

2019 DOT Case: Research data and outliers

During a particularly harsh winter, a state DOT is seeing an increase in crashes and complaints about signal lights in some major municipal thoroughfares where the lights have been completely obscured by blowing snow and ice. Years ago, the incandescent lights at most of these intersections were replaced with LED lights, but then it was discovered that the LED lights are more prone to snow accumulation. As a fix, several municipalities purchased new LED signal lights with a built-in heating system activated by a small thermostat. Overall these heating systems have worked adequately, but during particularly serious ice or snow storms, a small fraction of the heating systems for these thermostats have simply ceased to function completely. While the flaw is only affecting one signal at a time, when that signal light happens to be at an intersection, it has been causing confusion and sometimes crashes during heavy snowstorms. Thus, the random failures of the thermostats are a cause for concern: these heated LED systems are not nearly old enough to be experiencing failures. The DOT contracts an independent research firm to study the quality, durability, and effectiveness of the existing thermostats and heating systems deployed for their LED signal lights; the firm is asked to provide recommendations about an appropriate replacement schedule, should that be required.

The research firm selects representative samples from five different areas of one large (500,000 person) municipality in the region where the DOT has installed the heated thermostats with their LED signals. Four of the study samples show a better than 98.5% reliability with the heating systems, with only 1-1.5% of the systems ceasing to function during testing. The fifth study sample shows 93% reliability, but approximately 7% of the units failed catastrophically, and careful analysis of all of the failed units reveals them to have a minor manufacturing defect that could lead to premature failure, especially during unusually long (10+ hour) snow storms. The researchers recommend inspection of all of the installed units in the city to identify and replace the flawed units.

One of the key decision-makers at the DOT is a PE who receives the firm's preliminary results and recommendations. He had been hoping for a different recommendation. Inspection of all of the installed units would be time-consuming and costly, and it is not at all clear that the costs (to the taxpayer) are worth the relatively small risk of crashes occurring whenever there is a failure happening during a snowstorm. He suspects that such an initiative would not be financially supported by DOT policy-makers; in fact, he is concerned that they will be irritated by this seemingly minor problem at a time when he and the people in his unit really need upper-management's good will for multiple other large-scale projects. At the same time, he really doesn't want to have this research study on file with the DOT because it does raise safety concerns, even though they are minor concerns. He is worried about liabilities of the study.

What do you think he should do? To whom should he be speaking first, and what should he say?

Part 2

The PE decides he is so uncomfortable moving forward with these results, that he doesn't even consider showing the report to his colleagues at the DOT. Instead, he considers the following four options:

1. Ask the research firm to look at their data again and "clean it up" by dropping the outlier, given that four of the samples showed fairly high reliability. Suggest that without that outlier, the recommendations could be revised simply to a "watch and wait" approach, rather than fullscale inspection and replacement.
2. Ask the research firm whether they would consider revising their recommendations to focus only on inspection and replacement in the area of the city where the units with the highest failure rate occurred.
3. Invite the lead author of the research study to a private meeting. While there, raise a number of questions about their testing methods, to suggest that perhaps a mistake was made with the fifth sample. Ask them to re-do their testing, and rethink their recommendations. Suggest that if that can be done, there may be more research work in the future for a firm that is willing to work so collaboratively.
4. Tell the researchers that the project cannot be closed out yet because the results are under discussion. Tell others at the DOT that the results of this initial study are "inconclusive." Then, contract a different research firm to run a new study of the heated LED lights.

Which of these options are in your opinion the least ethical? What are possible consequences for some of the least ethical options here?

Could you see one of these options as being acceptable if part of the option were changed? If so, how would you change the option in a way that might make it okay?