

How to Write an Effective NCHRP Research Problem Statement.

Writing an effective research problem statement is not a simple matter, even to transportation practitioners who face serious problems and challenges on a daily basis. The research needed might be obvious to them but difficult to describe to non-specialists. They may not have thought about how to quantify it or how to justify the needed research with respect to other agency or national priorities. A serious problem to them might not even be on a decision-maker's radar screen.

This document was written to provide some guidance on developing research problem statements for the National Cooperative Highway Research Program. The heading numbers in roman numerals refer to the sections of the standard NCHRP template for problem statements. The original document was developed for the document *Funding Sources for Transportation Research: Competitive Programs*, <http://www.trb.org/ResearchFunding/ResearchFunding.aspx>.

II. PROBLEM TITLE

The research problem statement title should briefly and immediately convey to the reader what the proposed study is about. It does not have to capture every element, nuance, and expected task of the research problem. It is like the title of a book – it should attract your attention, quickly convey the subject, draw you in, and make you want to read what's inside.

Here's a general rule: the more deeply you are involved in a particular subject, the harder it is for you to step back and see the big picture. You may be tempted to title your problem statement something like this ...

“Collection, analysis, and compilation of current best practices for the design of roundabouts for U.S. roadways and how those design elements will impact safety, capacity, and contribute to effective traffic management objectives.”

... rather than this:

“Design guide for roundabouts.”

The first alternative might be a good title for a PhD thesis; the second title is a far better choice for a research problem statement.

How will a title reflect on the problem statement? Can it really have an impact on whether or not it is funded? The answer is yes, for at least three reasons. 1) branding is important – a good title will help the reviewer establish a connection with your proposal 2) a negative first impression will likely linger with the reviewer while reading the rest of the problem statement, and 3) if the title is confusing, chances are the rest of the problem statement will be just as hard to understand. A good title is like a good sound bite – people will remember it.

Hint: Look at every word in your title and ask yourself if it's necessary.

III. RESEARCH PROBLEM STATEMENT

The background statement is your opportunity to convince the reviewer that this problem statement addresses a serious issue and merits funding. It should set the context and relate this particular issue to larger national or regional goals and objectives. If the problem statement is about some new technology that can reduce the severity of vehicle crashes, begin with statements about the overall importance of road safety. Talk about the economic and societal costs of crashes. Talk about national goals to improve road safety. Then describe how the particular subject of this problem statement relates to those national or agency needs.

Similarly, if you are proposing a study that will reduce congestion on urban streets, describe the extent of the problem. How much time is lost due to congestion nationally? How much does it impact air quality? How does your particular problem contribute to the solution? If your problem statement describes a method or practice that will improve efficiencies in your agency procedures, how much time is wasted by current methods?

Do your homework. As best you can, estimate how much time, money, or lives are lost as a result of this specific problem you want to address. Think about it: if you can't do that, why should your project be funded?

Don't be parochial. Demonstrating that something is a serious problem in your state doesn't make it a national issue. If you know that this problem is affecting other regions or states, name them in your problem statement. The more people affected, the greater the payoff if the problem is solved. Involve others and garner support. If you can get other agencies or committees to endorse your problem statement, you're doing a better job of demonstrating that the effort warrants funding.

Hint: When writing the background section, keep thinking "Why should my CEO care about this problem?"

IV. LITERATURE SEARCH SUMMARY

The first time a reviewer reads your problem statement, it will probably remind them of other projects they've heard about on the same or similar topics. They may believe that your research is duplicative of work that has already been done. You need to anticipate this and explain how your project is different - how it builds on the existing body of research, how your proposed study takes a different approach, how it uses new methodologies or expanded data sets, or how it pulls together all the existing work into an implementable product. Describe any shortcomings or deficiencies in the current body of research, and how your project will address them.

Base your comments on a thorough review of the relevant literature and ongoing research. The place to start in the transportation sector is the TRID (Transportation Research International Documentation) database which is available online at the TRB website. If you need help, contact your librarian or information specialist. If you don't have one, contact a major reference library, or the TRB information services. If your problem statement fails to find or identify a high profile project on the same or similar topic, your credibility will be suspect.

Hint: Be specific in describing the research problem statement's relationship to the existing body of knowledge. Reference the most significant related studies by name and discuss how your project will advance the state of knowledge and yield new or additional practical benefits.

V. RESEARCH OBJECTIVE

Describe in very brief terms what the expected product of this research will be. The objective should be short, concise, and accurate. Don't put details in the objective related to how the study will be done unless some new or innovative research methodology is the key element of the research. The details will be in the research plan and reflected in the final product. If your objective is "to produce a new fuel-efficient vehicle," say so. Don't say that the objective is "to produce a new fuel-efficient vehicle, including the design, construction, testing, and installation of all necessary components including body, frame, power train, tires, wheels, seats, mirrors, and other appurtenances to be determined through a survey of user needs, performance measures, and financial constraints." If those things need to be done to accomplish the objective, put them in task statements.

Hint: Go back and read the advice above on titling your problem statement. A very reasonable objective statement is "...to develop (insert your title)".

If you have identified specific tasks that absolutely have to be part of the project workplan, include them in the problem statement. However, don't let your own biases determine the research plan. Focus your attention on providing a full and accurate description of the final product. To the extent possible, give the proposing research team the flexibility to describe a research plan that they feel will accomplish the project objectives.

Hint: The more detail you include in the task statements, the less opportunity a researcher has to show initiative and innovation, and the more every proposal will come in looking the same. Don't be prescriptive.

VI. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

The statements need to identify the funds required; cost is one of the evaluation criteria. This may be the most difficult part of the problem statement, if you do not have research experience in the academic or private sector. How can you possibly estimate how much money will be needed to achieve the project objectives? Here are some general guidelines.

What kind of tasks do you anticipate? What is a reasonable amount of time to accomplish these tasks? Personnel time will most likely make up the majority of the budget. Will the tasks be labor intensive, require specialized equipment or a specific software? If field or laboratory testing will be required, it will be more expensive than "desk-based analysis". If specialized equipment or software must be purchased or developed, the costs can escalate quickly. Take a look at other NCHRP projects and determine the typical funding range.

Hint: If you work with consultants or academics on TRB or other committees, talk to them about the level of resources needed to undertake the work. They are in a position to review the project objectives and help you come up with a reasonable budget estimate.

VII. URGENCY, PAYOFF POTENTIAL, AND IMPLEMENTATION

This is where you need to justify the funding of your problem statement. If the program can only fund 20 projects from a pool of 50 good problem statements, why should yours be picked? You need to be specific and provide as much detail as you can on the potential benefits of your project. What are the consequences of NOT doing this work? How will it affect productivity, budget, customers' quality of life? Here are some examples of compelling statements, IF they are justifiable.

“Streamlining the review process could cut 6 months off average project delivery times.”

“65% of road users indicate that this is a major problem. Resolving this issue could result in a significant increase in customer satisfaction.”

“If this project is brought to a successful conclusion and the results implemented, and could produce only a 2% increase in pavement life, the savings to highway agencies and road users could be in excess of \$5 million a year.”

“This project is a necessary step in the development of an overall safety plan that could save thousands of lives every year.”

Hint: Be positive but honest. Use real numbers if you can measure or estimate them.

Good research advances the state of knowledge in transportation. For long-term, strategic research, several phases of research may be needed to achieve an implementable solution. Address follow-on research as well as implementation in your research problem statement to demonstrate that you are aware of the scale and scope of the research, the potential barriers and impediments to implementation, and the activities and champions needed to support the end work. This increases the comfort level of the funding agency that the results of the research project have a good chance of finding their way into practice and hence yield the benefits to their fullest potential. If you are developing a product that will require ongoing maintenance (like software or a website clearinghouse), make sure you identify who will take responsibility for it.

Hint: If you are aware of a specific national body that will need to take ownership of the project results, identify them in your problem statement. It may be an AASHTO committee representing the stakeholders in this particular subject area in all 50 states. Make sure this group is aware and supportive of your problem statement.

Concluding Comments and Tips

For the most part, research projects will be selected for funding by “educated generalists” – managers and executives who are not subject experts (or at least not experts in *every* subject). That is the audience for whom you need to write. Ask someone you know and trust from outside your own field of expertise to review your problem statement. If he or she doesn’t understand something in it, chances are many of the reviewers will have the same reaction.

Get as much support as possible for your research problem statement before you submit it. Show it to your colleagues, other experts, and managers in your organization to get their advice. Modify the statement if necessary to address their ideas.

If at first you don’t succeed, don’t give up. If your research problem statement is not selected, find out why. If possible, get the reviewers’ comments. Did the reviewers understand the problem statement? If not, what could you have done to make it clearer? Was it considered a good statement but not a top priority or have a high potential payoff? If so, did you do a sufficient job estimating and describing the potential benefits?

Hint: Don’t be discouraged or embarrassed by constructive reviews; they are the best guidance you will ever get for writing better problem statements.

Good Luck!