

Experimental Features in Highway Construction
Work Plan Development and Reporting Guidelines

Alaska Department of Transportation & Public Facilities
Division of Design & Engineering Services
Statewide Research & Technology Transfer

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Introduction

The Federal Highway Administration (FHWA) established the Experimental Features Program in order to encourage innovations in state highway design and construction. Experimental features built under this program are eligible for federal funding participation, which is normally limited to more proven and conventional items. Another feature of the Program is that if an experimental feature fails prematurely, the FHWA will financially participate for its repair or replacement.

There are only two criteria necessary for an innovation to qualify as an "experimental feature".

1. The innovation must have potential benefits to the highway agency or the public.
2. The highway agency (DOT&PF) must follow up the use of the feature with an evaluation of how well it worked.

Description of Experimental Feature

The FHWA's Federal Aid Highway Program Manual Vol. 6, Chap. 4, Sec. 2, Subset. 4 describes an experimental feature as:

"a material, process, method, equipment item, traffic operational device, or other feature that:

1. has not been sufficiently tested under actual service conditions to merit acceptance without reservation in normal highway construction, or
2. has been accepted but needs to be compared with alternative acceptable features before determining their relative merits and cost effectiveness."

This broad definition shows that a wide variety of things can qualify for the program. Experimental features are often physical objects such as unique protective coatings, new asphalt material to compare against traditional materials, unique designs to prevent erosion or permafrost melting, innovative technologies to capture data more accurately, etc.

The Three Types of Experimental Feature Projects

The Alaska Department of Transportation and Public Facilities (DOT&PF) defines three types of Experimental feature projects as follows:

Category 1 – Projects with a long-term or complex level of field testing, instrumentation, evaluation, and reporting, involving HP&R funding for the evaluation phase as an "Experimental Construction Study."

Category 2 - Projects requiring a minimum of advance planning, moderately controlled conditions and simple evaluations based on comparisons with "control sections" constructed in a standard manner.

Category 3 - Projects incorporating an item of new technology that FHWA promotes and directly funds as part of their Demonstration Projects Program. DOT&PF and/or FHWA design these projects to encourage evaluation of alternate standard items to permit performance and economic comparisons.

Any section of DOT&PF may submit proposals in any of these categories. Submit the proposals to the FHWA through the Research Section's Experimental Features Coordinator, who can also provide help (if needed) in preparing the proposal.

Experimental Features Work Plan and Reporting Guidelines

Most experimental features for DOT&PF are Category 1 or 2 projects. The DOT&PF statewide Research Section provides the following general guidelines to help in the preparation of Category 1 and 2 experimental feature work plans and reports. Contact the ADOT&PF statewide Research Section for answers to specific questions not addressed by these guidelines.

Suggested Work Plan Format for Category 1 or 2 Projects

Experimental Feature in Construction

Work Plan

Work Plan Title

For inclusion in:

Federal Project Name

Federal Project #

State Project #

Month, Year

Description of Experimental Feature

Generally describe the feature that the ADOT&PF will be constructing and evaluating. Be clear and concise.

Background / History

Include an explanation/description of why the feature is experimental. Provide knowledge and important background for the development of the work plan.

Objectives and Scope

Describe the problem with a clear hypothesis on how this Experimental Feature will solve that problem. Describe the knowledge that DOT&PF expects to gain at the completion of the evaluation

Describe the scope of the evaluation to set limits on what is and what is not to be included in the evaluation. Define "success." Define "failure."

For Category 1 projects: Create a budget that includes construction evaluation, a minimum of 3 years of post-construction monitoring, and reporting. Define who will complete this work (i.e. in-house or consultant)

Work Plan

The plan of work demonstrates an understanding of the techniques and method you will use to construct and evaluate the experimental feature. Include enough information that will allow the exact locations of each subsection listed below to be revisited/reproduced in the future.

We recommend including the following subsections:

I. Description of Test Site

- a) Construction project number(s)
- b) Route Number(s) and/or name(s)
- c) Location(s) of the experimental feature (Category 1 projects should consider including a blue information road sign adjacent to the site with description "Test Site.")
- d) Lengths and/or quantities at specific locations
- e) Conceptual specifications and/or drawings
- f) Other relevant details

II. Control Site

- a) Construction project number(s)
- b) Route Number(s) and/or name(s)
- c) Location(s) of the experimental feature
- d) Lengths and/or quantities at specific locations
- e) Conceptual specifications and/or drawings
- f) Other relevant details

III. Method of Evaluation

The method of evaluation should include procedures and specify equipment and personnel for measuring, and comparing (control vs. experimental sections).

Document the following where applicable:

- 1) Cost and Economic Analysis
 - Include Total costs and Unit Costs, cost comparisons to standards or accepted practice, and maintenance, etc.
- 2) Construction
 - Include installation or application, Production Rates, Costs, Techniques, Personnel used, Suppliers and their availability, Appearance, Quality, Problems, Inspections, etc.
- 3) Measures of Effectiveness
 - Include data comparisons, inspections, statistical techniques, equipment, survey, etc.
- 4) Maintenance
 - Include record keeping, cost data, aesthetics, problems, etc.
- 5) Equipment
 - List any specialized testing equipment required to perform the evaluation. Costs, vendors, installation requirements, and if over \$5K it must meet FHWA Buy America requirements.

IV. Reporting

Provide a proposed reporting schedule that includes:

- 1) Expected date that installation will be completed
- 2) Date that a construction report will be submitted (generally within 3 months after installation)

- 3) Dates that interim reports, if any, will be submitted (generally once per year throughout the evaluation period)
- 4) Date that final report will be submitted. The final report is a summary report. It should contain the basic data and conclusions of the previous reports as well as reaching an overall project conclusion with recommendations for DOT&PF on the product's future. Names of persons and/or sections who are responsible for preparing the reports.

V. Cost Estimate

Include a cost estimate for construction (Phase 4 funding Engineer's Estimate from project manager of parent project) and a separate cost estimate to complete the above activities for the evaluation of the experimental feature.

Requesting FHWA approval for Experimental Feature

Once the above plan is complete and packaged for submittal, the Research Program Manager (or project engineer) will submit to the AK FHWA division office for consideration. This step should be done at the Pre-PS&E phase of the parent project schedule to ensure FHWA has adequate review time to consider the request. Document correspondence with FHWA and save the approval letter in the project folder.

Reporting Guidelines for Category 1&2 Projects

Several reports are required throughout the project. At minimum a construction report, an interim report, and a final report should be provided. Guidelines on these reports are as follows:

Construction Report

Submit this report as soon as possible after installation of the experimental feature but no later than 3 months post construction. With FHWA approval, you may sometimes delay the construction report for a few months, so that preliminary performance information may be included with it. Draft reports are shared with the technical advisors of the project for comment before finalizing. The report should include (where applicable):

- 1) Unit costs and quantities
- 2) Dates and locations of installations
- 3) Ease of installation (or problems)
- 4) Photographs (prints, or digital photos, not Xeroxes)
- 5) Production rates
- 6) Techniques
- 7) Appearance
- 8) As-built drawings and specifications
- 9) Other information that would be helpful for the design or construction of this type of feature.

Construction reports should be prepared in accordance with the Federal Highway Administration Guidelines and FAPG G 6042.8.

Interim Reports

The work plan specifies the requirements for interim reports. A brief annual update is usually all that is necessary. It can often be simply a memo to the Experimental Features Coordinator. Interim reports normally address some or all of the following:

- 1) Progress of construction/evaluation
- 2) Inspections, measurements, etc.
- 3) Maintenance needs and costs
- 4) Effectiveness
- 5) Appearance/noise/aesthetics
- 6) Public response
- 7) Economics/cost effectiveness
- 8) Other pertinent information

Final Report

Write the final report as soon as it becomes evident that additional information of interest or experimental value is unlikely to develop. In some cases, this may occur before the end of the evaluation period specified in the work plan.

The final report should be complete and independent by itself. It therefore should contain the basic data and conclusions of the earlier reports. Often the earlier reports can simply be included (in complete or edited form) as chapters in the final report.

The final report should include, where applicable:

1. Introductory discussion that summarizes the problem statement, experimental feature monitoring plan
2. The data collected, or summaries of them
3. Overall performance of the experimental feature
4. Cost effectiveness of the experimental feature
5. Documentation of effectiveness
6. Documentation of maintenance and associated issues
7. Recommendations for further experimentation, if needed
8. Recommendations for design or construction technique modifications, if needed
9. Description of conditions under which future use of the feature is recommended
10. Other information, recommendations, or conclusions that would be useful to others interested in the feature.

Guidance for Construction Photographs

Photographs are very helpful in most cases and can eliminate the need for wordy descriptions. When documenting experimental features, the following items are good guidelines to help ensure the quality of the photo, examples can be seen in Figures 1 -3:

- Provide a timestamp on the photo

- Include features that help orient the photo, such as guard rails, horizon lines, and buildings
- If a close-up is necessary, consider utilizing a ruler to provide scale.
- [Sometimes a series of photos is the best way to depict the process and materials used. For applications such as a waterproof membrane (Figures 1-2), before and after photos are an excellent way to understand the means and methods of application.]



Figure 1: “A 3 part primer (2 parts with a hardener) was rolled onto the deck. There is a 12 minute gel time once the hardener is added so this process was done by mixing a single 5 gallon bucket at a time. This process took approximately 1 hour.”



Figure 2: The first layer dries within 28 minutes but remains tacky for much longer. The second layer was started around 10 PM but was delayed due to rain. The first and second layers are identical in chemistry, only the color is different to ensure another complete 60 mil coat.



Installing Wavetronix at Wilbur St & Airport Way



Radar Unit



Complete radar detector installation at Lathrop St & Airport Way, facing west. The detector immediately to the right of the center signal housing is the stop bar detection for eastbound traffic. The second detector to right of the center signal housing is the advance detector for westbound traffic. Proper orientation of detectors and appropriately identifying approach speeds and line of sight at each intersection leg is critical for the initial setup of radar detection.

Figure 3: A series of photos showing the installation of a Wavetronix Radar Detection System

Experimental Project Failure Steps

Having an experimental feature not perform as intended sometimes occurs. That is the reason for completing the above rigorous process of evaluation and receiving up front assurance of FHWA financial participation. If the project needs to be repaired or replaced, please follow the below steps for the two scenarios:

- (1) Repair: work with the research project manager to document the repair needed, cost estimate for repair, any analysis completed explaining the damage, and propose a parent project to include the repair work.
- (2) Replacement: work needing complete or partial replacement should have a thorough report with the analysis of the above reporting sections for both post-construction and monitoring (any periodic monitoring if less than the planned yearly), in addition to the rest of the items listed for “Repair” scenario.

Prepare this documentation and review with the technical advisors and Research Program Manager before submitting to AK FHWA Division office for concurrence. Document correspondence and save in the project folder. Include the results of the repair or replacement in the final report.