## INTRODUCTION

I've decided to discuss the decision making process that the Office of Road Design used to find a way to better estimate the costs of lump sum construction quantities when generating project cost estimates. Lump sum quantities are those quantities that are paid to contractors up front in one lump sum payment and cannot be measured by traditional metrics, like dollar per ton, square yard, or foot.

## INTELLIGENCE PHASE

The Office of Road Design first became aware that there was a problem with their cost estimates when the Office of Financial Management noticed huge discrepancies between Road Design's estimates and those of contractors who were bidding for the construction of the roadway projects. A more detailed comparison yielded that most of the discrepancies resided in the estimates for lump sum items. Road Design was then mandated to fix their cost estimates so that funding could be more accurately allocated to projects.

The information resources that were readily available included Road Design's cost estimates for the last several years and contractor's bid prices over the same period. This data provided a starting point for the decision makers. Lump sum quantity costs had not been previously analyzed so the first information resource that had to be obtained was to associate meaning to all the data. The data was researched and analyzed, and then broken down into type of project (4-lane, bridge, interstate, etc.), location of project (rural vs. urban), and project length (by mile or station). Other information resources that were obtained to specifically support the decision were construction cost estimation experts, who had extensive experience

in construction activities and possessed knowledge regarding generally accepted practices in estimating lump sum costs.

In hindsight, I believe the intelligence phase could have been performed better if the individuals comprising the decision making team had been selected with more care and consideration. As selected, the team consisted of mostly junior engineers who had little experience generating cost estimates, much less construction know-how. A lot of time was spent educating them on the ins-and-outs of the cost estimating process. Also, the inexperienced team members were ready to believe, on faith, just about anything they were told, and were unable to temper "hearsay" with experience. The team seemed to be selected haphazardly, looking for people who had simply had time to commit to the team, instead of people who had any sort of experience with the problem.

One heuristic that I believe was helpful during the intelligence phase was that of confirmation. For the most part, actions and ideas that were generally considered as positive steps in solving this problem were thoroughly explored and confirming evidence was found to corroborate these ideas. What kept this heuristic from becoming a bias was that disconfirming evidence was also sought and researched. This allowed the decision making team to possess an accurate assessment of the quality of all proposed actions, so they could chose an alternative, that had been thoroughly dissected, with confidence.

Pessimism, in my opinion, helped keep the team from getting lost in the minutiae of the problem. This heuristic kept the decision-makers grounded in reality. Early on in the decision-making process, the leader of the team reminded the team members that the types of costs that they'd be investigating would not be able to be pinpointed exactly. He set the goal

of estimating these items with 20% of final bid price. Essentially, he stated it was not worth the investment of time and mental energy to generate precise estimates, when precision was not necessary or even desirable. This type of pessimism was especially important when the team consisted of young, ambitious engineers, who were eager to develop cost estimates with two decimal point accuracy and who were gung-ho to do extensive research to find the information they would need. The pessimism heuristic kept the team from wasting time and kept the team members focused.

However, I believe the pessimism heuristic, while helpful, led the group to engage in the bias of prudence. In the information phase and brainstorming sessions, experienced group members vocally discounted some proposed metrics and ideas as too extreme or too precise. This led to group members becoming afraid to look foolish in the eyes of others and they refrained from volunteering metrics that would lead to high dollar costs. I believe this led to an overabundance of conservative metrics and, perhaps, missed opportunities in how to construct cost estimates for these important lump sum items.

Another bias that I believe hurt the decision-making team was that of status quo. There seemed to be a prevailing belief that, despite the discrepancies between cost estimates that the way that Road Design estimated lump sum quantities was sufficient, simply because that is the way that it has always been done. Some members of the decision-making team believed that it was not worth the time and mental energy to devise a new way to perform cost estimates. I believe this bias slowed the decision-making process, as some members of the team seemed to be solidly averse to any new proposal.