintenance under annual contracts, permanent storage or cover of salt is seldom established.
- Towns are having trouble attracting contractors due to the rising costs of operating such a seasonal service.
- Town staff that get trained on new information and technology related to winter maintenance are often constrained in their town financially and don't get to implement the new approaches.
- Black and dry road conditions are expected by most stakeholders. Although there is no such official policy here in New Hampshire, an expectation has been created over time.

## IV-C Salt Usage Data

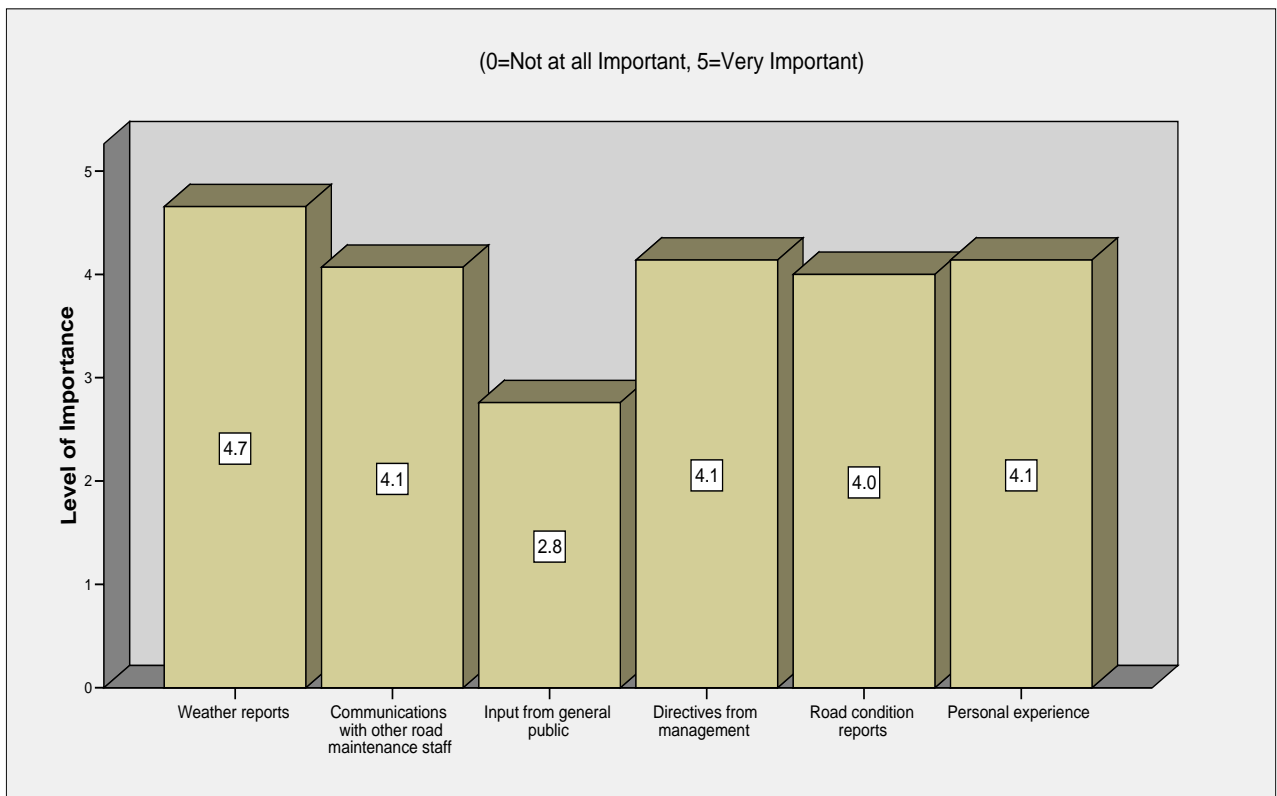
The following questions collected data to identify key informants' beliefs about how best to obtain data on salt usage. As stakeholders are knowledgeable about the issue and approach it from diverse professional perspectives, incidents of high agreement are important for identifying useful vectors of information delivery.

**3(d). Identification of feasible methods by which to obtain accurate information on salt usage for winter road maintenance by state, private, and municipal applicators.**

### Sources of Data

The first question in this section of the survey asked respondents how important each of the following sources of information are when making decisions about the application of road salt. Weather reports are identified as the most important source of information, and other sources being equally regarded with one another. The exception is input from the general public, which is the least important source of information for these decisions.

**Means of Respondents' Beliefs About How Important Each of the Following Sources of Information When Making Decisions about the Application of Road Salt**



What unavailable sources of information do you wish you had?

- Roadway Weather Information System (RWIS), Maintenance Decision Support System (MDSS), and other technology based decision making tools
- Ability to track radar on the internet
- Easy access to forecasts and future weather conditions

What available sources of information are unnecessary?

- Safety service input
- Citizen reports (calls from public)

Respondents were asked how they do (or would) use the sources of information described above in their decision-making processes. Although the responses were quite similar overall there was some distinction between the state level operators and the local and private operators based on the tools they have available:

1. All - Weather reports to decide on pre-treatment and clean-up at the end
- 2a. State Level - Roadway Weather Information System (RWIS) and Maintenance Decision Support System (MDSS)
- 2b. Locals and Privates - Track radar on internet, drive by inspection, and in general “play by ear”

To the best of your knowledge, who collects and maintains information on salt usage?

- DOT
- DPW/Road Agent
- Private Contractors

### **Responses by Employment Sector**

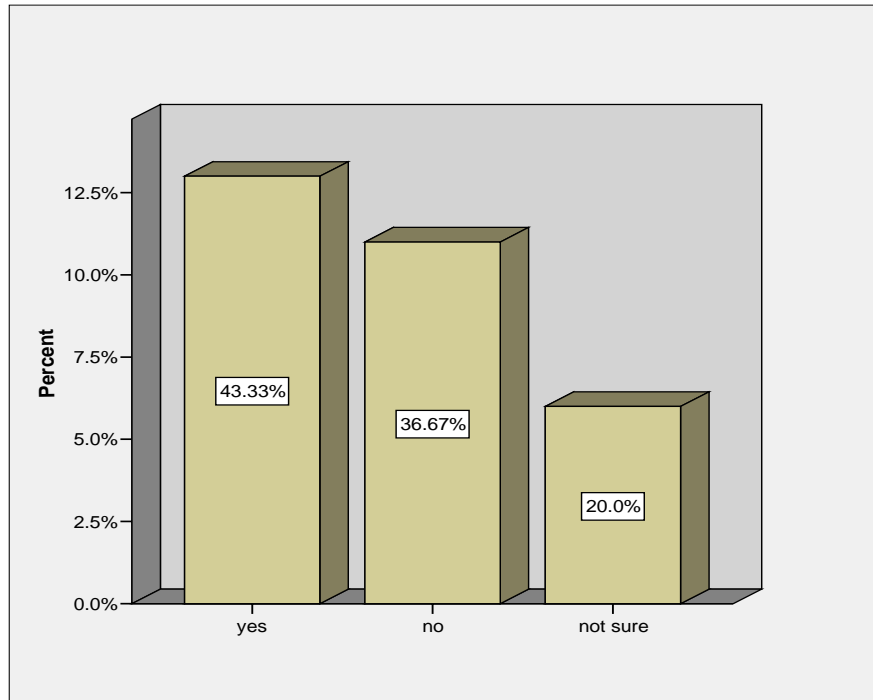
**As with several other analyses, there was a surprising amount of consistency across the different types of work respondents do professionally. The only source of information whose utility was viewed differently by respondents was “Directives from management.” “On the Ground” Road Maintenance personnel felt that directives from management were less important than did all other groups of types of work.**

**Most responses did not vary significantly based on employment sector; however the use of road conditions reports did vary greatly. Private contractors rated road condition reports of extremely low importance, while state regulatory agencies, federal government employees, municipalities, and those who indicated “other” tended to rate road condition reports of very high importance.**

### Adequacy of the System

Respondents were next asked to indicate their satisfaction with how road salt usage data is collected. The chart and table below summarize responses and indicate that there was not a great deal of consensus on this issue, as more than half of respondents were not satisfied with data collection or were not sure how it is conducted. This question identifies an educational and/or research need among stakeholders in these issues.

**Are you satisfied with how road salt data is currently collectetd and maintained?**

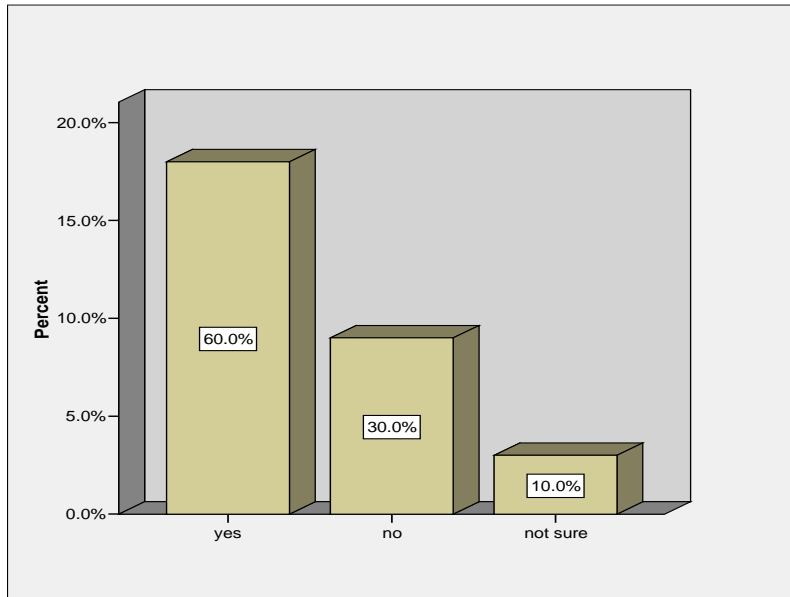


**Are you satisfied with how road salt usage data is collected and maintained?**

		Frequency	Percent	Valid Percent
Valid	yes	13	36.1	43.3
	no	11	30.6	36.7
	not sure	6	16.7	20.0
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

A related question asked respondents if they felt road salt usage data was easily accessible to them, and the responses summarized below indicate most feel the data is accessible to them.

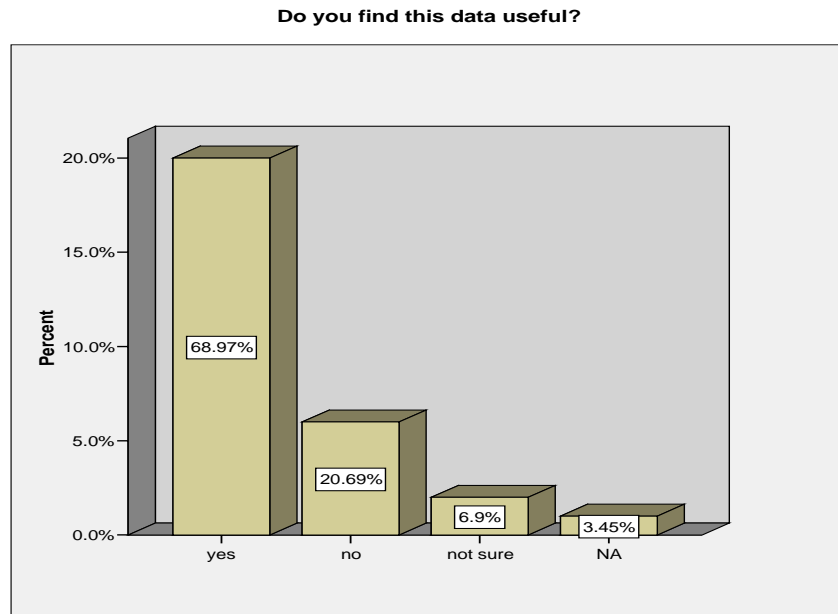
**Is road salt usage data easily accessible to you?**



**Is road salt usage data easily accessible to you?**

		Frequency	Percent	Valid Percent
Valid	yes	18	50.0	60.0
	no	9	25.0	30.0
	not sure	3	8.3	10.0
	Total	30	83.3	100.0
Missing		6	16.7	
Total		36	100.0	

The final question about the existing collection of salt usage data asked respondents if they find the data collected useful. The majority of respondents stated that the data is indeed useful.



Would you suggest any changes to how road salt data is currently collected?

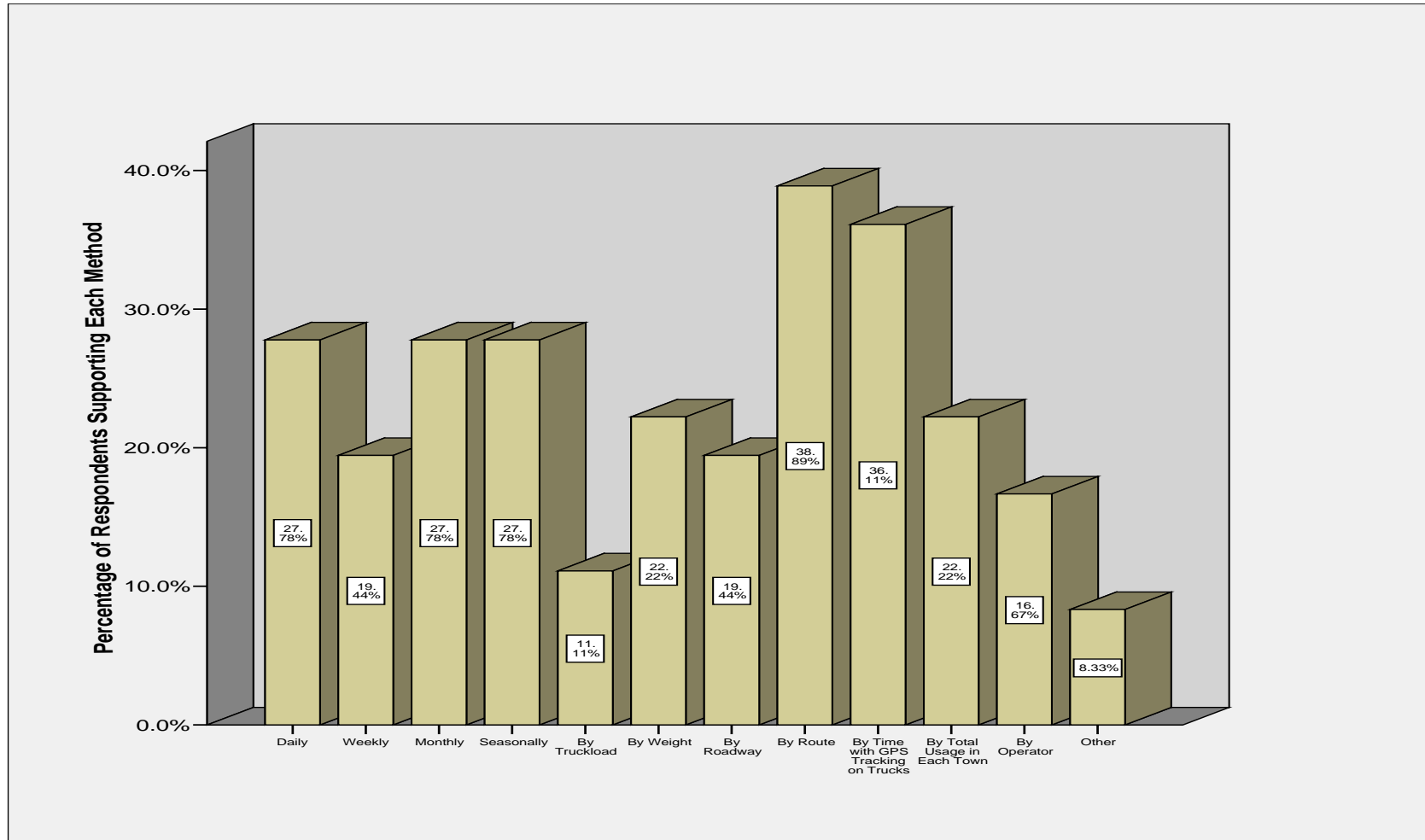
- Create a State website on usage
- More accurately tracked data
- Uniform recording of data

Any changes to how the data is currently distributed to you?

- No – because they are the ones collecting it mostly
- Electronically - on web and up to date

The final question in this section of the survey focused on the identification of feasible methods by which to obtain accurate information on salt usage by asking respondents to identify what they believe is the most effective way to report road salt usage. The findings summarized in the table and chart below indicate that “tracking use by route” or “tracking use by time with GPS tracking on trucks” are the means of tracking respondents believe would be most effective.

**What is the Most Effective Way to Report Salt Usage?**



Other effective ways to report road salt usage include:

- By storm event
- By Watershed
- Annually
- Automate as much as possible – if more detailed information is desired

### **Responses by Employment Sector**

**Again, most responses did not vary significantly by employment sector. The exception was that of only five respondents who did not indicate that “by roadway” was an effective method of reporting, four individuals listed “other” as their employment sector.**

#### ***Salt Usage Data - Trends and Issues Identified:***

- More data is needed on the impacts of salt in New Hampshire, and on recommended surface treatment levels.
- Improvements need to be made in the reporting of salt usage, and in communicating why this data is important.
- Currently salt usage data is viewed as most critical for budgeting and purchasing needs.
- Although most decision making on surface treatment follows a similar process, the tools available vary quite a bit. The State has access to advanced decision making technology for some routes, while some of the smaller towns don't even have access to radar on the internet.

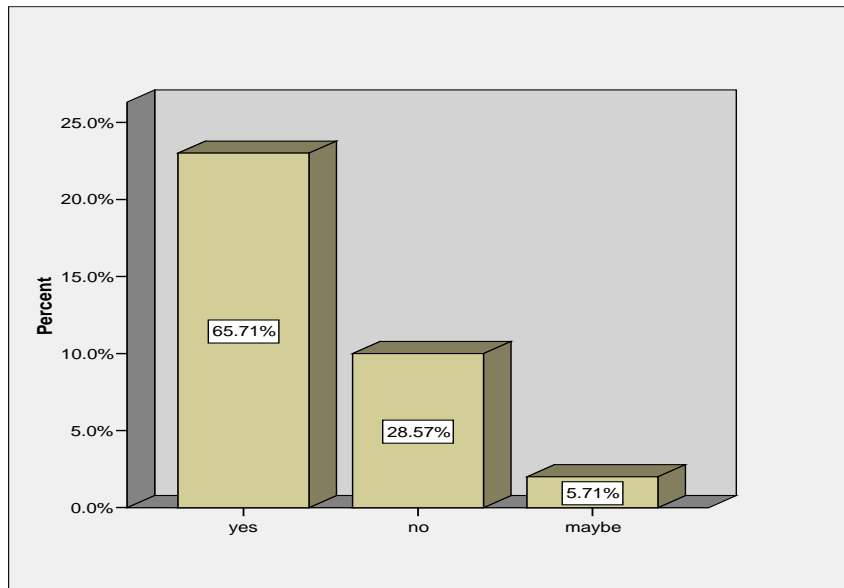
## IV-D Regulations

Regulating the use of road salt on private roadways and in parking lots is very challenging, due in part to the de-centralized nature of the activity. This section of the survey drew on the expertise and knowledge of respondents by asking them questions relevant to identifying the best way to address this issue. The research question guiding this inquiry is:

**3(e). Identification of possible regulatory approaches for reducing the application of salt to roadways and parking lots, and the effects it would have on their operations**

The first question in this section asked respondents if they thought a regulatory approach to reducing salt use is appropriate. As the data below indicates the majority of respondents feel the regulatory approach is appropriate.

**Is a Regulatory Approach to the Reduction of Road Salt Appropriate?**



**Do you think a regulatory approach to the reduction of road salt is appropriate?**

		Frequency	Percent	Valid Percent
Valid	yes	22	66.7	68.8
	no	8	24.2	25.0
	maybe	2	6.1	6.3
	Total	32	97.0	100.0
Missing		1	3.0	
Total		33	100.0	

Why or why not?

**NO**

- Every town is different and has different impacts on resources
- Salt is used to provide expected level of service on roads. Must reduce expectations first
- Don't need extra government
- Educate instead

**YES**

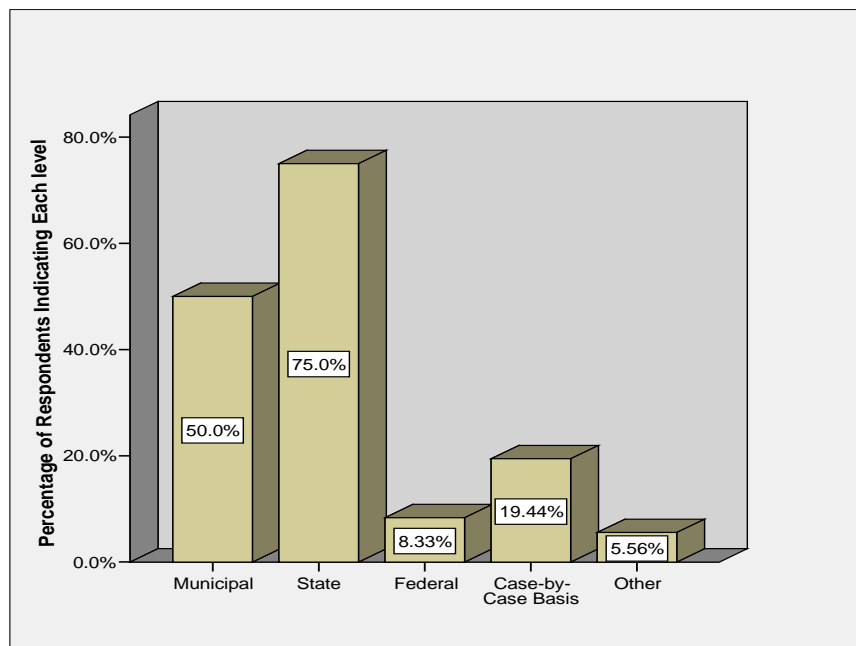
- Provides framework/guidelines
- Regulations with incentives of some kind to work
- Needed to make change - justifies change to constituents and clients
- Free them from liability

**Maybe**

- Legislative body would support if benefits outweigh costs
- Concern with how it will be enforced

Respondents were also asked to indicate the level at which regulations should be implemented if the regulation of road salt does take place. The data below indicate strong support for regulation at the state or municipal level, but respondents feel any higher level administration of regulations would inevitably fail to account for regional variances affecting the issues.

**Level at Which Regulation Should Take Place**

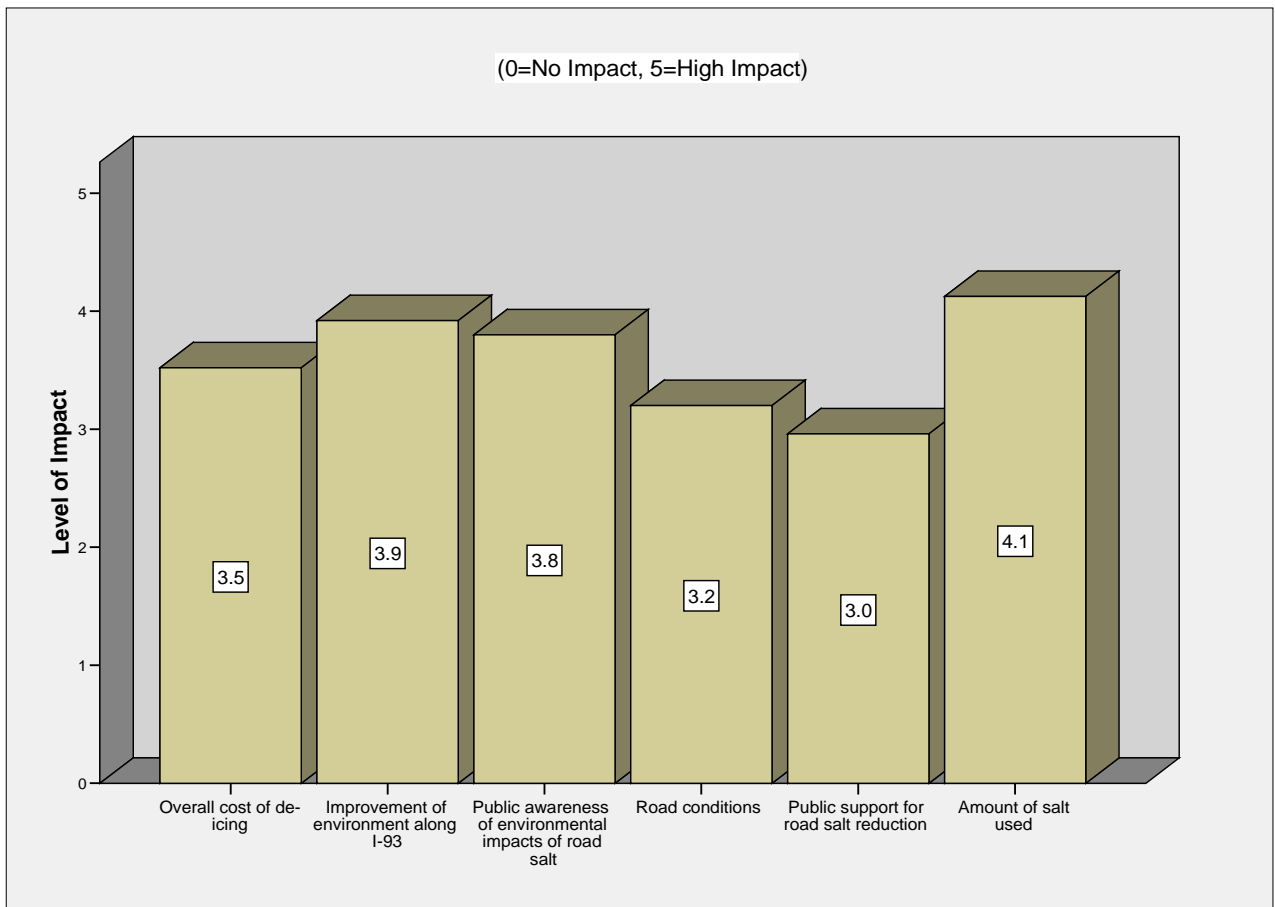


Other recommendations on how regulations could be implemented include:

- Where there are problems/violations and needs
- With enabling legislation from the state
- Allow adjustment locally – due to differing conditions

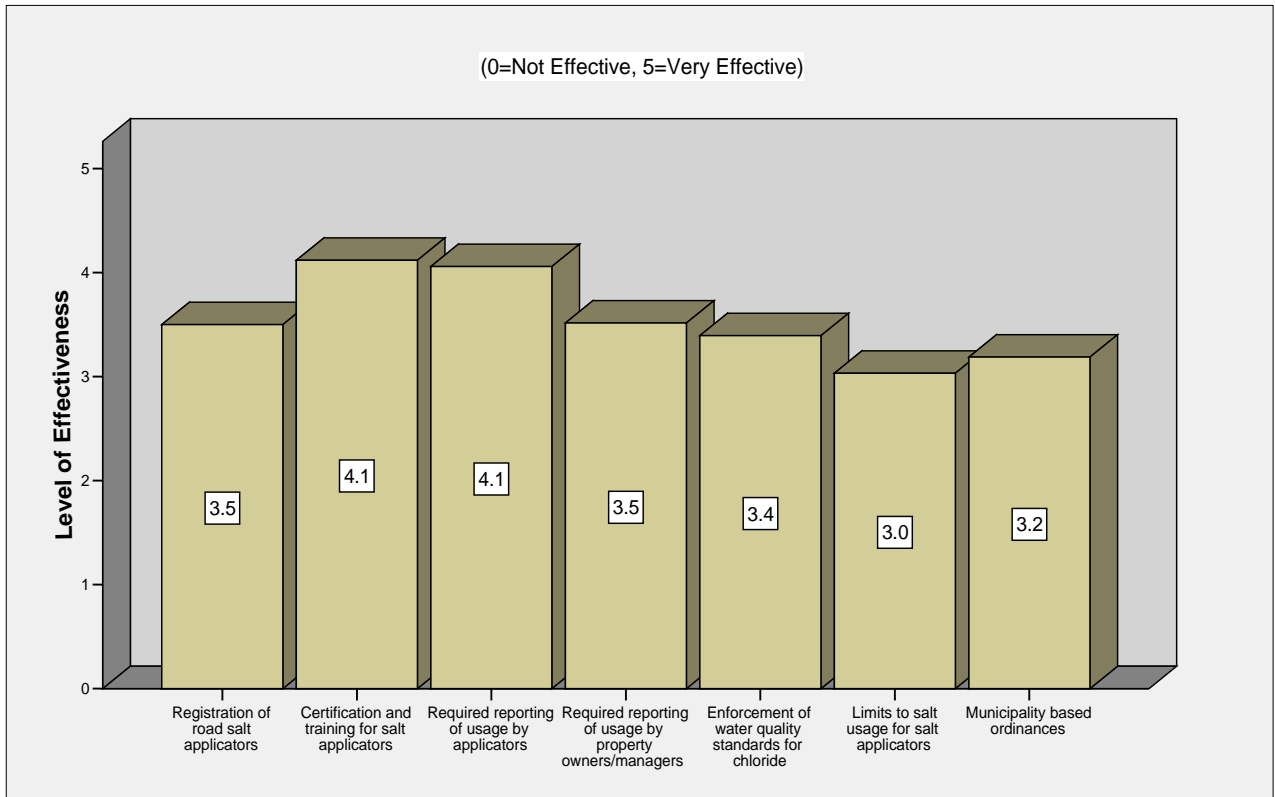
The effectiveness of regulation is only part of the picture of implementation, and the effects of enacting and enforcing regulations must also be examined. Respondents were asked to identify how much regulations aimed at reducing road salt application would impact each of the following issues. In combination respondents feel all of the issues identified would impact operations at a medium to high level, which means that these impacts should be well understood before deciding on a course of regulatory actions.

**Means of Respondents' Beliefs About the Extent to which Regulations Aimed at Reducing Road Salt Application will Impact the Following Issues**



The intent of this work is to provide information that can be used to make decisions about efforts to reduce road salt use and its impacts, and the next question gave respondents the opportunity to address a critical issue: How important do they believe each of the possible types of regulations would be at reducing road salt application. Respondents believe that salt application training and mandatory reporting would be the most effective regulatory measures.

**Means of Respondents' Beliefs About the Extent to which Types of Regulations Aimed at Reducing Road Salt Application would be Effective**



Are there any other regulatory options you think would be effective that I did not ask about?

- DOT, towns, and private all treated the same
- Report sand, salt, and chemical usage
- Water softener regulations – concern over their impact and contribution

Could you suggest any alternatives to state regulation of road salt?

- Incentive systems
- Education
- Local regulations
- Voluntary cutbacks
- Behavior modification

## Responses by Employment Sector

**There was great consistency across the different types of work respondents do professionally in their perceptions of the impacts of regulations on the various operations and issues they were asked about in the questionnaire.**

**"On the Ground" Road Maintenance personnel and respondents in the "Other" category both felt that the impacts on overall cost of de-icing from regulations would be relatively high, while it is also noteworthy that regulatory officials felt the impact would be significantly lower than the other groups of respondents.**

**State level regulatory employees and private contractors universally felt that the state level was not the one at which regulations would be best implemented; they also universally supported federal and case-by case regulation. State road maintenance employees answered largely in the inverse, favoring state level regulation foremost, federal slightly less and case by case very little. Federal employees felt universally that state level regulations were not appropriate, split fifty-fifty on federal regulation, and universally supported case-by-case regulation. Municipal employees were one third in support of state regulation, one hundred percent in support of federal regulation, and three quarters were behind case-by-case regulation.**

**The only type of regulation that respondents doing different types of work viewed differently was the effectiveness of the "Required reporting of usage by property owners/managers." As indicated by the data below, regulatory personnel and transportation field professionals both felt that such a regulatory measure would be effective, while other groups of respondents did not view the likely effectiveness as positively.**

**Registration of road salt applicators and required reporting of usage in the private sector were viewed as likely to have a much larger effect by state and federal employees, while municipal employees and private employees tended to think those methods would be of very little significance.**

### ***Regulations - Trends and Issues Identified:***

- There were many concerns over how regulations will be implemented, but the majority felt that was the only way to change practices.
- Depending on the structure of the regulations, and the salt application reductions required, many Workgroup members felt that some funding will be necessary for implementation.

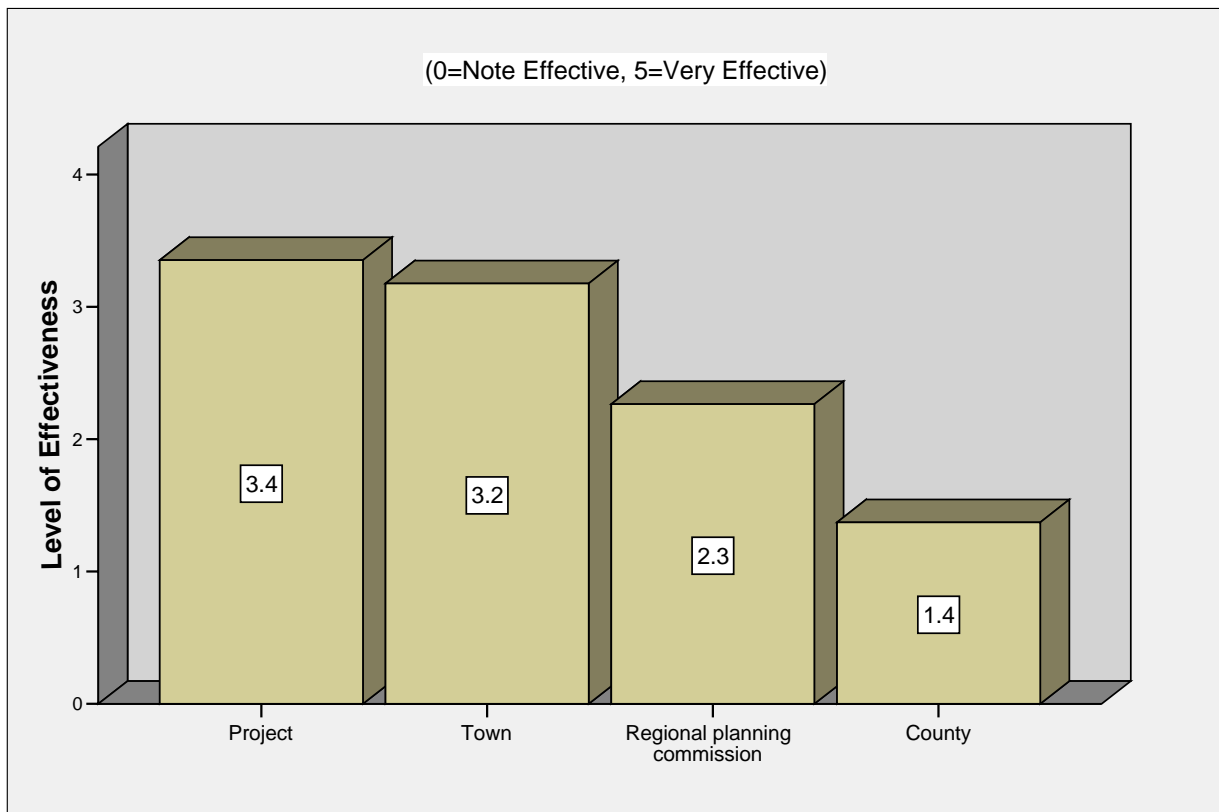
## IV-E Funding

The final topic examined in the survey queried respondents about their views on distributing funds intended to reduce the impacts of road salt use. Specifically, the guiding research question was:

**3(f). Identification of optimal criteria for distributing funds under the Salt Reduction Grant Program.**

The first question asked respondents their beliefs about the best way to administer grants for the salt reduction project. Responses indicate that most believe the funds should be administered on a project basis, with town level grant administration also perceived as effective. In contrast, regional and county levels of administration are perceived as less effective.

**Means of Respondents' Beliefs About the Effectiveness of Each of the Following Methods of Distributing Road Salt Reduction Funds**

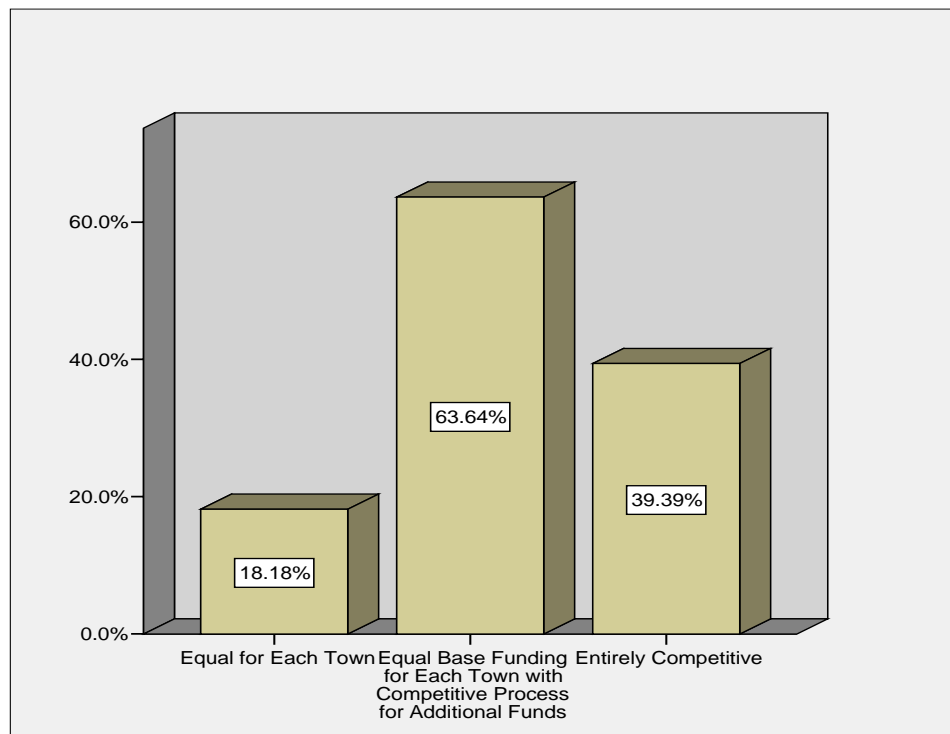


Are there other options or combinations of approaches that I did not ask about which you think would be effective?

- Pilot Programs and other targeted approaches
- By watershed or water body
- Factor in the political environment

Respondents were next asked to indicate their responses to several scenarios reflecting different means of awarding funds if they are distributed on a town-by-town basis. Each scenario was asked about individually, and the percentages below reflect the proportion of respondents approving of that individual scenario. The scenario questions were not exclusive, so the total approvals exceed 100%. Sixty-four percent of respondents felt that if funds are distributed by town, each town should receive an equal base level of funding, with a competitive process for additional funds. Forty percent of respondents approve of a fully competitive process for the funds, while 18% approve of equal funding for every town.

**Respondent Opinions on How Funding Should be Distributed**

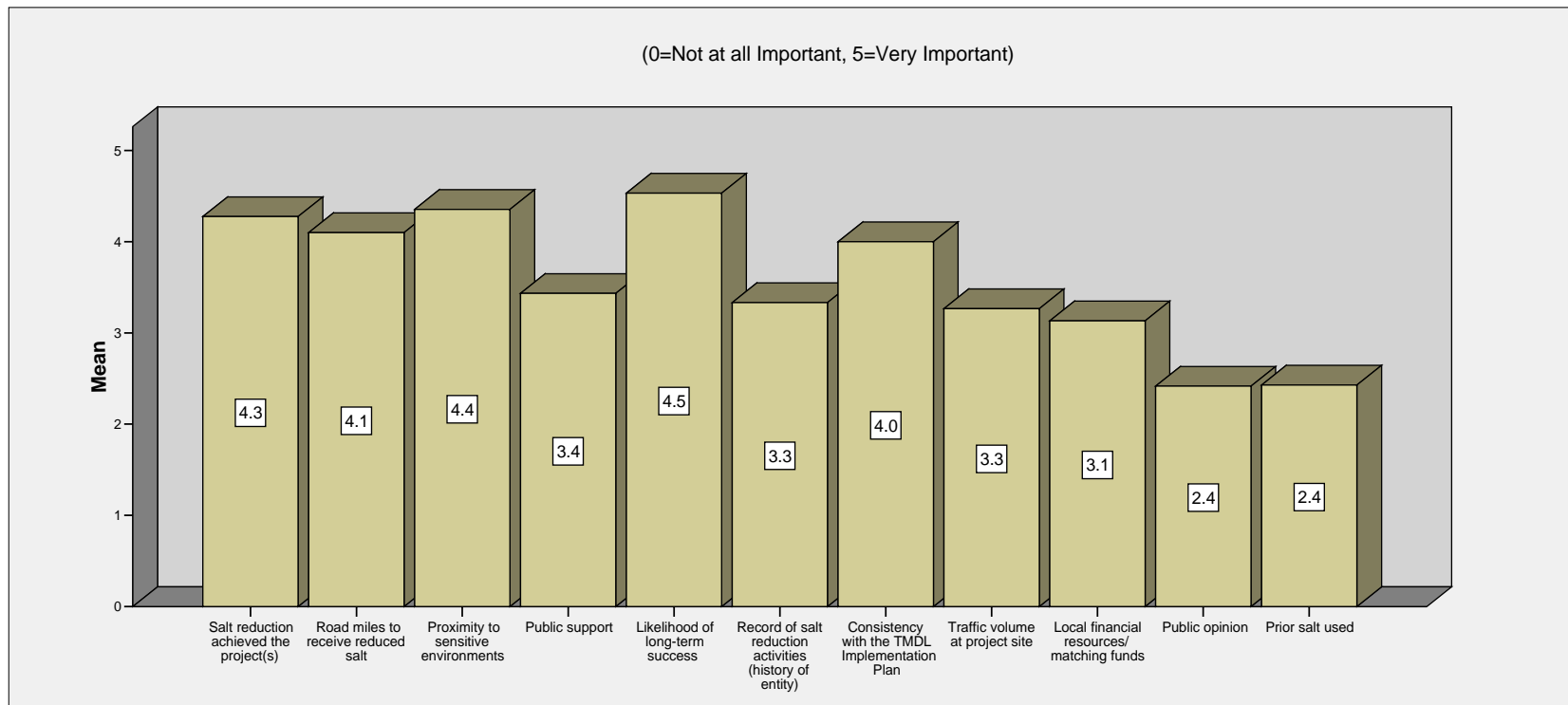


Are there other options or combinations of approaches that I did not ask about which you think would be effective?

- Calculation of road miles per town and the bodies of water closest to I-93
- High risk watersheds or areas with greatest need
- Hiring a center like T<sup>2</sup> to train and design operations in the impacted watersheds

Within a competitive grants program the criteria used to distribute funds are very important, as the decision making can have a large influence on the effectiveness of the program. Respondents were asked to identify how important each of the following criteria should be in distributing funds in such a program. The likelihood of long-term success and the proximity to sensitive environments were perceived as the most important criteria with public opinion and prior salt use as the least favored criteria for grant evaluation.

**Means of Respondents' Beliefs About How Important Each of the Following Criteria Are for Distributing Funds Under a Competitive Grant Application for the Road Salt Reduction Program**

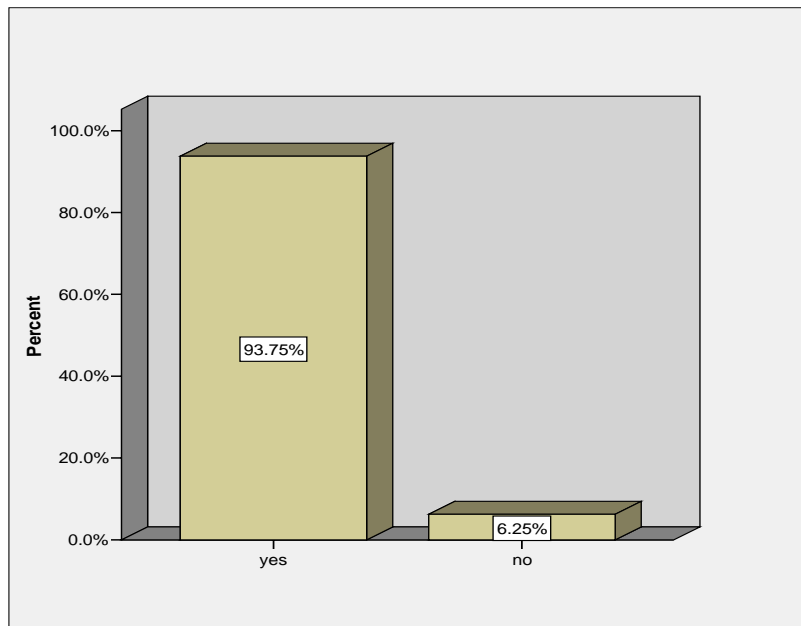


What, if any, additional means would you require to successfully compete for funds under the Salt Reduction Grant Program?

- No additional means would be required by most of the communities
- Awareness of funding opportunities
- Assistance proving benefits of a specific project or approach

The last question on the topic of funding asked respondents to indicate if they believed salt reduction requires resources other than money, and the vast majority, 94%, indicated that additional resources are needed. The qualitative data below identifies what resources respondents believe are needed.

**Does Road Salt Reduction Require Resources Other Than Money?**



**Does Road Salt Reduction Require Resources Other Than Money?**

		Frequency	Percent	Valid Percent
Valid	yes	30	83.3	93.8
	no	2	5.6	6.3
	Total	32	88.9	100.0
Missing	99	4	11.1	
Total		36	100.0	

Respondents identified the following additional resources:

- Education and Public Awareness
- General mindset and public driving behavior change
- Political will
- Buy-in of leadership

## Responses by Employment Sector

Groups of respondents defined by the type of work they do saw the importance of the various factors the same way, with one exception. When asked if it was important that the “road miles to receive reduced salt” are a factor in awarding grants Transportation field professionals did not feel that criteria was as important as other groups of respondents defined by the type of work they do professionally.

There was significant variance by employment sector only in viewing the responses for fund distribution based on county. While state regulatory agency employees tended to rate distribution by county even lower than other groups, only private contractors suggested that by county was a good way to distribute funds.

When asked for opinions on competition for competitive grants, responses did not vary greatly across employment sectors, although both federal and municipal employees ranked salt reduction achieved by projects somewhat lower than other respondents.

### ***Funding - Trends and Issues Identified:***

- Although there may be a need for some general distribution of funding, most workgroup members felt that the funding should be used to address problem areas and to create positive examples of solutions in NH.

### **Additional comments provided by respondents upon completion of the interview:**

- Add 5 cents to gas tax to pay for alternatives
- No regulation without long term funding
- Be pragmatic, gradual change is needed
- Need to spread environmental impact data
- EPA and DES should have acted on this issue much sooner.
- Pilot programs are needed to prove effectiveness

## IV-F Demographics of Participants

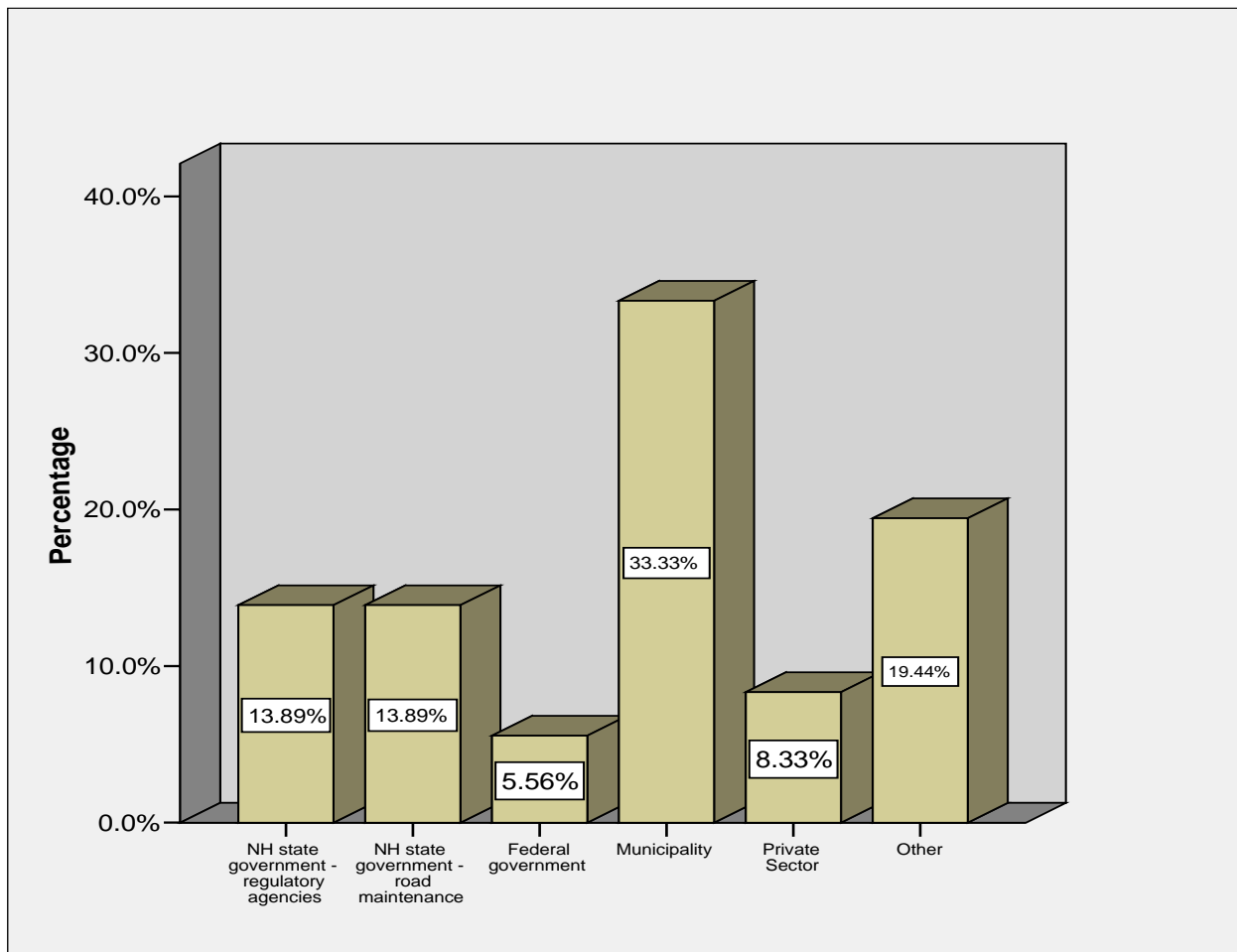
### Select Demographic Data Describing Interview Participants

The following charts and tables provide basic descriptive information about respondents to the survey. This information will also be used in the multivariate analyses that follow the report of descriptive findings, which is conducted to determine how different stakeholders view the issues covered by the survey to identify important similarities and differences

The data below is focused primarily on the employment sector of the respondent and how their work involves them in salt reduction issues, as these are the factors believed to be important in potential perspective differences on road salt reduction issues.

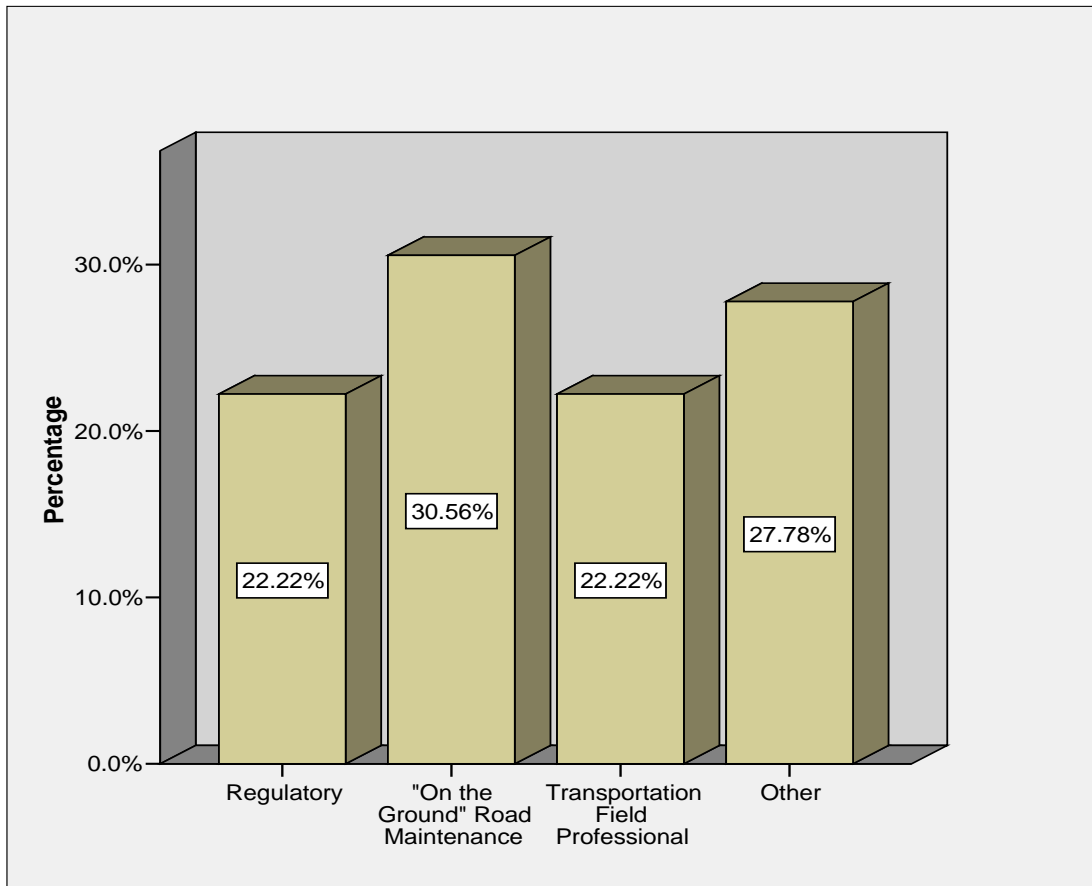
The chart below indicates that a third of the respondents work at the municipal level, while the other categories of employment are fairly evenly distributed across respondents.

**Current Employment of Respondents**



The final question asked respondents to self classify the type of work they do to enable the comparisons between different orientations to road salt reduction issues. The “on the ground” road maintenance was the most common classification of respondent, but overall the distribution of respondents across the categories of types of work was even.

**Type of Work Done by Respondents**



## **V. Salient Findings – Impact of Profession on Responses**

The second series of analyses conducted and discussed in the survey results section of this report identifies important findings from bivariate (two variable (i.e. Do DPW personnel think differently than Regulators on an issue?)) analyses of the data collected, with key implications of the findings presented with the data analyses. Only significant results and or important findings are reported in the text in the interest of concise data reporting. Tests of statistical significance, measures of strength of relationship, and expectations about important differences across stakeholders guided analyses conducted to identify the relationships of importance discussed in the following section. Important points will be clarified so that a familiarity with statistical procedures will not be necessary to make sense of the analyses that follow, but a brief review of the meaning of statistical significance will be useful for readers.

Traditionally in the social sciences tests of statistical significance enable analysts to identify relationships between variables that are 95% or more likely to be true in the population of all stakeholders, statistically speaking. Because of the small sample size in this study the level of statistical significance used to judge the ability to generalize a relationship was  $p < .1$ , or less than 10% change of error in making the assertion there are real differences between the groups in question in the population of stakeholders. If a relationship is “statistically significant” we are confident that it exists in the “real world” of stakeholders. Tests of statistical significance do not signify a strong or weak relationship between variables per se, nor do they necessarily indicate a finding is of importance in and of itself. Instead, they identify relationships that, based on statistical analyses, are worthy of consideration. Tests of statistical significance are combined with other procedures in this report to achieve analytic goals.

Respondents were asked to indicate their level of agreement with statements about the viability of road salt alternatives, and were also asked to rate their opinions on several other issues on numerical scales throughout the survey. For the first type of question “Strongly agree” was coded as a “1” for data analyses, and “Strongly Disagree” was coded as a “5.” In the data that follows about those questions, higher means indicate higher levels of disagreement among respondents in regards to the statement in question about whether the road salt alternative is a realistic one. In contrast, other scaled opinion questions use low scores to indicate less support of the item on the response continuum, and higher scores indicate a more positive scoring.

## V-A First Series of Bivariate Data Analyses (ANOVA)

The **first series** of bivariate data analyses (ANOVA) examine how the type of work respondents do professionally relates to the attitudinal measures in the survey that address multiple research questions. Respondents were asked to classify the type of work they do into one of four categories:

- Regulatory
- “On the ground” road maintenance
- Transportation field professional
- Other

Understanding how these different fields perceive road salt issues is important for the identification of communication needs and for the identification of areas of probable difference in future endeavors.

ANOVA works by comparing the mean response scores across all the categories of types of work, and using mathematical analyses to identify where differences in means are significant. The data reviewed below highlights significant findings from the analysis conducted on all variables, and only important results are discussed. The charts below present a standard sequence of analysis. The first chart reports the mean responses of the groups for different variables where relationships were identified, and provides other summary statistics about the analysis as well.

A second chart has been included in the Appendix as a supporting document and reports the findings of the procedures conducted to determine statistical significance (the chance of error in asserting there is a difference between the groups’ mean scores on the attitudinal question), and the level of significance itself is reported in the right-most cell of the table. Lower figures indicate less chance of error, and therefore represent “higher” levels of statistical significance. The last table (also included in the Appendix as a supporting document) reports the appropriate measure of association for ANOVA,  $\text{Eta}^2$ .  $\text{Eta}^2$  is very similar to other measures of association, and is interpreted as the percentage of the variance in the dependent variable that is explained by variance in the independent variable. In this case, the figure identifies the relative influence of being in different categories of work: the higher the figure, the more variance associated with that factor.

### Research Question 1

The first research question guiding the inquiry asked researchers to engage in the;

- *3(a). Identification of specific best management practices, techniques, and technologies used to reduce the application of salt to roadways and parking lots.*

The first analysis identifies road treatment alternatives whose likelihood of being a realistic alternative to reduce the impacts from road salt use respondents from different types of work view differently. **There are particularly meaningful differences about the belief that brine, RWIS, or pre-wetting are realistic alternatives, with “On the ground” road maintenance staff being most skeptical of these options. In contrast, overall “Transportation field professionals” were most skeptical of alternatives, as a whole.**

In combination the findings indicate there are differences in perceptions across different types of work, and highlight a key finding for the report: **These differences are important, and peer-based education is needed to overcome them, as interviews indicated that there is frequent skepticism about information that comes from sources outside the type of work stakeholders perform.**

Type of Work		realistic alternative - liquid potassium acetate	realistic alternative - brine	realistic alternative - roadway weather information systems	realistic alternative - pre-wetting road surface	realistic alternative - underbelly plows
Regulatory	Mean	3.00	1.86	1.57	1.86	2.00
	N	5	7	7	7	6
	Std. Deviation	.707	.690	.787	.690	.632
"On the Ground" Road Maintenance	Mean	2.83	3.18	2.83	3.00	3.00
	N	6	11	6	8	8
	Std. Deviation	.408	1.079	.983	.756	1.309
Transportation Field Professional	Mean	3.75	1.86	1.57	1.60	2.00
	N	4	7	7	5	5
	Std. Deviation	.500	.378	.535	.894	.707
Other	Mean	3.00	2.78	1.50	2.60	3.40
	N	2	9	2	5	5
	Std. Deviation	.000	.833	.707	.548	.894
Total	Mean	3.12	2.53	1.91	2.32	2.63
	N	17	34	22	25	24
	Std. Deviation	.600	.992	.921	.900	1.096

### **Research Questions 2 and 3**

The second and third research question explored the;

- *3(b). Identification of behaviors of the driving public, of safety personnel, of elected officials, and of road maintenance staff relative to the application of salt to roadways and parking lots; and 3(c) Identification of target audiences and communication strategies*

This analysis identifies how important respondents from different types of work believe several issues related to salt and salt storage are in efforts to reduce the impacts of salt. Surprisingly **there were few differences between respondents with different types of employment. The only important difference between the groups was in regards to how important an issue “what is done with salt “left over” at the end of the year” is perceived to be. The data below indicate that “On the ground” road maintenance staffs think this issue is of relatively low importance, while “Regulatory” and “Transportation field professional” workers think it is one of the most important issues.**

In combination the findings indicate there are few differences in perceptions across different types of work, which is encouraging: With the exception noted above, respondents doing different types of work perceive these issues in primarily the same ways, which should generate easier steps forward to mitigate impacts.

Salt use and storage - what is done with left over salt at end of year

Type of Work	Mean	N	Std. Deviation
Regulatory	4.83	6	.408
"On the Ground" Road Maintenance	3.00	10	2.000
Transportation Field Professional	4.57	7	.787
Other	3.33	6	1.633
Total	3.83	29	1.605

**The second and third research questions were also examined by looking at respondents’ perceptions of the conditions under which different stakeholders in road salt issues would be willing to explore road salt alternatives in a series of questions asking about each group. After extensive analyses no important differences were found, again highlighting an area of agreement among respondents.**

#### **Research Question 4**

The fourth research question asked researchers to collect information from respondents on the;

- ***3(d). Identification of feasible methods by which to obtain accurate information on salt usage for winter road maintenance by state, private, and municipal applicators.***

The first question in the questionnaire on this topic asked respondents to identify how important various sources of information are when making decisions about the application of road salt.

**As with several other analyses, there was a surprising amount of consistency across the different types of work respondents do professionally. The only source of information whose utility was viewed differently by respondents was “Directives from management.” As indicated by the data below "On the Ground" Road Maintenance personnel felt that directives from management were less important than did all other groups of types of work.**

The findings again indicate there are few differences in perceptions across different types of work, which is encouraging: With the exception noted above, respondents doing different types of work perceive the importance of information sources in primarily the same ways.

Importance of source of information for decisions about road salt application - directives from management

Type of Work	Mean	N	Std. Deviation
Regulatory	4.57	7	.535
"On the Ground" Road Maintenance	3.80	10	.789
Transportation Field Professional	4.17	6	.753
Other	4.75	4	.500
Total	4.22	27	.751

## Research Question 5

The fifth research question posed asked researchers to consider various regulatory approaches and their impacts;

- *3(e). Identification of possible regulatory approaches for reducing the application of salt to roadways and parking lots, and the effects it would have on their operations*

The first question in the questionnaire on this topic asked respondents to identify the extent to which regulations aimed at reducing road salt application will impact various aspects of operations and salt related issues.

**There was great consistency across the different types of work respondents do professionally in their perceptions of the impacts of regulations on the various operations and issues they were asked about in the questionnaire.** The only factor potentially impacted by regulations that respondents doing different types of work viewed differently was the impact on the “Overall cost of de-icing.” As indicated by the data below **"On the Ground" Road Maintenance personnel and respondents in the “Other” category both felt that the impacts on overall cost of de-icing from regulations would be relatively high, and it is also noteworthy that regulatory officials felt the impact would be significantly lower than the other groups of respondents.**

Overall, the findings again indicate there are few differences in perceptions across different types of work, with the caveat of the exception noted above.

Impact of regulations reducing road salt application on - overall cost of de-icing

Type of Work	Mean	N	Std. Deviation
Regulatory	2.67	6	1.366
"On the Ground" Road Maintenance	4.14	7	.900
Transportation Field Professional	3.17	6	1.472
Other	4.25	4	.500
Total	3.52	23	1.275

The second question in the questionnaire on this topic asked respondents to indicate the extent to which different types of regulations aimed at reducing road salt application would be effective.

**Once again there were few differences in respondents opinions about the effectiveness of various regulatory approaches across the different types of work respondents do professionally. The only type of regulation that respondents doing different types of work viewed differently was the effectiveness of the “Required reporting of usage by property owners/managers.” As indicated by the data below, regulatory personnel and transportation field professionals both felt that such a regulatory measure would be effective, while other groups of respondents did not view the likely effectiveness as positively.** In total the findings illustrate that respondents doing different types of work understand these issues in primarily similar ways.

Regulations effectiveness at reducing road salt application - required reporting of usage by property owners/managers

Type of Work	Mean	N	Std. Deviation
Regulatory	4.43	7	1.134
"On the Ground" Road Maintenance	3.10	10	1.792
Transportation Field Professional	4.00	7	.577
Other	2.71	7	1.380
Total	3.52	31	1.458

## **Research Question 6**

The final research question addressed in the questionnaire focused on the;  
**3(f). Identification of optimal criteria for distributing funds under the Salt Reduction Grant Program**

**The first question in the questionnaire on this topic asked respondents to identify how effective they felt it would be to distribute road salt reduction funds using various methods. There were no significant differences across groups of respondents defined by types of work they do professionally in their responses to this question.**

The second question created to address the final research question asked respondents to rate the importance of several criteria for distributing funds under a competitive grant application system for awarding road salt reduction funds. **Groups of respondents defined by the type of work they do saw the importance of the various factors the same way, with one exception. When asked if it was important that the “road miles to receive reduced salt” are a factor in awarding grants Transportation field professionals did not feel that criteria was as important as other groups of respondents defined by the type of work they do professionally.**

Importance of criteria for distributing funds under a competitive grant application for the program - road miles to receive reduced salt

Type of Work	Mean	N	Std. Deviation
Regulatory	4.00	7	.577
"On the Ground" Road Maintenance	4.56	9	.726
Transportation Field Professional	3.43	7	.976
Other	4.40	5	.548
Total	4.11	28	.832

## **First Series Summary**

The findings above highlight important differences across groups defined by the type of work respondents do professionally, but the most important conclusion is that there are far fewer differences across these groups than anticipated. These groups view the issues in question in very similar ways, which means more targeted educational efforts and information exchange is possible, as the various groups have more of their views and understandings in common than might be assumed before the comparisons were conducted.

## **V-B Second Series of Bivariate Data Analyses**

The **second series** of bivariate data analyses (ANOVA) examine how the respondent's employment sector relates to the attitudinal measures in the survey that address multiple research questions. Respondents were asked to classify their employment sector into one of six categories:

- New Hampshire State Government - Regulatory Agencies
- New Hampshire State Government - Road Maintenance
- Federal Government
- Municipality
- Private Contractor
- Other

Understanding the differences between stakeholders' views can help to identify important variances need to be considered when developing road salt reduction measures.

### **Research Question 1**

The first research question asked;

- *3(a). Identification of specific best management practices, techniques, and technologies used to reduce the application of salt to roadways and parking lots.*

**With the exception of calcium magnesium acetate, federal employees ranked every alternative lower than the other groups. Other variances among employment sector included significant preference from state regulatory agencies for both sodium acetate and magnesium chloride; state regulatory agency employees also ranked underbelly plows well below the mean.**

Employment Sector		realistic alternative - sodium acetate	realistic alternative - magnesium chloride	realistic alternative - pre-wetting road surface	realistic alternative - underbelly plows
New Hampshire State Government - Regulatory Agencies	Mean	3.67	4.00	2.20	2.00
	N	3	2	5	5
	Std. Deviation	.577	.000	.447	.707
New Hampshire State Government - Road Maintenance	Mean	3.00	2.40	2.75	2.00
	N	1	5	4	5
	Std. Deviation	.	.548	1.258	1.225
Federal Government	Mean	2.00	2.00	1.00	2.00
	N	1	2	2	1
	Std. Deviation	.	.000	.000	.
Municipality	Mean	3.00	2.86	2.80	3.63
	N	3	7	10	8
	Std. Deviation	.000	.378	.632	.916
Private Contractor	Mean	4.00	3.50	1.50	2.50
	N	1	2	2	2
	Std. Deviation	.	.707	.707	.707
Other	Mean		3.50	2.00	2.67
	N		4	2	3
	Std. Deviation		.577	.000	1.155
Total	Mean	3.22	2.95	2.36	2.67
	N	9	22	25	24
	Std. Deviation	.667	.722	.860	1.129

### **Research Question 2 and 3**

The second and third research question asked;

- *3(b). Identification of behaviors of the driving public, of safety personnel, of elected officials, and of road maintenance staff relative to the application of salt to roadways and parking lots; and 3(c) Identification of target audiences and communication strategies*

**There were no significant differences in responses varying by employment sectors related to salt use and storage to reduce impacts of salt.** This finding is encouraging, as it suggests that views on salt use and storage are consistent throughout these groups. There were also no significant differences in views and perceptions of different target audiences between groups.

### **Research Question 4**

The fourth research question tried to gauge;

- *3(c). Identification of feasible methods by which to obtain accurate information on salt usage for winter road maintenance by state, private, and municipal applicators.*

The first section included under the fourth research question asked for a rating of importance of different sources of obtaining information for making decisions about the application of road salt. **Most responses did not vary significantly based on employment sector; however the use of road conditions reports did vary greatly. Private contractors rated road condition reports of extremely low importance, while state regulatory agencies, federal government employees, municipalities, and those who indicated “other” tended to rate road condition reports of very high importance.**

Importance of source of information for decisions about road salt application - road condition reports

Employment Sector	Mean	N	Std. Deviation
New Hampshire State Government - Regulatory Agencies	4.40	5	.894
New Hampshire State Government - Road Maintenance	3.25	4	1.708
Federal Government	5.00	2	.000
Municipality	4.33	9	1.414
Private Contractor	1.00	2	.000
Other	4.33	3	.577
Total	3.96	25	1.485

The second section under the fourth research question asked what respondents thought the **most effective method of reporting salt usage is.** Again, most responses did not vary significantly by employment sector. The exception was that of only five respondents who did not indicate that “by roadway” was an effective method of reporting, four individuals listed “other” as their employment sector.

Most effective way to report road salt usage? By roadway

Employment Sector	Mean	N	Std. Deviation
New Hampshire State Government - Regulatory Agencies	.75	4	.500
New Hampshire State Government - Road Maintenance	1.00	4	.000
Federal Government	1.00	2	.000
Municipality	1.00	10	.000
Private Contractor	1.00	2	.000
Other	.00	4	.000
Total	.81	26	.402

### **Research Question 5**

The fifth research question posed asked researchers to consider various regulatory approaches and their impacts;

- *3(e). Identification of possible regulatory approaches for reducing the application of salt to roadways and parking lots, and the effects it would have on their operations*

The first question in the questionnaire on this topic asked respondents to identify the extent to which regulations aimed at reducing road salt application will impact various aspects of operations and salt related issues.

**State level regulatory employees and private contractors universally felt that the state level was not the one at which regulations would be best implemented; they also universally supported federal and case-by case regulation. State road maintenance employees answered largely in the inverse, favoring state level regulation foremost, federal slightly less and case by case very little. Federal employees felt universally that state level regulations were not appropriate, split fifty-fifty on federal regulation, and universally supported case-by-case regulation. Municipal employees were one third in support of state regulation, one hundred percent in support of federal regulation, and three quarters were behind case-by-case regulation.** Employment sector proved to be a very important factor in opinions on level at which regulation should take place, which suggests that depending on group, education may be needed extensively to help justify the level at which regulations may take place.

Employment Sector		If regulation takes place, how should regulations be implemented? state level	If regulation takes place, how should regulations be implemented? federal level	If regulation takes place, how should regulations be implemented? case-by-case basis
New Hampshire State Government - Regulatory Agencies	Mean	.00	1.00	1.00
	N	5	5	5
	Std. Deviation	.000	.000	.000
New Hampshire State Government - Road Maintenance	Mean	1.00	.75	.25
	N	4	4	4
	Std. Deviation	.000	.500	.500
Federal Government	Mean	.00	.50	1.00
	N	2	2	2
	Std. Deviation	.000	.707	.000
Municipality	Mean	.33	1.00	.75
	N	12	12	12
	Std. Deviation	.492	.000	.452
Private Contractor	Mean	.00	1.00	1.00
	N	3	3	3
	Std. Deviation	.000	.000	.000
Other	Mean	.00	1.00	.86
	N	7	7	7
	Std. Deviation	.000	.000	.378
Total	Mean	.24	.94	.79
	N	33	33	33
	Std. Deviation	.435	.242	.415

The second section regarding regulatory approaches asked for opinions about the impacts of regulations. **Registration of road salt applicators and required reporting of usage in the private sector were viewed as likely to have a much larger effect by state and federal employees, while municipal employees and private employees tended to think those methods would be of very little significance.**

Employment Sector		Regulations effectiveness at reducing road salt application - registration of road salt applicators	Regulations effectiveness at reducing road salt application - required reporting of usage by property owners/managers
New Hampshire State Government - Regulatory Agencies	Mean	4.20	4.20
	N	5	5
	Std. Deviation	.447	1.304
New Hampshire State Government - Road Maintenance	Mean	4.25	4.50
	N	4	4
	Std. Deviation	.500	.577
Federal Government	Mean	5.00	5.00
	N	2	2
	Std. Deviation	.000	.000
Municipality	Mean	2.64	3.18
	N	11	11
	Std. Deviation	1.690	1.250
Private Contractor	Mean	2.33	2.00
	N	3	3
	Std. Deviation	2.082	2.646
Other	Mean	4.29	3.17
	N	7	6
	Std. Deviation	.951	1.169
Total	Mean	3.56	3.52
	N	32	31
	Std. Deviation	1.501	1.458

**Research Question 6**

The final research question addressed in the questionnaire focused on the;

- o *3(f). Identification of optimal criteria for distributing funds under the Salt Reduction Grant Program*

The first question on this topic asked respondents to identify how effective they felt it would be to distribute road salt reduction funds using various methods. **There was significant variance by employment sector only in viewing the responses for fund distribution based on county. While state regulatory agency employees tended to rate distribution by county even lower than other groups, only private contractors suggested that by county was a good way to distribute funds.**

Effectiveness of distributing road salt reduction funds using method - by county

Employment Sector	Mean	N	Std. Deviation
New Hampshire State Government - Regulatory Agencies	.40	5	.548
New Hampshire State Government - Road Maintenance	1.25	4	1.258
Federal Government	1.50	2	.707
Municipality	1.33	12	1.303
Private Contractor	3.33	3	1.155
Other	1.29	7	1.113
Total	1.36	33	1.270

**The second section asked for opinions on competition for competitive grants, responses did not vary greatly across employment sectors, although both federal and municipal employees ranked salt reduction achieved by projects somewhat lower than other respondents.**

Importance of criteria for distributing funds under a competitive grant application for the program - salt reduction achieved the project(s)

Employment Sector	Mean	N	Std. Deviation
New Hampshire State Government - Regulatory Agencies	4.80	5	.447
New Hampshire State Government - Road Maintenance	5.00	4	.000
Federal Government	3.00	2	2.828
Municipality	3.56	9	.726
Private Contractor	5.00	2	.000
Other	4.83	6	.408
Total	4.32	28	1.020

## **Second Series Summary**

The data analyses reviewed in this section of the report show important differences across groups defined by the employment sector of respondents. However, the most important conclusion is the same as the one from the first multivariate analysis conducted: there are far fewer differences across these groups than anticipated. Respondents from the various sectors of employment view the issues in question in similar ways.

## V. Conclusions

It is clear from this portion of the Salt Reduction Study that the surfaces being treated throughout the watershed areas vary greatly, and often call for different approaches to treatment during storm events and general winter weather conditions. This is not a one size fits all situation. Most of the respondents that participated in this process recognized the general public as having a central role in this issue of treatment levels, and as having expectations of high levels of service on all roadways during and immediately following storm events. The increases in treatment quality and reductions in response time have created an expectation that roads will be open and passable most of the time.

The analysis of responses to the research questions, by profession, concluded that there are far fewer differences across these groups of stakeholders than anticipated. These groups view the issues in question in very similar ways, which means more targeted educational efforts and information exchange is possible, as the various groups have more of their views and understandings in common than might be assumed before the comparisons were conducted.

The most popular treatment and management solutions identified for reducing salt in the I-93 watersheds included training, equipment and infrastructure upgrades, and behavior change. There was not support for one product that could simply take the place of road salt. A combination of approaches will be necessary to reduce the current level of salt used on all roadway and parking surfaces. All of the stakeholders were open to changes, but some will need a strong directive in order to proceed with significant changes to their existing operations.

It is also clear that more data on the impacts of salt on the environment in New Hampshire is needed, in an easily accessible format, to all stakeholders and the public. More data and understanding is also needed on existing reduction efforts and alternatives being experimented with in New Hampshire. Brine is a perfect example of this. Although all of the respondents were aware of the use of brine on the Interstate, most were unsure of its success.

Another long term concern related to winter maintenance is the hiring of competent contractors. Rising operating costs (fuel, insurance, etc.) and shorter and more unpredictable winters are resulting in fewer companies and individuals who will enter into this seasonal profession. This will be a growing challenge for all treatment areas (state, local, and private).

The analysis of responses to the research questions by profession concluded that there are far fewer differences across these groups of stakeholders than anticipated. These groups view the issues in question in very similar ways, which means more targeted educational efforts and information exchange is possible, as the various groups have more of their views and understandings in common than might be assumed before the comparisons were conducted.

Lastly, as potential regulatory solutions are evaluated it will be important for the regulators to consider how they will be implemented, and what costs will be passed along to the local communities and private property owners. The respondents expressed an interest in any incentives that can assist with a transition to new winter maintenance practices. Included in that

is a need for this problem to be addressed at all levels, and by a partnership of stakeholders that include local and state leaders, the general public, and road maintenance professionals.

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