ECONOMIC IMPACTS OF CHEMICAL DEICERS

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PROBLEM

It is time to take a serious, in-depth look at the way we approach the problems of snow and ice removal in Michigan. It may be that once we understand the true cumulative costs of clearing winter precipitates, that those costs may exceed the benefits derived.

THE QUALITY IMPROVEMENT PROCESS AND FINDING HIDDEN COSTS

We live in an era where "Quality Improvement" is the buzz word; where consumer demands are high and cost containment and efficiencies are paramount. These factors are driven by the fact that we live in a highly competitive marketplace, where consumers have more choices and more knowledge of product and services and thereby carefully scrutinize their purchasing decisions. "Business as usual" strategies will not survive in today's dynamic, market-driven economies. Continuous improvement must be an ongoing process and must be ingrained in all work processes that add costs to the product or service we provide. Unfortunately, some of those costs can be invisible and slowly accumulate over time. It is those hidden costs of snow and ice removal practices that we seek to find and minimize.

HISTORICAL BACKGROUND

Direct costs to the University of Michigan for snow and ice removal are nearly a million dollars annually, but it is uncertain what additional hidden costs may be attached to providing this service. Those disguised, but directly related, costs would be in the form of repairs, deferred maintenance, and accelerated depreciation of campus facilities. Our customers demand high quality services but have no idea of what it costs to provide those services. The customer also has expectations based on previous experiences. If that experience is "clear, dry pavement" all winter long, those standards will have to be adhered to or the customer will feel that management is not doing its job. In addition, the customer is demanding good stewardship of its facilities and environment. Those organizations who meet or exceed all of these standards, while making the best use of labor and materials, will be the leaders of tomorrow.

TEAM HISTORY

In May of 1995, a seven member team of individuals from various departments within the University was formed to examine the problems caused by current de-icing strategies and to recommend alternative practices. The

team is comprised of members of various disciplines with this special and connected interest. Representatives from: Risk Management (insurance), Public Safety(police), Legal Counsel, Occupational Safety and Environmental Health, Parking Services, Construction Management, Building Services, Academics, and Grounds comprise the team and each member brings their respective interests and expertise together to challenge each other to identify, define, and find solutions to the problem.

The current team owes its existence to the earlier work of participants in the 1995 University of Michigan Business and Finance Management Institute. In the initial project, the seven member team outlined the indicators used to substantiate the need for further investigations of this problem. That report summarized many significant repair projects on campus which had a direct correlation to corrosion damage caused by deicing salts. As one of its recommendations, the report suggested the formation of a team to further investigate the problem. Senior Management then authorized the formation of the current "Salt Team".

The new "Salt Team" used the previously outlined report to further refine the indicators and develop a problem statement. The problem simply stated that "Current deicing strategies are identified as detrimental to the campus infrastructure and environment". The team then drafted its mission statement-"Establish and promote Best Management Practices for de-icing that minimize deterioration to buildings, infrastructure, and the environment without compromising safety." Stated another way, the task is, to strike a balance of customer satisfaction and safety with a cost effective, non-destructive, and environmentally sound snow and ice removal strategy.

DIFFICULTIES FACING CHANGE

The difficulties facing change at The University of Michigan vary for a number of reasons. First, high standards of "clear, dry pavement" have been well established and the customer expectation is correspondingly high. Any deviation from that standard is unacceptable, and is confirmed by a flurry of logged telephone requests for service. These service requests must then be dealt with expeditiously or they become potential grounds for "negligence" litigation in slip and fall lawsuits. Once this precedent had been clearly established, it became the norm. That norm then created unrealistic customer expectations which then drove the demands for service and their associated costs to even greater heights.

Secondly, the campus has experienced significant growth in the last few decades which resulted in increased exterior surface area to be kept clear of snow and ice. Increased exposure to legal liability and demands to control spiraling costs appeared simultaneously with the increased area requiring maintenance. Budgets have increased slightly or stayed relatively flat during this time necessitating the increased use of "inexpensive" deicers to meet the increasing customer demands. Prior to the 1960's, the use of deicing chemicals was virtually non-existent, where now the dependence on deicing salts is the standard practice.

Finally, the campus is highly diversified and decentralized amidst the City of Ann Arbor and is, in many locations, operational on a 24 hour basis. These factors all complicate the task of providing snow and ice removal services, and make the use of chemical deicing agents and abrasives at lower "perceived" costs, the logical choice.

THE ISSUE OF ECONOMICS

Economic issues lie at the heart of the problem. The cost issues are complex and not readily evident as they are diverse and encompass the passage of time. The process of deterioration caused by salt is a slow process that over time robs a structure of its beauty and its useful life. However, in order to identify any viable alternatives to the use of deicers, one must have a close approximation of the multitude of cost factors that are affected; not only those related to deicing materials, labor, and equipment, but those costs related to infrastructure deterioration, general liability and worker's compensation.

One of the basic premises which initiated our inquiry was a 1976 Environmental Protection Agency study which concluded that for each dollar spent on salt, an estimated $68.00 worth of infrastructure damage was caused by that salt. That figure did not include potential environmental damage, which was determined to be incalculable. Another study placed the cumulative costs of a ton of salt at $1,425.00 per ton instead of the actual $25.00 to $30.00 per ton. This information prompted the team to seek out all areas where deicers were doing damage to the campus infrastructure and environment, hence adding hidden, deferred costs to the bottom line.

INVESTIGATIONS

Signs of the effects of deicing salts appear everywhere; some very obvious and others obscured. In highly expensive parking structures where customer demands were high, significant restoration projects had been ongoing over the last five years with costs in the millions. These rehabilitation costs are immediately borne by the users in the form of increased parking fees. While the damage to the facilities and their need of repair is well founded, the customer cannot relate significant increases in the parking fees to this vital need for repair. Other paved surfaces (walks, streets, bridges, steps, plazas, and other masonry) have had to undergo serious restoration efforts due to deterioration, that was in large part, caused by deicing chemicals. Light poles, underground utilities, vehicles and other equipment, damage to interiors of buildings and the associated increased interior clean up costs, doors, storm drain cleaning and damage, and other exterior exposed metal structures have recognizable salt induced damage. Calculating the damage costs of these various structures will be difficult but are quantifiable. As the investigation proceeded, it was apparent just how extensive the salt induced damage was. Most of the damage had occurred over a period of years and was cumulative, but some of the damage and clean up costs could be associated with current years applications.

More troubling, yet difficult to quantify in monetary terms, were the intangibles: environmental, natural resources, and aesthetics. Issues that relate to water pollution via storm drains are being addressed with Non Point Discharge Elimination System (N.P.D.E.S.) permits and will have increasing cost implications. The natural resources that comprise the campus landscape can be partially replaced, but all carry costs; both real and intangible in regards to aesthetics. The real question though is how do you replace a tree that took a hundred plus years to grow? Aesthetic value is the most difficult to determine. How do you place a value on aesthetics? Do students chose one institution over another based on a visual first impression? If that student were particularly gifted and chose another comparable institution because of visual appearance could one then correlate that students future contributions to the institution as lost opportunity costs? How might the parents of that student be affected by the visual appearance of the institution? Is the general attitude and productivity of an institution linked to the "feel" of its external environment? These are all questions with intangible cost implications but are none-the-less worthy of our attention.

What are these deicers really costing us to apply? How can we compare the costs of other alternative deicing strategies to the costs of our current practices? How can we separate natural depreciation from accelerated "salt induced" depreciation and then equate that loss of useful life to dollars? The problem becomes one of quantifying all of these costs in order to perform cost/ benefit analysis as it relates to different alternative strategies; both chemical and labor intensive. These investigations are currently in progress.

MEETING THE CUSTOMERS NEEDS

The actual service we provide is customer safety and convenience. It is our hope that no one would ever be hurt from a slip and fall on snow or ice and that the inconveniences of winter are made as minimal as possible for the University community. We therefore live by the motto: "shoot for perfection; because when we fall short we will still be damn good." The customer is not interested in the details, only the results, and, unfortunately, is generally only aware when the job is not being done. We need to be certain that we understand when customer satisfaction is obtained, so that we do not throw additional resources at the problem at the risk of increasing infrastructure damage.

FINDING SOLUTIONS

How do we keep the customer happy and safe, watch the bottom line, and while we are at it, protect the publics investment in its infrastructure? The goal of our team is to craft "Best Management Practices" which balance the inter-relationship of these factors. Actually, this process is very much like the I.P.M. (Integrated Pest Management) we have all adapted to meet the challenge of optimizing our use of pesticides. Overuse and misuse of pesticides were recognized as harmful to the environment and becoming less effective which in turn caused us to re-evaluate our practices. This model can be adopted to develop a pro-active strategy to reduce and restructure our current use of chemical deicers in the control of snow and ice. In I.P.M., you first diagnose the problem, isolate the problem area, understand its life cycle, know its economic thresholds, monitor the numbers and damage, employ prevention strategies, apply both mechanical and chemical control measures (right products at the right rates), train staff in proper application techniques, and finally you evaluate the effectiveness of the program. Winter maintenance practices have many similarities.

A winter season produces many problems for us to deal with: snow, ice, freezing rain, frost, sub-zero temperatures, etc. Winter weather is highly variable. Snow storms have many different life cycles and come in varying intensities and no two winter precipitate events are the same. The strategies developed must take these facts in to consideration. The "Best Management Practices" which we identify will become our prevention strategies and control measures in what one could term an "Integrative Problem Management" approach to dealing with this problem. It is very apparent that there is no "one size fits all" approach to deal effectively with winter's mixed bag of tricks. All available tools must be identified, assembled, and analyzed before a strategy can be implemented. Such a strategy will be multi-faceted, will contain many contingencies and once established, will involve a great deal of training in order for the plan to be properly executed.

Developing an "Integrated Problem Management" plan that consists of well connected "Best Management Practices" will be the focus of the next few years effort of the University of Michigan "Salt Team". Continuing to further define the problems and find the solutions and then fashion them in to an integrated plan is the only way we can achieve our mission statement. As we gather more data, the focus on the cost/benefit relationships will become clearer. This will enable us to fashion a cohesive plan, that, when completed, will be implemented on a preliminary basis and evaluated as to their effectiveness. If the recommendations in the plan function well, they will be further analyzed and expanded in the next winter season. This process will require re-evaluation on an annual basis as new technologies and other details change from year to year.

We must always work at continuous improvement lest we create our own obsolescence. The damages caused by salt to the infrastructure and environment are not invisible but are certainly clouded by economic issues. The future economic viability of our Michigan institutions may be compromised if we are forced, by unsound practices, to have to continually rebuild our infrastructure. As Jonathan Swift said, "Vision is the Art of seeing things invisible" and we must use that vision to be good stewards of the resources of which we have been entrusted to protect.

SUGGESTED FURTHER READING:

Chemical Deicers and the Environment, edited by Frank M. D'Itri, Lewis Publishers, 1992

An Economic Analysis of the Environmental Impact of Highway Deicing, E.P.A., Office of Research and Development; Doanald M. Murray and Ulrich F. W. Ernst, ABT Associates, Inc.; May 1976

The Use of Selected Deicing Materials on Michigan Roads, Prepared for Michigan Department of Transportation by Public Sector Consultants, 1993

Special Report 235 Highway Deicing: Comparing Salt and Calcium Magnesium Acetate, Transportation Research Board, National Research Council, Washington, D.C., 1991

Highway Deicers: Standards, Practice and Research in the Province of Ontario, Parchanok, M. S., Manning, D, G., Armstrong, J. J., The Research and Development Branch, Ministry of Transportation of Ontario, Downsview, Ontario, Canada, 1991

Salt Related Damage to Woody Ornamentals, Craul, P. J., Presentation at the Michigan Turfgrass Foundation conference, Lansing, Michigan, 1995

Deicing Chemical use on the Michigan State Highway System, Legislative Service Bureau, Science and Technology Division, Prepared for the Honorable William Van Regenmorter, State Senator, 1991 **Note**: There is a bill currently being proposed to look at this issue in the Michigan Legislature.

Let's Stop Salt Damage, James R. Fazio, Editor, The National Arbor Day Foundation, Tree City USA Bulletin Number 32 for the Friends of Tree City USA