Airport Cooperative Research Program
Synthesis of Airport Practice

National Cooperative Highway Research Program
Synthesis of Highway Practice

and

Transit Cooperative Research Program
Synthesis of Transit Practice

Information for Principal Investigators Preparing Syntheses

TRB
Transportation Research Board
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Contents

1.0 OVERVIEW OF THE PROCESS FOR AN AIRPORT, HIGHWAY, OR TRANSIT OF PRACTICE

Syntheses are state-of-the-practice documents that synthesize knowledge and practice for the topics, prepared under contract by outside individuals or firms. Syntheses are currently developed under the Airport Cooperative Research Program (ACRP), National Cooperative Highway Research Program (NCHRP), and Transit Cooperative Research Program (TCRP). These reports are oriented toward practical solutions of specific airport, highway, and transit problems. The specific objectives of a synthesis are:

1. To locate and assemble information;
2. To learn what practice has been used;
3. To identify ongoing and recently completed research;
4. To learn what problems remain largely unsolved; and
5. To organize, evaluate, and document the useful information acquired.

Each synthesis is written under the oversight of a panel appointed for that specific topic, with the guidance of the CRP Responsible Staff Officer (RSO). The topic panel and staff review and make recommendations regarding the synthesis' technical adequacy and acceptability for publication, with approval by the TRB Division Committee. Synthesis are attributed to their authors, with recognition given to the topic panel.

The aim of a synthesis, first and foremost, is to get the facts out about what is going on with respect to a particular practice in air transportation, highway, or transit. In addition to this factual documentation, reviews of the state of the practice inevitably provide a basis for the author or authors to make assessments about:

- Performance resulting from current practices, including new and unusual practices;
- Current practices that are at odds with research findings;
- Current practices that appear to be working well and those that are not working well;
- Critical knowledge gaps that could be filled by additional research; and
- Other actions—e.g., training, revised standards—that could improve the state of the practice in a given area.

Such assessments are helpful provided they are well supported and clearly documented in the synthesis. Accordingly, it is desirable that they be incorporated to the maximum extent possible. The synthesis must, however, stay clear of any recommendations (other than for needed research) and of statements on sensitive or policy issues that would go beyond the purpose of the synthesis series and compromise the fact- finding and technical assessment mission.

It is important to recognize that the purpose of a synthesis is to document and describe current practice in a given area, but **not** to prescribe a practice or set of practices, as might be expected in a guidebook or manual. It is acceptable for a synthesis to highlight practices that are viewed as successful by many of the entities surveyed in developing the synthesis, or that are characterized as such in the literature reviewed by the synthesis author; but such practices should not be presented as "best" or "recommended" practices.

The only recommendations that are permitted in a synthesis are recommendations for needed research.

1.1 General Guidelines for Synthesis

One size fits all rules or guidelines clearly are not possible for such a varied series, but a few general guidelines are useful. These guidelines, while focused in particular on the final section, are intended to apply in spirit to the whole synthesis. It is also recognized that instances may arise in which there is good reason to deviate from these guidelines; such exceptions are handled on a case-by-case basis.

Each Synthesis should synthesize the state of knowledge and practice for the topic in accordance with the scope. This requires a review of pertinent literature and research, and an examination of current practice, and typically includes collecting data through surveys of transportation agencies and relevant stakeholders. Information gathered from these sources is then organized into a concise document that describes current knowledge and practice.

The final chapter of a synthesis should be titled Summary of Findings. This chapter summarizes facts about, and technical assessment of, the current state of the practice; any assessment of current practice must be supported by the text and stated carefully.

Statements about barriers to widespread implementation of promising methods or practices (e.g., lack of consistent standards) should be presented as an observation rather than a recommendation.

Synthesis should be descriptive, not prescriptive. It is acceptable to highlight practices that have been reported as successful by many survey respondents and/or that have been characterized as successful in the literature, but such practices should not be presented as “best” or “recommended” practices.

Recommendations for needed research are the only type of recommendations that are permitted in a synthesis. They generally should be limited to recommendations about where important knowledge gaps exist that could be corrected by research. No specific recommendations should be included concerning organizational arrangements for conducting the research (e.g., housing it at FHWA or NCHRP). The research recommendations should appear in the final Summary of Findings chapter.

Subject matter is important. The authors may have more latitude to draw conclusions for topics that are mostly technical (e.g., bridge welds) as opposed to topics where there are clearly policy implications (e.g., state license fees, warranties for road construction).

Potentially sensitive issues that require careful handling are likely when one or more of the following criteria apply:

- Widespread polarization of opinion already exists on the subject;
- There are strong commercial interests in the subject, and the findings or conclusions might favor or injure particular commercial interests; or
- The subject involves health, safety, or environmental issues (issues where public policy involves trade-offs among multiple objectives).

As a general rule, avoid conclusions that imply a need to change funding or public policy. Also avoid implied recommendations directed to particular organizations.

2.0 THE SYNTHESIS PROCESS

The RSO assigned to the project will assist the PI in the synthesis process that is consistent with CRP standards. The typical synthesis process is described in the rest of this section; however, the RSO and PI might modify or add steps and deliverables to the process to reach a publishable Synthesis in a timely manner.

2.1 Scope

Topics are selected by the ACRP Project 11-03, NCHRP Project 20-05, and TCRP Project J-07 oversight panels. The preliminary scope that is used in topic panel selection is modified at the first panel meeting. The revised scope guides the PI's work.

2.2 Topic Panel

Topic panel members are selected for their expertise in the topic. Panel members prepare the detailed scope of work and select the Principal Investigator (PI). Additional responsibilities of the topic panel are to guide and assist the PI during the synthesis process, pretest the survey or interview guide, review all deliverables including the technical content of the synthesis draft, and recommend a publication decision.

Once a PI (or contractor) is selected, the RSO forwards discussion notes from the first topic panel meeting to the PI and arranges a virtual meeting between the PI and the topic panel at the approximate date of contract execution.

2.3 Virtual Kick-Off Call

The RSO will initiate a virtual meeting with the selected PI to inform him/her about the selection and the Synthesis process based upon these *Instructions to Principal Investigators Preparing Syntheses*.

The RSO arranges a one-hour virtual meeting between the topic panel and PI at a date approximate with contract execution. The meeting is designed to introduce the panel members and PI, have the panel members offer guidance and assistance, and resolve any questions on the scope of work or level of effort required. The PI will provide questions in advance to guide the discussion. The meeting is also the time to solicit assistance from the panel to identify the list of survey recipients and to confirm the schedule of deliverables and meetings.

2.4 Work Plan, Outline, and Questionnaire—Stage 1 (First) Deliverable

The PI prepares a draft work plan, outline, survey/questionnaire, and list of proposed recipients for review and comment by the RSO and topic panel members.

The work plan should cite the major elements necessary to perform the work, a project schedule, survey/questionnaire, proposed interview/survey recipients, and methodology for identifying case examples. The project schedule should conform to the contract dates.

The outline should include a list of chapter titles, major headings, and subheadings. The outline should include the following sections: a summary, literature review, synthesized survey results, case examples, and summary of findings to include knowledge gaps and further research to address identified gaps.

The draft survey/questionnaire/interview guide should be prepared in a manner that follows the outline and balances the need for information with the need for brevity. Close-ended multiple-choice or yes/no questions should be used unless data collection is by interview. Specific procedures for the formulation, review, and distribution of survey instruments are required.

Questionnaires, surveys, distribution lists, and related materials must be approved by the RSO. Survey recipients/interview targets may include topic panelists.

2.5 Survey/Interview

NCHRP requires online surveys to be sent to one recipient at each state DOT including Washington, DC. The survey questions must be reviewed by the topic panel and the RSO. The email distribution list must be approved by the RSO. *The PI is responsible for providing a web-based survey tool.* The survey software plan that is used for the synthesis must not display advertising or polls. Survey questions must be yes/no or multiple-choice (no open-ended questions). The survey should include 20–25 questions and should not take longer than approximately 30 minutes to respond. The PI shall provide a link for panel members to pretest the final online survey. The RSO must transmit approval before the PI can begin data collection for the targeted population. The PI should strive for a survey response rate of 80% to 100%. All NCHRP synthesis must include an appendix that shows the aggregate response for each survey question as well as the individual responses from each responding state DOT.

ACRP requires the topic panel reviews the survey and interview questions. Airports surveyed will depend on the topic statement, but a diverse classification of airports should be interviewed or surveyed (Large Hub, Medium Hub, Small Hub, Nonhub, Reliever, and General Aviation.)

TCRP requires the topic panel approve both the interview/survey questions, and the list of transit systems proposed by the PI to be surveyed or interviewed. The selection of transit agencies will be guided by the topic statement, with an emphasis on ensuring a diverse range of perspectives. This includes engaging transit systems of varying sizes—large, medium, and small—as well as those that service rural and tribal communities. This is to help capture a comprehensive understanding of practices and challenges across different operational environments.

2.6 Literature Review

A literature review is conducted to obtain information on current knowledge, practices, and relevant research pertaining to the synthesis topic. Conducting a literature review involves collecting, evaluating, and analyzing publications that relate to the project scope. The PI should search TRB's Transportation Research Information Documentation (TRID), an integrated database of more than 1.3 million records of transportation research worldwide.

The literature review should answer the question of what is known or not known about this particular topic. A good literature review does not just summarize sources; it is *not* an annotated bibliography. Instead, a good literature review analyzes, synthesizes, and evaluates sources to give a clear picture of the state of knowledge on the subject.

2.7 Case Examples

Case examples are concise descriptions that effectively illustrate an agency's current practice. Agencies/sites (usually four or five) may be selected for more in-depth documentation of their current practices than a closed-ended survey allows. Selected agency/site practices should be diverse in terms of geographic location, agency size, and practice. Information is typically developed through telephone interviews. Agencies that are the subject of case examples should have the opportunity to review their write-ups for accuracy before the synthesis is published.

The PI's chosen case examples should be submitted to the topic panel for its input and RSO approval.

2.8 First Draft—Stage 2 (Second) Deliverable

The PI shall prepare and submit a complete first draft at least two weeks prior to the second meeting with the topic panel. The date of this meeting is set at the first topic panel meeting; *this is a firm date*. The first draft must be complete, including summary, all sections and appendices; all graphics (figures and tables) embedded, and line numbers provided on each page to assist panel review efficiency.

The RSO and PI may set some interim deliverable dates (for example, for the literature review chapter, survey results chapter, etc.).

2.9 Second Topic Panel Meeting with Principal Investigator to Review First Draft

The purpose of this second meeting is to work with the topic panel to review the first draft of the synthesis. Following the second panel meeting, The RSO will provide the PI with a list of principal panel comments needing attention and requiring written responses. If the panel deems it necessary, virtual meeting(s) prior to the due date of the next deliverable will be scheduled at this time.

Note: NCHRP and TCRP cover travel and lodging expenses for the PI to attend the meeting where the first draft is reviewed and discussed with the panel. During this meeting, the PI receives feedback and marked-up drafts from panel members. Other team members from the research team can attend at their own expense but must receive approval from the RSO. The staff travel coordinator will provide information on how to reserve travel and lodging, typically two months in advance of the meeting date.

2.10 Second Draft and Written Response to Topic Panel Comments—Stage 3 (Third) Deliverable

After the second topic panel meeting, the PI delivers a second draft to respond to the topic panel review of the first draft. This second draft should be complete with embedded graphics and appendices placed appropriately. This draft shall be accompanied by a document of point-by-point responses to the panel comments on the first draft. The response to comments document should include page numbers of the second draft where revisions have been made. This second draft and PI responses to panel comments are sent by the RSO to the topic panel for final panel review and ballot.

The National Academies have an ethical and legal obligation to provide proper attribution whenever material from other sources is included in its reports, online postings, and other publications and products.

Plagiarism, even unintentional, can cause serious harm to the credibility of both TRB and the

National Academies. iThenticate is the software program selected by the National Academies as tool to help detect plagiarism in NASEM reports. The RSO will conduct a plagiarism review using iThenticate for all CRP draft final reports and will work with the PI to address any concerns.

2.11 Final Draft and Written Response to Oversight Panel Comments—Stage 4 (Final) Deliverables

Upon receipt of written comments on the second draft from the topic panel, the PI prepares a third and final draft and written point-by-point responses to comments.

2.12 Internal Reviews, Editing, Typesetting, and Publication

The final draft is forwarded and internally reviewed and approved by the TRB Division Committee. After approval, the final draft will be edited, typeset, and published by CRP Publications, whose staff may contact the PI for small clarifications during this process.

2.13 Schedule

Below provides a generalized schedule for the synthesis programs.

ACRP/TCRP Synthesis Schedule	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1st Topic Panel Meeting-Scope, Consultant, Schedule	◆													
Contract Executed and Teleconference		◆												
Workplan, Outline, Data Collection Instrument and Recipients		◆												
Literature Review, Survey/Interview			━	━	━	━	━							
1st Draft Report							◆							
2nd Topic Panel Meeting to Review 1st Draft Report								◆						
2nd Draft Report and Response to Topic Panel Comments								◆						
Final Deliverables										◆				
Internal Review, Technical Editing, Publication										━	━	━	━	━

NCHRP Synthesis Schedule	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1st Topic Panel Meeting-Scope, Consultant, Schedule	◆															
Contract Executed and Teleconference		◆														
Workplan, Outline, Data Collection Instrument and Recipients			◆													
Literature Review, Survey/Interview			━	━	━	━	━	━								
1st Draft Report								◆								
2nd Topic Panel Meeting to Review 1st Draft Report									◆							
2nd Draft Report and Response to Topic Panel Comments											◆					
Final Deliverables												◆				
Internal Review, Technical Editing, Publication													━	━	━	━

Figure 1: General Synthesis Schedule for ACRP/TCRP and NCHRP

3.0 DELIVERABLES

There may be slightly different requirements for ACRP, NCHRP, and TCRP synthesis submittals. All deliverables are submitted through the Workfront CRP Project Management tool.

3.1 Stage 1—Work Plan, Outline, Questionnaire

This submittal is prepared for review by the topic panel and should be delivered electronically. A sample submittal is provided in the Start-up Memo, which is emailed by the RSO to the PI prior to the Virtual Kick-Off Call.

3.2 Stage 2—First Draft

The first draft shall be a complete synthesis in Microsoft Word and PDF with all sections and embedded graphics. Footnotes are not used in a synthesis. Line numbers are required for each page because the draft will be reviewed and commented upon by the topic panel during this stage. Each page should begin with line 1. Appendices do not require line numbering. *Syntheses <u>cannot</u> make recommendations about policy or practice.* Therefore, the synthesis must avoid directive words such as best, should, must, require, recommend, etc.

3.3 Stage 3—Second Draft and Written Response to Topic Panel Comments

The second draft shall be a complete synthesis in Microsoft Word and PDF with all sections and embedded graphics. Line numbering and any logos should be removed in this version of the synthesis. A point-by-point response-to-comments document should be included in Microsoft Word and PDF and should indicate the page number of the new version of the synthesis where revisions were made.

3.4 Stage 4—Final Deliverables

Comments from the review of the second draft are returned to the PI for final revision. The PI shall provide written point-by-point responses to the review comments as well as action taken, cross referenced to the revised synthesis pages. Otherwise, the response should state the reasons why revisions were not considered necessary.

If a large language model [(LLM), e.g., ChatGPT] or generative artificial intelligence (AI) tools are used in the writing of a deliverable or in the collection and analysis of data, the PI must be transparent in disclosing in the Research Approach (or similar) section how the AI tool was used and which tool was used. Contractors are fully responsible for the content of their deliverables, even those parts produced by an AI tool, and are thus liable for any breach of publication ethics.

Specifically, contractors are required to:

1. Clearly indicate the use of language models in the deliverable, including which model was used and for what purpose. Please use the Research Approach section, or similar, as appropriate.
2. Verify the accuracy, validity, and appropriateness of the content and any citations generated by language models and correct any errors or inconsistencies.
3. Provide a list of sources used to generate content and citations, including those generated by language models. Double-check citations to ensure they are accurate and properly

referenced.

4. Be conscious of the potential for plagiarism where the LLM may have reproduced substantial text from other sources. Check the original sources to be sure someone else's work is not being plagiarized.
5. Acknowledge the limitations of language models in the deliverable, including the potential for bias, errors, and gaps in knowledge.

Note that AI bots such as ChatGPT should not be listed as an author on deliverables.

In addition, contractors are prohibited from:

- Uploading to generative AI platforms findings, conclusions, or recommendations that have not been publicly released; and
- Using generative AI to create images or video.

The final draft shall be a complete synthesis with all sections and embedded graphics. All final deliverables shall be delivered electronically.

The final draft is reviewed by the TRB Division Committee. It must be approved to be published.

The following files are required for the final submittal:

- Final synthesis with cover page with all graphics embedded, no line numbers, all appendices. Microsoft Word and PDF versions are needed for technical editing and publication.
- Separate files for figures and tables that were not created in Word provided in their native format (e.g., .pptx, .ai) or in a cross-platform format (e.g., .jpg, .tiff, .png). Doing so enables the graphics in the final document to be clearer. The separate figure and table files should *not* be created by copying them out of the Word file into a .jpg, etc. Doing so may actually create *less* clear graphics in the final. If the original graphic files aren't available, we will make do with what is in the Word file.
- A synthesis cover that includes author names, affiliations, and locations as should appear in the publication.
- The cover picture with description and release. The description and release can be included as an element of the Certification of Compliance with Copyright.
- Completed and signed Certification of Compliance with Copyright form (See Section 5.8).
- Appendices can be in one separate file or in multiple files, one for each appendix.
- Ballot comments and point-by-point responses including page numbers and actions taken to the panel comments. You can insert your response underneath each comment set off in *italic* or **bold**, such as "*Response: xxxx*" Please submit in Microsoft Word.

Questions about preparing final deliverables can be sent to the CRP Editorial Staff at crpeditors@nas.edu.

Submit synthesis files, responses-to-comments document, and certification of copyright compliance through the CRP Workfront Project Management tool. Please upload all the final deliverables as one zip file to Workfront. Also, please provide notification via an email to staff when upload to Workfront is complete.

3.5 Invoices

All invoices are submitted electronically per direction provided at the time of contract execution. Payment is conditional upon receipt and acceptance of the deliverable.

4.0 ELEMENTS OF THE SYNTHESIS

Following is a discussion of the principal elements, ordered as they should appear in a typical published synthesis. **These instructions are part of the contract.** Synthesis not in conformance may be returned to the author for revisions.

4.1 Cover

Provide high-quality art for synthesis cover photo(s), including a brief description and picture credit. The cover art will be in color online and in print formats.

4.2 Title Page

The PI will provide a title page that includes author information (names, affiliations and locations) as should appear in the published synthesis.

4.3 About the Synthesis Program and Foreword

TRB staff writes this.

4.4 Table of Contents

The table of contents should show chapter and appendix titles and level one (or "A") headings and page numbers. A list of figures and a list of tables should be included after the table of contents.

Chapters in a typical synthesis include Summary, Introduction, Literature Review, State of the Practice (e.g., survey results), Case Examples, and Summary of Findings.

4.5 Summary

The summary is the part of the synthesis most likely to be read by the executive audience and others with more interest than time to spare. We therefore expect synthesis authors to write excellent summaries from which the lay reader can get a solid, workable picture of the synthesis findings. The summary should contain the following:

- No more than four pages (1,700 to 2,100 words)
- No headings
- No text boxes
- No footnotes or citations. If reference to a document is needed, provide the full title of the document and list the authors of the document within the text.
- Non-technical prose
- All sections should end with transition sentences that carry the thought from the previous paragraph into the following paragraph
- The summary should be able to stand on its own.

The summary should include a brief overview of the main points including:

- A paragraph or two of background on the topic
- A clear statement of the objective of the synthesis. (e.g., "The objective of this synthesis

was to document state DOT practice on....")

- Brief details of the study methodology (one or two sentences)—How was the information gathered (e.g., literature review, survey, interviews, case examples)? If a survey was used, to whom was the survey sent? What was the survey response rate (including number of surveys sent, number of survey responses, and if appropriate the response rate as a percentage)?
- Major findings of the synthesis. Findings should be concise and to the point; drawing from, but not repeating, the analytic "Summary of Findings" section.
- Further research, if applicable—what are the gaps in knowledge identified in this Synthesis and what research could be carried out to address those gaps.

4.6 Introduction or Background Chapter

The first chapter should provide brief, relevant background; define terms; clearly identify the issues to be addressed; and, if applicable, what "high profile" issues are not addressed and why. It should note any problems common among agencies concerning these issues and include a paragraph that succinctly describes how the synthesis is organized (methodology and chapter outline). The first chapter should also include a concise statement of the synthesis objective, and a description of the methodology used to gather the information.

4.7 Intermediate Chapters

These chapters discuss the information outlined in chapter one (topics required by the scope of work, literature search, survey results, case examples, etc.). Begin each chapter on a new page.

Survey results should appear as numeral representation rather than a response rate percentage.

4.8 Summary of Findings

The concluding chapter of a synthesis, probably the second most widely read section, is intended to portray the current state of practice. Findings must be supported and documented in the synthesis. It is acceptable for a synthesis to highlight practices that are viewed as "effective" by many of the entities surveyed in developing the synthesis or that are characterized as such in the literature reviewed by the authors; however, such practices should not be presented as "best" practices or "recommended" practices. The summary of findings should contain the following:

- A brief reiteration of the background and objective of the synthesis – no more than two or three sentences to place the information in context.
- Summary of the findings from the previous chapters – no more than two or three sentences for each chapter. The authors have conscientiously grounded their findings in the project survey responses, literature review, and interviews and does not recommend particular practices except as recommended by others.
- Statements of barriers to widespread implementation of promising methods or practices – as reported by survey respondents and case example agencies. The implementation of promising methods or practices should not be presented as recommendations.
- Further research areas – limited to statements of the knowledge gaps that limit practice and suggested research that could fill those gaps.

- No new information – however, the authors should not repeat verbatim information from the introduction or other chapters.

Note: The results from synthesis studies cannot include recommendations directed at the federal government. The purpose of these syntheses is to objectively summarize existing knowledge, practices, and experiences, rather than to advocate for specific actions or policy changes. The focus is on providing transportation professionals with comprehensive, unbiased information to inform their own decision-making, without making prescriptive recommendations.

4.9 References

Authors are responsible for the accuracy and completeness of all reference citations. Cite references in the text by author/date, with the citations listed in alphabetical order in the References section. *Do not use footnotes in the text*; cite all such information within the text or references. A reference style guide is shown beginning in Section 5.4.

4.10 Bibliography

A bibliography should be provided if documents are used as background materials in the preparation of the synthesis but are not specifically cited in the text. A bibliography may also be used to list documents that supplement the information given in the text. Publications listed in the bibliography should contain the same information as those cited in the references and must be arranged alphabetically by initial author surname. In the document, the bibliography follows the reference list. If circumstances warrant inclusion, an annotated bibliography may be provided. These entries should include all information given in a standard bibliography, plus a description and evaluation of the information contained in the document.

4.11 Glossary

If there are a number of terms used in the synthesis whose definition might be misinterpreted or be unfamiliar to the reader, these terms should be provided, with definition, in a glossary.

4.12 Abbreviations and Acronyms

Abbreviations and/or acronyms should be provided in a list that will follow the glossary. If the topic panel feels that abbreviations and acronyms are important to understand the text, they may be placed earlier in the synthesis or before the Summary. An Abbreviation/Acronyms style guide is found in Section 5.12.

4.13 Appendices

Appendices are used to present material that supplements the information given in the text, but that cannot be conveniently inserted into the text. Appendices should not be used to present information that is crucial to understanding the subject matter; this information should appear in the body of the synthesis. There is no limit on the number of appendices that can be included in a synthesis; however, each must be lettered and titled. Provide a list of appendix titles with the draft in the Table of Contents. Appendices follow the References section in the Table of Contents. Appendices of substantial length may be considered as web-only portion(s) of the document and should be provided in the first draft.

The following appendices are required:

Appendix A: Survey Questionnaire/Interview Guide (title as appropriate)
The blank questionnaire or unanswered interview guide is to be included.

Appendix B: Survey Responses
In NCHRP Syntheses, Appendix B must include agency responses to each survey question as an aggregate and by individual agency.

ACRP and TCRP Syntheses have many more potential respondents that provide confidential information on their practices; therefore, responses should not be attributed to the facility or organization. The names of individual survey respondents or interviewees should not be used in the synthesis. When surveys are sent, the PI needs to indicate to respondents that survey responses will be displayed by agency in the final Synthesis; however, individual names will not be attached to responses.

Examples of how agency responses to survey questions should be displayed in Appendix B are shown in Figure and Figure . Other examples can be found in published Syntheses.

Are construction acceptance requirements on pavement warranty projects different than non-warranty projects?

Response	DOTs	No. of Agencies
Yes	Alberta, Idaho, Ontario, Pennsylvania, Virginia, and West Virginia	6
No	California, Florida, Louisiana, Maine, Michigan, Nebraska, New Brunswick, New Jersey, New York, North Dakota, Ohio, and Utah	12

No. responding agencies: 18

Figure 2. Example of agency response to survey question in Appendix B.

10. How are your state's DOT data stored? (select all that apply – note that a user will see 10a if he or she selects GIS or CAD as a storage mechanism)

State	In a relational database system	In tabular format with no spatial reference	In tabular format with route and milepost attribution	In a spatial GIS system	In a CAD-based system	PDFs, drawings or other paper maps	KMZ file	Unknown format	Other
Alaska								x	
Arkansas					x				
California	x		x	x	x	x	x		
Colorado			x	x			x		
Florida									x
Idaho								x	
Illinois				x					
Indiana	x			x					
Iowa				x					
Kansas	x	x	x	x		x	x		x
Kentucky				x					
Louisiana	x								
Maryland				x					
Massachusetts				x		x			
Minnesota				x	x				x
Montana				x					
Nebraska								x	
Nevada						x			
New Hampshire									x
New York								x	
North Carolina				x					
Ohio	x			x		x			
Oklahoma	x			x					
Oregon	x		x	x					x
South Carolina	x		x	x					
Tennessee									
Texas				x					
Utah	x	x	x	x	x	x	x		
Vermont			x	x		x			
Washington	x		x	x	x	x			
Wisconsin				x		x			
Total	**10**	**2**	**8**	**21**	**5**	**9**	**4**	**4**	**5**

Figure 3. Example of agency response to survey question in Appendix B.

5.0 STYLE GUIDE

The current edition of Webster's *Third New International Dictionary* and the 18th Edition of the *Chicago Manual of Style* (2024) (and the Chicago Manual of Style Online: http://www.chicagomanualofstyle.org/home.html) are the preferred reference sources for spelling, capitalization, and compound words.

The CRP Word Template guide should guide formatting for all Syntheses.

5.1 Headings

The use of headings and subheadings in each chapter (except the Summary) is encouraged. However, the use of more than four levels of headings should be avoided. All headings are set flush left on a separate line except for level four. The following style for headings should be used:

LEVEL ONE ("A"): All caps, bold type, flush left. First paragraph begins flush left. **Level Two ("B"):** Initial cap, bold type, flush left. First paragraph begins flush left. *Level Three* ("C"): Initial cap, italic type, flush left. First paragraph begins flush left. *Level Four* ("D"): Initial cap, italic type, followed by two spaces, and run into the text.

A heading must be followed by two or more subheadings at the next level, not by a single subheading. References should not be cited in headings. Acronyms previously spelled out may be used in level two, three and four heads, but not level one.

5.2 Quotations

Quotations of five or more lines or two complete sentences (block quotes) should be indented and set off from the text without quotation marks. Quoted material within a block quotation should be enclosed in single quotation marks. Run short quotations into the text (two or fewer sentences), using double quotation marks. Cite appropriate references for all quotations directly following quoted material with page number(s).

Changes should not be made to quoted material; however, interpolations (in brackets) may be added, and obvious misspellings should be corrected.

5.3 Footnotes

Do not use footnotes to the text. Cite all such information within the text or references.

5.4 References

Each reference should contain the standard bibliographic data required in a scholarly reference list *with each section separated by a comma:*

- Last name and initials of up to the first six authors (or editors). The first author/editor is cited surname first, followed by initial(s). Subsequent names are cited initial(s) first, followed by surname.
- Title of work.
- Journal title, if applicable.
- For journal article, cite volume and issue number.
- Publisher, location of publisher (city/state, city/country), and edition if not a journal

article. Date of publication (or for website, date site accessed and date of publication).

- For symposium or conference, cite meeting dates and location.
- Inclusive pagination, if applicable. Total number of pages if entire work cited.
- If the author is also the publisher (e.g., see "Manual, Guide") only show as publisher. If not dated, specify as such where date would normally be cited (n.d.).
- Do not use ibid, idem, op. cit., or loc. cit.
- References to classified documents, personal correspondence (or telephone conversations), or other sources of information that are inaccessible to the reader should be avoided, if possible. If a reference of this type of communication must be included, insert directly into the text (e.g., T.C. Boyle, University of California, Berkeley, personal communication, March 1994).
- Unpublished work can be cited in the References. Provide as much information as possible [author(s), title, web address, other source material, date] and label as unpublished.
- Electronic sources
  - The following information is included: corporate or personal authors, title of the document or publication, publisher (if available), place of publication (if available), publication date (if available), complete URL, and date accessed (if provided by the author).
  - The italicization of titles follows the rules for printed publications and documents.
  - The URL identifies the location of the source on the Internet. Case should be preserved because it may be significant. Include "http://" if given.
  - In manuscript, do not break URLs. In pages, URLs may be broken across lines after a period, question mark, slash, or hyphen; do not add hyphens.
  - Do not edit, delete, or update references to electronic sources.

Examples of references follow.

BOOK:
Haas, R. and W.R. Hudson, *Pavement Management Systems*, McGraw–Hill, New York, N.Y., 1978.

BOOK CHAPTER:
Silverstein, L.G., "Safe Handling of Epoxy Resin Systems," In *Epoxy Resin Technology*, P.E. Bruins, Ed., Interscience Publishers, Boston, Mass., 1968, pp. 123–139.

JOURNAL ARTICLE:
Manning, D.G. and F.B. Holt, "Detecting Delamination in Concrete Bridge Decks," *Journal of the American Concrete Institute*, Vol. 2, No. 11, 1980, pp. 34–41.

NEWSPAPER ARTICLE:
Ringle, K., "D.C. Stoplights: Halt, Lame, and a Pain to Maintain," *The Washington Post*, Mar. 27, 1983, p. A1.

SYMPOSIUM:
Deen, R.C., H.F. Southgate, and G.W. Sharpe, "Evaluation of Asphaltic Pavements for Overlay Design," Presented at the ASTM Symposium on Pavement Maintenance and

Rehabilitation, Bal Harbour, Fla., Dec. 1–4, 1983.

REPORT:
Rhodes, J.R., J.A. Stout, R.D. Sieberg, and J.S. Shindler, *In Situ Determination of the Chloride Content of Portland Cement Concrete Bridge Deck,* Report FHWA/RD-80/030, Federal Highway Administration, Washington, D.C., 1980, 58 pp.

DISSERTATION:
Lee, S.W., Backcalculation of Pavement Moduli by Use of Pavement Surface Deflections, Ph.D. dissertation, University of Washington, Seattle, 1988.

PROCEEDINGS:
Horak, E., "The Use of Surface Deflection Base Measurements in the Mechanistic Analysis of Asphalt Pavements," *Proceedings of the 6th International Conference on Structural Design of Asphalt Pavements*, University of Michigan, Ann Arbor, May 5–8, 1987, pp. 5–10.

LAW, STATUTE, REGULATION:
Surface Transportation Assistance Act of 1978 (Public Law 95-599, 92 Stat. 2689).

MANUAL, GUIDE:
AASHTO Standard Bridge Design Specifications, 15th ed., American Association of State Highway and Transportation Officials, Washington, D.C., 1992.

PREPRINT:
Bay, J.A., K.H. Stokoe, B.F. McCullough, and D.R. Alexander, "Profiling a Flexible Highway Pavement," Preprint No. 991481, Prepared for the 1999 Annual Meeting of the Transportation Research Board, National Research Council, Washington, D.C., Jan. 11–15, 1999.

WEBSITE:
Nash, Carl E. (2020). "A Better Approach to Railroad Safety and Operation." *Issues in Science and Technology* 37, no. 1 (Fall 2020). https://issues.org/railroad-safety-operation-ptc-nash/ [Accessed January 6, 2025.]

ACCEPTED FOR PUBLICATION, BUT NOT YET PUBLISHED:
Bronzini, M., *Model Post-Secondary Curricula for the Transportation of Hazardous Materials,*
Transportation Research Board of the National Academies, Washington, D.C., forthcoming.

5.5 Tables

Tables provide a useful means of presenting large amounts of detailed information in limited space. Tables should supplement, not duplicate, information given in the text or illustrations. Tables should be understandable without continual reference to the text. Simple lists should *not* be presented as tables. Number tables consecutively in the text using Arabic numerals (e.g., Table 1). Number appendix tables by using the appropriate letter and Arabic number (e.g., for Table 1 in Appendix C, use C1). Each table should have a number and a title, column headings, a stub column (containing row headings), field column(s) (containing table data), and explanatory notes, if necessary.

- Column heads cannot be changed within a table. If this is the case, the table is actually two (or more) tables and should be redrawn as such.
- A table taken verbatim from another source must be referenced (add reference number or author–date after title or denote source as a note to the table) and permission to use it obtained from the copyright owner (see Section 5.8).
- Notes may be added when the information pertains to the entire table.
- Include a separate list of table titles with the draft.
- Tables will be placed as close to their initial callout as possible.
- When a dash (—) or a blank is used as data entry, please indicate its meaning in a note to the table (e.g., missing data, data not available).
- Use superscript numbers (or letters, if the table information consists of primarily numerals) for identifying noted material in any part of the table. Table notes should be numbered consecutively from left to right, top to bottom.

5.6 Illustrations

All figures should convey information clearly and completely. When submitting digital art, adherence to the following guidelines can help to reduce problems in the conversion of digital images to an acceptable format for printing. Illustrations should be introduced in the text prior to the figure.

Place figures and tables in text **and** provide separate electronic files for all figures and tables *not* created in Microsoft Word. These separate electronic files should be provided in the native file format of the originating program (for example, .ppt, .pptx, .ai, .psd, .xls, .xlsx) or, if the originating program is not a common one, a standard cross-program format (for example, .jpg, .tif, .pdf, .png). Tables created in Microsoft Word or Excel should stay in Microsoft Word or Excel.

Provide the highest possible resolution of artwork. Photos should be at least 300 dpi. If artwork needs to be scanned (i.e., was not created digitally), scan it at 1200 dpi (dots per inch/pixels per inch) at a minimum of 3 in. x 3 in.

Duplicates will not reproduce as well as glossy prints or computer-generated artwork and are generally not acceptable. Duplicate prints with shading will not reproduce well. Illustrations with several gradations of a color (i.e., more than three or four) will also generally not reproduce well. If possible, use hatching or other distinctive markings (e.g., vertical or horizontal lines or grids) to differentiate between bars. Include a separate list of all figure captions with the draft synthesis. Select colors in graphics that convey neutrality and avoid implying any judgments.

If possible, submit figures at the actual size they are to be reproduced. A full two-column figure is 41.5 picas (6.75 in. and 17.1 mm).

Type size for external lettering should be in the range of 8–10 points (2.1–2.7 mm) and 6–8 points (1.6–2.1 mm) for all internal lettering.

12-point type 10-point type 8-point type 6-point type

Labels on line drawings should be clear and legible. Interior graph lines in non-original line art tend not to reproduce well and need not be inserted. Similarly, shaded backgrounds should be removed because of inconsistent reproduction quality and replaced by cross-hatching or other distinctive markings.

Illustrations should be labeled by the word "Figure" and numbered consecutively, using Arabic numbers, throughout the Synthesis. In the text, cite as "Figure" with number (e.g., Figure 2).

Number figures in the appendix using the appropriate letter and consecutive Arabic numeral (e.g., Figure A3 for Figure 3 in Appendix A). Provide a one-line, descriptive caption for each figure, for example:

Figure 12. Schematic of a typical drain installation for a highway embankment.

If a figure is taken from another source, reference that source as a note under the figure or as part of the figure caption [e.g., *Source*: Carr and Black (1999) or Figure 1. Warren truss bridge (Carr and Black, 1999); *Source*: Indiana DOT, used with permission or Figure 30. Neoprene boot (*Courtesy*: Indiana DOT).]

Authors are strongly encouraged to provide alternative text (alt text) for illustrations (charts, graphs, photos, etc.). Alt text describes visual content so it can be accessible to those who use assistive technologies. "Authoring Meaningful Alternative Text" provides tips that include guidelines on writing alt text and resources on how to add alt text to Microsoft products and websites.

5.7 Vendors

Vendors should *not* be cited by name in the Synthesis as this may imply an endorsement or risks the possibility of omitting a vendor(s). Vendors can be described under neutral terms, such as Vendor 1 or Training Service 5. Company names and recognizable logos in photographs should be removed before they are submitted to TRB.

5.8 Copyright Permission

To reproduce any copyrighted materials (text, tables, figures, charts, etc.), written authorization must be obtained from the owner of the original copyright. It is the responsibility of the author to secure this permission. Permission is not needed for brief quotations (50 words or less) when the quotation is properly referenced. Permission must be obtained for longer quotations.

Material published by the U.S. government is not usually copyrighted and, if not, does not require permission, unless it credits a previously copyrighted source. A typical acknowledgment should read: "Reprinted with permission from Smith et al. Copyright 1983 American Institute of Physics."

For a figure, the acknowledgment should read: *Source*: . . ., used with permission (e.g., Arizona Department of Transportation, used with permission) or use the wording specified by the copyright owner.

For a table, reprinted without change, the acknowledgment should read: *Source*: . . ., used with permission (e.g., *Source*: Houston METRO, used with permission) or use the wording specified by the copyright owner.

Submission of the final deliverables must include a signed Certification of Compliance with Copyright Requirements indicating that the contractor has obtained all necessary permissions (document available for download in Word format here, and shown in Figure 1 below). CRP must be notified if only partial permission has been granted for a property or properties (for example, English language rights may be granted, but not other language rights).

Transportation Research Board
Cooperative Research Programs

Certification of Compliance with Copyright Requirements

Project Title and Number:

(The signature of an authorized representative of the contractor and its employees and agents ("Contractor") is required on the following unaltered statement in order for the TRB to accept the agency's draft final deliverables. **Failure to submit this executed and unaltered statement may prevent publication**.)

The Contractor certifies that no part of any draft final deliverable(s) being delivered to the Academy ("Work Product") nor the title to the Work Product infringes on any copyright, patent, property right, personal right, or other right; that all statements in the Contractor's Work Product are true to the Contractor's actual knowledge and belief, or based upon reasonable research for accuracy; and that the draft final deliverables supplied comply with Federal and state governmental requirements regarding copyright and patent law.

Anything other than full permission must be detailed below or attached. Full permission is defined as nonexclusive worldwide license to use the materials specified in all media and languages now or hereafter known, in both printed and electronic formats and in the creation and dissemination of derivative work, and subsequent and alternative editions of the revised final deliverable(s) (including versions made for use by blind or physically handicapped individuals).

Contracting Organization:

Authorized Representative: Title:

Signature: Date:

Figure 1. Certification of Compliance with Copyright Requirements (available for download here).

5.9 Use of Numbers

Always spell out numbers at the beginning of a sentence.

Within a sentence, use only Arabic numerals with units of measure, including time (e.g., 5 feet, 18%, 2 months). Otherwise, spell out all numbers one through nine (e.g., five bridges, two departments) and use Arabic numerals for numbers 10 and greater.

When using the International System of Units (SI), provide customary U.S. equivalents. The project staff uses ASTM E 380-91 for metric conversions.

Use Arabic numerals for all numbers with decimals (e.g., 5.7). For numbers of less than one, use a zero to the left of the decimal point (e.g., 0.06).

Spell out the word “number” in the text; “No.” can be used in tabular material.

Commas are used with numerals of four or more digits except for metric, years (date), page numbers, military time, and model numbers.

Hyphenate compound numbers.

5.10 Equations

Equations should be written so that all elements are easily definable and the spatial relations between symbols are obvious. All variables should be in italic type, with numbers, subscripts, and superscripts (unless variables) in Roman type. Display equations should be numbered sequentially throughout the text using an Arabic number in parentheses, set flush right on the same line as the equation, for example,

$$X^2 + Y^2 = Z^2 \tag{1}$$

When referring to an equation in the text, use the abbreviation “Eq.” followed by the number (e.g., This relationship can be illustrated by the use of Eq. 2).

Make sure that all symbols, Greek letters, and mathematical signs are exact, defined, and absolutely unambiguous, for example

- w versus ω [omega]
- p versus ρ [rho]
- Y versus Ψ [psi]
- capital O versus θ [theta] versus 0 [zero]
- capital X versus χ [chi] versus × [multiplication sign]
- lowercase l [el] versus number 1 [one]

Label all Greek letters at first mention.

5.11 Lists

Lists may be presented in three ways: (1) as a numbered series within a sentence; (2) as bulleted items, each on a separate line or lines; or (3) as numbered items, each on a separate line or lines. All items in a single list should follow the same grammatical style, either a word, phrase, sentence, or paragraph. All lists should show parallel construction.

5.12 Abbreviations/Acronyms

Abbreviations and acronyms should not be introduced unless they are repeated at least three times in the text or tables (except for units of measurement). Abbreviations used in the Summary and

Summary of Findings must be used at least three times as well. An abbreviation or acronym must be spelled out at first use [e.g., Intelligent Vehicle Highway System (IVHS)] unless it appears in a heading.

- A term should be represented by only one form of abbreviation/acronym, and no two terms should have the same abbreviation/acronym.
- Spell out all abbreviations in titles and headings, unless they are used as an adjective (e.g., "IVHS Technologies" is acceptable in a heading, assuming IVHS has been defined previously).
- United States is spelled out when used as a noun and abbreviated (U.S.) when used as an adjective (e.g., U.S. Department of Transportation).